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)**:**	***Banksia rufa* subsp. *pumila***
Nomination for (addition, deletion, change)**:**	**Addition**
Nominated conservation category and criteria:	**EN: B1ab(ii,iii,iv,v)+2ab(ii,iii,iv,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:	*Banksia rufa* subsp. *pumila*			
Common name:	None			
Family name:	Proteaceae	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	2010	Endangered	B1ab(ii,iii,iv,v)+B2ab(ii,iii,iv,v)
		5/4/2017	Endangered	B1ab(ii,iii,iv,v)+B2ab(ii,iii,iv,v)
	2.			

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:	Further survey showed an increase in the number of mature individuals from approximately 7,000 prior to 2009, to >15,000 individuals from 2011 to 2014.
• 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:	Since the assessment in 2010, the number of mature individuals has increased from 7,000 prior to 2009, to >15,000 from 2011 to 2014 as a result of further survey. However the habitat of the subpopulations is highly threatened by dieback disease and fire with all subpopulations infested with the disease. Testing of the species susceptibility has found that the species is highly susceptible with a number of plant deaths observed in all subpopulations. Without ongoing management a projected decline is expected. Meets criteria Endangered B1ab(ii,iii,iv,v)+B2ab(ii,iii,iv,v).

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?	**EN: B1ab(ii,iii,iv,v)+B2ab(ii,iii,iv,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)	• The total number of recorded mature individuals increased from 7,000 prior to 2009, to approximately 15,840 from 2011 to 2014 (extrapolated figure) due to further survey. However there has been a decline in individuals within some subpopulations due to *Phytophthora cinnamomi* and fire. It is likely the subspecies will decline in the future without ongoing management. • **Does not meet criterion**
B.	Geographic range (EOO and AOO, number of locations and evidence of decline)	• (B1) EOO <100 km^2. Using Minimum Convex Polygon (MCP) the EOO is estimated as 12 km^2, which was calculated by drawing a polygon around the subpopulations (5.4 km^2) and rectifying to be no less than the estimated AOO. • (B2) AOO >10 km^2 and <100 km^2. The area of mapped subpopulations is 0.487 km^2 or 48.7 hectares and 12 km^2 using the 2km x 2km grid method. • (a) Known from four locations within the Stirling Range National Park, as while threatening processes are the same, the four subpopulations are quite separate and the threats are operating independently. • (b) Continuing decline observed and projected: • (ii) An increase in the area of occupancy from 40 ha when surveyed prior to 2009, to 48.7 ha in 2011 to 2014, is due to the discovery of new individuals located in Subpopulation 4. A projected decline in the area of occupied habitat is expected due to the impact of disease and fire. With projected loss of subpopulations, there is a corresponding projected decline in the AOO. • (iii) Subpopulations 1, 3 and 4 occur within the Montane Mallee Thicket Threatened Ecological Community (TEC). This TEC is highly threatened by *Phytophthora cinnamomi* and fire. Plant deaths in association with the disease have been observed and it is suspected that infestations may directly and indirectly contribute to a decline in the area, extent and/or quality of habitat in each subpopulation. • (iv) There has been an historic reduction in the number of known subpopulations. A herbarium collection from 1987 “Northwest slopes of Little Mondurup” (SRNP) was not relocated during targeted surveys in 2006 and 2007. It is suspected that *Phytophthora cinnamomi* has caused the loss of this subpopulation after wildfire in 2000. There is the potential for further loss of subpopulations if *Phytophthora* and

		fire management fail to protect the subpopulations. • (v) Decline in the number of mature individuals was noted in 2000 in Subpopulations 1 and 2 (10% of Subpopulation 2 recorded as dead in 2009; and 10% of Subpopulation 4 dead in 2007) due to *Phytophthora cinnamomi*. It is likely that inappropriate fire intervals and *Phytophthora cinnamomi* infestation will lead to further reduction in the total population size. • **Meets criteria for EN: B1ab(ii,iii,iv,v) +B2ab(ii,iii,iv,v)**
C.	Small population size and decline (population size, distribution and evidence of decline)	• Known from approximately 15,840 mature individuals. • **Does not meet criterion**
D.	Very small or restricted population (population size)	• (D) The species is known from approximately 15,840 mature individuals in total. • **Does not meet criterion**
E.	Quantitative analysis (statistical probability of extinction)	• No information to assess.

Summary of assessment information

EOO	5.4 km^2 (MCP), recalculated to 12 km^2 so as not to be less than the AOO.	AOO	12 km^2 (2 km x 2 km grid). Extrapolated area of subpopulations 0.487 km^2	Generation length	Juvenile period approximately 5 years

No. locations	4	Severely fragmented	Yes ☐ No ☒ Unknown ☐
No. subpopulations	4	No. mature individuals	~15,840
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)*
Phytophthora dieback • *Phytophthora cinnamomi* kills plants and degrades associated habitat. The species has been tested and found to be highly susceptible to dieback disease with a very high risk of extinction. All subpopulations are infested and plant deaths have been observed. Past, current and future	Whole population	Catastrophic

Small population size • The species is only known from four subpopulations, all subject to threatening processes, placing it under serious threat from those process. Current, future	Whole population	Catastrophic
Altered fire regimes • Increased fire intervals may cause a decline in the number of individuals with fires in short succession capable of killing live plants before canopy-stored seed has been replenished. Past, current and future	Whole population	Severe
Drought • This is a threat to the subspecies if it occurs over a number of years. • 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 subspecies. **Future**	Whole population	Severe

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).

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

- Monitoring and surveys have been carried out to determine plant numbers and impact of threats;
- Seed has been collected and stored at Parks and Wildlife Threatened Flora Seed Centre.

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

- Monitor subpopulations annually or near-annually for factors such as habitat degradation (including the impact of dieback), population stability (expansion or decline), grazing, pollinator activity, seed production, recruitment, longevity, predation and the impact of phosphite application on the subspecies;
- Develop and implement a fire management strategy, to determine fire control measures and fire frequency, and method of construction and maintenance of firebreaks;
- Undertake surveys during the subspecies flowering period from September to October, in areas of potentially suitable habitat, such as sandy/clay/loam soils on sandstone and siltstone on the lower to mid slopes of the central Stirling Range and on spongelite in lowland habitat to the south;
- Continue to follow dieback hygiene measures, particularly during track maintenance adjacent Subpopulation

2 and when walking into populations in wet soil conditions;

- Apply phosphite, via aerial spraying, to assist in managing *Phytophthora* impacts;
- Establish new subpopulations through translocation into disease-free areas.

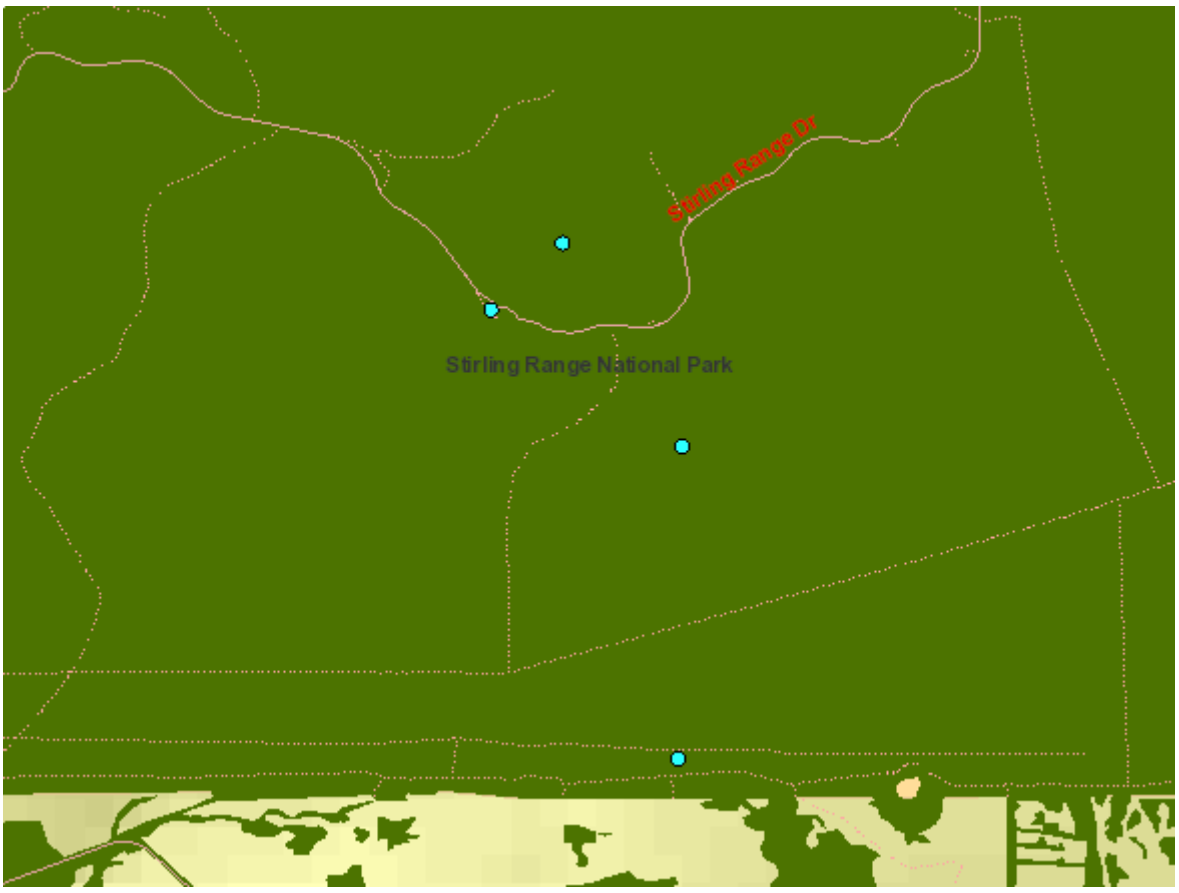
Research

Research biology and ecology of the subspecies including:

- a study of the soil seed bank dynamics and the role of various factors including disturbance, competition, drought, inundation and grazing in recruitment and seedling survival;
- determination of reproductive strategies, phenology and seasonal growth;
- investigation of the mating system and pollination biology;
- investigation of population genetic structure, levels of genetic diversity and minimum viable population size;
- impacts of dieback disease and phosphite application on the subspecies and its habitat; and
- the impact of changes in hydrology in the habitat.

Nomination prepared by:	
Contact details:	
Date submitted:	5/12/2016
If the nomination has been refereed or reviewed by experts, please provide their names and contact details:	

Location of *Banksia rufa* subsp. *pumila* with remnant vegetation



Summary of subpopulation information *(detailed information to be provided in the relevant sections of the form)*						
Location or Subpopulation *(include coordinates)*	Land tenure	Survey information: Date of survey and No. mature individuals	Area of Subpopulation	Site / habitat Condition	Threats *(note if past, present or future)*	Specific management actions
Subpopulation 1: Lookout Hill, north slopes and ridgeline, Stirling Range National Park.	National Park	2007: 3,000 2009: 3,000± 2011: 2–3,000 2014: 2,500 2015: 2,500	1.1 ha	Healthy. Healthy new growth visible. Little evidence of current *Phytophthora cinnamomi* activity.	Phytophthora dieback (past, present, future) Fire (past, present, future) Small population size (past, future) Drought (future)	Apply phosphite Develop a fire management plan Collect seed and test viability, conduct regeneration trials Implement disease hygiene measures Implement translocations
Subpopulation 2: 10.5km east on internal south firebreak of Chester Pass Rd, southern boundary, Stirling Range National Park.	National Park	2009: 2,800± 2011: 3,000+ (2,000+ juveniles)	43 ha	Moderate. *Phytophthora cinnamomi* adjacent. Plants burnt in 2007 buffer burn.	Phytophthora dieback (past, present, future) Fire (past, present, future) Small population size (past, future) Drought (future)	Apply phosphite Develop a fire management plan Collect seed and test viability, conduct regeneration trials Implement disease hygiene measures Implement translocations
Subpopulation 3: SW of summit of Mt Gog, E-W ridge, Stirling Range National Park.	National Park	2003: 1,000± 2011: 1–2,000 2016: 1,000	1.6 ha	Moderate. Combination of *Phytophthora cinnamomi* infested and healthy vegetation on ridge, few recent and older deaths.	Phytophthora dieback (past, present, future) Fire (past, present, future) Small population size (past, future) Drought (future)	Apply phosphite Develop a fire management plan Collect seed and test viability, conduct regeneration trials Implement disease hygiene measures

						Implement translocations
Subpopulation 4: Hosteller Hills, saddle between long E-W ridge and N-S ridge, Stirling Range National Park.	National Park	2007: 200± 2010: 12,000 (3,000 juveniles) 2014: 9,340 [250 dead]	3 ha	Moderate. *Phytophthora cinnamomi* present. Some dead plants at top of ridge. Scattered dead plants throughout subpopulation.	Phytophthora dieback (past, present, future) Fire (past, present, future) Small population size (past, future) Drought (future)	Apply phosphite Develop a fire management plan Collect seed and test viability, conduct regeneration trials Implement disease hygiene measures Implement translocations

Department of Environment and Conservation

Form to nominate a Western Australian species for listing as threatened, change of category or delisting (Updated 2016).

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

Answer all relevant sections, filling in the white boxes and indicating when there is no information available. To mark boxes with a **cross** ☒: on the **View** menu, point to **Toolbars**, and then click **Forms**. Click **Protect Form**, then check the box. Unlock the form by clicking and you will then be able to type text in the white table cells.

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 "N/A".

SECTION 1. NOMINATION			
1.1. Nomination information			
Flora ☒	**Fauna** ☐	**Nomination for: Addition** ☒	**Change of category** ☐ **Delisting** ☐
Banksia rufa subsp. *pumila* (A.S.George) A.R.Mast & K.R.Thiele			
1.2. Common Name **If the species has a generally accepted common name, please show it here. This name will be used on all official documentation.**			
None			
1.3. Current Conservation Status. If none, type 'None'.			
International IUCN Red List Category and Criteria applicable to the highest rank category only e.g. Vulnerable (B1ab(iv);D(1))	None		
National EPBC Act 1999 Category	None		
State of WA Wildlife Conservation Notice Schedule	Endangered		
State of WA IUCN Category	B1ab(ii,iii,iv,v)+B2ab(ii,iii,iv,v)		
State of WA Priority	None		
Is the species listed as 'Threatened' in any other Australian State or Territory? If Yes, list these States and/or Territories and the status for each.			
No ☒ **Yes** ☐			
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? If Yes, please provide details.			
No ☒ **Yes** ☐			

1.4. Nominated Conservation Status. Type one category for each of the fields. If none, write 'None'.	
International IUCN Red List Category and Criteria applicable to the highest rank category only e.g. Vulnerable (B1ab(iv);D(1))	
National EPBC Act 1999	Endangered B1ab(iii,iv,v)+B2ab(iii,iv,v)
State of WA Wildlife Conservation Notice Schedule	Schedule 2
State of WA IUCN Category	Endangered B1ab(iii,iv,v)+B2ab(iii,iv,v)
State of WA Priority	None

1.5. 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.

- *Banksia rufa* subsp*. pumila* was listed as Priority 2 (State of W.A Priority). It is known from only 4 subpopulations located within the Stirling Range National Park (SRNP).

- The species is susceptible to *Phytophthora cinnamomi* and monitoring has revealed that all subpopulations are either infested by or in close proximity to the pathogen. *P. cinnamomi* and inappropriate fire regimes are considered to have contributed to a continuing decline in the area, extent and quality of habitat for the species.

- The species occurs on mountain slopes and one lowland location in the Stirling Range National Park. DEC staff have surveyed potential habitat for the species since 2001. Despite extensive survey, no additional subpopulations have been found since 2007.

- The current occurrence of four subpopulations with a very small area of occupancy renders the species vulnerable to extinction through catastrophic or other unpredictable environmental events.

- It is the view of the compiler that *Banksia rufa* subsp*. pumila* should be considered for listing on the State of WA Wildlife Conservation Notice Schedule as Declared Rare Flora (DRF). The species meets the IUCN category and criteria:

- **Endangered B1ab(iii,iv,v)+B2ab(iii,iv,v)**

  B1. Extent of occurrence < 100km²
  B2. Area of occupancy <10km²
  (a) # of locations = <5
  (b) Continuing decline in (iii,iv,v) area, extent and/or quality of habitat, number of locations or subpopulations and number of mature individuals.

- Further survey in 2010 resulted in the extension to Subpopulation 4. The number of mature individuals increased from 7,000 prior to 2009, to >15,000 from 2011 to 2014 as a result. However the habitat of the subpopulations is still highly threatened by dieback disease and recent testing of the species susceptibility has found that the species is highly susceptible. Without ongoing management a projected decline is expected. Still meets criteria for Endangered B1ab(iii,iv,v)+B2ab(iii,iv,v). The subcriterion (ii) now not included as the AOO is calculated using the 2x2 km grid method and subpopulation extinction may not result in a decline in the estimated AOO.

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 taxon from closely related taxa. Include details of the type specimen, changes in taxonomy, scientific names and common names used for the species.

Banksia rufa subsp*. pumila* was first collected by K. Alcock in 1986 from Talyuberlup Peak in the Stirling Range National Park. The species was described by Alex George in 1996 as *Dryandra ferruginea* subsp*. pumila.*

Mast & Thiele (2008) published a paper titled "The transfer of *Dryandra* to *Banksia*" in which they synonymised *Dryandra* under *Banksia* and as a result, changed the generic and specific epithets of *Dryandra ferruginea* subsp. *pumila* to *Banksia rufa* subsp*. pumila.*

Is this species conventionally accepted? 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).

No ☐ **Yes** ☒

n/a

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

None known.

2.2. Description

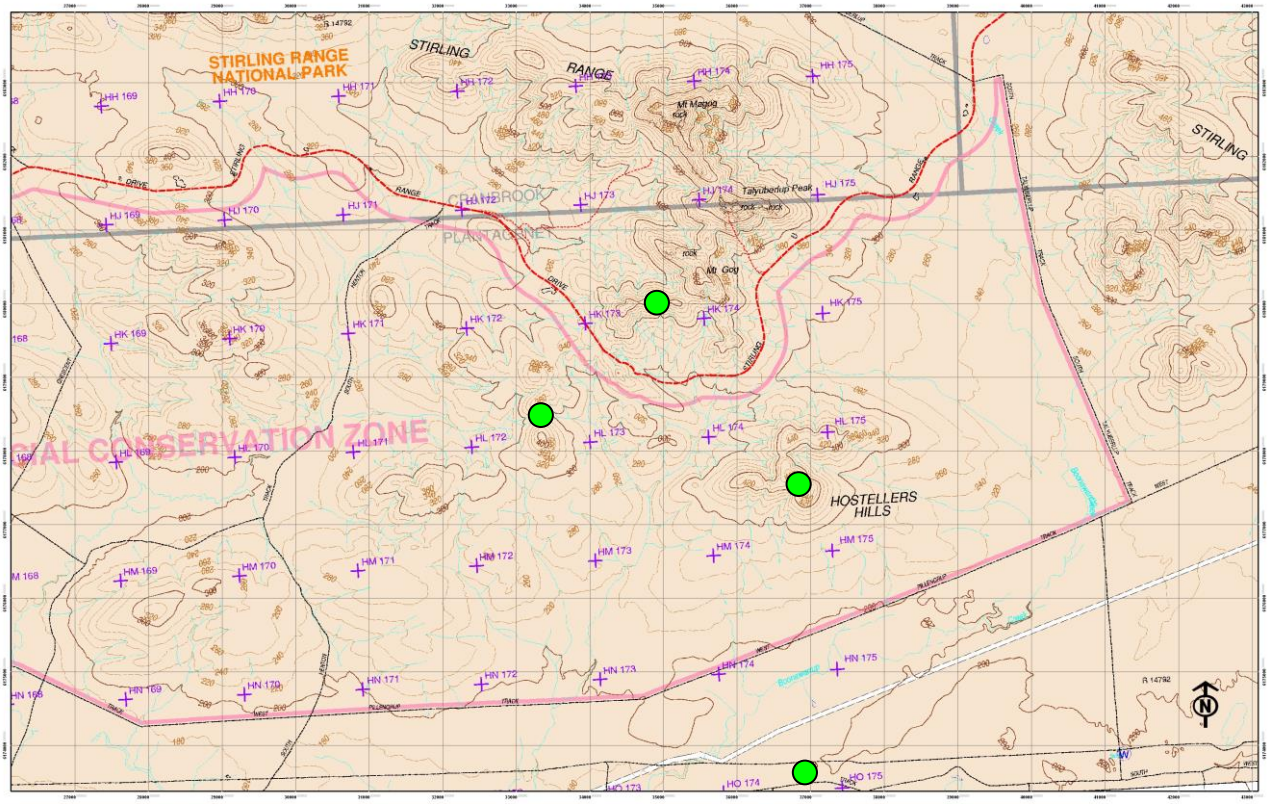
Describe the physical appearance, habit, behaviour/dispersion and life history. Include anatomy or habit (e.g. size and/or weight, sex and age variation, social structure) and dispersion (e.g. solitary, clumped or flocks etc), and life history (eg short lived, long lived, geophytic, etc).

A member of the family Proteaceae, *Banksia rufa* subsp*. pumila* is an erect, non-lignotuberous shrub to 0.3 m high. The leaves are pinnately divided into lobes reaching just over halfway to the midrib, with almost flat margins and are 8-15 cm long and 1.8-3.5 cm wide. The flowers are yellow and the follicles are 1.5cm long, broadly obovate with a slight basal notch (George 1996).

2.3. Distribution

Describe the distribution of the species <u>in Australia</u> and, if possible, provide a map.

Banksia rufa subsp*. pumila* is endemic to the Stirling Range National Park in south west Western Australia. It is currently known from four subpopulations located at Lookout Hill, SW Mt Gog, Hosteller Hills and a site adjacent to the southern boundary of the National Park. The linear range of the species is approximately 7 km.



● *Banksia rufa* subsp*. pumila* subpopulations

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

Banksia rufa subsp*. pumila* grows in sandy/clay/loam soils on sandstone and siltstone on the lower to mid slopes of the central Stirling Range and on spongelite in lowland habitat to the south. While the former habitat is relatively abundant on mountain slopes in the SRNP, these mountains have been extensively surveyed by S Barrett since 1994 and prior to this by G Keighery. Furthermore much of this habitat is infested by *P. cinnamomi* and therefore is no longer suitable habitat or alternatively *P. cinnamomi* is likely to be in close proximity to any subpopulation. The lowland habitat on spongelite is rare within the SRNP. Similar habitat at Kamballup 10 km south of SRNP has been well-surveyed as well as several private property remnants between the SRNP and Kamballup in the course of survey for another DRF species that occurs on spongelite.

Biological habitat

Banksia rufa subsp*. pumila* has been recorded growing in shrub mallee thicket and mallee heath communities. Associated species include; *Eucalyptus preissiana, Lambertia fairallii* (CR), *Banksia pseudoplumosa* (EN), *Darwinia wittwerorum* (EN), *Banksia hirta, B. drummondii, B. sphaerocarpa, B. seneciifolia, B. gardneri, Xanthorrhoea platyphylla, Hypocalymma speciosum, Allocasuarina trichodon* and *Acacia baxteri.*
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?
Banksia rufa subsp*. pumila* occurs within *the* Montane Mallee Thicket TEC (Subpopulations 1, 3 and 4). Associated listed species include *Lambertia fairallii* (CR), *Banksia pseudoplumosa* (EN), *Deyeuxia drummondii* (VU) and *Darwinia wittwerorum* (EN).
2.5. Reproduction **Provide an overview of the breeding system.** **For <u>fauna</u>: Provide an overview of the breeding system and breeding success, including: when does it breed; what conditions are needed for breeding; are there any breeding behaviours that may make it vulnerable to a threatening process?** **For <u>flora</u>: 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?**
Banksia rufa subsp*. pumila* has been recorded flowering from September to October. Due to the absence of a lignotuber and observations after fire, this species is considered to be a serotinous obligate re-seeder with a juvenile period of approximately 5 years. Little else is known of the species' reproductive biology.
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).**
No data.
Questions 2.7 and 2.8 apply to <u>fauna</u> nominations only
2.7. Feeding **Summarise food items or sources and timing/availability.**
N/A
Briefly describe feeding behaviours, including those that may make the species vulnerable to a threatening processes.
N/A
2.8. Movements **Describe any relevant daily or seasonal pattern of movement for the species, including relevant arrival/departure dates if migratory. Provide details of home range/territories.**
N/A
SECTION 3. INTERNATIONAL CONTEXT
For species that are distributed both in <u>Australia</u> and in <u>other countries</u>.
3.1. Distribution **Describe the global distribution.**
Endemic to WA
Provide an overview of the global population size, trends, threats and security of the species outside of Australia.
N/A
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? – provide 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).

In 2009 the total number of mature individuals is approximately 7,000 (15,840 estimated 2011 to 2014). Since 2000 ongoing deaths have been noted in Subpopulations 1 and 2, for example 10% of Subpopulation 2 was recorded as dead in 2009; and 10% of Subpopulation 4 was dead in 2007 due to *Phytophthora cinnamomi*.

It is likely that inappropriate fire intervals and *Phytophthora cinnamomi* infestation may lead to further reduction in the total subpopulation size.

Provide 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.

Four. The species is currently known from four subpopulations consisting of approximately 7,000 mature plants (15,840 from 2011 to 2014) that occupy an area of approximately 40 ha (48.7 ha in 2014).

For <u>flora</u>, and where applicable, for <u>fauna</u>, detail the location, land tenure, estimated number of individuals, area of occupancy, and condition of site 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
Subpopulation #1 Look out Hill (SRNP)	National Park	03/03/2009 20/08/2015	3,000+/- 2,500	2ha 1.1ha	Moderate Currently healthy. New growth visible, little evidence of Pc activity.
Subpopulation #2 Southern Boundary of Park (SRNP)	National Park	06/03/2009 09/06/2011	2,800+/- 3,000+/-	35ha 43ha	Moderate. Currently moderate. Pc adjacent, plants burnt in 2007 buffer burn.
Subpopulation #3 SW Gog (SNRP)	National Park	24/10/2003 17/03/2016	1,000+/- 1,000	2ha 1.6ha	Moderate Currently moderate. Pc infested combined with healthy vegetation on ridge, few recent and older deaths.

Subpopulation #4 Hostellers Hills (SNRP)	National Park	21/06/2007 18/12/2014	200+/- 9,340 (250 dead)	1ha 3ha	Moderate Moderate. Pc present, scattered dead plants at top of ridge and throughout subpopulation.

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

The number of individuals in the subpopulations has been estimated. For Subpopulation 2 this was carried out by firstly defining the perimeter of the subpopulation (marking with a GPS) then recording the number of individuals contained within a virtual 10 X10m plot. Several replicates were made and an average of plants per 10,000m^2 was calculated. The subpopulation boundary was then plotted using ArcGis to establish the area occupied by the species and the individuals per 10,000m^2 calculation applied to determine an estimate of the total plants within the given area.

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

There has been a known reduction in the number of known locations. A herbarium collection from 1987 "Northwest slopes of Little Mondurup" (SRNP) was not relocated during targeted surveys in 2006 and 2007. It is suspected that *Phytophthora cinnamomi* has caused the loss of this subpopulation after wildfire in 2000.

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 current estimated extent of occurrence is 12 km^2 (5.4 km^2 in 2014, recalculated to 12 km^2 so as not to be less than the AOO) (based on the minimum convex polygon encompassing the extant subpopulations). The current known area of occupancy for the species is approximately 0.04 km^2 (0.487 km^2 in 2014); AOO estimated as 12 km^2 using the 2x2 km grid method.

Is the distribution of the species severely fragmented? Why?

No. The species is currently known from 4 subpopulations that are small and isolated, but this is presumed to be a natural situation, and the intervening area is vegetated. The four subpopulations are separated by 7 km in distance. Considering the dispersal capacity of the species, following an extinction event these populations have a reduced probability of recolonisation.

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 subpopulations are considered necessary for the long-term 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.

Banksia rufa subsp*. pumila* is a small, distinctive shrub and that is easily recognisable, even when not flowering. Searches are best concentrated on lower to mid slopes of mountains within the central Stirling Range.

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

Banksia rufa subsp*. pumila* is a small distinctive shrub that is easily recognisable, even when not flowering. The species is distinguished from the closely related *Banksia rufa* subsp*. rufa* by its smaller habitat, shorter leaves and flatter leaf margins (George 1996).

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.

Banksia rufa subsp*. pumila* has been well surveyed. The species was originally known only from Subpopulation 1 on Lookout Hill. In 1987, Greg Keighery collected the species from Little Mondurup, but further survey has been unable to relocate this subpopulation which is now infested by *P. cinnamomi*. Subpopulation 2 was found by S. Barrett in 2000 located on a fire break on the southern boundary of the Stirling Range National Park. Further survey by S. Barrett located Subpopulation 3 on the southwest slopes of Mt Gog in 2003 and Subpopulation 4 on Hosteller Hill in 2007. Survey by Parks and Wildlife staff in 2010 and 2014 located new individuals and new extent of Subpopulation 4.

Suitable habitat is relatively abundant on mountain slopes in the SRNP and these mountains have been extensively surveyed by S Barrett since 1994 and prior to this by G Keighery. Much of this habitat is infested by *P. cinnamomi* and therefore is no longer likely to support the species. The lowland habitat on spongelite is rare within the SRNP. Similar habitat at Kamballup 10 km south of SRNP has been well-surveyed as well as several areas on private property between the SRNP and Kamballup in the course of survey for another DRF species that occurs on spongelite. A vouchered specimen located on North Woogenilup Rd, near the southern boundary of the Park was considered to be *B. rufa* ssp *rufa* by *Dryandra* expert Margaret Pieroni.

Despite extensive survey of suitable habitat since 1996 a total of only four subpopulations have been recorded. Even if more plants were found, the species range is unlikely to be extended more than a few kilometres to the south and it is believed that the current known distribution is close to, if not the actual distribution [based on the mountain landform and the geology it occupies] (S. Barrett pers. com). The lowland habitat type is also rare and is not known to occur south of Kamballup. Furthermore, the area of suitable habitat for the species is very limited and fragmented due to inappropriate fire regimes and Phytophthora dieback.

4.3. Threats

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

a). how and where they impact this species

b). what the effect of the threat(s) has been so far (indicate whether it is known or suspected

c). present supporting information/research

d). does it only affect certain populations?

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

Current occurrence in four small subpopulations – actual threat.

a) *Banksia rufa subsp. pumila* occurs in only four subpopulations with a very small area of occupancy. It is considered to be highly vulnerable to random loss of a subpopulation through catastrophic or other unpredictable environmental events.
b) Insufficient information
c) All subpopulations are small and have a very small area of occupancy.
d) The suspected effect of catastrophic or unpredictable environmental events on these small subpopulations could be potentially disastrous and result in the extinction of the species.

Phytophthora Dieback (*Phytophthora cinnamomi*) – actual threat

a) Assessment of *B. rufa* subsp*. pumila's* habitat since 2000 revealed that all subpopulations are infested by *Phytophthora cinnamomi*.
b) Plant deaths in association with *Phytophthora cinnamomi* have been observed in all subpopulations.

c) Inoculation in a shade house has confirmed the species susceptibility to *Phytophthora cinnamomi.* Using a predictive *P. cinnamomi* risk-assessment tool, Barrett *et al.* (2008) have ranked the species with a very high risk of extinction due to the impacts of *Phytophthora* and the interaction of the pathogen with other threatening processes.
d) This threat affects all subpopulations.

e) The spread of *Phytophthora cinnamomi* throughout the species habitat will cause further decline in the area of occupancy and number of *Banksia rufa* subsp*. pumila* individuals.

Inappropriate fire regimes - potential threat

a) Increased fire intervals may cause a decline in numbers/area of occupancy, with fires in short succession capable of killing live plants before canopy-stored seed has been replenished. Therefore inappropriate fire regimes are considered a potential threat to the species.
b) Insufficient information.
c) Insufficient information.
d) This threat affects all subpopulations.
e) It is suspected that fires in short succession are capable of causing subpopulation declines.

If possible, provide information threats for each occurrence/location:				
Location	**Past threats**	**Current threats**	**Potential threats**	**Management requirements (see section 4.4)**
Subpopulation #1 Lookout Hill (SRNP)	Small subpopulation vulnerable to random catastrophic events. Inappropriate fire regimes. Phytophthora dieback (*Phytophthora cinnamomi*).	Small subpopulation vulnerable to random catastrophic events. Inappropriate fire regimes. Phytophthora dieback (*Phytophthora cinnamomi*).	Small subpopulation vulnerable to random catastrophic events. Inappropriate fire regimes. Phytophthora dieback (*Phytophthora cinnamomi*).	Fire management.
Subpopulation #2 Southern boundary fire break (SRNP)	Small subpopulation vulnerable to random catastrophic events. Inappropriate fire regimes. Phytophthora dieback (*Phytophthora cinnamomi*).	Small subpopulation vulnerable to random catastrophic events. Inappropriate fire regimes. Phytophthora dieback (*Phytophthora cinnamomi*).	Small subpopulation vulnerable to random catastrophic events. Inappropriate fire regimes. Phytophthora dieback (*Phytophthora cinnamomi*).	Fire management. Implementation of suitable hygiene practices during track maintenance and construction.
Subpopulation #3 SW Mt Gog (SRNP)	Small subpopulation vulnerable to random catastrophic events. Inappropriate fire regimes. Phytophthora dieback (*Phytophthora cinnamomi*).	Small subpopulation vulnerable to random catastrophic events. Inappropriate fire regimes. Phytophthora dieback (*Phytophthora cinnamomi*).	Small subpopulation vulnerable to random catastrophic events. Inappropriate fire regimes. Phytophthora dieback (*Phytophthora cinnamomi*).	Fire management. Application of phosphite.
Subpopulation #4 Hostellers Hills (SRNP)	Small subpopulation vulnerable to random catastrophic events. Inappropriate fire regimes. Phytophthora dieback (*Phytophthora cinnamomi*).	Small subpopulation vulnerable to random catastrophic events. Inappropriate fire regimes. Phytophthora dieback (*Phytophthora cinnamomi*).	Small subpopulation vulnerable to random catastrophic events. Inappropriate fire regimes. Phytophthora dieback (*Phytophthora cinnamomi*).	Fire management. Application of phosphite.

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.

Insufficient information.

4.4. Management

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

There are no management documents for this species.

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

No.

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

Banksia rufa subsp*. pumila* occurs in four subpopulations within the Stirling Range National Park. The DRF and Priority species within the park are actively managed.

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

Management recommendations include:

- Monitor subpopulations for evidence of grazing impacts, or changes in plant or site health;
- Collect seed and store at Parks and Wildlife Threatened Flora Seed Centre;
- Develop and implement a fire management strategy, including the need for, and method of, the construction and maintenance of firebreaks;
- Undertake surveys in areas of potentially suitable habitat;
- Continue to follow dieback hygiene measures, particularly during track maintenance adjacent Subpopulation 2;
- Apply phosphite to assist in managing *Phytophthora* impacts;
- Establish new subpopulations through translocation into disease-free areas;
- Research biology and ecology of the species, with a focus on pollination effectiveness, seed viability, conditions required for natural germination, response to threats (particularly dieback disease) and disturbances and reproductive biology.

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)	
Organisation(s)	
Address(s)	
Telephone number(s)	
Email(s)	
Date	Updated 6/12/2016

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

N/A

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.

Barrett, S., Shearer B., Crane C. and Cochrane, A. (2008) An extinction-risk assessment tool for flora threatened by *Phytophthora cinnamomi. Australian Journal of Botany* 56 pp: 477-486.

Barrett, S. (2009) Personal Communication 2nd July 2009. Dept. of Environment and Conservation, Albany W.A.

George, A.S (1996) New taxa and a new infrageneric classification in *Dryandra*. *Nuytsia* 10(3) pp: 362.

Mast, A. R. & Thiele, K. (2007) The transfer of *Dryandra* R.Br to *Banksia* L.f *Australian Systematic Botany* 20: pp: 63-71.

Florabase (2009) Western Australian Herbarium, *Department of Environment and Conservation, Como, W.A.* http://florabase.dec.wa.gov.au/