

## Notice of and reasons for the Final Determination

The NSW Threatened Species Scientific Committee, established under the *Biodiversity Conservation Act 2016* (the Act), has made a Final Determination to list *Acacia baueri* subsp. *aspera* (Maiden & Betche) Pedley as an ENDANGERED SPECIES in Part 2 of Schedule 1 of the Act and, as a consequence, to omit reference to *Acacia baueri* subsp. *aspera* (Maiden & Betche) Pedley in Part 3 of Schedule 1 (Vulnerable species) of the Act. Listing of Endangered species is provided for by Part 4 of the Act.

The NSW Threatened Species Scientific Committee is satisfied that *Acacia baueri* subsp. *aspera* (Maiden & Betche) Pedley has been duly assessed by the Commonwealth Threatened Species Scientific Committee under the Common Assessment Method, as provided by Section 4.14 of the Act. After due consideration of DCCEEW (2023), the NSW Threatened Species Scientific Committee has made a decision to list the species as Endangered.

## Summary of Conservation Assessment

*Acacia baueri* subsp. *aspera* (Maiden & Betche) Pedley was found to be Endangered in accordance with the following provisions in the *Biodiversity Conservation Regulation 2017*: Clause 4.3 (b)(d)(e i), Clause 4.4 (b)(e i, ii A(II)), and Clause 4.5 (b) because: 1) it has a highly restricted geographic distribution with an Extent of Occurrence (EOO) of 784 km<sup>2</sup> and an Area of Occupancy (AOO) of 36 km<sup>2</sup>; 2) the habitat of the subspecies is severely fragmented, and the population occurs within 2–4 threat-defined locations; 3) the total number of mature individuals is very low (<250), with a very low number of mature individuals (<250) in each subpopulation; and 4) there is inferred continuing decline in the number of mature individuals due to adverse fire regimes which are exacerbated by climate change.

The NSW Threatened Species Scientific Committee has found that:

1. *Acacia baueri* subsp. *aspera* (Maiden & Betche) Pedley (family Fabaceae) is a “highly-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).
2. *Acacia baueri* subsp. *aspera* is restricted to relatively high rainfall areas in 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 Dharawal NP/ Nature Reserve, and the Mount Keira 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). Traditional Owner groups within the distribution of *A. baueri* subsp. *aspera* include the Dharug, Tharawal and

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Gundunngarra (AIATSIS 1996). A recently redetermined record from ‘Molly Morgan Swamp’, east of Kangaloon, is the southernmost record of the subspecies.

3. *Acacia baueri* subsp. *aspera* is considered to occur across six subpopulations including the Kings Tableland (90 mature individuals), Molly Morgan Swamp (4 mature individuals), Royal NP (mature individuals unknown), Woronora Special Area (mature individuals unknown), Dharawal NP/ Nature Reserve (54–156 mature individuals), and the Mount Keira District (9 mature individuals) (DCCEEW 2023). Given that known subpopulations of *A. baueri* subsp. *aspera* are from very small, isolated sites, and the subspecies has naturally low fecundity, all of the known subpopulations could become small and non-viable over a three-generation period. As such, the subspecies’ distribution is considered severely fragmented.
4. The number of mature individuals of *Acacia baueri* subsp. *aspera* is estimated to be <250 primarily based on targeted surveys in 1999 and additional surveys in 2022–3 and a single survey in 2005 (DCCEEW 2023). Based on the survey data, the minimum number of mature individuals across all sites, using the most recent available survey records, is approximately 100-150. The total number of mature individuals is very low and might be declining in areas that have been long unburnt including three sites within Dharawal NP that had 96 plants observed in 1999 but only three plants observed in 2022, the Mt Keira district which includes a potentially extinct roadside population and another nearby roadside population that is very vulnerable with only a single seed pod observed, and ‘Molly Morgan Swamp’ which only had four plants observed in 2023 with no evidence of seed production. However, further monitoring is required to determine whether these observations represent an overall population decline or transitions between standing plant and seed bank stages of the species’ life cycle.
5. *Acacia baueri* subsp. *aspera* has a highly restricted distribution. It has an estimated Extent of Occurrence (EOO) of 784 km<sup>2</sup>, based on a minimum convex polygon, the method of assessment recommended by IUCN (2022). The Area of Occupancy (AOO) is estimated to be 36 km<sup>2</sup> based on 2 km x 2 km grid cells, the scale recommended by IUCN (2022). AOO and EOO estimates were calculated based on records from 1998 to 2010, obtained from state governments, museums, and CSIRO.
6. *Acacia baueri* subsp. *aspera* occurs on periodically wet soils in low, damp heathlands, often on exposed rocky outcrops and sandstone ridges and plateaus that receive on average more than 1100 mm of rainfall per annum (OEH 2019; PlantNET 2022). Recent observations during surveys to rediscover the ‘Molly Morgan Swamp’ site report the habitat as being dry sclerophyll, heathy woodland to low open forest on Hawkesbury Sandstone. Similarly, the Mt Keira habitat appears to be heathy sclerophyll woodland and low open forest on sandstone, with areas of damp heath and fernland. Associated tree species include *Eucalyptus sieberi* and *E. racemosa*, with common shrubs being *Banksia ericifolia*, *Leptospermum polygalifolium*, *L. trinervium* and *Kunzea ambigua*, with areas of *Melaleuca squarrosa* over a sedge-dominated ground stratum.
7. Peak flowering of *Acacia baueri* subsp. *aspera* occurs from December to March, with pods observed remaining on plants for several months, maturing in October to December (OEH 2019). Records and observations of *A. baueri* subsp. *aspera*

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suggest that individuals may live for 20 or more years (NSW NPWS 2000) and may live for several decades in unburnt or lightly burnt habitat. Pollination likely occurs primarily via insects. The most important *Acacia* pollinators are usually social and solitary bees (including the widely distributed European honeybee (*Apis mellifera*)) followed by wasps, flies, beetles and nectar-feeding birds in some cases (Stone *et al.* 2003). Line drawings show a well-formed aril on the seeds of *A. baueri*, which can contribute to dispersal by ants that use the aril as a food source and discard the seeds (Tame 1992; NSW Herbarium), often below ground in their nests (Hughes & Westoby 1990). Seed dispersal of *A. baueri* subsp. *aspera* has been reported to be restricted to within 1–2 metres of the parent plant (NSW NPWS 2000).

8. *Acacia baueri* subsp. *aspera* is reported to be an obligate seeder that recruits from a soil-stored seed bank after fire (Auld & O'Connell 1991; Halford 1998). *Acacia* seeds are physically dormant and typically long-lived in the soil seedbank, with a hard seed coat requiring long-term breakdown in the absence of disturbance (typically fire). Based on similar species, the seedbank longevity of *A. baueri* subsp. *aspera* is likely within the realm of at least 30–40 years, with 50 years also plausible (Auld 1986, 1987).
9. *Acacia baueri* subsp. *aspera* is predominately threatened by adverse fire regimes exacerbated by climate change. 'High frequency fire resulting in the disruption of life cycle processes in plants and animals and loss of vegetation structure and composition' and 'Anthropogenic climate change' are listed as Key Threatening Processes under the Act.
10. *Acacia baueri* subsp. *aspera* occurs across 2–4 threat-defined locations based on the most serious plausible threat of adverse fire regimes causing biodiversity declines. Using a conservative approach, the maximum plausible number of locations is estimated as four (Blue Mountains, Woronora Plateau, Royal NP and 'Molly Morgan Swamp'), and the minimum number is estimated as two (Blue Mountains, Woronora Plateau). The uncertainty surrounding this estimate is due to the large scale of the 2019–20 bushfires and the possibility that future fires may affect many of the subpopulations at once.
11. Adverse fire regimes are inferred to be causing continuing declines in the number of mature individuals for *Acacia baueri* subsp. *aspera*. Low frequency fire may be threatening the subspecies at some sites, as long fire-free intervals could result in population declines via seed bank decay after standing plants senescence and inputs to the seed bank cease (Auld 1987; Keith 1996). Notably, both the seed bank and the number of mature individuals is declining in this phase of the fire cycle. High fire frequency due to climate change may also disrupt maturation and seed bank replenishment, causing declines within subpopulations. Fecundity of the species is low, and it will take years of fruit production to accumulate a soil seed bank that is sufficiently large to avoid population declines after subsequent fires. It was estimated that 17–25% of the modelled subspecies range was burnt during the 2019–20 bushfires (depending on the age of records used; Gallagher 2020) and that the subpopulations that were burnt are currently threatened by a high frequency fire regime. Frequent low severity fires are particularly threatening, as they expose the seedbank to gradual attrition over time, by failing to stimulate recruitment or conditions that allow the subspecies to grow. Given that the

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frequency of fires in eastern Australia is rising, it is projected that the number of mature individuals will decline in the future due to high frequency fire exceeding the minimum fire free interval for this subspecies at some sites.

12. Increased fire frequency, extreme temperatures and fire danger weather due to climate change contribute to adverse fire regimes that are inferred to be causing continuing decline in the number of mature individuals for *Acacia baueri* subsp. *aspera*. Climate change is resulting in higher average temperatures throughout the year, more frequent dry periods and droughts, and overall more severe fire weather which is contributing to an increase in fire severity, frequency and changes to seasonality (Williamson *et al.* 2016; Abram *et al.* 2021). The increasingly dry conditions brought about by climate change may be particularly detrimental to *A. baueri* subsp. *aspera*, as it is known to occur in very exposed areas on shallow soils and post-fire seedlings face risks of desiccation in the event of post-fire droughts. Climate change projections show that southern Australia is likely to experience harsher fire weather (CSIRO 2015) and increased bushfire frequency and severity.
13. *Acacia baueri* subsp. *aspera* (Maiden & Betche) Pedley is not eligible to be listed as a Critically Endangered species.
14. *Acacia baueri* subsp. *aspera* (Maiden & Betche) Pedley is eligible to be listed as an Endangered species as, in the opinion of the NSW Threatened Species Scientific Committee, it is facing a very high risk of extinction in Australia in the near future as determined in accordance with the following criteria as prescribed by the *Biodiversity Conservation Regulation (2017)*:

**Assessment against *Biodiversity Conservation Regulation 2017* criteria**

The Clauses used for assessment are listed below for reference.

**Overall Assessment Outcome: Endangered under Clause 4.3 (b)(d)(e i), Clause 4.4 (b)(e i, ii A(II)) and Clause 4.5 (b)**

**Clause 4.2 – Reduction in population size of species  
(Equivalent to IUCN criterion A)**

**Assessment Outcome: Data Deficient**

<b>(1) - The species has undergone or is likely to undergo within a time frame appropriate to the life cycle and habitat characteristics of the taxon:</b>			
	(a)	for critically endangered species	a very large reduction in population size, or
	(b)	for endangered species	a large reduction in population size, or
	(c)	for vulnerable species	a moderate reduction in population size.
<b>(2) - The determination of that criteria is to be based on any of the following:</b>			
	(a)	direct observation,	
	(b)	an index of abundance appropriate to the taxon,	
	(c)	a decline in the geographic distribution or habitat quality,	
	(d)	the actual or potential levels of exploitation of the species,	
	(e)	the effects of introduced taxa, hybridisation, pathogens, pollutants, competitors or parasites.	

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**Clause 4.3 – Restricted geographic distribution of species and other conditions  
(Equivalent to IUCN criterion B)**

**Assessment Outcome: Endangered under Clause 4.3 (b)(d)(e i)**

<b>The geographic distribution of the species is:</b>		
(a)	for critically endangered species	very highly restricted, or
(b)	for endangered species	highly restricted, or
(c)	for vulnerable species	moderately restricted.
<b>and at least 2 of the following 3 conditions apply:</b>		
(d)	the population or habitat of the species is severely fragmented or nearly all the mature individuals of the species occur within a small number of locations,	
(e)	there is a projected or continuing decline in any of the following:	
	(i)	an index of abundance appropriate to the taxon,
	(ii)	the geographic distribution of the species,
	(iii)	habitat area, extent or quality,
	(iv)	the number of locations in which the species occurs or of populations of the species.
(f)	extreme fluctuations occur in any of the following:	
	(i)	an index of abundance appropriate to the taxon,
	(ii)	the geographic distribution of the species,
	(iii)	the number of locations in which the species occur or of populations of the species.

**Clause 4.4 – Low numbers of mature individuals of species and other conditions  
(Equivalent to IUCN criterion Clause C)**

**Assessment Outcome: Endangered under Clause 4.4 (b)(e i, ii A(II))**

<b>The estimated total number of mature individuals of the species is:</b>		
(a)	for critically endangered species	very low, or
(b)	for endangered species	low, or
(c)	for vulnerable species	moderately low.
<b>and either of the following 2 conditions apply:</b>		
(d)	a continuing decline in the number of mature individuals that is (according to an index of abundance appropriate to the species):	
	(i)	for critically endangered species very large, or
	(ii)	for endangered species large, or
	(iii)	for vulnerable species moderate,
(e)	both of the following apply:	
	(i)	a continuing decline in the number of mature individuals (according to an index of abundance appropriate to the species), and
	(ii)	at least one of the following applies:
	(A)	the number of individuals in each population of the species is:
		(I) for critically endangered species extremely low, or
		(II) for endangered species very low, or
		(III) for vulnerable species low,
	(B)	all or nearly all mature individuals of the species occur within one population,

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			(C)	extreme fluctuations occur in an index of abundance appropriate to the species.
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**Clause 4.5 – Low total numbers of mature individuals of species**

**(Equivalent to IUCN criterion D)**

**Assessment Outcome: Endangered under Clause 4.5 (b)**

The total number of mature individuals of the species is:			
	(a)	for critically endangered species	extremely low, or
	(b)	for endangered species	very low, or
	(c)	for vulnerable species	low.

**Clause 4.6 – Quantitative analysis of extinction probability**

**(Equivalent to IUCN criterion E)**

**Assessment Outcome: Data Deficient**

The probability of extinction of the species is estimated to be:			
	(a)	for critically endangered species	extremely high, or
	(b)	for endangered species	very high, or
	(c)	for vulnerable species	high.

**Clause 4.7 – Very highly restricted geographic distribution of species–vulnerable species**

**(Equivalent to IUCN criterion D2)**

**Assessment Outcome: Not Met**

	For vulnerable species,	the geographic distribution of the species or the number of locations of the species is very highly restricted such that the species is prone to the effects of human activities or stochastic events within a very short time period.
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NSW Threatened Species Scientific Committee

**Supporting Documentation:**

DCCEEW (Department of Climate Change, Energy, the Environment and Water) (2023). Conservation Advice for *Acacia baueri* subsp. *aspera* Australian Government, Canberra, ACT.

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