

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 *Styphelia perileuca* J.M.Powell as an ENDANGERED SPECIES in Part 2 of Schedule 1 of the Act and, as a consequence, to omit reference to *Styphelia perileuca* J.M.Powell from 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 *Styphelia perileuca* J.M.Powell has been duly assessed by the Commonwealth Threatened Species Scientific Committee under the Common Assessment Method as provided for by Part 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

Styphelia perileuca J.M.Powell was found to be Endangered in accordance with the following provisions in the *Biodiversity Conservation Regulation 2017*: Clause 4.3 (b) (d) (e i) because: i) the species has a highly restricted geographic distribution with an Extent of Occurrence of 148 km² and Area of Occupancy of 56 km²; ii) the species is known from two threat-defined locations; iii) continuing decline in the number of mature individuals is inferred due to adverse fire regimes and increased frequency and severity of drought and changes in precipitation due to climate change.

The NSW Threatened Species Scientific Committee has found that:

1. *Styphelia perileuca* (J.M. Powell 1992) is an erect to spreading shrub which grows 0.6–1.5 m high. The leaves are broad with a spiky tip, 6–12 mm long and 3–5 mm wide, with fine teeth along the edges. The single hanging flowers are pale green or translucent yellow green with fine red stripes. The fruit is 8–11 mm long, somewhat fleshy and translucent yellow-green in colour (description from Powell *et al.* 1992; DPIE 2020)
2. *Styphelia perileuca* is known from the eastern edge of the New England tablelands of New South Wales (NSW) near the town of Ebor (Powell *et al.* 1992; DPIE 2020). It occurs at four sites between Point Lookout Styx River State Forest and private lands at Yaraandoo in the south, and the northern edge of Cathedral Rock National Park (NP) in the north. Given these sites all occur within a 20 km radius, the NSW Threatened Species Scientific Committee consider them to form a single subpopulation as per the IUCN (2022) definition.
3. The estimated Extent of Occurrence (EOO) for *Styphelia perileuca* is 148 km², based on mapping of point records from 1984-2021 and is considered stable. The Area of Occupancy (AOO) is estimated to be 56 km² and is possibly contracting, following the 2019-20 bushfires. The EOO was calculated using a minimum convex

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hull, and the AOO calculated using a 2 x 2 km grid cell method, based on the IUCN Red List Guidelines (2022).

4. Prior to the 2019-20 bushfires 1130+ mature individuals were recorded across the four sites, including over 1000 mature individuals in Cathedral Rock NP. Surveys conducted in Cathedral Rock NP in September and December of 2021 located 30-50 mature individuals and 144 immature plants (ranging from 3–15 cm; Eco Logical Australia 2021). This survey only investigated a relatively small proportion of the Cathedral Rock NP population. Numbers post-fire at the other sites are unknown, however there was previously 54 mature individuals known in Styx River State Forest, two at Point Lookout and three at Yaraandoo. The number of mature *Styphelia perileuca* individuals across the four sites is therefore currently estimated at 110, based on post-fire surveys in and around Cathedral Rock NP, and pre-fire estimates across the other three sites. However, given that a limited proportion of the total known population has been adequately re-surveyed post-fire and the species can be difficult to detect when emerging (Eco Logical Australia 2021; UNE 2021; DCCEEW 2023), further surveys are required to confirm the current estimate.
5. *Styphelia perileuca* grows in open eucalypt forest in sandy soils or light brown sandy loams over granite, and occasionally in heath on trachyte (Powell *et al.* 1992; Sheringham & Westaway 1995). Associated species include *Eucalyptus dalrympleana* (Mountain Gum), *E. youmanii* (Youman's Stringybark) and *E. radiata* (Narrow-leaved Peppermint) (Powell *et al.* 1992; Sheringham & Westaway 1995). Sites where this species grows tend to be on broad ridges and gentle slopes at 1250–1500 m above sea level (Powell *et al.* 1992).
6. *Styphelia perileuca* flowers and fruits mainly in September to January. There are also single records of buds and flowers in March and April respectively (Powell *et al.* 1992). The species' pollinators are unknown; however, it is likely to be bird and/or insect pollinated, as is common in other Ericaceae (Ford *et al.* 1979; Keighery 1996; Johnson 2013). Little is known about the primary or secondary juvenile period of *S. perileuca*, or the longevity of adult plants. Other Ericaceae such as *Leucopogon* have primary juvenile periods of 3–11 years (Ooi 2019). Given its montane habitat where conditions for growth may be temperature limited, it is possible that the primary juvenile period for *S. perileuca* is relatively long compared to similar species. Assuming similarity, it may be towards the longer end of the 3–11 years range given for *Leucopogon* by Ooi (2019). Recent field surveys note the species appears to be slow growing (Eco Logical Australia 2021) and expert opinion concurs that the juvenile period is likely to be toward the longer end of the range given by Ooi (2019) (DPE pers. comm. February 2022).
7. *Styphelia perileuca* germination requirements are unknown but may be similar to other Ericaceae where fire is required to break seed dormancy in many species (Gilmour *et al.* 2000). It is possible the species displays delayed seed germination following fire, as has been observed in other Ericaceae species (Keith 2002; Ooi 2010). Reports on the fire response of *S. perileuca* state individuals of the species reshoot from lignotubers after severe fire (Beresford-Smith 1991 cited in Quinn *et al.* 1995). Other reports categorise the species as an obligate seeder, i.e. killed by

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fire and regenerates only from seed (Clarke *et al.* 2009). Observations from surveys following the 2019-20 bushfires suggest that that species exhibits both fire responses (Eco Logical Australia 2021). It is unclear if the *S. perileuca* is capable of recruiting in the absence of fire, although some other south-east Australian Ericaceae species produce a small percentage of seed that lacks physiological dormancy mechanisms, which could allow occasional recruitment in the absence of fire (Keith 1997).

8. The main threats to *Styphelia perileuca* are adverse fire regimes and increased droughts as a result of climate change. The species is susceptible to a high fire frequency regime that damages seedlings and regrowth before they can replenish the soil seed bank (Keith 1996; Gallagher *et al.* 2021). The 2019-20 bushfires are thought to have burnt two of the four surveyed sites (DPIE 2021). This illustrates the large spatial scale at which fire events can occur when fuelled by vegetation subject to widespread drought conditions (Nolan *et al.* 2020). Therefore, the number of threat-based locations is two. Other potential threats to the species include dieback caused by *Phytophthora cinnamomi*, herbivory and trampling by feral herbivores and negative impacts from recreational/management activities.
9. Adverse fire regimes likely presents a major threat to *Styphelia perileuca*, and there is an inferred decline in the number of mature individuals due to the impacts of high fire frequency. Changes to fire conditions under climate change may expose the species to “interval squeeze”, which is a narrowing the favourable interval between fires, thus accelerating population decline (Enright *et al.* 2015). Although *S. perileuca* has been observed both resprouting and regenerating from seedlings following the 2019-20 fires (Eco Logical Australian 2021), the species is negatively impacted by high frequency fires, where the fires are severe enough to kill adult plants and occur at short enough intervals to kill regenerating seedlings and resprouting plants before they are able to replenish the soil seed bank or develop sufficient woody tissue to withstand further fires (Keith 1996; DPIE 2020). High severity fire coupled with an increased fire frequency is likely to lead to population decline in *S. perileuca* with high adult plant mortality and mortality of some seed in the soil seed bank close to the surface (top 3–5 cm) (Palmer *et al.* 2018; Tangney *et al.* 2020).
10. The New England North West Region of NSW is expected to undergo an increase in severe and average Forest Fire Danger Index values, which are used as an indicator of fire risk. These increases are projected for summer and spring which represent peak fire risk season (DPIE 2014). These changes to fire conditions will likely increase the probability of frequent bushfires impacting the *Styphelia perileuca* into the future. While further research is required on the species’ fire ecology, the minimum recommended fire-free interval for the species is approximately 10 years (NSW NPWS 2021; DPIE 2021). This may be an underestimate given the species is thought to be slow growing and could have a primary juvenile period closer to 11 years (Ooi 2019; DPE pers. comm. February 2022). If future fires burn regrowth and seedlings before they can mature and replenish the soil seedbank, this is likely to cause a decline in the number of mature individuals through lack of recruitment.

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11. The effects of bushfires on *Styphelia perileuca* can be further exacerbated by drought across the species' distribution. Drought depletes carbohydrate resources held within plant tissues and reduces reproductive output in the years leading up to a fire event, impacting on the size of the seed bank available for post-fire recruitment (Nolan *et al.* 2020). Gallagher (2022) found that 53 percent of the species' modelled distribution was in severe drought in the 12 months preceding the 2019-20 bushfires which may impact on the species ability to regenerate post-fire. Post-fire drought can negatively impact post-fire recruitment success by reducing seed germination and seedling survival (Auld 2020).
12. *Styphelia perileuca* J.M.Powell is not eligible to be listed as a Critically endangered species.
13. *Styphelia perileuca* J.M.Powell 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*:

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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 4.2 – 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:		
(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 under Clause 4.3 (b)(d)(e i)

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.

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Clause 4.4 – Low numbers of mature individuals of species and other conditions

(Equivalent to IUCN criterion Clause C)

Assessment Outcome: Data deficient.

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:			
	(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: Data deficient.

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)

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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 (DCCEEW) (2023). Conservation Advice for *Styphelia perileuca* (montane green five-corners). Australian Government, Canberra, ACT.

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