**Consultation on Species Listing Eligibility and Conservation Actions**

***Acacia baueri* subsp. *aspera***

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

1) the eligibility of *Acacia baueri* subsp. *aspera* 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: species.consultation@environment.gov.au

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 24 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.awe.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:

<http://www.awe.gov.au/system/files/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 [‘Common Assessment Method’ (CAM)](https://www.awe.gov.au/environment/biodiversity/threatened/cam). 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: <https://www.awe.gov.au/about/commitment/privacy> .

**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.

**CONSULTATION QUESTIONS FOR *ACACIA* *BAUERI* SUBSP. *ASPERA***

**SECTION A - GENERAL**

1. Is the information used to assess the nationally threatened status of the species/subspecies 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 this assessment?
3. Can you provide additional data or information relavent to the taxonomy of the entity?
4. Have you been involved in previous state, territory or national assessments of this species/subspecies? If so, in what capacity?

**PART 1 – INFORMATION TO ASSIST LISTING ASSESSMENT**

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

**Biological information**

1. Can you provide any information or estimates on longevity, average life span and generation length?
2. Do you have any additional information on the ecology or biology of the species/subspecies not in the current advice?

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

**Population size**

1. Has the survey effort for this taxon been adequate to determine its national adult population size? If not, please provide justification for your response.
2. Do you consider the way the population size has been derived to be appropriate? Are there any assumptions and unquantified biases in the estimates? Did the estimates measure relative or absolute abundance? Do you accept the estimate of the total population size of the species/subspecies? If not, please provide justification for your response.
3. If not, can you provide a further estimate of the current population size of mature adults of the species/subspecies (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/subspecies 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:

□ 1–50 □ 51–250 □ 251–1000 □ 1000–2500 □ 2500–10 000 □ >10 000

Level of your confidence in this estimate:

□ 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

□ 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

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

1. 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**

1. Are you able to provide an estimate of the total population size at or soon after the start of the most recent three generation/10 year period? 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/subspecies 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:

□ 1–50 □ 51–250 □ 251–1000 □ >1000 □ >10 000

Level of your confidence in this estimate:

□ 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

□ 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

1. Are you able to comment on the extent of decline in the species/subspecies’ total population size over the last approximately three generations/10 year period)? 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:

□ 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

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

□ 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

1. Please provide (if known) any additional evidence which shows the population is stable, increasing or declining.

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

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

1. Does the assessment consider the entire geographic extent and national extent of the species/subspecies? If not, please provide justification for your response.
2. Has the survey effort for this species/subspecies been adequate to determine its national distribution? If not, please provide justification for your response.
3. Is the distribution described in the assessment accurate? If not, please provide justification for your response and provide alternate information.
4. 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.
5. 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:

□ <100 km2 □ 100 – 5 000 km2 □ 5 001 – 20 000 km2 □ >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

□ 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:

□ <10 km2 □ 11 – 500 km2 □ 501 – 2000 km2 □ >2000 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

□ 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

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

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

1. Do you consider that the way the historic distribution has been estimated is appropriate? Please provide justification for your response.
2. 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:

□ <100 km2 □ 100 – 5 000 km2 □ 5 001 – 20 000 km2 □ >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

□ 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:

□ <10 km2 □ 11 – 500 km2 □ 501 – 2000 km2 □ >2000 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

□ 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**

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

1. Do you consider that all major threats have been identified and described adequately?
2. To what degree are the identified threats likely to impact on the species/subspecies in the future?
3. Are the threats impacting on different populations equally, or do the threats vary across different populations?
4. Can you provide additional or alternative information on past, current or potential threats that may adversely affect the species/subspecies at any stage of its life cycle?
5. 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/SUBSPECIES? (If no, skip to section I)**

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

**SECTION I DO YOU HAVE INFORMATION ON STAKEHOLDERS IN THE RECOVERY OF THE SPECIES/SUBSPECIES?**

1. 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?
2. Are you aware of any cultural or social importance or use that the species/subspecies has?
3. What individuals or organisations are currently, or potentially could be, involved in management and recovery of the species/subspecies?
4. How aware of this species/subspecies are land managers where the species/subspecies is found?
5. What level of awareness is there with individuals or organisations around the issues affecting the species/subspecies?
	1. Where there is awareness, what are these interests of these individuals/organisations?
	2. Are there populations or areas of habitat that are particularly important to the community?

**PART 3 – ANY OTHER INFORMATION**

1. Do you have comments on any other matters relevant to the assessment of this species/subspecies?

Conservation Advice for
Acacia baueri subsp. Aspera

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.

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



*Acacia* *baueri* subsp. *aspera* © Copyright, Ollerenshaw P. (from Australian National Botanic Gardens)

## Conservation status

Acacia baueri subsp. aspera is proposed to be listed in the Critically Endangered category of the threatened species list under the Environment Protection and Biodiversity Conservation Act 1999.

Acacia baueri subsp. aspera was assessed by the Threatened Species Scientific Committee to be eligible for listing as Critically Endangered under Criterion 3. The Committee’s assessment is at Attachment A. The Committee’s assessment of the species’ eligibility against each of the listing criteria is:

* Criterion 1: Insufficient data
* Criterion 2: B1ab(iii,v)+2ab(iii,v): Endangered
* Criterion 3: C2a(i): Critically Endangered
* Criterion 4: D: Endangered
* Criterion 5: Insufficient data

The main factors that make the subspecies eligible for listing in the Critically Endangered category are a low number of mature individuals including a low number of mature individuals in each subpopulation, and continuing decline in the number of mature individuals and habitat quality.

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 [Species Profile and Threat Database](http://www.environment.gov.au/cgi-bin/sprat/public/sprat.pl).

## Species information

### Taxonomy

Conventionally accepted as Acacia baueri subsp. aspera (Maiden & Betche) Pedley (1972).

Some issues have been raised regarding the taxonomy of the subspecies. Two specimens previously determined as *Acacia baueri* subsp. *baueri* from Molly Morgan Swamp (east of Kangaloon) (PERTH 08034354), and NSW 79133 (northwest of Mount Keira, at junction of Wilton and Mount Ousley Roads) have recently been redetermined as the same taxonomic entity - a smooth phyllode variant of subsp. *aspera*. It is possible that these records are intermediates between subsp. *baueri* and subsp. *aspera*, though this is considered less likely (B Maslin 2021. pers comm 14 October; P Kodela 2021. pers comm 14 October). It is notable this is based only on those herbarium specimens and distributional evidence, and not field-based observation (B Maslin 2021. pers comm 14 October)).

This conclusion does not necessarily negate the validity of the subspecies but may indicate that genetic, as well as morphometric review is warranted to better understand the basis for distinguishing plants between the present subspecies, especially where their distributions overlap or adjoin (S Douglas 2021 pers comm. 10, 17 & 22 September; B Maslin 2021. pers comm 14 October). It is possible that the current subspecies would be better recognised at the variety level, and that they are perhaps maintained by differences in habitat characteristics and/or isolation of subpopulations that have begun to differentiate. In particular, it may be useful to compare specimens from the Sydney area and Woronora Plateau, with those from the higher Blue Mountains. It is feasible that the traits currently ascribed to subspecies *aspera* are most distinctive in the population in the higher Blue Mountains, and that plants from further east at lower elevations are less distinctive in that regard and hence exhibit characteristics intermediate between the subspecies (S Douglas 2021 pers comm. 10, 17 & 22 September).

From a taxonomic perspective, it may be more important to understand the variation patterns within *Acacia baueri*, rather than what rank (subspecies vs variant) should be applied to the subordinate entities (B Maslin 2021. pers comm 14 October; P Kodela 2021. pers comm 14 October). Given this, and that it has been previously listed at the subspecies level in NSW, it is considered appropriate to complete a conservation assessment at the subspecies level, noting the potential requirement for revision should a taxonomic review be completed.

### Description

*Acacia* *baueri* subsp. *aspera* (family Fabaceae) is a well-branched low shrub (0.1–1 m high). Branches are hairy and warty. Leaves are crowded, scattered or in irregular whorls, cylindrical and warty. Flowerheads occur in the angle between the leaf and stem and consist of 10–20 golden yellow flowers. Fruit is a slightly curved pod, 1–2 cm long. *Acacia* *baueri* subsp. *aspera* differs from *A.* *baueri* subsp. *baueri* which has smoother leaves in more regular whorls (OEH 2019).

### Distribution

*Acacia* *baueri* subsp. *aspera* is restricted to the Sydney region, where it occurs on the Kings Tableland in the central Blue Mountains, with sporadic occurrences on the Woronora Plateau in Royal National Park (NP), Woronora Special Area, in and near to Dharawal NP/ Nature Reserve, and the Mount Kiera district (OEH 2019; NSW Government 2021). The subspecies may also occur on the escarpment/Woronora Plateau in the Flat Rock Junction and Stanwell Tops area of the Illawarra (OEH 2019). The recently redetermined record from Molly Morgan Swamp, east of Kangaloon, is the southernmost record of the subspecies and is the only one for this area. It is also at the highest elevation of any records from the Woronora Plateau.

*Subpopulations*

**NSW National Parks and Wildlife Service (NPWS) environmental impact assessment guidelines (2000) for the subspecies state that “populations of *A.* *baueri* subsp. a*spera* are rare and typically small (<30 plants) with probable low genetic diversity” (NSW NPWS 2000).** It was reported that several older recorded subpopulations of *Acacia* *baueri* subsp. *aspera* appear to have become locally extinct or have declined in numbers over the last 30–100 years, with only one new subpopulation being recorded (NSW NPWS 2000). **The BioNet Atlas contains 36 location records for *Acacia* *baueri* subsp. a*spera*, and of these, four records (all from 1999) reported the number of individuals. They were, one (north of Mount Kiera), 12 (Blue Mountains areas), 30 (Blue Mountains area), and 60 plants (southwest of Wedderburn).** These records were associated with targeted surveys for the subspecies undertaken in 1999 by TA James for what is now NSW Department of Planning Industry and Environment (S Douglas 2021 pers comm. 22 September).

**In addition to these targeted surveys, there is likely to have been substantial general survey effort in much of the subspecies’ distribution. This includes vegetation survey plots established for vegetation community identification and mapping, plot and transect surveys undertaken for environmental impact assessments associated with long-wall coal mining, fire trail and utility easement maintenance, and for a range of other development proposals. However, there are no published data that indicates the population trajectory of the subspecies over any temporal scale. Currently, it is considered that the subspecies is under-surveyed in some parts of its distribution, and where information is provided, the number of plants observed is low to very low and declining** (S Douglas 2021 pers comm. 22 September).

As of 2000, there were no known ex-situ subpopulations of the subspecies in cultivation (NSW NPWS 2000). The species has been propagated and grown in gardens from seeds and cuttings (ANPSA 2010) though it is unclear if this has occurred with subsp. *aspera* or subsp. *baueri*.

Map 1 Modelled distribution of *Acacia* *baueri* subsp. *aspera*

 

**Source:** Base map Geoscience Australia; species distribution data [Species of National Environmental Significance](http://www.environment.gov.au/science/erin/databases-maps/snes) 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 to 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 Australians. Such knowledge may be only held by Indigenous groups and individuals who are the custodians of this knowledge.

The cultural significance of *Acacia baueri* subsp. *aspera* is not well understood, although many Acacia species were used by Indigenous Australians for a variety of purposes including as food, medicine and for material use (tools, weapons, etc.) (Morrison 2000). Traditional Owner groups within the distribution of Acacia baueri subsp. aspera include the Dharug and Tharawal (AIATSIS 1996). The subspecies occurs in three national parks, Royal NP, Dharawal NP, and the Blue Mountains NP (NSW Government 2021). These areas have particular significance in Aboriginal culture as well as European heritage and community significance. For example, Royal NP has many Indigenous Australian archaeological sites including rock engravings, shelters and drawings that provide a significant contribution to current knowledge about the life and activities of Indigenous Australians in the southern Sydney area (Attenbrow 2012). Dharawal NP also has approximately 236 archaeological sites, and the Greater Blue Mountains World Heritage area is considered to contain a diverse body of cultural heritage sites that reflects the heritage of Indigenous Australians from the southern Sydney region, as well as the cultural heritage of the urbanised Sydney basin (Taçon et al., 2007).

Wattles also have cultural and community significance through their role as part of the Australian identity. The Australian national floral emblem is *Acacia pycnantha* (golden wattle), and the emblem of the Order of Australia is also a wattle. Australia’s national colours are green and gold, and the wattle is considered a symbol of unity, remembrance and reflection (Australian Government 2018).

### Relevant biology and ecology

*Habitat*

*Acacia* *baueri* subsp. *aspera* occurs in low, damp heathlands, often on exposed rocky outcrops and sandstone ridges (OEH 2019; PlantNET 2021). Open conditions seem to be preferred by the subspecies, with it rarely observed where there is any shrub or tree canopy development. Many of the observations of the subspecies have been made following fire, suggesting preference for early successional habitats (OEH 2019).

*Biology and lifecycle*

Little is known about the biology and life-cycle of *Acacia* *baueri* subsp. *aspera.* Peak flowering occurs from December to March, with pods observed remaining on plants for several months, maturing in October to December (OEH 2019). Acacia species generally live between five and 100 years and records and observations of *Acacia baueri* subsp*. aspera* suggest that individuals can live for 20 or more years (NSW NPWS 2000).

Pollination likely occurs primarily via insects and potentially birds. The most important Acacia pollinators are usually social and solitary bees (including the widely distributed European honeybee (*Apis millifera*)) and *Apoidea* wasps, followed by flies, beetles and nectar-feeding birds in some cases (Stone et al. 2003). In *Acacia*, flower visitors can be divided into three trophic groups; specialist pollen and flower feeders (bees, beetles, many true flies), specialist nectar feeders (birds, butterflies and *Bombylidae* sp. (bee flies)), and opportunist foragers (flies, ants and wasps) (Stone et al. 2003). Species that secrete nectar attract more species-rich assemblages of visitors, though many of these species are likely not important as pollinators (Stone et al. 2003). For many acacias, pollen release occurs in the middle of the day to attract the most insects, as pollination is usually completed by diurnal species and nocturnal visitors are likely not useful as pollinators (Stone et al. 2003).

Seed dispersal in acacias often occurs through passive methods via water, wind, and gravity, though some species also have adaptations for dispersal by birds and/or ants (Gibson et al. 2011). Seed dispersal of *Acacia* *baueri* subsp. *aspera* has been reported to the restricted to within 1–2 metres of the parent plant, implying dispersal by gravity (NSW NPWS 2000).

The subspecies’ fire response is unknown; however, the frequency and severity of fire is likely to play an important role in subpopulation persistence (OEH 2019). The other subspecies, *Acacia* *baueri* subsp. *Baueri* is killed by fire and germinates following fire and other disturbances (Kenny et al. 2014; S Bell 2021 pers comm. 22 September), and many *Acacia* species are known to be obligate or facultative seeders that recruit from a soil-stored seed bank after fire (Auld & O’Connell 1991; Spooner 2005; Wright et al. 2016). The NSW Rural Fire Service Threatened Species Hazard Reduction List (2013) recommends burning the habitat of this subspecies no more than once every seven years.

*Acacia* *baueri* subsp. *aspera* is thought to have poor levels of recruitment, which may be related to an absence of fire. This is indicated by the small size and aging demographic structure of most known subpopulations. In 1999, surveys found the majority of plants were mature, woody at the base and well branched (T. James pers. comm. cited in NSW NPWS 2000). Although seed germination appears to be irregular, any loss in seed production and storage in the soil seedbank is likely to have a significant impact on germination and subpopulation size. As such, subpopulation maintenance between fire events is dependent upon low mortality rates and an absence of threats which increase mortality or limit seed set (NSW NPWS 2000).

### Habitat critical to the survival

*Acacia baueri* subsp. *aspera* occurs in low, damp heathlands, often on exposed rocky outcrops and sandstone ridges in open conditions. It may prefer successional habitats (OEH 2019). Within the distribution of the subspecies in the Woronora Plateau and Blue Mountains areas, such habitat is likely to be necessary for dispersal activities and long-term population maintenance.

The habitat critical to the survival of *Acacia baueri* subsp. *aspera* includes the area of occupancy of known subpopulations; areas of similar habitat adjoining known subpopulations (as described above), which provide potential habitat for natural range extension; areas of similar habitat that may contain the subspecies or be suitable for translocations (as described above); and the local catchment for the surface and/or groundwater that maintains the habitat of the subspecies.

### 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.

At this point in time there is insufficient information available to be able to describe, with spatial information, important populations of this subspecies. Further research is needed to do this. Until such information is available, all populations of this subspecies should be considered important.

### Threats

The main threats to *Acacia* *baueri* subsp. *aspera* include inappropriate fire regimes, land clearing and asset maintenance, weed invasion and climate change. Fire frequency and drought interact to influence recovery potential of fire impacted populations and weed invasion may also be facilitated by fires. The subspecies may also be at risk from low genetic diversity given its restricted distribution and small subpopulations, which may result in inbreeding depression and increased threat from stochastic events such as bushfires and droughts. Another potential threat may include browsing by feral herbivore species (e.g. *Rusa* spp.; deer), though more evidence is required to confirm this threat is active across the range.

Threats to the subspecies have been identified in Table 1 below. There is limited information on the current status of many of the identified threats and as such surveys are required to update this information.

Table 1 Threats

Threats in Table 1 are noted in approximate order of highest to lowest impact, based on available evidence.

| Threat  | Status **a** | Evidence  |
| --- | --- | --- |
| Habitat loss and disturbance |
| Inappropriate fire regimes | * Timing: current
* Confidence: inferred
* Consequence: major
* Trend: unknown
* Extent: across the entire range
 | The frequency and intensity of fire is likely to play an important role in *Acacia baueri* subsp. *aspera* subpopulation persistence (OEH 2019). The closely related *Acacia baueri* subsp. *baueri* is recorded as having adults killed by fire and then germinating from soil stored seed (i.e. an obligate seeder) (Kenny et al. 2014) as do many other acacias. If it is an obligate seeder, *Acacia baueri* subsp. *aspera* requires an appropriate interval between fires to reach reproductive maturity and produce sufficient seed for the next generation whilst not senescing (tolerable fire interval). For example, the NSW Rural Fire Service Threatened Species Hazard Reduction List (2013) recommends burning no more than once every seven years to ensure recruitment and maturation occurs. *Too frequent fire*It was estimated that 17–25% of the *Acacia baueri* subsp*. aspera* modelled range was burnt during the 2019–20 bushfires (depending on the age of records used; Gallagher 2020) and subpopulations that were burnt are currently threatened by a high frequency fire regime. If a fire at these subpopulations occurs in the next 7 years (NSW Rural Fire Service 2013), the plants in these previously burnt parts of the range would potentially be subject to loss of immature individuals with limited subsequent recruitment where the soil-stored seed bank is depleted. No surveys have been undertaken post 2019-20 fire to assess the impacts of the fires on the subspecies and its response, so the impacts of future fire are currently only suspected.The high frequency reoccurrence of low severity fires that do not clear out ground vegetation or exceed the heat-shock threshold for the seed coat to be broken may particularly threaten *Acacia* *baueri* subsp. *Aspera.* Such fires expose the seedbank to gradual attrition over time by failing to stimulate recruitment or conditions that allow the subspecies to grow. However, it is currently unknown how long the subspecies’ seeds remain viable in the soil, and how quickly this attrition may occur. Small patchy fires are also not as beneficial as larger widespread fires that cause mass germination due to the increased herbivory and other impacts on the low number of seedlings recruited from smaller fires.Bradstock et al. (1998) found that extinction probabilities in obligate seeder shrubs increased with fire frequency and scale, indicating that too-frequent fire is responsible for extinction more often than too-infrequent fire. However, prior to the 2019–20 bushfires, the main concern for *Acacia baueri* subsp*. aspera* was that most subpopulations were relatively small and aging due to too infrequent fires. *Too infrequent fire*Fire-free intervals longer than the generation length of the subspecies may be limiting recruitment in known subpopulations. The subspecies is thought to have poor levels of recruitment through seedling establishment, as indicated by the small size and aging structure of most known subpopulations in the absence of fire.Without fires and other disturbances, there is potential for larger plant species such as *Hakea*, *Banksia* (especially *Banksia* *ericifolia*) and *Allocasuarina* to shade out *Acacia* *baueri* subsp. *aspera* (OEH 2019). *Acacia* *baueri* subsp. *aspera* prefers open habitat and competing plants can shade out the subspecies if vegetation becomes too dense (S Douglas 2021 pers comm. 10 & 22 September). Areas of known, former and potential habitat within the subspecies range (e.g., Stanwell Tops and nearby parts of the Illawarra Escarpment and environs) show evidence of mesic shift in long unburnt areas. In such conditions, the subspecies may be severely suppressed by heavy shading, competition for water and nutrients, and potentially the allelopathic effects from mesophyll invaders such as *Pittosporum* *undulatum* (S Douglas 2021 pers comm. 10 & 22 September). However, the interactions between *Acacia* *baueri* subsp. *aspera* and competing plant species requires more research. The impact of encroaching vegetation may simply be part of the subspecies’ ecology, whereby the seedbank remains to recruit after the competitive release from over-topping vegetation after fire. It is also possible that the process of shading out does not begin until after most of the living *Acacia* *baueri* subsp. *aspera* plants are already dead through aging, If this is the case, it would be found mainly in the seed bank by the time larger shrubs invade. Further information is required on the ecology of the subspecies and interactions with competitors to determine if shading out occurs and is taking place to a greater extent than under the subspecies’ natural ecology. |
| Clearing of habitat | * Timing: future
* Confidence: suspected
* Consequence: moderate
* Trend: unknown
* Extent: across part of its range
 | Habitat loss due to clearing has been identified as a threat to the subspecies (OEH 2019). The subspecies occurs mainly in protected areas, however areas outside of these are at risk of clearing for changing land use. For instance, there is potential for Crown Land south of Dharawal National Park in Wollondilly Local Government Area (crossing the reserve boundary to private lands in the west, past Stokes Creek) to be developed/leased or used for non-conservation purposes (NSW Government n.d.). |
| Illegal recreation access | * Timing: current

Confidence: suspected* Consequence: moderate
* Trend: unknown
* Extent: across part of its range
 | Illegal access by four-wheel drive vehicles and trail bikes could cause physical habitat disturbance and damage to individual plants (NSW Government n.d.). Many of the known sites for the subspecies are within conservation areas, which are popular for recreational bushwalking, including the Blue Mountains, Royal National Park, and Dharawal National Park. Damage caused by trampling by bushwalkers may occur where tracks are widened or heavily trafficked. Indirect impacts such as the introduction of weeds and disease could also be exacerbated through recreational access. |
| Roadside maintenance | * Timing: current

Confidence: suspected* Consequence: moderate
* Trend: unknown
* Extent: unknown
 | Habitat degradation due to roadside maintenance has been identified as a threat to the subspecies (OEH 2019). Inappropriate maintenance of tracks and roads could cause direct mortality of *Acacia baueri* subsp. *aspera* plants, and cause degradation of habitat through removal or damage to native vegetation as well as indirect impact such as the introduction of weeds and disease. |
| Invasive species |
| Weed invasion | * Timing: current
* Confidence: inferred
* Consequence: moderate
* Trend: unknown
* Extent: across parts of the range
 | Weed invasions of natural ecosystems are an important threat to eastern Australia (Williams et al. 2000; van Klinken & Friedel 2018). Invasive weeds have the capacity to alter ecosystems and therefore habitat suitability for native species as well as directly outcompeting native plants.Weeds most commonly become established in areas of disturbance and habitat loss through weed invasion has been identified as a threat to the subspecies (OEH 2019). A record in the NSW Government’s BioNet Atlas database from the Wollongong area in 1999 identified weed invasion as a threat. This site was on unprotected land between woodland vegetation and a weed infested fill area. The subspecies has not been recorded at or near that site since 1999. Weed species that occur within suitable habitat for *Acacia* *baueri* subsp. *aspera* include whisky grass (*Andropogon virginicus*), African love grass (*Eragrostis* *curvula*), couch grass (*Elymus* *repens*), Canadian fleabane (*Conyza* *canadensis*), Madagascan fireweed (*Senecio* *madagascariensis*), and golden wreath wattle (*Acacia* *saligna*) (S Douglas 2021 pers comm. 10 September). |
| Disease |
| *Phytophthora* dieback caused byintroduced soil-borne pathogens such as *Phytophthora* *cinnamomi* and other *Phytophthora* spp. | * Timing: current
* Confidence:

suspected* Consequence: unknown
* Trend: increasing
* Extent: across the entire range
 | *Phytophthora* *cinnamomi* is an introduced soil-borne pathogen which infects a large range of plant species and may contribute to plant death, particularly when other stresses are present, such as waterlogging, drought and bushfire (Department of the Environment and Energy 2018). *Phytophthora cinnamomi* can disperse in water flowing from roots of infected plants to roots of healthy plants and mud clinging to vehicles, animals, and walkers (Department of the Environment and Energy 2018). *Phytophthora cinnamomi* is present across the range of *Acacia baueri* subsp. *aspera.* The subspecies’ susceptibility to the pathogen is currently unknown. Other Acacia species have shown varying levels of susceptibility from moderately susceptible to field resistant (or tolerant) (O’Gara et al. 2005). Across the subspecies’ range *P. cinnamomi* may impact more extensively on habitat that has been long unburnt (sheltered conditions) or climatically wetter habitat such as the Woronora Plateau (S Douglas 2021 pers comm. 10 September).There is potential for the pathogen to seriously impact upon the subspecies and/or its habitat if it is susceptible to infection. |
| Climate change |
| Changes to precipitation patterns and increasing temperatures and extreme climatic events | * Timing: current/future
* Confidence: observed
* Consequence: unknown
* Trend: increasing
* Extent: across the entire range
 | Climate change projections show that Australia’s climate will continue to become hotter and drier , and the incidence of drought is predicted to increase over southern Australia (CSIRO 2015). These climatic changes were evidenced by the severe drought conditions in eastern Australia from early 2017 to late 2019 (BOM 2021). In the Sydney metropolitan area (which includes the Blue Mountains), maximum temperatures are projected to increase by 0.3°C–1.0°C by 2030 and 1.6°C – 2.5°C by 2070, with more hot days and fewer cold nights (OEH 2014). Minimum temperatures are projected to increase by 0.4°C–0.8°C by 2030 and 1.4°C–2.5°C by 2070. Such changes in climate are likely to cause forest decline, with drought stress leading to plant mortality, particularly if bushfire co-occurs with drought (Burgman and Lamont 1992; Choat et al. 2012). The increasingly drier conditions brought about by climate change may be particularly impactful on *Acacia baueri* subsp. *aspera*, as it is known to occur in low, damp areas and may face a range shift in association with the contraction or shift in suitable habitat. However, it is also known to occur on exposed rocky ridges which may already be water limited, so may be somewhat adapted to dry habitat.Further, climate change projections show that southern Australia is likely to experience harsher fire weather (CSIRO 2015), and climate change will lead to increased bushfire frequency and severity. This is evidenced by the catastrophic bushfires of 2019–20, which were attributed to low fuel moisture content, leaf senescence and shedding, and lack of moist impediments to fire spread all of which were associated with drought conditions (Nolan et al. 2020). The Sydney metropolitan area is expected to undergo an increase in severe and average Forest Fire Danger Index values in the future, which are used as an indicator of fire risk. This may have direct mortality impacts via interval squeeze, whereby fires occur too regularly for the soil-stored seedbank to recover (Enright et al. 2015; Gallagher et al. 2021). Climate change may also lead to out-of-season fires . The season in which fire occurs can affect plants directly by disrupting phenological processes, or indirectly by affecting other species that influence habitat, food or trophic interactions. Fire season affects the long-term survival of plants through mortality of adults, the availability of propagules, and the post-fire establishment of seedlings (Miller et al. 2019), as well as dispersal of plant propagules (Keith et al. 2020). In temperate regions, spring fires may expose emerging seedlings to summer droughts, which may cause high mortality and limit population recovery, especially in winter-rainfall regions (Miller et al. 2019). |

Each threat has been described in Table 1 in terms of the extent that it is operating on the species. The risk matrix (Table 2) 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.

Table 2 *Acacia baueri* subsp. *aspera* Risk Matrix

| Likelihood | Consequences |
| --- | --- |
| Not significant | Minor | Moderate | Major | Catastrophic |
| **Almost certain** | **Low risk** | **Moderate risk** | **Very high risk** | **Very high risk** | **Very high risk** |
| **Likely** | **Low risk** | **Moderate risk** | **High risk**Weed invasion | **Very high risk**Inappropriate fire regimesChanges to precipitation patterns and increasing temperatures and extreme climatic events | **Very high risk** |
| **Possible** | **Low risk** | **Moderate risk** | **High risk**Clearing of habitatIllegal recreation accessRoadside maintenance | **Very high risk** | **Very high risk** |
| **Unlikely** | **Low risk** | **Low risk** | **Moderate risk** | **High risk** | **Very high risk** |
| **Unknown** | **Low risk** | **Low risk** | **Moderate risk** | **High risk***Phytophthora* dieback | **Very high risk** |

**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 2031, the population of *Acacia* *baueri* subsp. *aspera* will have increased in abundance and viable subpopulations are sustained in habitats which are managed for ongoing threats.

### Conservation and management priorities

#### Habitat loss and disturbance

* Protect subpopulations from clearing for development and other land use change or from impacts associated with maintenance work.
* Fires must be managed to ensure that prevailing fire regimes do not disrupt the life cycle of *Acacia baueri* subsp. *aspera*, that they support rather than degrade the habitat necessary to the subspecies, that they do not promote invasion of exotic species, and that they do not increase impacts of grazing/predation. Management strategies should utilise a precautionary approach that ensures ecosystem health does not decline due to fire management practices targeted at this subspecies.
* If research and monitoring of subpopulations indicates shading out by native shrubs/ trees is threatening the subspecies, investigate the possibility for prescribed burns or biomass removal of competing native vegetation.
* Physical damage to the habitat and individuals of the threatened species must be avoided during and after fire operations.
* Fire management authorities and land management agencies should be provided with suitable maps of known subpopulations and use these to install field markers to avoid damage to *Acacia baueri* subsp. a*spera* during burn operations*.*
* Ensure land managers are aware of the subspecies’ occurrence and provide protection measures against key and potential threats.
* Investigate opportunities to purchase land on which *Acacia baueri* subsp. *aspera* occurs from private landholders to add to the reserve system, or negotiation of conservation covenants or management agreements to protect habitat for the subspecies.
* Where monitoring indicates that illegal access is impacting upon a subpopulation/s, implement measures to protect the subspecies from the threat. This may include fencing of plants or installation of barriers to prevent access.

#### Climate change

* Map the exposure of the subspecies to climate change using distribution modelling and climate change projections, to locate existing habitat patches and identify future habitat that would be suitable for the subspecies.
* Undertake vulnerability assessments of the subspecies’ sensitivity and adaptive capacity to changing climate conditions which draw from genetic, physiological or ecological evidence.

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

* Control weeds and prevent introduction of new weeds to habitat for *Acacia baueri* subsp. *aspera*.
* Implement suitable hygiene protocols when undertaking survey, monitoring and management activities. *Refer to the Arrive Clean, Leave Clean Guidelines to help prevent the spread of invasive plant diseases and weeds threatening our native plants, animals, and ecosystems* (Department of the Environment 2015).

#### Disease

* Ensure appropriate hygiene protocols are adhered to when entering or exiting sites for survey, monitoring and management activities.
* If found to be susceptible to *Phytophthora cinnamomi,* develop and implement a *P. cinnamomi* management plan to ensure it is not introduced into known locations of *Acacia baueri* subsp. *aspera*.

#### Ex situ recovery action

* To manage the risk of losing genetic diversity, undertake appropriate seed collection and storage in long term custodial collections and regularly determine viability of stored seed. Best practice seed storage guidelines and procedures should be adhered to, to maximise seed viability and germinability. Seeds from all natural populations to be collected and stored.
* Establish plants in cultivation in appropriate institutions such as the Royal Botanic Gardens Sydney.

### Stakeholder engagement/community engagement

* Seek information on the cultural significance of *Acacia baueri* subsp. *aspera* from Traditional Owners.
* Engage and involve Traditional Owners in conservation actions, including the implementation of Indigenous fire management and other survey, monitoring and management actions.
* Raise awareness of *Acacia baueri* subsp. *aspera* presence with landholders and land managers and promote management complementary to the subspecies’ requirements.
* Increase the recognition and support for *Acacia baueri* subsp. *aspera* recovery by disseminating information on the subspecies and its conservation status to the public

### Survey and monitoring priorities

* Design and implement a monitoring program for known subpopulations to:
	+ determine subpopulation size, structure, reproductive status, and trend;
	+ map the area occupied by subpopulations;
	+ determine habitat condition, and identify threats and priorities for management intervention;
	+ monitor the progress of recovery, including the effectiveness of management actions and the need to adapt them if necessary.
* Identify, map, and survey potential habitat across the range of the subspecies, looking for previously undiscovered subpopulations within this habitat.
* Identify and map habitat critical to the survival of *Acacia baueri* subsp. *aspera*.

### Information and research priorities

* Undertake research to obtain currently unknown information on the subspecies biology and ecology.
* Identify and map important populations and habitat critical to the survival of the subspecies.
* Undertake genetic studies to determine the viability of small subpopulations and identify potential priorities for translocations, reintroductions, or subpopulation supplementation.
* Determine the susceptibility of *Acacia baueri* subsp. *aspera* to *Phytophthora* *cinnamomi*.

## Links to relevant implementation documents

[NSW: Species profile](https://www.environment.nsw.gov.au/threatenedSpeciesApp/profile.aspx?id=10005)

[NSW: Environmental impact assessment guidelines](https://www.environment.nsw.gov.au/resources/nature/AbaueriEia0500.pdf)

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## Attachment A: Listing Assessment for *Acacia baueri subsp. aspera*

### 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 [EPBC Regulations](http://www.environment.gov.au/system/files/pages/d72dfd1a-f0d8-4699-8d43-5d95bbb02428/files/tssc-guidelines-assessing-species-2018.pdf). The thresholds used correspond with those in the [IUCN Red List criteria](https://nc.iucnredlist.org/redlist/content/attachment_files/RedListGuidelines.pdf) except where noted in criterion 4, sub-criterion D2. The IUCN criteria are used by Australian jurisdictions to achieve consistent listing assessments through the Common Assessment Method (CAM).

### Key assessment parameters

Table 3 includes the key assessment parameters used in the assessment of eligibility for listing against the criteria.

Table 3 Key assessment parameters

| Metric | Estimate used in the assessment | Minimum plausible value | Maximum plausible value | Justification |
| --- | --- | --- | --- | --- |
| ****Number of mature individuals**** | < 250 | <129 | Unknown | It is assumed there are five known subpopulations (though there are likely undiscovered sites) (see below) and previous estimates of subpopulation sizes have been 1, 12, 30 and 60 (NSW NPWS 2000). If the number of mature individuals in the subpopulation that was not surveyed in 1999 is estimated as the mean subpopulation size (26 individuals), the total number of individuals was 129 as of 1999.It is unknown how population sizes have changed since 1999, though available evidence suggests that subpopulations have likely decreased (see Criterion 1 and Criterion 2). Therefore, though there is a high degree of uncertainty surrounding this population estimate, it is plausible to suggest that the estimate of mature individuals would be <250. Surveys of known subpopulations would be useful to provide a more certain estimate of population size. |
| ****Trend**** | declining | There is very limited information available on the subspecies, including no temporal data to assess any past or ongoing trends in population size or number of mature individuals. However, known subpopulations are aging, and sites impacted by the 2019–20 bushfires have likely declined. |
| ****Generation time (years)**** | 13 | 12 | 14 | The species is likely to have a generation time of approximately 12-18 years (see Criterion 1). |
| ****Extent of occurrence**** | 784 km2 | Unknown | 15,896 km2 | The extent of occurrence (EOO) is estimated at 784 km2. This figure is based on the mapping of point records from 1998 to 2010, obtained from state governments, museums, and CSIRO. The EOO was calculated using a minimum convex hull, as outlined in the Guidelines for Using the IUCN Red List Categories and Criteria (IUCN 2019).*The national prioritisation of Australian plants affected by the 2019–2020 bushfire season project* estimated an EOO for this subspecies of 15,896 km2 (Gallagher 2020). This estimate has been used as the maximum plausible value. The large discrepancy between these two estimates is due to the inclusion of a 1997 record near Temora. This record is suspect as it is isolated from other records and occurs outside of the known distribution of the subspecies. For these reasons it was not included in the calculations for the EOO used in the assessment. |
| ****Trend**** | Unknown | There is no information on the status of subpopulations and the impact and status of threats identified for the subspecies (historical/current). As such, the trend in EOO is unknown. |
| ****Area of Occupancy**** | 24 km2 | Unknown | 56 km2 | The area of occupancy (AOO) is estimated at 28 km2. This figure is based on the mapping of point records from 1998 to 2010, obtained from state governments, museums, and CSIRO. The AOO was calculated using the 2 x 2 km grid cell method, as outlined in the Guidelines for Using the IUCN Red List Categories and Criteria (IUCN 2019).*The national prioritisation of Australian plants affected by the 2019–2020 bushfire season project* estimates an AOO for this subspecies of 56 km2 (Gallagher 2020) which has been used as the maximum plausible value. |
| ****Trend**** | Unknown | There is no information on the status of known subpopulations. As such, the trend in AOO is unknown. |
| ****Number of subpopulations**** | 5 | 5 | Unknown | The five general areas where the subspecies occurs are geographically separated from one another, and records in each area are generally clumped together. These areas are Kings Tableland in the central Blue Mountains, and the following four areas on the Worona Plateau: Royal National Park, Woronora Special Area, in and near to Dharawal National Park/ Nature Reserve, and the Mount Kiera district (OEH 2019; NSW Government 2021). Areas within the Worona Plateau range from between ~8 km to ~20 km to the next nearest area, and the Blue Mountains area is ~70 km from the next closest area on the Worona Plateau. Given that seed dispersal has been reported to be restricted to within 1-2 metres of the parent plant (NSW NPWS 2000), these areas are unlikely to be exchanging genetic material. If it is assumed that no genetic exchange is occurring between these five areas, the number of subpopulations is estimated at 5. The maximum plausible value is unknown, as there are likely unknown sites extant due to the lack of knowledge surrounding the subspecies and its fragmented distribution. |
| ****Trend**** | Unknown | There is no information on the status of subpopulations and the impact and status of threats identified for the subspecies (historical/current). As such, the trend in number of subpopulations is unknown, |
| ****Basis of assessment of subpopulation number**** | See above. |
| ****No. locations**** | 2 | 2 | Unknown  | The number of locations is estimated at two, based on the plausible impact of inappropriate fire regimes (including a combination of two or more too frequent fire events). Given that fires occurred across large areas in the Blue Mountains during 2019–20, it is plausible that a single fire event could impact all known records in the region, and a subsequent fire event would lead to loss of juveniles at these sites. Subsequent fire events could also feasibly impact all individuals in the Illawarra (Woronora Plateau) region in a similar way, though these are substantially further apart and have settlements, such as Helensburgh, between them. Records in the Mount Kiera district are also relatively close to Wollongong, and the presence of these settlements may bolster fire protection responses and act as barriers that preclude a single fire from impacting all sites in the Woronora Plateau region.Using a precautionary approach, the minimum plausible number of locations is estimated as two (Blue Mountains and Woronora Plateau regions). The maximum plausible value is unknown, as there are likely unknown sites extant due to the lack of knowledge surrounding the subspecies.  |
| ****Trend**** | Decreasing | Prior to the 2019–20 bushfires, fires had not impacted such large areas of land at high severity in eastern Australia. However, the advent of these fires suggests that the scale of fire events has increased, which decreases the number of locations by providing a larger area across which subpopulations can be impacted by fire.  |
| ****Basis of assessment of location number**** | As per justification described above. |
| ****Fragmentation**** | Detailed information on the habitat patches associated with *Acacia baueri* subsp. *aspera* is not available, however the subspecies has a restricted geographic distribution, thought to occur in five general areas which are geographically separated from one another (see above). Each subpopulation is likely to be small and may be smaller than needed to support a viable population (Frankham et al. 2014). Seed dispersal has been reported to be restricted to within 1-2 metres of the parent plant (NSW NPWS 2000) and as a result are unlikely to be exchanging genetic material, with probable low genetic diversity (OEH 2019; NSW NPWS 2000). As such, the subspecies’ distribution is considered to be severely fragmented. |
| ****Fluctuations**** | The population size of *Acacia* *baueri* subsp. *aspera* may fluctuate following fire, however, there is no evidence to suggest that these fluctuations exceed one order of magnitude. There are no known extreme fluctuations in EOO, AOO, number of subpopulations or locations. |

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** | **Endangered****Severe reduction** | **Vulnerable****Substantial reduction** |
| **A1** | ≥ 90% | ≥ 70% | ≥ 50% |
| **A2, A3, A4** | ≥ 80% | ≥ 50% | ≥ 30% |
| **A1** Population reduction observed, estimated, inferred or suspected in the past and the causes of the reduction are clearly reversible AND understood AND ceased.**A2** Population reduction observed, estimated, inferred or suspected in the past where the causes of the reduction may not have ceased OR may not be understood OR may not be reversible.**A3** Population reduction, projected or suspected to be met in the future (up to a maximum of 100 years) [(*a) cannot be used for A3*]**A4** An observed, estimated, inferred, projected or suspected population reduction where the time period must include both the past and the future (up to a max. of 100 years in future), and where the causes of reduction may not have ceased OR may not be understood OR may not be reversible. | Based on any of the following | (a) direct observation [except A3](b) an index of abundance appropriate to the taxon(c) a decline in area of occupancy, extent of occurrence and/or quality of habitat(d) actual or potential levels of exploitation(e) the effects of introduced taxa, hybridization, pathogens, pollutants, competitors or parasites |

### Criterion 1 evidence

**Insufficient data to determine eligibility**

*Generation length*

An equation for generation time given in IUCN (2019) is: Generation time= age of first reproduction + [0.5 \* (length of reproductive period)].

Records and observations of *Acacia baueri* subsp*. aspera* suggest that plants can live for 20 or more years (NSW NPWS 2000). There is no information available on the age of first reproduction of the subspecies, though NSW Rural Fire Service (2013) recommends a minimum fire interval of seven years, implying that a soil seed bank has been developed by this time. In a review of the reproductive biology of 13 invasive *Acacia* species, ten matured in less than two years (77 percent), whereas in non-invasive *Acacia* species, only seven out of 26 matured at ages less than two years (Gibson et al. 2011). Given that the subspecies is found only in isolated areas, it appears the subspecies is more likely to be non-invasive. Using the above information, the juvenile period is estimated as 3–7 years.

Estimates

Generation time = 7 + [0.5 \* (20-7)] =14, assuming a juvenile period of seven years and longevity of 20 years.

Generation time = 3 + [0.5 \* (20-3)] =12, assuming a juvenile period of three years and longevity of 20 years.

Three generation period

The generation length of *Acacia* *baueri* subsp. *aspera* is estimated at 13 years, with a maximum estimated length of 14 years and a minimum estimated length of 12 years. This gives a period of 42–54 years with high uncertainty under Criterion 1. *Population reduction*

There is limited information available on the trajectory of the subspecies, including no temporal data to assess any past or ongoing trends in population size. In 2000, NSW NPWS reported that several older recorded subpopulations of *Acacia* *baueri* subsp. *aspera* appear to have become locally extinct or have declined in numbers over the last 30–100 years, with only one new population being recorded (NSW NPWS 2000). However, there was no information on the extent of these declines or how many subpopulations were lost. Environmental impact assessment guidelines for the subspecies published in 2000 stated that “populations of *A. baueri* subsp. *aspera* are rare and typically small (<30 plants) (NSW NPWS 2000) and targeted surveys undertaken in 1999 identified a total of 129 plants (see *Subpopulations*).

Aside from these targeted surveys, there appears to be little data on subpopulation sizes or trajectory despite the substantial general survey effort in much of the subspecies’ distribution. Surveys have been conducted in the distribution of the subspecies for various purposes, including vegetation community identification and mapping, plot and transect surveys undertaken for environmental impact assessments associated with long-wall coal mining, fire trail and utility easement maintenance, and for a range of other development proposals. The scarcity of records in these untargeted surveys may be because the subspecies is a low growing plant that is difficult to detect in vegetated landscapes.

During the 2019–2020 bushfires it was estimated that 17–25 percent of the subspecies modelled range was burnt (depending on the age of records used; Gallagher 2020). The current population size of *Acacia baueri* subsp. *aspera* is likely small, though targeted surveys have not been undertaken following the 2019–2020 bushfires. Experts suggest the subspecies is under-surveyed in some parts of its distribution, though may be in significant decline at known sites (S Douglas 2021 pers comm. 22 September). However, it is unclear if these declines exceed 30 percent.

*Conclusion*

There are insufficient data to demonstrate if the subspecies is eligible for listing under this criterion. However, the purpose of this consultation document is to elicit additional information to better understand the subspecies 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 km2** | **< 5,000 km2** | **< 20,000 km2** |
| **B2.** Area of occupancy (AOO) | **< 10 km2** | **< 500 km2** | **< 2,000 km2** |
| **AND at least 2 of the following 3 conditions:** |
| (a) Severely fragmented OR Number of locations | **= 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) 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(iii,v)+2ab(iii,v) for listing as Endangered**

*Extent of occurrence and area of occupancy*

The extent of occurrence (EOO) is estimated at 1026 km2 and the area of occupancy (AOO) is estimated at 28 km2. These figures are based on the mapping of point records from 1998 to 2010, obtained from state governments, museums, and CSIRO. It should be noted that the most recent record for the subspecies is from 2010. The EOO was calculated using a minimum convex hull, and the AOO calculated using the 2 x 2 km grid cell method, as outlined in the Guidelines for Using the IUCN Red List Categories and Criteria (IUCN 2019). The TSSC’s standard approach is to use the last 20 years of record data, unless there is evidence that a different time period is more appropriate. As the subspecies is not well surveyed across its range a shorter time period was not considered appropriate. Since 1990, the subspecies has only been recorded 16 times, 11 of these records were from 1998 and 1999, the other five of these records occurring between 2001 and 2010 (NSW Government 2021). The lack of recent record data may be a result of the lack of targeted survey effort for the subspecies, and as such a longer time period to include the bulk of records from 1998 and 1999 was considered appropriate for calculating the EOO and AOO. Also noting that many of the areas where the subspecies has been recorded are within reserved land and as such their persistence over longer time periods is considered to be more certain than if the subspecies were to occur predominantly on unreserved lands.

The subspecies’ EOO (<5,000 km2) and AOO (<500 km2) meet the requirements for listing as Endangered under B1 and B2.

*Severe fragmentation and number of locations*

“A taxon can be considered to be severely fragmented if most (>50%) of its total area of occupancy is in habitat patches that are (1) smaller than would be required to support a viable population, and (2) separated from other habitat patches by a large distance” (IUCN 2019).

Detailed information on the habitat patches associated with *Acacia* *baueri* subsp. *aspera* is not available, however the subspecies has a restricted geographic distribution, and is thought to occur in five general areas that **are geographically separated from one another**. These include Kings Tableland in the central Blue Mountains, Royal National Park, Woronora Special Area, in and near to Dharawal National Park/ Nature Reserve, and the Mount Kiera district (OEH 2019; NSW Government 2021). **Areas occupied within the Worona Plateau range from between ~8 km to ~20 km to the next nearest area, and the Blue Mountains area is ~70 km from the next closest area on the Worona Plateau.** Each subpopulation is likely to be **small (<30 plants)** and may be smaller than needed to support a viable population in the long-term (Frankham et al. 2014)**. Seed dispersal** has been reported to be restricted to within 1-2 metres of the parent plant (NSW NPWS 2000) and as a result are unlikely to be exchanging genetic material, with probable low genetic diversity (OEH 2019; NSW NPWS 2000). As such, the subspecies distribution is considered to be severely fragmented.

“The term ‘location’ defines a geographically or ecologically distinct area in which a single threatening event can rapidly affect all individuals of the taxon present. The size of the location depends on the area covered by the threatening event and may include part of one or many subpopulations. Where a taxon is affected by more than one threatening event, location should be defined by considering the most serious plausible threat” (IUCN 2019).

The number of locations is estimated at two, based on the plausible impact of inappropriate fire regimes (including a combination of two or more too frequent fire events) (Table 3). Given the impacts of the 2019–20 bushfires, it is plausible that a single fire event could impact all known records in the Blue Mountains, and a subsequent fire event would lead to loss of juveniles at these sites. Multiple fire events could also feasibly impact all individuals in the Illawarra (Woronora Plateau) region in a similar way. Using a precautionary approach, the minimum plausible number of locations is estimated as two (Blue Mountains and Woronora Plateau regions).

*Continuing decline*

Several threats have been reported for *Acacia* *baueri* subsp. *aspera* (OEH 2019; Table 1). However, there is limited information on the current status of many of the identified threats and no recent surveys have been undertaken. As such, new or evolving threats that have not previously been reported may be impacting upon the subspecies. Douglas (2021 pers comm. 22 September) recalls a conversation with the late Teresa James about her targeted survey for this subspecies, in which she expressed great concern for it because she had not been able to locate it at some earlier sites, and even when she did find it, numbers were low and these new records did not add to its distribution.

There is insufficient evidence to determine if there is any continuing decline in (i) extent of occurrence, (ii) area of occupancy, or (iv) number of locations or subpopulations. However, it is inferred that there is continuing decline in the (v) number of mature individuals based on expert opinion (see above) and observations of senescing mature individuals in many subpopulations. A limiting factor in this regard is the likely very long viability of the subspecies’ seed within the soil-stored seed bank (~100 years). This can mean that even when targeted survey occurs and previous occurrences of the subspecies are noted as absent, there is potential for the plant to regenerate from soil-stored seed if habitat is still present (S Douglas 2021 pers comm. 22 September). Thus, it can be difficult to determine if the combined number of seeds and mature individuals is declining. However, given that many sites have remained unburnt since 1999, the already senescing subpopulations have likely continued to decline, potentially in combination with an aging seed bank. This suggests there may be continuing decline in the number of mature individuals along with seed viability, though more evidence is required to confirm this.

Suitable habitat within the range of the subspecies is known to be impacted by weeds, inappropriate fire regimes and drought. Further, *Phytophthora* *cinnamomi* is present across the range of *Acacia* *baueri* subsp. *aspera*. While the susceptibility of the subspecies to the pathogen is unknown, it is very likely to be causing a decline in the quality of habitat particularly in long unburnt areas or climatically wetter habitat such as the Woronora Plateau (S Douglas 2021 pers comm. 10 September). These factors are inferred to be causing a continuing decline in the (iii) area, extent and/or quality of habitat for *Acacia* *baueri* subsp. *aspera*.

*Extreme fluctuations*

The population size of *Acacia* *baueri* subsp. *aspera* may fluctuate following fire, however, there is no evidence to suggest that these fluctuations exceed one order of magnitude. There are no known extreme fluctuations in EOO, AOO, number of subpopulations or locations.

The subspecies does not appear to meet the extreme fluctuations requirement for listing under this criterion.

*Conclusion*

Following assessment of the information available the Committee has determined that the geographic distribution is restricted and there are threats operating that would make the subspecies’ geographic distribution precarious for its survival. The subspecies appears to have met the relevant elements of Criterion 2 to make it eligible for listing as Endangered. However, the purpose of this consultation document is to elicit additional information to better understand the subspecies 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: |  |  |  |
| (a) | (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 C2a(i) for listing as Critically Endangered**

**The population size of *Acacia* *baueri* subsp. *aspera* is likely to be small, though no rigorous estimates of population size are available. The environmental impact assessment guidelines for the subspecies stated that “populations of *A.* *baueri* subsp. a*spera* are rare and typically small (<30 plants) (NSW NPWS 2000). The BioNet Atlas contains 36 records for *A.* *baueri* subsp. a*spera,* of these, four records (all from 1999) reported the number of individuals. They were, one (north of Mount Kiera), 12 (Blue Mountains areas), 30 (Blue Mountains area), and 60 plants (southwest of Wedderburn).** These records were associated with targeted surveys for the subspecies undertaken in 1999 by TA James for what is now NSW Department of Planning Industry and Environment (S Douglas 2021 pers comm. 22 September). Beyond these estimates, **there is very limited information available on the population size of subspecies and surveys to establish baseline data are identified as required actions for the three priority management sites under the NSW Saving our Species strategy (NSW Government n.d).** Targeted surveys have not been undertaken in recent years, nor following the 2019–2020 bushfires.

It is assumed there are five known subpopulations (though there are likely undiscovered sites) (Table 3). Previous estimates of subpopulation sizes have been 1, 12, 30 and 60 (NSW NPWS 2000). If the number of individuals in the subpopulation that was not surveyed in 1999 is estimated as the mean subpopulation size (26 individuals), the total number of individuals was 129 as of 1999. It is unclear how many individuals were mature during these surveys.

Available evidence suggests that the number of mature individuals in known subpopulations have likely decreased from 129 plants since the targeted surveys in 1999, through senescence and other threats (see Criterion 1 and Criterion 2). Therefore, it is plausible to estimate the number of mature individuals as <250, though it is notable that there is a high degree of uncertainty surrounding this estimate. Based on this population size, the subspecies is eligible for Critically Endangered under Criterion 3.

*Continuing decline*

As described under Criterion 2, a continuing decline the number of mature individuals and habitat quality is inferred.

*Precarious geographic distribution*

The number of mature individuals in each subpopulation is estimated as typically <30 (NSW NPWS 2000), though one subpopulation of 60 was previously observed southeast of Wedderburn. However, it is plausible that the number of mature individuals in the subpopulation has declined to <50 since 1999, as known subpopulations have been observed to be aging and senescing due to inappropriate fire regimes.. The 2019–20 bushfires do not appear to have affected this subpopulation, so recruitment as a result of these fires is unlikely. Targeted surveys are required to determine the current subpopulation sizes, though, using the precautionary principle, it is reasonable to suggest that all subpopulations have below 50 mature individuals.

*Conclusion*

The subspecies may meet the requirements for Critically Endangered. However, the purpose of this consultation document is to elicit additional information to better understand the subspecies 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 km2 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 [*common assessment method*](http://www.environment.gov.au/biodiversity/threatened/cam).

### Criterion 4 evidence

**Eligible under Criterion 4 D for listing as Endangered.**

As described above under the evidence for Criterion 3, the number of mature individuals is plausibly <250. There is a high degree of uncertainty surrounding this estimate, though it is considered to be appropriate based on the potential for a high proportion of the subpopulation to be senescent.

*Conclusion*

The total number of mature individuals is likely to be <250 which is considered very low. Therefore, the subspecies appears to have met the relevant elements of Criterion 4 to make it eligible for listing as Endangered. However, the purpose of this consultation document is to elicit additional information to better understand the subspecies 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 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 subspecies for listing in any category under this criterion.

### Adequacy of survey

The survey effort has been considered adequate and there is sufficient scientific evidence to support the assessment.

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