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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 beadleana* R.H.Jones & J.J.Bruhl as an ENDANGERED SPECIES in Part 2 of Schedule 1 of the Act. Listing of Endangered species is provided for by Part 4 of the Act. A Conservation Assessment report and Preliminary Determination for *Acacia beadleana* R.H.Jones & J.J.Bruhl as a Vulnerable species were published from 29 April 2022 to 29 July 2022. Following consideration of advice and submissions received, *Acacia beadleana* R.H.Jones & J.J.Bruhl is to be listed as an Endangered species. Listing of an Endangered species is provided for by Part 4 of the Act.

Summary of Conservation Assessment

Acacia beadleana R.H.Jones & J.J.Bruhl was found to be ENDANGERED in accordance with the following provisions in the *Biodiversity Conservation Regulation 2017*: Clause 4.3(b)(d)(e i,iii).

The main reasons for this species being eligible are; i) the species has a very highly restricted geographic distribution, extent of occurrence (EOO) and area of occurrence (AOO) are both 28 km²; ii) it most likely occurs in two threat defined locations; and, iii) continuing decline has been inferred in habitat quality and the number of mature individuals due to frequent fire impacting recruitment, while the number of mature individuals is projected to decline due to ongoing adverse fire regimes and drought.

The NSW Threatened Species Scientific Committee has found that:

1. *Acacia beadleana* (Fabaceae) is described by Jones and Bruhl (2006) as: "Single to multi-stemmed, lignotuberous, erect to spreading evergreen shrub, 0.4–2.5 m high. Stems woody, terete, roughened by phyllode scars. Branchlets terete with persistent, densely pilose indumentum; trichomes simple, hyaline appearing silver to white, antrorse to retrorse. Stipules subpersistent, narrowly triangular to triangular, 0.4–1 mm long, hairy. Pulvinus 0.5–1 mm long, sparsely hairy or sometimes glabrous. Phyllodes alternate and spiralled, crowded along the branchlets; narrowly elliptic, elliptic, linear to broadly linear, narrowly oblong, or narrowly oblanceolate 5–12.7 mm long, 0.6–1.4 mm wide, straight or recurved, often irregularly furrowed when dried; cross-section narrowly oblong to oblong; sparsely pilose; the hairs mostly restricted to abaxial margin, divergent, sometimes curved, antrorse to subappressed, hyaline and appearing silver to white; base cuneate; apex acute to short-acuminate and mucronate, mucro straight to oblique or hooked; two main veins (separating at proximal end of phyllode; one more or less central and the other closer to the abaxial edge) observed in cleared and stained phyllodes, nerves obscure in dried material; extrafloral nectary usually only one present, occasionally on the pulvinus or more often less than 2 mm distal to the pulvinus; stomata flush with phyllode surface, sometimes slightly raised. Inflorescence solitary, axillary; peduncles densely pilose, 5.8–15.5 mm long, proximally ebracteate; flower heads globular, bright golden-yellow, 32–46 flowered, 7–10 mm diameter when dried; bracteoles hairy; sepals, more than two

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thirds united from the base, hairy; petals sparsely hairy. Pods oblong; 20–60 mm long, 7–10.4 mm wide, glabrous, pruinose and purplish red when young, maturing to very dark brown outside and mid-tan inside, coriaceous, straight. Seeds of transverse orientation in pod; obloid or ovoid, 3.8–5 mm long, 2.5–3.5 mm wide; black to very dark brown; areole usually open, sometimes closed; aril extending to more than half the length of seed.”

2. Jones and Bruhl (2006) distinguish *A. beadleana* from *A. gordonii* (Tindale) Pedley and *A. brunioides* A.Cunn. ex G.Don subsp. *brunioides* based on morphology and geography. *Acacia gordonii* is restricted to the lower Blue Mountains (Bilpin, Faulconbridge) and the Sydney Hills (Glenorie), more than 450 km south of the Gibraltar Range where *A. beadleana* occurs. *Acacia beadleana* is most readily distinguished from *A. gordonii* by the distribution of phyllode and sepal indumentum and the number of flowers per head. The most similar, geographically proximal species to *A. beadleana* is *A. brunioides* subsp. *brunioides*, found c. 6 km from *A. beadleana* – but they differ in indumentum, flower colour and flower head number (Table 1 in Jones and Bruhl 2006).
3. *Acacia beadleana* occurs across granite derived communities in Gibraltar Range National Park, northern NSW (Jones and Bruhl 2006). *Acacia beadleana* occurs in the traditional lands of the Gumbaynggirr First Nation’s peoples.
4. *Acacia beadleana* is known from two subpopulations, separated by approximately 3.2 km. Subpopulation 1 is bisected by the Gwydir highway, and population 2 consists of three distinct patches separated from each other by 0.7-1.5 km.
5. The geographic distribution of *Acacia beadleana* is very highly restricted. Observation records define both the area of occupancy (AOO) and extent of occurrence for the species at 28 km²; extent of occurrence (EOO) is calculated as 11.8 km² based on a minimum convex polygon enclosing all validated records, however, when EOO is less than or equal to AOO, IUCN (2022) recommend EOO estimates be changed to be equal to AOO to ensure consistency with the definition of AOO as an area that fits within EOO.
6. There is a population estimate of 3750-4350 *Acacia beadleana* individuals, of which approximately 97% are likely to be mature. This estimate is based on a combination of plot sampling at known sites (D. Mackay in litt. September 2021) and expert advice (P. Sheringham in litt October 2022, May 2023).
7. *Acacia beadleana* grows in skeletal to deep sandy soils derived from granite and can often be found growing amid granite boulders in fire protected microhabitats. Jones and Bruhl (2006) describe the vegetation as a layered open woodland and heath with *Eucalyptus williamsiana*, *Leptospermum trinervium*, *Allocasuarina rigida*, *Callitris monticola*, *Acacia baeurlenii*, *Boronia anethifolia*, *Mirbelia speciosa*, *Leucopogon neoanglicus*, *Calytrix tetragona*, *Isopogon petiolaris*, *Lepidosperma gunnii*, *L. viscidum*, *Caustis flexuosa*, *Chaetospora turbinata*, *Conospermum burgessiorum* and *Trachymene incisa*.

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8. The longevity of *Acacia beadleana* individuals is not known, but the species is likely to be relatively long-lived. Plants are known to live for at least 16 years in a fire prone landscape when not burned, and may resprout after fire.
9. The primary juvenile period is not known, nor is the time it takes seedlings/juveniles to grow to a sufficient size to be able to resprout after a fire. Resprouting plants are likely fruit-bearing around three years after fire (D. Mackay *in litt.* 1 October 2022). Seed longevity in the soil seed bank is not known but in other species of acacias the hard coated seeds have remained viable with a half-life of 10.7 years in the soil seed bank (Auld 1986).
10. Peak flowering occurs from January to February but can occur throughout the year, and the main fruiting period is July to August (Jones and Bruhl 2006, J. Whitehead *in litt.* May 2023).
11. Pollinators and seed dispersers have not been documented for *Acacia beadleana*, but studies in other acacias suggest it is likely that bees, beetles and flies (and possibly birds) facilitate pollen movement in the species (Stone *et al.* 2003), while seed is likely ant dispersed (O'Dowd and Gill 1986). Introduced honeybees (*Apis mellifera*) and native hoverflies (*Melangyna* species) have been observed on flower heads of *A. beadleana* in March and May 2021 (J. Whitehead *in litt.* May 2023).
12. Based on the ecology of likely pollinators, a distance of at least 2 km between plant patches would generally be sufficient to isolate them from each other, with pollinators unlikely to move over this distance, restricting gene flow. As a consequence, there are considered to be two subpopulations of *Acacia beadleana* separated by around 3.2km.
13. *Acacia beadleana* is fire adapted, resprouting following fire and showing fire obligate seeding. *Acacia beadleana* has a lignotuber, and plants have been recorded resprouting after drought and fire (Jones and Bruhl 2006). The species also responds to fire through new recruitment from the soil seed bank (D. Mackay *in litt.* 2021).
14. Based on limited data for other resprouters (some eucalypts and Proteaceae species) (Keith 1996), a fire-free interval of at least 6-15 years may be needed to allow juvenile plants to become fire resistant, whereby they develop a sizable lignotuber and the ability to resprout after the next fire. Resprouting shrubs may tolerate exposure to one or possibly two occurrences of fire within a 15-year period.
15. Mortality is more likely to occur after fires if they are preceded or followed by drought conditions (Mackay 2021; *in litt.* October 2022). The impact of drought on *Acacia beadleana* may be a significant factor on seedling attrition and seedbank replenishment. Moisture stress causing attrition has been documented in other species of *Acacia* (Auld 1987). With adverse fire regimes and drought, new recruits to the population may be killed without contributing to future generations and the population size will decline if recruitment is insufficient to replace deaths of established plants (Keith 1996).
16. The main threat to *Acacia beadleana* is a change to fire regimes resulting in too frequent fire, leading to adult mortality and loss of recruits. '*High frequency fire*

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resulting in the disruption of life cycle processes in plants and animals and loss of vegetation structure and composition’ is listed as a Key Threatening Process under the Act.

17. Adverse fire regimes are the key threat to *Acacia beadleana*. High frequency fire in combination with drought is likely to disrupt the successful ongoing establishment and growth of seedlings and juvenile plants to replace those adults killed by fire. A continual loss of individuals and depletion of the seed bank to successive fires may threaten the viability of the population, particularly if lignotubers are weakened by ongoing drought or successive fires, and recruitment is insufficient to replace plants that die.
18. Fire is likely to increase in severity and frequency across the range of *Acacia beadleana*, with severe fire weather is projected to increase across the region by 2070 (AdaptNSW 2023). While a fire free interval of at least 7-15 years (or longer if drought conditions prevail) is needed to allow ongoing population persistence in this species, changes in fire regimes are likely to result in fire at a higher frequency than this, and so pose an ongoing threat to the species.
19. Drought has been observed to increase the impact of fire on *Acacia beadleana*, increasing mortality and decreasing the ability of populations to recover. Increasing temperature and decreasing rainfall as a consequence of climate change is likely to exacerbate the challenge of fire, and increase the background risk and severity of drought. Under future climate scenarios, the New England region is predicted to have changed rainfall conditions in the near future (2020-2039) with decreased rainfall across the region during summer and winter. Mean temperatures are projected to rise by 0.7°C by 2030 with the greatest increase during summer and spring. The region will have fewer colder nights under 2°C annually, and more hot days over 35°C annually (AdaptNSW 2023).
20. *Acacia beadleana* R.H.Jones & J.J.Bruhl 1966 is not eligible to be listed as a Critically Endangered species.
21. *Acacia beadleana* R.H.Jones & J.J.Bruhl 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:** Clause 4.3(b)(d)(e i,iii).

**Clause 4.2 – Reduction in population size of species
(Equivalent to IUCN criterion A)
Assessment Outcome: Data deficient**

(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:
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	(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.
(2) - The determination of that criteria is to be based on any of the following:			
	(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.	

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

Assessment Outcome: Endangered via Clause 4.3(b)(d)(e i,iii).

The geographic distribution of the species is:			
	(a)	for critically endangered species	very highly restricted, or
	(b)	for endangered species	highly restricted, or
	(c)	for vulnerable species	moderately restricted,
and at least 2 of the following 3 conditions apply:			
	(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 C)**

Assessment Outcome: Not met

The estimated total number of mature individuals of the species is:			
	(a)	for critically endangered species	very low, or
	(b)	for endangered species	low, or
	(c)	for vulnerable species	moderately low,
and either of the following 2 conditions apply:			

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	(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,
		(C)	extreme fluctuations occur in an index of abundance appropriate to the species.

Clause 4.5 - Low total numbers of mature individuals of species

(Equivalent to IUCN criterion D)

Assessment Outcome: Not met

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

Senior Professor Kristine French
Chairperson
NSW Threatened Species Scientific Committee

Supporting Documentation:

Gross & Scott (2024) Conservation Assessment of *Acacia beadleana* R.H.Jones & J.J.Bruhl (Fabaceae). NSW Threatened Species Scientific Committee.

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