

## Notice 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 the tree *Eucalyptus canobolensis* (L.A.S.Johnson & K.D.Hill) J.T.Hunter as an ENDANGERED SPECIES in Part 2 of Schedule 1 of the Act and, as a consequence, to omit reference to *Eucalyptus canobolensis* (L.A.S.Johnson & K.D.Hill) J.T.Hunter in Part 3 of Schedule 1 (Vulnerable species) of the Act. Listing of Endangered species is provided for by Part 4 of the Act.

### Summary of Conservation Assessment

*Eucalyptus canobolensis* (L.A.S.Johnson & K.D.Hill) J.T.Hunter was found to be Endangered in accordance with the following provisions in the *Biodiversity Conservation Regulation 2017*: Clause 4.2 (1) (b) (2) (c) and Clause 4.3 (b) (d) (e iii) because: i) the species has undergone a large reduction in population size based on a decline in geographic distribution in the last three generations; ii) the geographic distribution of the species is highly restricted; iii) the species is known from a small number of locations and iv) there is a continuing decline in the habitat quality of the species.

The NSW Threatened Species Scientific Committee has found that:

1. *Eucalyptus canobolensis* (L.A.S.Johnson & K.D.Hill) J.T.Hunter is described in the New South Wales (NSW) Flora Online (PlantNet, accessed March 2022) as a "Tree 8–12, rarely to 18 m high; bark smooth to base, shedding in ribbons. Juvenile leaves opposite, broad-ovate to orbiculate, glaucous. Adult leaves disjunct, lanceolate, mostly 10–18 cm long, 1.5–3.5 cm wide, green or grey-green, dull, concolorous. Umbellasters 3-flowered; peduncle distinctly flattened, 6–9 mm long; pedicels absent. Buds ovoid, glaucous or pruinose, 5–9 mm long, 3–5 mm diam., scar present; calyptra conical or hemispherical, slightly shorter than and as wide as hypanthium. Fruit cup-shaped, 5–9 mm long, 6–8 mm diam.; disc flat; valves exserted."
2. *Eucalyptus canobolensis* is endemic to NSW being restricted to high altitude areas around Mount Canobolas southwest of Orange in the Central Tablelands region. The species dominates parts of the Mount Canobolas State Conservation Area (MCSCA) with mixed aged stands occurring predominantly on basalt-derived soils above 1000 m altitude and being most common between 1200 to 1300 m, however plants are also found at elevations as low as 900 m (Hunter 1998a; NSW OEH 2019; Zimmer *et al.* 2021). *Eucalyptus canobolensis* often co-occurs with other eucalypts such as *E. pauciflora*, *E. dalrympleana*, *E. viminalis*, *E. macrorhyncha* and *E. dives* with *Exocarpos cupressiformis* and *Acacia melanoxylon* also in the canopy (Hunter 1998a; Scott 2012; R. Stapleton *in litt.* September 2022). The shrub layer under *E. canobolensis* often contains *Acacia dealbata*, *Cassinia longifolia*, *C. sifton* and *Pultenaea spinosa*, with the groundcover containing *Hibbertia obtusifolia*, *Cynoglossum australe*, *Acaena novae-zelandiae*, *Geranium*

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*solanderi* var. *solanderi*, *Bossiaea buxifolia*, *Viola betonicifolia*, *Hydrocotyle laxiflora*, *Stellaria pungens*, *Gonocarpus elatus*, *Glycine clandestina*, *Hardenbergia violacea*, *Senecio bathurstianus*, *S. quadridentatus*, *Poa labillardierei*, *P. sieberiana*, *Rytidosperma erianthum*, *R. racemosum* and *Urtica incisa* (R. Stapleton *in litt.* September 2022).

3. The geographic distribution of *Eucalyptus canobolensis* is highly restricted. The Extent of Occurrence (EOO) was estimated to be 171 km<sup>2</sup> based on a minimum convex polygon enclosing all accepted occurrences of the species, the method of assessment recommended by IUCN (2019). The Area of Occupancy (AOO) was estimated to be 104 km<sup>2</sup> based on a 2 x 2 km grid, the scale recommended by IUCN (2019).
4. Current population estimates vary, however it is reasonable to assume the population of *Eucalyptus canobolensis* is greater than 10,000 and possibly as high as 60,000 mature individuals, given the dominance of the species across the MCSCA (Hunter 1998b, Scott 2012).
5. *Eucalyptus canobolensis* is a long-lived tree with a generation length likely similar to other eucalypts of similar size, being approximately 70 years (Fensham *et al.* 2020). Larger trees are able to resprout both basally and epicormically in response to fire, although smaller trees resprout from the base only (Zimmer *et al.* 2021). Seedling growth and survival also appears to be linked to fire, with seedling density found to increase with increasing fire severity. Zimmer *et al.* (2021) found the highest densities of seedlings in plots burnt at extreme severity, while no seedlings were recorded in unburnt plots. Seedling density also decreased with increasing groundcover, including invasive weeds such as blackberry (*Rubus fruticosus* species complex) (Zimmer *et al.* 2021).
6. The main threats to *Eucalyptus canobolensis* include loss of habitat through land clearing and increases in blackberry infestations in the area, which interact with fire to reduce recruitment potential in post-fire landscapes. 'Clearing of native vegetation' and 'High frequency fire resulting in the disruption of life cycle processes in plants and animals and loss of vegetation structure and composition' are listed in the Act as Key Threatening Processes.
7. *Eucalyptus canobolensis* has suffered considerable range contraction as a result of past clearing of habitat. Much of the land above 900 m altitude within a 14 km radius of the Mount Canobolas summit (the distance to the furthest confirmed extant record) is currently used for native production forestry, softwood (pine) plantation forestry and agriculture. Within this radius there are c. 24,000 ha of land above 900 m elevation, of which 1,672 ha is the NSW National Parks and Wildlife Service-managed MCSCA. Production forestry makes up much of the rest of the mountain's slopes, most of which is softwood *Pinus radiata* plantations within Canobolas and Glenwood State Forests, with the remainder mostly used for agriculture and a small amount for mining. The plantation forests occupy a combined area of c. 10,200 ha above the 900m contour, or about 42% of the area. Although it is unlikely that *Eucalyptus canobolensis* occurred at similar densities down to the 900 m contour in the past, it is highly likely that a substantial reduction

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in area of occurrence, available habitat and number of mature individuals has occurred due to this change in land use and associated clearing within 3 generations in a long-lived eucalypt, as this would predate European settlement in the region (Fensham *et al.* 2020).

8. Continuing decline is inferred in the quality of remaining *Eucalyptus canobolensis* habitat as a result of large infestations of blackberry and increasing blackberry density in areas of unmanaged habitat around Mount Canobolas (Hunter 2000). The development of blackberry thickets contributes to flammability of habitat (NSW DPI 2019) and suppresses eucalypt seedling recruitment in post-fire landscapes as thickets rapidly re-establish pre-fire groundcover even after high fire intensities which would otherwise promote *E. canobolensis* germination (Ainsworth and Mahr 2006; NSW DPI 2019; Zimmer *et al.* 2021). Through these interactions with fire, the continued spread of blackberry is inferred to contribute to ongoing reduction in habitat quality for *E. canobolensis* as it reduces the recruitment potential of the eucalypt when fires do occur, as well as increasing the chance of fires killing young trees that are not yet able to reshoot epicormically, affecting the long-term viability of stands (Zimmer *et al.* 2021).
9. *Eucalyptus canobolensis* (L.A.S.Johnson & K.D.Hill) J.T.Hunter is not eligible to be listed as a Critically Endangered species.
10. *Eucalyptus canobolensis* (L.A.S.Johnson & K.D.Hill) J.T.Hunter 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 4.2 (1) (b) (2) (c) and 4.3 (b) (d) (e iii).**

**Clause 4.2 – Reduction in population size of species  
(Equivalent to IUCN criterion A)**

**Assessment Outcome: Endangered under Clause 4.2 (1)(b)(2)(c).**

<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,	

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	(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 iii).**

<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,
		(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 C)**

**Assessment Outcome: Clause not met**

<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,

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	(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: Clause not met**

<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)**

**Assessment Outcome: Data deficient**

<b>The probability of extinction of the species is estimated to be:</b>			
	(a)	for critically endangered species	extremely high, or
	(b)	for endangered species	very high, or
	(c)	for vulnerable species	high.

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## Clause 4.7 - Very highly restricted geographic distribution of species–vulnerable species

(Equivalent to IUCN criterion D2)

Assessment Outcome: Clause 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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Professor Kristine French  
Chairperson  
NSW Threatened Species Scientific Committee

### Supporting Documentation:

Phillips GP and Zimmer H. (2022) Conservation Assessment of *Eucalyptus canobolensis* (L.A.S.Johnson & K.D.Hill) J.T.Hunter (Myrtaceae). NSW Threatened Species Scientific Committee.

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