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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 *Prostanthera palustris* B.J.Conn as a CRITICALLY ENDANGERED SPECIES in Part 1 of Schedule 1 of the Act and, as a consequence, to omit reference to *Prostanthera palustris* B.J.Conn 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 *Prostanthera palustris* B.J.Conn 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 (2023), the NSW Threatened Species Scientific Committee has made a decision to list the species as Critically Endangered.

Summary of Conservation Assessment

Prostanthera palustris B.J.Conn was found to be Critically Endangered in accordance with the following provisions in the *Biodiversity Conservation Regulation 2017*: Clause 4.2(1)(a)(2)(a) and Clause 4.3(a)(d)(e i,iv) because: 1) the species has undergone a very large reduction in population size of at least 80% as a result of the 2019–20 bushfires, and the causes of these reductions have not ceased; 2) the species has a very highly restricted geographic distribution with an extent of occurrence of 54 km^2; 3) the species is restricted to a single threat-defined location; and 4) the species is estimated to be undergoing continuing decline in the number of subpopulations and the number of mature individuals due to adverse fire regimes.

The NSW Threatened Species Scientific Committee has found that:

1. *Prostanthera palustris* B.J.Conn (family Lamiaceae) is described by Conn (1997) as a “low spreading, weak subshrub, 0.2–0.3 m high. Branches subterete, laterally 2-ridged, hairy restricted to area between the ridges; hairs antrorse, more or less appressed, 0.4–0.7 mm long, white. Leaves non-aromatic; lamina spathulate, (3-)4–6(-8) mm long, (2.5-)3.5–5 mm wide, sparsely hairy, particularly on midrib and veins; base attenuate; margin entire, slightly recurved; apex rounded; petiole 1-2 mm long, grading into base of lamina. Inflorescence a frondose racemiform conflorescence, uniflorescence monadic; 4–10-flowered [per conflorescence]. Bracteoles not persistent, usually only base persisting, 1.2–1.5 mm long. Calyx 4–6 mm long; tube 2.5–3 mm long; lobes 1.5–3 mm long. Corolla 8–10 mm long, pale mauve, white with deep yellow dots in throat and inner adaxial-median surface of tube; Anthers with basal appendage, terminating in 4–6 narrowly triangular trichomes”.

2. *Prostanthera palustris* occurs on the north coast of New South Wales (NSW), approximately 20 km north of Yamba, in the Southeast Queensland bioregion (IBRA7). The species is largely restricted to Bundjalung National Park and Tabbimoble Swamp Nature Reserve (i.e., protected tenure), with only part of one population extending into private tenure.

3. *Prostanthera palustris* has a very highly restricted geographic range. Based on cleaned and spatially accurate records it is estimated to have an area of occupancy (AOO) of 40 km^2, measured with a 2 x 2 km grid as per IUCN Guidelines (IUCN 2022). The species extent of occurrence (EOO) is estimated to be 54 km^2.

4. Population estimates in 2019, prior to the 2019–20 bushfires, indicated there were approximately 27,000 individuals, most of which (approximately 25,000) were seedlings at two sites burnt that germinated after hazard reduction burns in 2018. All known populations were burnt during the 2019–20 bushfires, killing the vast majority of these seedlings and mature individuals. The population is believed to now primarily consist of seedlings, and fewer mature individuals appear to have escaped or resprouted after these fires than were observed in response to the 2018 hazard reduction burn (20:80 ratio of resprouts to seedlings in 2018; P. Sheringham pers. comm. December 2021). There are approximately 1,000 seedlings observed to date. Allowing for further recruitment and additional seedlings once surveys are conducted at the remaining unsurveyed populations, there will likely be fewer than 2500 mature individuals and possibly as low as 1000 mature individuals depending on seedling survival rates. This represents an estimated decline of 80−92% over three generations (24 years).

5. Prior to the 2019–20 bushfires there were seven distinct populations of the species: Black Rocks-Jerusalem Creek, Macauleys Lead, Hell Hole, Unnamed Trails one and two, Serendipity Trail, Pocket Trail, and Tabbimoble Swamp Nature Reserve. It is unknown whether genetic exchange between populations occurs. The most likely pollinators are bees, beetles and flies (Wilson *et* al. 2017) which generally transport pollen shorter distances than vertebrate pollinators such as birds, and the distance between populations is approximately 5–6 km. The 2019–20 bushfires led to the loss of at least two populations (Black Rocks-Jerusalem Creek and Pocket Trail), the near loss of the second largest known population (Serendipity Trail), which as of 2021 has only four plants observed, and the possible loss of the largest population (Unnamed Trails one and two), which at the time of the 2019–20 bushfires was recovering from a 2018 hazard reduction burn, but which has not been resurveyed. The Jerusalem Creek portion of the Black Rocks-Jerusalem Creek population appears to have been lost prior to the fires, having not been relocated since before 2017 (P Sheringham pers. comm. February 2022).

6. *Prostanthera palustris* occurs in wet heath on coastal Pleistocene backbarrier flats and dune swales. It is found in areas of high moisture, being restricted to wetter vegetation types that are subject to periodic inundation and extended waterlogging in poorly drained white siliceous sandy soil with high organic content. This habitat is dominated by *Hakea actites*, *Xanthorrhoea fulva*, *Banksia ericifolia* subsp. *macrantha*, *Leptospermum liversidgei, Melaleuca thymifolia, Grevillea humilis* subsp. *lucens*, *Hibbertia salicifolia, H. serpyllifolia*, *Schoenus brevifolius*, *Ptilothrix deusta*, and *Boronia falcifolia*, or open woodland with emergent *Lophostemon suaveolens* and *Melaleuca linariifolia*. However, it is not found in the wettest sites where sedges dominate (P Sheringham pers. comm. December 2021).

7. *Prostanthera palustris* appears to have a successional life cycle, and where it occurs in taller vegetation, it grows primarily during a short window (several years) post-fire before being overgrown and outcompeted by taller vegetation, retreating to the soil seed bank until the next fire. In lower vegetation, mature plants persist

for longer periods (OEH North East 2019). Fire is believed to be the primary stimulus for recruitment events, and the species has some capacity to resprout at least in response to low-moderate severity fire with up to 20% of the plants observed resprouting following the 2018 hazard reduction burn (P Sheringham pers. comm. December 2021). Seedlings have a primary juvenile period of around three to four years though some may mature faster, while resprouts may start producing flowers as soon as 15 months post-fire (OEH North East 2019). *Prostanthera* seeds are typically small (< 3 mm) (Tierney 2006) and have primarily been observed dispersing via gravity (NSW NPWS 2000). The soil seed bank is believed to be long-lived (possibly 10 years or longer) and viability of the seed bank is unknown.

8. *Prostanthera palustris* has been estimated to be experiencing a continuing decline in the number of populations and mature individuals. The cause of the current declines, high frequency fire, has not ceased and is likely to increase under climate change. 'High frequency fire resulting in the disruption of life cycle processes in plants and animals and loss of vegetation structure and composition' and 'Anthropogenic Climate Change' are Key Threatening Processes under the Act.

9. The number of threat-defined locations is estimated to be one, based on the most serious plausible threat of high frequency fire. All populations were burnt during both the 2019–20 bushfires and in 2001.

10. Although *Prostanthera palustris* is able to resprout following low to moderate severity fire, high frequency fire will deplete the soil seedbank and may quickly exhaust the plants' ability to resprout, leading to declines. At least two populations are believed to have been lost as a consequence of high frequency fire (both populations experienced two fires approximately one year apart). Two fires in quick succession appear to be sufficient to completely deplete the soil seed bank. Most populations have been burnt several times over the past 60 years, with the lowest average interval of five years at the Hell Hole population (Gallagher 2020; Gallagher *et al*. 2021). This moderate fire frequency appears tolerable for *P. palustris* given the Hell Hole population has persisted at least up until the 2019–20 bushfires. However, if juveniles are unable to recruit and mature, and allowed sufficient time to replenish the seed bank, it will lead to a long slow decline.

11. High severity fire kills resprouting plants and seedlings before they can mature and replenish the soil seed bank in preparation for the next fire. The severity of the 2019–20 bushfires may also have contributed to the loss of some populations of *Prostanthera palustris*. Small seeded species such as *Prostanthera* are limited to recruiting from the top few centimetres of the soil seed bank, however, this is also the region within the soil profile most exposed to extreme temperatures (Liyanage and Ooi 2017). Consequently, small seeded species may be killed during high severity fires that heat the upper layers of soil to lethal temperatures (Liyanage and Ooi 2017). Higher severity fires would also contribute to lower survival rate of mature individuals reducing the number of potential resprouting individuals.

12. *Prostanthera palustris* B.J.Conn 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 4.2(1)(a)(2)(a) and Clause 4.3(a)(d)(e i,iv)

Clause 4.2 – Reduction in population size of species
(Equivalent to IUCN criterion A)
Assessment Outcome: Critically Endangered under Clause 4.2(1)(a)(2)(a)

(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: Critically Endangered under Clause 4.3(a)(d)(e i,iv)

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.	

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)(d ii)

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: 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 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.

Professor Kristine French
Chairperson
NSW Threatened Species Scientific Committee

Supporting Documentation:

Commonwealth DCCEEW (Department of Climate Change, Energy, the Environment and Water) (2023) Conservation Advice for *Prostanthera palustris* (swamp mint-bush). Australian Government, Canberra.

References:

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