Department of
Parks and Wildlife

Interim Recovery Plan No. **345**

Albany Cone Bush (*Isopogon uncinatus*)

Interim Recovery Plan
2014–2019

Department of Parks and Wildlife, Western Australia

June 2014

List of Acronyms

The following acronyms are used in this plan:

ADTFRT	Albany District Threatened Flora Recovery Team
BGPA	Botanic Gardens and Parks Authority
CALM	Department of Conservation and Land Management
CCWA	Conservation Commission of Western Australia
CITES	Convention on International Trade in Endangered Species
CR	Critically Endangered
DEC	Department of Environment and Conservation
DAA	Department of Aboriginal Affairs
DPaW	Department of Parks and Wildlife (also shown as Parks and Wildlife and the department)
DRF	Declared Rare Flora
EN	Endangered
EPBC	Environment Protection and Biodiversity Conservation
IBRA	Interim Biogeographic Regionalisation for Australia
IRP	Interim Recovery Plan
IUCN	International Union for Conservation of Nature
LGA	Local Government Authority
MRWA	Main Roads Western Australia
NRM	Natural Resource Management
PEC	Priority Ecological Community
RDL	Department of Regional Development and Lands
RP	Recovery Plan
SCB	Species and Communities Branch
SCD	Science and Conservation Division
SWALSC	South West Aboriginal Land and Sea Council
TEC	Threatened Ecological Community
TFSC	Threatened Flora Seed Centre
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 Policy Statements Nos. 44 and 50 (CALM 1992; CALM 1994). Note: The Department of Conservation and Land Management (CALM) formally became the Department of Environment and Conservation (DEC) in July 2006 and the Department of Parks and Wildlife in July 2013. 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.

The department 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, within one year of endorsement of that rank by the Minister.

This plan, which results from a review of, and replaces plan No. 82 Albany Cone Bush (*Isopogon uncinatus*) (Phillimore and Brown 2001), will operate from June 2014 to May 2019 but will remain in force until withdrawn or replaced. It is intended that, if the species is still ranked as CR in Western Australia, this plan will be reviewed after five years and the need for further recovery actions assessed.

This plan was given regional approval on 6 June 2014 and was approved by the Director of Science and Conservation on 13 June 2014. The provision of funds identified in this plan is dependent on budgetary and other constraints affecting the department, as well as the need to address other priorities.

Information in this plan was accurate at June 2014.

Plan preparation: This plan was prepared by:

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Cover photograph by Damien Rathbone.

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Summary

Scientific name:	***Isopogon uncinatus***	**Common name:**	Albany Cone Bush
Family:	Proteaceae	**Flowering period:**	October–December
DPaW region:	South Coast	**DPaW district:**	Albany
Shires:	City of Albany, Plantagenet	**NRM region:**	South Coast Regional Initiative Planning Team
IBRA regions:	Jarrah Forest, Warren	**Recovery team:**	ADTFRT
IBRA subregions:	Warren WAR01, Southern Jarrah Forest JAF02		

Distribution and habitat: *Isopogon uncinatus* is endemic to the Albany area, growing in seasonally damp, shallow sandy-clay soil over granite or in gravelly soil derived from decomposed laterite over granite, in saddles between summit rocks. Associated vegetation is heath (Robinson and Coates 1995).

Habitat critical to the survival of the species, and important populations: Given that *Isopogon uncinatus* is ranked as Critically Endangered (CR), 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 *I. uncinatus* 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.

Conservation status: *Isopogon uncinatus* is specially protected under the Western Australian *Wildlife Conservation Act 1950* and is ranked as CR in Western Australia under International Union for Nature Conservation (IUCN 2001) criteria B1ab(iii,iv,v)+B2ab(iii,iv,v) due to its extent of occurrence being less than 100km^2, area of occupancy less than 10km^2, severely fragmented populations and a continuing decline in the quality of habitat, number of locations and mature individuals. The species is listed as Endangered (EN) under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

Threats: The main threats to the species are disease, changed disturbance regimes, competition from associated species, fire, clearing, road and track maintenance and recreational activities.

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. Relevant land managers have been made aware of this species and its locations.
2. Aerial phosphite spraying has been undertaken at Populations 5, 10a and 13.
3. The species has been extensively surveyed for in areas of suitable habitat by the department's Albany District staff.
4. 4,094 seeds and 193 fruits collected from *Isopogon uncinatus* are stored in the TFSC at –18°C.
5. The Botanic Gardens and Parks Authority (BGPA) have three plants of *Isopogon uncinatus* in their nursery.
6. Monitoring of Populations 1 and 6, and Subpopulations 3a, 10a and 10b has been undertaken annually since 2001.
7. An article on the species prepared by Sarah Barrett appeared in The West Australian (Weekend Extra) newspaper in November 2000.
8. Declared Rare Flora (DRF) markers have been installed at Populations 10, 11 and 14.

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 species in the wild.

Recovery criteria

Criteria for recovery success:

- The number of extant populations has increased from 14 to 15 or more over the term of the plan and/or
- The number of mature individuals has increased by 20% or more over the term of the plan from 333 to 400 or more.

Criteria for recovery failure:

- The number of populations has decreased from 14 to 13 or less over the term of the plan and/or
- The number of mature individuals has decreased by 20% or more over the term of the plan from 333 to 266 or less.

Recovery actions

1. Coordinate recovery actions
2. Apply phosphite
3. Monitor populations
4. Determine susceptibility to disease
5. Develop and implement a fire management strategy
6. Manage recreational impacts
7. Develop and implement a translocation proposal
8. Maintain disease hygiene
9. Undertake surveys
10. Undertake regeneration trials
11. Collect and store seed
12. Obtain biological and ecological information
13. Ensure long-term protection of habitat
14. Liaise with land managers and Aboriginal communities
15. Promote awareness
16. Map habitat critical to the survival of *Isopogon uncinatus*
17. Review this plan and assess the need for further recovery actions

1. Background

Analysis of outputs and effectiveness of Interim Recovery Plan (IRP) No. 82 (2001-2003) by Phillimore and Brown.

The criteria for success in the previous plan (the number of individuals within populations and/or the number of populations have increased) have been met. At the time the previous plan was written the species was known from nine populations, including 16 subpopulations, comprising less than 100 mature plants. An additional five populations and two subpopulations have since been located and the number of mature individuals has increased from less than 100 to 333 (233% increase).

Although many recovery actions in the previous plan have now been fully or partially implemented, there are some actions that are still outstanding or are ongoing. In addition, the taxon's restricted extent of occurrence and occupancy, a continuing decline in its quality of habitat and plant numbers, and its current critical ranking, warrant further recovery. *Action 12* Write a full Recovery Plan is redundant as the department no longer produces full recovery plans for flora. Current plans have been extended to a five year term and are to be reviewed and updated if required.

Table 1: Status of recovery actions included in previous plan

Recovery action	Status	Result
Coordinate recovery actions	Ongoing	Recovery actions have been conducted by the Albany District Flora Conservation Officer with assistance from the ADTFRT. The team meets biannually.
Apply phosphite	Ongoing	Aerial spraying at Populations 5 and 13 and Subpopulation 10a is being undertaken biennially to triennially with up to 24kg of phosphite sprayed per hectare of each year. Spraying of Population 6 was undertaken between 1999 and 2003 but has not continued since.
Monitor the impact of phosphite	Ongoing	Staff from the department's Albany District are monitoring the effectiveness of phosphite application with 5x5m quadrats at Population 10 monitored annually since 2001.
Conduct further surveys	Ongoing	The species has been surveyed for in areas of suitable habitat. Where possible volunteers have assisted.
Develop and implement a fire management strategy	Not completed	No specific fire management strategy has been developed. However, with the exception of Population 7, all populations have been excluded from prescribed burns.
Notify and liaise with relevant land managers	Completed and ongoing	The majority of land managers have been informed of the threatened status of the species and its location. The DOD, who are leasing land containing Population 3a, have yet to be notified.
Monitor populations	Ongoing	Monitoring data has been collected on population demography, associated species, threats and post fire recruitment.
Collect seed and cutting material	Material collected	The TFSC currently holds 4,094 seeds and 193 fruits. BGPA have three plants of *Isopogon uncinatus* in their nursery, grown from seed collected by the TFSC in March 2011.
Vest reserve #27107 with the Conservation Commission	National park created	Reserve #27107 (Gull Rock), in which Populations 6, and 10 occur, is now a national park, managed by the department.
Obtain biological and ecological information	Started, ongoing	Out of 17 plants inoculated with *Phytophthora* dieback, 24% died, indicating the species to be moderately resistant.
Promote awareness	Ongoing	Awareness promotion has included several articles and presentations.
Write a full Recovery Plan	No longer a requirement	As the department no longer produces full recovery plans for flora, this plan will be reviewed after five years and a new plan prepared if required.

All ongoing recovery actions included in the previous plan are included in this revised plan. New recovery actions in this plan are to determine susceptibility to diseases such as aerial canker, manage recreational impacts, undertake and monitor translocations, undertake regeneration trials, ensure long-term protection of habitat, map habitat critical to the species' survival, and review this plan and assess the need for further recovery actions.

History

Robert Brown described *Isopogon uncinatus* in 1830 from collections made from the King George Sound area by William Baxter in 1828. As at December 2013, *Isopogon uncinatus* is known from 15 populations, comprising of 333 mature plants. However, five populations no longer have mature plants.

Description

Isopogon uncinatus is a small, tufted shrub 10 to 40cm high. The leaves, which are up to 20cm long by 1.2cm wide, have a small but obvious hook at the apex. The young leaves are reddish-pink and hairy, becoming pale green and hairless with age. The stem is usually very short but may elongate to 15cm in closed heath. Clusters of pale lemon flowers are borne at ground level or just above. Old fruits remain packed together on the short woody stem (Brown *et al*. 1998).

Isopogon uncinatus is difficult to identify without close examination. In particular, its leaves are very similar in shape to *Conospermum capitatum*.

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; Robinson, C.J. and Coates, D.J. (1995) *Declared Rare and Poorly Known Flora in the Albany District*. Department of Conservation and Land Management, Western Australia, Australian Nature Conservation Agency, Canberra; Sainsbury, R.M. (1987) A Field Guide to *Isopogons* and *Petrophiles*. University of Western Australia Press, Western Australia; Western Australian Herbarium (1998–) *FloraBase- the Western Australian Flora*. Department of Parks and Wildlife. http://florabase.dpaw.wa.gov.au/.

Distribution and habitat

Isopogon uncinatus is endemic to Western Australia where it is confined to the Albany area. Soil is seasonally damp, shallow sandy-clay over granite or gravelly soil from decomposed laterite over granite, in saddles between summit rocks (Robinson and Coates 1995). Associated species include *Hakea elliptica*, *H. ceratophylla*, *H. varia*, *H. ferruginea*, *H. trifurcata*, *Anthocercis viscosa*, *Taxandria marginata*, *T. parviceps*, *Acacia myrtifolia*, *Verticordia plumosa*, *Corymbia calophylla*, *E. marginata*, *Andersonia sprengelioides*, *A. caerulea*, *Adenanthos obovatus*, *Conospermum caeruleum*, *C. capitatum*, *Banksia grandis*, *B. occidentalis*, *B. formosa*, *B. quercifolia*, *Isopogon attenuatus*, *I. cuneatus*, *Xanthorrhoea platyphylla*, *Platysace compressa* and *Gastrolobium coriaceum*.

Table 2. Summary of population land vesting, purpose and manager

Population number & location	Parks and Wildlife district	Shire	Vesting	Purpose	Manager
1a. S of Albany	Albany	Albany	CCWA	National park	Parks and Wildlife
1b. S of Albany	Albany	Albany	CCWA	National park	Parks and Wildlife
1c–f. S of Albany	Albany	Albany	CCWA	National park	Parks and Wildlife
1g. S of Albany	Albany	Albany	CCWA	National park	Parks and Wildlife
2. NW of Albany	Albany	Albany	Private property		Landowners
3a. WSW of Albany	Albany	Albany	RDL	Defence	Department of Defence
3b. WSW of Albany	Albany	Albany	LGA	Parkland and recreation	City of Albany
5. S of Albany	Albany	Albany	LGA	Recreation	City of Albany
6. E of Albany	Albany	Albany	CCWA	National park	Parks and Wildlife
7a. S of Albany	Albany	Albany	CCWA	National park	Parks and Wildlife
7b. S of Albany	Albany	Albany	CCWA	National park	Parks and Wildlife
7c. S of Albany	Albany	Albany	CCWA	National park	Parks and Wildlife
8. S of Albany	Albany	Albany	CCWA	National park	Parks and Wildlife
9. S Niggerhead Rock	Albany	Albany	CCWA	National park	Parks and Wildlife
10a. Gull Rock	Albany	Albany	CCWA	National park	Parks and Wildlife
10b. Gull Rock	Albany	Albany	CCWA	National park	Parks and Wildlife
11. Narrikup	Albany	Plantagenet	LGA	Recreation	Shire of Plantagenet
12. Narrikup	Albany	Plantagenet	MRWA	Road reserve	MRWA
13. W of Cheyne Beach	Albany	Albany	CCWA	National park	Parks and Wildlife
14a. S of Manypeaks	Albany	Albany	Minister for Water Resources	Water reserve	Department of Water
14b. S of Manypeaks	Albany	Albany	Minister for Water Resources	Water reserve	Department of Water
14c. S of Manypeaks	Albany	Albany	Minister for Water Resources	Water reserve	Department of Water
14d. S of Manypeaks	Albany	Albany	Minister for Water Resources	Water reserve	Department of Water
15. W of Cheyne Beach	Albany	Albany	CCWA	National park	Parks and Wildlife

Biology and ecology

Current information on the biology and ecology of *Isopogon uncinatus* has come from field observations and demographic monitoring. New growth of *I. uncinatus* appears pink to red and emerges from the base of new cones (fruiting bodies). Old cones are scattered along stems at ground level or develop into a mat-like clump. Termite predation of cones is also apparent where contact with soil occurs.

Some variation in morphology has been noted between populations. *Isopogon uncinatus* plants in Population 1 were considered very small compared with those in Population 3 but the influence of fire history and plant longevity is unclear. With the exception of Population 3 where plants with dimensions of 40 x 40cm were present in the early 2000s, plants at all other populations rarely reach more than 25 x 25cm and more commonly 15 x 15cm even at >10 years after fire (S Barrett unpublished data). This is likely to be related to individual plant health and longevity as well as fire history. Plants in Population 5 were observed in the 1990s to grow more as an understorey with longer, narrower, darker green and more prominently hooked leaves than those of other populations.

According to Sainsbury (1987), *Isopogon* species are not easy to cultivate and BGPA nursery staff have had difficulty in propagating the species.

In 1992 and again in recent years, it was noted that many adult plants at Population 1 were dying from unknown causes, possibly drought, competition or plant pathogens.

Phytophthora dieback is present at the majority of sites containing *Isopogon uncinatus*. Population 1 is the most significant non-infested population. Results of preliminary testing under laboratory conditions indicate the species is moderately susceptible to dieback. Twenty four per cent of 17 plants receiving two inoculations of the pathogen died.

Regular monitoring of 5 x 5m quadrats has been undertaken at Population 1 and Subpopulations 3a, 10a and 10b since 2001. Data collected includes counts of the number of adults, juveniles, seedlings and the number of dead individuals (see table 3). This data will be used to investigate population demography and to evaluate the effectiveness of phosphite application. Four of the five populations monitored have shown declines in the number of adults over the last 10 years.

Table 3. Summary of quadrat monitoring for Populations 1, 3, 6 and 10

Population number	Date	Number of adults	Number of juveniles/seedlings	Total dead (adults + juveniles+seedlings)
1	15/05/2001	142	203	27
	06/11/2001	253	90	4
	05/08/2002	247	100	9
	11/11/2002	307	46	0
	12/06/2003	291	33	32
	24/10/2003	301	35	9
	10/09/2004	295	42	24
	05/09/2006	170	54	65
	24/10/2007	106	126	26
	23/12/2008	55	46	31
	14/02/2011	8	16	24
	02/05/2011	75	26	0
	03/07/2012	2	28	0
3a	15/05/2001	52	22	12
	06/11/2001	53	30	5
	27/04/2002	49	24	11
	29/10/2002	51	57	1
	23/05/2003	43	27	36
	24/10/2003	44	35	3
	02/09/2004	47	29	8
	14/09/2006	28	46	12
	30/10/2007	30	47	3
	17/11/2008	27	17	0
	06/11/2009	0	0	0
	21/09/2010	0	3	0
	02/05/2011	0	8	0
	22/05/2012	0	11	0
6	16/05/2001	10	26	0
	16/11/2001	2	22	22
	27/04/2002	2	12	10
	08/11/2002	2	23	1
	29/05/2003	3	15	7
	20/10/2003	3	21	5
	14/09/2004	5	17	2

	15/12/2005	5	11	2
	14/12/2006	4	17	1
	31/08/2007	11	12	7
	06/08/2008	12	12	3
	30/03/2011	8	1	0
	18/05/2012	15	0	0
10a	16/05/2001	102	74	5
	06/11/2001	110	67	9
	27/04/2002	106	65	10
	08/11/2002	113	61	4
	29/05/2003	111	56	8
	24/10/2003	119	45	4
	14/09/2004	121	33	9
	15/12/2005	124	33	2
	14/12/2006	118	41	10
	31/08/2007	116	30	4
	06/08/2008	109	31	16
	15/03/2011	75	26	0
	18/05/2012	58	45	9
10b	16/05/2001	26	15	4
	08/11/2001	29	11	2
	27/04/2002	16	6	17
	08/11/2002	19	5	2
	29/05/2003	16	0	8
	20/10/2003	14	3	1
	14/09/2004	9	8	8
	15/12/2005	9	4	1
	14/12/2006	5	5	3
	31/08/2007	3	8	2
	06/08/2008	6	1	3
	30/03/2011	2	0	2

Fires killed the majority of adult plants in Populations 1 and 9 during the summer of 1997, Population 14 in the summer of 2000 and Population 3 in the summer 2009. However, recruitment has taken place from seed released from cones.

Conservation status

Isopogon uncinatus is specially protected under the Western Australian *Wildlife Conservation Act 1950* and is ranked as Critically Endangered (CR) in Western Australia under International Union for Nature Conservation (IUCN 2001) criteria B1ab(iii,iv,v)+2ab(iii,iv,v) due to its extent of occurrence being less than 100km^2, area of occupancy less than 10km^2, severely fragmented populations and a continuing decline in the quality of habitat, number of locations and mature individuals. The species is listed as Endangered (EN) under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

Threats

- **Disease** caused by the pathogen *Phytophthora cinnamomi* is a threat to all populations. Although preliminary testing has revealed that the species is only moderately susceptible, its habitat is highly susceptible and *P. cinnamomi* is present in all populations.

- **Factors influencing growth, reproduction and survival** including changed disturbance regimes, competition from associated species, drought, plant pathogens, small population size and fragmentation are a threat to the species. Few plants in most populations appear to reach their full size and reproductive potential. At Populations 1 and 5, plants in denser vegetation appear to have been outcompeted.
- **Altered fire regimes**. Infrequent fires may be required to germinate seed, however, frequent fire that occurs before plants mature would likely deplete the seed store.
- **Clearing** is a threat to Population 11.
- **Road and track maintenance** which includes grading, chemical spraying, the construction of drainage channels and the mowing of roadside vegetation is a threat to Populations 7, 12 and 14.
- **Recreational activities** that result in the crushing of plants by trampling and turning vehicles have the potential to impact on Population 10.

The intent of this plan is to provide actions that will mitigate immediate threats to *Isopogon uncinatus*. Although climate change and drought may have a long-term effect on the species, actions taken directly to prevent their impact are beyond the scope of this plan.

Table 4. Summary of population information and threats

Population number & location	Land status	Year	Number of plants			Condition	Threats
			mature	seedlings/ juveniles	dead		
1a-g. S of Albany	National park	1992 1997 2001 2003 2006 2011	110 50 400 800 600 100	30 0 650 110 51 150	0 200 4 100 95 50	Poor- Burnt 2011	Disease
2. NW of Albany	Private property	1990 1999	1 0	0 0	0 0		Disease
3a. WSW of Albany	Non vested reserve (Defence purposes)	1992 2001 2002 2006 2009 2011	60 75 60 *40 0 0	1 25 27 *60 0 10	0 5 11 *20 80 0	Poor- burnt October 2009	Disease
3b. WSW of Albany	Shire reserve (parks and recreation)	2001 2003 2005 2011	*40 *35 *60 0	*5 *10 *40 0	*5 *2 *8 0	Poor- burnt October 2009	Disease
5. S of Albany	Shire reserve (recreation)	1993 1997 2001	9 8 0	0 0 0	0 0 0		Disease
7c. S of Albany	National park	2000 2001 2011 2012	4 3 0 0	0 0 0 0	0 2 0 0	Poor – Burnt 2011	Disease, track maintenance
8. S of Albany	National park	2000 2002 2004	1 1 1	0 0 0	1 0 0	Moderate	Disease
9. S Niggerhead Rock	National park	2000 2007	0 106	131 0	0 0	Healthy	Disease

10a. Gull Rock	National park	2001 2002 2009 2012	100 100 118 80	200 200 30 80	20 10 8 9	Moderate	Disease, recreational activities
10b. Gull Rock	National park	2001 2003 2004 2008 2011	30 30 25 6 12	80 40 few 1 0	5 5 8 3 5	Poor	Disease, recreational activities
11. Narrikup	Shire reserve (recreation)	2001 2002 2005 2011	34 40 5 4	9 6 15 0	3 0 1 0	Moderate	Disease, clearing
12. Narrikup	MWRA road reserve	2002 2007	0 0	13 0	7 0	Healthy	Road maintenance
13. W of Cheyne Beach	National park	2002 2007 2011	10 9 10	2 10 1	0 1 0	Moderate	Disease
14a. S of Manypeaks	Water reserve	2008 2009 2011	*60 *20 5	0 0 1	0 *40 0	Moderate	Disease, track maintenance
14b. S of Manypeaks	Water reserve	2008 2009 2011	*60 *20 4	0 0 0	0 *40 0	Moderate	Disease, track maintenance
14c. S of Manypeaks	Water reserve	2008	*60	0	0	Moderate	Disease
14d. S of Manypeaks	Water reserve	2008	*60	0	0	Moderate	Disease
15. W of Cheyne Beach	National park	2011	3	1	0	Moderate	Disease

Note: Populations in **bold text** are considered to be important populations; () = number of seedlings/juveniles; and* = 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 *Isopogon uncinatus* 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
- Reduction in population size
- Spread or amplification of *Phytophthora* dieback
- A major increase in disturbance in the vicinity of a population.

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

Given that *Isopogon uncinatus* is ranked as CR, 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 *I. uncinatus* 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 *Isopogon uncinatus* will also improve the status of associated native vegetation. Five Declared Rare Flora (DRF) and nine Priority flora occur within 500m of the species (see table 5).

Table 5. Conservation-listed flora species occurring within 500m of *Isopogon uncinatus*

Species name	Conservation status (WA)	Conservation status (EPBC Act)
Banksia brownii	DRF (CR)	EN
Banksia verticillata	DRF (VU)	VU
Chordifex abortivus	DRF (VU)	EN
Conostylis misera	DRF (VU)	EN
Verticordia fimbrilepis subsp. *australis*	DRF (EN)	VU
Usnea pulvinata (lichen)	Priority 1	
Degelia flabellata (lichen)	Priority 2	
Banksia seneciifolia	Priority 3	
Boronia crassipes	Priority 3	
Melaleuca diosmifolia	Priority 3	
Synaphea preissii	Priority 3	
Eucalyptus acies	Priority 4	
Laxmannia jamesii	Priority 4	
Pleurophascum occidentale (moss)	Priority 4	

For a description of conservation codes for Western Australian flora see http://www.dpaw.wa.gov.au/images/documents/plants-animals/threatened-species/Listings/Conservation_code_definitions_18092013.pdf

Four threatened fauna species will benefit from the management of *Isopogon uncinatus*. These include Baudin's Cockatoo (*Calyptorhynchus baudinii*) (EN), Noisy scrub-bird (*Atrichornis clamosus*) (EN), Western Bristlebird (*Dasyornis longirostris*) (Vulnerable (VU)) and Carnaby's Cockatoo (*Calyptorhynchus latirostris*) (EN).

Isopogon uncinatus occurs adjacent to two Priority Ecological Communities (PECs) "*Melaleuca striata/Banksia* spp. Coastal Heath" (Priority 1) and "*Taxandria spathulata* Heath" (Priority 4). For a description of Threatened Ecological Community (TEC) categories see DEC (2010).

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 species 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 one site (#5708, Mutton Bird Island) of Aboriginal significance adjacent to a population of *Isopogon uncinatus*. 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 species in the vicinity of these sites. Indigenous opportunity for future 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 species occurs.

Social and economic impacts

Impacts may be through restrictions imposed on the management of land, the loss of land available for development and the cost of implementing recovery actions.

Affected interests

Affected interests include private landholders, Department of Defence, City of Albany, Plantagenet Shire, Main Roads Western Australia (MRWA) and Water Corporation.

Evaluation of the plan's performance

The department, with assistance from 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

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 species in the wild.

Recovery criteria

Criteria for recovery success:
- The number of extant populations has increased from 14 to 15 or more over the term of the plan and/or
- The number of mature individuals has increased by 20% or more over the term of the plan from 333 to 400 or more.

Criteria for recovery failure:
- The number of populations has decreased from 14 to 13 or less over the term of the plan and/or
- The number of mature individuals has decreased by 20% or more over the term of the plan from 333 to 266 or less.

3. Recovery actions

Existing recovery actions

Relevant land managers have been made aware of this species and its locations. Notifications detail the current status of the species and associated legal obligations.

Aerial spraying with phosphite commenced in 1996 and has occurred regularly since 1999. The following table outlines dates during which populations were sprayed with phosphite. Populations are sprayed twice with 12kg per hectare each except where stated.

Table 6. *Isopogon uncinatus* populations sprayed with phosphite

Population number	Location	Area sprayed (hectares)	Dates sprayed (sprayed twice except where stated)
5	Vancouver Peninsula	1	1996, 1999, 2001, 2003 (1 spray), 2004, 2006, 2008, 2009 (1 spray), 2010, 2012 (1 spray)
6	Gull Rock granite	1	1999, 2001, 2003
10a	Gull Rock National Park	2	2001, 2004, 2006, 2008, 2009 (1 spray), 2010
13	Waychinicup National Park	3	1999, 2001, 2003 (1 spray), 2004, 2006, 2008, 2009 (1 spray), 2010, 2012 (1 spray)

New populations have been discovered following extensive surveys by the department's Albany District staff.

Over 4,000 seeds and 193 *Isopogon uncinatus* fruits are currently stored in the Threatened Flora Seed Centre (TFSC) at –18°C (see table 7). Germination rate ranges from 30 to 78%.

Table 7. TFSC collection details for *Isopogon uncinatus*

Accession number	Date collected	Population number	Collection type	Seeds/follicles in storage	Germination rate (%)
00031	12/12/1992	3	I/17	2,163	63
00204	12/01/1995	1	B/0	760	62
00205	12/01/1995	1	B/50	479	78
00320	22/02/1996	1	B/20	66 fruit	Insufficient to test
00321	22/02/1996	1	B/20	350	33
00916	4/01/2002	11	B/10	92	30
00985	26/04/2002	10	B/20, I/8	171	64
01219	11/06/2003	1	B/40	93 fruit	Insufficient to test
03111	9/11/2009	3	B/10	34 fruit	Insufficient to test
03467	15/03/2011	10	I/7	79	58

Note: 'I' = collection of individuals and the number of plants collected; 'B' = bulked collection and the number of plants sampled.

The Botanic Gardens and Parks Authority (BGPA) have three plants of *Isopogon uncinatus* in their nursery, germinated from seed collected by the TFSC in March 2011. No propagation records are available.

Monitoring of Population 1 and 6, and Subpopulations 3a, 10a and 10b has been undertaken annually since 2001. Data collected includes counts of the number of adults, juveniles and seedlings and the number of dead plants.

An article titled "Help Needed to Search for Bush" by Sarah Barrett was published in The West Australian (Weekend Extra) newspaper in November 2000.

DRF markers have been installed at Populations 10, 11 and 14. Dashboard stickers and posters describing the significance of DRF markers have been produced and distributed to Shires and other organisations.

Future recovery actions

The department, with the assistance of the ADTFRT, is overseeing the implementation of this plan. Where recovery actions are implemented on lands other than those managed by the department, 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, 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.

1. Coordinate recovery actions

The department, with assistance from the ADTFRT, will coordinate recovery actions for *Isopogon uncinatus* and include information on progress in annual reports to the department's Corporate Executive and funding bodies.

Action:	Coordinate recovery actions
Responsibility:	The department (Albany District), with assistance from the ADTFRT
Cost:	$8,000 per year

2. Apply phosphite

Isopogon uncinatus is considered to be moderately susceptible to *Phytophthora* dieback and the habitat in which it occurs is highly susceptible. The department will apply phosphite to populations as required. Application of phosphite will also protect other threatened plant species.

Action:	Apply phosphite
Responsibility:	The department (Albany District)
Cost:	$4,000 per year

3. Monitor populations

Monitoring of grazing, weed invasion, habitat degradation, disease, population stability (expansion or decline), pollinator activity, seed production, recruitment, and longevity will be undertaken. Regular monitoring to evaluate the effectiveness of phosphite application will also continue.

Action:	Monitor populations
Responsibility:	The department (Albany District), with assistance from the ADTFRT
Cost:	$8,000 per year

4. Determine susceptibility to disease

If possible, the susceptibility of the species to aerial canker (e.g. *Botryosphaeria* spp.) or root diseases such as *Armillaria luteobubalina* will be determined.

Action:	Determine susceptibility to disease
Responsibility:	The department (Albany District, Science and Conservation Division(SCD))
Cost:	$3,000 in year 1

5. Develop and implement a fire management strategy

A fire management strategy will be developed that recommends fire frequency, intensity, season and control measures.

Action:	Develop and implement a fire management strategy
Responsibility:	The department (Albany District)
Cost:	$10,000 in year 1, and $6,000 in years 2–5

6. Manage recreational impacts

Vehicles entering the bushland containing Population 10 are threatening the species through the construction of multiple tracks, and the potential introduction of pests and diseases. Methods for management should be investigated.

Action:	Manage recreational impacts
Responsibility:	The department (Albany District)
Cost:	$10,000 in years 1 and 2

7. Develop and implement a translocation proposal

If required, a translocation proposal will be developed and suitable translocation sites selected. Information on the translocation of threatened plants and animals in the wild is provided in the department's Policy Statement No. 29 *Translocation of Threatened Flora and Fauna* (CALM 1995), and the Australian Network for Plant Conservation translocation guidelines (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 a translocation proposal
Responsibility:	The department (SCD, Albany District), BGPA
Cost:	$42,000 in years 1 and 2; and $26,500 in years 3–5 as required

8. Maintain disease hygiene

Disease hygiene measures are required for all populations. Dieback hygiene (outlined in CALM 2003) will be followed during installation and maintenance of firebreaks and when walking into populations in wet soil conditions. Signs advising of the dieback risk and high conservation values of the sites will be installed if required.

Action:	Maintain disease hygiene
Responsibility:	The department (Albany District)
Cost:	$4,000 per year

9. Undertake surveys

Additional surveys for *Isopogon uncinatus* should be conducted in areas of potential habitat. All surveyed areas will be recorded and the presence or absence of the species documented to increase survey efficiency and reduce unnecessary duplicate surveys.

Action:	Undertake surveys
Responsibility:	The department (Albany District), with assistance from the ADTFRT
Cost:	$10,000 per year

10. Undertake regeneration trials

Various disturbance techniques should be investigated (i.e. soil disturbance and fire), to determine which is the best method for germinating *Isopogon uncinatus* seed in the wild.

Action:	Undertake regeneration trials
Responsibility:	The department (SCD, Albany District)
Cost:	$10,000 in years 1 and 3, $4,000 in years 2, 4 and 5

11. Collect and store seed

To guard against the possible future extinction of the species, if wild populations are lost, it is recommended that additional seed be collected and stored in the TFSC and BGPA.

Action:	Collect and store seed
Responsibility:	The department (Albany District, TFSC), BGPA
Cost:	$10,000 per year

12. Obtain biological and ecological information

Improved knowledge of the biology and ecology of the species will provide a scientific basis for management of *Isopogon uncinatus* in the wild and will ideally include:

1. Reproductive strategies, phenology and seasonal growth;
2. Reproductive success and pollination biology;
3. Soil seed bank dynamics and the role of various factors including disturbance, competition, drought, inundation and grazing in recruitment and seedling survival and survival of mature plants;
4. Minimum viable population size; and
5. The impact of *Phytophthora* dieback and the effectiveness of control techniques on *Isopogon uncinatus* and its habitat.

Action:	Obtain biological and ecological information
Responsibility:	The department (SCD, Albany District)
Cost:	$50,000 in years 1–3

13. Ensure long-term protection of habitat

The department will investigate the possibility of having land containing Populations 5, 11 and 14 and Subpopulations 3a and 3b acquired as reserves.

Action:	Ensure long-term protection of habitat
Responsibility:	The department (Albany District, Species and Communities Branch (SCB))
Cost:	$3,000 in years 1 and 2

14. Liaise with land managers and Aboriginal communities

Staff from the department's Albany District will liaise with appropriate land managers to ensure that populations of *Isopogon uncinatus* are not accidentaly damaged or destroyed, and the habitat is maintained in a suitable condition for the conservation of the species. Indigenous consultation will take place to determine if there are any issues or interests in areas that are habitat for the species.

Action:	Liaise with land managers and Aboriginal communities
Responsibility:	The department (Albany District)
Cost:	$4,000 per year

15. Promote awareness

The importance of biodiversity conservation and the protection of *Isopogon uncinatus* will be promoted to the public through an information sheet which includes a description of the plant, its habitat type, threats, management actions and photos. Formal links with local naturalist groups and interested individuals will also be encouraged.

Action:	Promote awareness
Responsibility:	The department (Albany District, SCB, Public Information and Corporate Affairs(PICA)), with assistance from the ADTFRT
Cost:	$7,000 in years 1 and 2; $5,000 in years 3–5

16. Map habitat critical to the survival of *Isopogon uncinatus*

Although habitat critical to the survival of the species is alluded to in Section 1, it has not yet been mapped. If additional populations are located, habitat critical to their survival will also be determined and mapped.

Action:	Map habitat critical to the survival of *Isopogon uncinatus*
Responsibility:	The department (SCB, Albany District)
Cost:	$6,000 in year 2

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

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

Action:	Review this plan and assess the need for further recovery actions
Responsibility:	The department (SCB, Albany District)
Cost:	$6,000 in year 5

Table 8. Summary of recovery actions

Recovery action	Priority	Responsibility	Completion date
Coordinate recovery actions	High	The department (Albany District), with assistance from the ADTFRT	Ongoing
Apply phosphite	High	The department (Albany District)	Ongoing
Monitor populations	High	The department (Albany District), with assistance from the ADTFRT	Ongoing
Determine susceptibility to disease	High	The department (Albany District, SCD)	2015
Develop and implement a fire management strategy	High	The department (Albany District)	Developed by 2015 with implementation ongoing
Manage recreational impacts	High	The department (Albany District)	2016
Develop and implement a translocation proposal	High	The department (SCD, Albany District), BGPA	2019
Maintain disease hygiene	High	The department (Albany District)	Ongoing
Undertake surveys	High	The department (Albany District), with assistance from the ADTFRT and volunteers	Ongoing
Undertake regeneration trials	High	The department (SCD, Albany District)	2019
Collect and store seed	High	The department (Albany District, TFSC), BGPA	2019
Obtain biological and ecological information	High	The department (SCD, Albany District)	2017
Ensure long-term protection of habitat	High	The department (Albany District, SCB)	2016
Liaise with land managers and aboriginal communities	Medium	The department (Albany District)	Ongoing
Promote awareness	Medium	The department (Albany District, SCB, PICA), with assistance from the ADTFRT	2019
Map habitat critical to the survival of *Isopogon uncinatus*	Medium	The department (SCB, Albany District)	2016
Review this plan and assess the need for further recovery actions	Medium	The department (SCB, Albany District)	2019

4. Term of plan

This plan will operate from June 2014 to May 2019 but will remain in force until withdrawn or replaced. If the species is still ranked CR after five years, the need for further recovery actions will be determined.

5. References

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6. Taxonomic description

Isopogon uncinatus

Brown, R. (1830) *Prodromus Florae Novae Hollandiae*. London.

Isopogon uncinatus has entire and sword-like leaves with a curved apex. The stem is short and flowerheads are aggregated.

Sainsbury, R.M. (1987) A Field Guide to *Isopogons* and *Petrophiles*. University of Western Australia Press, Western Australia.

A small shrub, 15cm to 30cm high and across, with very short stems. Leaves are linear to lanceolate, young ones are hooked (uncinate) and topped with small points, the mature leaves are petiolate and can be up to 30cm long. Flower heads are normally found in sessile clusters at ground level. Outer bracts are few and glabrous, and the cone scales are lanceolate and villous- the outer scales broad and the inner ones narrow. The small yellow flowers emerge in early November.