

# Abridged Threatened Species Nomination Form

For nominations/assessments under the Common Assessment Method (CAM) where supporting information is available, but not in a format suitable for demonstrating compliance with the CAM, and assessment against the IUCN Red List threat status.

## Cover Page *(Office use only for Assessment)*

<b>Species name</b> (scientific and common name):	<b><i>Rhizanthella gardneri</i> (Western Underground Orchid)</b>
<b>Nomination for</b> (addition, deletion, change):	<b>Change of criteria</b>
<b>Nominated conservation category and criteria:</b>	<b>CR C1+2a(i); D</b>

Scientific committee assessment of eligibility against the criteria:		
This assessment is consistent with the standards set out in Schedule 1, item 2.7 (h) and 2.8 of the Common Assessment Method Memorandum of Understanding.		Yes <input type="checkbox"/> No <input type="checkbox"/>
<b>A.</b>	Population size reduction	•
<b>B.</b>	Geographic range	•
<b>C.</b>	Small population size and decline	•
<b>D.</b>	Very small or restricted population	•
<b>E.</b>	Quantitative analysis	•

Outcome:	
<i>Scientific committee Meeting date:</i>	
<i>Scientific committee comments:</i>	
<i>Recommendation:</i>	

<i>Ministerial approval:</i>		<i>Date of Gazetta/ Legislative effect:</i>	
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# Nomination/Proposal summary *(to be completed by nominator)*

Current conservation status				
Scientific name:	<i>Rhizanthella gardneri</i>			
Common name:	Underground orchid			
Family name:	Orchidaceae	Fauna <input type="checkbox"/>	Flora <input checked="" type="checkbox"/>	
Nomination for:	Listing <input type="checkbox"/>	Change of status/criteria <input checked="" type="checkbox"/>	Delisting <input type="checkbox"/>	
1. Is the species currently on any conservation list, either in a State or Territory, Australia or Internationally? 2. Is it present in an Australian jurisdiction, but not listed?		Provide details of the occurrence and listing status for each jurisdiction in the following table		
Jurisdiction	State / Territory in which the species occurs	Date listed or assessed (or N/A)	Listing category i.e. critically endangered or 'none'	Listing criteria i.e. B1ab(iii)+2ab(iii)
International(IUCN Red List)				
National (EPBC Act)			Endangered (as previously circumscribed as <i>R. gardneri</i> )	
State/Territory	1. WA (as previously circumscribed as <i>R. gardneri</i> )	1980	Critically Endangered	B2ab(ii,iii,v); C2a(i); D
		17/8/2010	Critically Endangered	B2ab(iii); D
	2. WA	10/4/2018 (TSSC)	Critically Endangered	C1+2a (i); D
Consistent with Schedule 1, item 2.7 (h) and 2.8 of the Common Assessment Method Memorandum of Understanding, it is confirmed that:				
<ul style="list-style-type: none"> <li>this assessment meets the standard of evidence required by the Common Assessment Method to document the eligibility of the species under the IUCN criteria;</li> </ul>			Yes <input checked="" type="checkbox"/>	No <input type="checkbox"/>
Comments:				
<ul style="list-style-type: none"> <li>surveys of the species were adequate to inform the assessment;</li> </ul>			Yes <input checked="" type="checkbox"/>	No <input type="checkbox"/>
Comments:	There is some variability in annual counts due to the cryptic nature of the species, and the potential to disrupt populations if frequent intensive monitoring was undertaken.			
<ul style="list-style-type: none"> <li>the conclusion of the assessment remains current and that any further information that may have become available since the assessment was completed supports or is consistent with the conclusion of the assessment.</li> </ul>			Yes <input checked="" type="checkbox"/>	No <input type="checkbox"/>

<b>Comments:</b>		<p><i>Rhizanthella gardneri</i> is currently listed as Endangered under the EPBC Act. This listing was a transition listing in 1999 from the <i>Endangered Species Protection Act 1992</i>, which did not have a Critically Endangered category. The species was known from two disjunct areas approximately 300 km apart. However, Dixon and Christenhusz (2018) revised the taxonomy of the species and determined that the southern subpopulations, situated in the Munglinup area, approximately 90 km west of Esperance on the southern coast of WA, are a separate species, <i>R. johnstonii</i>, based on differences in morphology and distribution. This nomination seeks to amend the ranking criteria of <i>R. gardneri</i> as it is now circumscribed, and update the ranking under the EPBC Act. Another nomination seeks to separately list <i>R. johnstonii</i>.</p> <p>The area of occupancy is now calculated as 12 km<sup>2</sup> using the 2 km by 2 km grid system, which exceeds the threshold for CR under criterion B2 (&lt; 10 km<sup>2</sup>), and this criterion is no longer applicable. Monitoring has shown the species has declined over the past 29-36 years, although variability in doing plant counts makes it unreliable to estimate a rate of decline. A decline in habitat quality from drying climate and subsequent effects on associated habitat, weeds, rabbits and inappropriate fire regimes has also been observed and is expected to continue without ongoing management. Criterion CR C1+2a(i) now applies.</p> <p>The total count of mature individuals has not exceeded 50 since 1982/89. Criterion CR D applies.</p>
<b>Nominated national conservation status: category and criteria</b>		
Presumed extinct (EX) <input type="checkbox"/> Critically endangered (CR) <input checked="" type="checkbox"/> Endangered (EN) <input type="checkbox"/> Vulnerable (VU) <input type="checkbox"/>		
None (least concern) <input type="checkbox"/> Data Deficient <input type="checkbox"/> Conservation Dependent <input type="checkbox"/>		
<b>What are the IUCN Red List criteria that support the recommended conservation status category?</b>		<b>CR: C1+2a(i); D</b>
<b>Eligibility against the IUCN Red List criteria (A, B, C, D and E)</b>		
<i>Provide justification for the nominated conservation status; is the species eligible or ineligible for listing against the five criteria. For <b>delisting</b>, provide details for why the species no longer meets the requirements of the current conservation status.</i>		
<b>A.</b>	Population size reduction (evidence of decline)	<ul style="list-style-type: none"> <li>The species has potentially declined by 94% over 29-36 years, however, reliable population trend information is not available due to the cryptic nature of the species, and the potential to disrupt populations if frequent intensive monitoring was undertaken. It cannot be reliably stated that the past decline was greater than 80%.</li> <li><b>Unable to assess</b></li> </ul>
<b>B.</b>	Geographic range (EOO and AOO, number of locations and evidence of decline)	<ul style="list-style-type: none"> <li>(B1) Using Minimum Convex Polygon (MCP) the EOO is approximately 105 km<sup>2</sup> which was calculated by drawing a polygon around the plants.</li> <li>(B2) Area of Occupancy is 12 km<sup>2</sup> using the 2 km x 2 km grid method, or mapped area of 0.225 km<sup>2</sup>.</li> <li>(a) Known from two locations, in the Corrigin area southeast of Perth, which are severely fragmented. The two locations occur in a highly cleared landscape with a distance of approximately 35 km between them. The seed dispersal agent is currently unknown, but it is thought that small marsupials may eat the succulent fruits produced by the plant and deposit seed in their faeces.</li> <li>(b) Continuing decline observed and projected:</li> </ul>

		<ul style="list-style-type: none"> <li>(iii) Ongoing threats to habitat quality from drying climate and subsequent effects on associated habitat, and from competition from invasive weeds, damage and disturbance to individuals of the species by rabbits, and inappropriate fire regimes.</li> <li><b>Meets criteria for Endangered B1ab(iii)+2ab(iii)</b></li> </ul>
<b>C.</b>	Small population size and decline  (population size, distribution and evidence of decline)	<ul style="list-style-type: none"> <li>(C) Known from nine (and less than 50 over the past 30 years) mature individuals in total.</li> <li>(C1) The number of individuals for this species has declined from 152 plants in 1982/1989 to approximately nine plants in 2017. This is a potential decline of 94% over 29-36 years, although variability in doing plant counts may mean this decline is less, but not significantly less, than this rate. The generation length is unknown, however is likely to be less than eight to 10 years, and so the observed decline per generation would likely be greater than the 25% decline required to meet Critically Endangered Criteria C1.</li> <li>(C2) (a) There has been an observed decline in number of individuals at two subpopulations. The Babakin subpopulation has declined from 110 plants in 1982, to only three plants being observed in 2017. The Kunjin subpopulation has declined from 38 plants in 1989, to two plants being observed in 2017. The subpopulation west of Babakin has remained relatively stable in plant numbers, with plant numbers ranging between four to 10 plants over the 36 years known to exist. It is projected that there will be a continuing decline in the future as the quality of the habitat continues to decline.</li> <li>(i) As shown in the table in Appendix A, each subpopulation contains &lt; 50 mature individuals.</li> <li>(ii) Subpopulation 2 (Babakin, NE of Corrigin) contains 44 % of the total number of individuals.</li> <li><b>Meets criteria for Critically Endangered C1+2a(i)</b></li> </ul>
<b>D.</b>	Very small or restricted population  (population size)	<ul style="list-style-type: none"> <li>(D) There were a total of nine plants recorded from the three subpopulations in 2017 based on partial counts. There is some variability in the annual counts, but since 2001 the total annual counts of mature individuals has not exceeded 29 (&lt; 50).</li> <li><b>Meets Critically Endangered D</b></li> </ul>
<b>E.</b>	Quantitative analysis  (statistical probability of extinction)	<ul style="list-style-type: none"> <li>No information to assess.</li> </ul>

#### Summary of assessment information

EOO	105 km <sup>2</sup> (MCP)	AOO	12 km <sup>2</sup> (2 km x 2 km grid) or mapped area of 0.225 km <sup>2</sup> .	Generation length	Unknown
No. locations	2	Severely fragmented	Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Unknown <input type="checkbox"/>		
No. subpopulations	3	No. mature individuals	9 (partial counts)		
Percentage global population within Australia				100	



Percentage population decline over 10 years or 3 generations	Unknown
<b>Morphology / physical description (provide details)</b>	
<p><i>Rhizanthella gardneri</i> is a small, succulent, tuberous, perennial herb. The plants have a horizontal, thickened, branching rhizome 6 to 12 cm below ground level (Rogers 1928, DEC 2010). The pink-purple flowers are approximately 6 mm long and 5 mm wide, erect and solitary and produced on an underground capitulum. This species is almost completely subterranean except occasionally the ends of the bracts of the capitulum can emerge from the soil (Spooner 2003). The Western underground orchid is leafless and lacks chlorophyll (DEC 2010).</p> <p><i>Rhizanthella gardneri</i> differs from <i>R. johnstonii</i> (South Coast Underground Orchid) in flowering earlier and having more flowers in a larger capitulum that are a much darker purple pink. The bracts are also darker, purple pink on the margins and apex. The species also has a different <i>Melaleuca</i> host preference of <i>M. scalena</i>. (Dixon and Christenhusz 2018).</p>	
	
Photograph of <i>Rhizanthella gardneri</i> by Andrew Brown.	
<b>Survey effort</b>	
<p><i>Rhizanthella gardneri</i> was fortuitously discovered seven times between 1928 and 1959 during ploughing of recently rolled and burnt bushland between Corrigin and Dowerin in the Western Australian wheatbelt. Following the</p>	

discovery of the species near Munglinup (now the related south coast underground orchid *Rhizanthella johnstonii*) in 1979, Dr Kingsley Dixon and members of the WA Native Orchid Study and Conservation Group (WANOSCG) undertook targeted surveys for the species, and in 1981 and 1982 located two more subpopulations near the original sighting at Corrigin. In 1985 a further subpopulation was discovered west of Corrigin and some 36 flowering plants were located at the site during surveys in 1989 (DEC 2010). In 2017, orchid specialist Andrew Brown and some volunteers undertook monitoring of the known occurrences of *Rhizanthella gardneri*, and whilst doing so did opportunistic searches of adjoining potential habitat. No new populations have been located since 1985.

#### Distribution (provide details)

*Rhizanthella gardneri* is endemic to Western Australia. It is known from two locations in the Corrigin area southeast of Perth, in the Wheatbelt region (DEC 2010). Plants occur under leaf and bark litter in thickets of *Melaleuca scalena* with scattered emergent *Eucalyptus* and *Acacia* species. Soil is either sandy-clay or sandy-loam. Populations occur in a conservation reserve and a town reserve (DEC 2010).

#### Biology / ecology (provide details)

*Rhizanthella gardneri* flowers in mid-May to early June (DEC 2010). Each plant produces up to 100 small, inward facing, cream to reddish coloured flowers, encased in a circle of 6 to 12 large, cream or pinkish-cream to violet bracts (DEC 2010). These bracts form a tulip-like head that curves over the flowers forming a protective canopy over the flowers. Once pollinated, each flower produces a berry-like fleshy fruit containing 20 to 150 seeds. The fruit does not open spontaneously to release the seeds; this is unique amongst the Western Australian orchids as all other orchid species produce a pod that opens spontaneously, releasing thousands of minute seeds that are dispersed by the wind (DEC 2010).

The species is holomycotrophic and acquires nutrients from a shared mycorrhizal fungus (*Ceratobasidium* sp.) association with the fine root systems of *Melaleuca scalena* and grows in coarse sandy clay or sandy loam with a thin layer of surface leaf litter. The specialised holomycotrophic association with a fungus that links the orchid to the root system of a specific autotrophic host is key to explaining why the species is restricted to only a few sites. Thus the conservation of the orchid is reliant on ensuring the health of the host species (Dixon and Christenhusz 2018).

Due to its subterranean habit, the underground orchid may be relatively unaffected by drought, however, flowering may be variable with rainfall. It is likely that drought also has indirect impacts on underground orchids due to reduced productivity of the host plants and their associated fungus and/or through loss of litter from the soil surface. There is evidence that drought has degraded the habitat of *R. gardneri* (the northern populations) with canopy decline being observed in the early 2000's (M. Brundrett, 2011).

Small fungal gnats (flies possibly belonging to several families) and termites pollinate flowers of *R. gardneri*. These are small enough to get through the gaps in the leaf and bark litter that covers the tulip-like flower of the orchid. The gnats crawl through the litter into the tiny opening at the top of the floral bracts and down to the flowers (DEC 2010). How seed is dispersed is unknown, but small marsupials that are now extinct in the known distribution of the orchid may have eaten the succulent fruits produced by the plant and deposited its seed in their faeces (DEC 2010).

#### Threats (detail how the species is being impacted)

Threat (describe the threat and how it impacts on the species. Specify if the threat is past, current or potential)	Extent (give details of impact on whole species or specific subpopulations)	Impact (what is the level of threat to the conservation of the species)
Drying climate and subsequent effects on habitat. <ul style="list-style-type: none"> <li>A decrease in annual rainfall has resulted in a lack of moisture availability for <i>Melaleuca scalena</i> at key growth stages and this may be impacting on productivity (biomass accumulation and litter fall). A reduction in</li> </ul>	Whole population	Severe

<p>productivity will in turn impact on soil nutrient cycling, soil moisture retention and fungal activity.</p> <ul style="list-style-type: none"> <li>Climate change modelling for the south west predicts a decline in rainfall, and some seasonal shift to summer rainfall events, which is likely to increase the potential impact of drought on the species.</li> </ul> <p>Past, current and future</p>		
<p>Altered hydrology</p> <ul style="list-style-type: none"> <li>All subpopulations are located adjacent to drainage lines, and so changes to these drainage lines, such as through agricultural practices resulting in vegetation removal, will impact on the hydrology of the areas of the subpopulations. Altered hydrology may reduce the available water for the associated <i>Melaleuca</i> species and also erode the soil leaf layer.</li> <li>Rising saline water tables, resulting from agricultural practices and vegetation removal, are possibly causing deaths among the associated <i>Melaleuca scalena</i> and are likely to become an increasing future threat.</li> </ul> <p>Past, current and future</p>	Whole population	Severe
<p>Altered fire regimes</p> <ul style="list-style-type: none"> <li>Likely to alter the habitat of the species. Past experiences suggest that extreme/high fire intensities may result in a major change in vegetation structure and be catastrophic for <i>R. gardneri</i> survival.</li> <li>Recent monitoring has indicated associated habitat at Subpopulation 6 is senescing and producing less leaf litter, and may require a burn.</li> </ul> <p>Past, current and future</p>	Whole population	Severe
<p>Rabbits</p> <ul style="list-style-type: none"> <li>Potential grazing of plants limit recruitment.</li> <li>Disturbance to plants and roots from rabbit diggings.</li> </ul> <p>Current and future</p>	Whole population	Severe
<p>Disturbance of habitat during surveys</p> <ul style="list-style-type: none"> <li>The method used to locate plants is destructive, requiring the removal of leaf litter beneath <i>Melaleuca scalena</i>. The litter, when replaced, is mixed with soil resulting in soil compaction.</li> </ul> <p>Past, current and future</p>	Whole population	Severe



<p>Weeds</p> <ul style="list-style-type: none"> <li>Weeds suppress plant growth by competing for light, soil moisture, nutrients and pollinators. They also increase the fire hazard due to the easy ignition of high fuel loads, which are produced annually by many grass weed species. Weeds occur adjacent Subpopulation 1 and have the potential to invade the area containing the plants.</li> </ul> <p>Future</p>	Subpopulation 1	Severe
<p>Habitat degradation from surrounding land use</p> <ul style="list-style-type: none"> <li>All known subpopulations occur within small patches of natural remnant vegetation surrounded by agricultural land and are subject to stresses from surrounding land use which may result in altered hydrology, an increase in weeds, chemical spray drift etc.</li> </ul> <p>Past, current, future</p>	Whole population	Severe
<p>Changes in land use</p> <ul style="list-style-type: none"> <li>Subpopulation 6 is located in a town site reserve vested with the Shire of Corrigin. Changes in land use have the potential to impact on the subpopulation.</li> </ul> <p>Future</p>	Subpopulation 6	Severe
<b>Management and Recovery</b>		
Is there a Recovery Plan (RP) or Conservation Management Plan operational for the species?		Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>
<p>List all relevant recovery or management plans (including draft, in-preparation, out-of-date, national and State/Territory recovery plans, recovery plans for other species or ecological communities, or other management plans that may benefit or be relevant to the nominated species).</p> <ul style="list-style-type: none"> <li>Department of Environment and Conservation (2010) Underground Orchid (<i>Rhizanthella gardneri</i>) Interim Recovery Plan 2010-2015. Interim Recovery Plan No. 302. Department of Environment and Conservation, Western Australia.</li> </ul>		
<p>List current management or research actions, if any, that are being undertaken that benefit the conservation of the species.</p> <ul style="list-style-type: none"> <li>Monitoring and surveys have been carried out to determine plant numbers and impact of threats;</li> <li>Protecting the sites from fire unless required for ecological reasons, and implemented early intervention in any wildfires which may threaten the site;</li> <li>Surveying for additional subpopulations;</li> <li>Vesting of two reserves near Babakin, containing subpopulations of <i>Rhizanthella gardneri</i>, with the Conservation and Parks Commission as nature reserves;</li> <li>Examination of genetic variation by Botanical Gardens and Parks Authority (BGPA) using a non-destructive sampling technique for DNA extraction from floral bract material collected in 2001;</li> <li>Isolation of mycorrhizal fungi by BGPA from sections of rhizomes by to inoculate <i>Melaleuca scalena</i> hosts <i>ex-situ</i> and have enabled the germination and subsequent development of <i>Rhizanthella gardneri</i> rhizomes in glasshouse pot culture;</li> </ul>		

- Collection of seed from Subpopulations 1 and 2 in 2003 for storage at BGPA. Some seed (germplasm) and mycorrhizal fungal isolates were also placed in interim cryostorage at BGPA;
- Preliminary *in situ* seed baiting trials conducted by BGPA in 2002, 2003 and 2005;
- Research on the role of mycorrhizal fungi in nutrient supply and habitat specificity in 2004;
- Fencing of Subpopulation 6 in 2004;
- An irrigation system and a system of logging moisture probes to monitor moisture availability;
- Installation of interpretative signage by Bruce Rock Landcare Group to raise public awareness of at each site where the species occurs.

*List further recommended management or research actions, if any, that would benefit the conservation of the species. Please ensure that this section addresses all identified threats.*

#### Management

- Develop monitoring protocols to reduce impacts during surveys/monitoring. Surveys/monitoring must be conducted by experts using proven techniques tailored to this species' life cycle and undertaken in vegetation types deemed suitable for the species;
- Monitor the subpopulations for population stability, changes in plant or site health, and evidence of rabbit or weed impacts;
- Survey potential habitat areas for new subpopulations.
- Install rabbit-proof fencing/caging around subpopulations or individuals when required;
- Control rabbits through scatter baiting if necessary;
- Ongoing liaison with Shire of Corrigin and adjacent private property owners to ensure that subpopulations of the species are not accidentally damaged or destroyed, and the habitat is maintained in a suitable condition for the conservation of the species;
- Develop and implement a fire management strategy, including associated weed control measures and the need for and method of the construction and maintenance of firebreak;
- Develop a translocation proposal and select a disease free translocation site;
- Map habitat critical to the survival of the species to facilitate its protection and appropriate management;
- Ensure security of tenure of Subpopulation 6 through land acquisition;
- Rehabilitate habitat with local endemics plant species where required;
- Make further collections of seed and associated mycorrhizal fungi and develop long-term storage protocols;
- Undertake weed control where required.

#### Research

- Research biology and ecology of the species, with a focus on orchid-fungus relationship, pollination effectiveness, seed viability, conditions required for natural germination, response to threats and disturbances and reproductive biology;
- Determine the reasons for habitat degradation;
- Characterise the effects of seasonal climatic variation to habitat.

<b>Nomination prepared by:</b>	
<b>Contact details:</b>	
<b>Date submitted:</b>	9/5/2018

If the nomination has been refereed or reviewed by experts, please provide their names and contact details:

## References

Brundrett, M. (2011) Wheatbelt Orchid Rescue Project Final Report 6. *Population Survey Data for Southern Populations of the Western Underground Orchid (Rhizanthella gardneri)*. Wheatbelt Orchid Rescue Project, University of Western Australia.

Department of Environment and Conservation (DEC) (2010) Underground Orchid (*Rhizanthella gardneri*) Interim Recovery Plan 2010-2015. Interim Recovery Plan No. 302. Department of Environment and Conservation, Western Australia.

Dixon, K.W. & Christenhusz, M.J.M. (2018) Flowering in darkness: a new species of subterranean orchid *Rhizanthella* (Orchidaceae; Orchidoideae; Diurideae) from Western Australia. *Phytotaxa* 334 (1): 075-079.

Spooner, A. (2003) *Rhizanthella gardneri* - underground orchid. Western Australia Department of Parks and Wildlife.

Viewed: 26 August 2016. Available on the Internet at: <https://florabase.dpaw.wa.gov.au/browse/profile/1699>.

**Summary of subpopulation information** (detailed information to be provided in the relevant sections of the form)

\*Note: Populations 3,4 and 5 have been re-identified as *Rhizanthella johnstonii*

Location (include coordinates)	Land tenure	Survey information: Date of survey and No. mature individuals	AOO	Site / habitat Condition	Threats (note if past, present or future)	Specific management actions
Subpopulation 1: Babakin, NE of Corrigin	Nature reserve	1982: 110 2001: 15 2002: 10 2003: 1 2004/05: 0 2006: 14 2009: 8 2017: 3 (partial)	0.225 km <sup>2</sup> (total for Subpops 1,2,3)	Moderate	Senescence of associated habitat (past, current, future) Altered hydrology (past, current, future) Fire (past, present, future) Rabbits (current, future) Disturbance from surveys (past, current, future) Weeds (future) Degradation of habitat (past, present, future) Climate change (past, present, future)	Develop monitoring protocols to reduce impacts Install fencing/cages Develop a fire management plan Undertake baiting for rabbits Collect seed and associated mycorrhizal fungi Monitor soil moisture Rehabilitate habitat Establish new populations through translocation Undertake weed control
Subpopulation 2: Babakin, NE of Corrigin	Nature reserve	1982: 4 2001: 6 2002: 2 2004/05: 1 2006: 2 2009: 4 2017: 4 (partial)		Moderate	Senescence of associated habitat (past, current, future) Altered hydrology (past, current, future) Fire (past, present, future) Rabbits (current, future) Disturbance from surveys (past, current, future) Degradation of habitat (past, present, future)	Develop monitoring protocols to reduce impacts Install fencing/cages Develop a fire management plan Undertake baiting for rabbits Collect seed and associated mycorrhizal fungi Monitor soil moisture

					Climate change (past, present, future)	Rehabilitate habitat Establish new populations through translocation
Subpopulation 6: Kunjin, SW of Corrigin	Town reserve (Government purposes)	1989: 38 2001: 2 2002: 3 2003-05: 0 2006: 5 2009: 6 2017: 2 (partial)		Poor; habitat degraded and senescing	Senescence of associated habitat (past, current, future) Altered hydrology (past, current, future) Fire (past, present, future) Rabbits (current, future) Disturbance from surveys (past, current, future) Degradation of habitat (past, present, future) Climate change (past, present, future)	Develop monitoring protocols to reduce impacts Install fencing/cages Develop a fire management plan Undertake baiting for rabbits Collect seed and associated mycorrhizal fungi Monitor soil moisture Rehabilitate habitat Establish new populations through translocation Liaise with Shire of Corrigin