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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 *Telopea aspera* Crisp & P.H.Weston as an ENDANGERED SPECIES in Part 2 of Schedule 1 of the Act. Listing of Endangered species is provided for by Part 4 of the Act.

The NSW Threatened Species Scientific Committee is satisfied that *Telopea aspera* Crisp & P.H.Weston 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 Commonwealth DCCEEW (2024), the NSW Threatened Species Scientific Committee has made a decision to list the species as Endangered.

Summary of Conservation Assessment

Telopea aspera Crisp & P.H.Weston was found to be Endangered in accordance with the following provisions in the *Biodiversity Conservation Regulation 2017*: Clause 4.3(b)(d)(e i) because: 1) the species has a highly restricted geographic distribution with an estimated extent of occurrence of 119 km^2 and an estimated area of occupancy of 92 km^2; 2) it is known from a single threat-defined location; and 3) there is inferred continuing decline in the number of mature individuals due to adverse fire regimes, illegal collection, and increased frequency and duration of drought.

The NSW Threatened Species Scientific Committee has found that:

1. *Telopea aspera* Crisp & P.H.Weston (family Proteaceae) is an “erect shrub to 3 m tall, with 1–few stems, slender, sparingly branched, ferruginous-hairy on axes and especially on abaxial leaf surfaces (with 30–80 hairs per mm^2). Adult leaves elliptic to obovate-elliptic or narrowly so, 6–24 cm long, 2–8 cm wide; margins serrate in apical half, with 3–11 teeth extending to basal halves, ±abruptly contracted to petiole, very coriaceous and harsh to the touch; apices acute to truncate; veins prominently raised; surfaces minutely granulate when dried. Intermediate leaves pinnatisect to pinnatifid. Conflorescences few, very broadly to depressed-ovoid, 100–180-flowered, 6–8.5 cm diam. (excluding bracts); anthesis acropetal; involucral bracts conspicuous, mostly 30–75 mm long, bright red, glabrous except tips. Flowers usually scarlet; pedicels 3–27 mm long; tepals 20–30 mm long, cohering along margins in a slit tube; style incurved. Body of follicle 7–11 cm long” (Crisp and Weston 1995).
2. *Telopea aspera* is endemic to northern New South Wales (NSW), where it is restricted to the Gibraltar Range on the eastern edge of the New England Tablelands east of Glen Innes.
3. *Telopea aspera* has a highly restricted geographic distribution. 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 (2024) and was estimated to be 119 km^2. The area of occupancy (AOO) is

estimated to be 92 km^2 based on 2 x 2 km grid cells, the scale recommended by IUCN (2024).

4. The population of *Telopea aspera* is estimated to contain 3,500–10,000 mature individuals based on surveys conducted from 2020–2023 (P. Sheringham pers. comm. June 2023 in Commonwealth DCCEEW 2024). The population is considered to be a single subpopulation as defined by IUCN (2024).

5. *Telopea aspera* grows in shrubby woodland and open forest communities on shallow soil over granite within the Gibraltar Range (Crisp and Weston 1991). It occurs on ridges and north, intermediate and west-facing slopes in undulating to hilly areas interspersed with granite tors and also on flat to undulating areas (Hunter and Sheringham 2008; P. Sheringham pers. comm. March 2022 in Commonwealth DCCEEW 2024). *Telopea aspera* is often found in association with *Eucalyptus olida*, *E. cameronii, Elaeocarpus reticulatus, Acacia nova-anglica, Gaudium trinervium*, *Lomatia silaifolia, Persoonia rufa, Pultenaea tarik, Grevillea acerata*, *Gompholobium latifolium, Leucopogon affinis, Dampiera purpurea, Hibbertia villosa, Hakea laevipes* subsp. *graniticola, Boronia microphylla, Gleichenia dicarpa, Pteridium esculentum, Amperea xiphoclada, Dianella caerulea* and *Pimelea linifolia* (Hunter and Sheringham 2008; P. Sheringham pers. comm. March 2022, June 2023 in Commonwealth DCCEEW 2024).

6. *Telopea aspera* flowers from October to November (Croft *et al.* 2006; P. Sheringham pers. comm. January 2022 in Commonwealth DCCEEW 2024) and is likely adapted to pollination by birds as in other waratahs (Nixon 1989). Waratahs also have no persistent canopy or soil seed bank. Instead, following fire, they resprout and then flower and produce a transient seed bank, with this response often referred to as pyrogenic flowering (Auld and Ooi 2008). *Telopea aspera* resprouts from an underground woody lignotuber (a source of energy and nutrients for rapid growth) if the above-ground parts of the plant are burnt (Croft *et al*. 2006) or harvested. The species is known to recover after fire through vigorous resprouting but with minimal or no seedling recruitment (Croft *et al*. 2006; P. Sheringham pers. comm. June 2023 in Commonwealth DCCEEW 2024). The species appears to flower most prolifically two years after fire (Mackay *et al.* 2021; P. Sheringham pers. comm. January 2022 in Commonwealth DCCEEW 2024).

7. *Telopea aspera* is primarily threatened by adverse fire regimes and illegal collection. Risks posed by fire regimes may be exacerbated by increased frequency and duration of drought due to climate change. ‘High frequency fire resulting in the disruption of life cycle processes in plants and animals and loss of vegetation structure and competition’ and ‘Anthropogenic climate change’ are listed as Key Threatening Processes under the Act.

8. *Telopea aspera* is known from one threat-defined location based on the threat of high fire frequency. The species has a single subpopulation, consisting of sporadic and scattered clusters of individuals within the Gibraltar Range (P. Sheringham pers. comm. January 2022 in Commonwealth DCCEEW 2024). The 2019-20 bushfires overlapped with approximately 79% of the species’ modelled distribution and burned 90–95% of individuals, and so it is feasible for a single fire to affect the species’ entire distribution (Gallagher *et al.* 2021; P. Sheringham pers. comm. January 2022 in Commonwealth DCCEEW 2024). If another major fire was to

occur too soon, most individuals could be at high risk of poor recovery and accordingly a single threatening event (e.g., fire) could rapidly affect all individuals of the species across the population.

9. Continuing decline in the number of mature individuals of *Telopea aspera* is inferred due to adverse fire regimes. *Telopea aspera* is already experiencing a high fire frequency regime (NPWS 2021). As fire frequency and severity are projected to continue to increase due to climate change (Dowdy *et al.* 2019; Bureau of Meteorology and CSIRO 2020; van Oldenborgh *et al*. 2021), *T. aspera* is highly susceptible to decline in the future, due to high severity fires leading to direct mortality of standing plants and as fire-free intervals continue to shorten (Enright *et al.* 2015), feasibly becoming too short to meet the life-history requirements of the species. High frequency fires would prevent recruited individuals from developing fire-resistant organs and thus recruitment could fail to compensate mortality of established individuals (Keith 1996) in the future. To a lesser extent this can limit post-fire recruitment due to mortality of immature lignotubers (Bradstock 1995), thus leading to reduced reproductive capacity of the species over time. Additionally, extreme and extended soil heating from high severity fires can directly damage regenerative organs located below ground (Bowman *et al.* 2009) and increase soil hydrophobicity (Santin and Doerr 2016). This can further increase the threat to vegetative organs, particularly when depth of burial is shallow, fire residence time is high, ground fuel consumption is high and soil moisture is low.

10. Continuing decline in the number of mature individuals of *Telopea aspera* is also inferred due to illegal collection and increased frequency and duration of drought. Evidence of illegal collection has been observed before and after the 2019–20 bushfires at some sites, as well as deliberate cutting of stems to stimulate flowering in following seasons (Mackay *et al.* 2021). If more frequent fires and illegal collection continue to take place then the interaction between these threats may also lead to limited opportunities for flowering and seed production in affected stands and consequently decrease any seedling recruitment that may occur. Additionally, increasing drought events may reduce the species' resilience to fire via slower rates of maturation and lower fecundity (Enright *et al*. 2015; Henzler *et al.* 2018). This is likely to result in a net loss of mature individuals and an ongoing and non-reversible decline in population size of the species in coming decades. Furthermore, projected changes in precipitation and temperature may also lead to a decline in the population size, primarily due to the effect of declining rainfall on seed production and seedling survival (Midgley *et al*. 2006; Fitzpatrick *et al*. 2008; Shimizu-Kimura *et al.* 2017).

11. *Telopea aspera* Crisp & P.H.Weston is not eligible to be listed as a Critically Endangered species.

12. *Telopea aspera* Crisp & P.H.Weston Hill 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 4.3(b)(d)(e i)

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: Endangered under Clause 4.3(b)(d)(e 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,	
	(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: Vulnerable under Clause 4.4(c)(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: Not met

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: 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.

Professor Angela Moles, FRSN
Chairperson
NSW Threatened Species Scientific Committee

Supporting Documentation:

Commonwealth DCCEEW (Department of Climate Change, Energy, the Environment and Water) (2024). Conservation Advice for *Telopea aspera* (Gibraltar Range waratah). Australian Government, Canberra, ACT.

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