

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 shrub *Pittosporum kororoense* Benwell 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.

This species is currently provisionally listed as a Critically Endangered species under the previous name of *Pittosporum* sp. Coffs Harbour (A.S.Benwell 342, NSW1102028).

Summary of Conservation Assessment

Pittosporum kororoense Benwell 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,iv) and Clause 4.4(a)(d(i))(e(i,iiB)). The main reasons for this species being eligible are: i) it has a very highly restricted geographic range, ii) its population is severely fragmented, iii) it has a very low number of mature individuals, (iv) there is observed and inferred continuing decline and v) all mature individuals of the species occur within one population.

The NSW Threatened Species Scientific Committee has found that:

1. *Pittosporum kororoense* Benwell is a recently described species from the New South Wales mid-north coast. *Pittosporum kororoense* Benwell has previously been referred to as '*Pittosporum* sp. Coffs Harbour (A.S.Benwell 342, NSW1102028)'. *Pittosporum kororoense* is distinct from other known *Pittosporum* species (Makinson *in litt.* October 2021; Cayzer *in litt.* November 2021; Benwell 2023). A genomic study has also supported *P. kororoense* Benwell as a new species (ReCER 2021).
2. *Pittosporum kororoense* Benwell is described as a "shrub to 1.2 m high, single-stemmed, rhizomatous, often growing in dense, clonal patches 1–4 metres diameter, sometimes in small aggregations (<10 stems), rarely as a lone stem; stems arising from horizontal roots. Stems with grey-brown bark, knobbly with many petiole/branchlet scars and short, smooth sections; branching verticillate, bi- or trifurcate, ascending; twiglets brown, glabrous, vertically ridged, lenticellate, cataphylls ± persisting at ultimate nodes; shoots non-spinescent. Indumentum of white T-hairs only, very sparse on leaves, denser on pedicles, otherwise plant glabrous. Leaves alternate but becoming whorled/congested/verticillate (through shortening of internode distances) at terminal nodes; oblanceolate to almost obovate and elliptical, up to 85–112 mm long, 22–30 mm wide, petiole up to 5–8 mm; apex acute, finely mucronate, hooked; base almost sessile, winged to a thick triangular base; adaxial surface smooth, secondary veins slightly impressed, mid-vein in slightly raised groove; abaxial surface much paler, smooth, 7–8 pairs

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secondary veins, very slightly raised, tertiary venation not visible when fresh, becoming more pronounced on drying on both surfaces, reticulum faint but distinct; scattered white T-shaped hairs only; margins when fresh are flat with the apices slightly down turning, spines absent. Inflorescences aggregated in ultimate leaf whorls; each terminal on a slender shoot up to 10 mm long, arising from a basal involucre 1–2 mm long and wide; 1–3 single flowers, each flower subtended by a leaf; indeterminate growth (becomes axillary as shoot develops next season); pilose with T-shaped hairs: short base, longer arm, white; flower buds bullet-shaped; pedicels pilose to 3 mm long; flowers actinomorphic, unisexual, functionally male with vestigial pistil, corolla hypocrateriform/salverform, persisting slightly tubular with the petal apices reflexing; sepals to 5 mm long, very narrow, linear/acuminate, appressed, sparsely hairy on outer surface, not recurving and not caducous; petals 10–11 mm long, 3 mm wide, initially creamy yellow becoming slightly darker yellow with age. *Male flowers*, only male flowers seen. *Stamens* 6–8 mm long. *Anthers* nearly 2 mm long, slender rectangular, apices recurving backwards revealing slits and pollen; filaments adnate to petal, joined at anthesis; pistil to 7 mm long, ovary barely differentiated, 2 mm long, on a 2 mm stipe from the basal nectary. *Style* 4 mm long with little stigmatic development. *Fruit* a sub-globose capsule held upright, 8–12 mm long, 10 mm diam, plus a 2 mm long basal, lobed nectary, dehiscence loculicidal, 4-grooved, 2-valved, pedicel elongating to 7 mm as fruit ripens; exocarp yellow, glabrous, rugulose, on a 2 mm thick, erect stalk; valves bright, glossy yellow on inside surface; fruit very rare. *Ovary* funicles inserted basally in 2 loculi; seeds 2–6 per fruit, angular to reniform, fresh seed to 5 mm long with succulent, red outer layer, sticky/resinous; valves open to 90° and held flat to present red seeds, then after seeds are taken or fall, reflexed 180° to touch pedicel and curl up.” (Benwell 2023)

3. Two other *Pittosporum* species (*P. undulatum* and *P. revolutum*) grow in the same general area as *P. kororoense*. Another related *Pittosporum* species (*P. lancifolium*) occurs on the far north coast near Lismore. The main features that distinguish *Pittosporum kororoense* from these three other *Pittosporum* species include: its habit as a low erect shrub producing prolific ramets from rhizomes (cf. tall shrub to sizeable trees in *P. undulatum* and *P. lancifolium*; or shrub or small tree 1–4 m tall for *P. revolutum*); inflorescences 1-3-flowered, unbranched (cf. 6–35-flowered and very often branched (compound umbels) in *P. undulatum*; cf. 4–16?-flowered in *P. revolutum*, sometimes branched (compound); cf. 1– or rarely 2–flowered and unbranched/non-compound in *P. lancifolium*); fruit dull orange at maturity (cf. black in *P. lancifolium*), and containing only two(-6) seeds (cf. 12–14 in *P. lancifolium*; ‘numerous’ in *P. undulatum*; 20–78 in *P. revolutum*); and a lack of foliar aromaticity and floral fragrance (Makinson *in litt.* October 2021).
4. *Pittosporum kororoense* is endemic to New South Wales and is currently known to occur in a small area near Coffs Harbour on the New South Wales mid-north coast. The species is currently known from one population scattered across eight sites associated with wet sclerophyll-rainforest in sheltered areas, including lower, south-facing slopes, along drainage lines and in gullies, generally within 5 km of the ocean (Anon. *in litt.* October 2021). The sites are at low elevations apart from the western-most site at 200m elevation in the headwaters of a creek. Much of the area between the sites is cleared. The largest site where *Pittosporum kororoense*

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occurs in forest 30-40 m high and dominated by *Lophostemon confertus* (Brush Box), with *Eucalyptus grandis* (Flooded Gum), *E. microcorys* (Tallowwood) and *E. pilularis* (Blackbutt) subdominant. The forest mid-stratum consists of rainforest trees 5-20 m high, including *Dysoxylum mollissimum* (Red Bean), *Cryptocarya microneura* (Murrogun), *Cryptocarya rigida* (Forest Maple), *Elaeocarpus reticulatus* (Blue-berry Ash), *Endiandra discolor* (Domatia Tree), *Synoum glandulosum* (Scentless Rosewood), *Niemeyera whitei* (Rusty Plum), *Archontophoenix cunninghamiana* (Bangalow Palm), *Ficus watkinsiana* (Strangling Fig) and other tree species, as well as shrubs, vines, herbs and ground ferns. Exotic species such as *Hypoestes phyllostachya* (Polka-dot-plant) may be present. The soil is a red-yellow clay podzol formed on metasediment. A few plants of *Pittosporum* sp. Coffs Harbour extend to the mid slope into *Eucalyptus* spp. dominated forest (*E. microcorys*, *E. grandis*, *E. saligna*, *E. acmenoides*) (Benwell 2023). There is a recent potential sighting of the species 50 km south of the Coffs Harbour area (Benwell 2023). *Pittosporum kororoense* may occur in other topographies, vegetation communities and edaphic conditions.

5. Since the species first came to scientific attention in January 2021, there have been three targeted surveys for *Pittosporum kororoense*. These surveys were undertaken for Transport for NSW (TfNSW) given that part of the population of *Pittosporum kororoense* was to be affected by approved roadworks. The surveys were carried out near the original site and up to 15 km away, in the same type of habitat (i.e. topography and broad vegetation type – primary or secondary (altered) forest).
6. The geographic distribution of *Pittosporum kororoense* is very highly restricted. The area of occupancy (AOO) and the extent of occurrence (EOO) were estimated using the GeoCAT tool (Bachman *et al.* 2011) with the adjustment of the grid reference point to give the minimum AOO estimate as per NSW TSSC Guidelines (2020) and IUCN (2022). Occurrence data were available from Ecos Environmental (2022). The AOO was estimated to be 8 km² based on the species occupying two (2 km x 2 km) grid cells, the spatial scale of assessment recommended by IUCN (2022). The EOO was estimated to be 3.2 km² based on a minimum convex polygon enclosing all reliably mapped occurrences of the species, the method of assessment recommended by IUCN (2022). However, the EOO was made equal to the AOO (i.e., 8 km²), as IUCN (2022) note that “If EOO is less than AOO, EOO should be changed to make it equal to AOO to ensure consistency with the definition of AOO as an area within EOO.”
7. *Pittosporum kororoense* is a clonal species (ReCER 2021, 2022), based on the growth form comprising multiple stems (ramets – genetically identical stems) emerging from the ground and linked by an underground root system forming a mature individual (or genet) (Anon *in litt.* October 2021). This is an unusual growth form among its congeners. The stems generally grow 0.5-1 m high, with a maximum height of 1.3 m and form a low thicket. Patches of *P. kororoense* vary in size from <2 to 15 m² or more and have a few to over 500 individual stems. Some patches are very small, consisting of <10 stems, and a few occurrences are single stems. Observations from monthly visits to the largest site of *P. kororoense* between January and July 2021 showed seed production was very low, with a total

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of only 15 fruits recorded. The red fleshy seeds are displayed in opened fruit against a bright yellow background formed by the inside surface of the open fruit valves, indicating seeds of the species may be dispersed by birds. The few seeds in these open fruits appeared to be viable (i.e. with filled seeds). Observations at the start of a second season in September 2021 showed flowers were fairly common in the *P. kororoense* patches, but initial post-flowering observations indicate very low fruit set (none observed). Whilst flowering in September lasts about 4 weeks, the fruit maturation period to fruit opening may be about six months.

8. The total number of mature individuals of *Pittosporum kororoense* is estimated to be very low. Estimating the number of mature individuals in clonal species requires interpretation of the composition of independent reproductive units (*sensu* IUCN 2022). The individual stems (ramets) within the patches of *P. kororoense* are not known to survive independently as they are linked by underground roots. A genetics study of *P. kororoense* confirmed clonality and high levels of inbreeding (ReCER 2021) and that different patches generally represent different genetic individuals (genets). Using a precautionary approach, the best indicator for the number of mature individuals of *P. kororoense* can be considered to comprise the number of patches of plants as a lower bound, with the upper bound an estimate of the number of genets (as some patches may contain more than one genet, or one genet may include several patches). The total number of patches was approximately 57 (Ecos Environmental 2022). For the number of genets, ReCER (2022) analysed 10 patches (these were subsequently cleared for roadworks) and found that they comprised 17 unique genets. Assuming this ratio of patches to genets applies across all sites, then on average, 1 patch represents 1.7 unique genets, giving an estimate of 57 remaining patches or 97 genets in total for the species. Hence the total number of mature individuals was estimated to be 57-97.
9. *Pittosporum kororoense* is facing immediate threat from clearing and habitat degradation from road construction works for the approved Coffs Harbour bypass project. Other threats to *Pittosporum kororoense* are from land clearing, habitat disturbance from agricultural activities and urban development, weed impacts, recreational impacts and rubbish dumping. One of the known sites is within a State Forest and one is in a Nature Reserve.
10. Much of the likely habitat for *Pittosporum kororoense* has been cleared in the past for grazing by domestic stock, timber collection, food production, such as bananas, and more recently for urban development and blueberry farms. The largest site where the species occurs is under threat from the approved Coffs Harbour highway bypass project. Thirty-three percent of the estimated number of mature individuals of the species have either been recently cleared (15%) or likely to be impacted by the roadworks (18%) as they are within the roadworks project boundary. Of the total number of known stems of the species, it is estimated 62% will be affected by the roadworks project, with 30% removed and a further 32% may be impacted due their proximity to the roadworks (Ecos Environmental 2022). TfNSW (2022) have outlined a number of impacts to *P. kororoense* plants and habitat due to the roadworks project. Clearing of the adjacent vegetation may lead to changes in the micro-climatic conditions of the site (TfNSW 2022). Micro-climatic stress during dry periods may reduce the ability of seedlings and juvenile plants to survive and

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establish. The edges of remnant bush that are exposed are also at an increased risk of weed invasion reducing the suitability of the habitat. Pest fauna movement may increase due to the introduction of cleared areas adjacent to the highway and may lead to increased grazing on individual threatened plants and/or predation of seeds as well as introducing/spreading pathogens and disease (TfNSW 2022). The increased accumulation of dust on the photosynthesising leaf surfaces of individual plants has the potential to cause individual plant stress and/or mortality (TfNSW 2022). These changes will likely lead to reduced plant health, reduced reproduction and/or individual plant survival and reduced establishment and survival of seedlings and juvenile plants of *P. kororoense*. The largest site is surrounded by privately owned cleared land used for agricultural activities where slashing, track-making, drainage works etc. can lead to edge effects and loss and degradation of habitat. Recreational impacts such as trail bike riding and rubbish dumping have been observed at the largest site. 'Clearing of native vegetation' is listed as a Key Threatening Process under the Act.

11. Exotic plant species have invaded some habitat areas for the species, notably at the largest site (that will be impacted by the roadworks) where *Cinnamomum camphora* (Camphor Laurel) and *Hypoestes phyllostachya* (Polka-dot Plant) occur. In some areas of the largest site the weeds are dense (TfNSW 2022). Weed species compete with *Pittosporum kororoense* for habitat, and may change micro-habitat conditions and impede recruitment of *P. kororoense* resprouts or seedlings and other native species. 'Loss and degradation of native plant and animal habitat by invasion of escaped garden plants, including aquatic plants' is listed as a Key Threatening Process under the Act.
12. *Pittosporum kororoense* is severely fragmented. The single population of the species consists of an estimated 57-97 mature individuals largely distributed over approximately 8 sites of remnant habitat. Although the species is likely to have some resilience to disturbance (recovery from underground roots), the very small population size across a few small habitat remnants, in combination with ongoing threats suggests, on a precautionary basis, that the species is severely fragmented.
13. *Pittosporum kororoense* Benwell 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*:

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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,iv) and Clause 4.4(a)(d(i)),(e(i,iiB)).

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

Assessment Outcome: Vulnerable under Clause 4.2(1)(c),(2)(a,b,c).

(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,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.

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**Clause 4.4 – Low numbers of mature individuals of species and other conditions
(Equivalent to IUCN criterion Clause C)**

Assessment Outcome: Critically Endangered under Clause 4.4 (a)(d(i)),(e(i,ii (B))

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: Endangered under Clause 4.5(b).

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.

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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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Chairperson
NSW Threatened Species Scientific Committee

Supporting Documentation:

Scott, J (2023) Conservation Assessment of *Pittosporum kororoense* Benwell (Pittosporaceae). NSW Threatened Species Scientific Committee.

References:

Bachman S, Moat J, Hill AW, de la Torre J, Scott B (2011) 'Supporting Red List threat assessments with GeoCAT: geospatial conservation assessment tool.' In: Smith V, Penev L (Eds) e-Infrastructures for data publishing in biodiversity science. *ZooKeys* **150**: 117–126. The GeoCAT tool can be accessed at: <http://geocat.kew.org/>

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IUCN Standards and Petitions Subcommittee (2022) Guidelines for Using the IUCN Red List Categories and Criteria. Version 15.1 Available at: <https://www.iucnredlist.org/resources/redlistguidelines>

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PlantNET (The NSW Plant Information Network System) Royal Botanic Gardens and Domain Trust, Sydney.

<http://plantnet.rbgsyd.nsw.gov.au> (accessed 3rd November 2021) at
[https://plantnet.rbgsyd.nsw.gov.au/cgi-bin/NSWfl.pl?page=nswfl&lvl=sp&name=Pittosporum~sp.+Coffs+Harbour+\(A.S.B.enwell+342,+NSW1102028\)](https://plantnet.rbgsyd.nsw.gov.au/cgi-bin/NSWfl.pl?page=nswfl&lvl=sp&name=Pittosporum~sp.+Coffs+Harbour+(A.S.B.enwell+342,+NSW1102028))

ReCER (2021) Report for Stage #1 of Conservation genomic project on *Pittosporum* sp. 'Coffs Harbour'. Confidential unpublished report prepared by the Research Centre for Ecosystem Resilience (Royal Botanic Garden Sydney).

ReCER (2022) Conservation genomics of *Pittosporum* sp. Coffs Harbour Phase 2. Confidential unpublished report prepared by the Research Centre for Ecosystem Resilience (Royal Botanic Garden Sydney).

Transport for New South Wales (2022) Coffs Harbour Bypass *Pittosporum* sp. Coffs Harbour & [REDACTED] Exclusion Zone Management Plan Issue 4 | 26 May 2022. CONFIDENTIAL DOCUMENT – not for public release.

A notice of determination to provisionally list this species under the previous name of *Pittosporum* sp. Coffs Harbour (A.S.Benwell 342, NSW1102028) as a critically endangered species was published on 21/02/2022