

NSW Threatened Species Scientific Committee

Conservation Assessment of *Pultenaea rubescens* R.L.Barrett, Clugston & Jobson (Fabaceae)

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Nature and Natural Capital Strategy Division

NSW Department of Climate Change, Energy, the Environment and Water

***Pultenaea rubescens* R.L.Barrett, Clugston & Jobson (Fabaceae)**

Distribution: Endemic to NSW

Current EPBC Act Status: Not listed

Current NSW BC Act Status: Provisional listing as Endangered

Proposed listing on NSW BC Act: Endangered

No change to listing: Inclusion of conservation assessment to support current listing.

Summary of Conservation Assessment

Pultenaea rubescens R.L.Barrett, Clugston & Jobson was found to be eligible for listing as Endangered under IUCN Criteria B1ab(iii,v)+2ab(iii,v).

The main reasons for this species being eligible are (1) it has a highly restricted geographic distribution; (2) the species is found at 3–6 threat-defined locations; (3) there is an inferred continuing decline in the number of mature individuals and the area, extent and/or quality of habitat due to grazing and trampling by escaped cattle and feral pigs, and the adverse effects of high fire frequency; and (4) there is a projected continuing decline in the number of mature individuals and the area, extent and/or quality of habitat due to the disturbance and habitat degradation associated with the proposed Oven Mountain Pumped Hydro Energy Storage project.



Pultenaea rubescens. Credit: Paul Rossington.

Description and Taxonomy

Pultenaea rubescens R.L.Barrett, Clugston & Jobson (Carrai bush-pea, family Fabaceae) was described by Barrett *et al.* (2024) as a "Diminutive, procumbent subshrub with few, slender, trailing (or sometimes ascending over vegetation), few-branched stems 25–75(–90) cm long arising from a slender rootstock (nodulation common on fine roots). Cotyledons not seen. Branchlets spreading to ascending, 15–30 cm high; initially with a sparsely appressed silky hairs 0.6–1.6 mm long, but glabrescent on older stems; very shortly-ribbed below petioles (sometimes with a low ridge extending along the stem for up to 15 mm on dried specimens). Stipules lanceolate, tightly appressed to stem, fused for c. 9/10 their length (commonly tearing as they age, so appearing fused for only 1/2 their length), (4.8–)5.3–6.9 mm long, each c. 0.3 mm wide at sinus, weakly keeled, apex usually not spreading, acuminate, scarious, dark to pale brown at base, grading to translucent (except for midrib) towards apex, margins glabrous. Seedling leaves narrowly elliptic, 8–21 mm long, 2–4 mm wide, increasing in length as plants develop, larger than the adult form. Adult leaves alternate, sparse; petiole 0.7–1.2 mm long; lamina linear to narrowly oblanceolate, 8–15(–24) mm long, 1.1–1.6(–2.4) mm wide, discolorous, darker above; apex usually partly recurved, acuminate, apiculus 0.2–1.1(–1.4) mm long, dark brown to black; margins recurved, sometimes strongly so, but not hiding abaxial surface; adaxial surface distinctly concave to almost canaliculate, often with a row of simple appressed hairs along inconspicuous midrib; abaxial surface silky with persistent appressed hairs. Inflorescence a small, dense, terminal head of 5–9 solitary flowers; heads and individual flowers subtended by persistent, imbricate, pale-brown, scarious, enlarged stipules; stipules completely hiding pedicels, ovate to elliptic, 3.1–5.7 mm long, [fused pair] 1.8–2.6 mm wide at widest point, glabrous on face with uniformly ciliate margins, weakly keeled; reduced leaf-like bract acuminate or \pm filiform, glabrous or villous, free portion 1.0–1.5(–2.1) mm long, reaching as long or longer than stipule apices. Pedicels 0.5–1.1 mm long, moderately hairy; floral bracteoles inserted 0.2–0.7 mm above base of calyx, 2.5–4.0 mm long, reaching 3/4–9/10 as long as calyx, lanceolate, acuminate, concave, keeled, with scattered long white hairs, particularly along outer edge of keel; floral stipules absent. Flowers 4.1–4.7 mm long; calyx tube broadly obconic, 1.4–1.9 mm long, greenish to red, moderately silky, appressed hairy; lobes 5, subequal, the upper pair shortly fused, triangular, 1.4–2.6 mm long, acuminate, greenish to reddish tinge on inside base of lobes, moderately densely silky hairy; standard petal hooded over keels and wings, \pm circular when flattened, emarginate, 3.5–5.1 mm long including 1.3–2.0 mm claw, 2.4–4.8 mm wide, face orange-yellow to dark orange with faint to prominent reddish-orange ring near base with radiating lines reaching almost to the apex, reverse reddish orange; wing petals narrow-oblong, apex obtuse, 3.1–3.9 mm long including 1.8 mm claw, 0.9 mm wide, yellow with reddish-orange line along lower edge and apex; keel petals naviculate, \pm narrow-oblong, 3.1–3.7 mm long including 1.25 mm claw, 0.8 mm wide (folded), \pm equal to wings, dark red to almost purple near apex (and drying purple), grading abruptly to white at base; style and stamens reaching similar length, slightly upwardly curved near apex; staminal filaments 3.1–3.8 mm long; anthers c. 0.2 mm long, purple; ovary with a short stipe, 2-ovulate, 1.1–1.3 mm long, covered with densely silky with long white hairs to 0.5 mm long; style 2.9–3.1 mm long, slowly tapering, hairy in lower 1/3, slightly upwardly curved near apex; stigma inconspicuous, slightly capitate. Fruit ovoid, compressed, 3.8–4.3 mm long (excluding beak), 2.2–2.6 mm wide, c. 1.1 mm thick, with obtuse base, densely appressed sericeous; style partially persistent. Seeds released by

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opening of apical half of pod, dark brown, 1.6–1.8 mm long, 1.2–1.3 mm wide, aril white, c. 0.9 mm long, coralline, with long, irregular fingers.”

Pultenaea rubescens is currently known to occur in the NSW North Coast and New England Tablelands bioregions (IBRA bioregions, Commonwealth DCCEE 2024a), disjunct from the closely related *P. parrisiae* (Parris' bush-pea), which occurs in southern New South Wales (NSW) and north-eastern Victoria (Barrett *et al.* 2024). *Pultenaea rubescens* differs from *P. parrisiae* and *P. elusa* (elusive bush-pea) with “sparser indument on the stems, larger juvenile leaves, distinctly petiolate adult leaves that are only moderately recurved at the apex, inflorescence bracts which are commonly shorter and broader, pedicels of intermediate length, bracteoles attached on calyx wall (as for *P. elusa*), and smaller calyx and corolla” (Barrett *et al.* 2024).

The phrase name ‘*Pultenaea* sp. Werrikimbe NP (L.M.Copeland 4477)’ refers to a separate undescribed species and has previously been misapplied to *Pultenaea rubescens* (R. Barrett *in litt.* October 2024), including in the provisional listing of *P. rubescens* (NSW TSSC 2024).

Distribution

There are three currently known *Pultenaea rubescens* subpopulations (Table 1): Oven Mountain, Carrai East, and Werrikimbe. These occur on the Carrai Plateau, Walcha Plateau, and Comboyne Plateau (IBRA subregions, Commonwealth DCCEE 2024b).

Oven Mountain is located ~58 km ESE of Armidale and is largely on freehold land with ~25% of individuals counted in Carrai State Conservation Area (SCA), and ~5% in Carrai National Park (EMM Consulting *in litt.* October 2024; NSW Government 2024). Carrai East is located ~7 km ESE of the Oven Mountain subpopulation and entirely within Carrai SCA. The Werrikimbe subpopulation is located ~46 km south of the Oven Mountain subpopulation, predominately within Werrikimbe National Park, with some records in Doyles River State Forest.

Area of occupancy and extent of occurrence

Pultenaea rubescens has an estimated area of occupancy (AOO) of 48 km², and an estimated extent of occurrence (EOO) of 347 km². As recommended by IUCN (2024), AOO is based on 2 x 2 km grid cells, while EOO is based on a minimum convex polygon enclosing mapped records for the species. The records used for these estimates were retrieved from the National Herbarium of New South Wales (RBGDT 2024) and targeted surveys by EMM Consulting (*in litt.* October 2024), Young (2024), and Owner (2025). Two of the RBGDT (2024) records were excluded: One was a duplicate of a targeted survey record, and the other was a specimen of *Pultenaea* sp. Werrikimbe NP (L.M.Copeland 4477) (*i.e.*, misapplied to *P. rubescens*).

Abundance

It is estimated that there are 1,875–26,800 *Pultenaea rubescens* individuals, of which the proportion that are mature is unknown. Surveys undertaken on the Carrai Plateau from 2022–2023 detected a total of 595 *Pultenaea rubescens* in the Oven Mountain and Carrai East subpopulations; many of these had finished flowering and some plants were senescing (EMM consulting *in litt.* October 2024; EMM 2024a). Lower densities of *P. rubescens* were recorded in 2023 compared to 2022 (EMM 2024a). If

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P. rubescens is a short-lived obligate seeder, this putative trend may reflect typical postfire survivorship patterns, with additional mortality during a dry period associated with a climatic switch from La Nina to El Nino in 2023 (EMM 2024a; Commonwealth of Australia 2025), or other causes of senescence (e.g., disease). Over the species' range, there was above average rainfall prior to surveys in 2022 and below average rainfall prior to surveys in 2023 (Commonwealth of Australia 2025).

Subsequently, Barrett *et al.* (2024) estimated that the total Carrai Plateau area (encompassing both the Oven Mountain and Carrai East subpopulations) may contain 1,000–1,200 *Pultenaea rubescens* individuals based on an estimate of approximately 15–20% of the species' habitat having been surveyed, and the observation that patches typically contain between just a few, to >50 individuals. It was noted that *P. rubescens* is difficult to detect, and most surveys to date have been undertaken after peak flowering, so there is some potential for underestimation (Barrett *et al.* 2024).

Additionally, in a survey of the Werrikimbe subpopulation in 2024, 640 waypoints were recorded (Owner 2025). The waypoints were described as “records where the species was found in areas of currently occupied habitat, noting that other *Pultenaea rubescens* individuals also occur at each waypoint, and likely in between waypoints” (Owner 2025). Assuming that each waypoint represents two individuals results in a minimum estimate of 1,280 individuals for this subpopulation. Owner (2025) identified other areas of potential habitat in the Werrikimbe locality, of which it is estimated that ~5% has been surveyed, resulting in a maximum estimate of 25,600 individuals for this subpopulation. There is very high uncertainty around the maximum estimate because it assumes that the species is present in all non-surveyed potential habitat areas at the same density of occurrence as the surveyed areas, which was also assumed (*i.e.*, two individuals per waypoint).

Table 1. Subpopulation information for *Pultenaea rubescens*. Counts may include both mature and immature individuals. The years that the count data were collected are listed under the subpopulation name. Fire history was derived from the intersection of occurrence records with NSW DCCEEW (2024) data. Note that some fires may not have been recorded, and some inherent inaccuracy in the positioning of both the occurrence records and fire boundaries is expected.

Subpopulation	Counts of individuals	Fire history (extent)
Oven Mountain (~5 sites) 2022; 2023	552 (EMM Consulting <i>in litt.</i> October 2024)	2019/20 caused by lightning (all sites) 2012/13 prescribed burn and wildfire caused by legal burning off (all sites) 2003/04 wildfire caused by legal burning off (southern site only) 2000/01 wildfire cause undetermined (all sites) 1993/94 wildfire cause undetermined (all except southern site) 1991/92 wildfire cause undetermined (north-east site only) 1986/87 wildfire cause undetermined (southern and eastern sites only)
Carrai East	43	2019/20 caused by lightning (all sites)

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Subpopulation	Counts of individuals	Fire history (extent)
(~7 sites) 2023	(EMM Consulting <i>in litt.</i> October 2024)	2017/18 wildfire caused by illegal burning off (western and central sites only) 2012/13 wildfire caused by legal burning off (all sites) 2007/08 wildfire cause undetermined (all sites)
Werrikimbe (~4 sites) 2023; 2024	~1,280 (Owner 2025) ≥200 (D. Young <i>in litt.</i> February 2024).	2019/20 caused by lightning (all sites) 2002/03 caused by lightning (part of central site only) 1991/92 wildfire cause undetermined (all except northern site) 1986/87 wildfire cause undetermined (all except northern site) 1979/80 wildfire cause undetermined (one site only) 1976/77 wildfire cause undetermined (northern two sites only)

Ecology

Habitat

Pultenaea rubescens “grows in drainage depressions and the margins of usually perpetually wet sedge-dominated swamps surrounded by dry, sclerophyll eucalypt forest with a sparse canopy, occupying the interzone between these two habitats, only where this interzone is relatively extensive, and the shrub layer is not too tall or dense. It grows in wet heath with a ground layer of grasses, sedges and forbs, in sand over granite, at 900–1,030 m altitude” (Barrett *et al.* 2024). In Werrikimbe National Park it has also been found around 1,100 metres altitude (Owner 2025). *Pultenaea rubescens* may also occur in other topographies, vegetation communities and edaphic conditions.

Species associated with *Pultenaea rubescens* include *Asperula gunnii*, *Baloskion fimbriatum*, *Banksia marginata*, *Callistemon pallidus*, *Callistemon pityoides*, *Comesperma* sp., Cyperaceae species, *Daviesia* sp., *Empodisma minus*, *Epacris breviflora*, *Epacris paludosa*, *Eucalyptus campanulata*, *Eucalyptus radiata*, *Gahnia* sp., *Gleichenia dicarpa*, *Gonocarpus micranthus*, *Hibbertia* spp., *Hypericum japonicum*, *Lepidosperma* sp., *Leptospermum* sp., Poaceae species, *Prostanthera scutellarioides*, *Pultenaea dentata*, *Pultenaea retusa*, Restionaceae species and *Sphaerolobium minus* (Barrett *et al.* 2024).

Pollination and dispersal

Flowering of *Pultenaea rubescens* has been recorded in October–November, but likely starts in September, with fruit present in late November (Barrett *et al.* 2024). Pollination of *P. rubescens* by native bees (e.g., *Trichocolletes* species) and *Apis mellifera* (European honey bee) is inferred from observations of other *Pultenaea* species (Gross 1992; Ogilvie 2009). It is also inferred that the seeds are physically dormant (Auld and O’Connell 1991) and locally dispersed by ants, generally less than 10 metres (Berg 1975; Rice and Westoby 1981; Auld 1996).

Fire ecology

The fire response of *Pultenaea rubescens* is unknown. However, *P. parrisiae* is known to be an obligate seeder that is killed by fire and has a persistent soil stored seed bank (Auld 1996; Ferrer-Paris and Keith 2022). It is inferred that the greatest density of

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P. rubescens would occur in the early successional stage following fire (Kok and de West 2004; Barrett *et al.* 2024) because the primary mechanism of breaking seed dormancy is likely to be heating of the soil by the passage of fire (Auld 1996). In experiments with other *Pultenaea* species, the largest germination response was generally at temperatures of 60–100°C (Auld and O’Connell 1991). The persistence of *P. rubescens* is likely to be optimal when there is both sufficient soil heating during fires for germination, and an adequate length of time between fires for seedlings to reach maturity and replenish the soil seed bank (Auld 1996).

In the 35–45 years prior to the 2019/20 fires, the interval of fire variously affecting sites in the Oven Mountain subpopulation of *Pultenaea rubescens* averaged eight years (range 2–14 years, Table 1; NSW DCCEE 2024). The average fire interval across sites was shorter in the Carrai East subpopulation (mean five years, range 2–7 years), and longer in the Werrikimbe subpopulation (mean 16 years, range 5–43 years) (Table 1; NSW DCCEE 2024). The post-fire recovery time of this species may vary depending on the severity and season of burning, and the environmental conditions after the fire.

Lifespan and generation length

The lifespan of *Pultenaea rubescens* is unknown, but it is thought to be relatively short-lived (Barrett *et al.* 2024). Some senescence of *P. rubescens* individuals was observed despite good rainfall prior to the November 2022 surveys (EMM 2024a; Barrett *et al.* 2024). If not a result of disease (unknown), this may be a natural self-thinning of young plants due to competition in the habitat often seen after a fire. The estimated generation length of *Pultenaea rubescens* is 14 years. This estimate was based on the sum of an inferred juvenile period and median time to germination (IUCN 2024). The observation of old fruit on individuals recorded in January 2022 following the 2019/20 wildfires suggests a juvenile period of approximately two years (EMM Consulting *in litt.* October 2024). The fecundity of young *P. rubescens* is unknown. Median time to germination was assumed to be equal to the median fire interval across all known sites of *P. rubescens* excluding fires with known anthropogenic ignition sources (*i.e.*, 12 years, Table 1; NSW DCCEE 2024). Fires with an “undetermined” cause (Table 1) were included and may contribute to an underestimated generation length if they were not naturally occurring.

Cultural Significance

The Dhanggati and Birpai peoples are the Traditional Custodians of the lands on which *Pultenaea rubescens* occurs (Horton 1996). This assessment is not intended to be comprehensive of the traditional ecological knowledge that exists for *Pultenaea rubescens*, or to speak for Aboriginal people. Aboriginal people have a long history of biocultural knowledge, which comes from observing and being on Country, and evolves as it is tested, validated and passed through generations (Woodward *et al.* 2020). Aboriginal peoples have cared for Country for tens of thousands of years (Bowler *et al.* 2003; Clarkson *et al.* 2017). Although no specific information was gathered for *P. rubescens*, it is acknowledged that traditional ecological knowledge exists for all plants, animals and fungi connected within the kinship system (Woodward *et al.* 2020).

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Threats

Pultenaea rubescens individuals and their habitat are subject to grazing and trampling by escaped cattle and feral pigs, and disturbance and habitat degradation from trail maintenance, which brings with it the risk of introducing pathogenic species of *Phytophthora*. The proposed Oven Mountain Pumped Hydro Energy Storage (OMPS) project, which has been declared a Critical State Significant Infrastructure project (EMM 2024a), could increase the extent of disturbance and habitat degradation, including through the exclusion of fire for long periods. Additionally, the current fire regime, particularly across the northern subpopulations, may be contributing to continuing decline in the abundance of *P. rubescens*.

Disturbance and habitat degradation

The part of the Oven Mountain subpopulation of *Pultenaea rubescens* that occurs on freehold land is in the project area of the proposed OMPS project (EMM 2024a). Following the identification of *P. rubescens* occurring within the construction envelope, the OMPS project design was modified to avoid the clearing of any individuals and minimise indirect adverse effects (EMM 2024a). Individuals and their habitat (*i.e.*, the species polygon) identified within the construction envelope would be buffered from areas to be disturbed by 30 m, except for ~0.35 ha of the species polygon, which would be “impacted indirectly” (EMM 2024a). However, disturbance to *P. rubescens* individuals and degradation of their habitat may occur if the OMPS project is approved given the proposed disturbance immediately adjacent to that buffer.

On the eastern side of the Oven Mountain subpopulation, approximately 293 *Pultenaea rubescens* individuals occur on both sides of an existing trail, which is proposed to become part of an access road (EMM 2024a) and would therefore be susceptible to roadside disturbance. The western patch of the species (~143 individuals) within the construction envelope is immediately adjacent to a proposed permanent spoil emplacement area (up to 35 m high) and a temporary fly camp (*i.e.*, worker accommodation) (EMM 2024a, 2024b). Modelling shows that the spoil will not create new shading to the habitat supporting *P. rubescens* (EMM 2024a). However, potential adverse effects from the close proximity of these features include changes to the microhabitat (*e.g.*, changed soil moisture due to altered water flow and drainage), increased dust during construction (which may inhibit growth of vegetation), and the introduction of weeds and pathogens (EMM 2024a).

Bush fire safety requirements may place *Pultenaea rubescens* or its habitat at risk of direct disturbance. The OMPS project proposal described in EMM (2024b) has no asset protection zones (APZs) or bushfire fuel management located in the microhabitat of *P. rubescens*. However, the bush fire assessment report recommends that the proposed fly camp adjacent to the western patch of *P. rubescens* should have a refuge building requiring an APZ setback of 67–93 m (van Dorst 2024), which would encroach on the species and its habitat, unless the fly camp is relocated.

There is geological evidence of mineral values in Carrai SCA (OEH 2014), which may pose a future threat to the Oven Mountain and Carrai East subpopulations of *Pultenaea rubescens*. It was recommended that the area remain an SCA to allow for exploration and mining, subject to environmental assessment (OEH 2014). Additionally, in Werrikimbe National Park there is potential for trail maintenance to adversely affect some *Pultenaea rubescens* individuals.

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'Clearing of native vegetation' is listed as a Key Threatening Process under the NSW *Biodiversity Conservation Act 2016*. 'Land clearance' is listed as a Key Threatening Process under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*.

Exclusion of fire

Like most native legumes in eastern NSW, seed germination and seedling recruitment in *Pultenaea* species are likely to be closely cued by the passage of fire (Auld and O'Connell 1991). The western patch of *Pultenaea rubescens* in the Oven Mountain subpopulation may be affected by reduced seedling recruitment if the proposed neighbouring reservoir and spoil pile change how wildfire spreads and excludes fire from the site (EMM 2024a), or fire exclusion is implemented to protect the fly camp (van Dorst 2024). Over time mature individuals would be expected to senesce and the viability of seeds in the soil seed bank may decline (there are no estimates of seed longevity for this species), resulting in the potential extirpation of that patch. In addition, habitat quality in that area may also be adversely affected if successional changes alter vegetation structure and composition such that it becomes unsuitable for *P. rubescens*.

'Fire regimes that cause declines in biodiversity' is listed as a Key Threatening Process under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*.

High fire frequency

Although some *Pultenaea rubescens* may flower within 2–3 years after fire, effective replenishment of the soil seed bank (and maintenance of subpopulations) may take much longer if the fecundity of young plants is relatively low. Intervals between fires that allow persistence are expected to be at least 7–10 years for *Pultenaea* species (NSW RFS 2013). *Pultenaea rubescens* has experienced fire intervals of less than seven years at all three subpopulations (Table 1) and such short fire intervals have likely led to declines when they occurred. Impacts of high fire frequency are likely to continue given the harsher fire-weather climate projected for the future (CSIRO 2025) combined with any prescribed fire used to protect proposed infrastructure.

'High frequency fire resulting in the disruption of life cycle processes in plants and animals and loss of vegetation structure and composition' is listed as a Key Threatening Process under the NSW *Biodiversity Conservation Act 2016*.

Pathogenic species of *Phytophthora*

The Oven Mountain subpopulation of *Pultenaea rubescens* is at risk of adverse effects from the introduction of pathogens during surveys and works for the proposed OMPS project (EMM 2024a). The susceptibility of *P. rubescens* to disease and death from *Phytophthora* spp. is inferred from other *Pultenaea* species. Barker and Wardlaw (1995) found that *P. paleacea* is highly susceptible to disease and death when infected by *Phytophthora cinnamomi*, while Wan *et al.* (2020) found *P. parrisiae* is highly susceptible to *Phytophthora gregata*. Given that these pathogens are water dispersed (Cahill *et al.* 2008), their spread may be hastened in swampy areas and by the movement of mud on machinery, as well as changed stormwater and surface water runoff from the proposed OMPS project (EMM 2024a). *Phytophthora cinnamomi* has been recorded in Werrikimbe National Park (McDougall and Summerell 2001), with

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the Racecourse and Werrikimbe Trails the focus of containment controls (*i.e.*, north of the currently known records of *P. rubescens* in that locality) (OEH 2012).

‘Infection of native plants by *Phytophthora cinnamomi*’ is listed as a Key Threatening Process under the NSW *Biodiversity Conservation Act 2016*. ‘Dieback caused by the root-rot fungus (*Phytophthora cinnamomi*)’ is listed as a Key Threatening Process under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*.

Grazing and trampling by escaped cattle and feral pigs

Grazing and trampling of swamp vegetation by escaped cattle and feral pigs (*Sus scrofa*) were recorded as potential threats to *Pultenaea rubescens* and its habitat during surveys of the Oven Mountain and Carrai East subpopulations (EMM 2024a). Escaped cattle occurred on National Parks and Wildlife Service (NPWS) estate in areas adjacent to private property with damaged fences (EMM 2024a). Damage by feral pigs was particularly prominent in areas also affected by cattle grazing and historical soil disturbance (EMM 2024a).

Extensive local ground disturbance by feral pigs also occurs in parts of Werrikimbe National Park (NSW DEC 2005). This activity encourages weed invasion, initiates soil erosion and exacerbates the spread of soil pathogens. It has been of particular concern in the Racecourse Swamp, Bishops Swamp, Upper Mooraback and Lower Mooraback sections of the park, which are north of the currently known records of *Pultenaea rubescens* (NSW DEC 2005; OEH 2012).

‘Predation, habitat degradation, competition and disease transmission by Feral Pigs, *Sus scrofa* Linnaeus 1758’ is listed as a Key Threatening Process under the NSW *Biodiversity Conservation Act 2016*. ‘Novel biota and their impact on biodiversity’, and ‘Predation, Habitat Degradation, Competition and Disease Transmission by Feral Pigs’, are listed as Key Threatening Processes under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*.

Threat-defined Locations

Pultenaea rubescens is considered to have 3–6 threat-defined locations, with the minimum plausible number of locations being equal to the number of subpopulations. The most serious plausible threat is disturbance and habitat degradation from the proposed OMPS project, which would be likely to adversely affect part of the Oven Mountain subpopulation. The next most serious plausible threat is grazing and trampling by feral pigs, which is likely to adversely affect the remainder of the population gradually and cumulatively over multiple sites within a single generation (*i.e.*, 14 years). Given the core range of feral pigs can be many square kilometres (Wilson *et al.* 2023), simultaneous adverse effects on multiple sites containing *P. rubescens* are plausible (*i.e.*, summing to the estimated number of threat-defined locations above).

Assessment against IUCN Red List criteria

For this assessment it is considered that the survey of *Pultenaea rubescens* has been adequate and there is sufficient scientific evidence to support the listing outcome.

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Criterion A Population size reduction

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 where the causes of the reduction are clearly reversible AND understood AND have ceased.</p> <p>A2 Population reduction observed, estimated, inferred, or suspected in the past where the causes of reduction may not have ceased OR may not be understood OR may not be reversible.</p> <p>A3 Population reduction projected, inferred 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>based on any of the following:</p> <p>(a) direct observation [except A3] (b) an index of abundance appropriate to the taxon (c) a decline in area of occupancy (AOO), extent of occurrence (EOO) and/or habitat quality (d) actual or potential levels of exploitation (e) effects of introduced taxa, hybridization, pathogens, pollutants, competitors or parasites.</p>			

Outcome

Pultenaea rubescens is considered data deficient under Criterion A.

Population reductions

Given that targeted surveys for *Pultenaea rubescens* commenced in 2022, there is insufficient data to assess whether there has been a reduction in its population size over the past 42 years (i.e., three generations), nor project how threats may cause a reduction in the future.

Criterion B Geographic range

B. Geographic range in the form of either B1 (extent of occurrence) AND/OR B2 (area of occupancy)			
	Critically Endangered	Endangered	Vulnerable
B1. Extent of occurrence (EOO)	< 100 km ²	< 5,000 km ²	< 20,000 km ²
B2. Area of occupancy (AOO)	< 10 km ²	< 500 km ²	< 2,000 km ²
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			

Outcome

Pultenaea rubescens is eligible for listing as Endangered under Criterion B1ab(iii,v)+2ab(iii,v).

EOO and AOO

Pultenaea rubescens has an estimated area of occupancy (AOO) of 48 km², and an estimated extent of occurrence (EOO) of 347 km².

Number of threat-defined locations

Pultenaea rubescens is found at 3–6 threat-defined locations when considering the most serious plausible threats of disturbance and habitat degradation from the proposed OMPS project and grazing and trampling by feral pigs.

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Severely fragmented

Pultenaea rubescens does not meet the IUCN (2024) definition of severely fragmented because >50% of the species' individuals are likely to occur in a viable subpopulation.

Continuing decline

There is an inferred continuing decline in the number of mature individuals and the area, extent and/or quality of habitat for *Pultenaea rubescens* due to grazing and trampling by escaped cattle and feral pigs, and the adverse effects of high fire frequency. There is also a projected continuing decline in the number of mature individuals and the area, extent and/or quality of habitat for *P. rubescens* due to the disturbance and habitat degradation associated with the outcome of the application for the OMPS project.

Extreme fluctuations

Pultenaea rubescens is not known to undergo extreme fluctuations in geographic distribution, number of locations or subpopulations, or population size. It is suspected that natural fluctuations may occur, dependent on rainfall and/or time since fire (EMM 2024a).

Conclusion

Pultenaea rubescens is eligible to be listed as Endangered under Criterion B because it has a highly restricted geographic distribution (EOO <5,000 km²; AOO <500 km²) with 3–6 threat-defined locations, which meets the threshold of ≤5 under the recommended precautionary approach (IUCN 2024). In addition, there is an inferred continuing decline in the number of mature individuals and the area, extent and/or quality of habitat for *P. rubescens* due to grazing and trampling by escaped cattle and feral pigs, and the adverse effects of high fire frequency. There is also a projected continuing decline in the number of mature individuals and the area, extent and/or quality of habitat for *P. rubescens* due to the disturbance and habitat degradation associated with the outcome of the application for the OMPS project.

Criterion C Small population size and decline

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 at 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			

Outcome

Pultenaea rubescens is eligible for listing as Vulnerable under Criterion C1.

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Number of mature individuals

The estimated population size for *Pultenaea rubescens* is 1,875–26,800 individuals of mixed age class, though there is very high uncertainty around the maximum estimate (detailed in the 'Abundance' section).

Continuing decline

There is an inferred continuing decline in the number of mature individuals for *Pultenaea rubescens* due to grazing and trampling by escaped cattle and feral pigs, and the adverse effects of high fire frequency. There is also a projected continuing decline in the number of mature individuals from the disturbance and habitat degradation associated with the outcome of the application for the OMPS project.

Should the OMPS project go ahead, a $\geq 10\%$ reduction in the number of *Pultenaea rubescens* within 42 years (*i.e.*, three generations) is projected given that there are ~436 individuals in close proximity to the project area. This precautionarily assumes that the total population size of this species is not substantially greater than the minimum estimate of 1,875, and that a large proportion of the individuals close to the areas to be disturbed by the OMPS project will be eliminated over three generations.

Mature individuals in each subpopulation

The largest known subpopulation of *Pultenaea rubescens*, Werrikimbe, is estimated to contain a minimum of 1,280 individuals, of which the proportion that are mature is unknown.

% of mature individuals in a single subpopulation

The largest known subpopulation of *Pultenaea rubescens*, Werrikimbe, contains an estimated 52–98% of the estimated total population of the species. The minimum estimate assumes a total population size of 2,480, while the maximum assumes a total population size of 26,195.

Extreme fluctuations

Pultenaea rubescens is not known to undergo extreme fluctuations in population size. It is suspected that natural fluctuations may occur, dependent on rainfall and/or time since fire (EMM 2024a).

Conclusion

Pultenaea rubescens is eligible to be listed as Vulnerable under Criterion C because the estimated minimum population size is likely to be less than 10,000 individuals and it is projected that there would be a decline of at least 10% of the species' population over three generations should the OMPS project go ahead.

A realistic but precautionary attitude to uncertainty places the maximum total population estimate at 11,740 (*i.e.*, 40% of the sum of the minimum and maximum estimates), which is more than the threshold of <10,000 for Vulnerable. However, given the very high uncertainty around the maximum estimate (due to the assumptions detailed in the 'Abundance' section), the weight of currently available evidence suggests that the total population size is most likely <10,000 mature individuals.

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Although the minimum population size is also less than the threshold of 2,500 individuals, the required subcriteria for listing as Endangered under Criterion C are not met.

Criterion D Very small or restricted population

D. Very small or restricted population			
	Critically Endangered	Endangered	Vulnerable
D. Number of mature individuals	< 50	< 250	D1. < 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 taxon to CR or EX in a very short time.	-	-	D2. typically: AOO < 20 km ² or number of locations ≤ 5

Outcome

The thresholds for listing under Criterion D are not met for *Pultenaea rubescens*.

Number of mature individuals

The estimated population size for *Pultenaea rubescens* is 1,875–26,800 individuals of mixed age class.

Risk of future extinction in a very short amount of time (D2)

Pultenaea rubescens occurs at 3–6 threat-defined locations and has an estimated AOO of 48 km². There is no plausible future threat known at this time that could rapidly drive the species to Critically Endangered or Extinct.

Criterion E Quantitative Analysis

E. Quantitative Analysis			
	Critically Endangered	Endangered	Vulnerable
Indicating the probability of extinction in the wild to be:	≥ 50% in 10 years or 3 generations, whichever is longer (100 years max.)	≥ 20% in 20 years or 5 generations, whichever is longer (100 years max.)	≥ 10% in 100 years

Outcome

Pultenaea rubescens is considered data deficient under Criterion E.

Probability of extinction

There is currently insufficient data to undertake a quantitative analysis to determine the extinction probability of *Pultenaea rubescens*.

Conservation and Management Actions

Pultenaea rubescens is currently not listed on the NSW *Biodiversity Conservation Act 2016*. Following publication of a Final Determination by the NSW Threatened Species Scientific Committee, a Biodiversity Conservation Program will be developed by the NSW Department of Climate Change, Energy, the Environment and Water.

The actions listed below are general suggestions only.

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Habitat loss, disturbance and modification

- Ensure sites near roads and trails are managed to exclude detrimental habitat disturbance and loss.
- Include measures to minimise habitat loss, disturbance, and modification should the OMPS project be approved.

Fire management

- a) Ensure intervals between fires are sufficient to allow replenishment of the soil seed bank (a precautionary minimum fire free interval of 10 years is suggested).
- Ensure the species is burnt under a fire of sufficient severity to promote seed germination.
- Avoid use of fire retardants near known subpopulations.

Pathogens

- Implement vehicle and equipment hygiene protocols to prevent the spread of *Phytophthora* species.

Ex situ conservation

- Develop a targeted seed collection program for ex situ seed banking to support future reintroduction projects.

Stakeholders

- Inform landowners and managers of sites where there are known populations of *Pultenaea rubescens* and consult with these groups regarding options for conservation management and protection of the species.
- Ensure parties undertaking road and trail maintenance are aware of the presence of *Pultenaea rubescens*.

Survey and Monitoring Priorities

While ensuring strict adherence to hygiene protocols and minimal disturbance to *Pultenaea rubescens* individuals and their habitat, maintain a monitoring program to:

- Determine the number of mature individuals.
- Tag individuals to monitor life history over time and across fire events, including time to first fruit production, peak fruit production, and survivorship.
- Monitor recruitment and plant health after fire events.
- Determine trends in population size.
- Monitor for habitat degradation by recreational activities or other site disturbances, including weed incursion.
- Monitor for any adverse pathogen impacts, especially on seedling recruitment.
- Survey other areas of potential habitat for *Pultenaea rubescens* individuals.

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Information and Research Priorities

- Conduct research into the life history and ecology of *Pultenaea rubescens*, including longevity, pollinators, recruitment, seed bank dynamics in relation to time since fire, germination in relation to fire severity, seed longevity, seed dispersal, time to maturity, and magnitude of fecundity over time once mature.
- Confirm whether *Pultenaea rubescens* is killed by fire (100% leaf scorch), or if it can resprout, whether this ability varies with fire severity.
- Test susceptibility of *Pultenaea rubescens* to disease and death from *Phytophthora* species.
- Investigate the feasibility of establishing translocated populations.

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Climate Change, Energy, the Environment and Water, North East, Biodiversity, Conservation and Science.

Expert Communications

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APPENDIX 1

Assessment against *Biodiversity Conservation Regulation 2017* criteria

The Clauses used for assessment are listed below for reference.

Overall Assessment Outcome:

Pultenaea rubescens was found to be Endangered under Clause 4.3(b)(d)(e i,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 i,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,
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:	

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	(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 C)

Assessment Outcome: Vulnerable under Clause 4.4(c)(d iii)

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: 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.

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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: 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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