

Australian Government

Department of Agriculture, Water and the Environment

Consultation on Species Listing Eligibility and Conservation Actions

Andersonia axilliflora (giant andersonia)

You are invited to provide your views and supporting reasons related to:

1) the eligibility of *Andersonia axilliflora* (giant andersonia) for inclusion on the EPBC Act threatened species list in the Critically Endangered category; and

2) the necessary conservation actions for the above species.

The purpose of this consultation document is to elicit additional information to better understand the status of the species and help inform on conservation actions and further planning. As such, the below draft assessment should be considered to be **tentative** as it may change following responses to this consultation process.

Evidence provided by experts, stakeholders and the general public are welcome. Responses can be provided by any interested person.

Anyone may nominate a native species, ecological community or threatening process for listing under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) or for a transfer of an item already on the list to a new listing category. The Threatened Species Scientific Committee (the Committee) undertakes the assessment of species to determine eligibility for inclusion in the list of threatened species and provides its recommendation to the Australian Government Minister for the Environment.

Responses are to be provided in writing by email to: <u>species.consultation@awe.gov.au</u>. Please include species scientific name in Subject field.

or by mail to:

The Director Bushfire Affected Species Assessments Section Department of Agriculture, Water and the Environment John Gorton Building, King Edward Terrace GPO Box 858 Canberra ACT 2601

Responses are required to be submitted by 2 March 2022.

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General background information about listing threatened species

The Australian Government helps protect species at risk of extinction by listing them as threatened under Part 13 of the EPBC Act. Once listed under the EPBC Act, the species becomes a Matter of National Environmental Significance (MNES) and must be protected from significant impacts through the assessment and approval provisions of the EPBC Act. More information about threatened species is available on the department's website at: https://www.gov.au/environment/biodiversity/threatened

Public nominations to list threatened species under the EPBC Act are received annually by the department. In order to determine if a species is eligible for listing as threatened under the EPBC Act, the Threatened Species Scientific Committee (the Committee) undertakes a rigorous scientific assessment of its status to determine if the species is eligible for listing against a set of criteria. These criteria are available on the Department's website at: https://www.awe.gov.au/sites/default/files/env/pages/d72dfd1a-f0d8-4699-8d43-5d95bbb02428/files/tssc-guidelines-assessing-species-2021.pdf.

As part of the assessment process, the Committee consults with the public and stakeholders to obtain specific details about the species, as well as advice on what conservation actions might be appropriate. Information provided through the consultation process is considered by the Committee in its assessment. The Committee provides its advice on the assessment (together with comments received) to the Minister regarding the eligibility of the species for listing under a particular category and what conservation actions might be appropriate. The Minister decides to add, or not to add, the species to the list of threatened species under the EPBC Act. More detailed information about the listing process is at: https://www.awe.gov.au/environment/biodiversity/threatened/nominations.

To promote the recovery of listed threatened species and ecological communities, conservation advices and where required, recovery plans are made or adopted in accordance with Part 13 of the EPBC Act. Conservation advices provide guidance at the time of listing on known threats and priority recovery actions that can be undertaken at a local and regional level. Recovery plans describe key threats and identify specific recovery actions that can be undertaken to enable recovery activities to occur within a planned and logical national framework. Information about recovery plans is available on the department's website at: https://www.awe.gov.au/environment/biodiversity/threatened/recovery-plans.

Privacy notice

The Department will collect, use, store and disclose the personal information you provide in a manner consistent with the Department's obligations under the Privacy Act 1988 (Cth) and the Department's Privacy Policy.

Any personal information that you provide within, or in addition to, your comments in the threatened species assessment process may be used by the Department for the purposes of its functions relating to threatened species assessments, including contacting you if we have any questions about your comments in the future.

Further, the Commonwealth, State and Territory governments have agreed to share threatened species assessment documentation (including comments) to ensure that all States and Territories have access to the same documentation when making a decision on the status of a potentially threatened species. This is also known as the <u>'Common Assessment Method' (CAM)</u>. As a result, any personal information that you have provided in connection with your comments may be shared between Commonwealth, State or Territory government entities to assist with their assessment processes.

The Department's Privacy Policy contains details about how respondents may access and make corrections to personal information that the Department holds about the respondent,

how respondents may make a complaint about a breach of an Australian Privacy Principle, and how the Department will deal with that complaint. A copy of the Department's Privacy Policy is available at: <u>https://www.awe.gov.au/about/commitment/privacy</u>.

Information about this consultation process

Responses to this consultation can be provided electronically or in hard copy to the contact addresses provided on Page 1. All responses received will be provided in full to the Committee and then to the Australian Government Minister for the Environment.

In providing comments, please provide references to published data where possible. Should the Committee use the information you provide in formulating its advice, the information will be attributed to you and referenced as a 'personal communication' unless you provide references or otherwise attribute this information (please specify if your organisation requires that this information is attributed to your organisation instead of yourself). The final advice by the Committee will be published on the department's website following the listing decision by the Minister.

Information provided through consultation may be subject to freedom of information legislation and court processes. It is also important to note that under the EPBC Act, the deliberations and recommendations of the Committee are confidential until the Minister has made a final decision on the nomination, unless otherwise determined by the Minister.

<u>CONSULTATION QUESTIONS FOR ANDERSONIA AXILLIFLORA (GIANT</u> <u>ANDERSONIA)</u>

SECTION A - GENERAL

- 1. Is the information used to assess the nationally threatened status of *Andersonia axilliflora* (giant andersonia) robust? Have all the underlying assumptions been made explicit? Please provide justification for your response.
- 2. Can you provide additional data or information relevant to these assessments?
- 3. Have you been involved in previous state, territory or national assessments of this species? If so, in what capacity?

PART 1 – INFORMATION TO ASSIST LISTING ASSESSMENT

<u>SECTION B</u> DO YOU HAVE ADDITIONAL INFORMATION ON THE ECOLOGY OR BIOLOGY OF THE SPECIES? (If no, skip to section C)

Biological information

4. Can you provide any additional or alternative references, information or estimates on longevity, average life span and generation length?

5. Do you have any additional information on the ecology or biology of the species not in the current advice, including fire response or susceptibility to *Phytophthora cinnamomi*?

<u>SECTION C</u> ARE YOU AWARE OF THE STATUS OF THE TOTAL NATIONAL POPULATION OF THE SPECIES? (If no, skip to section D)

Population size

- 6. Has the survey effort for giant andersonia been adequate to determine its national adult population size? If not, please provide justification for your response.
- 7. Do you consider the way the population size has been derived to be appropriate? Are there any assumptions and unquantified biases in the estimates? Do you accept the estimate of the total population size of the species? If not, please provide justification for your response.
- 8. If not, can you provide a further estimate of the current population size of mature adults of the species (national extent)? Please provide supporting justification or other information.

If, because of uncertainty, you are unable to provide a single number, you may wish to provide an estimated range. If so, please choose one of the ranges suggested in the table below of possible species numbers, and also choose the level of confidence you have in this estimate:

Number of mature individuals is estimated to be in the range of:

□ 0-10 □ 10-50 □ 50-100 □ >100 □ >500 □ >1 000

Level of your confidence in this estimate:

- \Box 0–30% low level of certainty/ a bit of a guess/ not much information to go on
- □ 31–50% more than a guess, some level of supporting evidence
- \Box 51–95% reasonably certain, information suggests this range
- 95–100% high level of certainty, information indicates quantity within this range
- 99–100% very high level of certainty, data are accurate within this range

<u>SECTION D</u> ARE YOU AWARE OF TRENDS IN THE OVERALL POPULATION OF THE SPECIES? (If no, skip to section E)

9. Does the current and predicted rate of decline used in the assessment seem reasonable? Do you consider that the way this estimate has been derived is appropriate? If not, please provide justification of your response.

Evidence of total population size change

10. Are you able to provide an estimate of the total population size for the species? Please provide justification for your response.

If, because of uncertainty, you are unable to provide a single number, you may wish to provide an estimated range. If so, please choose one of the ranges suggested in the table below of possible species numbers, and also choose the level of confidence you have in this estimate.

Number of mature individuals is estimated to be in the range of:

□ 0-10 □ 10-50 □ 50-100 □ >100 □ >500 □ >1000

Level of your confidence in this estimate:

 \Box 0–30% - low level of certainty/ a bit of a guess/ not much information to go on

- \Box 31–50% more than a guess, some level of supporting evidence
- \Box 51–95% reasonably certain, information suggests this range
- 95–100% high level of certainty, information indicates quantity within this range
- 99–100% very high level of certainty, data are accurate within this range
- 11. Are you able to comment on the extent of decline in the species total population size over the last approximately 66-96 years (i.e. three generations)? Please provide justification for your response.

If, because of uncertainty, you are unable to provide an estimate of decline, you may wish to provide an estimated range. If so, please choose one of the ranges suggested in the table below of ranges of decline, and also choose the level of confidence you have in this estimated range.

Decline estimated to be in the range of:

□ 1–30% □31–50% □51–80% □81–100% □90–100%

Level of your confidence in this estimated decline:

 \Box 0–30% - low level of certainty/ a bit of a guess/ not much information to go on

 \Box 31–50% - more than a guess, some level of supporting evidence

 \Box 51–95% - reasonably certain, suggests this range of decline

- \Box 95–100% high level of certainty, information indicates a decline within this range
- 99–100% very high level of certainty, data are accurate within this range
- 12. Please provide (if known) any additional evidence which shows the population is stable, increasing or declining.

<u>SECTION E</u> ARE YOU AWARE OF INFORMATION ON THE TOTAL RANGE OF THE SPECIES? (If no, skip to section F)

Current Distribution/range/extent of occurrence, area of occupancy

- 13. Does the assessment consider the entire geographic extent and national extent of the species? If not, please provide justification for your response.
- 14. Has the survey effort for this species been adequate to determine its national distribution? If not, please provide justification for your response.
- 15. Is the distribution described in the assessment accurate? If not, please provide justification for your response and provide alternate information.
- 16. Do you agree that the way the current extent of occurrence and/or area of occupancy have been estimated is appropriate? Please provide justification for your response.
- 17. Can you provide estimates (or if you disagree with the estimates provided, alternative estimates) of the extent of occurrence and/or area of occupancy?

If, because of uncertainty, you are unable to provide an estimate of extent of occurrence, you may wish to provide an estimated range. If so, please choose one of the ranges suggested in the table below of ranges of extent of occurrence, and also choose the level of confidence you have in this estimated range.

Current extent of occurrence is estimated to be in the range of:

 \Box <100 km² \Box 100 - 5 000 km² \Box 5 001 - 20 000 km² \Box >20 000 km²

Level of your confidence in this estimated extent of occurrence

- 0–30% low level of certainty/ a bit of a guess/ not much data to go on
- \Box 31–50% more than a guess, some level of supporting evidence
- □ 51–95% reasonably certain, data suggests this range of decline
- 95–100% high level of certainty, data indicates a decline within this range

99–100% - very high level of certainty, data is accurate within this range

If, because of uncertainty, you are unable to provide an estimate of area of occupancy, you may wish to provide an estimated range. If so, please choose one of the ranges suggested in the table below of ranges of area of occupancy, and also choose the level of confidence you have in this estimated range.

Current area of occupancy is estimated to be in the range of:

 \Box <10 km² \Box 11 – 500 km² \Box 501 – 2 000 km² \Box >2 000 km²

Level of your confidence in this estimated extent of occurrence:

 \Box 0–30% - low level of certainty/ a bit of a guess/ not much data to go on

 \Box 31–50% - more than a guess, some level of supporting evidence

□ 51–95% - reasonably certain, data suggests this range of decline

95–100% - high level of certainty, data indicates a decline within this range

99–100% - very high level of certainty, data is accurate within this range

<u>SECTION F</u> ARE YOU AWARE OF TRENDS IN THE TOTAL RANGE OF THE SPECIES? (If no, skip to section G)

Past Distribution/range/extent of occurrence, area of occupancy

- 18. Do you consider that the way the historic distribution has been estimated is appropriate? Please provide justification for your response.
- 19. Can you provide estimates (or if you disagree with the estimates provided, alternative estimates) of the former extent of occurrence and/or area of occupancy?

If, because of uncertainty, you are unable to provide an estimate of past extent of occurrence, you may wish to provide an estimated range. If so, please choose one of the ranges suggested in the table below of ranges of past extent of occurrence, and also choose the level of confidence you have in this estimated range.

Past extent of occurrence is estimated to be in the range of:

 \Box <100 km² \Box 100 – 5 000 km² \Box 5 001 – 20 000 km² \Box >20 000 km²

Level of your confidence in this estimated extent of occurrence

 \Box 0–30% - low level of certainty/ a bit of a guess/ not much data to go on

 \Box 31–50% - more than a guess, some level of supporting evidence

□ 51–95% - reasonably certain, data suggests this range of decline

95–100% - high level of certainty, data indicates a decline within this range

99–100% - very high level of certainty, data is accurate within this range

If, because of uncertainty, you are unable to provide an estimate of past area of occupancy, you may wish to provide an estimated range. If so, please choose one of the ranges suggested in the table below of ranges of past area of occupancy, and also choose the level of confidence you have in this estimated range:

Past area of occupancy is estimated to be in the range of:

 \Box <10 km² \Box 11 – 500 km² \Box 501 – 2 000 km² \Box >2 000 km²

Level of your confidence in this estimated extent of occurrence:

 \Box 0–30% - low level of certainty/ a bit of a guess/ not much data to go on

 \Box 31–50% - more than a guess, some level of supporting evidence

□ 51–95% - reasonably certain, data suggests this range of decline

95–100% -high level of certainty, data indicates a decline within this range

99–100% - very high level of certainty, data is accurate within this range

PART 2 – INFORMATION FOR CONSERVATION ADVICE ON THREATS AND CONSERVATION ACTIONS

<u>SECTION G</u> DO YOU HAVE INFORMATION ON THREATS TO THE SURVIVAL OF THE SPECIES? (If no, skip to section H)

- 20. Do you consider that all major threats have been identified and described adequately?
- 21. To what degree are the identified threats likely to impact on the species in the future?
- 22. Are the threats impacting on different populations equally, or do the threats vary across different populations?
- 23. Can you provide additional or alternative information on past, current or potential threats that may adversely affect the species at any stage of its life cycle?
- 24. Can you provide supporting data/justification or other information for your responses to these questions about threats?

SECTION H DO YOU HAVE INFORMATION ON CURRENT OR FUTURE MANAGEMENT FOR THE RECOVERY OF THE SPECIES? (If no, skip to section I)

- 25. What planning, management and recovery actions are currently in place supporting protection and recovery of the species? To what extent have they been effective?
- 26. Can you recommend any additional or alternative specific threat abatement or conservation actions that would aid the protection and recovery of the species?
- 27. Would you recommend translocation (outside of the species' historic range) as a viable option as a conservation action for this species?

<u>SECTION I</u> DO YOU HAVE INFORMATION ON STAKEHOLDERS IN THE RECOVERY OF THE SPECIES?

- 28. Are you aware of other knowledge (e.g. traditional ecological knowledge) or individuals/groups with knowledge that may help better understand population trends/fluctuations, or critical areas of habitat?
- 29. Are you aware of any cultural or social importance or use that the species has?
- 30. What individuals or organisations are currently, or potentially could be, involved in management and recovery of the species?
- 31. How aware of the giant andersonia are land managers adjacent to the Stirling Range National Park where the species is found?
- 32. What level of awareness is there with individuals or organisations around the issues affecting the species?
 - a. Where there is awareness, what are these interests of these individuals/organisations?
 - b. Are there populations or areas of habitat that are particularly important to the community?

PART 3 – ANY OTHER INFORMATION

33. Do you have comments on any other matters relevant to the assessment of the giant andersonia?

Conservation Advice for Andersonia axilliflora (giant andersonia)

This draft document is being released for consultation on the species listing eligibility and conservation actions

The purpose of this consultation document is to elicit additional information to better understand the status of the species and help inform conservation actions, further planning and a potential recovery plan. The draft assessment below should therefore be considered **tentative** at this stage, as it may change as a result of responses to this consultation process.

<u>Note</u>: Specific consultation questions relating to the below draft assessment and preliminary determination have been included in the consultation cover paper for your consideration.

This document combines the approved conservation advice and listing assessment for the taxon. It provides a foundation for conservation action and further planning.



Photos of giant andersonia (Andersonia axilliflora) © Copyright, S Barrett (personal collection)

Conservation status

Andersonia axilliflora (giant andersonia) is proposed to be transferred from the Endangered category to the Critically Endangered category of the threatened species list under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). The giant andersonia

was originally listed under the *Endangered Species Protection Act 1992* before being transferred to the EPBC Act.

- Criterion 1: A4abe: Critically Endangered
- Criterion 2: B1ab(i,ii,iii,iv,v): Critically Endangered
- Criterion 3: C1 + C2a(i): Critically Endangered
- Criterion 4: D1: Endangered
- Criterion 5: Insufficient data

The main factors that make the species eligible for listing in the Critically Endangered category are a small population size, very restricted distribution, continuing decline and less than 50 individuals in each subpopulation.

Species can also be listed as threatened under state and territory legislation. For information on the current listing status of this species under relevant state or territory legislation, see the <u>Species Profile and Threat Database</u>.

Species information

Taxonomy

Conventionally accepted as Andersonia axilliflora (Stschegl.) Druce (1917).

Taxonomic synonyms for the species include *Sphincterostoma axilliforum, Andersonia colossea* and *Sprengelia colossea* (CHAH 2021).

Description

The following description for giant andersonia has been adapted from Evans et al. (2003) and DAWE (2016). The giant andersonia is a slow growing robust shrub that grows 2-3 m tall in the family Ericaceae and is the tallest species in the genus *Andersonia*. The branchlets are erect and covered in distinctive overlapping triangular-shaped leaves (3 cm long); the leaves are broad at the base, where they clasp at the stem and taper to a point at the tip. At the end of the branchlets, up to 30 cream flowers (1 cm long) are hidden behind floral leaves of the flower calyx. The floral leaves are creamy white, extend beyond the flowers and also taper to a sharp point.

Distribution

The giant andersonia is endemic to the eastern peaks montane habitat of the Stirling Range National Park (SRNP), south-western Western Australia (WA) (Barrett & Yates 2015). The Stirling Range is approximately 90 km north of Albany. The species occurs on peaks between Ellen Peak and Mt Success at altitudes of 750 to 1 080 m above sea level (Map 1; Evans et al. 2003).

There are 11 subpopulations as at 2021 which have an estimated total population of 80 mature individuals and 1216 juveniles (Table 1; Barrett unpublished data). The number of mature individuals prior to the 2018 and 2019 fires across subpopulations has declined from 389 (Table 1, 5; Evans et al., 2003), however, subpopulations 7 and 8 are missing post-fire data. The number of juvenile plants has increased from pre-2003 estimates of 898, however subpopulations 7 and

8 are missing data on the number of juvenile individuals (Table 1). The 11 subpopulations may have previously occurred as three larger subpopulations (Evans et al. 2003), however fires and dieback caused by *Phytophthora cinnamomi* infection have led to fragmentation across the range (DAWE 2016).

The giant andersonia is a key species indicative of the distribution of the Eastern Stirling Range Montane Heath and Thicket Threatened Ecological Community (TEC; DAWE 2016). The TEC is listed as Critically Endangered in WA and Endangered under the EPBC Act. The species is found within the Interim Biogeographic Regionalisation of Australia (IBRA) region of the Esperance Plains (ALA 2021).

Subpopulation	Year (No. of mature plants)*	Fire history	Condition in 2003#
1. Bluff Knoll, Stirling Range NP	1999 (20) {500} [20] 2001 (100+) {~ 600} [many] 2003 (250+) {500+} 2021 (20) {200}	Pre 1972, 1991, 2000, 2018, 2019	Moderate condition
2. Ellen Pk, Stirling range NP	1999 (0) {90} 2001 (5) {15} 2002 (5) 2020 (0) {3}	2018	Poor condition. Grazing threat at this locality.
3. East Bluff, Stirling Range NP	1998 (0) {100} 2000 (0){100}^ 2003 (0){70}^ 2021 (12) {87}	2000, 2018, 2019	Poor condition.
4. Isongerup, Stirling Range NP	2000 (150) {150} 2003 (50) [5] 2021 (35) {850}	1991, 2000, 2018	Moderate condition.
5. Pyungoorup, Stirling Range NP	2000 (20) [5] 2003 (3) {4} 2020 (0) {7}	1991, 2000, 2018, 2019	Poor condition.
6. Bakers Knob, Stirling Range NP	1997 (75) [25] 2002 (0) {30} 2021 (0) {1}	1991, 2000, 2018, 2019	Moderate condition.
7. Second Arrow, Stirling Range NP	1997 (50+) (no post-fire survey data)	1991, 2018	Moderate condition.
8. First Arrow, Stirling Range NP	1997 (20+) pre 2018 fire (~15) (no post-fire survey data)	1991 2018	Moderate condition.
9. Moonoongoonderup, Stirling Range NP	2000 (0) {300} [150] 2002 (0) {100} 2003 (0) {100} 2020 (6) {18}	1991, 2000, 2019	Poor condition.
10. Mt Success, Stirling Range NP	1999 (15) {250} 2002 (11) {5} 2021 (7) {18}	2019	Moderate condition.
11. Coyanerup, Stirling Range NP	2000 (0) {24} [20] 2021 (0) {55}	1991, 2018	Poor condition.

Table 1 Distribution of the giant andersonia	i (Evans et al. 2003; Barro	ett unpublished data)
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* { } = number of juvenile plants, []= number of dead plants. ^ = assumed number of juvenile plants, however a small portion could be mature individuals.



Map 1 Modelled distribution of giant andersonia

Source: Base map Geoscience Australia; species distribution data <u>Species of National Environmental Significance</u> database. **Caveat:** The information presented in this map has been provided by a range of groups and agencies. While every effort has been made to ensure accuracy and completeness, no guarantee is given, nor responsibility taken by the Commonwealth for errors or omissions, and the Commonwealth does not accept responsibility in respect of any information or advice given in relation to, or as a consequence of, anything containing herein.

Species distribution mapping: The species distribution mapping categories are indicative only and aim to capture (a) the specific habitat type or geographic feature that represents recent observed locations of the species (known to occur) or preferred habitat occurring in close proximity to these locations (likely to occur); and (b) the broad environmental envelope or geographic region that encompasses all areas that could provide habitat for the species (may occur). These presence categories are created using an extensive database of species observations records, national and regional-scale environmental data, environmental modelling techniques and documented scientific research.

Cultural and community significance

This section describes some published examples of this significance but is not intended to be comprehensive, applicable to, or speak for, all Indigenous people. Such knowledge may be only held by Indigenous groups and individuals who are the custodians of this knowledge.

The cultural significance of giant andersonia is not well understood. However, Aboriginal people have had a long and continuous association with country within Koi Kyenunu-ruff (Stirling Range) which is located within the region of the Minang people, according to the Map of Indigenous Australia (AIATSIS 1996). The region is also home to the Nyungar peoples and contains areas of significant cultural importance to them including camping grounds and sacred freshwater holes (gnamma) (Mia 2008). Bula Meela (Bluff Knoll), is of particular cultural importance as it is where the spirits of Nyungar people go after death (Mia 2008).

Relevant biology and ecology

Habitat

The giant andersonia is found along rocky slopes, outcrops & ledges within the montane heath and thicket ecosystem that grows on sandy loam to peaty clam loam acidic soils (pH < 5) with quartz and quartzite fragments (Barrett & Yates 2015). The soils contain higher macronutrient and organic carbon concentrations in comparison to the nutrient poor soils of the surrounding lowland plains (Barrett 2001). Plant growth is limited by low temperatures and high wind speeds that prevail for much of the year (Barrett 1996).

The vegetation community occupied by giant andersonia is characterised by species such as *Kunzea montana* (mountain kunzea), *Beaufortia anisandra* (dark beaufortia), *Sphenotoma* sp. Stirling Range (Stirling Range paper heath), *Andersonia echinocephala*, several *Darwinia* species, *Banksia solandri* (Stirling Range banksia), *Calothamnus montanus* and *Banksia concinna* (Evans et al. 2003).

Reproductive Ecology

The giant andersonia is an obligate seeder, with relatively high rates of germination following fire when sufficient seed is available. As a montane species, giant andersonia is slow-growing and has taken 14 years for 50% of the population to reach reproductive maturity (S Barrett pers comm 28 September). However, several plants at subpopulation three were documented to have flowered within nine years following bushfires in 1991 (Evans et al. 2003). Therefore, the range in time to reach reproductive maturity is 9–14 years (Barrett & Yates 2015; S Barrett 2021 pers comm 28 September). Mature plants can grow up to 3 m tall however eight years post-fire most plants remain small (i.e. plants ranged from 20 to 40 cm tall; Evans et al. 2003).

Keighery (1996) suggests that most species in the genus *Andersonia* are pollinated by insects, possibly moths and butterflies, however two species are bird-pollinated. Beetles have been observed pollinating giant andersonia at subpopulation 1 (Evans et al. 2003), and in recent years, a species of click beetle has been noted (S. Barrett 2021. pers comm 16 December). Seeds are thought to be dispersed by either gravity or wind (Keighery 1996), but very little research has been done specifically on the giant andersonia to confirm the dominant dispersal mechanism.

Fire Ecology

Like other *Andersonia* species, adult plants of giant andersonia are killed by fire and do not resprout (Bell et al. 1996). Population persistence is contingent on the availability of soil-stored seed which germinates following fire. Field observations indicate that there is patchy mass germination and seedling growth post-fire (Table 1), however inter-fire recruitment and staggered recruitment after fire has also been observed (S. Barrett 2021 pers comm 28 September). Seeds are thought to remain viable in the soil for long periods based on the recruitment events and long fire intervals (Evans et al. 2003) though the specific time associated with viability is unknown.

Optimum germination temperature for the species is yet to be confirmed. However, optimum germination temperatures in other small-seeded species (e.g., *Andersonia echinocephala*) have a narrow, low range (Cochrane & Daws 2008). This suggests that at the seed germination stage, the giant andersonia could be highly vulnerable to the effect of future increased temperatures from climate change. Other cues are also likely to be responsible (and important) for initiation of germination. For example, germination of seeds following smoke application (smoke water and

aerosol smoke) has been shown in many Western Australian plants, including other members of the genus (Dixon et al. 1995; Roche et al. 1997; Roche et al. 1998). Non-optimal germination conditions may therefore reduce or delay the germination response and limit population recovery, as shown in other species with physiological dormancy mechanisms (Ooi et al. 2007; Miller et al. 2019).

Habitat critical to the survival

The species is found on rocky slopes, outcrops & ledges along the upper slopes and summits of the eastern peaks of the Stirling Range (Evans et al. 2003; Western Australian Herbarium 1998). The species grows on shallow soils and peaty sand underlain by schist which supports dense low heath or thicket, and scrub vegetation (DAWE 2016). The species occurs in a region that is distinctively montane, with skeletal organic soils, low temperatures, high humidity and exposure, and occasional snowfalls on the mountain peaks (Moir & Leng 2013 cited in Barrett & Yates 2015). The species is also confined to high altitudes of 750 m to 1080 m above sea level. All such habitat is considered habitat critical to the survival of the giant andersonia.

No Critical Habitat as defined under section 207A of the EPBC Act has been identified or included in the Register of Critical Habitat.

Important populations

In this section, the word population is used to refer to subpopulation, in keeping with the terminology used in the EPBC Act and state/territory environmental legislation.

There is sufficient evidence through the species' eligibility for listing and limited range to declare all subpopulations as important populations of this taxon under particular pressure of survival. All populations therefore require protection to support the recovery of the species.

Threats

The main threats to giant andersonia are disease, inappropriate fire regimes, climate change related drought, and herbivory (Table 2). The giant andersonia has a very restricted range, placing subpopulations at risk of localised extirpation from a single threatening event, despite its reservation within a national park. Threats in Table 2 are noted in approximate order of highest to lowest impact, based on available evidence.

Threat	Status a	Evidence
Disease		
Dieback caused by Phytophthora cinnamomi	Timing: historical/current Confidence: observed Consequence: catastrophic Trend: unknown	Giant andersonia is highly susceptible to the effects of dieback disease caused by the invasive soil-borne water mould, <i>Phytophthora cinnamomi</i> (Evans et al. 2003). This pathogen infects the root systems of adults and juveniles of the species and is highly infectious (DEE 2018). <i>Phytophthora cinnamomi</i> spreads through water runoff,

Table 2 Threats impacting giant andersonia

Threat	Status ^a	Evidence
	Extent: across part of its range	transportation of infected soil by humans and animals, and root-to-root contact, spreading both uphill and downhill (Shearer & Tippet 1989). Humans facilitate spread through movement of vehicles during firebreak and track use, and through movement by hikers. The species is found within the vicinity of the Ridge Walk in SRNP, which is a 26 km mountain bushwalk that connects Ellen Peak to Bluff Knoll (DBCA 2017). Hikers that deviate from the main path can facilitate spread. The ridge was also used by the army for training exercises in the 1980s, which may have also lead to spread (S Barrett 2021. pers comm 16 December).
		<i>Phytophthora cinnamomi</i> thrives best in mild moist conditions such as those produced by spring, autumn or summer rainfall (Shearer & Tippet 1989).
		Up to 80% of Stirling National Park is infested with <i>P. cinnamomi</i> (DBCA 2021). All subpopulations of giant andersonia occur in areas known to be affected by the pathogen and all subpopulations are infested (S Barrett 2021. pers comm 16 December; Evans et al. 2003; DAWE 2016). Long-term monitoring showed that the pathogen caused a 70% decline at subpopulation one from 2001–2011 and a 92% decline at subpopulation nine from 1999–2007 (Barrett & Yates 2015). Other species in the community where the giant andersonia occurs have also significantly declined because of infection (Barrett & Yates 2015) and many species within the TEC are susceptible to the pathogen (Evans et al. 2003; DBCA 2021). Dieback caused by <i>P. cinnamomi</i> is listed as a key threatening process under the EPBC Act (DEE 2018). There are also fire-disease interactions which increase the susceptibility of giant andersonia to the pathogen following fire, as evident by wide-scale deaths of
		seedlings in the community due to infection post-fire (Barrett 2000; Evans et al. 2003). Fire exacerbates the effect of phytophthora by removing vegetation cover. This facilitates the spread of the disease through increased surface flow of water, which acts as a vector for the disease.
Habitat loss, disturba	ance and modification (including fir	e)
Inappropriate fire regimes	Timing: historical/current/future Confidence: observed Consequence: catastrophic Trend: increasing Extent: across all of its range	The giant andersonia is an obligate seeder and regenerates from soil-stored seed following exposure to smoke and fire (Barrett & Yates 2015; DAWE 2016). However, the species is sensitive to frequent fire regimes as fire kills mature individuals and seedlings. Local extinction can occur if fire intervals are too short and prevent sufficient regeneration to build up sufficient seedbank reserves. The giant andersonia takes between 9–14 years to reach reproductive maturity (Barrett & Yates 2015; S Barrett 2021. pers comm 28 September). This indicates that a minimum fire-free interval of between 18–28 years may be required for the species following Gill & Nicholls (1989) who considers doubling the juvenile period as an effective method to estimate the minimum fire-free interval and present a lower risk to the species (Gosper et al. 2013). Further, due to interactions between fire and other threats, particularly diseases like <i>Phytophthora cinnamomi</i> , long fire-free intervals for many species in the montane community are required (>25 years) (Barrett 2000)

Threat	Status ^a	Evidence
		The montane region where the species is found has been exposed to major fire events in 1972, 1991, 2000, 2018 and 2019 (Barrett & Yates 2015). These fires include prescribed burns and wildfires (OBRM 2018; DAWE 2020). Subpopulation 1 (Bluff Knoll) was exposed to all five fire events, whereas all other subpopulations were exposed to between one to four fire events, with most being exposed to at least three (Table 1). Not all mature individuals within a subpopulation were killed after exposure to these events. Despite this, the majority of subpopulations have seen a considerable reduction in number of mature individuals between fire events from 1999 to 2020 (Table 1). The number of seedlings growing post-fire has also declined within the same time period which could indicate a reduction in the soil seedbank or high post-fire seedling mortality. Reductions in the size of the soil seedbank are also likely due to insufficient time between fires for plants to reach reproductive maturity and replenish seed (fire intervals ranged from 1 year to 9 years across subpopulations), and other threats acting on mature individuals and preventing seedlings reaching maturity (Barrett & Yates 2015). By contrast, subpopulation 4 has seen the largest seedling recruitment event on record (850 seedlings following the 2018 fire, Table 1), though this is likely due to considerable survey effort. Prescribed burning can also exacerbate the impact of wildfires that are also increasing in frequency due to climate change (Clarke 2015; Dowdy et al. 2019; BOM & CSIRO 2020). The 2018 fire was the result of an escaped prescribed burn and was followed a year later by a bushfire in 2019. Four subpopulations were burnt by both fire events (i.e. in 2018 and 2019), though only small proportions of plants at Bluff Knoll and Pyungoorup were burnt. Although some mature individuals survived both fires (Table 1) due to their patchy nature, the interaction
		between prescribed burns and bushfires poses a significant risk to the species. Sensitivity to fire season is also an important consideration in the fire regime because the seeds of giant andersonia are dormant until cued by physiological conditions. If fire occurs outside of the natural fire season, non-optimal conditions may reduce or delay the germination response and limit population recovery as shown in other species with physiological dormancy mechanisms (Ooi et al. 2007; Miller et al. 2019). Other potential fire-related threats include fire-disease, fire drought and fire horbivore interactions (see holow)
Browsing by	Timing: current	Although browsing by native species such as quokka is a
Setonix brachyurus (quokka)	Confidence: observed Consequence: major Trend: increasing Extent: across the entire range	natural ecosystem process, the state of equilibrium in the habitat of the giant andersonia has been altered because of human induced threatening processes (Rathbone & Barrett 2017). Therefore, browsing by native species on plants with critically low numbers, as is the case for giant andersonia, presents a significant threat to population persistence and undermines conservation recovery actions for the species (Rathbone & Barrett 2017). Quokka are known to feed directly on giant andersonia
		which can prevent the species from flowering and setting seed and inhibit growth. For example, herbivore exclusion experiments at Bluff Knoll (subpopulation 1) over a one-year period showed growth in the volume of

Threat	Status ^a	Evidence
		giant andersonia of 9242 cm ³ in fenced plots, compared to a loss of 318 cm ³ in unfenced plots (Rathbone & Barrett 2017). The impact of quokka browsing was an order of magnitude greater than that of introduced species, such as rabbits (Rathbone & Barrett 2017).
		Quokka are found throughout the SRNP and have been shown to be responsible for 75% of grazing pressure on threatened flora within the montane heath ecosystem of SRNP, including the giant andersonia (Rathbone & Barrett 2017). Interactions between browsing and fire are also a threat to giant andersonia because herbivore populations increase following fire and therefore slow the recovery of the species (Rathbone & Barrett 2017). Disease and browsing interactions may also be a threat. For example, browsing could exacerbate <i>P. cinnamomi</i> activity by keeping vegetation cover low which enables soil temperatures to increase and subsequent microbial activity to decrease. Browsing could also facilitate the spread of the disease by enabling the pathogen to spread more easily following rainfall (S Barrett 2021. 16 December).
Damage from use of the habitat	Timing: current Confidence: observed Consequence: moderate Trend: increasing Extent: across part of its range	The Stirling Range has a long history of recreational use dating back to the 1920s when the Stirling Range Tourist Association made the area accessible to tourists by creating roads (DBCA 2017). Today the SRNP is highly valued by tourists for bushwalking, nature observation and rock-climbing (Barrett 2000). A popular mountain walking track called Ridge Walk, extends the length of the giant andersonia range, from Ellen Peak to Bluff Knoll in SRNP (Barrett 2000) and is approximately 26 km long (DBCA 2017). Bluff Knoll is the most popular site being the highest mountain in southwest WA.
		Recreational use has caused a number of impacts to the giant andersonia. The most significant impact is the interaction between recreational use and disease. Recreational activities, such as bushwalking, have facilitated the spread of <i>P. cinnamomi</i> , based on the distribution of the pathogen with the accessibility of tracks to the mountain peaks (Barrett 2000). The pathogen favours moist soil conditions that prevail for much of the year on the higher mountain peaks where recreational impacts are high (Barrett 2000).
		Other impacts to the giant andersonia from recreational use include erosion, trampling and nutrient enrichment (Barrett 2000). Shallow montane soils are easily eroded by foot traffic which reduces the available area for seedling recruitment. Trampling can directly damage plants due to their slow growth rate; seedlings would be most susceptible. Increased nutrients from accumulation of human excreta, can facilitate weed invasion particularly in low nutrient soils (Heddle & Specht 1975). Other potential recreational use interactions include recreational use and fire (see above).
Reductions in precipitation due to climate change	Timing: current/future Confidence: observed/estimated Consequence: major Trend: increasing Extent: across the entire range	Mean annual rainfall in the southwest region of WA has declined since 1970 with reductions becoming larger and more widespread since 2000 (DIICCRTRS 2013). The largest reductions have been observed in autumn and winter, when most precipitation occurs (DIICCRTRS 2013). Future climate change predictions for southwest Australia relative to 1990 include averaged annual

Threat	Status ^a	Evidence
		precipitation decreases of 5–10% by 2030 and 30-40% by 2070 (Suppiah et al. 2007; Ford et al. 2013).
		It is unknown how the giant andersonia will respond to reduced precipitation and drying. The mountain peaks where the species occurs have moist soil conditions throughout the majority of the year (Barrett 2000). Reduced soil moisture could expose plants to hydraulic stress and decrease habitat for the species, as shown in other montane species (Enright et al. 2014). Reduced precipitation will likely increase fire risk during dry periods. For example, leaf litter in mallee-heath must have a moisture content less than 8% before fires can be sustained and spread (Allan & Herford 1999). Because the montane heath and thicket is confined to mountain summits, there is no bioclimatic going for
		component species to disperse to with suitable habitat under projected warming and drying (Barrett & Yates 2015).
		Prolonged drying conditions may also impact recruitment in giant andersonia by reducing soil moisture. However, this is yet to be confirmed. Pre-fire and post-fire droughts could also limit population persistence by reducing health and reproductive output of standing plants. For example, drought deaths have been observed in summer of 2019–20.
Invasive species		
Browsing by Oryctolagus cuniculus (rabbits)	Timing: current Confidence: estimated Consequence: minor Trend: increasing Extent: across the entire range	Rabbits have been observed in SRNP and they have been observed infrequently browsing on threatened flora within the montane heath ecosystem of SRNP (Rathbone & Barrett 2017). However, they are not identified as a significant threat in the Management Plan for SRNP and populations in the northern range of the park are managed through state-led control programs (DCALM 1999). Further, sensing cameras deployed intermittently on Bluff Knoll between 2011 and 2015 reveal that rabbits were infrequent grazers of threatened montane heath ecosystems and were only captured in one grazing event out of 96 grazing events captured on camera (Rathbone & Barrett 2017). However, recent observations show that there has been a high impact of rabbits on the TEC on East Bluff, particularly in areas burnt in both 2018 & 2019 (S Barrett 2021. pers comm 16 December). Browsing from rabbits is identified as a significant threat (DEE 2016) and could be a potential threat to the giant andersonia as low grazing pressure would prevent subpopulations from recovering, given their critically low numbers. This threat could also increase if rabbit populations became unmanaged. The low grazing pressure by rabbits was also only tested at one subpopulation in SRNP. Therefore, there could be higher grazing pressure in the unsurveyed subpopulations. Interactions between browsing by rabbits and fire, and
		browsing by rabbits and disease are also a potential threat to the species.
Weeds	Timing: future Confidence: suspected Consequence: unknown Trend: unknown Extent: across part of its range	Weeds are not currently considered a threat to the montane heath and thicket ecosystem of the SRNP, despite 93 species of weeds having been recorded in SRNP (Allan & Herford 1999). However, weeds may become a threat in the future as climate related changes result in species range shifts into montane regions (Petitpierre et al. 2016). Future growth in recreational

Threat	Status ^a	Evidence
		use in SRNP could also increase the risk of weeds through increased soil disturbance (Allan & Herford 1999).

^aTiming—identify the temporal nature of the threat;

Confidence—identify the extent to which we have confidence about the impact of the threat on the species; Consequence—identify the severity of the threat;

Trend—identify the extent to which it will continue to operate on the species;

Extent—identify its spatial content in terms of the range of the species.

Each threat has been described in Table 2 in terms of the extent that it is operating on the species. The risk matrix (Table 3) provides a visual depiction of the level of risk being imposed by a threat and supports the prioritisation of subsequent management and conservation actions. In preparing a risk matrix, several factors have been taken into consideration, they are: the life stage they affect; the duration of the impact; and the efficacy of current management regimes, assuming that management will continue to be applied appropriately. The risk matrix and ranking of threats has been developed in consultation with experts and using available literature. Threats with unknown consequences (weeds) have not been included in Table 3.

Likelihood Consequences Not significant Minor Moderate Major Catastrophic Almost certain Low risk Moderate risk Very high risk Very high risk Very high risk **Browsing by** Dieback caused Setonix by Phytophthora brachyurus cinnamomic (quokka) Inappropriate fire regimes Increased frequency and intensity of fire Likely Low risk Moderate risk High risk Very high risk Very high risk **Damage from Reductions in** recreational precipitation use of the as result of habitat climate change Possible Low risk Moderate risk High risk Very high risk Very high risk **Browsing by Oryctolagus** cuniculus (rabbits) Unlikely Low risk Moderate risk High risk Very high risk Low risk High risk Unknown Low risk Low risk Moderate risk Very high risk

Table 3 Giant andersonia risk matrix

Categories for likelihood are defined as follows:

Almost certain – expected to occur every year

Likely – expected to occur at least once every five years

Possible – might occur at some time

Unlikely – such events are known to have occurred on a worldwide bases but only a few ties Unknown – currently unknown how often the incident will occur **Categories for consequences are defined as follows:** Not significant – no long-term effect on individuals or populations Minor – individuals are adversely affected but no effect at population level Moderate – population recovery stalls or reduces Major – population decreases Catastrophic – population extirpation/extinction

Priority actions have then been developed to manage the threat particularly where the risk was deemed to be 'very high' (red shading) or 'high' (yellow shading). For those threats with an unknown or low risk outcome (green and blue shading) it may be more appropriate to identify further research or maintain a watching brief.

Conservation and recovery actions

Primary conservation objective

By 2030, the giant andersonia has increased in abundance, viable populations are sustained in habitats where high-risk manageable threats are managed effectively, and a viable ex-situ collection of the giant andersonia is maintained to allow for conservation translocation in the event of future threatening events.

Conservation and management priorities

Habitat loss, disturbance and modification (including fire)

- Avoid risks of escape of prescribed fires, as has occurred in the past. Review the need for prescribed burning within or near Stirling Range National Park, identify essential needs, if any, and consider eliminating the practice. However, if prescribed fires are essential for other conservation values, then critically review the evidence that a proposed burn is controllable, cannot escape, and is unable to reach the peaks where giant andersonia is found, and only proceed when these outcomes can be achieved.
- Develop and implement an evidenced-based fire management strategy that optimises the survival of the giant andersonia:
 - Avoid planned burns in all habitat until an appropriate fire-free management interval is derived based on sound scientific evidence for the species. The interval needs to take into account the minimum period required to establish sufficient soil seedbank reserves to ensure the survival of the next generation and the risk of interacting threats (Table 2), and is suggested to be approximately 18–28 years for giant andersonia.
 - Take the likelihood of increasingly frequent bushfires into account when developing planned burning programs, to avoid excessive, frequent burning of any subpopulations.
 - Minimise risks of escape of prescribed fires in the SRNP and adjacent land, by ensuring consultation with relevant authorities and land holders has been undertaken and protocols have been put in place to ensure prescribed burns can be controlled.
 - Provide maps of known occurrences to local and State fire services and consult with them if prescribed burn planning is being undertaken.
 - Avoid application of fire retardants in the vicinity of the population during fire suppression operations.

- Implement actions to reduce the potential impact of quokka on the giant andersonia, in consultation with land managers and community groups, particularly following fire when seedlings are at their most vulnerable. For example, maintain existing fenced exclosures around plants and establish new ones as required.
- Minimise impacts from recreational activities, where possible, particularly around high-use areas such as Bluff Knoll. For example, consider the use of fences or buffer zones, and signs to communicate risk and control run-off from tracks.

Disease

- Implement a hygiene management plan and risk assessment to protect known subpopulations from introduction of new isolates of *P. cinnamomi* or other pathogens (refer to the Threat abatement plan for disease in natural ecosystems caused by *Phytophthora cinnamomi*; DEE 2018). This may include but is not limited to:
 - Ensure soil or water are not introduced into the area for firefighting, track maintenance, infrastructure development or revegetation activities.
 - Minimise risk of transmission by recreational users through the provision of adequate cleaning stations and signage.
 - Ensure appropriate hygiene protocols following that of DBCA (2020) are adhered to by government or service workers when entering or exiting known localities.
- Implement mitigation measures in areas that are known to be infested by *P. cinnamomi*, including, but not limited to, the application of a biodegradable, systemic fungicide such as phosphite (or other alternatives). In order to minimise potential off-target impacts that may result from the build-up of phosphorus in low-nutrient soils (Lambers et al. 2013; Hopper et al. 2021), ensure that applications of phosphite are highly localised and targeted.

Climate change and fire

- Identify current and future habitat likely to remain or become suitable habitat due to climate change (if any) and ensure impacts of other threats to this habitat are minimised (if possible).
- Spread the risk to the species associated with climate change and fire by establishing translocated populations in suitable habitat.

Invasive species (including threats from grazing, trampling, predation)

- Implement management actions for rabbits, in consultation with land managers and community groups, as detailed in the relevant threat abatement plan (DEE 2016).
- Implement weed management actions in consultation with land managers and community groups, using appropriate techniques to minimise the effect of herbicide on native vegetation, according to the Australian Weeds Strategy 2017-2027 (IPAC 2016).

Ex situ recovery action

• Manage the risk of losing genetic diversity, by undertaking appropriate seed collection across subpopulations. Ensure that the integrity of subpopulations is not compromised, by collecting only the minimum number of seeds required for propagation and taking into consideration the number of mature individuals and seeds within each subpopulation. Propagate seeds using previously successful methods and use propagated individuals for

seed banking and storage in long term custodial collections. Determine viability of stored seed at entry into the seed bank and at regular intervals. Best practice seed storage guidelines and procedures should be adhered to, to maximise seed viability (Martyn Yenson et al. 2021).

• Manage the risk of loss of the species by undertaking conservation translocations of propagated individuals in suitable habitat with secure land tenure, to increase the number of subpopulations of giant andersonia, in accordance with the Guidelines for the Translocation of Threatened Plants in Australia (Commander et al. 2018). Ensure that translocation sites are free from *P. cinnamomi*.

Stakeholder engagement/community engagement

- Engage with the Indigenous community to identify Indigenous management responsibilities and cultural connections to giant andersonia. Identify and encourage collaboration opportunities and awareness of this species. Incorporate Indigenous fire management practises into the fire management strategy.
- Raise awareness of the threat of *P. cinnamomi* with the Department of Fire and Emergency Services, other fire and land management agencies, and the general public, to minimise the risk of spread.
- Engage with researchers, local community and government agencies to inform the development of conservation actions for the giant andersonia and obtain the most up-to-date advice on the species.

Survey and monitoring priorities

- Establish and maintain a monitoring program for all subpopulations to:
 - determine population size and trends,
 - determine habitat conditions and stability,
 - assess threats and their impacts (disease, herbivory, weeds, etc.), including the effect of fire on the life-cycle on the species,
 - o document recruitment, longevity, pollination activity and seed production, and
 - monitor the effectiveness of management actions and the need to adapt them, if necessary.
- Monitor the incidence and impacts of *P. cinnamomi*.
- Monitor the activity and impact of herbivores (quokka) in giant andersonia habitat.

Information and research priorities

- Undertake research into the species' fire ecology, including seedling survival post-fire and the fire interval required to allow plants to reach reproductive maturity and establish a soil seed bank.
- Undertake research into the species' reproductive ecology including reproductive strategies, pollinators, seedling recruitment, soil seedbank dynamics and longevity in the soil, species longevity, fecundity, and seed germination requirements. Improve understanding of the impacts of climate change on population viability, including the impacts of increased bushfire frequency and change in precipitation

- Investigate new methods for the effective control of *P. cinnamomi* and treatment of the disease it causes, in order to reduce potential off-target impacts caused by the application of phosphite.
- Undertake research into the species' genetics, including its genetic diversity and minimum viable population size.
- Investigate options for linking or establishing additional subpopulations.

Recovery plan decision

A decision about whether this species requires a Recovery Plan is yet to be determined. The purpose of this consultation document is to elicit additional information to help inform the decision.

Links to relevant implementation documents

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THREATENED SPECIES SCIENTIFIC COMMITTEE

Established under the Environment Protection and Biodiversity Conservation Act 1999

The Threatened Species Scientific Committee finalised this assessment on DD Month Year.

Attachment A: Listing Assessment for Andersonia axilliflora

Reason for assessment

This assessment follows prioritisation of a nomination from the TSSC

Assessment of eligibility for listing

This assessment uses the criteria set out in the <u>EPBC Regulations</u>. The thresholds used correspond with those in the <u>IUCN Red List criteria</u> except where noted in criterion 4, subcriterion D2. The IUCN criteria are used by Australian jurisdictions to achieve consistent listing assessments through the Common Assessment Method (CAM).

Key assessment parameters

Table 4 includes the key assessment parameters used in the assessment of eligibility for listing against the criteria.

Metric	Estimate used in the assessment	Minimum plausible value	Maximum plausible value	Justification
Number of mature individuals	96	80	145	The minimum plausible value is based on post-fire surveys in 2020 and 2021 that indicate there are 80 mature individuals of this species recorded (Table 1, Table 5). However, two subpopulations were not surveyed post-fire (subpopulation 7 and 8). Therefore, the maximum plausible value is based on the minimum plausible value including the number of mature individuals at the last survey for subpopulation 7 (50) and subpopulation 8 (15). The remaining population has declined over time from 280 mature individuals. The percent population decline has been calculated using the minimum plausible value (80) to estimate the most likely current number of individuals at subpopulations 7 and 8, to derive the estimate used in the assessment. This derives a population decline of 71% (((80- 280)/280)*100). Based on the 71% decline, the current estimated number of mature individuals at subpopulation 8 declined from 50 to 16, and the current estimate used in the assessment to 96 mature individuals. Although the mature populations may fluctuate in response to fire (i.e., mature individuals are killed by fire and then recruit from seedlings), high seedling mortality, coupled with the long time to
				reach maturity and continuing decline in number of mature individuals, justifies this approach.

Table 4 Key assessment parameters

Metric	Estimate used in the assessment	Minimum plausible value	Maximum plausible value	Justification
Trend	Declining			Although the number of juveniles is greater than the number of mature individuals (e.g., there are 1119 juveniles recorded in 2020/21), very few of these juveniles appear to reach maturity due to the combined impact of threats from <i>P.</i> <i>cinnamomi</i> , fire, herbivory from quokka, recreational use, and altered precipitation (Table 2). Therefore, a net decline of mature individuals is estimated.
Generation time (years)	27	22	32	Generation time can be estimated using a time to reproductive maturity of 14 years with 50% of the population having flowered within this period (S Barrett 2021. pers comm 28 September; Barrett et al. 2009), and a longevity of between 30–50 years (based on a range because the longevity of the species is unknown). This provides a minimum and maximum plausible value of 22 and 32 years, respectively (see calculation under Criterion 1). The estimate used in the assessment represents a midpoint between the minimum and maximum value.
Extent of occurrence	64	64	68	The minimum plausible value was attained by mapping cleaned point occurrence records from 1996–2019, obtained from state governments, herbarium collections, and other sources. The EOO was then calculated using a minimum convex hull over these areas (IUCN 2019). The maximum plausible value was attained using the same process as the minimum value, however it considered all known records from 1928–2019. The estimate used in the assessment is based on the minimum plausible value as all subpopulations are still extant, despite their declining trajectory. Records from 1928 and 1968 (additional records included in the maximum plausible value) most likely include
				subpopulations that are now locally extinct, as they have not been identified through ongoing widespread surveys in the region.
Trend	Contracting	v		The population trajectory of giant andersonia is likely to decline as 5 of the 11 subpopulations have no or a limited number of mature individuals post-fire, and either no or a low number of juveniles (Table 1). The decline in EOO is likely due to the combined impact of threats from <i>P.</i> <i>cinnamomi</i> , fire, herbivory from quokka, recreational use, and altered precipitation (Table 2).

Metric	Estimate used in the assessment	Minimum plausible value	Maximum plausible value	Justification
Area of Occupancy	36	36	44	The minimum plausible value was attained by mapping cleaned point records from 1996–2019, obtained from state governments, herbarium collections, and other sources. The AOO was then calculated using a 2x2 km grid cell method over these points, based on the IUCN Red List Guidelines (IUCN 2019).
				The maximum plausible value was attained using the same process as the minimum value; however it considered all known records from 1928–2019.
				The estimate used in the assessment is based on the minimum plausible value as all subpopulations are still extant, despite their declining trajectory. Records from 1928 and 1968 (additional records included in the maximum plausible value) most likely include subpopulations that are now locally extinct, as they have not been identified through ongoing widespread surveys in the region.
Trend	Contracting			The population trajectory of giant andersonia is likely to decline as 5 of the 11 subpopulations have no or a limited number of mature individuals post-fire, and either no or a low number of juveniles (subpopulations 2, 5, 6, 10 and 11; Table 1). The decline in AOO is likely due to the combined impact of threats from <i>P. cinnamomi</i> , fire, herbivory from quokka, recreational use, and altered precipitation (Table 2).
Number of subpopulations	11	11	11	There are currently 11 extant subpopulations. Despite the declining trajectory in number of individuals, all subpopulations have either >2 mature individuals, and/or >1 juvenile (Table 1).
Trend	Declining			Although there are 11 extant subpopulations currently, three subpopulations have no mature individuals and between 1–7 juveniles (subpopulation 2, 5 and 6). Very few juveniles appear to reach maturity due to the combined impact of threats from <i>P. cinnamomi</i> , fire, herbivory from quokka, recreational use, and altered precipitation (Table 2). Therefore, these three subpopulations are projected to be lost and a net decline in the number of subpopulations is estimated.
Basis of assessment of subpopulation number	Each subpopula gene flow is pro	ation occurs c esumed to be	on a different n limited.	nountain summit in the eastern extent of SRNP and

Metric	Estimate used in the assessment	Minimum plausible value	Maximum plausible value	Justification
No. locations	1	1	4	The population of the giant andersonia is confined to a restricted habitat in the eastern SRNP. The major threats facing the species are high fire frequency and infection by <i>Phytophthora</i> <i>cinnamomi</i> .
				Due to the very restricted EOO of the species it is plausible that a single fire event could impact all subpopulations of the giant andersonia. The frequency of high fire danger weather (Forest Fire Danger Index) is increasing in southwest WA (CSIRO & Bureau of Meteorology 2020) as a result of climate change and consequently, fires are increasing through time (DIICCSRTE 2013; Barrett & Yates 2015; Dowdy et al. 2019). One location represents the most plausible minimum value. <i>Phytophthora cinnamomi</i> is present at all subpopulations. These subpopulations are connected through recreational and fire maintenance activities. The high prevalence of the pathogen in the SRNP coupled with the high susceptibility of the species to the pathogen and increasing rates of exposure, indicates that one location represents the most plausible minimum value. A location of one represents the most likely estimate used in the assessment. The maximum plausible value considers all fire periods as individual locations (1991, 2000, 2018 and 2019) because not all fire events affected every subpopulation.
Trend	Declining			The frequency of fire has increased through time, and therefore two locations could be reduced to one given the projected increase in frequency of future fire events because of climate change. Therefore, the number of locations is expected to decline.
Basis of assessment of location number	The giant ander predictions inc The most recer of some popula fires) prevent t in population d	rsonia is foun lude an increa It fires of eith tions burning he plant from eclines.	d in a very res ased risk of fre er 2018 or 201 g in both fires. I reaching mate	tricted range in eastern SRNP. Climate change quent and intense fires and reduced precipitation. 9 impacted all subpopulations with small sections Repeated fires in close succession (e.g., 1991 & 2000 urity and replenishing the soil seed bank and result
Fragmentation	The population is not considered severely fragmented due to insufficient information on gene flow among subpopulations and the very restricted distribution of the species within SRNP.			
Fluctuations	There are no ki locations.	nown extreme	e fluctuations i	n EOO, AOO, and number of subpopulations or

Criterion 1 Population size reduction

Reduction in total numbers (measured over the longer of 10 years or 3 generations) based on any of A1 to A4						
		Critically Endangered Very severe reduction	Endai Sever	ngered re reduction		Vulnerable Substantial reduction
A1		≥ 90%	≥ 70%	Ď		≥ 50%
A2, A	3, A4	≥ 80%	≥ 50%	b		≥ 30%
A1 A2	Population reduction observed, estimat past and the causes of the reduction are understood AND ceased. Population reduction observed, estimat past where the causes of the reduction be understood OR may not be reversible	ed, inferred or suspected in e clearly reversible AND ed, inferred or suspected in may not have ceased OR ma e.	a the	Ś	(a) (b) (c)	direct observation [except A3] an index of abundance appropriate to the taxon a decline in area of occupancy, extent of occurrence and/or quality of habitat
A3	Population reduction, projected or susp to a maximum of 100 years) [(<i>a</i>) cannot	ected to be met in the futur t be used for A3]	e (up	Based on any of the following	(d) (e)	actual or potential levels of exploitation the effects of introduced
A4	An observed, estimated, inferred, project reduction where the time period must if future (up to a max. of 100 years in future reduction may not have ceased OR may be reversible.	cted or suspected populatio nclude both the past and th ire), and where the causes o not be understood OR may	n e of not			taxa, hybridization, pathogens, pollutants, competitors or parasites

Criterion 1 evidence

Eligible under Criterion 1 A4abe for listing as Critically Endangered

Generation time

The giant andersonia has a very long juvenile period of approximately 14 years (based on 50 percent flowering) (S Barrett pers comm 28 September; Barrett et al. 2009) and a long-life span of approximately 30–50 years (species longevity remains unconfirmed). Following the IUCN guidelines for calculating generation length, the generation time is in the range of:

Generation time = age of first reproduction + [0.5 * (length of reproductive period)]Generation time = 14 + [0.5 * (50 - 14)] = 32 years

OR

Generation time = 14 + [0.5 * (30 - 14)] = 22 years

This gives an estimated three-generation period of approximately 66–96 years.

Past Population Reduction

Monitoring data are unavailable prior to 1997, so population trends prior to this time are unknown. However, it is likely that prior to this period, the threats of fire and *P. cinnamomi* were considerably lower. Fire occurred in the SRNP in February 1972 and April 1991, and there is an anecdotal report of fire in the late 1950s (Barrett 2000). *Phytophthora cinnamomi* was recorded in SRNP in 1974, a decade after extensive firebreak systems were constructed in the park and approximately 50 years after access roads were constructed to allow for tourism (Barrett 2000). Spread of the disease to mountain peaks where the species occurs, has likely been facilitated by hikers. The popularity of hiking in SRNP is likely to have increased following recommendations in bushwalking guides from 1989 (Rankin 1989; Morphett 1996). The ridge was also used by the army for training exercises (in all weather conditions) in the 1980s, which may have led to spread (S Barrett 2021. pers comm 16 December).80

Population declines can be estimated using count data collected over one generation period (22–32 years), which represents the most likely period of population decline. The population has been observed to decline over 24 years (1997–2021), by the following equation:

Percent decline = $\left[\frac{(current pop. no. - historic pop. no.)}{historic pop. no.}\right] * 100\%$

Percent decline =
$$\left[\frac{(80-280)}{280}\right] * 100 = 71\%$$

The reduction in population cannot be estimated for subpopulation 7 and 8, as post-fire data has not been collected from these two subpopulations (Table 5). Therefore, this value represents the decline from the remaining nine subpopulations. It is expected that subpopulations 7 and 8 are exposed to a similar level of decline due to the presence of the same threatening processes as the other subpopulations (Table 2, 4). All subpopulations have been affected by the pathogen, *P. cinnamomi*.

Subpopulation Earliest Record (from 1997)		Pre 2018-19 fires	Post 2018-19 fires
1. Bluff Knoll, Stirling Range NP	20	250 (minimum)	20
2. Ellen Park, Stirling range NP	0	5	0
3. East Bluff, Stirling Range NP	0	0	12
4. Isongerup, Stirling Range NP	150	50	35
5. Pyungoorup, Stirling Range NP	20	3	0
6. Bakers Knobb, Stirling Range NP	75	0	0
7. Second arrow, Stirling Range NP	50 (minimum)	50	nd
8. First arrow, Stirling Range NP	20 (minimum)	20	nd
9. Moonoongooderup, Stirling Range NP	0	0	6
10. Mt Success, Stirling Range NP	15	11	7
11. Coyanerup, Stirling Range NP	0	0	0
TOTAL	350	389	80

Table 5 Evidence of population decline within all mature individuals of giant andersonia subpopulations

nd = no data

Conclusion

A decline of 71% has been estimated over only one generation, the majority of subpopulations have not recovered, and threatening processes are ongoing and not expected to reduce in the future. Therefore, there is a high probability that in the next two generations the decline will exceed 80 percent.

The species meets the Criterion 1 A4abe and is eligible for listing as Critically Endangered. However, the purpose of this consultation document is to elicit additional information to better understand the species' status. This conclusion should therefore be considered to be tentative at this stage, as it may be changed as a result of responses to this consultation process.

Criterion 2 Geographic distribution as indicators for either extent of occurrence AND/OR area of occupancy

		Critically Endangered Very restricted	Endangered Restricted	Vulnerable Limited	
B1.	Extent of occurrence (EOO)	< 100 km ²	< 5,000 km ²	< 20,000 km ²	
B2.	Area of occupancy (AOO)	< 10 km ²	< 500 km ²	< 2,000 km ²	
AND	AND at least 2 of the following 3 conditions:				
(a)	Severely fragmented OR Number of locations	gmented OR Number= 1 ≤ 5 ≤ 10			
(b) Continuing decline observed, estimated, inferred or projected in any of: (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)	(c) Extreme fluctuations in any of: (i) extent of occurrence; (ii) area of occupancy; (iii) number of locations or subpopulations; (iv) number of mature individuals				

Criterion 2 evidence

Eligible under Criterion 2 B1ab(i,ii,iii,iv,v) for listing as Critically Endangered

Extent of occurrence (EOO) and area of occupancy (AOO)

The most plausible extent of occurrence (EOO) and area of occupancy (AOO) of the giant andersonia are estimated at 64 km² (64 km²–68 km²) and 36 km² (36 km²–44 km²), respectively. The estimate of EOO was attained by mapping point records from 1997–2021, obtained from state governments, herbarium collections, and other sources. The EOO was then calculated using a minimum convex hull (IUCN 2019). The AOO was calculated using a 2x2 km grid cell method, based on the IUCN Red List Guidelines (IUCN 2019).

The estimates meet the thresholds for Critically Endangered under B1 (EOO < 100 km²) and Endangered under B2 (AOO < 500 km²).

Number of locations

The most plausible threats to the taxon are disease from *P. cinnamomi*, the interaction between *P. cinnamomi* and high fire frequency, inappropriate fire regimes (high fire frequency), and the interaction between threats such as fire, drying conditions from reduced rainfall and herbivory. While the taxon may have soil-stored seed that can survive and germinate after fire, multiple fires in rapid succession and recruitment failure caused by post-fire infection by *P. cinnamomi*, drying conditions or herbivory, could deplete the seed bank and could result in rapid declines (DCALM 2003; Gallagher et al. 2021).

The taxon has a very restricted geographic distribution meaning that wildfires can impact a considerable portion of the range of the species, as all subpopulations were affected by fires in 2018 and/or 2019 (Table 1; Gallagher 2020). Subsequently, the estimated number of locations is

one (during severe fires), and possibly up to four (during mild fires that burn patchily across the landscape and during cooler periods).

Projections of future conditions for this region include an increased risk of more frequent fires (DIICCSRTE 2013; Dowdy et al. 2019). This presents a considerable risk to a species with a possible long-life span (could be 50+ years) and likely time to reproductive maturity of 9–14 years (S Barrett pers comm 28 September; Barrett et al. 2009). Therefore, the species is likely to continue to decline as fire-free intervals continue to shorten (Enright et al. 2015; Gallagher 2020; Gallagher et al. 2021).

Further, if fire events are followed by infection by *P. cinnamomi* (Evans et al. 2003), drying conditions or herbivory (Rathbone & Barrett 2017) that impact seedling recruitment, the population will remain on a declining trajectory. The population could also be threatened by browsing from feral rabbits and competition with weeds which have the potential to cause further decline in the population.

Up to 80 percent of SRNP is infested with the *P. cinnamomi* (DBCA 2021) and the pathogen is present in all subpopulations (Evans et al. 2003; DAWE 2016). Long-term monitoring showed that giant andersonia is highly susceptible to the pathogen and resulted in a 70 percent decline at subpopulation one from 2001–2011 and a 92 percent decline at subpopulation nine from 1999–2007 (Barrett & Yates 2015). Recreational activities, such as bushwalking, have facilitated the spread of *P. cinnamomi*, (Barrett 2000) because hikers carrying the pathogen on their footwear seek the mountain tops where giant andersonia occurs and where favourable moist conditions for the pathogen prevail (Barrett 2000). The high prevalence of the pathogen in the SRNP coupled with the high susceptibility of giant andersonia to the pathogen and increasing rates of exposure, indicates that the population should be considered one location.

Therefore, the taxon's number of locations is likely to be one, meeting the threshold for Critically Endangered under subcriterion (a).

Severe fragmentation

There is insufficient information on gene flow among subpopulations and dispersal to determine whether the population of this species is severely fragmented.

Continuing decline

Continuing decline of mature individuals has been observed in the majority of subpopulations (Table 1), because the number of mature individuals has declined from 280 mature individuals in 1997 to 80 mature individuals in 2021. It should be noted that at Bluff Knoll only, there was a temporary increase in mature individuals, after a fire in 2000, to 250+ in 2003 (Table 1) but it has since reduced back to the same number as in 1999. No other subpopulation has shown such a fluctuation.

Continuing decline is also projected in the number of subpopulations, AOO and EOO of giant andersonia. Although there are 11 extant subpopulations currently, three subpopulations have no mature individuals and only between 1–7 juveniles (subpopulation 2, 5 and 6). Very few juveniles appear to reach maturity due to the combined impact of threats from *P. cinnamomi*, fire, herbivory from quokka, recreational use, and altered precipitation (Table 2). Therefore, it is

highly likely that subpopulations with no or low numbers of mature individuals and/or juveniles will be lost (S Barrett pers comm, 28 September 2021).

Future climate change predictions for southwest Australia include elevated temperatures, and reduced precipitation which increases the Forest Fire Danger Indices (FFDI) (Dowdy et al. 2019; BOM & CSIRO 2020). Fires that occur at intervals shorter than the minimum tolerable fire interval could deplete the soil-seed bank and kill immature plants before they reach maturity (Gallagher et al. 2021). Therefore, shorter fire intervals are projected to contribute to a decline in habitat quality for giant andersonia.

Giant andersonia is highly susceptible to the effects of dieback disease caused by *Phytophthora cinnamomi* (Evans et al. 2003) and every subpopulation has been infested (DAWE 2016; S Barrett pers comm 15 October 2021). The pathogen was shown to be responsible for subpopulation declines of up to 92% (Table 2; Barrett & Yates 2015). Increased use of the area by hikers and for fire management may be facilitating spread. The widespread threat of *P. cinnamomi* is contributing to the decline in habitat quality for the species.

Declines in habitat quality are also occurring through increased recreational use of the area and potentially through browsing by rabbits and competition with weeds.

Extreme fluctuations

There are no known extreme fluctuations in EOO, AOO, and number of subpopulations, locations or mature individuals.

Conclusion

The Committee considers that the species' EOO and AOO are very restricted, and continuing decline is observed in number of mature individuals, and projected in the number of subpopulations, AOO, EOO, and the area, extent and quality of habitat due to threats posed by inappropriate fire regimes, disease, browsing, and decreasing precipitation caused by climate change.

Therefore, the taxon has met the relevant elements of Criterion 2 to make it eligible for listing as Critically Endangered. However, the purpose of this consultation document is to elicit additional information to better understand the varieties status. This conclusion should therefore be considered to be tentative at this stage, as it may be changed as a result of responses to this consultation process.

Criterion 3 Population size and decline

	Critically Endangered Very low	Endangered Low	Vulnerable Limited
Estimated number of mature individuals	< 250	< 2,500	< 10,000
AND either (C1) or (C2) is true			
C1. An observed, estimated or projected continuing decline of at least (up to a max. of 100 years in future)	Very high rate 25% in 3 years or 1 generation (whichever is longer)	High rate 20% in 5 years or 2 generation (whichever is longer)	Substantial rate 10% in 10 years or 3 generations (whichever is longer)
C2. An observed, estimated, projected or inferred continuing decline AND its geographic distribution is precarious for its survival based on at least 1 of the following 3 conditions:			
(i) Number of mature individuals in each subpopulation	≤ 50	≤250	≤ 1,000
(ii) % of mature individuals in one subpopulation =	90 - 100%	95 - 100%	100%
(b) Extreme fluctuations in the number of mature individuals			

Criterion 3 evidence

Eligible under Criterion 3 C1 + C2a(i) for listing as Critically Endangered

Number of mature individuals

The population size of the giant andersonia is very low based on the number of mature individuals, of which 80 are currently observed and up to 96 are estimated. The very long time to reach reproductive maturity (14 years) and the increased susceptibility of juveniles to threats such as P. *cinnamomi* (Barrett 2000; Evans et al. 2003) and possibly herbivory, are resulting in significant losses at the juvenile stage and preventing population recovery.

Prior to the 2018 and 2019 fires, there was a total of approximately 280 mature individuals (Table 1). However, in 2020-21 (post-fire) the total number of mature individuals had decreased to approximately 96. Despite high seedling recruitment following this event, particularly within subpopulation 1, 3, and 4 (between 97–850 seedlings), recruitment was low in six subpopulations (between 0–40), and two subpopulations were not surveyed post-fire. Therefore, a net increase in the mature number of individuals is unlikely at these six subpopulations. Net increase in the number of mature individuals at subpopulations 1, 3 and 4 is also compromised by the combined effect of threats from elevated fire risk, dieback caused by *P. cinnamomi*, altered precipitation patterns and browsing on seedling survival.

The number of mature individuals appears to meet the requirements for listing as Critically Endangered (<250).

Continuing decline

As discussed in Criteria 1 and 2 (see above), the species appears to be undergoing continuing decline in the number of mature individuals of 71% within a one-generation period. Therefore, the species meets the C1 requirement for listing as Critically Endangered.

Number of mature individuals in each subpopulation

The number of mature individuals in each subpopulation ranges from 0 to 35, indicating that the species meets the requirements for listing as Critically Endangered (<50).

The number of mature individuals is spread across potentially seven subpopulations and the species does not undergo extreme fluctuations.

Conclusion

The species' population size is less than <250 mature individuals, and the number of mature individuals appears to be undergoing continuing decline and has < 50 individuals in each subpopulation.

The data presented above demonstrate that the species is eligible for listing as Critically Endangered under this criterion. However, the purpose of this consultation document is to elicit additional information to better understand the species' status. This conclusion should therefore be considered to be tentative at this stage, as it may be changed as a result of responses to this consultation process.

Criterion 4 Number of mature individuals

	Critically Endangered Extremely low	Endangered Very Low	Vulnerable Low
D. Number of mature individuals	< 50	< 250	< 1,000
D2. ¹ Only applies to the Vulnerable category Restricted area of occupancy or number of locations with a plausible future threat that could drive the species to critically endangered or Extinct in a very short time			D2. Typically: area of occupancy < 20 km ² or number of locations ≤ 5

¹ The IUCN Red List Criterion D allows for species to be listed as Vulnerable under Criterion D2. The corresponding Criterion 4 in the EPBC Regulations does not currently include the provision for listing a species under D2. As such, a species cannot currently be listed under the EPBC Act under Criterion D2 only. However, assessments may include information relevant to D2. This information will not be considered by the Committee in making its recommendation of the species' eligibility for listing under the EPBC Act, but may assist other jurisdictions to adopt the assessment outcome under the <u>common</u> <u>assessment method</u>.

Criterion 4 evidence

Eligible under Criterion 4 D for listing as Endangered

The population size of the giant andersonia is very low based on the number of mature individuals, of which 80 are currently observed and up to 96 are estimated. The relatively long time to reach reproductive maturity for a shrub (9-14 years) and the increased susceptibility of juveniles to threats such as P. *cinnamomi* (Barrett 2000; Evans et al. 2003) and possibly herbivory, are resulting in significant losses at the juvenile stage and inhibiting the population to recover.

The Committee considers the total number of mature individuals to be <100 which is considered very low. Therefore, the taxon has met the relevant elements of Criterion 4 to make it eligible for listing as Endangered.

Criterion 5 Quantitative analysis

	Critically Endangered Immediate future	Endangered Near future	Vulnerable Medium-term future
Indicating the probability of extinction in the wild to be:	≥ 50% in 10 years or 3 generations, whichever is longer (100 years max.)	≥ 20% in 20 years or 5 generations, whichever is longer (100 years max.)	≥ 10% in 100 years

Criterion 5 evidence

Insufficient data to determine eligibility

Population viability analysis has not been undertaken. Therefore, there is insufficient information to determine the eligibility of the taxon for listing in any category under this criterion.

Adequacy of survey

Targeted surveys have been conducted from 1997 to 2021 by staff from the Department of Biodiversity, Conservation and Attractions with Sarah Barrett being the primary field officer coordinator for the species. It is possible that other subpopulations may be located in unsurveyed habitat as areas of the SRNP can be difficult to access. However, given the long survey history in the region, the existence of additional subpopulations is unlikely. Consequently, survey effort has been considered adequate and there is sufficient scientific evidence to support the assessment. © Commonwealth of Australia 2021



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This publication is available at the SPRAT profile for Andersonia axilliflora (giant andersonia).

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