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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 *Pultenaea baeuerlenii* F.Muell. as an ENDANGERED SPECIES in Part 2 of Schedule 1 of the Act and, as a consequence, to omit reference to *Pultenaea baeuerlenii* F.Muell. 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 *Pultenaea baeuerlenii* F.Muell. 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 Endangered.

### Summary of Conservation Assessment

*Pultenaea baeuerlenii* F.Muell. was found to be Endangered in accordance with the following provisions in the *Biodiversity Conservation Regulation 2017*: Clause 4.3 (b)(d)(e i,ii,iii,iv) because: (1) it has a highly restricted geographic distribution with an estimated Extent of Occurrence (EOO) of 146 km<sup>2</sup> and an estimated Area of Occupancy (AOO) of 20 km<sup>2</sup>; (2) the population occurs across three threat -defined locations; and (3) there is an inferred continuing decline in the EOO, AOO, number of locations and subpopulations, and the number of mature individuals due to adverse fire regimes, and interactions between drought and fire, which are exacerbated by climate change.

The NSW Threatened Species Scientific Committee has found that:

1. *Pultenaea baeuerlenii* F.Muell. (Fabaceae), also known as the Budawang bush-pea, is described by de Kok and West (2003) as an “Erect shrub, 0.6–1(–1.5) m high; branchlets densely to moderately hairy, hairs appressed to ascending. Leaves alternate, 7–12.5 × 0.6–0.8 mm, ratio 11.5–17.8, linear, terete to broadly u-shaped, straight, tuberculate (and microscopic papillae at the leaf margin), only midvein prominent, paler above, glabrous; apex acute, pungent, recurved to straight; base attenuate to cuneate. Petioles not decurrent. Stipules 5–7 mm long, appressed to erect. Inflorescences dense, flower-subtending bracts herbaceous with enlarged stipules. Bracteoles 5–7 mm long, linear. Calyx 6.5–7 mm long, sparsely hairy; lobes all straight, apex acuminate. Standard 9.7–11 mm long, yellow to orange sometimes with red striations at front; wing 7.2–10 mm long, yellow to orange; keel 8–10 mm long, yellow. Style gently curved. Pods 5.5–7.2 mm long; seeds 3 mm long”.
2. *Pultenaea baeuerlenii* is endemic to NSW where it is confined to the Budawang Range in the Southern Tablelands on Yuin Country. The species is known from four subpopulations within Morton and Budawang National Parks at Currockbilly Mountain, Corang Peak, Bhundoo Hill and Burrumbeet Brook. Subpopulations

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recorded at Bhundoo Hill and Burrumbeet Brook have not been located since 2000 and 1979 respectively, and are likely to be locally extinct. A 1994 record from Pigeon House Mountain is not supported by a herbarium specimen and occurs in atypical habitat; this record may not represent a valid subpopulation.

3. *Pultenaea baeuerlenii* has a highly restricted distribution. It has an estimated Extent of Occurrence (EOO) of 146 km<sup>2</sup>, based on a minimum convex polygon, the method of assessment recommended by IUCN (2022). The Area of Occupancy (AOO) is estimated to be 20 km<sup>2</sup> based on 2 x 2 km grid cells, the scale recommended by IUCN (2022). AOO and EOO estimates were based on cleaned records obtained from the Atlas of Living Australia and the NSW Bionet Atlas and include both herbarium specimens and human observations.
4. The total number of mature individuals of *Pultenaea baeuerlenii* is estimated to be 185–370 based on surveys conducted following the 2019–20 bushfires. Surveys found >70 plants at Currockbilly Mountain and >213 plants at Corang Trig, however surveys did not search all habitat. A maximum estimate of 1,956 plants was calculated based on extrapolation of the observed density of plants surveyed. However, as the surveys were biased towards areas where plants occurred in relatively high densities, the conservative estimate of c. 370 plants across both subpopulations is considered more representative (J. Lemmon pers. comm. July 2022 in Commonwealth DCCEEW 2023).
5. *Pultenaea baeuerlenii* occurs in moist heathland or bog, often in shallow gullies; in peaty sand or humus over sandstone, at 700–1200 m elevation. It is associated with *Baeckea linifolia*, *Blandfordia nobilis*, *Boronia subulifolia*, *Boronia rhomboidea*, *Bossiaea kiamensis*, *Dracophyllum secundum*, *Eucalyptus moorei*, *E. stricta*, *Gymnoschoenus sphaerocephalus*, *Hakea microcarpa*, and *Melaleuca squarrosa* (de Kok and West 2003). *Pultenaea baeuerlenii* has also been recorded growing in the heads of gullies near the summit of Currockbilly Mountain (Leigh *et al.* 1984).
6. Flowering of *Pultenaea baeuerlenii* occurs mainly from October to December but has also been observed in autumn (Leigh *et al.* 1984; de Kok and West 2003). Fruiting occurs from January to March (Leigh *et al.* 1984; de Kok and West 2003). Pollinators are likely to be native bees and/or beetles; these are unlikely to traverse the distances and different habitats between subpopulations to exchange genetic material (Scaccabarozzi *et al.* 2020). Seed is likely dispersed only a short distance (<10 m), primarily via ants and gravity (Auld 1996).
7. The estimated time to maturity for *Pultenaea baeuerlenii* is 2–3 years (J. Lemmon pers. comm. January 2022 in Commonwealth DCCEEW 2023). Its generation length is estimated to be 7–15 years based on observations from similar leguminous species (NSW Scientific Committee 2008).
8. *Pultenaea baeuerlenii* is an obligate seeder, with some plants displaying an ability to resprout, likely dependent on fire conditions (J. Lemmon pers. comm. January 2022 in Commonwealth DCCEEW 2023). *Pultenaea baeuerlenii* is likely to be similar to other *Pultenaea* species, which are generally fire-killed obligate seeders, and regenerate from long-lived persistent seedbanks that rely on fire to break dormancy, with little germination during inter-fire periods (e.g., Muir *et al.* 2014).

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Seed size may be related to dormancy-breaking temperature thresholds (negative relationship) and the temperature that is lethal to seeds (positive relationship) (Liyanage and Ooi 2018).

9. The main threats to *Pultenaea baeuerlenii* include adverse fire regimes, disease, and the cumulative effects of drought and fire, which are exacerbated by climate change. 'High frequency fire resulting in the disruption of life cycle processes in plants and animals and loss of vegetation structure and competition', 'Anthropogenic climate change', and 'Infection of native plants by *Phytophthora cinnamomi*' are listed as Key Threatening Processes under the Act.
10. Adverse fire regimes are inferred to be causing continuing declines in the EOO, AOO, number of locations, number of subpopulations, and number of mature individuals for *Pultenaea baeuerlenii*. *Pultenaea baeuerlenii* has a highly restricted distribution and a tendency to grow in gully heads where high fire severity is common. This species could be at risk of extinction should individuals be killed by fire before they have time to mature and set seed, *i.e.*, from high frequency fire (Leigh *et al.* 1984). A history of high fire frequency has possibly already resulted in the extirpation the Bhundoo Hill subpopulation, which has not been relocated since 2000. The Corang Peak and Currockbilly Mountain subpopulations both experienced severe fire in 2013, less than 10 years before the 2019–20 fires. Corang Peak showed delayed recovery after the 2013 fires, with recruitment not seen until 2.4 years after the fire (J. Lemmon pers. comm. January 2022 in Commonwealth DCCEEW 2023).
11. Climate change is predicted to increase the incidence and severity of fire weather and interactions between fire and drought, and is inferred to contribute to continuing declines in the EOO, AOO, number of locations, number of subpopulations, and number of mature individuals for *Pultenaea baeuerlenii*. High frequency fire and pre-fire drought, which are the likely cause of current reductions in the number of mature individuals, has not ceased and is likely to increase under climate change (Abram *et al.* 2021; Gallagher 2020). The association of *P. baeuerlenii* with wet heath and moist gullies indicates a preference for wetter conditions, and prolonged or severe droughts may directly kill plants, or make them more susceptible to other threats such as fire, flooding, disease and competition by weeds.
12. Both *Phytophthora cinnamomi* and *Armillaria luteobubalina* (honey fungus) are present at Corang Peak, one of the key *Pultenaea baeuerlenii* locations (Craven & McDougall 2015; McDougall & Liew 2024). *Pultenaea baeuerlenii* is highly susceptible to *P. cinnamomi* (McDougall & Liew 2024), as well as infection by *A. luteobubalina*, a soil borne fungus which causes root rot and wood decay in plants, often leading to mortality. This pathogen has been found to infect *P. baeuerlenii* plants when in poor health (K McDougall pers. comm. February 2022).
13. *Pultenaea baeuerlenii* is known from three threat-defined locations based on the most plausible threats being adverse fire regimes and interactions between drought and fire. All known extant subpopulations were burnt during the 2019–20 bushfires and pre-fire drought severity was high across all subpopulations.

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However, the species occurs in three separate regions in the Budawangs, therefore not all subpopulations are likely to be affected by a single fire event.

14. *Pultenaea baeuerlenii* F.Muell. is not eligible to be listed as a Critically Endangered species.

15. *Pultenaea baeuerlenii* F.Muell. 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 i,ii,iii,iv)**

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

(Equivalent to IUCN criterion A)

**Assessment Outcome: Data Deficient**

<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: Endangered under Clause 4.3 (b)(d)(e i,ii,iii,iv)**

<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,	

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	(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**

<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: Vulnerable under Clause 4.5 (c)**

<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.

### Clause 4.6 – Quantitative analysis of extinction probability (Equivalent to IUCN criterion E)

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## 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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Senior 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 *Pultenaea baeuerlenii* (Budawang bush-pea). Australian Government, Canberra, ACT.

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