

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 *Boronia subulifolia* Cheel 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.

The NSW Threatened Species Scientific Committee is satisfied that *Boronia subulifolia* Cheel has been duly assessed by the Commonwealth Threatened Species Scientific Committee under the Common Assessment Method, as provided by Section 4.14 of the Act. After due consideration of Commonwealth DCCEEW (2025), the NSW Threatened Species Scientific Committee has made a decision to list the species as Endangered.

Summary of Conservation Assessment

Boronia subulifolia Cheel was found to be Endangered in accordance with the following provisions in the *Biodiversity Conservation Regulation 2017*: Clause 4.3(b)(d)(e iii). The main reasons for this species being eligible are: 1) it has a highly restricted geographic distribution with an estimated extent of occurrence of 1,014 km² and an estimated area of occupancy of 116 km²; 2) it is known from 2–5 threat-defined locations; and 3) it is inferred to be undergoing continuing decline in the area, extent and quality of habitat due to the threats of adverse fire regimes and drought exacerbated by climate change, and trampling and herbivory from feral herbivores.

The NSW Threatened Species Scientific Committee has found that:

1. *Boronia subulifolia* Cheel (family Rutaceae) is described by Duretto (2003) as an “Erect, woody shrub to 1.2 m high. Branchlets not obviously glandular, pilose, hairs usually evenly spread around branches but sometimes denser or only present between leaf decurrencies, becoming glabrous with age, hairs to 0.75 mm long; leaves and flowers often quite congested. Leaves imparipinnate, (3–)5–7(–13)-foliate, entire leaf in outline 6–20 mm long, 4–26 mm wide, not obviously glandular, glabrous or glabrescent or pilose at leaflet nodes or sparsely to moderately pilose all over; petiole 1–4 mm long; rachis segments 2–8 mm long; leaflets linear or linear-oblong or linear-lanceolate, flat to subterete, concolorous, dorsiventral, palisade mesophyll almost encircling entire leaf, margins entire, tip acute; terminal leaflets similar to lateral leaflets, sometimes shorter, 2.5–1.5 mm long, 0.5–1 mm wide. Inflorescence terminal or axillary, 1(–3)-flowered, not obviously glandular, pilose, shorter or longer than leaves; peduncles to 1 mm long; prophylls 1–3 mm long, deltate; anthopodia 1–4 mm long. Sepals narrowly deltate, 2.5–4 mm long, 1–2 mm wide, not obviously glandular, adaxial surface glabrous, abaxial surface pilose to glabrescent, tip with sometimes prominent subterminal apiculum. Petals light to deep pink, 5–8 mm long, adaxial surface with a moderate cover of minute simple hairs, abaxial surface sparsely and minutely pilose to sparsely pilose, hairs concentrated along margins, usually caducous, tip with subterminal apiculum. Staminal filaments pilose below glandular tuberculate tip; anthers glabrous, apiculum absent or minute. Ovary glabrous; style pilose; stigma entire, minute, scarcely wider than style. Cocci 3–4.5 mm long, 1.5–2.5 mm wide, glabrous or with few hairs along suture. Seed black c. 2 mm long, c. 1 mm wide.”

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2. *Boronia subulifolia* is endemic to southeastern New South Wales (NSW) where it is largely confined to the Budawang Ranges in Budawang National Park (NP) and the Pigeon House Range in Morton NP. There are up to 20 known subpopulations based on records of the species, with most records centred on peaks in the region. The southernmost subpopulation occurs at Mount Currockbilly, with a string of subpopulations then occurring across Byangee Mountain, The Castle and Mount Cole, and across cliffs around Corang Peak. North of these localities, the species is known from scattered sites across the Endrick and Sassafras areas of Morton NP (ALA 2023).
3. The Extent of Occurrence (EOO) for *Boronia subulifolia* is estimated to be 1,014 km² based on a minimum convex polygon enclosing cleaned mapped occurrences of the species, the method of assessment recommended by the IUCN (2024). The Area of Occupancy (AOO) is estimated to be 116 km² based on 2 x 2 km grid cells, the scale recommended by the IUCN (2024).
4. The population of *Boronia subulifolia* is estimated to range from 2,000–6,000 mature individuals. There have been no comprehensive surveys of the species and there are no pre-fire population estimates available. However, targeted surveys following the 2019–2020 fires found that two subpopulations were still occupied and likely experienced a flush of recruitment resulting in over 100 seedlings in each subpopulation, some of which had already matured (Le Breton and Jordan 2022). A survey in November 2022 also found hundreds of plants (at least 200 across a 250 m transect) at a site adjacent to Mount Cole (R. Melrose and J. Percival pers. obs. November 2022 in Commonwealth DCCEEW 2025). Assuming a mean of 100 mature individuals over 20 known subpopulations, the minimum plausible value is estimated to be 2,000. Assuming a more generous mean of 300 mature individuals across the 20 known subpopulations, the maximum plausible value for the population is estimated to be 6,000.
5. *Boronia subulifolia* is typically found in heath and dry sclerophyll woodland on rocky sandstone slopes (Duretto 2003). Records describe the species as occurring on sandy soil, often wetter than adjacent soil (ALA 2023). Associated flora from different sites includes *Eucalyptus piperita*, *Eucalyptus. stricta*, *Allocasuarina nana*, *Allocasuarina distyla*, *Lepidosperma urophorum*, *Leptospermum scoparium*, *Gaudium attenuatum*, *Gleichenia dicarpa*, *Phyllota phyllicoides* and *Baeckea linifolia*. In targeted surveys, patches of the *Boronia subulifolia* were quite discrete and scattered, occurring over a few metres, with large areas of seemingly suitable habitat around sites devoid of plants (Le Breton and Jordan 2022).
6. *Boronia subulifolia* flowers from September to December (Duretto 2003). *Boronia* seeds generally persist in the soil (Auld 2001), and the seeds usually possess physiological dormancy and also require fire and heat cues for germination (Mackenzie *et al.* 2016; Mackenzie *et al.* 2021). *Boronia* species have thus been found to have seasonal germination requirements such as cold temperature stratification over winter before they can germinate (Mackenzie *et al.* 2016; Mackenzie *et al.* 2021). The inferred ecology suggests *Boronia subulifolia* likely responds to fire with a flush of recruitment, provided the required dormancy breaking and germination cues have been met (*i.e.*, temperature stratification, smoke and heat cues). The flush of recruitment may be delayed, depending on the

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timing of fire in relation to seasonal dormancy (Mackenzie *et al.* 2021). This is supported by field observations in 2022 (around 22 months post-fire), where numerous seedlings and some flowering plants had grown from seed post-fire, and no resprouts were observed (Le Breton and Jordan 2022). Further field observations in November 2022 noted small plants flowering, with no plants larger/older than the post-fire cohort (R. Melrose and J. Percival pers. obs. November 2022 in Commonwealth DCCEEW 2025). These observations suggest that the species is an obligate seeder with a primary juvenile period of around two years.

7. *Boronia subulifolia* is primarily threatened by adverse fire regimes and drought exacerbated by climate change and trampling and herbivory by feral animals including feral deer, pigs, rabbits and goats. 'High frequency fire resulting in the disruption of life cycle processes in plants and animals and loss of vegetation structure and composition', 'Anthropogenic Climate Change', 'Competition and grazing by the feral European rabbit *Oryctolagus cuniculus* (L.)', 'Competition and habitat degradation by feral goats, *Capra hircus* Linnaeus 1758', 'Herbivory and environmental degradation caused by feral deer', and 'Predation, habitat degradation, competition and disease transmission by feral pigs *Sus scrofa* Linnaeus 1758' are listed as Key Threatening Processes under the Act.
8. *Boronia subulifolia* is estimated to occur across 2–5 threat-defined locations when considering the most serious plausible threat of adverse fire regimes (including high frequency fire, low frequency fire, out-of-season fire, and the interaction between fire and drought). Fires outside the natural fire season (spring - summer) may be detrimental to the species due to delayed and reduced germination responses (Mackenzie *et al.* 2021). Gallagher (2020) estimated that 80% of the species' modelled habitat and 98% of occurrences burnt during the 2019–2020 bushfires (including 29% of modelled habitat and 62% of occurrences burnt at high severity) with on-ground observations supporting these estimates. Fire regimes that cause declines in biodiversity will become more likely due to climate change. Therefore, the number of locations is estimated to be less than or equal to five but more than one based on the likelihood that future fires will cover large areas but are unlikely to burn all subpopulations at an intolerable interval.
9. Continuing decline in the area, extent and quality of habitat of *Boronia subulifolia* is inferred due to adverse fire regimes and drought, which may be exacerbated by climate change. *Boronia* species have particular seasonal germination requirements and are likely to be sensitive to out of season fire regimes. Out-of-season fires could result in delayed and reduced germination, as such fires occur when the seed is dormant and therefore cannot respond to smoke and heat cues (Mackenzie *et al.* 2016, 2021). The adverse effects of fires on germination are also strongly influenced by moisture availability (both the timing of post-fire rainfall and the duration soils stay moist enough for germination) (Mackenzie *et al.* 2021). Altered fire regimes and drought can also collectively reduce the amount of habitat that experiences a suitable fire regime and sufficient rainfall at the right times of year for the species to persist. *Boronia subulifolia* is also facing pressure from biotic threats such as herbivory from feral herbivores found within Budawang and Morton NPs, which includes deer, pigs, rabbits, and goats. These feral herbivores can exert severe browsing pressure on mature plants where herbivore populations are

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large, or via interactions with fire when seedlings may be particularly sensitive and palatable.

10. *Boronia subulifolia* Cheel is not eligible to be listed as a Critically Endangered species.

11. *Boronia subulifolia* Cheel 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: Endangered under Clause 4.3(b)(d)(e 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:			
	(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 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.

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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 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:	

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			(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: Vulnerable under Clause 4.7

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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Supporting Documentation:

Commonwealth Department of Climate Change, Energy, the Environment and Water (DCCEEW) (2025). Conservation advice for *Boronia subulifolia*. Australian Government, Canberra, ACT.

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