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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 remove *Bertya opposens* (F.Muell. ex Benth.) Guymer from the Schedules of the Act, and to retain *Bertya opposens* (F.Muell. ex Benth.) Guymer as a VULNERABLE species in Part 3 of Schedule 1 of the Act.

A Conservation Assessment report and Preliminary Determination for *Bertya opposens* (F.Muell. ex Benth.) Guymer to remove the species from the Schedules of the Act was published from 15 December 2023 to 15 March 2024. Following consideration of advice and submissions received, *B. opposens* (F.Muell. ex Benth.) Guymer is to be retained as a Vulnerable species. Listing of Vulnerable species is provided for by Part 4 of the Act.

Summary of Conservation Assessment

Bertya opposens (F.Muell. ex Benth.) Guymer was found to be Vulnerable in accordance with the following provisions in the *Biodiversity Conservation Regulation 2017*: Clause 4.3(c)(d)(ei,ii,iii,iv) because: (1) *B. opposens* has a moderately restricted geographic range, with an area of occupancy (AOO) of 322 km²; (2) the species is known from seven threat-defined locations; (3) there is an estimated and inferred continuing decline in the area, extent and quality of habitat, and number of mature individuals occurring due to clearing and fragmentation of habitat, largely due to activities associated with coal mining and gas, as well as maintenance and establishment of tracks; and (4) it is inferred that continuing decline in the number of subpopulations and AOO will occur in the future, due to the existence of extremely small subpopulations comprised of one to two individuals.

The NSW Threatened Species Scientific Committee has found that:

1. *Bertya opposens* (F.Muell. ex Benth.) Guymer (Euphorbiaceae) is described as a “slender shrub or small tree to 4 m high with a thick, whitish to brown tomentum. Leaves mostly opposite, oblong to oblanceolate or narrow-elliptic, 10–50 mm long, 5–25 mm wide, with an apical gland; margins recurved to revolute, upper surface hairy, becoming scabrous, lower surface densely white-tomentose with prominent midrib; petiole 3–5 mm long. Flowers ± sessile, 1–3 male and female flowers together; bracts 4, conspicuous, narrow, 2–5 mm long, thick, yellowish brown tomentose, 2 inner bracts ± obscure, heavily viscid. Perianth segments 4, broad-ovate, 5–6 mm long, mostly glabrous and viscid; female segments fused towards the base, lobes oblong-ovate. Ovary densely villous; styles 3 or 4, mostly deeply 4-lobed. Capsule ovoid to globose, 8–9 mm long, densely villous” (PlantNet 2023).
2. *Bertya opposens* has a widespread but sparse distribution, ranging from central Queensland (QLD) south into the northwest plains of New South Wales (NSW). The species has a total of 45 recognised subpopulations across its range. In NSW, four subpopulations have been recorded: two on private properties near Coolabah and Cobar respectively, and two to the south of Narrabri, including the largest known subpopulation of the species in Jacks Creek State Forest (NSW Scientific Committee 2010). The subpopulation near Cobar has not been seen since 1982

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and may now be extinct (NSW Scientific Committee 2010). In QLD, *B. opponens* is widely distributed. It is bounded roughly by White Mountains National Park in the northwest, Burton in the northeast, Chesterton Range National Park in the central west, St George in the southwest, and Toowoomba in the southeast. *Bertya opponens* is considered to occur within 41 subpopulations in QLD.

3. The total known population of *Bertya opponens* is estimated to be greater than five million individuals (Austen 1999, cited in NSW Scientific Committee 2010), including an estimated 1,066,930 individuals on land owned by Whitehaven Coal in the Jacks Creek area (Eco Logical Australia 2019). It is not known what proportion of the population comprises mature individuals. Based on the limited estimates for subpopulation sizes available, it is estimated that over 99% of the population occurs in the Jacks Creek subpopulation in NSW.
4. *Bertya opponens* has a widespread geographic distribution but highly restricted area of occupancy (AOO). 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) and was measured at 606,408 km². The AOO was calculated using 2 x 2 km grid cells, the scale recommended by IUCN (2022) and was calculated to be 322 km².
5. *Bertya opponens* appears to be positively associated with disturbance, such as fire or mechanical disturbance, which appears to trigger germination and/or suckering (OEH 2023). Individuals are prolific along the edges of the firebreaks and tracks in Jacks Creek State Forest, suggesting physical disturbance of the soil substrate can be beneficial (NPWS 2002; M. Saunders pers. obs. September 2021). The NSW Scientific Committee (2010) states that it is believed that most plants of *B. opponens* are killed by fire; however, the species has been observed to resprout after fire (P. Forster *in litt.* July 2023; C. Eddie pers. comm. July 2023). Observational data of subpopulations in QLD indicate that many of these subpopulations are dominated by mature individuals with limited recruitment evident, likely due to decreased fire frequencies across the landscape resulting from anthropogenic modifications (C. Eddie pers. comm. July 2023).
6. It is considered likely that *Bertya opponens* is largely wind-pollinated, as the anthers and styles are exposed, and the flowers lack chemical and colour attractants associated with insect-pollination; however, bees have been recorded visiting the flowers of *B. opponens* (NPWS 2002).
7. Investigations into the seed germination cues and seed viability of *Bertya opponens* suggest the species has high seed viability (up to 88%) and a physiological dormancy, possibly related to an environmental cue, such a diurnal temperature shift or seasonal change (G. Phillips *in litt.* July 2023; RBGDT 2023). Other members of the genus have high seed viability (*ca.* 97%) and contain conditional seed dormancies, with triggers including heat and/or scarification (Scott and Gross 2004).
8. It is estimated that *Bertya opponens* reaches sexual maturity at 4–5 years and has a maximum lifespan of 25–30 years (P. Forster *in litt.* July 2023).
9. A number of threats are considered to be operating on *Bertya opponens* across its wide geographic distribution. These threats include drought, adverse fire regimes, clearing and fragmentation of habitat. 'High frequency fire resulting in the disruption

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of life cycle processes in plants and animals and loss of vegetation structure and composition', 'Clearing of native vegetation' and 'Anthropogenic Climate Change' are listed as Key Threatening Processes under the Act.

10. The most serious plausible threat that results in the lowest number of locations for *Bertya opposens* is considered to be drought, which results in the species having seven threat-defined locations. These locations can be defined across the distribution of *B. opposens* using the Interim Biogeographic Regionalisation for Australia (IBRA; DCCEEW 2023), and Köppen climate classes (Bureau of Meteorology 2024). This is because the IBRA bioregions are defined by common climate, geology, landform, native vegetation and species information (DCCEEW 2023), and attributes that influence the effects of drought events such as productivity and natural drought frequency are known to differ across ecoregions (Pausas and Ribiero 2013). Additionally, significant differences in drought characteristics and propagation are found between the Köppen climate classes (Fuentes *et al.* 2022). This means that the effects of drought are likely to differ across the different combinations of IBRA bioregions and Köppen climate class regions where *B. opposens* occurs.
11. *Bertya opposens* has been identified as being vulnerable to fires which occur too frequently (Boyes 2004; OEH 2023). Conversely, long absences of fire appear to limit recruitment in *B. opposens*, resulting in subpopulations dominated with mature individuals and few juveniles (C. Eddie pers. comm. July 2023). There is a risk that continued absence of fire could lead to plant senescence and the degradation of the seedbank. Despite climate change projections of increased fire weather and more frequent fires (Abatzoglou *et al.* 2019; Dowdy *et al.* 2019; Jones *et al.* 2022; AdaptNSW 2023), the widespread distribution of *B. opposens* means that changes to fire regimes are not considered likely to rapidly drive the species to extinction. Although Jacks Creek has had multiple historical fires, these have largely occurred in different sections of the state forest (NPWS 2023). Furthermore, there has not been a significant fire in Jacks Creek since 1991, with only a small fire recorded in 2013. Fire at such frequencies is likely to promote recruitment, while the species' ability to resprout after being burnt reduces the probability of repeat fires causing local extinctions. However, the species is predominantly an obligate seeder with juveniles that are unlikely to resprout after being burnt. Therefore, fire that occurs frequently enough to kill juvenile *B. opposens* prior to seed production is a threat, while low frequency fire has been identified as a causative factor in the low levels of observed recruitment in QLD subpopulations. Although adverse fire regimes are considered a primary threat to *B. opposens*, the threat is attenuated by the wide, sparse distribution of its population.
12. Activities associated with coal and gas mining continue to clear and fragment *Bertya opposens* habitat. A report by Eco Logical Australia (2019) found that land owned by Whitehaven Coal for the Narrabri underground coalmine in the Jacks Creek area supported an estimated 1,066,930 plants of *B. opposens*, with approximately 266,000 of those in areas subject to underground disturbance, and up to 26,654 of those potentially subject to direct impacts. Similarly, the Narrabri Gas Project operated by Santos was found to be directly affecting 10,309 *B. opposens* plants (DAFF 2020). *Bertya opposens* has also been recorded within the Santos Gladstone Liquefied Natural Gas project footprint in QLD (Santos 2014; DSD 2015).

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13. Drought is a threat to *Bertya opposens* and has been observed to cause mortality of individuals (L. Copeland *in litt.* July 2023). The assumed extinction of the Winderera subpopulation near Cobar may have been caused by extreme drought in the 1980s, which may have killed any seedlings that germinated following the 1984 bushfire (L. Miller pers. comm., cited in NPWS 2002). However, the subpopulation at Jacks Creek did not appear to have been significantly affected by the 2017–2019 drought, with plants of all age classes observed to be thriving in 2021 (M. Saunders pers. obs. Sept 2021). It is likely that subpopulations occurring on deeper soils, such as Jacks Creek, would fare better under drought conditions than those located on shallow or skeletal soils, due to inherent differences in root-moisture availability. Drought may also interact with fire to drive continuing decline in *B. opposens*, especially in smaller subpopulations. In subpopulations that occur in wetter and more productive regions, such as those in the Temperate and Subtropical Köppen climate regions closer to the coast in Queensland, fire activity is often driven by drought occurrence as fuels are typically highly available (Pausas and Ribeiro 2013). Fire behaviour is also highly influenced by prolonged drought, with increasingly severe drought episodes producing more widespread and severe fires (Collins *et al.* 2022; Lindenmayer *et al.* 2022). These interactions show that any increases in drought, especially in subtropical and temperate areas, are also likely to be a primary driver in increased incidences of severe fire, which may cause further continuing declines in *B. opposens*.
14. Vegetation disturbance and removal occurs in the Jacks Creek State Forest area along road verges as part of track/firebreak maintenance and to establish sites for apiarists (NPWS 2002). Clearing also occurs for the establishment of tracks associated with gas and coal mining activities in the Jacks Creek State Forest area (M Saunders pers. obs. May 2022) and in the vicinity of several subpopulations in QLD (C. Eddie pers. comm. July 2023). It is likely that similar small-scale clearing for track maintenance may occur at other subpopulations. However, *Bertya opposens* appears resilient to temporary clearing, commonly resprouting after clearing has occurred (NPWS 2002). The geographic spread of *B. opposens* and the proportion of subpopulations that are fully or partially protected means that clearing and fragmentation of habitat is unlikely to drive *B. opposens* to extinction in the near-term; however, clearing continues to be a threat to subpopulations on non-reserved lands and is contributing to continuing decline in the area, extent and quality of habitat and the number of mature individuals and may be contributing to ongoing decline in the AOO and number of subpopulations. One subpopulation in QLD with only *ca.* 2 individuals is currently threatened by development (Queensland Herbarium 2023).
15. It is estimated and inferred that continuing decline in the area, extent and quality of habitat, and number of mature individuals is occurring due to clearing and fragmentation of habitat, largely due to activities associated with coal mining and gas, as well as maintenance and establishment of tracks. It is inferred that continuing decline in the number of subpopulations and AOO will occur in the future, due to the existence of extremely small subpopulations comprised of one to two individuals. Such small subpopulations are also at inherent risk of loss through stochastic events arising from the combined effects of increasingly severe drought and adverse fire regimes. Subpopulations located on non-reserved lands will

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continue to be threatened by adverse disturbance regimes, which can include clearing, due to the poorly applied protections governing these land tenures.

16. *Bertya opposens* (F.Muell. ex Benth.) Guymer is not eligible to be listed as an Endangered or Critically Endangered species.

17. *Bertya opposens* (F.Muell. ex Benth.) Guymer 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*:

Assessment against *Biodiversity Conservation Regulation 2017* criteria

The Clauses used for assessment are listed below for reference.

Overall Assessment Outcome: Vulnerable under Clause 4.3(c)(d)(ei,ii,iii,iv).

Clause 4.2 – Reduction in population size of species

(Equivalent to IUCN criterion A)

Assessment Outcome: Not met

(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: Vulnerable under Clause 4.3(c)(d)(ei,ii,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:			

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	(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: Not met

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.

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**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.
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Chairperson
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Supporting Documentation:

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