

## Notice 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 remove *Eucalyptus approximans* Maiden from the Schedules of the Act by omitting reference to this species from Part 3 of Schedule 1 (Vulnerable species). The omission of species from the Schedules is provided for by Part 4 of the Act.

### Summary of Conservation Assessment

The NSW Threatened Species Scientific Committee has found that:

1. *Eucalyptus approximans* Maiden is described by Slee *et al.* (2020) (as *Eucalyptus approximans* subsp. *approximans*) as a “Slender mallee to 6 m tall. Forming a lignotuber. Bark smooth, white, grey, brown or pinkish, occasionally with ribbons of decorticated bark in the upper branches. Juvenile growth (coppice or field seedlings to 50 cm): stem rounded or square in cross-section, warty on lower internodes; juvenile leaves at first subsessile, opposite for 2 to 5 pairs then alternate, shortly petiolate, narrowly lanceolate to linear, 6.5–14 cm long, 1–2 cm wide, glossy, green. Adult leaves alternate, petiole 0.2–1.5 cm long; blade linear to lanceolate to falcate, 5.5–12 cm long, 0.5–1.6 cm wide, base tapering evenly to petiole, margin entire, concolorous, glossy, green, side-veins obscure or, if visible, acute, reticulation absent or sparse, intramarginal vein obscure or if present well removed from margin, oil glands numerous, island. Inflorescence axillary unbranched, peduncles 0.4–1.2 cm long, buds usually 7 (rarely 3) per umbel, pedicels 0.1–0.3 cm long. Mature buds clavate, 0.5 cm long, 0.3 cm wide, warty, scar absent, operculum rounded to flattened, stamens inflexed or irregularly flexed, anther reniform to cordate, versatile, dorsifixed, dehiscing by confluent slits, style short or long, ovary chambers 3 or 4 with 2 vertical ovule rows. Flowers white. Fruit on pedicels 0.1–0.3 cm long, cylindrical or cup-shaped, 0.6–0.8 cm long, 0.5–0.8 cm wide, disc slightly raised, level or descending, valves 3 or 4, near rim level or enclosed. Seeds pale to mid brown, 1–2 mm long, pyramidal or obliquely pyramidal, dorsal surface smooth, hilum terminal.”
2. *Eucalyptus approximans* is a naturally rare species endemic to two mountain areas on the NSW Northern Tablelands near Ebor, approximately 70–80 km east of Armidale. Initially thought to be restricted to a single site at Barren Mountain within New England National Park (NSW Scientific Committee 2008), the species is now also known to occur in Cathedral Rock National Park approximately 25 km to the west of Barren Mountain (Copeland 2017; Phillips *et al.* 2018).
3. *Eucalyptus approximans* grows in heathy shrublands around rocky outcrops in shallow, nutrient poor soils above 1250 m elevation (Copeland 2008; Phillips *et al.* 2018). However, soil profiles differ between the two sites where the species occurs. Barren Mountain has deeper, fine-textured soils derived from trachyte, whereas Cathedral Rock has shallow, coarse-textured sandy soils derived from granite (Copeland 2017, Phillips *et al.* 2018). *E. approximans* often forms dense stands with a high number of shrubs, ferns and sedges underneath and rarely co-occurs with other species of

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eucalypts, likely due to the limitations of the preferred shallow soils (Copeland 2008). Co-occurring species at Barren Mountain include *Melaleuca tortifolia*, *Gahnia* sp., *Allocasuarina rigida* and *Gleichenia dicarpa* (Phillips *et al.* 2018). At Cathedral Rock the species occurs with *Eucalyptus acaciiformis*, *Leucopogon neoanglicus*, *Leucopogon affinis*, *Leptospermum novae-angliae* and *Lomandra longifolia* (Phillips *et al.* 2018).

4. Using available survey information, the minimum global population of *E. approximans* is estimated to be 48,629 mature individuals based on the lowest bounds of the estimates at Barren Mountain and verified site counts at Cathedral Rock.
5. The geographic distribution of *Eucalyptus approximans* is very highly restricted. The Extent of Occurrence (EOO) is based on a minimum convex polygon enclosing all mapped occurrences of the species, the method of assessment recommended by IUCN (2022). EOO was measured at 16 km<sup>2</sup> when only considering verified locations, and 66 km<sup>2</sup> when including unverified sites identified by helicopter survey in Cathedral Rock NP. Area of Occupancy (AOO) was calculated using 2 x 2 km grid cells, the scale recommended by IUCN (2022), and was calculated to be 20 km<sup>2</sup> when considering only verified locations and 28 km<sup>2</sup> when including unverified sites identified by helicopter survey in Cathedral Rock NP.
6. *Eucalyptus approximans* is known to readily reshoot from a basal lignotuber as the primary regenerative strategy following disturbance such as fire (Clarke *et al.* 2000; Nicolle 2006). Recent surveys showed 100% of individuals in the Cathedral Rock subpopulation were reshooting from lignotubers following extreme fire conditions in December 2019 (Mitchell-Williams 2022), with a similar response recorded post-fire in 2004 (M. Dwyer *in litt.* 2005). Only 30 months post-fire, reshooting stems had attained 35–50% of the height of dead standing mature stems (Mitchell-Williams 2022), despite the stand showing significant signs of drought stress prior to burning (Phillips *et al.* 2018). Growing trials on *E. approximans* have shown the lignotuber is developed enough to provide sufficient regenerative capacity to produce multiple secondary stems following mechanical removal of the main stem only 24 months after germination (G. Phillips pers. obs. June 2021). However, removal of stems through burning is known to limit stem regeneration faster than mechanical removal in other mallees (Noble and Diggle 2013). Many lignotuber sprouting mallees produce reproductively fertile stems 4–7 years after germination (Nicolle 2006), indicating a primary juvenile period of this length.
7. Seedling recruitment is relatively rare in mallee eucalypts (Wellington and Noble 1985) and a lack of seedlings and/or juvenile plants has been noted in long unburnt stands of *Eucalyptus approximans* (Phillips *et al.* 2018). Even post-fire, seedling recruitment in mallees can be low despite the release of large volumes of seed from the canopy stored seed bank (Tozer and Bradstock 1997) and this appears true for *E. approximans*. Only 150–350 seedlings were observed amongst a count of 1904–2904 resprouting individuals in Cathedral Rock NP 30 months after the 2019 wildfires (Mitchell-Williams 2022). Drought also severely limits recruitment (Wellington and Noble 1985; Auld *et al.* 1993) though only minimal recruitment is needed to maintain a

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population due to the high survivorship of the lignotuberous mature plants (Tozer and Bradstock 1997).

8. If the most serious likely future threat of increased frequency and duration of drought due to climate change is considered, both subpopulations of *Eucalyptus approximans* can be treated as separate threat-defined locations. The two subpopulations are approximately 25 km apart and in different landscape positions at different elevations (Copeland 2017), so the threat response, if it were to occur, is likely to differ between them.
9. Continuing decline is not evident in the known subpopulations of *Eucalyptus approximans*. The Barren Mountain subpopulation is currently long unburnt (NSW NPWS 2014) and despite dieback being apparent in the midst of extreme drought, reshooting has been noted after rainfall (Phillips *et al.* 2018). Additionally, at Cathedral Rock vigorous resprouting of 100% of mature individuals and presence of relatively substantial number of seedlings has been noted following extreme fire conditions on the back of prolonged drought (Phillips *et al.* 2018; Mitchell-Williams 2022). No clearing of stands is known or predicted as almost all plants are in conservation reserves and the few unreserved plants are in land not conducive to clearing (Copeland 2008). Therefore, no observed, estimated, inferred or projected decline in Extent of Occurrence, Area of Occupancy, extent and/or quality of habitat, number of locations or number of individuals is yet evident. Future declines resulting from the identified threats of changes in fire regime and increased frequency and duration of drought due to climate change are only regarded as plausible future threats, not satisfying the definition for continuing decline (IUCN 2022).
10. While changes in fire regimes and increased frequency and duration of drought due to climate change may adversely affect the species sometime in the future, these effects are likely to be gradual and slow acting if or when they commence given the fire and drought tolerance conferred by the lignotuberous habit (Nicolle 2006) and a very high observed survivability rate even after extreme fires following prolonged drought to date (Mitchell-Williams 2022). Thus, these threats are considered unlikely to rapidly drive the species to extinction in a very short time after the threats become apparent, which is here considered the maximum allowable timeframe of 100 years into the future given the 70-year generation length of *E. approximans*.
11. In view of the above, the NSW Threatened Species Scientific Committee is of the opinion that *Eucalyptus approximans* Maiden is not eligible to be listed as a threatened species in any category under the Act.

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## Assessment against *Biodiversity Conservation Regulation 2017* criteria

The Clauses used for assessment are listed below for reference.

### Overall Assessment Outcome:

*Eucalyptus approximans* was found to be Least Concern and thus ineligible for listing as a threatened species as none of the Clauses were met.

### Clause 4.2 – Reduction in population size of species

(Equivalent to IUCN criterion A)

Assessment Outcome: Clause not met

<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: Clause 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,
		(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 C)**

**Assessment Outcome: Clause 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.

### Clause 4.5 - Low total numbers of mature individuals of species

**(Equivalent to IUCN criterion D)**

**Assessment Outcome: Clause not met**

<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: Clause 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:

Phillips G.P. (2022) Conservation Assessment of *Eucalyptus approximans* Maiden (Myrtaceae). NSW Threatened Species Scientific Committee.

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