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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 the tree *Callitris oblonga* subsp. *parva* K.D.Hill as a CRITICALLY ENDANGERED SPECIES in Part 1 of Schedule 1 of the Act and, as a consequence, to omit reference to *Callitris oblonga* A.Rich. & Rich. from Part 3 of Schedule 1 (Vulnerable Species) of the Act. Listing of Critically Endangered species is provided for by Part 4 of the Act.

Summary of Conservation Assessment

Callitris oblonga subsp. *parva* K.D.Hill was found to be Critically Endangered in accordance with the following provisions in the *Biodiversity Conservation Regulation 2017*: Clause 4.2(1 a)(2 a,b) because: (1) the taxon has suffered an estimated reduction in the number of mature individuals of approximately 89% since 1990 and this reduction is projected to continue across a three-generation timeframe of 72 years (1990-2062); and (2) this reduction has occurred due to adverse fire regimes, particularly increasingly frequent occurrences of severe wildfire.

The NSW Threatened Species Scientific Committee has found that:

1. *Callitris oblonga* subsp. *parva* K.D.Hill is a small tree or shrub to 5 m tall. Branches dense, erect. Leaves c. 4 mm long on ultimate branchlets, dark green; dorsal surface prominently but not acutely keeled. Male cones solitary or in clusters of 2–5, ovoid, to 2 mm long. Female cones usually clustered, sessile or on short, thick fruiting branchlets, ovoid, 12–15 mm long, 10–14 mm diam., distinctly longer than broad, persistent and holding seeds for several years after maturity; cone scales 6 (rarely 8 on fruiting juvenile branches), thick, with a short, thickened dorsal point near or at the apex, separating almost to the base, incurved after opening; alternate scales reduced, about two-thirds as long as intervening scales; larger scales tapered; columella narrow, entire, 3-lobed, 1–3 mm high. Seeds numerous, dark brown; wings 2 or 3, c. 2 mm wide (Hill 1998).
2. *Callitris oblonga* subsp. *parva* is an uncommon taxon with a sporadic and highly localised distribution along the eastern fringe of the NSW Northern Tablelands (Hill 1998). It is currently known from the Boonoo Boonoo River, Basket Swamp Creek and Wellingtons Creek in the Boonoo Boonoo area northeast of Tenterfield, the Sara River and Backwater Creek near Backwater, Marengo Creek north of Ebor, Bullock Creek, Serpentine Creek and Sandy Creek in the Snowy Range southeast of Ebor and the upper Hastings River east of Walcha (Nadolny and Benson 1993; Hunter 2020; Greenloaning Biostudies 2022). This scattered distribution is thought to indicate *C. oblonga* subsp. *parva* may be a relict taxon with a previously more widespread distribution (Nadolny and Benson 1993).
3. The population of *Callitris oblonga* subsp. *parva* consists of five subpopulations as defined by the IUCN (IUCN 2022). Conifers regularly exhibit long-distance gene flow through wind pollination, with some conifers having effective pollen dispersal of up to 30 km (Bagnoli *et al.* 2011). Seed dispersal, most likely by wind, has also been suggested to explain high gene flow over several kilometres in the related

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Callitris verrucosa (Dunker 2015). Coupled with the ability for *C. oblonga* seeds to be transported downstream by water flow (Brown 1990; DCCEEW 2023), this means sites either united by river catchments or within overland distances of up to 10 km, such as those at Boonoo Boonoo, Backwater, and the Snowy Range, can be linked as subpopulations likely to be experiencing regular gene flow. Isolated stands distant by more than 30 km from the next nearest, such as Marengo Creek and the Hastings River, are less likely to experience gene flow and are thus treated as distinct subpopulations.

4. The minimum estimated population size of *Callitris oblonga* subsp. *parva* prior to 2019 is 22,922 mature individuals. Following recent post-fire surveys, this number has reduced to an estimated 2,517 mature individuals, representing an overall population reduction of 89%. While recruitment is now underway within burnt subpopulations (A. Fawcett *in litt.* June 2023), recruitment is expected to be limited overall as there is evidence of extensive seedling losses at two sites. Over 600 seedlings recorded at the Hastings River in 2020 (Hunter 2020) and over 200 seedlings recorded at Bullock Creek in February 2021 (Phillips and Cohen 2021) were subsequently not found again in May 2021 (Greenloaning Biostudies 2022). This is in line with other recent survey findings for the related *C. oblonga* subsp. *corangensis* (G. Wright pers. comm. June 2023). This limited recruitment, as well as access limitations of surveys to date (Nadolny and Benson 1993; Hunter 2020; Greenloaning Biostudies 2022), means that the current estimate of 2,517 mature individuals is considered a conservative minimum population size.
5. The geographic distribution of *Callitris oblonga* subsp. *parva* is highly restricted. The Area of Occupancy (AOO) of *C. oblonga* subsp. *parva* is estimated to be 96 km² using 2 x 2 km grid cells, the scale recommended by IUCN (2022). The Extent of Occurrence (EOO) is estimated to be 6,184 km² and is based on a minimum convex polygon enclosing all mapped occurrences of the species, the method of assessment recommended by IUCN (2022).
6. When the threat of adverse fire regimes, especially increased frequency and severity of wildfires, is considered, the five subpopulations of *Callitris oblonga* subsp. *parva* can be treated as five threat-defined locations, as per the IUCN definition (IUCN 2022). This is due to the increased frequency and severity of wildfires being the most serious plausible threat that results in the lowest number of locations for the taxon. The large distances between these locations are significant enough that each is considered a geographically distinct area where a single fire event is unlikely to extend to any other location based on the fire history of the region, although each subpopulation is considered at equal risk of decline induced by repeat fire given all were affected to some extent in the 2019/20 fire season (NSW NPWS 2022).
7. *Callitris oblonga* subsp. *parva* is typically found along montane rivers and streams in shrublands, open woodlands and riparian heaths, although it can occupy drier sites on exposed ridges near to river bends, often some distance from the stream channel itself (Nadolny and Benson 1993; Hunter 1999; Greenloaning Biostudies

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- 2022). Quite often it is found at bends, pools or confluences in streams where the banks are gently sloping, and seed is more easily deposited with lower flow rates (Brown 1990). *Callitris oblonga* subsp. *parva* usually grows on alluvial, sandy soils on granite and metamorphic geologies, and can also grow in crevices on bare rock although it is often stunted in these cases (Brown 1990; Nadolny and Benson 1993). It appears to favour wetter, cool areas with average minimum winter temperatures approaching zero and an average annual rainfall 800–1,200 mm (Nadolny and Benson 1993).
8. Species that commonly co-occur with *C. oblonga* subsp. *parva* include *Eucalyptus nova-anglica*, *E. pauciflora*, *E. acaciiformis*, *Allocasuarina littoralis*, *Bursaria spinosa*, *Gleichenia dicarpa*, *Leptospermum polygalifolium*, *Epacris microphylla*, *Hakea microcarpa*, *Acacia rubida*, and *Lomandra longifolia* (Nadolny and Benson 1993; Phillips and Cohen 2021). The Plant Community Types (PCT) that *Callitris oblonga* subsp. *parva* has been recorded in include Eastern New England Granite Wet Heath (PCT 3934), Western New England Felsic Rock Shrubland (PCT 3828), Armidale Creekflat Snow Gum Woodland-Scrub (PCT 3351), Eastern New England Leucogranite Mallee Scrub (PCT 3827) and Eastern New England Ranges Blackbutt Forest (PCT 3501) (Hunter 1999, 2004, 2005; G. Phillips pers. obs. November 2021; Phillips and Cohen 2021; DPE 2022a, 2022b). However, *C. oblonga* subsp. *parva* may not be confined to these PCTs and may be found within other PCTs that occur in the area.
 9. *Callitris oblonga* subsp. *parva* is an obligate seeding species, with fire and floods causing documented plant mortality, and it is not known to reproduce vegetatively (Nadolny and Benson 1993; OEH 2021). Damage through grazing stimulates coppicing from the base (Nadolny and Benson 1993), and this may mean that large plants are able to survive lighter disturbances, with plant age and stem size determining the chance of survival.
 10. The species does not retain a soil seedbank. Seed is held in cones in the canopy for long periods and released once the limb holding the cones dies, typically following a major disturbance such as fire or flood (Nadolny and Benson 1993). The reduction of competition for the seedlings following fire or flood then allows mass recruitment, commonly resulting in thick, even-aged stands (Brown 1990; Hunter 2020).
 11. *Callitris oblonga* subsp. *parva* is moderately fast growing, with plants being reproductively mature at 1 m tall and two years of age (W. Sheather pers. comm. in Nadolny and Benson 1993). Studies have shown trees in the Sandy Creek site to be approximately 10–12 years of age at heights of 2–4 m and 20 years of age at 6 m, with tagged plants growing an average of 0.36 m per year (Nadolny and Benson 1993). The lifespan of *C. oblonga* subsp. *parva* is likely typically dictated by disturbance events; however, the maximum lifespan is considered similar to *C. oblonga* subsp. *oblonga*, which is estimated at approximately 70 years (Harris 1989). The generation length of *C. oblonga* subsp. *parva* is therefore estimated at approximately 24 years.
 12. The primary threat to *Callitris oblonga* subsp. *parva* is adverse fire regimes, in particular increased frequency of wildfires. This can eliminate or rapidly reduce the size of stands and has been the main driver of population reductions across the population to date (Nadolny and Benson 1993; Hunter 2020; Greenloaning

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Biostudies 2022) and climate change is expected to exacerbate this threat into the future. Additional identified threats include flooding, grazing by domestic stock, clearing for agriculture and infrastructure, competition from weeds, and damage from feral pigs (Nadolny and Benson 1993; Hunter 2020; Phillips and Cohen 2021; Greenloaning Biostudies 2022). 'High frequency fire resulting in the disruption of life cycle processes in plants and animals and loss of vegetation structure and composition', 'Anthropogenic Climate Change', 'Clearing of native vegetation' and 'Predation, habitat degradation, competition and disease transmission by Feral Pigs, *Sus scrofa* Linnaeus 1758' are listed as Key Threatening Processes under the Act.

13. *Callitris oblonga* subsp. *parva* is a relict species, occupying wet habitat along watercourses that provide refugia from fire (Nadolny and Benson 1993). However, since 1990, several separate fires have burnt through stands of *C. oblonga* subsp. *parva* (NSW NPWS 2022) and this is resulting in a decline in abundance and habitat extent and quality across all sites. Following major fires since 2019, abundances in individual sites where fires have occurred have decreased by 84–99%, with the overall population reduction due to fire since 1990 now estimated to be approximately 89% (Hunter 2020; Greenloaning Biostudies 2022). Although limited recruitment is underway in some stands (A. Fawcett *in litt.* June 2023, pers. comm. July 2023), recruitment failure is apparent in some subpopulations and declines in surviving plants are continuing year on year due to continuing ill health of plants and the additional effects of flooding, grazing of domestic stock, clearing for agriculture and competition from weeds (Hunter 2020; Dakin 2021; G. Phillips pers. obs. November 2021; Greenloaning Biostudies 2022). As regeneration has not been observed in more intensely managed agricultural areas (G. Phillips pers. obs. November 2021) and fires are becoming more frequent in the habitat of *C. oblonga* subsp. *parva*, the estimated population reductions are considered to be irreversible and have not ceased.
14. At Hastings River, the rate of decline between 1990-2019 was 83%. This subpopulation has been regularly surveyed in this timeframe, documenting the effects of a single intense fire that burnt the population in 1994 and the subsequent 25 years of recovery. The decline of 99% following the 2020 fire at this site can be considered a genuine reduction in the number of mature individuals rather than a demographic fluctuation. A low recruitment rate of similar proportion to 1994-2019 is expected to follow, and estimated reductions at other sites can also be considered genuine in the same manner. Given the New England Tableland region in which *C. oblonga* subsp. *parva* occurs is projected to become hotter, have fewer colder nights under 2°C annually, more hot days over 35°C annually, and an increase in average and severe fire weather by 2079 (CSIRO and BOM 2022; AdaptNSW 2023), it is highly plausible that more frequent fires driven by these changes in climate will impact the *C. oblonga* subsp. *parva* population in the future and exacerbate already estimated declines in the abundance of the taxon. Therefore, *C. oblonga* subsp. *parva* is estimated to have undergone a very large, irreversible reduction of 89% in the number of mature individuals since the earliest

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surveys in 1990, and this is projected to continue across a window spanning three generations (72 years) to 2062.

15. *Callitris oblonga* subsp. *parva* 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 4.2(1 a)(2 a,b).

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

Assessment Outcome: Critically Endangered under Clause 4.2(1 a)(2 a,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:		
(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,ii,iii)(f i)

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,	

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	(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: Vulnerable under Clause 4.4(c)(d i)(e i,ii C).

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: Clause not met.

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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.
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Supporting Documentation:

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