

# NSW Threatened Species Scientific Committee

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## Conservation Assessment of *Acacia beadleana* R.H.Jones & J.J.Bruhl (Fabaceae)

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### ***Acacia beadleana* R.H.Jones & J.J.Bruhl**

Distribution: Endemic to NSW

Current EPBC Act Status: Not listed

Current NSW BC Act Status: Not listed



LHS: Image KD Mackay; RHS image JJ Bruhl

Proposed listing on NSW BC Act and EPBC Act: Vulnerable

Conservation Advice: *Acacia beadleana*

### **Summary of Conservation Assessment**

*Acacia beadleana* was found to be eligible for listing as Vulnerable under Criteria D1 and D2. The main reasons for this species being eligible for listing are that (i) there are a low number of mature individuals in the wild, and (ii) there is a restricted area of occupancy and number of locations with a plausible future threat that could drive the taxon to Critically Endangered in a very short time.

### **Description and Taxonomy**

*Acacia beadleana* 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

## NSW Threatened Species Scientific Committee

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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 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.”

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).

### Distribution and Abundance

Using the map from the Australian Institute of Aboriginal and Torres Strait Islander Studies (AIATSIS, Horton 1996) *Acacia beadleana* occurs in the traditional lands of the Gumbaynggirr First Nation peoples.

*Acacia beadleana* is a naturally rare species known only from three subpopulations and about 1000 plants in the Gibraltar Range National Park, east of Glen Innes, northern NSW (Figure 1). It is abundant at these locations.

Subpopulations wax and wane in response to fire. In 2006 Jones and Bruhl (2006) noted that each subpopulation was comprised of c. 100 plants. More recently after the fires of 2019-2020, Mackay in November to December 2020 and March to May

# NSW Threatened Species Scientific Committee

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2021 estimated 1000 plants (50% seedlings in one monitoring plot in one subpopulation only) across three subpopulations.

Mackay (*in litt.* September 2021) provides these estimates of occupied habitat:

Gwydir Highway	Anvil Rock Walk	Dandahra Craggs Walk
50 Ha	100 Ha	4 Ha

This gives a total occupied habitat of 154 ha.

The geographic distribution of *Acacia beadleana* is very highly restricted. The area of occupancy (AOO) was estimated to be 8 km<sup>2</sup>, based on the species' occupying two 2 x 2 km grid cells, the spatial scale of assessment recommended by IUCN (2019). The extent of occurrence (EOO) was also estimated to be 8 km<sup>2</sup>. The EOO is reported as equal to AOO, despite the range of the species (estimated to be approximately 1 km<sup>2</sup>) measured by a minimum convex polygon containing all the known sites of occurrence, being less than AOO. This is to ensure consistency with the definition of AOO as an area within EOO, following IUCN Guidelines (2019).

Figure 1. Distribution of *Acacia beadleana*

A confidential detailed map of the distribution of *Acacia beadleana* is given in Appendix 1.

## Ecology

Population-based ecological knowledge for the species has been collected since 1997 (Jones and Bruhl 2006) with the most recent and detailed work being undertaken for the NSW SOS program by Mackay (*in litt.* September 2021). Peak flowering occurs in January – February and the main fruiting period is July to August (Jones and Bruhl 2006).

## Fire Ecology

*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 seedbank (D. Mackay, *in litt.* September 2021) but it is noteworthy that after the 2019-2020 fires there were few seedlings at the time of surveys in November to December 2020 and March to May 2021.

## Fire History and Management

Gibraltar Range National Park has a history of frequent fires (Croft *et al.* 2006) with the recent fires occurring between September 16 2019 and January 7 2020 (NPWS Fire History database, 2021).

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

# NSW Threatened Species Scientific Committee

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allow juvenile plants to become fire resistant, whereby they develop 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. Longer intervals will also be needed to ensure fire resistance in appreciable numbers of recruits and hence, population persistence. “If successive fires occur at intervals of less than this duration, then new recruits to the population will be killed without contributing to future generations. Thus, population size will decline if recruitment is insufficient to replace deaths of established plants” (Keith 1996).

## Threats

Threats to *Acacia beadleana* are currently considered to be few. Mackay (*in litt.* September 2021) reported that the population was healthy with no sign of mortality, disease or dieback. The subpopulation adjacent to the Gwydir Highway could be at risk from future road works.

There is a risk of decline in *Acacia beadleana* if the population experiences out-of-season fires or high frequency, or high intensity fires that prevents a seed bank from being replenished. All individuals of *Acacia beadleana* are found in small patches that are likely to be concurrently impacted by a single fire event. A continual loss of individuals and depletion of the seed bank to successive fires may threaten the viability of the population if lignotubers weaken and recruitment is insufficient to replace plants that die. While continuing decline is not currently inferred, the species should be reassessed if there is evidence of a fire free interval of less than 6 years and a lack of recruitment between fires.

## **Assessment against IUCN Red List criteria**

For this assessment it is considered that the survey of *Acacia beadleana* has been adequate and there is enough scientific evidence to support the listing outcome.

*Criterion A*                      *Population size reduction*

Assessment Outcome: Not met

Justification: Numbers of recorded plants have increased from c. 100 plants x 3 subpopulations in 2005 (Jones and Bruhl 2006) to 200-500 (three subpopulations total 1000 plants) in 2020 (D. Mackay *in litt.* September 2021)

*Criterion B*                      *Geographic range*

Assessment Outcome: Not met.

Justification: Whilst *Acacia beadleana* meets the threshold for Critically Endangered for geographic range, at least two of the three subcriteria are not met.

*Acacia beadleana* is endemic to a restricted area in NSW. The extent of occurrence (EOO) was estimated to be 8 km<sup>2</sup>. The EOO is reported as equal to AOO, measured by a minimum convex polygon containing all the known sites of occurrence, being less than AOO. This is to ensure consistency with the definition of AOO as an area within EOO, following IUCN Guidelines (2019). To be listed as Critically Endangered under Criterion B1, a species must have an EOO of <100 km<sup>2</sup>. *Acacia beadleana*

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# NSW Threatened Species Scientific Committee

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meets the EOO threshold for Critically Endangered. The AOO was estimated to be 8 km<sup>2</sup>. This calculation was based on the species occupying two (2 x 2 km) grid squares, the spatial scale of assessment recommended by IUCN (2019). To be listed as Critically Endangered under Criterion B2, a species must have an AOO of <10 km<sup>2</sup>. *Acacia beadleana* meets the AOO threshold for Critically Endangered.

In addition to these thresholds, at least two of three other conditions must be met.

- a) The population or habitat is observed or inferred to be severely fragmented or there is 1 (CR), ≤5 (EN) or ≤10 (VU) locations.

Assessment Outcome: Met for Critically Endangered.

Justification: *Acacia beadleana* is known from three subpopulations, with the greatest distance between them being c. 5 km. As the 2019-2020 fires impacted all subpopulations, all individuals of *Acacia beadleana* can be burnt in a single fire event and the species is considered to have a single threat-defined location.

- 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.

Assessment Outcome: Not met.

Justification: Decline is not currently inferred as the species responds to fire by resprouting and seedling recruitment. At present, there is no evidence that the current fire regime is leading to decline. However, the species should be reassessed if there is evidence of mortality and a lack of recruitment between fires.

- c) Extreme fluctuations.

Assessment Outcome: Not met.

Justification: Extreme fluctuations are unlikely because mature plants are apparently long-lived and capable of surviving fires.

## *Criterion C Small population size and decline*

Assessment Outcome: Not met.

Justification: There are an estimated 1000 mature plants in the wild with lignotubers and one population with c. 100 seedlings. Whilst *Acacia beadleana* meets the threshold for Endangered for population size (250 to 2,500 mature individuals), C1 is data deficient and C2 is not met as there is currently no evidence for continuing decline.

At least one of two additional conditions must be met. These are:

- C1. An observed, estimated or projected continuing decline of at least 20 % in 5 years or 2 generations, whichever is longer (up to a max. of 100 years in the future).

Assessment Outcome: Not met

# NSW Threatened Species Scientific Committee

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Justification: The number of individuals in the wild has increased by ten-fold since 2005 and 2021

C2. An observed, estimated, projected or inferred continuing decline

Assessment Outcome: Not met.

Justification: Decline is not currently inferred as the species responds to fire by resprouting and seedling recruitment. There is no evidence that the current fire regime is leading to decline.

In addition, at least 1 of the following 3 conditions:

- a (i). Number of mature individuals in each subpopulation  $\leq 50$  (CR);  $\leq 250$  (EN) or  $\leq 1000$  (VU).

Assessment Outcome: Met for Vulnerable.

Justification: All subpopulations have at least 200 mature individuals – two subpopulations have more than 300 plants.

- a (ii). The percentage of mature individuals in one subpopulation is 90-100% (CR); 95-100% (EN) or 100% (VU)

Assessment Outcome: Met for Vulnerable.

Justification: In the Gwydir Highway subpopulation, 50% of the population are seedlings. In the two other subpopulations, 100% of the subpopulation are mature plants or lignotuberous regrowth from mature plants.

- b. Extreme fluctuations in the number of mature individuals

Assessment Outcome: Not met.

Justification: Extreme fluctuations are unlikely.

*Criterion D Very small or restricted population*

Assessment Outcome: Vulnerable

Justification: There are about 1000 mature individuals in the wild.

To be listed as Vulnerable, a species must meet at least one of the two following conditions:

D1. Population size estimated to number fewer than 1,000 mature individuals

Assessment Outcome: Vulnerable

Justification: Mackay (*in litt.* September 2021) estimates the total number of individuals in the wild to be c. 1000 plants. Each of the three subpopulations has less than 500 plants and few of the censused plants in 2021 were seedlings (c. 10% in one subpopulation and 0% in two subpopulations).

D2. Restricted area of occupancy (typically  $<20$  km<sup>2</sup>) or number of locations (typically  $<5$ ) with a plausible future threat that could drive the taxon to CR or EX in a very short time.

Assessment Outcome: Vulnerable.

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# NSW Threatened Species Scientific Committee

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Justification: *Acacia beadleana* has a highly restricted area of occupancy of 8km<sup>2</sup>, and occurs at a single location based on the most serious plausible threat (adverse fire regime).

## *Criterion E Quantitative Analysis*

Assessment Outcome: Data Deficient.

Justification: No quantitative analysis has been undertaken at this time.

## **Conservation and Management Actions**

### Habitat loss, disturbance and modification

- Prevent habitat disturbance (road works) in the vicinity of populations.
- Minimise adverse fire regimes. Ensure prescribed burns in the vicinity of the species provide a sufficient fire-free interval (10-15 years) to allow maturation of individuals and accumulation of plant-stored resources for resprouting and replenishment of the soil seed bank. In addition, it is also important that there is sufficient time between fires to enable seedling recruits to become fire resistant (i.e. be able to resprout from root suckering following fire).
- Ex-situ conservation
- Develop a targeted *Acacia beadleana* seed collection program for *ex-situ* seed banking.

### Stakeholders

- Liaise with managers of Gibraltar Range National Park for conservation management and protection of the species.
- Liaise with authorities with fire management responsibilities to ensure there is effective communication between agencies regarding the requirement of fire-free intervals in habitat of *Acacia beadleana*, particularly along the Gwydir Highway.
- Update the Fire Plan of Management for Gibraltar Range National Park so the area where *Acacia beadleana* occurs ideally has fire-free intervals sufficient to allow juvenile plants to become fire resistant (this is likely to be in the order of 10-15 years).
- Provide detailed maps of the extent of the population in the Gwydir Highway population to the Roads Authority so that the population can be protected during road maintenance activities

## **Survey and Monitoring priorities**

- Monitor for signs of habitat degradation.
- Regularly monitor the population size, age structure and habitat of *A. beadleana* to determine whether there is a decline in the population. Tag individuals with fire-proof tags to monitor survival over time.
- Re-survey the population following every fire to check for plant survival, recruitment and for signs of any decline.

# NSW Threatened Species Scientific Committee

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## Information and Research priorities

Recruitment and seedling survival: Plots have been established by K.D. Mackay (UNE) at three locations. These plots should be used in an ongoing monitoring program. New seedlings should be carefully tagged with fire-proof tags/labels for annual monitoring. Monitoring labelled plants through time will allow for a Population Viability Analysis to be built in due course that will then allow for modelling of stochastic events on population persistence.

Fire biology: The response to fire has been determined for this species. Seedbank assessments could be helpful to understand longer term persistence after fires and the population size of seedbanks pre and post fire.

## References

Croft P, Hofmeyer D, Hunter JT (2006). Fire responses in four rare plant species at Gibraltar Range National Park, Northern Tablelands, NSW. *Proceedings of the Linnean Society of New South Wales* **127**, 57-62.

Horton DR (1996) The AIATSIS Map of Indigenous Australia. Australian Institute of Aboriginal and Torres Strait Islander Studies, accessed from <https://aiatsis.gov.au/explore/articles/aiatsis-map-indigenous-australia>

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## Expert Communications

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# NSW Threatened Species Scientific Committee

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## APPENDIX 1

**Assessment against NSW Biodiversity Conservation Regulation 2017 criteria**  
The Clauses used for the assessment are listed below for reference.

**Overall Assessment Outcome:**

*Acacia beadleana* was found to be Vulnerable under Clause 4.5(c) and Clause 4.7.

**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.	

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

**Assessment Outcome: Not met.**

\* Although *Acacia beadleana* meets the threshold for very highly restricted geographic distribution (EOO and AOO) for Critically Endangered, the species is currently considered to only meet one of the three conditions, i.e. it only meets (d), and not either (e) or (f). Hence for the overall assessment, Clause 4.3 is not met.

<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,

## NSW Threatened Species Scientific Committee

	(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.**

\* Although *Acacia beadleana* meets the threshold for low number of mature individuals (Endangered), the species is not currently considered to meet either (d) or (e). Hence for the overall assessment, Clause 4.4 is not met.

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

# NSW Threatened Species Scientific Committee

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## Clause 4.5 - Low total numbers of mature individuals of species (Equivalent to IUCN criterion D)

**Assessment Outcome: Vulnerable under Clause 4.5(c).**

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: Vulnerable.**

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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