

## Notice of and reasons for the 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 *Grevillea raybrownii* Olde & Marriott as a VULNERABLE SPECIES in Part 3 of Schedule 1 of the Act. Listing of Vulnerable species is provided for by Part 4 of the Act.

### Summary of Conservation Assessment

*Grevillea raybrownii* is eligible for listing as Vulnerable, as the highest threat category met by the taxon across all categories, under Clause 4.3 (c) (d) (e i, iii) and Clause 4.4 (c) (e i, ii AIII) because: i) the species has a highly restricted geographic range with an extent of occurrence of 885 km<sup>2</sup> and an area of occupancy of 96 km<sup>2</sup>; ii) there is estimated to be a moderately low number of mature individuals; (iii) there are a number of threats affecting both the habitat and some mature individuals at many of the populations; (iv) the lower bound for the estimate of the number of locations is <10; and (v) there are estimated to be <1000 mature individuals in each population.

The NSW Threatened Species Scientific Committee has found that:

1. *Grevillea raybrownii* Olde & Marriott (family Proteaceae) is described in PlantNET 2018 as a “bushy shrub to 1.5 m high. Leaves bipinnatisect, 2.5–5 cm long, primary lobes 3–5, narrow-linear, secondary lobes divaricate; ultimate lobes linear, subulate, 0.5–2.4 cm long, 0.6–1.2 mm wide, pungent; upper surface glabrous, lower surface double grooved. Conflorences ovoid, dense, brown in bud. Perianth white with rusty limb, sericeous outside, glabrous inside. Gynoecium 6–7 mm long, glabrous; ovary white-silky, developing lilac hairs after anthesis, subsessile; style white in the lower half, lilac in the upper half, glabrous; pollen presenter erect, conical. Follicle sericeous, red striped and blotched on dorsal side.”
2. *Grevillea raybrownii* is endemic to New South Wales, where 12 populations are currently known to occur in the Wingecarribee and Wollongong local government areas. It is present in Nattai National Park and the Upper Nepean State Conservation Area (S. Douglas *in litt.* Sept 2016).
3. *Grevillea raybrownii* generally occurs on ridgetops and, less often, slopes and benches of Hawkesbury Sandstone and Mittagong Formation (S. Douglas *in litt.* Sept 2016). It occurs in *Eucalyptus* open forest and woodland with a shrubby understorey on sandy, gravelly loam soils derived from sandstone (Olde and Marriott 1994; PlantNET 2018) that are low in nutrients (S. Douglas *in litt.* Sept 2016). *Grevillea raybrownii* is killed by fire and regeneration is from seed that is stored in the soil (OEH 2014). Recruitment appears to be promoted by fire or other disturbance.
4. The total population of *Grevillea raybrownii* is unknown, as there have been no formal estimates of plant numbers of the species over its distribution. Based on habitat specificity and plant counts at some of the known sites, there are estimated to be less than 2,500 individuals (S. Douglas *in litt.* Sept 2016). However, as there are areas of potentially suitable habitat in water catchment land nearby to known populations, plant numbers may exceed this estimate of 2,500 but are expected to be less than 10,000.

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5. *Grevillea raybrownii* has a highly restricted geographic distribution. The extent of occurrence is estimated to be 885 km<sup>2</sup>, based on a minimum convex polygon enclosing all mapped occurrences of the species, the method of assessment recommended by IUCN (2017). The area of occupancy is estimated to be 96 km<sup>2</sup>, based on the species occupying 24 (2 km x 2 km) grid cells, the spatial scale of assessment recommended by IUCN (2017).
6. There has previously been a loss of *Grevillea raybrownii* habitat as a result of clearing for urban and rural areas. Currently, the main threat to the species is from disturbance to its remaining habitat. Many sites are near roads and along ridgetop fire trails that may be subject to road maintenance activities and clearing for infrastructure and its maintenance. Ongoing recreational pressures have damaged plants and habitat, with tracks through the habitat and rubbish dumping observed at one population near the Nattai River at Welby (S. Douglas *in litt.* Sept 2016; NSW BioNet sighting). The population in Belanglo State Forest is threatened by slashing and herbicide use for the maintenance of Asset Protection Zones (NSW BioNet sighting 2016). 'Clearing of native vegetation' is listed as a Key Threatening Process under the Act.
7. *Grevillea raybrownii* is an obligate seeder (Olde & Marriott 1994; Benson & McDougall 2000) and is threatened by high frequency fire. There is evidence that fire frequencies have been relatively high at some sites containing populations such as the Water Catchment land in the eastern part of the distribution, where hazard reduction burning is carried out regularly to protect the drinking water catchment and mining infrastructure, and at Belanglo State Forest where hazard reduction burning occurs to protect pine plantations (SEED 2018). Any future increase in fire frequency resulting from the combination of hazard reduction burning and wildfires may be detrimental to the species and its ability to regenerate after fire. 'High frequency fire resulting in the disruption of life cycle processes in plants and animals and loss of vegetation structure and composition' is listed as a Key Threatening Process under the Act.
8. *Grevillea raybrownii* Olde & Marriott is not eligible to be listed as an Endangered or a Critically endangered species.
9. *Grevillea raybrownii* Olde & Marriott is eligible to be listed as a Vulnerable species as, in the opinion of the NSW Threatened Species Scientific Committee, it is facing a high risk of extinction in Australia in the medium-term future as determined in accordance with the following criteria as prescribed by the *Biodiversity Conservation Regulation 2017*:

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Clause 4.2 – Reduction in population size of species  
 (Equivalent to IUCN criterion A)  
 Assessment Outcome: Data deficient.

<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:</b>			
	(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.
<b>(2) - The determination of that criteria is to be based on any of the following:</b>			
	(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: Vulnerable via Clause 4.3 (c\*) (d) (e i, iii).  
 [Equivalent to Criterion B via B1ab(iii, v)+B2ab(iii, v).]

\* Although *Grevillea raybrownii* meets the thresholds for highly restricted geographic distribution (EOO and AOO) for an endangered species, only at the vulnerable threshold are two of the three other required conditions met.

<b>The geographic distribution of the species is:</b>			
	(a)	for critically endangered species	very highly restricted, or
	(b)	for endangered species	highly restricted, or
	(c)	for vulnerable species	moderately restricted.
<b>and at least 2 of the following 3 conditions apply:</b>			
	(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: Vulnerable under Clause 4.4 (c) (e i, ii A(III))  
[equivalent to IUCN Criterion C via C2a(i).]

<b>The estimated total number of mature individuals of the species is:</b>			
	(a)	for <del>critically endangered species</del>	<del>very low, or</del>
	(b)	for <del>endangered species</del>	<del>low, or</del>
	(c)	for vulnerable species	moderately low.
<b>and either of the following 2 conditions apply:</b>			
	(d)	a continuing decline in the number of mature individuals that is (according to an index of abundance appropriate to the species):	
		(i) for <del>critically endangered species</del>	<del>very large, or</del>
		(ii) for <del>endangered species</del>	<del>large, or</del>
		(iii) for <del>vulnerable species</del>	<del>moderate,</del>
	(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 <del>critically endangered species</del> extremely low, or
			(II) for <del>endangered species</del> very low, or
			(III) for vulnerable species low,
		(B)	<del>all or nearly all mature individuals of the species occur within one population,</del>
		(C)	<del>extreme fluctuations occur in an index of abundance appropriate to the species.</del>

Clause 4.5 - Low total numbers of mature individuals of species  
(Equivalent to IUCN criterion D)  
Assessment Outcome: Not met.

<b>The total number of mature individuals of the species is:</b>			
	(a)	for <del>critically endangered species</del>	<del>extremely low, or</del>
	(b)	for <del>endangered species</del>	<del>very low, or</del>
	(c)	for vulnerable species	low.

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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,	<del>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.</del>
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Dr Marco Duretto  
Chairperson  
NSW Threatened Species Scientific Committee

## Supporting Document:

Scott J (2019) Conservation Assessment of *Grevillea raybrownii* Olde & Marriott (Proteaceae). Version 1.0. NSW Threatened Species Scientific Committee.

## References:

Benson D, McDougall L (2000) Ecology of Sydney plant species part 7b: dicotyledon families Proteaceae to Rubiaceae. *Cunninghamia* 6, 1016–1202.

IUCN Standards and Petitions Subcommittee (2017) Guidelines for Using the IUCN Red List Categories and Criteria. Version 12. Prepared by the Standards and Petitions Subcommittee. <http://www.iucnredlist.org/documents/RedListGuidelines.pdf>.

Office of Environment and Heritage (OEH) NSW Bionet Atlas (accessed May 2018) <http://www.bionet.nsw.gov.au/>

Office of Environment and Heritage (2014) NSW Flora Fire Response Database Version 2.1 Unpublished database.

Olde PM, Marriott NR (1994) Taxonomic studies in *Grevillea triternata* and *Grevillea ramosissima* (Proteaceae: Grevilleoideae). *Telopea* 5, 773–779.

PlantNET (The NSW Plant Information Network System) Royal Botanic Gardens and Domain Trust, Sydney. <http://plantnet.rbgsyd.nsw.gov.au> (accessed 13 Feb 2018).

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SEED Office of Environment and Heritage, NSW. Fire History data layers. Accessed May 2018 via SEED portal (Sharing and Enabling Environmental Data).

<https://datasets.seed.nsw.gov.au/dataset/fire-history-wildfires-and-prescribed-burns-1e8b6>