

# Threatened species nomination

For nominations/assessments under the Common Assessment Method (CAM).

## Cover Page (Office use only)

<b>Species name</b> (scientific and common name):	<b><i>Hibbertia</i> sp. Toolbrunup (J.R. Wheeler 2504)</b>
<b>Nomination for</b> (addition, deletion, change):	<b>Addition</b>
<b>Nominated conservation category and criteria:</b>	<b>Critically Endangered B1ab(v)+2ab(v); C2a(i); D</b>

TSSC 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>TSSC Meeting date:</i>			
<i>TSSC comments:</i>			
<i>Recommendation:</i>			
<i>Ministerial approval:</i>		<i>Government Gazette/ Legislative effect:</i>	

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

<b>Current conservation status</b>				
<b>Scientific name:</b>	<i>Hibbertia</i> sp. Toolbrunup (J.R. Wheeler 2504)			
<b>Common name:</b>	None			
<b>Family name:</b>	Dilleniaceae	Fauna <input type="checkbox"/>		Flora <input checked="" type="checkbox"/>
<b>Nomination for:</b>	Listing <input checked="" type="checkbox"/>		Change of status <input type="checkbox"/>	Delisting <input type="checkbox"/>
Is the species currently on any conservation list, either in WA, Australia or Internationally?		Yes <input checked="" type="checkbox"/> If Yes; complete the following table		No <input type="checkbox"/> If No; go to the next question
<b>Jurisdiction</b>	<b>List or Act name</b>	<b>Date listed or assessed</b>	<b>Listing category i.e. critically endangered</b>	<b>Listing criteria i.e. B1ab(iii)+2ab(iii)</b>
International	IUCN Red List			
National	EPBC Act			
State of WA	WC Act	Assessed 5/4/2017	Critically Endangered	B1ab(v)+2ab(v); C2a(i); D
	DPaW Priority list	1 <input type="checkbox"/>	2 <input checked="" type="checkbox"/>	3 <input type="checkbox"/> 4 <input type="checkbox"/> 5 <input type="checkbox"/>
Other States or Territories				
<b>Consistent with Schedule 1, item 2.7 (h) and 2.8 of the Common Assessment Method Memorandum of Understanding, it is confirmed that:</b>				
<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"/>
<b>Comments:</b>				
<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"/>
<b>Comments:</b>	Refer to nomination			
<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>				
<b>Nominated conservation status: category and criteria</b> (including recommended categories for deleted species)				
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 criteria support the conservation status category above?</b>			B1ab(v)+2ab(v); C2a(i); D	

Eligibility against the criteria					
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.					
A.	Population size reduction	<ul style="list-style-type: none"> <li>Despite the discovery of 4 new individuals in 2016, overall there has been a decline in numbers of mature individuals in Subpopulation 1 from an estimated 30+ in 1999 to 8 mature plants after intensive survey in 2015. No historical data is available for Subpopulation 2 which was only discovered in 2016.</li> <li>Insufficient information to assess.</li> </ul>			
B.	Geographic range	<ul style="list-style-type: none"> <li>EOO 8 km<sup>2</sup> and AOO 8 km<sup>2</sup></li> <li>Number of locations 1 and 2 subpopulations. These subpopulations are considered a single location as they both occur within the Stirling Range National Park and are subject to the same threatening processes including grazing, fire and dieback disease. These threats are likely to impact both subpopulations.</li> <li>Continuing decline in numbers of mature individuals in sub-population 1 since 1992 (estimated 30+ in <u>lower</u> section of population 1 in both 1992 and 1999 (DPaW TPFL), actual count of 8 mature plants in 2016. Thus inferred decline in number of mature individuals and projected to continue with mature plants dying and seedlings not persisting. A projected decline in Subpopulation 2 is also expected due to the ongoing threat from grazing, dieback disease, fire and drought.</li> <li><b>Meets criteria for Critically Endangered B1ab(v)+2ab(v)</b></li> </ul>			
C.	Small population size and decline	<ul style="list-style-type: none"> <li>Total population size of 15 mature individuals.</li> <li>Continuing decline in numbers of plants in sub-population 1 since 1992 (estimated 30+ in <u>lower</u> section of population 1 in both 1992 and 1999 (DPaW TPFL), actual count of 8 mature plants in 2016. This equates to a decline of approximately 75% over 17 years. This observed decline in number of plants is expected to continue with mature plants dying and seedlings not persisting.</li> <li>Number of mature individuals within each subpopulation &lt;50.</li> <li>80% of total number of individuals in Subpopulation 1.</li> <li><b>Meets criteria for Critically Endangered C2a(i)</b></li> </ul>			
D.	Very small or restricted population	<ul style="list-style-type: none"> <li>Total population size of 15 mature individuals</li> <li>Potential population size, inferred from potential habitat (24 ha) not surveyed, of 227 mature plants (based on an average of 8.8 plants / ha in known sub-populations) if all potential habitat supports plants.</li> <li><b>Meets criteria for Critically Endangered D</b></li> </ul>			
E.	Quantitative analysis	<ul style="list-style-type: none"> <li>No data to assess</li> </ul>			
Summary of assessment information (detailed information to be provided in the relevant sections of the form)					
EOO	478 ha, recalculated to 8 km <sup>2</sup> so as not less	AOO	8 km <sup>2</sup> using the 2 km x 2 km grid	Generation length	unknown

	than AOO		method. Actual area occupied habitat 1.7 ha  Potential area of occupied habitat 25.7 ha		
No. locations	1	Severely fragmented	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Unknown <input type="checkbox"/>		
No. subpopulations	2	No. mature individuals	15		
Percentage global population within WA			100		
Percentage global population within Australia			100		
Percentage population decline over 10 years or 3 generations			Approximately 75 % over 17 years		

Summary of subpopulation information (detailed information to be provided in the relevant sections of the form)						
Location	Land tenure	Survey information: Date of survey and No. mature individuals	Area of occupied habitat	Site / habitat Condition	Threats (note if past, present or future)	Specific management actions
Toolbrunup (Subpopulation 1)	NP	1999: 30+ [5 dead] 2015: 8 (9 juveniles/seedlings) 2016: *12 (11 juveniles) *includes new plants (4 mature, 1 juvenile and 1 dead) located 2016	1 ha	Moderate	Herbivory Quokka or Brush-tail possum (past, present, future) Phytophthora dieback (past, present, future) Fire (past, present, future) Drought (past, present, future)	Fencing as required Monitor population trends Develop a fire management plan Implement disease hygiene measures
Mt Hassell (Subpopulation 2)	NP	November 2016: 3 mature (7 juveniles/seedlings)	0.7 ha	Moderate	Herbivory Quokka or Brush-tail possum (past, present, future) Phytophthora dieback (past, present, future) Fire (past, present, future) <b>Drought (past, present, future)</b>	Fencing as required Monitor population trends Develop a fire management plan Implement disease hygiene measures

## Nomination detail

Please refer to the Departments guidelines on nominating species for amendment of the Western Australian threatened species lists at [http://www.dpaw.wa.gov.au/images/documents/plants-animals/threatened-species/Listings/Threatened\\_Species\\_Nomination\\_Guidelines\\_2014.pdf](http://www.dpaw.wa.gov.au/images/documents/plants-animals/threatened-species/Listings/Threatened_Species_Nomination_Guidelines_2014.pdf)

For technical information on terminology used in this form, and the intent of information requirements, as they relate to an assessment of this nomination against the IUCN Red List criteria, refer to the 2001 *IUCN Red List Categories and Criteria. Version 3.1* [http://www.iucnredlist.org/documents/redlist\\_cats\\_crit\\_en.pdf](http://www.iucnredlist.org/documents/redlist_cats_crit_en.pdf)

and *Guidelines for Using the IUCN Red List Categories and Criteria Version 11* (February 2014) <http://cmsdocs.s3.amazonaws.com/RedListGuidelines.pdf>

### Section 1: Taxonomy

1.1 Current taxonomy	
Species name and Author:	<b><i>Hibbertia</i> sp. Toolbrunup (J.R. Wheeler 2504)</b>
Subspecies name(s) and Author:	
Is the species/subspecies conventionally accepted?	Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>
Is there any controversy about the taxonomy?	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>
<i>If not conventionally accepted and/or if there is any controversy; provide details:</i>	
Has the species/subspecies been formally named?	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>
Has the species/subspecies been recently described?	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>
<i>If the species has not been formally named or described; is it in the process of being described? Is there an anticipated date for the publication of the description? Has a type specimen been deposited? And if so provide the registration number and where deposited.</i>	<p>The <i>Hibbertia commutata</i> group including the <i>Hibbertia argentea</i> complex is currently being revised by taxonomist Kevin Thiele. The <i>H. argentea</i> group comprises a species from Cape Riche (<i>H. argentea</i>) as well as three species from the Stirling Range of which one is now <i>Hibbertia</i> sp. Toolbrunup (J.R. Wheeler 2504) (K. Thiele pers. comm.).</p> <p>Type specimen PERTH 01065475 <i>Hibbertia</i> sp. Toolbrunup (J.R. Wheeler 2504)</p>
If there are any closely related taxa provide details and include key distinguishing features:	<p>Kevin's Thiele's <u>draft</u> treatment of the <i>Hibbertia commutata</i> group including the <i>Hibbertia argentea</i> complex states:</p> <p><i>"Hibbertia argentea</i> has traditionally been circumscribed to include plants from the Stirling Range segregated here as <i>H. toolbrunup</i>, <i>H. inopinata</i> and <i>H. barrettae</i>. All four species have a more or less silvery-sericeous indumentum on at least younger leaves. <i>H. argentea</i> is most similar to <i>H. toolbrunup</i>, differing in carpel number and, subtly, in leaf indumentum. Leaves of <i>H. toolbrunup</i> are very concolorous both fresh and dried. On dried specimens the sericeous hairs are very closely appressed and parallel, appearing almost matted. In <i>H. argentea</i>, by contrast, the leaves are distinctly</p>

	greener above when fresh (slightly so when dried), and the hairs, while still relatively appressed, are looser, slightly more flexuose and never have a matted appearance. <i>H. argentea</i> consistently has three carpels, while <i>H. sp. toolbrunup</i> (J.R. Wheeler 2504) consistently has two. <i>H. inopinata</i> and <i>H. barrettae</i> have a quite different leaf indumentum, and tend to have ovate rather than elliptic leaves. Both have two carpels, which in <i>H. inopinata</i> are sparsely pubescent.
<b>1.2 Taxonomic history</b>	
Are there recent synonyms for the species?	Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>
If Yes; provide details of synonyms:	<i>Hibbertia argentea</i>
Have there been recent changes in the taxonomy or nomenclature?	Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>
If Yes; provide details of changes:	Three Stirling Range species within the <i>Hibbertia argentea</i> group to be segregated as <i>H. sp. toolbrunup</i> (J.R. Wheeler 2504), <i>H. inopinata</i> and <i>H. barrettae</i> , <i>Hibbertia argentea</i> is now restricted to Cape Riche.
<b>1.3 Hybridisation</b>	
Is there any known hybridism with other species in the wild?	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Unknown <input type="checkbox"/>
If Yes; Where does this occur and how frequently?	

## Section 2: Species information

<b>2.1 Morphology / physical description</b>
Insert photograph(s) of species or provide as an attachment:





Species description :	<p><i>Hibbertia</i> sp. Toolbrunup (J.R. Wheeler 2504) is an erect bushy shrub to 1.2 m with striking silvery foliage.</p> <p><i>Hibbertia</i> sp. Toolbrunup (J.R. Wheeler 2504) has elliptical leaves, concolorous with appressed-silvery-silky on both surfaces. Leaves are concolorous both fresh and dried. On dried specimens the sericeous hairs are very closely appressed and parallel, appearing almost matted.</p> <p>Flowers are yellow; the ovary has two carpels (<i>Hibbertia argentea</i> has three).</p> <p>The trunk can be up to 7 cm in diameter with rough, brown flaky bark.</p> <p>Plants grow up to 1.2 m tall, 0.7x 0.7 m wide, however a range of size classes are present either representing different recruitment events and/or grazing impacts and the majority of plants are &lt;1.0 m tall (S. Barrett 2016).</p>
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## 2.2 Biology (provide details)

Flowers in spring, fruits in summer.

Five plants in sub-population 1 were observed to have been killed by fire following the 1996 fire (Threatened flora records). Seedlings to 5cm were observed in sub-population 1 in spring 2015.

Limited re-sprouting from grazing is likely however the species is considered to be primarily a re-seeder with a soil-stored seed-bank.

No other forms of disturbance have been observed.

Seed was collected in December 2015, and from seed bags in March 2016, from sub-population 1.

No germination trials have been undertaken.

Pollinators: unknown.



Genetic diversity unknown but presumed to be low.
<b>2.3 Ecology (<i>provide details</i>)</b>
<p>The taxon is presumed to be a moderately long-lived perennial shrub from anecdotal observations only. While the habitat surrounding the scree slopes was burnt in 1996, it is likely that most of the plants on the scree did not burn therefore it is difficult to be confident of plant ages. In addition, inter-fire recruitment is apparent and therefore there is likely to be a range of ages in the population.</p> <p>Some mature plants in population 1 appeared unhealthy in May 2016 which could be related to senescence.</p> <p>Populations appear to be uneven-aged in relation to time since fire. Seedlings to 3 cm were observed in spring (November) 2015 in sub-population 1. However, these did not persist over summer (due to either drought or grazing) and recruitment is likely to be sporadic. Seedlings were also observed in sub-population 2 in November 2016.</p> <p>While the fringing vegetation was burnt in a wild-fire in summer 1996, the scree slopes appear to have largely escaped fire. However a flora report (23/12/99) (TPFL) noted that approximately 5 plants appeared to have been killed by fire at sub-population 1.</p> <p>One dead plant in population 1 was observed in June 2016 - cause of death unknown.</p> <p>The species habitat on skeletal soils is likely to make recruitment difficult and dependent on sufficient moisture – seedlings roots need to grow through the scree layer to access moisture in soil or organic material.</p>

### Section 3: Habitat

<b>3.1 Habitat (<i>provide details in response to the question below</i>)</b>	
Described the habitat suitable for the species (biological and non-biological). Include descriptions of specific purpose habitat (e.g. foraging, breeding, roosting, seasonal migration, different life stages).	<p>Occurs on skeletal soils on quartzite scree boulders, on steep slopes.</p> <p><b>Vegetation:</b> Very open scrub fringed by marri woodland</p> <p>Very open shrub to 1.0 m: <i>Hibbertia</i> sp. Toolbrunup (J.R. Wheeler 2504)</p> <p>Very open herb &lt; 1 m: <i>Pteridium esculentum</i></p> <p>Fringing woodland: <i>Corymbia calophylla</i>, <i>Trymalium odoratissimum</i>, <i>Hakea florida</i>, <i>Hakea baxteri</i>, <i>Banksia oreophila</i>, <i>Acacia veronica</i>, <i>Darwinia hypericifolia</i>, <i>Platytheca juniperina</i>.</p>
If the species occurs in a variety of habitats, is there a preferred habitat?	No other habitat known
Does the species use refugia? (include what is it and when is it used)	The scree slope may be considered refugia habitat
Is the habitat restricted in extent or number of locations?	Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Unknown <input type="checkbox"/>
If Yes, provide details:	Scree slopes in Stirling Range are most common in the Toolbrunup-Mt Hassell area. Less abundant scree areas occur east of Chester Pass.
Is this species reliant on a threatened or priority species or ecological community?	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Unknown <input type="checkbox"/>

If Yes, provide details:		
Are there any other species (sympatric species) that may affect the conservation status of the nominated species?		Yes <input type="checkbox"/> No <input type="checkbox"/> Unknown <input checked="" type="checkbox"/>
If Yes, provide details:	<i>Banksia brownii</i> (CR) and <i>Gastrolobium vestitum</i> (EN) occur within several 100 m on Toolbrunup and Mt Hassell, the Montane Mallee Thicket PEC also occurs within 100m at both locations.	
What is the area, extent, abundance of habitat?	Area: 24 ha; extent: 478 ha	
What is the quality of habitat?	Moderate to excellent, some grazing impacts. <i>Phytophthora</i> dieback is likely to have modified fringing habitat.	
Is there a decline in habitat area, extent or quality?	Yes <input type="checkbox"/> No <input type="checkbox"/> Unknown <input checked="" type="checkbox"/>	
If there is a decline, is the decline continuing?	Yes <input type="checkbox"/> No <input type="checkbox"/> Unknown <input checked="" type="checkbox"/>	
Provide details:		
What is the critical habitat or habitat important for the survival of the species?	Scree slopes and fringing woodland vegetation in the Toolbrunup-Mt Hassell area, Stirling Range National Park (SRNP).	

#### Section 4: Survey

4.1 Survey methods (Provide details)		
What survey methods are applicable to the species?	Transect surveys of scree slopes. <b>A major limitation is the remote, rocky, steep terrain and the instability of scree slopes.</b>	
Are there preferred or recommended survey methods that yield better results for the species?	Drones would be much more effective and a much safer method of survey.	
Are there special requirements, techniques, expertise or other considerations that are necessary when surveying for this species?	No	
Are there reasons why the species may not be detected during surveys?	Heavy grazing may make plants difficult to see, otherwise very obvious.	
Can the species be identified in the field?		Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>
Provide details:	<i>Hibbertia</i> sp. Toolbrunup (J.R. Wheeler 2504) is an erect bushy shrub to 1.2 m with striking silvery foliage.  The species is highly distinctive with its silvery foliage and conspicuous yellow flowers The habitat – scree slopes or mountain summits - is highly distinctive.	
Can the species be easily confused within similar species in the field?		Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Unknown <input type="checkbox"/>
Provide details:		
List any published survey guidelines, guidance statements, protocols, standard operating procedures or		

other documents that are relevant to conducting surveys for this species.	
None	
<b>4.2 Survey effort</b>	
Has the species been well surveyed?	Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>
Have targeted surveys been conducted for the species?	Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>
Provide details of the successful and unsuccessful surveys undertaken for the species:	<p>Survey for species within the <i>Hibbertia argentea</i> group has occurred over many years in the SRNP with a Biological Survey of Mountain 1994-1996 and survey for Priority-listed flora since 1996. While numerous collections of <i>Hibbertia</i> were made from other mountains, none of these were <i>Hibbertia</i> sp. Toolbrunup (J.R. Wheeler 2504).</p> <p>No plants were observed on the Toolbrunup summit area 1994-1996 or since then.</p> <p>A different species in the <i>Hibbertia argentea</i> group ('<i>H. barrettiae</i>') occurs east of Chester Pass and another species again occurs to the west.</p> <p>A collection from a hill south of Toolbrunup in 2004 was determined to be '<i>H. barrettiae</i>'. No collections from the <i>Hibbertia argentea</i> group have been made from Mt Trio, the nearest mountain to Toolbrunup and Mt Hassell.</p> <p>The scree slope north of the Arrows in the eastern Stirling's has been surveyed and no <i>Hibbertia</i> from this group observed.</p> <p>No plants have been recorded from large areas of scree further upslope along the walk-trail on Toolbrunup.</p> <p>Open scree areas upslope of sub-population 1 were targeted in June 2016 resulting in an extension of sub-population 1, and a new sub-population of 3 mature plants was located north of Mt Hassell in November 2016.</p> <p>Potential habitat is therefore most likely limited to the Toolbrunup-Mt Hassell area; this is also the area in the SRNP with the greatest incidence of scree. An additional 24 ha of habitat (25.7 total) has been mapped.</p> <p>As it is difficult to survey all of the scree on these mountains, and based on the low densities recorded in current populations, the potential number of mature individuals may be inferred to be 227 (based an average of 8.8 mature plants / ha in known sub-populations).</p>
<b>4.3 Research (Provide details)</b>	
Has the species been well researched?	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Partially <input type="checkbox"/> Unknown <input type="checkbox"/>
What research has been or is being conducted?	No formal research
What are the knowledge gaps for the species?	<p>Pollinator unknown</p> <p>Reproductive biology, juvenile period unknown</p> <p>Herbivore unknown</p> <p>Susceptibility to <i>Phytophthora cinnamomi</i> unknown</p> <p>Genetic variability unknown</p>
Research recommendations:	<p>Determine source of herbivory using IR cameras.</p> <p>Document juvenile period and determine generation time.</p> <p>Establish monitoring to document population trends, recruitment,</p>

	demography Determine susceptibility to <i>Phytophthora cinnamomi</i> Investigate genetics
<b>4.4 Monitoring</b> ( <i>Provide details</i> )	
Is the species being monitored, either directly (targeted) or indirectly (general monitoring)?	All plants in population 1 have been tagged and numbered.
What methods are used for monitoring?	Direct counts of mature plants, juveniles and seedlings
Monitoring recommendations:	Monitor growth, health, reproduction (dependent on staff resources).

## Section 5: Geographic range

<b>5.1 Distribution</b>		
<i>Insert map(s) of the species distribution, or provide as an attachment:</i> Attachment		
What is the current distribution of the species within Western Australia?	Toolbrunup-Mt Hassell area SRNP.	
What percentage of the species distribution is within WA?	100	
What is the current distribution of the species within the other Australian States and Territories?	None	
Does the species occur outside of Australia?		Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>
If Yes, what percentage of the species distribution is within Australia, or what is the significance of the occurrence in Australia?	n/a	
What is the current international trend for the species? (if known)	n/a	
<b>5.2 Migration</b> ( <i>fauna only</i> )		
Is the species migratory?		Yes <input type="checkbox"/> No <input type="checkbox"/> Unknown <input type="checkbox"/>
Is the migration within WA or within Australia or international?		
<b>5.3 Extent of Occurrence (EOO) within Australia</b>		
What is the current EOO?	478 ha	

How has this been calculated?	Using ARCGIS – minimum convex polygon including potential / critical habitat
What is the historical EOO?	34 ha: Historic area of occupancy would have included a population on the summit of Toolbrunup.  The species was collected from the summit of Mt Toolbrunup by A. Morrison in 1902 (FloraBase records).
What is the current EOO trend?	Decreasing <input type="checkbox"/> Increasing <input type="checkbox"/> Stable <input type="checkbox"/> Unknown <input checked="" type="checkbox"/>
<i>Provide details on the current trend – quantify if possible</i>	Increasing through survey from 34 ha to 478 ha Nov 2016.
If there has been a change in EOO when did this change occur?	Increase from survey Nov 2016 Mt Hassell.
Was the change observed, estimated, inferred or projected?	Observed.
If the EOO is decreasing / declining, is it continuing?	Yes <input type="checkbox"/> No <input type="checkbox"/> Unknown <input type="checkbox"/>
Is the continuing decline observed, estimated, inferred or projected?	n/a
Is there extreme fluctuation in EOO?	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Unknown <input type="checkbox"/>
<i>If Yes, provide details:</i>	
<b>5.4 Area of Occupancy (AOO) within Australia</b>	
What is the current AOO?	Actual area occupied habitat 1.7 ha. 8 km <sup>2</sup> using the 2 km x 2 km grid method.
How has this been calculated?	Using ARCGIS – area of polygons
What is the historical AOO?	Unknown but historic area of occupancy would have included a population on the summit of Toolbrunup.
What is the current AOO trend?	Decreasing <input type="checkbox"/> Increasing <input type="checkbox"/> Stable <input type="checkbox"/> Unknown <input checked="" type="checkbox"/>
<i>Provide details on the current trend – quantify if possible</i>	Increase from survey Nov 2016 Mt Hassell.
If there has been a change in AOO when did this change occur?	Increasing through survey from 0.8 ha November 2015 to 1.7 ha Nov 2016 but historical decrease since 1902.
Was the change observed, estimated, inferred or projected? Give details.	Observed from survey, inferred from herbarium record.
If the AOO is decreasing / declining, is it continuing?	Yes <input type="checkbox"/> No <input type="checkbox"/> Unknown <input checked="" type="checkbox"/>
Is the continuing decline observed, estimated, inferred or projected? Give details.	
Is there extreme fluctuation in AOO?	Yes <input type="checkbox"/> No <input type="checkbox"/> Unknown <input checked="" type="checkbox"/>



If Yes, provide details:		
<b>5.5 Number of Locations</b>		
<p><b>'Locations'</b> are defined as a geographically or ecologically distinct area in which a single threatening event can rapidly affect all individuals of the taxon present. The size of the location depends on the area covered by the threatening event and may include part of one or many subpopulations. Where a taxon is affected by more than one threatening event, location should be defined by considering the most serious plausible threat. (IUCN 2001).</p>		
At how many locations does the species occur?	One	
Has there been a change in the number of locations?	Decrease <input type="checkbox"/> Increase <input type="checkbox"/> No change <input checked="" type="checkbox"/> Unknown <input type="checkbox"/>	
If there has been a change, when did this change occur?		
Was the change observed, estimated, inferred or projected? Give details.		
If the number of locations is decreasing / declining, is it continuing?	Yes <input type="checkbox"/> No <input type="checkbox"/> Unknown <input checked="" type="checkbox"/>	
Is the continuing decline observed, estimated, inferred or projected? Give details.		
Is there extreme fluctuation in the number of locations?	Yes <input type="checkbox"/> No <input type="checkbox"/> Unknown <input checked="" type="checkbox"/>	
If Yes, provide details:		
Does this species occur on any off-shore islands?	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>	
If Yes, provide details:		
<b>5.6 Fragmentation</b>		
Is the distribution fragmented?	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Unknown <input type="checkbox"/>	
<p>The phrase '<b>severely fragmented</b>' refers to the situation in which increased extinction risks to the taxon results from the fact that most of its individuals are found in small and relatively isolated subpopulations (in certain circumstances this may be inferred from habitat information). These small subpopulations may go extinct, with a reduced probability of recolonization.</p>		
Is the distribution severely fragmented?	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Unknown <input type="checkbox"/>	
If Yes, provide details:		
<b>5.7 Land tenure</b>		
Is the species known to occur on lands managed primarily for nature conservation? i.e. national parks, conservation parks, nature reserves and other lands with secure tenure being managed for conservation	Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>	
If Yes; provide details:		Stirling Range National Park

Is the species known to occur on lands that are under threat? i.e. mining tenement, zoned for development		Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>
If Yes; provide details:		
Provide details of other land tenures where the species occurs as this relates to the species conservation status		

## Section 6: Population

<p><b>‘Population’</b> is used in a specific sense in the Red List Criteria that is different to its common biological usage. Population is here defined as the total number of mature individuals of the taxon. In the case of taxa obligately dependent on other taxa for all or part of their life cycles, biologically appropriate values for the host taxon should be used. (IUCN 2001)</p>				
<p><b>‘Subpopulations’</b> are defined as geographically or otherwise distinct groups in the population between which there is little demographic or genetic exchange (typically one successful migrant individual or gamete per year or less).</p>				
<b>6.1 Subpopulations</b>				
Location (include coordinates)	Land tenure	Survey information: Date of survey and No. mature individuals	AOO	Site / habitat Condition
Toolbrunup (Subpopulation 1)	NP	1999: 30+ [5 dead] 2015: 8 (9 juveniles/seedlings) 1/6/16: 12 (11 juveniles)	1.0 ha	Moderate
Mt Hassell (Subpopulation 2)	NP	8/11/16: 3 (7 juveniles/seedlings)	0.7 ha	Moderate
<b>6.2 Population size (Australian context) (include how numbers were determined/calculated)</b>				
What is the total population size?	15 mature plants			
What is the number of subpopulations?	2			
What percentage of the population is within WA?	100			
What percentage of the population is within Australia?	100			
<b>6.3 Population dynamics (Australian context) (include how numbers were determined/calculated)</b>				

What is the number of mature individuals?	15, actual count
What is the number of immature individuals?	18, actual count
What is the number of senescing/past reproductive individuals?	?1
What is the maximum number of mature individuals per subpopulation?	12
What is the percentage of mature individuals in the largest subpopulation?	80%
What percentage of mature individuals is within WA?	100
What percentage of global mature individuals is within Australia?	100
What is the age of sexual maturity?	Unknown
What is the life expectancy?	unknown
What is the generation length?	Unknown
What is the reproductive capacity? (i.e. litter size or number of seeds)	Unknown
What is the reproductive success?	Unknown
<b>6.4 Population trend</b>	
What is the current population trend (mature individuals)?	Decreasing <input checked="" type="checkbox"/> Increasing <input type="checkbox"/> Stable <input type="checkbox"/> Unknown <input type="checkbox"/>
What is the percentage of the population change and over what time period?	Approx 75% decline since 1999 (30+ mature plants) in lower section of sub-population 1 to 8 mature plants April 2016.
How has this been calculated?	Estimated from Threatened flora records 1999 - 2016.
If the trend is decreasing; are the causes of the reduction understood?	Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Unknown <input type="checkbox"/>
Have the causes of the reduction ceased?	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Unknown <input type="checkbox"/>
Are the causes of the reduction reversible?	Yes <input type="checkbox"/> No <input type="checkbox"/> Unknown <input checked="" type="checkbox"/>
Is the reduction continuing (continuing decline)?	Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Unknown <input type="checkbox"/>
Has the change been observed, estimated, inferred or is it suspected (direct observation, index of abundance appropriate to the species)?	Change inferred from estimates of population size 1999 to 2016. Change projected to continue as herbivory protected to continue. Observation of failure of seedling establishment.

When was the reduction or is it anticipated to occur?		Past <input checked="" type="checkbox"/> Present <input type="checkbox"/> Future <input checked="" type="checkbox"/>
What is the period of time for the reduction (in years and generations)?	17 years	
Has there been a reduction in the number of subpopulations?		Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Unknown <input type="checkbox"/>
If Yes, provide details:	Population on summit of Toolbrunup is considered to be extinct.	
Are there extreme fluctuations in population size?		Yes <input type="checkbox"/> No <input type="checkbox"/> Unknown <input checked="" type="checkbox"/>
If Yes, provide details:		
<b>6.5 Translocations and captive/enclosed subpopulations</b>		
Have there been translocations (introduction or re-introduction)?		Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Unknown <input type="checkbox"/>
Are there proposed translocations (introduction or re-introduction)?		Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Unknown <input type="checkbox"/>
Are there captive/enclosed/cultivated subpopulations?		Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Unknown <input type="checkbox"/>
Are there proposed captive/enclosed/cultivated subpopulations?		Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Unknown <input type="checkbox"/>
Are there self-sustaining translocated subpopulations?		Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Unknown <input type="checkbox"/>
If Yes, provide details:	Seed was collected from sub-population 1 in December 2015 (hand-picked) and March 2016 (seed bags) and 81 seed are stored at the DPAW Threatened Flora Seed Centre.	
Are there translocated subpopulations that are not self-sustaining?		Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Unknown <input type="checkbox"/>
If Yes, provide details:		
Are there self-sustaining captive/enclosed subpopulations?		Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Unknown <input type="checkbox"/>
If Yes, provide details:		
Are there captive/enclosed subpopulations that are not self-sustaining?		Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Unknown <input type="checkbox"/>
If Yes, provide details:		
Other information on translocations and captive/enclosed subpopulations for the species (including failures):		
<b>6.6 Important subpopulations</b>		
Identify any subpopulations that are important or necessary for the long-term survival of the species and provide details for why they are considered as such (i.e. key breeding, edge or range, maintenance of genetic diversity):		

All sub-populations are important.



## Section 7: Threats

7.1 Threats (detail how the species is being impacted, i.e. how severe, the extent, evidence of the impact)				
Threat (describe how the threat impacts on the species. Include abiotic and biotic causes, human related e.g. exploitation, and biological characteristics of the species e.g. low genetic diversity)	Extent (give details of impact on whole species or specific subpopulations)	Impact (what is the level of threat to the conservation of the species)	Evidence	Time period (past, present, future)
Herbivory	Affects plants in both sub-populations	Prevents reproduction, limits establishment of new recruits.	Direct signs of browsing of foliage in current sub-populations.  Toolbrunup sub-population: The Threatened species, <i>Leucopogon gnaphalioides</i> , occurred on Toolbrunup until recently (last plant seen in 2003) but is now considered locally extinct. Herbivory is considered to have contributed to this however <i>Phytophthora</i> dieback cannot be excluded.	Past, present, future
<i>Phytophthora</i> dieback	Unknown	Unknown	None at present  Toolbrunup sub-population: The Threatened species, <i>Leucopogon gnaphalioides</i> , occurred on Toolbrunup until recently (last plant seen in 2003) but is now considered locally extinct. Herbivory is considered to have contributed to this however <i>Phytophthora</i> dieback cannot be excluded.	Past, present, future
Fire	Whole species	Extreme	Killed by fire and appears to regenerate from soil stored seed. If fire frequency is increased the soil seed bank could be depleted before juvenile plants have reached maturity.	Past, present, future

Drought	Whole species	Extreme	The species occurs on skeletal soils making recruitment difficult and dependent on sufficient moisture as the seedlings roots need to grow through the scree layer to access moisture in the soil.	Past, present, future
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## Section 8: Management

8.1 Current management	
Is the species managed?	Yes, directly <input checked="" type="checkbox"/> Yes, indirectly <input type="checkbox"/> No <input type="checkbox"/>
If Yes; provide details of current or past management actions:	Seed collected from sub-population 1 Plants tagged for monitoring sub-population 1 2 juvenile plants fenced
Does the species benefit from the management of another species or ecological community?	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Unknown <input type="checkbox"/>
If Yes; provide details:	
8.2 Recovery planning	
Is there an approved Recovery Plan (RP) or Interim Recovery Plan (IRP) for the species?	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>
List all relevant recovery plans or interim recovery plans (including draft, in-preparation, out-of-date, national and other State/Territory plans, and plans for other species or ecological communities that may benefit or be relevant to the nominated species)	
List other documents that may be relevant to the management of the species or the lands on which it occurs (i.e. area management plans, conservation advices, referral guidelines)	
Interim recovery plan for nearby Threatened species <i>Banksia brownii</i> Management plan for Stirling Range and Porongurup National Parks 1999-2009 Interim recovery plan for Montane Mallee Thicket of the Stirling Range	
8.3 Management recommendations	
Fence juvenile plants to protect from herbivory, determine source of herbivory using IR cameras. Ongoing monitoring to document population trends, recruitment, demography. Implement <i>Phytophthora</i> management if confirmed as threat. Research: Determine susceptibility to <i>Phytophthora cinnamomi</i> . Investigate genetics to confirm species status as a distinct taxa. Document juvenile period and generation length.	

## Section 9: Nominator details

Nominator name(s):	
Contact details:	
Date submitted:	16/11/16

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

Nomination has been discussed at Albany Threatened Flora recovery team meetings 2016 (Chair - Sarah Comer)

## Section 10: References

### 9.1 References

Barrett S (1996) Biological survey of mountains in southern Western Australia. Environment Australia. (Department of Conservation and Land Management: Perth)

Barrett S (2005) Interim Recovery Plan for Montane Mallee Thicket of the Stirling Range. Department of Conservation and Land Management: Perth

Department of Conservation & Land Management (1999) Management Plan for the Stirling Range and Porongurup Range National Parks 1999-2009.