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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 *Sannantha whitei* 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 *Sannantha whitei* 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 DCCEEW (2024), the NSW Threatened Species Scientific Committee has made a decision to list the species as Critically Endangered.

Summary of Conservation Assessment

Sannantha whitei 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 iii) and Clause 4.5(a) because: 1) the species has a very highly restricted geographic distribution with an estimated Extent of Occurrence and Area of Occupancy of 4 km^2; 2) it is considered to be severely fragmented, and is known from a single threat-defined location; and 3) there is an observed and inferred continuing decline in the area, extent and quality of habitat due to weeds, increased fire frequency and severity, flooding and soil erosion due to climate change and invasive herbivores, and 4) the number of mature individuals is estimated to be 49.

The NSW Threatened Species Scientific Committee has found that:

1. *Sannantha whitei* Peter G.Wilson (family Myrtaceae) is described by Wilson and Heslewood (2014) as a “spreading shrub 0.6–1 m high. Bark grey, persistent, fibrous. Branchlets somewhat quadrangular, ± flanged (more conspicuously so on older branchlets), margins entire; oil glands present, not markedly papillose; colleters (very small stipule-like structures) often occur in the axils of leaves. Leaves petiolate; petiole 0.5–0.6 mm long; lamina narrowly elliptical to narrowly obovate, 2.7–4.0 mm long, 0.7–1.1 mm wide, ± concolorous, concavo-convex, not keeled, oil glands prominent, particularly on lower surface, midrib not visible, intramarginal vein not visible, apex shortly acuminate, ~0.1 mm long. Inflorescence axillary, 1–3-flowered; peduncles 1.2–3.5 mm long; pedicels 1.2–3.0 mm long; bracts caducous. Flowers 5-merous (rarely 4-merous); hypanthium smooth, glandular, obconical, 1.5–2.0 mm long, fused to the ovary throughout; sepals variable in size, up to ~0.5 x 1.2–1.3 mm; inner lobe (when developed) thin with irregular margins; outer lobe rudimentary or sometimes well developed, 0.2–0.5 mm long. Corolla 6.0–8.0 mm across; petals broadly suborbicular, 2.2–3.0 x 2.1–2.9 mm, white, oil glands present, margins somewhat irregular. Stamens (5–)6–8, in groups of 1 or 2 opposite the calyx lobes but towards their margins; filaments terete, 0.8–1.0 mm long, geniculate, with brown connective gland fused to upper part of filament at the bend; anthers adnate, dehiscing by pores, with loculi fused. Style terete, up to 1.0 mm long after anthesis, set into a pit on the ovary

summit; stigma broadly capitate, ~0.5 mm wide. Ovary 3-locular; ovules 11–15 per loculus, arranged radially around placenta attached towards the base of the ovary. Fruit hemispherical, 1.0–1.8 x 1.8–2.4 mm, valves at rim level or slightly exserted. Seeds D-shaped, 0.5–0.7 mm long, brown, with flat sides and rounded backs, minutely reticulate."

2. *Sannantha whitei* is known only from the Goonoowigall State Conservation Area (SCA), southeast of Inverell in northern NSW and occurs where the country of the Kamilaroi, the Jukambul, and the Anaiwan people meet (AIATSIS 1996; NSW NPWS 2020). The species is believed to be restricted to a single population consisting of approximately three patches of plants, spread over roughly 100 m, including one patch newly located during surveys in 2021 (Croft 2021).

3. *Sannantha whitei* has a very highly restricted geographic distribution. The area of occupancy (AOO) is estimated to be 4 km^2 based on the species occupying a single (2 x 2 km) grid cell, the scale recommended for assessing the area of occupancy by IUCN (2022). The extent of occurrence (EOO) is reported as equal to AOO (4 km^2), on the basis that the EOO cannot be smaller than AOO as per the IUCN (2022) definition.

4. *Sannantha whitei* habitat consists of largely damp areas near drainage lines or creeks. It is found in sandy alluvial soils derived from granite, often associated with large granite boulders and rocky outcrops (Wilson and Heslewood 2014). The soils in Goonoowigall SCA are classified as Tenosols (Australian Soil Classification; DPE 2023) and have high sand and gravel content, low fertility, are erodible and have a low water holding capacity (NSW NPWS 2020). The vegetation is described as woodland dominated by *Eucalyptus prava* and *Callitris endlicheri* (Wilson and Heslewood 2014), with other associated species including *E. dealbata*, *Angophora* sp. and *Acacia* sp. with a grassy understory (Croft 2021).

5. *The population of Sannantha whitei* is likely to be severely fragmented as it is known from a single population comprising a small number of mature individuals. The total number of mature individuals of *Sannantha whitei* is estimated to be 49. Prior to the 2019–20 bushfires, population size was unknown, recorded only as "localised" or "locally common". Surveys following the 2019–20 bushfires confirmed the persistence of the species in the easternmost patch and identified a new patch 40 m to the west, however, no plants or seedlings could be located at the westernmost patch (Croft 2021). It is uncertain whether this is due to genuine loss of individuals after fire or spatial uncertainty as given the proximity of patches, it is possible the westernmost and newest patches are one and the same, falling within the error bounds for the accuracy of the 2013 record of the westernmost patch. Post-fire surveys found 49 plants resprouting. This may represent 100% of the pre-fire population in these patches as no dead plants could be identified.

6. Flowering of *Sannantha whitei* occurs from summer to autumn (Wilson and Heslewood 2014). Pollinators are unknown but are likely non-specialised and include insects and birds given the flower morphology (Wilson and Heslewood 2014). Seeds are small and likely non-dormant as in other *Sannantha* species (Australian Seed Bank Partnership 2022). Seeds may be held in the canopy and dispersed via wind as noted for other *Sannantha* species (Falster *et al.* 2021). The

association with alluvial sands at sites and observations of sediment deposition on some resprouting plants following flooding (Croft 2021) may indicate that the occurrence of the species in the area is a consequence of dispersal via flood waters. This could occur via secondary dispersal of seed or dispersal of lignotubers from which plants were able to establish after being caught in the lee of the boulders. If seeds are non-dormant then it is unlikely they form a long-lived soil stored seed bank, which may be supported by the absence of any seedlings observed following the 2019–20 bushfires (Croft 2021).

7. The primary juvenile period for *Sannantha whitei* is unknown. The secondary juvenile period is also unknown but the absence of any buds or flowers in August 2021 (Croft 2021), approximately 17 months post-fire, suggests it is at least two years. *Sannantha* species are often long-lived with an estimated lifespan of up to 50 years (Falster *et al.* 2021).

8. *Sannantha whitei* has been observed to vigorously resprout from lignotubers following severe fire (Croft 2021) and so is likely a facultative seeder. Resprouting is also likely beneficial for the species' persistence in the riparian zone in response to periodic flooding. The species' preference for damp areas and rocky outcrops may suggest that the species is sensitive to drought or fire, as these areas may act as refugia during drought or fire events, or may indicate a legacy of prior land clearing which has restricted the species to less accessible terrain in the riparian zone.

9. The main threats to *Sannantha whitei* include flooding, soil erosion, and increased fire frequency and severity due to climate change, weed invasion, and invasive herbivores. 'Anthropogenic climate change', 'High frequency fire resulting in the disruption of life cycle processes in plants and animals and loss of vegetation structure and competition', 'Invasion of native plant communities by exotic perennial grasses', 'loss and degradation of native plant and animal habitat by invasion of escaped garden plants, including aquatic plants', 'Competition and grazing by the feral European rabbit, *Oryctolagus cuniculus*', 'Competition and habitat degradation by feral goats, *Capra hircus*' and 'Predation, habitat degradation, competition and disease transmission by feral pigs, *Sus scrofa*' are listed as Key Threatening Processes under the Act.

10. *Sannantha whitei* is known from one threat-defined location. This definition of location is based on the fact that the entire population may be rapidly affected by any of the most serious plausible threats such as a severe flooding event or high frequency fire.

11. Changes in precipitation patterns due to climate change are expected to increase the risk of flooding and soil erosion across the region where *Sannantha whitei* occurs, contributing to continued declines in the extent, area and quality of habitat. *Sannantha whitei* occurs in riparian areas and near waterways which places it at risk from floods. Flooding was recorded at Inverell in 2020 and 2021 and may have contributed to recruitment failure. Observations of sediment and flood debris deposited on resprouting individuals following the 2019–20 bushfires (Croft 2021) indicate that post-fire flooding may be responsible for the absence of seedlings observed after the fires. Post-fire flooding can scour the soil seed bank, uproot

plants and kill or bury seedlings (Petit and Naiman 2007). More frequent extreme weather events such as heavy downpours are a major cause of soil erosion due to the soil not absorbing the large amounts of water leading to water flows across the surface taking a layer of topsoil with it. Steep terrain has a higher risk of rainfall erosion in comparison to flat terrain, and results in loss of the finest soil particles that contain most of the available nutrients and organic matter in the soil. Hillslope erosion in the New England and North West regions is predicted to increase by 4–17% in the next 60 years (AdaptNSW 2015).

12. Increased frequency and severity of fires due to climate change is inferred to be contributing to continuing decline in the extent, area and quality of habitat for *Sannantha whitei*. Severe fires that can kill mature individuals are the primary threat posed by fire to this species. The 2019–20 bushfires burnt the *S. whitei* population at high severity and while the species was observed to resprout vigorously in some patches occupied (Croft 2021) no seedlings were located across the burnt area. Although the species may be able to resprout after further high severity fires, carbohydrate reserves in the lignotuber may become progressively depleted, particularly if fires occur more frequently into the future. Fire history records indicate that the species may not have been affected by high fire frequency in the past (NSW DPIE 2022). However, severe fire weather is expected to increase during summer and spring by 2070 (AdaptNSW 2022), suggesting high fire frequency may become a threat in the future. Repeated burns may eventually exhaust the species' ability to resprout, however, the number and frequency of fires required is unknown. Additionally, if the population is burnt too frequently before juvenile plants can reach fire resistance size and replace any adults that die or replenish the canopy seed bank it may also lead to overall population decline. The interaction between fire and climate change, soil erosion, and weeds may exacerbate these threats leading to further reductions in habitat quality.

13. Invasive weeds have been observed to be contributing to continuing decline in the area, extent and quality of habitat of *Sannantha whitei*. Weeds can invade, establish in, and outcompete native vegetation, particularly following disturbance events such as fires (Brown *et al*. 2016), reducing recruitment success. Exotic perennial grasses are a noted threat in the SCA, particularly Coolatai grass (*Hyparrhenia hirta*) (NSW NPWS 2020) which was observed across the population during post-fire surveys (Croft 2021). Other weeds that may adversely affect the species and which are known to occur in Goonoowigall SCA include blackberry (*Rubus fruticosus* agg.), mother-of-millions (*Bryophyllum* sp.), prickly pear (*Opuntia* sp.) and tree of heaven (*Ailanthus altissima)* (NSW NPWS 2020).

14. Disturbance by invasive herbivores is inferred to be contributing to continuing decline in the area, extent and quality of habitat of *Sannantha whitei*. Browsing and habitat degradation by goats (*Capra hircus*) is a known threat to other plant species in the region and may adversely affect *S. whitei* (NSW NPWS 2020). Feral pigs (*Sus scrofa*) and rabbits (*Oryctolagus cuniculusi*) also occur in the SCA, and may threaten the species through habitat degradation and disturbance (NSW NPWS 2020). No browsing was observed during recent surveys (Croft 2021).

15. *Sannantha whitei* Peter G.Wilson 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 iii) and Clause 4.5 (a)

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 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: 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			
		(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: Critically Endangered under Clause 4.5(a)

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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