



## *Phebalium squamulosum* subsp. *squamulosum* Forest Phebalium

### Taxonomy

*Phebalium squamulosum* subsp. *squamulosum* Vent.

The style is usually glabrous, but in specimens from near Yarra Junction it is basally lepidote. Although calyces are typically truncate, near Bairnsdale plants with broadly deltate-toothed calyces are common. These and other local forms often appear distinctive, but there is extreme and often overlapping variation across this subspecies' wide range (VicFlora 2019).

### Current conservation status

Categorised as Rare in the 2014 Advisory list of rare or threatened flora (DEPI 2014).

### Proposed conservation status

Endangered in Victoria

Criterion B2ab(iii)

### Species Information

#### Description and Life History

The taxon is a shrub to c. 3 m high; branchlets smooth, ferruginous-lepidote. Leaves papery or coriaceous, oblong to elliptic, 15-50 mm long, 2-9 mm wide, apex acute, truncate or retuse, upper surface smooth or rarely slightly scabrous, not glandular-verrucose, midrib slightly or deeply impressed, lower surface densely silvery- to ferruginous-lepidote or stellate-tomentose, margin entire or somewhat crenulate, flat, recurved or revolute. Inflorescence a terminal, (3-)5-10(or more)-flowered umbel-like cluster; peduncle absent or short; pedicels 3-8 mm long. Calyx shortly hemispherical or subturbinate, 0.5-1.2 mm long, silvery- to ferruginous-lepidote, smooth to verrucose; petals imbricate, elliptic, 2-4.5 mm long, yellow to cream, silvery- to ferruginous-lepidote outside; stamens exserted, anthers yellow; disc not apparent; ovary lepidote. Follicles erect, truncate or slightly rounded at apex, c. 3.5 mm long. Flowers Spring (VicFlora 2019).

#### Generation Length

The generation length of *Phebalium squamulosum* subsp. *squamulosum* is estimated to be 35 to 70 years. This based on a plausible longevity of 35-70 years and the inference that the taxon is a fire-sensitive obligate seed regenerator (OSR) which recruits episodically post-fire at pre-settlement intervals of 35-75 years or more depending on local habitat conditions. There may also be some trickle recruitment in response to localised disturbance events. Like most Rutaceae, the taxon recruits from long-persistent soil-stored seedbanks which can greatly outlast the lifespan of the last cohort of post-fire recruits.

#### Distribution

The taxon is scattered in Victoria the from Healesville area eastwards to the New South Wales border. A 1914 specimen purportedly from Wilsons Promontory may represent a southern outlier, but is perhaps a result of mislabelling. It also occurs in SA, NSW, Qld (VicFlora 2019).

The taxon is highly disjunct in Victoria, with strongholds in the Warburton to Powelltown district in the Central Highlands and the Genoa to Howe Range district in far East Gippsland, with isolated occurrences in the Baw Baw,



# *Phebalium squamulosum* subsp. *squamulosum* Forest Phebalium

Mitchell River Gorge, Bruthen and Brodribb River districts and near Elusive Lake in the Lower Wingan area. Even more remarkable is the apparent disjunction between the occurrences in the Mount Gambier district in SA and the closest records in the Yarra River catchment in central Victoria.

The identity of a 1987 Albrecht collection taken in the Moroka Gorge in the Victorian Alps is problematic. One duplicate at CBG has been determined as subsp. *squamulosum*, yet this collection is the only support in the Australian Virtual Herbarium for the assertion in VicFlora (2017) that subsp. *ozothamnoides* occurs in the Moroka River Gorge.

## Habitat

The taxon is scattered in foothill to montane forests, often on shallow rocky soils (VicFlora 2019).

## Threats

Historic decline due to habitat loss to agriculture is likely to have been relatively minor, since most Victorian occurrences are on public land.

Current and future threats include targeted or incidental browsing by Sambar deer (*Rusa unicolor*) or other native or exotic herbivores and the potential impact of increasing fire risk, repeat fire events at intervals close to the tolerable fire interval (TFI) for the taxon and recruitment failure in response to climatic drying and warming and imposed anthropogenic fire regimes.

Recruiting stands are particularly susceptible to targeted browsing by native and exotic herbivores including wallabies, rabbits, deer, and potentially, possums, although the distinctive oil content of the foliage and bark may reduce palatability for some herbivores. All occurrences are at increasing risk of exposure to Sambar Deer (*Rusa unicolor*) which are currently undergoing a large increase in local range and density throughout the known Victorian range of the taxon (VBA 2019). Sambar have demonstrated their ability to browse and ringbark, by antler-rubbing, juvenile and adult stands of the closely related *Nematolepis wilsonii* in the Central Highlands of Victoria, and now constitute the greatest threat to that highly localised endemic.

The increasing risk of extreme drought stress is likely to become an increasingly significant long-term threat, particularly to stands recruiting following intense bushfire. When coupled with targeted browsing by Sambar and other herbivores, this is likely to result in recruitment failure, seedbank depletion and local extinction.

# Phebalium squamulosum subsp. squamulosum

## Forest Phebalium

### IUCN Criteria

Criterion A. Population size reduction. Population reduction (measured over the longer of 10 years or 3 generations) based on any of A1 to A4			
	Critically Endangered	Endangered	Vulnerable
A1	≥ 90%	≥ 70%	≥ 50%
A2, A3, A4	≥ 80%	≥ 50%	≥ 30%
<p>A1 Population reduction observed, estimated, inferred or suspected in the past and the causes of the reduction are clearly reversible AND understood AND ceased.</p> <p>A2 Population reduction observed, estimated, inferred or suspected in the past where the causes of the reduction may not have ceased OR may not be understood OR may not be reversible.</p> <p>A3 Population reduction, projected or suspected to be met in the future (up to a maximum of 100 years) [(a) cannot be used for A3]</p> <p>A4 An observed, estimated, inferred, projected or suspected population reduction where the time period must include both the past and the future (up to a max. of 100 years in future), and where the causes of reduction may not have ceased OR may not be understood OR may not be reversible.</p>			
<p style="text-align: center;"><i>based on any of the following:</i></p> <ul style="list-style-type: none"> <li>(a) direct observation [except A3]</li> <li>(b) an index of abundance appropriate to the taxon</li> <li>(c) a decline in area of occupancy, extent of occurrence and/or quality of habitat</li> <li>(d) actual or potential levels of exploitation</li> <li>(e) the effects of introduced taxa, hybridization, pathogens, pollutants, competitors or parasites</li> </ul>			

### Evidence:

#### Ineligible under Criterion A

There is insufficient evidence to determine whether there has been or will be a reduction in population sufficient to meet any threshold for Criterion A.

# *Phebalium squamulosum* subsp. *squamulosum* Forest Phebalium

Criterion B. Geographic range in the form of either B1 (extent of occurrence) and/or B2 (area of occupancy)			
	Critically Endangered Very restricted	Endangered Restricted	Vulnerable Limited
B1. Extent of occurrence (EOO)	< 100 km <sup>2</sup>	< 5,000 km <sup>2</sup>	< 20,000 km <sup>2</sup>
B2. Area of occupancy (AOO)	< 10 km <sup>2</sup>	< 500 km <sup>2</sup>	< 2,000 km <sup>2</sup>
AND at least 2 of the following 3 conditions:			
(a) Severely fragmented OR Number of locations	= 1	≤ 5	≤ 10
(b) Continuing decline observed, estimated, inferred or projected in any of: (i) extent of occurrence; (ii) area of occupancy; (iii) area, extent and/or quality of habitat; (iv) number of locations or subpopulations; (v) number of mature individuals			
(c) Extreme fluctuations in any of: (i) extent of occurrence; (ii) area of occupancy; (iii) number of locations or subpopulations; (iv) number of mature individuals			

## Evidence:

### Eligible under Criterion B1 as Vulnerable

The Extent of Occurrence (EoO) across the taxon's range is estimated to be 14,380 km<sup>2</sup>, based on accepted, post-1970 records in the Victorian Biodiversity Atlas (VBA).

The taxon is estimated to be severely fragmented and is estimated to have fewer than 10 locations. It has a continuing decline in (iii) above, based on the current and projected impact of the identified threats.

The taxon is severely fragmented naturally at the regional and landscape scales, with geographically isolated occurrences separated by distances greatly exceeding the dispersal range of the taxon, which has no specialised mechanism for long-distance dispersal. Seed is likely to be dispersed by ants (myrmecochory) at the metre scale only.

### Eligible under Criterion B2 as Endangered

The Area of Occupancy (AoO) across the taxon's range is estimated to be 212 km<sup>2</sup>, based on 2 x 2 km grids derived from accepted, post-1970 records in the VBA.

As above, it is severely fragmented, have fewer than 10 locations and has a continuing decline in (iii) above.

# *Phebalium squamulosum* subsp. *squamulosum* Forest Phebalium

Criterion C. Small Population size and decline				
		Critically Endangered	Endangered	Vulnerable
Number of mature individuals		< 250	< 2,500	< 10,000
AND at least one of C1 or C2				
C1	An observed, estimated or projected continuing decline of at least (up to a max. of 100 years in future):	25% in 3 years or 1 generation (whichever is longer)	20% in 5 years or 2 generations (whichever is longer)	10% in 10 years or 3 generations (whichever is longer)
C2	An observed, estimated, projected or inferred continuing decline AND least 1 of the following 3 conditions:			
(a)	(i) Number of mature individuals in each subpopulation	≤ 50	≤ 250	≤ 1,000
	(ii) % of mature individuals in one subpopulation =	90 – 100%	95 – 100%	100%
(b)	Extreme fluctuations in the number of mature individuals			

## Evidence:

### Ineligible under Criterion C as Data Deficient

There is insufficient evidence to determine the number of mature individuals.

Criterion D. Very small or restricted populations				
		Critically Endangered	Endangered	Vulnerable
Number of mature individuals (observed or estimated)		< 50	< 250	< 1,000
D2. Only applies to the VU category Restricted area of occupancy or number of locations with a plausible future threat that could drive the species to critically endangered or Extinct in a very short time.		-	-	D2. Typically: AoO < 20 km <sup>2</sup> or number of locations ≤ 5

## Evidence:

### Ineligible under criterion D

The taxon is not eligible under criterion D.

**Criterion E (Quantitative Analysis) was not addressed as the taxon does not have a detailed Population Viability Analysis.**

## References

DEPI (2014) Advisory list of rare or threatened plants in Victoria - 2014. Department of Environment and Primary Industries, Melbourne. (Retrieved from [https://www.environment.vic.gov.au/\\_\\_data/assets/pdf\\_file/0021/50448/Advisory-List-of-Rare-or-Threatened-Plants-in-Victoria-2014.pdf](https://www.environment.vic.gov.au/__data/assets/pdf_file/0021/50448/Advisory-List-of-Rare-or-Threatened-Plants-in-Victoria-2014.pdf))



*Phebalium squamulosum* subsp. *squamulosum*  
Forest Phebalium

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