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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 *Acacia lanigera* var. *gracilipes* Benth. as an ENDANGERED SPECIES in Part 2 of Schedule 1 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 *Acacia lanigera* var. *gracilipes* 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

Acacia lanigera var. *gracilipes* Benth. 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) the geographic distribution of *Acacia lanigera* var. *gracilipes* Benth. is highly restricted with an Extent of Occurrence (EOO) of 1,720 km² and an Area of Occupancy (AOO) of 40 km²; 2) it is known from a single threat-defined location; and 3) there is an inferred continuing decline in the EOO, AOO, the area, extent and quality of habitat, the number of locations and subpopulations, and the number of mature individuals due to adverse fire regimes, increased frequency of droughts due to climate change, and erosion associated with riparian flooding, extreme weather events or landslips.

The NSW Threatened Species Scientific Committee has found that:

1. *Acacia lanigera* var. *gracilipes* Benth. (Fabaceae) is a rigid shrub growing 1–2 m high. Branchlets are densely hairy, and phyllodes (leaf-like structures) are 3.5–4 cm long and 3–4 mm wide (VicFlora 2017). Phyllodes tend to be elliptical in shape, taper to a point in a gradual or sharp manner, and have a gland either at, or close to the base of the phyllode (Maslin 2001; VicFlora 2017; PlantNET 2021a). Peduncles (flower stalks) are smooth, without hairs, and are 6–9 mm long. Flower heads are spherical in shape, measure at approximately 5 mm in diameter, and are golden in colour (Maslin 2001). *Acacia lanigera* var. *gracilipes* can be distinguished from *A. lanigera* var. *lanigera* by its longer peduncles and lack of woolly hairs (PlantNET 2021b).
2. *Acacia lanigera* var. *gracilipes* occurs in the far south-east of Australia, across the border of New South Wales (NSW) and Victoria. The variety has been recorded along the Wallagaraugh River in NSW, and along the Genoa River and near Mountain Creek south of Mt Deddick in Victoria (DELWP 2021; PlantNET 2021a). *Acacia lanigera* var. *gracilipes* was known from eight sites prior to the 2019-20 bushfires (DPE 2021; RBGV 2022). Following the 2019-20 bushfires, four sites have been confirmed to be extant, two were found to have no plants present but

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may persist in the soil seedbank (DPE 2021; RBGV 2022), and two have not been surveyed.

3. *Acacia lanigera* var. *gracilipes* has a highly restricted distribution. The Extent of Occurrence (EOO) is estimated to be 1,720 km² based on a minimum convex hull polygon encompassing all cleaned records of the species, as recommended by IUCN (2022). The Area of Occupancy (AOO) is estimated to be 40 km² based on 2 x 2 km grid cells, the scale recommended for assessing AOO by IUCN (2022).
4. The estimated number of mature individuals of *Acacia lanigera* var. *gracilipes* is 656 based on surveys following the 2019-20 bushfires. The surveys showed that four sites contained about 26 mature *A. lanigera* var. *gracilipes*, only one of which occurred in NSW (DPE 2021; RBGV 2022). Approximately 900 seedlings (400 in NSW) were recorded across the four extant sites. Applying a natural attrition rate of 30%, the total number of seedlings predicted to reach reproductive maturity is 630.
5. *Acacia lanigera* var. *gracilipes* typically grows amongst granite boulders within shrublands or open forest (Maslin 2001; VicFlora 2017) where it forms part of the shrubby understorey (DEE 2016). NSW subpopulations of *A. lanigera* var. *gracilipes* grow in granite-derived sandy loams. These soils are usually nutrient limited, with low clay content and elevated water conductivity (Huang and Hartemink 2020). There is some evidence that the fire history in south-eastern Australia has resulted in a shift in habitats that *A. lanigera* var. *gracilipes* now occupies. Surveys following the 2019-20 bushfires revealed that the variety is now mostly confined to riparian areas (DELWP pers. comm. July 2021; DPE 2021), which are often characterised by the presence of boulders and large rocky shelves that transect the watercourse (RBGV pers. comm. June 2021; Tolsma *et al.* 2022). However, it is thought that this apparent preference of *A. lanigera* var. *gracilipes* for riparian areas is a product of the region's more recent fire history, and not any specific ecological requirements sought by the variety (D. Cheal pers. comm. July 2021). The variety is believed to be sensitive to fire, so the current distribution of subpopulations within mostly riparian areas is a reflection of the variety's intolerance to historic fire regimes as opposed to its lack of capacity to establish in upslope forest habitats (DELWP pers. comm. July 2021). Rocky riparian habitats are thought to provide some degree of protection against bushfires, and it is considered unlikely that the variety has any dependence on soil moisture as an ecological requirement (D. Cheal pers. comm. July 2021).
6. *Acacia lanigera* var. *gracilipes* flowers from August to September (VicFlora 2017a). Pollination is likely carried out by generalist insects and other invertebrates, as documented in other *Acacia* species (Falster *et al.* 2021). Birds may also serve as pollinators for the variety (Gibson *et al.* 2011), and are known to frequent other acacias (Stone *et al.* 2003). *Acacia lanigera* is known to have seeds with elaiosomes which increases the likelihood of ant dispersal (Berg 1975; Lengyel *et al.* 2010). The age of maturity in *A. lanigera* var. *gracilipes* is estimated at about 5–7 years, after which the plant is capable of flowering and setting seed (DELWP 2021). Plant longevity is thought to be a minimum of 50 years, derived from the closely related *A. lanigera* var. *whanii* (DELWP 2021; DELWP pers. comm. July 2021). Maturation of seeds occurs en masse and seed longevity is considered to

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be relatively prolonged within the soil seedbank (White *et al.* 2020 cited in Falster *et al.* 2021).

7. Surveys conducted following the 2019-20 bushfires revealed that *Acacia lanigera* var. *gracilipes* is capable of resprouting (DELWP pers. comm. July 2021). Regeneration after low fire severity was observed in resprouting adult plants within the subpopulation situated near Wangarabell, Vic (DELWP pers. comm. 2021). However, the variety is thought to have low resprouting potential (D. Cheal pers. comm. July 2021), and may only be capable of resprouting under low to moderate fire severity. High-severity fires will kill adult *A. lanigera* var. *gracilipes* plants (DPE 2021; RBGV 2021), leaving only the seed bank to provide regeneration.
8. The main threats to the persistence of *Acacia lanigera* var. *gracilipes* include adverse fire regimes; increased frequency of drought due to climate change; and erosion associated with riparian flooding, extreme weather events or landslips. '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 listed as Key Threatening Processes under the Act.
9. *Acacia lanigera* var. *gracilipes* occurs at one threat-defined location based on the most serious plausible threat of adverse fire regimes. The unprecedented size of the 2019-20 bushfires and the immense scale of their effects (Gallagher *et al.* 2021) provide evidence that a single fire could act upon all sites of the taxon. This is supported by post-fire surveys which found that all visited subpopulations of *A. lanigera* var. *gracilipes* were burnt during the 2019-20 fires.
10. Adverse fire regimes are inferred to be causing continuing declines in the EOO, AOO, quality of habitat, number of subpopulations, and the number of mature individuals for *Acacia lanigera* var. *gracilipes*. High frequency fires can kill seedlings before they reach reproductive maturity (in addition to killing mature plants), which limits seed production and potential for recruitment (Keith 2012; A. Tolsma pers. comm. July 2021). Low frequency fires could also pose a threat to *A. lanigera* var. *gracilipes* if recruitment is limited in the absence of fire. A lack of fire may reduce germination, leading to the senescence of mature plants without further recruitment. High severity fires pose a risk to the variety's ability to recover post-fire as they kill adult plants and can damage the soil seed bank (Auld and Bradstock 1996; Bowman *et al.* 2009). The variety may also be sensitive to the radiant heat produced by a bushfire, as many adult plants were observed dead along riparian habitat without any evidence of the plants having been burnt (RBGV pers. comm. June 2021; DELWP 2021). Increasing average temperatures associated with climate change are also expected to influence fire danger and the length of the fire season in eastern Australia with a predicted increase in the frequency and severity of bushfires, and the number of days with high fire danger (CSIRO and BOM 2015; CSIRO and BOM 2020).
11. Climate change is predicted to increase the frequency of extreme temperatures, droughts and fire danger weather, and changes in precipitation, and is inferred to contribute to continued declines in the EOO, AOO, quality of habitat, number of subpopulations, and the number of mature individuals for *Acacia lanigera* var. *gracilipes*. Prolonged drought and below average precipitation are predicted to

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cause considerable hydraulic stress to *A. lanigera* var. *gracilipes*, with adult plant mortality likely during extended drought events (DELWP pers. comm. July 2021). Seedlings may be particularly vulnerable during periods of increasing drought frequency (Wujeska-Klaue *et al.* 2015). Death of seedlings due to drought-related stress can jeopardise seed production by decreasing the addition of mature individuals to the population, which could in turn result in the broadscale failure of recruitment (DELWP pers. comm. July 2021).

12. Erosion is inferred to be contributing to continuing declines in the quality of habitat and the number of mature individuals for *Acacia lanigera* var. *gracilipes*. Potential for erosion was noted within all Victorian subpopulations of *A. lanigera* var. *gracilipes* (RBGV 2021; DPE 2021), as they occur along or near rivers, often among sloping riparian habitats where riverbank erosion is likely to channel water into the waterway after rainfall events. Plants may also be uprooted and displaced by floodwaters during high-intensity flood events. The 2019-20 bushfires were followed by severe flooding events in February 2020. Extremely dense ash and sediment loads within the fire's path washed into surrounding streams, resulting in the slugging of waterways (Ward *et al.* 2022). These flood events also accelerated the erosion of riverbanks and riparian areas, as high-severity bushfires consume the upper protective soil/leaf litter layer and change the properties of the soil itself so that it becomes water-repellent (Robichaud *et al.* 2009). Increased erosion and sedimentation of *A. lanigera* var. *gracilipes* habitat (now almost exclusively riparian) may have further degraded the habitat quality, and challenged the species' ability to persist post-fire.
13. *Acacia lanigera* var. *gracilipes* Benth. is not eligible to be listed as a Critically Endangered species.
14. *Acacia lanigera* var. *gracilipes* Benth. 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.

(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:			

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	(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)

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: Data Deficient.

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	

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		(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: 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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Senior Professor Kristine French
Chairperson
NSW Threatened Species Scientific Committee

Supporting Documentation:

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