Department of **Biodiversity, Conservation and Attractions**

GOVERNMENT OF WESTERN AUSTRALIA

Interim Recovery Plan No. **389**

Conospermum galeatum

Interim Recovery Plan

Department of Biodiversity, Conservation and Attractions, Western Australia

April 2020

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
DBCA	Department of Biodiversity, Conservation and Attractions
DPaW	Department of Parks and Wildlife
DPLH	Department of Planning, Lands and Heritage
DWER	Department of Water and Environment Regulation
EPBC Act	Environment Protection and Biodiversity Conservation Act
GPS	Global Positioning System
IBRA	Interim Biogeographic Regionalisation for Australia
IRP	Interim Recovery Plan
IUCN	International Union for Conservation of Nature
NRM	Natural Resource Management
PEC	Priority Ecological Community
PICA	Public Information and Corporate Affairs
RP	Recovery Plan
SCP	Species and Communities Program
SWALSC	South West Aboriginal Land and Sea Council
TEC	Threatened Ecological Community
TFSC	Threatened Flora Seed Collection
TPFL	Threatened and Priority Flora database
UCL	Unallocated Crown land
UNEP-WCMC	United Nations Environment Program World Conservation Monitoring Centre
VU	Vulnerable
WA	Western Australia
WRTFCRT	Wheatbelt Region Threatened Flora and Communities Recovery Team

Foreword

Interim recovery plans (IRPs) are developed under Section 105 of the *Biodiversity Conservation Act 2016* and within the framework laid down in Department of Biodiversity, Conservation and Attractions (DBCA) *Corporate Policy Statement No. 35* (DPaW 2015*a*) and *DBCA Corporate Guideline No. 35* (DPaW 2015*b*). In the absence of sufficient scientific information to prepare a recovery plan (RP), an IRP makes provision for the conservation, protection and management of a threatened species or ecological community in order to stop its decline and support its recovery, so that its chances of long-term survival in the wild are maximised. An IRP outlines the recovery actions that are required to address those threatening processes most affecting the ongoing survival of the threatened species or ecological community and begin the recovery process.

DBCA is committed to ensuring that threatened species and ecological communities are conserved through the preparation and implementation of Recovery Plans (RPs) or Interim Recovery Plans (IRPs), and by ensuring that urgent conservation actions commence as soon as possible. A collaborative approach is taken towards the implementation of RPs and IRPs – DBCA works with government departments, other government bodies, research institutions, companies, individuals and other relevant organisations that are identified in a plan as stakeholders. Under Sections 103 and 113 of the *Biodiversity Conservation Act 2016*, public authorities must have regard to RPs and IRPs when performing functions that relate to matters dealt with in a plan.

This plan will operate from April 2020 and will remain in force until withdrawn or replaced. If *Conospermum galeatum* is still listed as threatened flora in Western Australia following five years of implementation, this plan will be reviewed and the need for further recovery actions assessed.

Notice of this plan was published in the Western Australian Government Gazette. The plan was given regional endorsement on 22 January 2020 and was approved by the Executive Director of Biodiversity and Conservation Science on 31 January 2020. Consultation with the Conservation and Parks Commission occurred on 14 February 2020, and the plan was available for public consultation from 19 February to 18 March 2020. The Director General of DBCA approved the plan on 30 April 2020. The attainment of objectives and the provision of funds identified in this plan are subject to budgetary and other constraints affecting the parties involved, as well as the need to address other priorities.

Approved IRPs are subject to amendment where deemed necessary by the Director General. Information in this plan was accurate at January 2020.

Plan preparation: This plan was prepared by:

Robyn Luu	Project Officer, DBCA Species and Communities Program, Locked Bag 104, Bentley Delivery Centre, Western Australia 6983
Tanya Llorens	Botanist, DBCA Species and Communities Program, Locked Bag 104, Bentley Delivery Centre, Western Australia 6983

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

Brett Beecham	Regional Leader, Conservation, DBCA Wheatbelt Region
Andrew Crawford	Research Scientist, WA Seed Centre, DBCA Biodiversity and Conservation Science
Mike Hislop	Technical Officer, DBCA Biodiversity and Conservation Science
Bert Hort	DBCA Volunteer
David Jolliffe	Conservation Coordinator (flora), DBCA Wheatbelt Region
Greg Keighery	Research Associate, DBCA Biodiversity and Conservation Science
Bree Phillips	Flora Conservation Officer, DBCA Wheatbelt Region
Amanda Shade	Curator (Nursery), Botanic Gardens and Parks Authority
Kaitlyn York	Flora Conservation Officer, DBCA Wheatbelt Region

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Cover photograph by Jill Symington.

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Summary

Scientific name:	*Conospermum galeatum*	**NRM region:**	Avon
Common name:	NA	**IBRA region:**	Avon Wheatbelt
Family:	Proteaceae	**IBRA subregion:**	Avon Wheatbelt P1
Flowering period:	August–November	**Recovery team:**	Wheatbelt Region Threatened Flora and Communities Recovery Team
DBCA region:	Wheatbelt		
Shires:	Quairading, Tammin		

Distribution and habitat: *Conospermum galeatum* is confined to two locations near Quairading and Tammin, growing in deep white and yellow sand with *Banksia prionotes* and *Xylomelum angustifolium* (Lullfitz *et al*. 2008).

Habitat important for the survival of the species, and important subpopulations: All known habitat for wild subpopulations is considered to be important for the survival of the species, and all subpopulations are considered to be important for the long-term survival of the species. Habitat important for the survival of *Conospermum galeatum* includes the area of occupancy of subpopulations, areas of similar habitat surrounding and linking subpopulations (these providing potential habitat for subpopulation expansion and for pollinators), additional occurrences of similar habitat that may contain undiscovered subpopulations of the species or be suitable for future translocations, and the local surface hydrology or drainage that maintains the habitat of the species.

Conservation status: *Conospermum galeatum* was originally listed as specially protected under the Western Australian *Wildlife Conservation Act 1950* on 17 February 2012. This Act has now been superseded by the *Biodiversity Conservation Act 2016*. The species is categorised as Critically Endangered in Western Australia under International Union for Conservation of Nature (IUCN) 2001 Red List criteria B1ab(iii,iv)+B2ab(iii,iv); C2a(ii) due to the extent of occurrence being less than 100 km^2; area of occupancy less than 10 km^2; two locations; and continuing decline in the area, extent and/or quality of habitat and number of mature individuals. As *C. galeatum* no longer meets these criteria for Critically Endangered, a process is underway to formally change the listing criteria with a proposed category of Endangered. The species was listed as Critically Endangered under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* on 11 May 2018.

Threats: The threats to the species are hydrological changes, disease, poor recruitment, herbivores, small subpopulation size, habitat degradation, inappropriate fire regimes, rubbish dumping and illegal vehicle access.

Existing recovery actions: DBCA has been overseeing the implementation of recovery actions for *Conospermum galeatum*. The established Wheatbelt Region Threatened Flora and Communities Recovery Team (WRTFCRT) assists with the co-ordination of recovery actions. The following recovery actions have been or are currently being implemented and have been considered in the preparation of this plan:

1. Landowners and managers have been notified of the location and threatened status of *Conospermum galeatum*.
2. Extensive surveys were conducted for *Conospermum galeatum* in 2009, 2011 and 2016 near Kellerberrin, Tammin, Quairading, Badjaling and Narembeen.
3. Approximately 1,700 *Conospermum galeatum* fruits are currently stored at –20°C in the Threatened Flora Seed Collection at the WA Seed Centre, DBCA.
4. Seed bags were placed on individuals at Subpopulation 1 in November 2017 for seed collection.
5. Two individuals located on the firebreak at Subpopulation 1 were caged in 2017 to avoid damage during firebreak maintenance.
6. Water quality testing and soil pathogen testing was undertaken at the subpopulations in consultation with the Shire of Quairading.

7. A Quairading hydrological monitoring plan has been developed by DBCA based on hydrological advice from Department of Water and Environment Regulation (DWER) and DBCA.
8. Monitoring has been carried out opportunistically with numbers of individuals and current threats recorded, and plant locations recorded via GPS.

Plan objectives: The objectives of this plan are to abate identified threats and maintain or enhance extant subpopulations and their habitat to ensure the long-term conservation of the species in the wild.

Performance criteria

Criteria for success
The objectives of this plan will have been achieved if one or more of the following take place over the term of the plan:

- The known subpopulations have remained extant and the number of mature individuals within the subpopulations has increased by >10%; or
- New subpopulations have been found, increasing the number of known subpopulations from three to four or more with no net loss of mature individuals; or
- The area of occupancy has not declined and the number of mature individuals within the known subpopulations has remained within a 10% range or has increased by >10%.

Criteria for failure
The objectives of this plan will not have been achieved if one or more of the following take place over the term of the plan:

- Any subpopulation has been lost that results in a reduction in the extent of occurrence; or
- The number of mature individuals has decreased by >10%; or
- The area of occupancy has decreased by >10%.

Recovery actions

1. Monitor subpopulations
2. Undertake surveys
3. Implement hydrological monitoring plan
4. Undertake regeneration trials
5. Implement grazing control
6. Consider the development of a translocation proposal
7. Develop and implement a fire management strategy
8. Assess the need for weed control and undertake if required
9. Remove rubbish if required
10. Restrict access
11. Collect and store seed
12. Ensure long-term protection of habitat
13. Acquire biological and ecological knowledge
14. Liaise with land managers and Aboriginal communities
15. Promote awareness
16. Map habitat important for the survival of *Conospermum galeatum*
17. Review this plan and evaluate its performance

1. Background

History

Conospermum galeatum was collected from 'Kellerberrin' by R.B. Leake in 1897 with a second collection made from the same location in 1901. The species was described by E.M. Bennett in 1995 from a specimen collected between Bruce Rock and Narembeen by William Blackall in 1929. Collections have since been made between Narembeen and Bruce Rock, Kellerberrin, Tammin and Quairading. The species is currently only known from two locations, one near Quairading and one near Tammin. The location near Quairading was first collected as a WA Herbarium record in 1998 where it was observed as being "common post-fire". Although not recorded since then, this subpopulation may still exist in the seed bank. A second subpopulation at the Quairading location was discovered in 2010 and now constitutes the largest subpopulation. A second location, consisting initially of three juveniles, was discovered in scrub-rolled, recently-burnt vegetation near Tammin by volunteer Bert Hort in 2016. Ten specimens collected from the eastern Darling Range are considered conspecific with typical *C. galeatum* but differ in the hairs on the lower lip being shorter and less dense. These collections have been designated *C.* aff. *galeatum*. Further assessment of the status of the Darling Range morphotype is required in the context of future focused taxonomic work on the genus.

Description

Conospermum galeatum is an open shrub 0.5 to 1 m tall. Inflorescences are formed of diversely branching flower clusters on stems that are extensions of the branch. The perianth is predominantly white with a blue upper lip, woolly in appearance, 5 to 8 mm long and forms a hairy tube. The leaves distinguish it from other local *Conospermum* species and are about 30 to 60 mm long by 0.2 to 0.8 mm wide, slender, thread-like and slightly incurved. The leaf blade is characterised by longitudinal grooves and ends in a sharp point. The scientific name *galeatum* is derived from the Latin word *galeatus* which means helmet shaped (Lullfitz *et al*. 2008).

Illustrations and/or further information

Lullfitz, B., Konnur, A., Alderton, J., Jolliffe, D. and Squire, M. (2008) *Threatened and poorly known flora of the Yilgarn Region*. Department of Environment and Conservation, Bentley, Western Australia.

Western Australian Herbarium (1998–) *FloraBase—the Western Australian Flora*. Department of Biodiversity, Conservation and Attractions. http://florabase.dpaw.wa.gov.au/

Distribution and habitat

Conospermum galeatum is endemic to Western Australia where it is historically known from Bruce Rock, Narembeen, Kellerberrin, Quairading and Tammin. Currently the species occurs in three subpopulations at two locations approximately 25 km apart, one location near Quairading and the other south of Tammin. It grows in deep white and yellow sand and is associated at Subpopulation

1 with *Banksia prionotes*, *Xylomelum angustifolium*, *Adenanthos cygnorum*, *Acacia pulchella*, *Grevillea levis*, *Nuytsia floribunda*, *Leptospermum erubescens*, *Conospermum stoechadis* and *C. eatoniae* (Priority 3) (Lullfitz *et al*. 2008). At Subpopulation 3, *C. galeatum* occurs with *Allocasuarina campestris*, *Isotropis cuneifolia*, *Banksia sphaerocarpa*, *Hakea cygna*, *Callitris arenaria*, *Anigozanthos humilis*, *Calothamnus* sp., *Petrophile* sp., *Dampiera* sp. and *Hibbertia* sp.

The extent of occurrence for extant subpopulations is 19 km^2 and the area of occupancy is estimated to be 8 km^2 using the IUCN (2012) 2 km x 2 km grid system (mapped AOO estimated to be 0.0085 km^2).

The known subpopulations of *C. galeatum* occur on Crown reserves and unallocated Crown land (UCL) that are managed by the Shire of Quairading, and on a nature reserve managed by DBCA (Tables 1 and 2).

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

TPFL subpopulation number & location	DBCA region	Shire	Vesting	Purpose	Manager
1a. Quairading	Wheatbelt	Quairading	Department of Planning, Lands and Heritage	Rifle range and club (historical use only)	Shire of Quairading
1b. Quairading	Wheatbelt	Quairading	Not vested	Unallocated Crown Land	Shire of Quairading
2. Quairading	Wheatbelt	Quairading	Shire of Quairading	Common	Shire of Quairading
3. South of Tammin	Wheatbelt	Tammin	Conservation and Parks Commission (CPC)	Conservation of Flora and Fauna (CFF)	DBCA

Biology and ecology

Conospermum galeatum is thought to be a disturbance opportunist with a short-to-medium life span (10 to 15 years). Adult plants appear to be killed by fire with recruitment of seedlings from soil-stored seed.

The species' response to *Phytophthora* is not known. Soil samples taken from the reserve returned a positive result for two *Phytophthora* species, *P. littoralis* and *P. inundata*, the former thought to be native; and the latter thought to be introduced (Burgess *et al*. 2017). The susceptibility of *Conospermum galeatum* to *Phytophthora* spp. is unknown. Although many Proteaceous species are susceptible to *P. cinnamomi* (Grose 1986), family responses to *Phytophthora* can be poor predictors of species susceptibility (Shearer *et al*. 2013).

Conservation status

Conospermum galeatum was originally listed as specially protected under the Western Australian *Wildlife Conservation Act 1950* on 17 February 2012. This Act has now been superseded by the *Biodiversity Conservation Act 2016*. *Conospermum galeatum* is categorised as Critically Endangered in Western Australia under International Union for Conservation of Nature (IUCN) 2001 Red List criteria B1ab(iii,iv)+B2ab(iii,iv); C2a(ii) due to the extent of occurrence being less than 100 km^2; area

of occupancy less than 10 km^2; two locations; and continuing decline in the area, extent and/or quality of habitat and number of mature individuals. As *C. galeatum* no longer meets these criteria for Critically Endangered, a process is underway to formally change the listing criteria with a proposed category of Endangered. The species was listed as Critically Endangered under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) on 11 May 2018.

Threats

The following threats to the survival of *Conospermum galeatum* have been identified:

- **Hydrological changes.** Sudden plant deaths at Subpopulation 1 were observed in August 2018 following a surface water flooding event within the reserve. Water quality testing, undertaken in consultation with the Shire of Quairading, concluded the water was slightly brackish (5.13mS) and slightly alkaline (7.9). It is likely this flood event is a common occurrence when the valley floor becomes saturated with groundwater perched upon bedrock. Initial investigations indicate that plant deaths may be due to an increase in soil acidity and waterlogging (B. Phillips[1], pers. comm.).
- **Disease.** Soil samples taken from near Subpopulation 1 in 2018 returned a positive result for two *Phytophthora* species, the native *P. littoralis* and introduced *P. inundata*. It is not known whether *Conospermum galeatum* is susceptible to these pathogens. However, some other plant species that occur in the same habitat are highly susceptible to *Phytophthora* spp. and any changes to vegetation composition may impact on *C. galeatum* over the long term. Land managers should be aware of the presence of these pathogens in their water source and use appropriate measures to prevent or remediate infection of plants.
- **Poor recruitment** has been observed in the species in the past due to a reduction in fire frequency or other factors in the species' habitat which may positively influence reproduction. Utilisation of fire as a tool for management should be investigated.
- **Herbivores.** Rabbits and kangaroos are present at all subpopulations and have the potential to impact negatively on the species and its associated habitat through grazing, digging and the input of nutrients into the soil. Netted cages have been erected around individuals at Subpopulation 3 to reduce grazing.
- **Small subpopulation size.** As *C. galeatum* is known from mature plants in only two small subpopulations, there is a high likelihood of the species declining due to stochastic demographic or environmental events such as wildfire.
- **Habitat degradation.** Habitat degradation due to weed invasion is a threat to Subpopulation 1 of *C. galeatum*.
- **Inappropriate fire regimes** are likely to impact the viability of the subpopulations. Seeds of *C. galeatum* germinate following fire; however, fire occurring too frequently could deplete the soil seed store. If fire occurs too infrequently (likely to be several decades), the soil seed store may decay, preventing the regeneration of populations where adult plants have senesced. Fire may facilitate weed invasion in disturbed areas and should be followed up with appropriate weed control.
- **Rubbish dumping** including garden refuse and other material into the bushland is a threat to Subpopulation 1 of *C. galeatum*.
- **Illegal vehicle access,** particularly motorbikes, is a threat to Subpopulation 1. The habitat is at risk of degradation with erosion of vegetation occurring where tracks have been created, and

[1] Flora Conservation Officer, DBCA Wheatbelt Region

there is an increased risk of trampling damaging the species. In the past, branches have been placed along the tracks to block access.

The intent of this plan is to identify actions that will mitigate immediate threats to *Conospermum galeatum*. 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 2. Summary of subpopulation information and threats

TPFL subpopulation number & location	Land status	Year / no. of mature individuals		Current condition of:		Recent fire history	Threats
				Plants	Habitat		
1. Quairading	Crown land managed by Shire	2010 2011 2012 2016 2017 2018 2019	14 [4] 24 (17) [23] 30 (10) 16 175 308 254 [44]	Moderate	Moderate	1996 (BF) 2015 (PB – partial subpopulation)	Hydrological changes, disease, weeds, inappropriate fire, grazing (rabbits), rubbish dumping, illegal vehicle use, poor recruitment, small subpopulation size
2. Quairading	Common	1998	"Common"			1996 (BF)	Lack of recruitment
3. South of Tammin	Nature reserve	2016 2017	(3) 8	Healthy	Very good	May 2015 (PB)	Hydrological changes, disease, inappropriate fire, grazing (kangaroos), small subpopulation size, disease

Note: ( ) = number of seedlings/juveniles; [ ] = number of dead individuals. Subpopulation 2 refers to collection PERTH 05437865. Fire history refers to bushfire (BF) or prescribed burn (PB) events where details are known or suspected.

Guide for decision-makers

Section 1 provides details of current and possible future threats. Proposed development and/or land clearing activities in the immediate vicinity of *Conospermum galeatum* may require formal assessment. Actions that could cause any of the following may potentially produce a significant impact on the species:

- Damage or destruction of occupied or potential habitat;
- Alteration of the local surface hydrology or drainage;
- Reduction in subpopulation size;
- A major increase in disturbance in the vicinity of the subpopulations.

Habitat important for the survival of the species, and important subpopulations

All subpopulations and all known habitat for subpopulations are considered to be important for the survival of the species. Habitat important for the survival of *Conospermum galeatum* includes the

area of occupancy of subpopulations, areas of similar habitat surrounding and linking subpopulations (these providing potential habitat for subpopulation expansion and for pollinators), additional occurrences of similar habitat that may contain undiscovered subpopulations of the species or be suitable for future translocations, and the local surface hydrology or drainage 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 *Conospermum galeatum* will also benefit three threatened and nine priority flora species listed in Table 3.

Table 3. Conservation-listed flora species occurring within 500 m of *Conospermum galeatum*

Species name	Conservation status (WA)	Conservation status (EPBC Act 1999)
Banksia cuneata	Threatened (EN)	EN
Jacksonia quairading	Threatened (EN)	EN
Calectasia pignattiana	Threatened (VU)	VU
Banksia splendida subsp. *splendida*	Priority 2	-
Jacksonia rubra	Priority 2	-
Leucopogon cymbiformis	Priority 2	-
Stylidium pseudosacculatum	Priority 2	-
Stylidium squamellosum	Priority 2	-
Acacia phaeocalyx	Priority 3	-
Banksia horrida	Priority 3	-
Conospermum eatoniae	Priority 3	-
Stylidium sacculatum	Priority 3	-

For a description of conservation codes for Western Australian flora and fauna see https://www.dpaw.wa.gov.au/images/documents/plants-animals/threatened-species/Listings/Conservation%20code%20definitions.pdf

Subpopulation 2 of *Conospermum galeatum* occurs within the priority 1 ecological community (PEC) '*Banksia prionotes* and *Xylomelum angustifolium* low woodlands on transported yellow sand'[2]. This community has a species-rich understorey consisting of *Grevillea eriostachya*, *Melaleuca leptospermoides*, *Verticordia roei*, *Calytrix leschenaultii*, *Dampiera* spp., *Tetrapora preissiana* and *Borya constricta*. Subpopulation 1b also occurs on the edge of the Priority 3 ecological community 'Eucalypt woodlands of the Western Australian Wheatbelt'.

One threatened fauna species, Shield-backed Trapdoor Spider (*Idiosoma nigrum*), may also benefit from the management of *Conospermum galeatum*.

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. *Conospermum galeatum* 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.

[2] For definitions and categories of Priority Ecological Communities (PECs) see https://www.dpaw.wa.gov.au/images/plants-animals/threatened-species/definitions_categories_and_criteria_for_threatened_and_priority_ecological_communities.pdf.

Stakeholder consultation

In the course of preparing this plan, the authors consulted with the following stakeholders:

- Conservation and Parks Commission
- Department of Planning, Lands and Heritage
- Shire of Quairading

Aboriginal engagement

Involvement of the Aboriginal community will be sought through the working group for the Ballardong Regional Corporation of the South West Native Title Settlement, to assist in the identification of cultural values for land occupied by *Conospermum galeatum*, to identify any groups with a cultural connection to land that is important for the species' conservation, and to determine whether there are any community issues or interests identified in the IRP. Continued liaison between DBCA and the Aboriginal community will identify areas in which collaboration will assist implementation of recovery actions. The opportunity for involvement of the Aboriginal community in the implementation of the plan is included as a recovery action.

A search of the Department of Planning, Lands and Heritage Aboriginal Heritage Inquiry System did not reveal any sites of Aboriginal significance adjacent to the subpopulations of *Conospermum galeatum*. 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

Subpopulations 1 and 2 occur on UCL and Crown reserves, both of which are managed by the Shire of Quairading. Social and economic impacts may occur through the cost of implementing recovery actions (removing rubbish, controlling weeds, controlling access), and restrictions imposed on the management of this land.

Affected interests

The implementation of this IRP has some implications for the Shire of Quairading. Recovery actions refer to continued liaison between affected stakeholders.

Evaluation of the plan's performance

DBCA, with the assistance of the Wheatbelt Region Threatened Flora and Communities Recovery Team (WRTFCRT) will evaluate the performance of this plan. The plan will be reviewed following five years of implementation.

2. Recovery objectives and criteria

Plan objectives

The objectives of this plan are to abate identified threats and maintain or enhance extant subpopulations and their habitat, to ensure the long-term conservation of *Conospermum galeatum* in the wild.

Performance criteria

Criteria for success
The objectives of this plan will have been achieved if one or more of the following take place over the term of the plan:

- The known subpopulations have remained extant and the number of mature individuals within the subpopulations has increased by >10%; or
- New subpopulations have been found, increasing the number of known subpopulations from three to four or more with no net loss of mature individuals; or
- The area of occupancy has not declined and the number of mature individuals within the known subpopulations has remained within a 10% range or has increased by >10%.

Criteria for failure
The objectives of this plan will not have been achieved if one or more of the following take place over the term of the plan:

- Any subpopulation has been lost that results in a reduction in the extent of occurrence; or
- The number of mature individuals has decreased by >10%; or
- The area of occupancy has decreased by >10%.

3. Recovery actions

Existing recovery actions

DBCA is overseeing the implementation of recovery actions for *Conospermum galeatum*. The established WRTFCRT assists with the co-ordination of recovery actions.

Notifications sent to the Shire of Quairading detail the current threatened status of *C. galeatum* and the associated legal obligations in regard to its protection.

Extensive surveys were conducted for *C. galeatum* in 2009, 2011 and 2016. Remnant vegetation near Kellerberrin, Tammin, Quairading, Badjaling and Narembeen was searched, and two new subpopulations were discovered.

Approximately 1,700 *C. galeatum* fruits are currently stored at –20°C in the Threatened Flora Seed Collection (TFSC) at the WA Seed Centre (see Table 4). Most of the fruit has not been tested for viability or germination. Seed bags were placed on individuals at Subpopulation 1 in November 2017 for seed collection.

Table 4. WA Seed Centre collection details for Subpopulation 1 of *Conospermum galeatum*

Accession number	Date collected	Individuals in storage[1]	Fruits in storage	Estimated germinable seeds
03629-1	30/11/2011	I/2	28	not yet tested
03766-1	15/11/2012	I/23	1,421	not yet tested
04502-1	15/12/2014	I/5	261	207
06309-1	9/01/2018		not yet processed	

[1]I =a collection of individuals/number of individual plants that seeds were collected from

Two individuals located on the firebreak at Subpopulation 1 were caged in 2017 to avoid damage during firebreak maintenance.

Water quality testing and soil pathogen testing was undertaken in 2018 and 2019 at Subpopulation 1 in consultation with the Shire of Quairading. A hydrological monitoring plan was subsequently developed by DBCA (DBCA 2019), based on hydrological advice received from Department of Water and Environment Regulation (DWER) and DBCA. The plan is in the early stage of implementation.

Monitoring has been carried out opportunistically with numbers of individuals and current threats recorded. Global Positioning System (GPS) locations of individuals within subpopulations have been recorded in Geographic Information System databases at Wheatbelt Region and within Species and Communities Program (SCP).

Future recovery actions

DBCA will continue to oversee the implementation of recovery actions for *Conospermum galeatum*. The WRTFCRT helps to coordinate recovery activities for many species and ecological communities, including *C. galeatum*.

The following recovery actions are approximately 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. Where these recovery actions are implemented on lands other than those managed by DBCA, permission has been or will be sought from the appropriate land managers prior to actions being undertaken.

1. Monitor subpopulations

Monitoring of subpopulations and their habitat should be undertaken regularly to identify trends or potential management requirements. Subpopulation monitoring should record the health and expansion or decline of subpopulations, and other observations such as pollinator activity or seed production. Site monitoring should include observations of grazing, habitat degradation including weed invasion, and hydrological status (drought). Specific monitoring of hydrology and activities relating to research into the biology and ecology of *Conospermum galeatum* are included in other recovery actions detailed below.

Action: Monitor subpopulations
Responsibility: DBCA (Wheatbelt Region)
Cost: $4,000 per year

2. Undertake surveys

Surveys for new occurrences or extensions to known subpopulations should be undertaken from late August to early November in areas of potential habitat. All surveyed areas should be recorded and the presence or absence of *Conospermum galeatum* documented to improve survey efficiency and prevent duplication of effort. As the species germinates in response to fire, locations of old collections, particularly collection PERTH 05437865 from near Quairading (Subpopulation 2), should be surveyed after they are burnt. Where feasible, volunteers will be encouraged to participate.

Action: Undertake surveys
Responsibility: DBCA (Wheatbelt Region), with assistance from volunteers
Cost: $10,000 per year

3. Implement hydrological monitoring plan

The draft Quairading Hydrological Monitoring Plan (2019–2021) will continue to be implemented. The plan aims to:

- Monitor the impact of the surface water on *C. galeatum* to inform further management decisions.
- Implement hygiene management protocols to reduce the spread of *Phytophthora* species. A hygiene management plan will be developed and implemented at the site in consultation with the Shire of Quairading. Disease hygiene as outlined in DPaW (2015*d*) will be followed with access restricted to dry soil conditions where possible and additional hygiene measures undertaken during moist soil conditions.
- Salvage material from a range of *C. galeatum* plants for ex situ conservation if the subpopulations cannot be effectively managed in situ (see Action 11) (DBCA 2019).

Action: Implement hydrological monitoring plan
Responsibility: DBCA (Wheatbelt Region), Shire of Quairading
Cost: As outlined in monitoring plan

4. Undertake regeneration trials

Observational evidence suggests that appropriate natural disturbance events (physical or fire) may be the most effective means of germinating *Conospermum galeatum* in the wild. Different disturbance techniques should be investigated (i.e. soil disturbance and fire) at Subpopulation 1 and/or 2, to determine the most successful and appropriate method. Records will need to be maintained for future research. Any disturbance trials will need to be undertaken in conjunction with weed control.

Action: Undertake regeneration trials
Responsibility: DBCA (Biodiversity and Conservation Science, Wheatbelt Region)
Cost: $10,000 in years 1 and 3, $4,000 in years 2, 4 and 5

5. Implement grazing control

If annual monitoring of *Conospermum galeatum* ascertains that the threat from rabbits and kangaroos is high, control measures such as protective fencing, baiting (rabbits) and trapping may be required.

Action: Implement grazing control
Responsibility: DBCA (Wheatbelt Region), Shire of Quairading
Cost: $4,000 in years 1, 3 and 5

6. Consider the development of a translocation proposal

Translocations may be required for the long-term conservation of *Conospermum galeatum* if the natural subpopulations decline, with the priority being augmentation of any secure subpopulations. Translocation should not be used as a substitute for encouraging natural regeneration from existing soil seed banks, but may be useful in complementing natural regeneration.

Information on the translocation of threatened plants and animals in the wild is provided in DBCA Corporate Policy Statement No. 35 (DPaW 2015*a*), DBCA Corporate Guideline No. 36 (DPaW 2015*c*) and the Australian Network for Plant Conservation (ANPC) Translocation Guidelines (Commander *et al*. 2018). A translocation may decrease the risk of extinction when a species is represented by few subpopulations and the creation of additional self-sustaining, secure subpopulations may decrease its susceptibility to catastrophic events and environmental stochasticity (Commander *et al*. 2018). For small subpopulations that may be declining in size or subject to high levels of inbreeding, successful subpopulation enhancement may increase subpopulation stability and hence long-term viability (Commander *et al*. 2018).

Depending on the characteristics of the species, a minimum viable subpopulation size of 200 to 250 mature individuals is a useful initial translocation target (Commander *et al*. 2018), but 1,000 or more individuals may be required to maintain evolutionary potential (Frankham *et al*. 2014). Suitable translocation sites may include where the species currently occurs, where it was known to have occurred historically, and other areas that contain similar habitat (soil, associated vegetation type and structure, aspect, mutualisms *etc*.), preferably within the known range of the species (Commander *et al*. 2018). Other factors that should be considered when selecting recipient sites include the security of land tenure for conservation, the ability to effectively mitigate threats to the species, and potential negative consequences to existing biodiversity and cultural values at the site (Commander *et al*. 2018).

All translocation proposals require the approval of DBCA's Executive Director of Biodiversity and Conservation Science. Monitoring of translocations and reporting against success criteria are essential components of a translocation and will be included in the timetable developed for the translocation proposal.

Action: Develop and implement a translocation proposal
Responsibility: DBCA (Biodiversity and Conservation Science, Wheatbelt Region)
Cost: $42,000 in years 1–2; and $26,500 in years 3–5 as required

7. Develop and implement a fire management strategy

A fire management strategy will be developed in consultation with land owners/managers that recommends fire frequency, intensity and seasonality, precautions to prevent wildfire and strategies for reacting to wildfire, and the need, method of construction and maintenance of firebreaks. The risk of too-frequent or otherwise inappropriate fire occurring in the habitat of the subpopulations should be minimised, except where it is being used to assist recovery.

Action: Develop and implement a fire management strategy
Responsibility: DBCA (Wheatbelt Region)
Cost: $10,000 in year 1, and $6,000 in years 2–5

8. Assess the need for weed control and undertake if required

As weeds have the potential to impact Subpopulation 1, the following actions are recommended where required:

1. Determine which weeds are present and map them;
2. If considered a threat, select and implement appropriate control techniques;
3. Monitor the success of the treatment in controlling the weeds, and the tolerance of *C. galeatum* plants and associated native plant species to the treatment methods; and
4. Report on the method and success of the treatment.

Action: Assess the need for weed control and undertake if required
Responsibility: DBCA (Wheatbelt Region)
Cost: $10,000 per year, as required

9. Remove rubbish if required

If rubbish is dumped within the habitat of Subpopulation 1 of *Conospermum galeatum*, the need for it to be removed will be assessed.

Action: Remove rubbish if required
Responsibility: DBCA (Wheatbelt Region), Shire of Quairading
Cost: $5,000 in year 1

10. Restrict access

Barriers such as bollards or fencing may be required to control access to Subpopulation 1 and protect vegetation.

Action: Restrict access
Responsibility: DBCA (Wheatbelt Region), Shire of Quairading
Cost: $10,000 in year 1

11. Collect and store seed

To guard against the extinction of the natural subpopulations of *Conospermum galeatum*, additional seed should be collected and stored in the TFSC at the WA Seed Centre. Collections should be made from a wide range of reproductive plants in order to sample and preserve the maximum possible range of genetic diversity.

Action: Collect and store seed
Responsibility: DBCA (Wheatbelt Region, TFSC at WA Seed Centre)
Cost: $4,000 per year

12. Ensure long-term protection of habitat

DBCA will investigate ways and means of achieving long-term protection of habitat at Subpopulations 1 and 2.

Action: Ensure long-term protection of habitat
Responsibility: DBCA (Wheatbelt Region, SCP)
Cost: $2,000 per year

13. Acquire biological and ecological knowledge

It is recommended that research be conducted to acquire additional knowledge of the biology and ecology of *Conospermum galeatum* to inform effective management. Research is required in the following areas, approximately in order of descending priority:

1. Clarification of the taxonomic boundary between *C. galeatum* and *C.* aff. *galeatum*;
2. Soil seed bank dynamics and the role of various factors including disturbance, competition, drought, inundation and grazing in recruitment and seedling survival;
3. Identification of pollinators and their habitat requirements;
4. Reproductive strategies, phenology and seasonal growth;
5. Reproductive success and pollination biology; and
6. Longevity of plants, time taken to reach maturity, and minimum viable population size.

Action: Aquire biological and ecological knowledge
Responsibility: DBCA (Biodiversity and Conservation Science, Wheatbelt Region)
Cost: $50,000 in years 1–3

14. Liaise with land managers and Aboriginal communities

Staff from DBCA Wheatbelt Region will liaise with the Shires of Quairading and Tammin to ensure that subpopulations of *Conospermum galeatum* are not accidentaly damaged or destroyed, and their habitat is maintained in a suitable condition for the conservation of the species. Consultation with the Aboriginal community will take place to determine any issues or interests in areas that are habitat for the species.

Action: Liaise with land managers and Aboriginal communities

Responsibility: DBCA (Wheatbelt Region)
Cost: $2,000 per year

15. Promote awareness

The importance of biodiversity conservation and the protection of *Conospermum galeatum* will be promoted to the public. This will be achieved through an information campaign using local print and electronic media and by setting up poster displays. Formal links with local naturalist groups and interested individuals will also be encouraged.

Action: Promote awareness
Responsibility: DBCA (Wheatbelt Region, SCP, Public Information and Corporate Affairs (PICA))
Cost: $7,000 in years 1–2; $5,000 in years 3–5

16. Map habitat important for the survival of *Conospermum galeatum*

Although spatial data relating to habitat that is important for the survival of *Conospermum galeatum* has been identified in Section 1, it has not been mapped. If additional subpopulations are located, habitat important for their survival will also be determined and mapped.

Action: Map habitat important for the survival of *Conospermum galeatum*
Responsibility: DBCA (Wheatbelt Region, SCP)
Cost: $6,000 in year 2

17. Review this plan and evaluate its performance

DBCA, in conjunction with the WRTFCRT, will evaluate the performance of this Interim Recovery Plan. If *C. galeatum* is still listed as threatened in Western Australia following five years of implementation of this plan, the plan will be reviewed and an assessment made of the need for a new or revised plan.

Action: Review this plan and evaluate its performance
Responsibility: DBCA (SCP, Wheatbelt Region)
Cost: $6,000 in year 5

Table 5. Summary of recovery actions

Recovery action	Priority	Responsibility	Completion date
Monitor subpopulations	High	DBCA (Wheatbelt Region)	Ongoing
Undertake surveys	High	DBCA (Wheatbelt Region), with assistance from volunteers	Ongoing
Implement hydrological monitoring plan	High	DBCA (Wheatbelt Region), Shire of Quairading	2021
Undertake regeneration trials	High	DBCA (Biodiversity and Conservation Science, Wheatbelt Region)	2024
Implement grazing control	High	DBCA (Wheatbelt Region), Shire of Quairading	Ongoing
Consider the development of a translocation proposal	High	DBCA (Biodiversity and Conservation Science, Wheatbelt Region)	2024
Develop and implement a fire management strategy	High	DBCA (Wheatbelt Region)	Developed initially, implementation ongoing
Assess the need for weed control and undertake if required	High	DBCA (Wheatbelt Region)	Ongoing
Remove rubbish if required	High	DBCA (Wheatbelt Region), Shire of Quairading	2020
Restrict access	High	DBCA (Wheatbelt Region), Shire of Quairading	2020
Collect and store seed	High	DBCA (Wheatbelt Region TFSC at WA Seed Centre)	2024
Ensure long-term protection of habitat	High	DBCA (Wheatbelt Region, SCP)	2024
Acquire biological and ecological knowledge	High	DBCA (Biodiversity and Conservation Science, Wheatbelt Region)	2022
Liaise with land managers and Aboriginal communities	Medium	DBCA (Wheatbelt Region)	Ongoing
Promote awareness	Medium	DBCA (Wheatbelt Region, SCP, PICA)	2024
Map habitat important for the survival of *Conospermum galeatum*	Medium	DBCA (SCP, Wheatbelt Region)	2021
Review this plan and evaluate its performance	Medium	DBCA (SCP, Wheatbelt Region)	2024

4. Term of plan

This plan will operate from April 2020 and will remain in force until withdrawn or replaced. If *Conospermum galeatum* is still listed as threatened following five years of implementation, the plan will be reviewed and the need for further recovery actions assessed.

5. References

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6. Taxonomic description

Description by E.M. Bennett in *Flora of Australia* 16: 485 (1995).

Open shrub to 70 cm tall. Leaves filiform, 4–5 cm long, c. 0.5mm wide, curved, canaliculated, acute. Inflorescence a panicle of spikes; axis an extension of the branch; peduncle 16–20 cm long, glabrous, striate; rachis glabrous; bracteoles ovate, 2.5–3 mm long, 2–3 mm wide, blue, woolly at base and sides, acute. Perianth white, woolly; tube 5–8 mm long; upper lip ovate, 1–1.5 mm long, c. 2 mm wide, blue, glabrous, with ±scattered white hairs on midline, woolly at base; apex acute, recurved; lower lip united for c. 1 mm; lobes oblong, 0.75–1 mm long, 0.25 mm wide, short- woolly, recurved.