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)*

Species name (scientific and common name)**:**	***Goodenia arthrotricha***
Nomination for (addition, deletion, change)**:**	**Addition**
Nominated conservation category and criteria:	**EN: B2ab(iii,v)**

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 ☐ No ☐
A.	Population size reduction	•
B.	Geographic range	•
C.	Small population size and decline	•
D.	Very small or restricted population	•
E.	Quantitative analysis	•

Outcome*:*			
Scientific committee Meeting date:			
Scientific committee comments:			
Recommendation:			
Ministerial approval:		*Date of Gazettal/ Legislative effect:*	

Nomination/Proposal summary *(to be completed by nominator)*

Current conservation status				
Scientific name:	*Goodenia arthrotricha*			
Common name:	None			
Family name:	Goodeniaceae	Fauna ☐	Flora ☒	
Nomination for:	Listing ☒	Change of status/criteria ☐	Delisting ☐	
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)				
State / Territory	1. WA	2008	Endangered	B2ab(iii,v); C2a(ii)
	2. WA	11/7/2016	Endangered	B2ab(iii,v)
	3.			

Consistent with Schedule 1, item 2.7 (h) and 2.8 of the Common Assessment Method Memorandum of Understanding, it is confirmed that:	
• this assessment meets the standard of evidence required by the Common Assessment Method to document the eligibility of the species under the IUCN criteria;	Yes ☒ No ☐
Comments:	
• surveys of the species were adequate to inform the assessment;	Yes ☒ No ☐
Comments:	Intensive surveys were undertaken in 2005 and 2006 with further surveys in following years. There is limited habitat available for further population to occur.
• 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.	Yes ☒ No ☐
Comments:	Assessment is consistent with 2008 assessment, however, the percentage of plants in the largest population has reduced from 99% to 83% following the discovery of a new population, and hence the criterion C2a(ii) no longer applies. Criterion B2ab(iii,v) still applies to Endangered. New assessment endorsed WA TSSC 11/7/2016.

Nominated national conservation status: category and criteria					
Presumed extinct (EX) ☐	Critically endangered (CR) ☐	Endangered (EN) ☒	Vulnerable (VU) ☐		
None (least concern) ☐	Data Deficient ☐	Conservation Dependent ☐			
What are the IUCN Red List criteria that support the recommended conservation status category?	**B2ab(iii,v)**				
Eligibility against the IUCN Red List criteria (A, B, C, D and E)					
*Provide justification for the nominated conservation status; is the species eligible or ineligible for listing against the five criteria. For **delisting**, provide details for why the species no longer meets the requirements of the current conservation status.*					
A.	Population size reduction (evidence of decline)	• Monitoring from 2005 to 2006 showed a decline in observed plants at known sites. However, there is insufficient monitoring data to reliably show rate of decline.			
B.	Geographic range (EOO and AOO, number of locations and evidence of decline)	• Known from five locations (EEO 2,244 km^2). Actual area of occupancy is 1.36 ha. AOO using the 2x2 km^2 grid system is 28 km^2. • Ongoing decline in number of plants monitored from 2005 to 2006, and expected to continue in populations on insecure land tenure. • Decline in condition of habitat due to rail maintenance, weeds, and rabbits. • Locations are fragmented as each site is in well separated areas of remnant vegetation but a number of the remnant areas are large and do not meet the definition for severely fragmented. • **Meets EN:B2ab(iii,v)**				
C.	Small population size and decline (population size, distribution and evidence of decline)	• Known from 2,965 plants at 5 locations, ranging from north of Moora to southeast of Perth near Orange Grove, 170 km south. • Majority of plants (83%) located in one location. • Ongoing decline likely in degraded habitat sites. • **Does not meet EN: C2a(ii)**			
D.	Very small or restricted population (population size)	• 2,965 plants. • **Does not meet criterion**			
E.	Quantitative analysis (statistical probability of extinction)	• No data			
Summary of assessment information					
EOO	2,244 km^2	AOO	28 km^2 (2x2km grid method)	Generation length	-

			Mapped area of subpopulations 1.36km^2		

No. locations	5	Severely fragmented	Yes ☐ No ☒ Unknown ☐
No. subpopulations	6	No. mature individuals	2,965

Percentage global population within Australia	100
Percentage population decline over 10 years or 3 generations	unknown

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)*
Refer to table at end.		

Management and Recovery

Is there a Recovery Plan (RP) or Conservation Management Plan operational for the species?	Yes ☐ No ☒

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).

- None

List current management or research actions, if any, that are being undertaken that benefit the conservation of the species.

- Protect the site from fire unless required for ecological reasons, and implement early intervention in any wildfires which may threaten the site;
- Survey for additional populations;
- Protect population and its habitat within the nature reserve from seismic exploration activities;
- Liaise with Brookfield Rail minimise disturbance to remnant vegetation when maintaining rail reserves;
- Liaise with City of Gosnells to protect the remnant vegetation on which the species occurs;
- Installation of markers at rail reserve to protect habitat when maintaining rail reserves;
- Monitor the populations for evidence of rabbits or weed impacts, or changes in plant or site health;
- Protect the site from fire unless required for ecological reasons, and implement early intervention in any wildfires which may threaten the site.

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

- Acquire private property location in which population occurs north of Bindoon;
- Protect private property populations from sheep by ensuring maintenance of fences;
- Ensure adjacent quarry operations do not impact on the population southeast of Perth;
- Ensure seismic exploration operations do not impact on the species, and its habitat;
- Control rabbits if evidence of a rabbit population or herbivory noted;
- Control infestations of weeds, and thin dense canopies of *Allocasuarina campestris* that might impact the species and its habitat;
- Collect seed for storage and *ex situ* propagation;

- Stimulate germination of soil.

Research

- Determine species pollination ecology, seed germination requirements and viability, and longevity;
- Determine disturbance response of the species and attempt to stimulate germination.

Nomination prepared by:	
Contact details:	
Date submitted:	4/7/2016
If the nomination has been refereed or reviewed by experts, please provide their names and contact details:	

Summary of subpopulation information *(detailed information to be provided in the relevant sections of the form)*						
Location *(include coordinates)*	Land tenure	Survey information: Date of survey and No. mature individuals	Mapped area of subpopulations	Site / habitat Condition	Threats *(note if past, present or future)*	Specific management actions
Private property Lot 52, 15km north of Moora	Private property	2005: 4 2006: 4	<0.1 ha	Poor, was grazed by sheep prior to being fenced. *Allocasuarina campestris* in high density, forming continuous canopy.	Past • Land clearing for agriculture • Grazing (sheep) • Habitat destruction Current • Fire • Competition (*Allocasuarina campestris*) • Poor seedling recruitment • Small population size Future • Small population size • Encroachment of *Allocasuarina campestris* • Poor recruitment • Fire • Drought/ climate change	As above
Private property Lot 5, Wells Glover Rd, Mooliabeenee (10km north of Bindoon)	Private property	2006: 2,456	1 ha	Healthy	Past • Land clearing for agriculture • Grazing • Habitat destruction Current	As above

					• Fire • Habitat destruction (insecure tenure) • Poor recruitment Future • Clearing • Habitat destruction • Fire • Poor recruitment • Drought/ climate change	
Rail reserve 30km south of Moora; Koodjee NR	Rail reserve, nature reserve	Rail reserve: 2005: 235 2006: 5 Nature reserve: not surveyed since collected in 1990 (no plant count undertaken at time; noted as 'uncommon')	<0.1 ha	Poor, population on rail reserve severely impacted by rail maintenance	Past • Habitat destruction • Rail maintenance Current • Small population size • Rail maintenance • Weeds • Fire • Poor recruitment Future • Rail maintenance • Fire • Weeds • Poor recruitment • Drought/ climate change	As above
Ellis Brook Valley Reserve, Orange Grove, SE of Perth	Shire reserve (parks and recreation)	2005: 44 2006: 20 2013: 200+	0.115 ha	Moderate, plants occur on exposed granite slopes and are dying back.	Past • Rabbits • Habitat destruction (rock spoil encroachment)	As above

					Current • Fire • Habitat destruction (rock spoil encroachment) Future • Habitat destruction (quarry) • Fire • Drought/ climate change	
Boonanarring Nature Reserve, north of Gingin	Nature reserve	2007/08: ~1,000 2011: 300+ (not fully surveyed)	0.045 ha	Excellent, some disturbance to habitat from drilling, vehicle access	Past • Land clearance • Seismic survey, exploration Current • Fire • Seismic survey (shot holes, access) Future • Seismic survey, exploration • Fire • Drought/ climate change	As above

Department of Environment and Conservation

Nomination of a Western Australian species for listing as threatened, change of status or delisting. 2007 (updated 2016)

To fill out this form you must refer to the attached Guidelines. Incomplete forms will result in delays in assessment, or rejection of the nomination.

Answer all relevant sections, indicating when there is no information available. Mark boxes with a **cross** ☒.

Note, this application form applies to both flora and fauna species, and hence some questions or options may not be applicable to the nominated species – for these questions, type or write "N/A".

SECTION 1. NOMINATION		
1.1. Nomination information		
Flora ☒	**Fauna** ☐	**Nomination for: Addition**
1.2. Scientific Name This name will be used to identify the species on all official documentation. Use the approved name used by the Western Australian Museum or Herbarium. If this is not possible, use unpublished names or numbers of voucher specimens.		
Goodenia arthrotricha F.Muell.		
1.3. Common Name If the species has a generally accepted common name, please show it here. This name will be used on all official documentation.		
1.4. Current Conservation Status		
Priority 2 (2007; EN 2016)		
International		
IUCN Red List		Currently not listed
Categories and Criteria applicable to the highest rank category only e.g. B1ab(iv);D		N/A
National		
EPBC Act 1999		Currently not listed
State of Western Australia		
Wildlife Conservation Notice Schedule		Schedule 2: Endangered (2016)
IUCN Ranking		EN (2016)
Priority		
Is the species listed as 'Threatened' in any other Australian State or Territory No ☒ Yes ☐ If Yes, list these States and/or Territories and the status for each.		

Does the species have specific protection (e.g. listed on an annex or appendix) under any other legislation, inter-governmental or international arrangements e.g. CITES? No ☒ Yes ☐
If yes, please provide details.

1.5. Nominated Conservation Status

Write one category for each of the fields. If none, write 'None'.

International	
IUCN Red List	N/A
Categories and Criteria applicable to the highest rank category only e.g. B1ab(iv);D	
National	
EPBC Act 1999	EN: B2ab(iii,v)
State of Western Australia	
Wildlife Conservation Notice Schedule	
IUCN Ranking	EN: B2ab(iii,v); C2a(ii) (2007)
Priority	N/A

1.6. Reasons for the Nomination

Briefly summarise the reasons for the nomination in dot points. Please include details relevant to the IUCN Categories and Criteria where appropriate.

- Small number of populations (4 in 2007; 5 in 2016)
- Low number of plants in total (2485 plants in 2007, 2965 in 2016)
- Very low number of plants in 3 of 4 populations (less than 20) in 2007; 83% in one population 2016
- 4 of 5 populations currently in unsecure tenure and under threat (2016) with two showing decline

SECTION 2. SPECIES

2.1. Taxonomy

Describe the taxonomic history, using references, and describe the key distinguishing features that can be used to separate this taxa from closely related taxa. Include details of the type specimen, changes in taxonomy, scientific names and common names used for the species.

Goodenia arthrotricha was described by Ferdinand von Mueller in 1868 from collections made by the first colonial botanist James Drummond (Carolin 1992). It was placed within the *Scaevolina* infrageneric subsection of *Goodenia*, a group of species all with distributions in north-western Australia excepting *G. arthrotricha*. The type is held at the Kew Gardens Herbarium.

Goodenia arthrotricha is closely related to a number of Pilbara species but most similar in the south-west of WA to *G. caerula*. *G. arthrotricha* is distinguished from this species by the presence of glandular hairs, being viscid to touch. This species also has a white corolla throat in contrast to the yellow throat of *G. caerula*..

Is this species conventionally accepted? No ☐ Yes ☒ If no, explain why. For example, is there any controversy about the taxonomy? For undescribed species, detail the location of voucher specimens (these should be numbered and held in a recognised institution and be available for reference purposes).

Describe any known hybridisation with other species in the wild, indicating where this occurs and how frequently.

None known.

2.2. Description

Describe the physical appearance, habit, behaviour/dispersion and life history. Include anatomy or habit (e.g. size and/or weight, sex and age variation, social structure) and dispersion (e.g. solitary, clumped or flocks etc), and life history (eg short lived, long lived, geophytic, etc).

This species is an erect perennial herb with a blue and white corolla. This species occurs in association with granite and gneiss geology and is most likely a long-lived fire responsive reseeder.

2.3. Distribution

Describe the distribution of the species in Australia and, if possible, attach a map.

This species is known from only four locations (five, 2016), extending from Gosnells in the south to just north of Moora in Western Australia (Refer to page 5 of the attached report).

2.4. Habitat

Describe the non-biological habitat (e.g. aspect, topography, substrate, climate) and biological habitat (e.g. forest type, associated species, sympatric species). If the species occurs in various habitats (e.g. for different activities such as breeding, feeding, roosting, dispersing, basking etc) then describe each habitat.

Non-biological habitat

Goodenia arthrotricha occurs along the slopes of the Darling and Gingin Scarps and is associated with granite or gneiss outcropping and underlying geology. Found on shallow skeletal soils either below granite outcropping or on areas where the granite is close to the surface.

Biological habitat

This species, not specifically associated with one vegetation type, is associated with various fringing rocky outcrop vegetation including *Allocasuarina* shrublands and low *Leptospermum* heath. Other associated species include *Regelia megacephala, Adenanthos* aff. *cygnorum, Hakea incrassata, Labichea lanceolata.*

This species is also associated with the threatened taxon *Conospermum densiflorum* subspecies *unicephalatum* at population 3 (south Moora).

Refer to pages 8-12 of the attached report.

Does the (fauna) species use refuge habitat e.g. in times of fire, drought or flood? Describe this habitat.
N/A

Is the species part of, or does it rely on, a listed threatened ecological community? Is it associated with any other listed threatened species?

This species is also associated with the threatened taxon *Conospermum densiflorum* subspecies *unicephalatum* at population 3 (south Moora).

2.5. Reproduction

Provide an overview of the breeding system.
For flora: When does the species flower and set fruit? Is the seed produced viable? What conditions are needed for this? What is the pollinating mechanism? If the species is capable of vegetative reproduction, a description of how this occurs, the conditions needed and when. Does the species require a disturbance regime (e.g. fire, ground disturbance) in order to reproduce?

This species begins flowering in late spring (November) and finishes in Autumn (March) though this may dependant upon rainfall. Viable seed is set and viability trials on this species have found that it was at 95%. The pollination is reliant upon invertebrates (Hoverflys – Diptera). This species also appears to be disturbance responsive and further trials are required to determine this.
Refer to pages 12-16 of the attached report.

2.6. Population dynamics

Provide details on ages of sexual maturity, extent of breeding success, life expectancy and natural mortality. Describe population structure (presence of juveniles/seedlings, mature and senescing individuals).

It appears that from late Spring through to early summer is probably the natural time of year this species is physiologically timed to reproduce. Nothing is known of the breeding success or ages of sexual maturity. All of the populations are comprised of predominantly adult plants with very low levels of recruitment. Recruitment is most likely to occur post a disturbance event such as a fire, with post fire regeneration most likely from a persistent seed bank, but may also possess the ability to resprout from old growth.
Refer to pages 17-18 of the attached report.

SECTION 3. INTERNATIONAL CONTEXT

For species that are distributed both inside and outside Australia

3.1. Distribution

Describe the global distribution.

Does not occur outside of Western Australia.

Give an overview of the global population size, trends, threats and security of the species outside of Australia.

Does not occur outside of Western Australia.

Explain the relationship between the Australian population and the global population. What percentage of the global population occurs in Australia? Is the Australian population distinct, geographically separate or does part, or all, of the population move in/out of Australia's jurisdiction? Do global threats affect the Australian population?
N/A

SECTION 4. CONSERVATION STATUS AND MANAGEMENT

4.1. Population

What is the total population size in terms of number of mature individuals? Has there been any known reduction in the size of the population, or is this likely in the future? – give details. Are there other useful measures of population size and what are they? Or if these are unavailable, provide an estimate of abundance? (e.g. scarce, locally abundant etc).

The total number of individuals (2007) is 2,485 (2016: 2,965). During a study undertaken of this species from November 2005 through to November 2006 it was noted that two of the populations had reduced in size, from 235 plants to 5 and from 44 plants to approximately 20 individuals. The reduction in population size for the first population was likely caused by railway maintenance activities, and for the second population by grazing. It is also suspected that mining activities may have impacted the second population.

Give locations of: captive/propagated occurrences or *ex situ* collections; recent re-introductions to the wild; and sites for proposed re-introductions. Have these sites been identified in recovery plans?
_N/A

How many locations do you consider the species occurs in and why? Where a species is affected by more than one threatening event, location should be defined by considering the most serious plausible threat.

This species is known from only four (2007: five, 2016). Other likely habitats have been searched for in 2005 and 2006 with no new populations being located.

For flora, and where applicable, for fauna, detail the location, land tenure, estimated number of individuals, area of occupancy, and condition, for each known location or occurrence.

Location	Land status	Date of most recent survey	Number of individuals at location	Area of occupancy at location	Condition of site
13.5km N of Moora	Private property (in process of being purchased by DEC)	Sept 2006	4	<0.1ha	Poor
30km S of Moora	Rail Reserve/ nature reserve	Sept 2006	5 (none seen in NR)	<0.1ha	Poor
10km N of Bindoon	Private Property	Sept 2006	2456	1ha	Healthy
Ellis Brook Valley Reserve	Shire Reserve	Sept 2013	*c.* 200+	0.115ha	Poor
Boonanarring Nature Reserve, north of Gingin	Nature reserve	2011	~300+	0.045ha	Excellent

Has the number of individuals been counted ☒, or is this an estimate ☐. Provide details of the method of determining the number of individuals.

Each plant was counted individually except where the population contained more than several individuals. In this case the populations were counted using 10 x 10m grid squares.
Refer to page 5 of attached report.

Has there been any known reduction in the number of locations, or is this likely in the future? – give details.

A historical population near Wannamal was not located during 2005/06 surveys and it is likely to have been cleared. Overall four extant populations were located from seven previously known. Two of the extant populations may have been recently partially cleared.

What is the extent of occurrence (in km^2) for the species; explain how it was calculated and datasets used. If an accurate estimate is unavailable provide a range of values or a minimum or maximum area estimate. Include estimates of past, current and possible future extent of occurrence. If available, include data that indicates the percentage decline over 10 years or 3 generations (whichever is longer) that has occurred or is predicted to occur.

The full extent known range is less than 500km. This was calculated using the known locations and ArcGIS 9.

What is the area of occupancy (in km^2) for the species; explain how it was calculated and datasets used. If an accurate estimate is unavailable provide a range of values or a minimum or maximum area estimate. Include estimates of past, current and possible future area of occupancy. If available, include data that indicates the percentage decline over 10 years or 3 generations (whichever is longer) that has occurred or is predicted to occur.

The extent of occurrence is 2,244 km^2. This was calculated based on a polygon estimated from the geographic position of the five known locations. The actual area of occupancy is 1.36 hectares or using the 2x2 km^2 grid system is 28 km^2.

Is the distribution of the species severely fragmented? Why?

The distribution is relatively fragmented and widely dispersed. This is most likely due to the sporadic distribution of suitable habitat and/or geology. Other factors would also include the large amount habitat destruction across its known range plus impact from stock and rabbit grazing.

Identify important occurrences necessary for the long-term survival and recovery of the species? This may include: key breeding populations, those near the edge of the range of the species or those needed to maintain genetic diversity.

All occurrences are equally important for the survival of the species due to the small number of populations. Though the largest population has 99% (83%, 2016) of the known number of plants and therefore its protection is essential to future survival of the species.

4.2. Survey effort

Describe the methods to conduct surveys. For example, (e.g. season, time of day, weather conditions); length, intensity and pattern of search effort (including where species not encountered); any limitations and expert requirements.

Surveys were carried out between November 2005 and November 2006 between the hours of 8.30am and 6.30pm on clear calm days. The geographical extent of the survey was carried out using records from labels attached to voucher specimens lodged at the Western Australian Herbarium and DEC field information. This data provided seven locations to search as a baseline for the survey. All of the locations stated in the available data were thoroughly searched by foot. Some of the records did not have latitude and longitude coordinates stated to a high enough accuracy to locate the populations exactly and in these instances, other locality data was used and a wider area was searched by walking zigzag transects at 5 five metres apart in habitat thought to be suitable to contain the species.
Refer to attached report.

Give details on the distinctiveness and detectability of the species, or the distinctiveness of its habitat, that would assist survey success.

Individual plants can grow up to a 1 metre in height and occur in dense stands. *G. arthrotricha* displays large blue/white flowers and its stems remains green through to about late summer/autumn, when all other herbs have died off, and thus populations can be relatively conspicuous in the summer months. Three of the four extant populations were associated with rock outcropping and surrounding periphery where parent material is close to the surface and soils are skeletal, composed of medium to course gravel in a light brown sandy clay matrix. The fourth habitat was in an open heath with small scattered thickets on lateritic gravel in a sandy clay matrix, and so the gravel matrix soil may be an general indicator.

Has the species been reasonably well surveyed? Provide an overview of surveys to date (include surveys of known occurrences and surveys for additional occurrences) and the likelihood of its current known distribution and/or population size being its actual distribution and/or population size. Include comments on potential habitat and surveys that were conducted, but where the species was not present/found.

G. arthrotricha has been the subject of a study sponsored by Tiwest Pty Ltd. The report includes a full survey and census of all known populations. As stated above only four of the seven locations were found to support extant populations and it is highly probable, considering the rigour of the survey that these populations represent the actual size and distribution of this species. The record for Wannamal sourced from a voucher specimen (specimen # 1019759) proved be in area of suitable habitat (rock out cropping) however despite this no population was found and reasons for extinction were not clear from field observations. The two remaining populations i.e. Kirup (specimen # 05608961) and a record for an unspecified location (specimen # 1616110) were found to no longer supprt suitable habitat though the latter location was never confirmed.

Depending on whether or not there was suitable habitat present, an area between 1-5km radius from areas where species were known to occur was searched, including the south west section of a group of hills about 5km south west of GA-SM1 (the rail reserve population). Overall, this probably covers most of the suitable habitat between Perth and the most northerly record. There is always a chance that there are other populations out there, but the trend seems to be that populations are disappearing rather than new populations being found. Also it could be argued that considering the amount of attention granite rock outcrops in the area have received over the last decade, new populations would have turned up by now.

Further surveys discovered a new population in 2007/2008 and this population was monitored in 2011.

4.3. Threats

Identify past, current and future threats indicating whether they are actual or potential. For each threat describe:

1. How and where they impact this species.

The main threats to populations of this species include grazing (sheep and rabbits), habitat destruction, small population size, unsecure tenure, encroachment of *Allocasuarina campestris*, inappropriate fire regimes and weed encroachment. All of these threatening processes are currently impacting the species and have resulted in a loss of plants for some of the populations. All of the threats are likely to have impacted the populations to some extent in the past, particularly habitat destruction. Refer to pages 18-19 of attached report.

2. What the effect of the threat(s) has been so far (indicate whether it is known or suspected; present supporting information/research, does it only affect certain populations?).

Information gained from the study conducted from November 2005 through to November 2006 shows that grazing by rabbits has resulted in a number of plants in Population 4 dying, with the numbers reduced by approximately half. It is suspected that this population may have been affected by habitat loss. At Population 1 grazing by sheep has resulted in damage to plants however they appear to have recovered by excluding sheep from the population. The disturbance to Population 3, likely caused by rail maintenance activities, has resulted in severe destruction of the population from 235 plants to just five.

3. What is its expected effect in the future (is there supporting research/information; is the threat only suspected; does it only affect certain populations?).

Three of the four populations have experienced (2007) a decline in plant numbers due to the above-mentioned threatening processes. The population containing 99 percent (83% in 2016) of the known plants for the species is in unsecure tenure, and was on the market for sale at the time of the last survey. Seedling recruitment in all populations was very low and threatens the existence of the species into the future.

If possible, provide information threats for each occurrence/location:

Location	Past threats	Current threats	Potential threats	Management requirements (see section 4.4)
Population 1 (North Moora)	Habitat destruction, Sheep grazing	Small isolated population; poor seedling recruitment.	Loss of population, Encroachment of *Allocasuarina campestris*; Decline in population as a result of inappropriate fire regime	Develop a Recovery Plan for the species Ensure that fencing is maintained so that sheep are excluded from entering the vegetation again. Undertake control burn at site to determine whether any germination from seed bank and monitor program post burn.
Population 2 (Bindoon)	Habitat destruction, Grazing	Habitat destruction due to unsecure tenure, Poor seedling recruitment	Clearing, Destruction of habitat, Inappropriate fire regime	Pursue acquisition and have it added to the conservation estate; Liaise with landowner; Undertake disturbance trials
Population 3 (South Moora)	Habitat destruction	Disturbance likely due to rail maintenance activities, Weed encroachment, Small isolated population, Poor seedling recruitment	Further disturbance due to rail activities, Weed encroachment, Inappropriate fire regime	Liaise with land manager to ensure no further disturbance to this population; Monitor the response of the population to disturbance.
Population 4 (Ellis Brook Valley Reserve)	Habitat destruction, Grazing	Grazing, Habitat destruction due to spoil burying plants, Small population, Poor recruitment	Inappropriate fire regime, Habitat destruction	Fencing; Rabbit control; Liaison with adjacent landholders;

Population 5 Boonanarring Nature Reserve	Land clearance, Seismic survey/exploration	Seismic survey/ exploration, Fire	Seismic survey/ exploration, Fire, drought	Ensure seismic exploration operations do not impact on the species, and its habitat

Identify and explain why additional biological characteristics particular to the species are threatening to its survival (e.g. low genetic diversity). Identify and explain any models addressing the survival of the species.

N/A

4.4. Management

Identify key management documentation for the species e.g. recovery plans, conservation plans, threat abatement plans etc.

There is currently no management documentation for the conservation of this species. It is recommended that a Recovery Plan be written for it.

Does this species benefit from the management of another species or community? Explain.

No. Although population 3 co-occurs with the DRF, *Conospermum densiflorum* subsp. *unicephalatum*, both of the species (*Goodenia* and *Conospermum*) were disturbed between the DRF markers likely due to rail maintenance activities.

How well is the species represented in conservation reserves or covenanted land? Which of these are actively managed for this species? Give details.

This species is poorly represented in conservation reserves. Population 1, containing four plants is currently in the process of being acquired by DPaW. The other populations occur in rail reserve, private property and a local government reserve.

Are there any management or research recommendations that will assist in the conservation of the species? Give details.

Yes.

Management requirements include:

- Undertake a control burn at Population 1 to determine whether there is any germination from the seed bank, but exclude the four individuals then implement a monitoring program to assess the success of the trial; Ensure that fence is maintained so that sheep are excluded from the population;
- Control infestations of weeds, and thin dense canopies of *Allocasuarina campestris* that might impact Population 1.
- Maintain liaison with rail managers to minimise disturbance to remnant vegetation when maintaining railway line at Population 3; Possibly undertake a control burn at this site.
- Pursue the acquisition of the property containing Population 2; Liaise with the landowner regarding management of the species; Undertake disturbance trials.
- At Population 4 implement rabbit/weed control and /or fence the plants; Liaise with the adjacent owners of the quarry to ensure measures are undertaken to prevent further spoil burying the plants.
- Maintain liaison with oil and gas exploration contractors to ensure activities do not impact on the species and its habitat;
- Protect all sites from fire unless required for ecological reasons, and implement early intervention in any wildfires which may threaten the site;
- Survey any newly identified areas of suitable habitat;
- Collect and store seed;
- Establish new populations in more secure locations, if a suitable location can be found;
- Determine fire response;
- Undertake systematic monitoring of populations to determine population trends.

Refer to pages 19-20 of attached report.

4.5. Other

Is there any additional information that is relevant to consideration of the conservation status of this species?

No

SECTION 5. NOMINATOR	
Nominator(s) name(s)	
Signature(s)	
Organisation (s)	
Address(s)	
Telephone number(s)	
Email(s)	
Date	
If the nomination has been refereed or reviewed by experts, provide their names and contact details:	

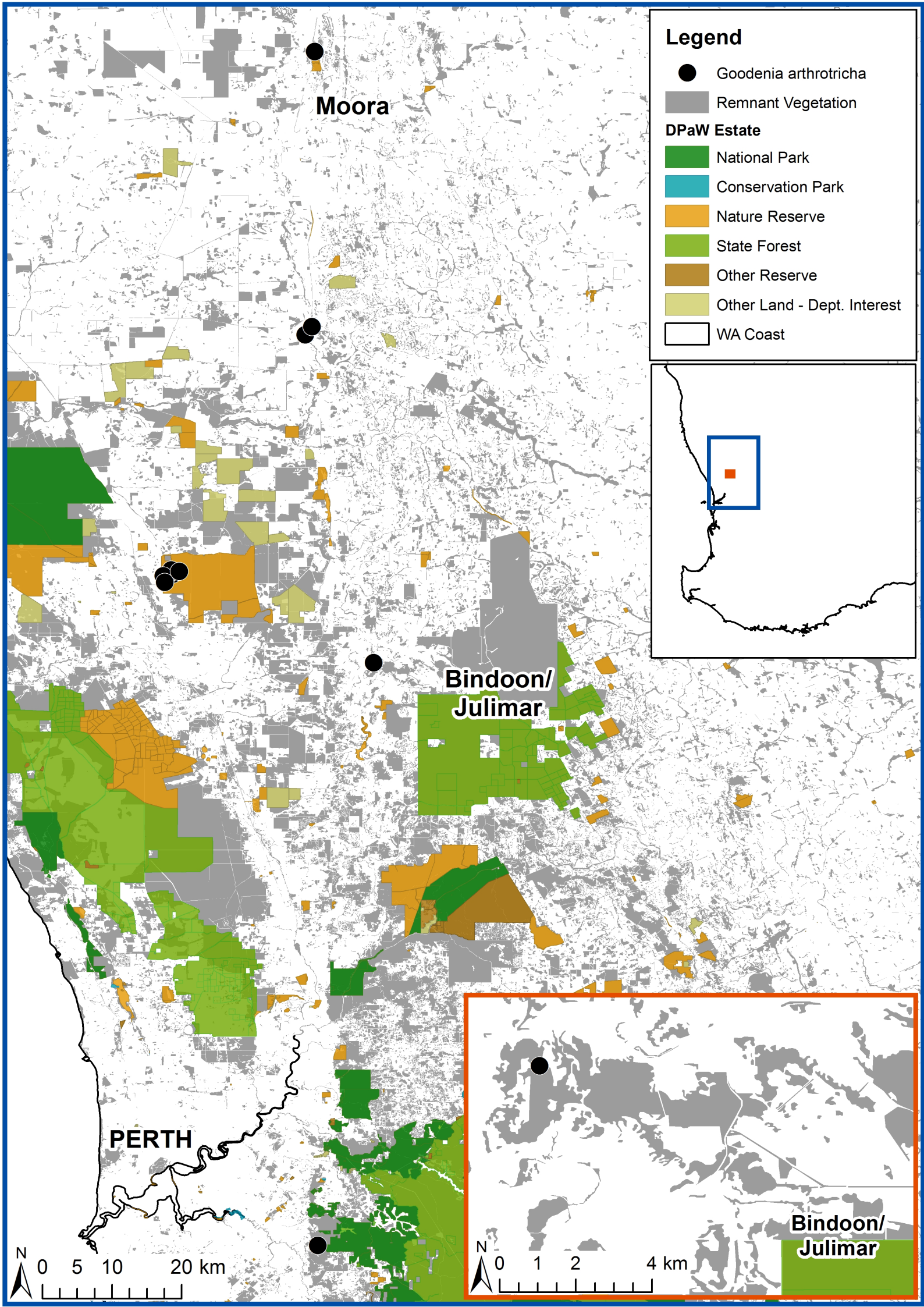
SECTION 6. REFERENCES
What references or sources did you use to prepare your nomination? Include written material, electronic sources and verbal information. Include full references, address of web pages and the names and contact details of authorities with whom you had verbal communications.
Vincent, B., Hoskins, M. and Sage, L. 2006. *The conservation status and life history strategy of the threatened species Goodenia arthrotricha (in draft).* Sage, L.W. and Pigott, J.P. 2003. Conservation status of *Goodenia* (Goodeniaceae) in Western Australia, including a review of threatened, rare and poorly known species, *Journal of The Royal Society of Western Australia*, vol. 86, pp.123-133.

SECTION 7. RECOMMENDATION	
7.1. Approval (to be completed by the TSSC Chair)	
Is the nomination accepted? Yes ☐ No ☐	
Status for the State of WA	
IUCN Status	
Categories and Criteria	
Priority	
DEC Region(s)	
DEC District(s)	

7.2. Non-approval
If nomination not accepted, give reasons.
7.3. Date of recommended change of status |
7.4. Comments
Were any conditions applied to the recommended change in conservation status? Provide details of actions required to be completed if nomination was deferred or rejected. Were any management or research recommendations made for the species? Provide details.

IUCN RED LIST CATEGORIES AND CRITERIA VERSION 3.1 (2001)

	CRITICALLY ENDANGERED	ENDANGERED	VULNERABLE
(A) REDUCTION IN POPULATION SIZE BASED ON **ANY** OF			
1) An observed, estimated, inferred or suspected population reduction of _____, over the last 10 years or 3 generations, whichever is the longer, where the causes are clearly reversible AND understood AND ceased, based on (a), (b), (c), (d) or (e)	≥90%	≥70%	≥50%
2) An observed, estimated, inferred or suspected population reduction of at least __50%__ over the last 10 years or 3 generations, whichever is the longer, where the reduction or its causes may not have ceased OR may not be understood OR may not be reversible based on (a), (b), (c), (d) or (e)	≥80%	≥50%	≥30%
3) A population size reduction of _____, projected or suspected to be met within the next 10 years or 3 generations, whichever is the longer (up to a maximum of 100 years) based on (and specifying) any of (b) to (e) under A1	≥80%	≥50%.	≥30%
4) An observed, estimated, inferred or suspected population reduction of _____ over any 10 year or 3 generation period, whichever is the longer (up to a maximum of 100 years in the future) where the time period must include both the past and the future, and where the reduction or its causes may not have ceased OR be understood OR may not be reversible, based on (a), (b), (c), (d) or (e)	≥80%	≥50%	≥30%
(a) direct observation, (b) an index of abundance appropriate for the taxon, (c) a decline in area of occupancy, extent of occurrence and/or quality of habitat, (d) actual or potential levels of exploitation, (e) the effects of introduced taxa, hybridisation, pathogens, pollutants, competitors or parasites.			
(B) GEOGRAPHIC RANGE IN THE FORM OF **EITHER** B1 **OR** B2 **OR** BOTH			
1) Extent of occurrence __170 km__ and estimates indicating at least 2 of (a)-(c)	<100 km^2	<5 000 km^2	<20 000 km^2
2) Area of occupancy ___1.7 ha__ and estimates indicating at least 2 of (a)-(c)	<10 km^2	500 km^2	<2 000 km^2
(a) Severely fragmented or known to exist at no more than _4_ locations	one	five	ten
(b) Continuing decline, observed, inferred or projected, in **ANY** of the following: (i) extent of occurrence, (ii) area of occupancy, (iii) area, extent and/or quality of habitat, (iv) number of locations or subpopulations, (v) number of mature individuals.			
(c) Extreme fluctuations in any of the following: (i) extent of occurrence, (ii) area of occupancy, (iii) area, extent and/or quality of habitat, (iii) number of locations or sub-populations, (iv) number of mature individuals.			
(C) POPULATION ESTIMATED TO NUMBER _2485_ MATURE INDIVIDUALS AND **EITHER**	<250	<2 500	<10 000
1) An estimated continuing decline of at least _____ within three years or one generation whichever is the longer (up to a maximum of 100 years in the future) **OR**	25%	20%	10%
2) A continuing decline, observed, projected, or inferred, in numbers of mature individuals **AND** at least one of (a) or (b)			
(a) population structure in the form of one of (i) no subpopulation estimated to contain more than _____ mature individuals) **OR**	50	250	1 000
(ii) at least _99_% of mature individuals in one subpopulation	90%	95%	100%
(b) Extreme fluctuations in number of mature individuals			
(D) (CR and EN) POPULATION SIZE ESTIMATED TO BE LESS THAN _____ MATURE INDIVIDUALS	50	250	not applicable
(D) (VU ONLY) POPULATION VERY SMALL OR RESTRICTED IN THE FORM OF **EITHER**			
1) population estimated to number less than _____ mature individuals. **OR**	not applicable	not applicable	1000
2) population with a very restricted area of occupancy (typically less than 20 km^2) OR number of locations (typically five or fewer) such that it is prone to the effects of human activities or stochastic events within a very short period of time in an uncertain future, and is thus capable of becoming Critically Endangered or even Extinct in a very short time period.	not applicable	not applicable	applies
(E) QUANTITATIVE ANALYSIS SHOWING PROBABILITY OF EXTINCTION IN THE WILD IS AT LEAST __50%___	50% within ten years or three generations, whichever is the longer (up to a maximum of 100 years)	20% within 20 years or five generations, whichever is the longer (up to a maximum of 100 years)	10% within 100 years


Legend
Goodenia arthrotricha
Remnant Vegetation
DPaW Estate
National Park
Conservation Park
Nature Reserve
State Forest
Other Reserve
Other Land - Dept. Interest
WA Coast
Moora
Bindoon/
Julimar
PERTH
N
0 5 10 20 km
N
0 1 2 4 km
Bindoon/
Julimar