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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 *Aggreflorum benwellii* (A.R.Bean) Peter G.Wilson as a CRITICALLY ENDANGERED SPECIES in Part 1 of Schedule 1 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 *Aggreflorum benwellii* (A.R.Bean) Peter G.Wilson 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 (2024), the NSW Threatened Species Scientific Committee has made a decision to list the species as Critically Endangered.

Summary of Conservation Assessment

Aggreflorum benwellii (A.R.Bean) Peter G.Wilson was found to be Critically Endangered in accordance with the following provisions in the *Biodiversity Conservation Regulation 2017*: Clause 4.3(a)(d)(e i,iii) because: 1) the species has a very highly restricted geographic distribution with an estimated area of occupancy and extent of occurrence of 4 km^2; 2) it is known from a single threat-defined location; and 3) there is an inferred continuing decline in the area, extent and quality of habitat and the number of mature individuals due to adverse fire regimes, increasing frequency and duration of drought due to climate change, and browsing by feral goats.

The NSW Threatened Species Scientific Committee has found that:

1. *Aggreflorum benwellii* (A.R.Bean) Peter G.Wilson (family Myrtaceae) is described by Bean (2004) as a “Spreading shrub to 3 m high; bark smooth and deciduous throughout, orange or green coloured, peeling in ribbons. Branchlets with conspicuous stem flanges, pubescence sparse and mainly on margins of stem flanges. Leaves alternate, subsessile, discolorous, narrowly elliptic, 18–25 x 2.7–5.0 mm, apex obtuse or mucronate, margins of young leaves with silky hairs, otherwise glabrous. Inflorescence axillary, comprising 1–3 bracteolate monads, floral bracts shed before anthesis. Flowers with pedicels *c*. 1.2 mm long at anthesis; hypanthium glabrous, *c*. 3 mm long, sepals obtuse, 1.2–1.4 mm long, inner and outer surfaces glabrous, margins ciliate; petals white, obovate to orbicular, 2.6–2.7 mm long, oil glands present. Stamens 1.5–2 mm long, anthers versatile, cells parallel; stigma capitate; roof of ovary glabrous. Ovary three locular. Fruit thin walled, campanulate to hemispherical, 2.5–3 mm long, 4–4.7 mm diameter, glabrous; sepals sparsely hairy, persistent. Seeds pale brown, obovoid to ellipsoidal, reticulate, 0.8–0.9 mm long.” The species was originally described as *Leptospermum benwellii* (Bean 2004), however in 2023 the species was transferred to genus *Aggreflorum* (Wilson and Heslewood 2023).

2. *Aggreflorum benwellii* is restricted to the Mount Munningyundo area in Nymboida National Park (NP), approximately 50 km west of Grafton in New South Wales

(NSW). The population consists of four subpopulations all within 2 km of each other.

3. *Aggreflorum benwellii* has a very highly restricted geographic distribution. The area of occupancy (AOO) is estimated to be 4 km^2 based on 2 x 2 km grid cells, the scale recommended by IUCN (2024). The extent of occurrence (EOO) is based on a minimum convex polygon enclosing all mapped occurrences of the species, the method of assessment recommended by IUCN (2024) and was estimated to be <4 km^2. However, where EOO is less than or equal to AOO, then IUCN (2024) recommend EOO estimates be changed to be equal to AOO to ensure consistency with the definition of AOO as an area that fits within EOO. Therefore, the EOO for *A. benwellii* is also estimated to be 4 km^2.

4. Prior to the 2019/20 fires, the total population of *Aggreflorum benwellii* was estimated to be 300–1000 plants, including 200–300 plants in the largest subpopulation (P. Croft pers. comm. June 2022 in Commonwealth DCCEEW 2024). Post-fire surveys in 2021 were conducted in two of the smaller subpopulations and found a total of 145 mature individuals remained between them (Eco Logical Australia 2021). The number of mature individuals at the largest subpopulation is uncertain as the site was not revisited in 2021, however there is estimated to be 63–188 mature individuals surviving (assuming pre-fire estimate of 250 and applying a 25–75% survival rate). The number of mature plants in the remaining subpopulation is unknown, although it is likely to be less than 250 based on the area of habitat it occupies. This means the current post-2019/20 population is estimated to consist of a minimum of approximately 210–330 mature individuals.

5. *Aggreflorum benwellii* has been recorded as occurring on steep slopes of acid volcanic rock. However, one occurence was recorded on a black metamorphic substrate. The species typically occurs in open shrubland communities and is often associated with stunted canopy species in the upper stratum. All occurrences within the Mount Munningyundo area are commonly associated with *Eucalyptus campanulata* and *E. notabilis* in the upper stratum, *Plectranthus graveolens*, *Acacia falciformis* and *Ozothamnus diosmifolius* in the mid storey stratum, and *Themeda triandra*, *Xanthorrhoea malacophylla* and *Stylidium laricifolium* in the understorey. Known populations occur at elevations of 900 to 1000 m above sea level.

6. *Aggreflorum benwellii* belongs to a group of non-woody fruited species (Wilson and Heslewood 2023). Fruits can last for up to six months on the parent plant and then shed all their seed before the next seasons' crop starts to form (G. Phillips pers. comm. October 2023 in Commonwealth DCCEEW 2024). The species is unlikely to have a long-persistent soil stored seedbank given the small, soft seeds and the lack of seed dormancy as indicated by germination trials (Australian Seed Bank Partnership 2007; G. Phillips pers. comm. October 2023 in Commonwealth DCCEEW 2024).

7. *Aggreflorum benwellii* can resprout from lignotubers and is expected to be able to fruit within 12 months of resprouting. Flowering has been recorded in November and it fruits from March to May (Bean 2004). It is likely that fruits and seeds of *A.*

benwellii within the canopy of shrubs at the time of a fire are killed (G. Phillips pers. comm. October 2023 in Commonwealth DCCEEW 2024). This, and an apparent lack of seed dormancy may explain a lack of seedling recruitment following the 2019–20 bushfires at all surveyed subpopulations. Kubiak (2009) found that in *Gaudium trinervium*, a related species with similarly thin-walled fruits, seedlings emerged 126 weeks post fire following flowering at 17–32 weeks post-fire and fruit production at 37 weeks post-fire, and similarly delayed seedling emergence may also occur in *A. benwellii.*

8. The primary threat to *Aggreflorum benwellii* is adverse fire regimes. High fire frequency that kills seedlings before they can mature or exhaust the ability of mature plants to resprout is one of the most significant threats to *A. benwellii*. Increased frequency and duration of drought due to climate change, infection by myrtle rust, and browsing by feral goats (*Capra hircus*) are also recognised as threats to the species. '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', 'Introduction and establishment of exotic rust fungi of the order Pucciniales pathogenic on plants of the family Myrtaceae', and 'Competition and habitat degradation by feral goats, *Capra hircus*' are listed as Key Threatening Processes under the Act.

9. *Aggreflorum benwellii* is known from one threat-defined location based on the threat of high fire frequency. The 2019–20 bushfires burnt both surveyed occurences, and it is likely that the two unsurveyed populations were also affected by the same fire based on the species geographic distribution and fire mapping (NSW DPE 2022). All occurrences were also burnt in the three years prior to the 2019-20 bushfires (NSW DPE 2022), meaning the risk level of repeat fires is currently similar across all subpopulations.

10. Given an increased likelihood of high frequency and severity fire and drought projected under future climate change scenarios (Williamson *et al*. 2016; Ukkola *et al.* 2020; Abram *et al*. 2021), it is inferred that continuing decline will occur in the area, extent and quality of habitat and number of mature individuals of *Aggreflorum benwellii*. High fire frequency is likely to cause adult mortality, eliminate juvenile recruitment and affect the ongoing ability of adult plants to resprout. Rocky outcrops, such as where *A. benwellii* occurs, may act as refugia from fire due to a lack of continuous fuel. Although fire still occurs in these areas, both fire frequency and severity are likely to be minimised on rocky outcrops compared to surrounding vegetation (Clarke 2002). However, climate change driven shifts in temperature, rainfall and fire weather make it more likely that fire will penetrate these refugia. Although the species is resprouting following the 2019–20 fires, fruits and seeds of *A. benwellii* are destroyed by fire (G. Phillips pers. comm. October 2023 in Commonwealth DCCEEW 2024) and there will be population declines if burnt too frequently as no juvenile plants can reach fire resistance size and replace any adults that senesce. This may be evidenced by a lack of seedling recruitment after the 2019–20 bushfires observed during surveys in 2021, following on from fires in August 2016 and July 2019 that preceded the 2019/20 wildfires in the *A. benwellii* population (NSW DPE 2022).

11. Additionally, *Aggreflorum benwellii* and its habitat are susceptible to drought given the exposed, shallow skeletal soils which have little ability to retain moisture (Gerrard 2003). Very stunted plants were observed during post-fire surveys (Eco Logical Australia 2021), which may be attributed to soil characteristics, the natural habit of the species, or the impacts of the recent drought. There is evidence that, in rock outcrops, recovery from drought may be dominated by grasses and herbs which inhibit shrub recruitment (Benwell 2007). If browsing by pest herbivores also continues , it could compound the effect of droughts and fires by further inhibiting recruitment or placing further strain on drought stressed plants and drive continuing decline.

12. *Aggreflorum benwellii* (A.R.Bean) Peter G.Wilson Hill 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 4.3(a)(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: Critically Endangered under Clause 4.3(a)(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:				
		(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)(e i,ii A(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 Caroline Gross
Chairperson
NSW Threatened Species Scientific Committee

Supporting Documentation:

Commonwealth DCCEEW (Department of Climate Change, Energy, the Environment and Water) (2024). Conservation Advice for *Leptospermum benwellii*. Australian Government, Canberra, ACT.

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