

## 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 the shrub *Acacia constablei* Tindale as a CRITICALLY ENDANGERED SPECIES in Part 1 of Schedule 1 of the Act and, as a consequence, omit reference to *Acacia constablei* Tindale from Part 3 of Schedule 1 (Vulnerable species) of the Act. Listing of Critically Endangered species is provided for by Part 4 of the Act.

The NSW Threatened Species Scientific Committee is satisfied that *Acacia constablei* Tindale has been duly assessed by the Commonwealth Threatened Species Scientific Committee under the Common Assessment Method. The acceptance of this assessment is provided for by Part 4.14 of the Act.

The NSW Threatened Species Scientific Committee accepts the assessment outcome of the Commonwealth Threatened Species Scientific Committee in its Conservation Advice for *Acacia constablei* Tindale of Critically Endangered under Criterion 2: B1ab(v).

### Summary of Conservation Assessment

*Acacia constablei* Tindale was found to be Critically Endangered in accordance with the following provisions in the *Biodiversity Conservation Regulation 2017*: Clause 4.3 (a) (d) (e i) because: i) it has a very highly restricted distribution (EOO 20km<sup>2</sup>); ii) it is only found at a single location; and iii) there is projected continuing decline in the number of mature individuals as a consequence of increased severity of drought from climate change, and adverse fire regimes resulting in low recruitment and increased competition from shrubs.

The NSW Threatened Species Scientific Committee has found that:

1. *Acacia constablei* (Narrabarba Wattle) Tindale (Fabaceae) is an erect or spreading shrub or small tree with bipinnate leaves comprising 6–15 pairs of pinnae each with 9–30 pairs of pinnules (leaflets). The bark is smooth and light-grey and the branchlets are covered in a dense mat of short fine hairs and have characteristic knobbly ridges about 0.5 mm high (Briggs & Leigh 1990). The species has pale yellow to white/cream flower heads which are globular and 5–7 mm in diameter (Harden 2002). Individuals mostly range from 1 to 3 m high but can grow to 7 m in sheltered situations (Orchard & Wilson 2001).
2. *Acacia constablei* is most closely related to the widespread *Acacia mearnsii* (Black Wattle), with which it occurs at *Acacia constablei* type locality, and to *Acacia nanodealbata* (Dwarf Silver-wattle), a Victorian endemic species (NPWS 2002).
3. *Acacia constablei* is endemic to the Narrabarba and Green Cape area south of Eden on the South Coast of New South Wales (NSW) where it is known from three sites. The first site (Narrabarba Hill site) occurs across seven rocky outcrops on and around Narrabarba Hill. The second site (Wonboyn River site) occurs on one rocky outcrop approximately 1.4 km to the north of Narrabarba Hill on the other side of the Wonboyn River. Both the

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Narrabarba Hill and Wonboyn River site are in the Narrabarba Hill Flora Reserve, which is located in Nadgee State Forest and managed by the Forestry Corporation of NSW (Forestry Corporation of NSW 2015).

The third site (Green Cape site) is located near a clifftop at Green Cape in Beowa National Park (G. Phillips *in litt.* 23 November 2021). However, the plants at Green Cape show variable characteristics that intergrade between *Acacia constablei* and *Acacia mearnsii* and identification can be difficult (Miles 2022a).

4. The geographic distribution of *Acacia constablei* is very highly restricted. The Extent of Occurrence (EOO) is estimated at 20 km<sup>2</sup> while the Area of Occupancy (AOO) is estimated to be ≤ 20 km<sup>2</sup>. Both EOO and AOO were calculated using records from 1999–2021, which captures all known sites. The EOO was calculated using a minimum convex hull, and the AOO calculated using a 2 x 2 km grid cell method, based on the IUCN Red List Guidelines (2022).
5. *Acacia constablei* is found primarily on rhyolite and aplite rocky outcrops, but occasionally occurs on sandstone. The species grows mostly in nutrient poor, skeletal soils but sometimes in rich, brown to black loams (Briggs & Leigh 1990; Orchard & Wilson 2001; NPWS 2002; OEH 2021). The species is associated with large expanses of bare rock (NPWS 2002) and grows on all aspects but predominantly on westerly-facing slopes (Briggs & Leigh 1990). The largest currently known site is in Narrabarba Hill Flora Reserve, where it occurs on a long, narrow razorback ridge running north-west to south-east, with very steep exposed rocky slopes (Briggs & Leigh 1990). Other sites occupied by the species contain large expanses of fairly flat rock and exposed coastal rocky clifftops. *Acacia constablei* is likely to be susceptible to extreme drought since the water-carrying capacity of the soil associated with the outcrops is generally low (NPWS 2002).
6. *Acacia constablei* is known from c. 209 adults and 4,930–5,940 seedlings at last census (2022). The species experiences population fluctuations, apparently in relation to fire events, and has an estimated generation length of between 11 and 21 years. Post-fire recruitment results in a large population of seedlings which reach maturity in as little as two years. In the absence of fire, the population of *Acacia constablei* declines over time until the recurrence of fire, which promotes recruitment of a new cohort of seedlings. Records indicate that there were over 1,200 mature plants in 1986/87, approximately 6–7 years after the last recorded fire. By 2002 this number had increased to 5,700, mature plants. In 2017, 37 years after the last recorded fire, there were only 236 mature plants recorded. Some recruitment in the absence of fire has been observed in *Acacia constablei* following heavy rainfall events and disturbance (Miles 2017).
7. *Acacia constablei* forms almost impenetrable whipstick-like (tall spindly) scrub (Tindale 1980; Orchard & Wilson 2001) and is the dominant or co-dominant shrub or small tree where it occurs on rocky outcrops (NPWS 2002). The species can form an open shrubland of sparsely branched shrubs up to approximately 3 m high (although individual plants are much larger where more favourable conditions allow, such as at the edges of outcrops with deeper soils). The rocky outcrops are bounded by forests dominated by *Eucalyptus sieberi* (Silvertop Ash). *Allocasuarina littoralis* (Black Sheoak) is also abundant here, often forming dense stands to 8 m high. These *Allocasuarina littoralis* stands appear to compete strongly with *Acacia constablei* and mortality of the subordinate *Acacia constablei* is commonly observed, possibly resulting from the combined effects of light and moisture

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competition (NPWS 2002). Other common woody plant species occurring with *Acacia constablei* include *Melaleuca armillaris* subsp. *armillaris* (Giant Honey-myrtle), *Kunzea ambigua* (Tick Bush), *Zieria littoralis* (Coastal Zieria) and *Platysace lanceolata* (Lance-leaf Platysace) (NPWS 2002; OEH 2021). The herbaceous component of the vegetation is dominated by *Rytidosperma longifolium* (Long-leafed Wallaby Grass) and *Lepidosperma urophorum* (Tailed Rapier-sedge) (NPWS 2002; OEH 2021).

8. *Acacia constablei* can have a variable flowering season depending on environmental conditions (D. Bain *in litt.* 28 January 2022). Flowering has been observed in June-August, and a few specimens have also been recorded flowering in February and March (NPWS 2002). Sites burnt in the 2019–20 bushfires have been recorded flowering in January 2022 (D. Bain *in litt.* 28 January 2022). The species' pollinators are unknown; however, they are assumed to be insects as is common in other *Acacia* species (Stone *et al.* 2003). Birds seeking extra-floral nectar may also be involved in pollination (NPWS 2002). The most important pollinators for acacias are usually social and solitary bees (including the widely distributed European Honeybee (*Apis mellifera*) and Apoidea wasps, followed by flies, beetles and possibly nectar-feeding birds in some cases (Forde & Forde 1976; Stone *et al.* 2003). Seeds of *Acacia constablei* are assumed to ripen about three months after pollination, as is typical in the genus (NPWS 2002).
9. Seed dispersal in many acacias is undertaken by ants and/or birds, although passive dispersal via water, wind, and gravity, also occurs (Gibson *et al.* 2011). Aside from dispersal, birds and ants also assist with germination. Scarification of the hard seed coat occurs in the bird gut, and ants bury seeds in subterranean nests where the seed will stay until suitable conditions (heat and moisture) are met for germination (Gibson *et al.* 2011).
10. *Acacia constablei* is an obligate seeder – it is killed by fire and regenerates primarily from seed post-fire (Godfree *et al.* 2021). The species has been observed occasionally resprouting in the absence of fire, with some resprouting observed lower down the stem where the top of a plant has died as a result of drought (J. Miles *in litt.* 9 December 2021). The species is assumed to develop a long-lived soil-stored seed bank (as does the related *Acacia mearnsii*), but no data are available on the size or seed longevity of the seed bank (NPWS 2002). Like other *Acacia* species, the seeds of *Acacia constablei* are likely to require heat to break seed dormancy (Bradstock & Auld 1995). However, the rate of fire-induced germination depends on seed depth and fire intensity (Auld & Denham 2006). The widespread 2019–2020 bushfires burnt the eight rocky outcrops where the species occurs in the Narrabarba area with varying extent and intensity (Miles 2021) and stimulated a mass recruitment event. The site at Green Cape was not burnt, however the fire came within 100m of this site (G. Phillips *in litt.* 3 December 2021).
11. Plants in areas burnt in the 2019–20 bushfires were observed flowering in January 2022, therefore time to first flowering is two years (D. Bain *in litt.* 28 January 2022). The survival rate of seedlings to maturity for *Acacia constablei* is unknown but is being investigated following the 2019–20 bushfires (D. Bain *in litt.* 4 November 2021). The main threats to *Acacia constablei* are increasing severity of drought from climate change and fire regimes that cause declines in biodiversity. These threats also interact to influence recovery potential of the species. Auld *et al.* (2020) ranked *Acacia constablei* as vulnerable to post-fire herbivory and recommended exclusion or removal of feral grazers, stock and excessive native herbivores. On-ground observations show that while browsing by

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herbivores appeared initially to be a threat, browsing pressure had largely ceased at 16 months post-fire and was not considered significant (Miles 2021). The current fire-free interval recommended to enable *Acacia constablei* to mature and replenish the soil stored seedbank is 15 years (OEH 2021); however, this may be revised as understanding of the species' ecology improves.

12. The most serious plausible threat to *Acacia constablei* is an increased frequency and intensity of drought that will cause a decline in habitat quality. The species is vulnerable to drought as soils associated with rocky outcrops have a low water-carrying capacity (NPWS 2002). Following drought in 1997 and 1998, an estimated 25% of plants at Narrabarba Hill died and other sites were similarly affected (NPWS 2002). Severe drought conditions across NSW from early 2017 to late 2019 also impacted the species, with the number of mature individuals declining substantially during these years (DCCEEW 2023). The entire modelled range of *Acacia constablei* was subject to high accumulated drought severity in the twelve months prior to September 2019 (Gallagher 2022). *Acacia constablei* is also ranked as highly vulnerable to the interactive effects of fire and drought (Gallagher *et al.* 2022). Post-fire recruitment and seedling survival can be threatened by drought, as environments with higher precipitation may have greater capacity to regenerate compared to environments where drought conditions are present pre- or post-fire (Auld 2020). Climate change is predicted to increase the time spent in drought for this species, with rainfall projected to decrease in spring and winter and increase in summer and autumn and an increase in the annual number of hot days (OEH 2014). The effects of drought may also be exacerbated by other factors such as changes to vegetation structure caused by fire or competition from *Allocasuarina littoralis* and other native shrubs. Under drought, *Acacia constablei* has one threat-defined location. 'Anthropogenic Climate Change' is listed as a Key Threatening Process under the Act.
13. Adverse fire regimes pose a threat to *Acacia constablei*. Low fire frequency poses a threat to *Acacia constablei* as it appears to have limited recruitment in the absence of fire. The maximum tolerable fire-free interval for the species is unknown. Low severity fire can lead to competition from other plants, particularly from *Allocasuarina littoralis*, which suppresses or kills many *Acacia constablei* plants at the edges of outcrops. *Allocasuarina littoralis*, at least when young, is responsive to low severity burns, and the burns may stimulate high levels of recruitment in this species to the detriment of *Acacia constablei*. It may be that these low severity burns are too cool to stimulate significant recruitment of *Acacia constablei* (NPWS 2002).
14. Low severity fires, particularly repeat low severity fires, could pose a threat to *Acacia constablei* as they can kill mature individuals without stimulating large levels of germination (Keith 1996) and increase competition from other native shrubs. High frequency fires are recognised as a threat to fire-dependent species, especially as climate change increases the likelihood of large-scale fires (Ooi *et al.* 2006; Enright *et al.* 2015; Gallagher *et al.* 2021), which may impact *Acacia constablei* if immature plants are burnt before they mature "Fire regimes that cause declines in biodiversity" is listed as a Key Threatening Process under the EPBC Act.

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15. *Acacia constablei* Tindale is eligible to be listed as a Critically Endangered species as, in the opinion of the NSW Threatened Species Scientific Committee, it is facing an extremely high risk of extinction in Australia in the immediate 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: Critically Endangered under Clause 4.3 (a) (d) (e i).**

### 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: Critically Endangered under Clause 4.3 (a) (d) (e iii).**

<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.

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	(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,
		(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: Endangered under Clause 4.5 (b)**

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

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## 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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Senior Professor Kristine French  
Chairperson  
NSW Threatened Species Scientific Committee

### Supporting Documentation:

Department of Climate Change, Energy, the Environment and Water (2023) Conservation Advice for *Acacia constablei* (Narrabarba wattle). Canberra.

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