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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 reject a proposal to list the shrub *Hibbertia superans* Toelken as a Critically Endangered species in Part 1 of Schedule 1 of the Act, and to retain *Hibbertia superans* Toelken as an Endangered species in Part 2 of Schedule 1 of the Act.

A Conservation Assessment report and Preliminary Determination for *Hibbertia superans* Toelken to list the species as Critically Endangered was published from 26 May 2023 to 26 August 2023. Following consideration of advice and submissions received, *Hibbertia superans* Toelken is to be retained as an Endangered species. Listing of Endangered species is provided for by Part 4 of the Act.

Summary of Conservation Assessment

Hibbertia superans Toelken was found to be Endangered in accordance with the following provisions in the *Biodiversity Conservation Regulation 2017*: Clause 4.2 (1)(b)(2)(b), Clause 4.3 (b)(d)(e i,ii,iii) and Clause 4.4 (b)(d ii)(e i,ii (B)) because: (1) a large population reduction of up to 77% of mature individuals has been estimated as a result of clearing for residential development, adverse fire regimes, habitat degradation from disturbance, and competition from weeds over a two to three generation timespan; (2) the species has a highly restricted geographic distribution with an area of occupancy of 140 km^2 and an extent of occurrence of 1,048 km^2; (3) the species is considered to be severely fragmented; (4) there is an estimated and inferred continuing decline in AOO, habitat quality and mature individuals from vegetation clearing for residential and rural residential development, adverse fire regimes, habitat degradation from human activities, and competition from weeds; (5) the estimated total number of mature individuals of the species is low (*c.* 750); and (6) Most mature individuals exist within a single subpopulation, with the largest containing approximately 90% of known mature plants.

The NSW Threatened Species Scientific Committee has found that:

1. *Hibbertia superans* is described by PlantNET (2022) as “low spreading shrubs with few to many, weak twisting branches to 40 cm long. Leaves linear, rarely linear-elliptic, (5.6-) 7.5 - 10 (-12.3) mm long, 0.9 -1.2 (-1.4) mm wide; apex acuminate to acute; base gradually tapering to petiole, petiole to 0.5 mm long; margins revolute, appearing thickened. Young branches and leaves covered with long silky hairs over a dense indumentum of short stiff hairs. Longer hairs often wearing off with age. Some scattered stellate hairs also present, particularly on the younger branches and the lower surface of leaves. Flowers single; sessile or shortly pedicellate; terminal on main branches (or rarely on short shoots); bracts linear, 8.3 - 9.5 mm long, 1.0 - 1.3 mm wide, leaf-like with distinct central vein, villous sometimes becoming tomentose above and below. Calyx not accrescent; outer calyx lobes linear-lanceolate, acute, with slender central vein, villous-tomentose, mostly 7.5 - 9 mm long and 1.4 - 1.7 mm wide, much longer than inner lobes; inner calyx lobes oblong-elliptic to obovate, obtuse to rounded, 4.2 - 6.5 (-7.6) x 1.9 - 2.7

mm, outside villous over more or less appressed pubescent, inside rarely with a few appressed hairs towards the apex. Petals broadly obovate, 5.5 - 6.7 mm long, emarginate. Stamens 6 - 9, subequal; filaments basally connate, but often some more than others; anthers narrowly oblong, (1.4-) 1.6 - 1.8 mm long, dehiscing mainly by lateral slits. Pistils 2; ovaries laterally compressed, each with 4 ovules; style from outer apex of ovary, curved outwards and around the cluster of stamens to end at the apex of the outer anthers. Fruit villous with very dense erect simple hairs. Seeds oblong-obovoid, often oblique, 1.5 - 1.7 x 1.1 - 1.4 mm, fleshy aril expanding into a scarcely lobed sheath adpressed to the base of seed, often to one side of base of seed." *Hibbertia superans* has been recorded up to 40 cm high and spreading up to 1 m wide (R. Miller *in litt*. December 2022).

2. *Hibbertia superans* is endemic to the Greater Sydney region of NSW. It mainly occurs in the northwest Sydney region between Baulkham Hills and Wisemans Ferry. It has also been recorded in very small numbers in the Berowra Valley, Belrose, North Turramurra, Dural and Manly, and in the lower Blue Mountains between Blaxland and Faulconbridge.

3. The geographic distribution of *Hibbertia superans* is highly restricted. The Extent of Occurrence (EOO) is 1,048 km ^{2} and the Area of Occupancy (AOO) is 140 km^2. The Extent of Occurrence (EOO) is based on a minimum convex polygon enclosing all mapped occurrences of the species, the method of assessment recommended by IUCN (2022). The AOO is based on 2 x 2 km grid cells, the scale recommended for assessing area of occupancy by IUCN (2022). The EOO and AOO encompasses the entire known past and extant distribution of the species.

4. The total population size of *Hibbertia superans* is estimated to be approximately 750 mature individuals. Historically it has been recorded from approximately 45 sites, with eleven sites with over 100 mature individuals and much smaller numbers at the other sites. Currently, the two largest sites of *H. superans* are adjacent to Cattai Creek, Kellyville. The population of *Hibbertia superans* is considered to consist of eleven subpopulations, with the largest located in northwest Sydney from Castle Hill to Glenorie containing 90% of the population.

5. *Hibbertia superans* has been estimated to have undergone a large reduction in population size since the late 1990s and early 2000s, well within a three generation timespan of 21-36 years. Population trend data is available for 92% (at 16 sites) of the population of *H. superans* recorded in the late 1990s and early 2000s (3,380 mature individuals at 45 sites). From this large subset of the population (3,092 mature individuals), there has been a 77% decline in 2-3 generations to 722 mature individuals as of 2022. This is as a result of land clearing for residential and rural-residential development, adverse fire regimes and human disturbance. The population trajectory of the other 8% of the population (280 individuals) is unknown but is inferred to have experienced a similar decline on the basis of known or likely active threats. The population decline of *H. superans* is also inferred to continue into the future with residential and rural-residential development prioritised for the region, including in areas of key subpopulations such as at Kellyville (DPE 2017). This means a population reduction of approximately 77% in the number of mature individuals is estimated to have occurred over the past three-generation timeframe

of 21-36 years, with the causes of this reduction being irreversible and not having ceased, and this reduction is inferred to continue at similar rates into the future.

6. *Hibbertia superans* is considered severely fragmented because >50% of the total AOO consists of stands of the species that are considered smaller than is required to support a viable population and most patches are isolated within a fragmented urban matrix. 128 km^2 (91%) of the AOO of *H. superans* contains stands of 12 or less individuals, and much habitat is currently not considered conducive to persistence as 88% of known sites are potentially long-unburnt or being burnt too frequently. This means that most individuals of *H. superans* are found in small and relatively isolated subpopulations with a low chance of recolonisation in the event of local extinctions, meeting the IUCN (2022) definition for severe fragmentation.

7. *Hibbertia superans* occurs in dry sclerophyll forest on sandstone ridgetops, often close to the shale/sandstone transition (Toelken 2000; James 2012; PlantNET 2022). *Hibbertia superans* is often associated with canopy species such as *Allocasuarina littoralis*, *Angophora bakeri*, *A. hispida, Corymbia gummifera, C. eximia*, *Eucalyptus piperita, E. racemosa, E. cryptica, E. squamosa* and a large diversity of understory shrubs including other threatened flora such as *Acacia bynoeana*, *Darwinia biflora*, *Epacris purpurascens* var. *purpurascens*, *Leucopogon fletcheri* subsp. *fletcheri*, *Persoonia hirsuta* and *Pimelea curviflora* var. *curviflora* (NSW Scientific Committee 2001; Miller 2022). *Hibbertia superans* has been recorded in two Sydney Basin Bioregion threatened ecological communities: Sydney Turpentine-Ironbark Forest and Duffy's Forest Ecological Community.

8. *Hibbertia superans* flowers from July – December (PlantNET 2022). Flowers first appear from resprouting material about two years after fire (DPE 2022b). The time to first flowering of seedlings is unknown. *Hibbertia superans* is a facultative seeder that is well-adapted to repeated fire in the landscape. The longevity of *H. superans* seeds in the seedbank is unknown, however *Hibbertia* species are thought to have a persistent seedbank (TSSC 2016; Cuneo *et al*. 2018). It recovers well after fire mostly from re-growth from the rootstock (James 2012).

9. *Hibbertia superans* is threatened by vegetation clearing for residential and rural residential development, adverse fire regimes, habitat degradation from human activity, competition from weeds, and disease (NSW Scientific Committee 2001; Miller 2022). 'Clearing of Native Vegetation', 'High frequency fire resulting in the disruption of life cycle processes in plants and animals and loss of vegetation structure and composition', 'Invasion and establishment of exotic vines and scramblers', 'Invasion of native plant communities by exotic perennial grasses', and 'Loss and degradation of native plant and animal habitat by invasion of escaped garden plants, including aquatic plants', and 'Infection of native plants by *Phytophthora cinnamomi*' are listed as key threatening processes on the Act.

10. Continuing decline is estimated and inferred in the AOO, the habitat quality, and the number of mature individuals of *Hibbertia superans* from vegetation clearing for residential and rural residential development, adverse fire regimes, habitat degradation from human activities and competition from weeds. There is no evidence that any of the current threats are being managed for this species, and further losses through clearing for development are likely given the prioritisation for

residential development in northwest Sydney, including in areas hosting key *H. superans* subpopulations (DPE 2017). Where *H. superans* sites are on private land or in reserves surrounded by urban development, fire regimes are seldom maintained appropriately for the species, and can vary from long-unburnt to regularly burnt, with both situations causing decline in habitat and mature individuals. There is no targeted weed or anthropogenic management for this species at any site. The risk of *Phytophthora cinnamomi* infection in at urban and peri-urban sites is ever-present.

11. *Hibbertia superans* Toelken is not eligible to be listed as a Critically Endangered species.

12. *Hibbertia superans* Toelken 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)(b), Clause 4.3 (b)(d)(e i,ii,iii) and Clause 4.4 (b)(d ii)(e i,ii (B))

Clause 4.2 – Reduction in population size of species
(Equivalent to IUCN criterion A)
Assessment Outcome: Endangered under Clause 4.2 (1)(b)(2)(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)

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 C)
Assessment Outcome: Endangered under Clause 4.4 (b)(d ii)(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: 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: 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.

Senior Professor Kristine French
Chairperson
NSW Threatened Species Scientific Committee

Supporting Documentation:

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TSSC (2016) Conservation Advice *Hibbertia spanantha* Julian's hibbertia http://www.environment.gov.au/biodiversity/threatened/species/pubs/88475-conservation-advice-07122016.pdf