

NSW Threatened Species Scientific Committee

Conservation Assessment of *Grevillea scortechinii* subsp. *sarmentosa* (Blakely & McKie) McGill. (Proteaceae)

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***Grevillea scortechinii* subsp. *sarmentosa* (Blakely & McKie) McGill. (Proteaceae)**

Distribution: Endemic to NSW

Current EPBC Act Status: Not listed

Current NSW BC Act Status: Vulnerable

Proposed listing on NSW BC Act: Critically Endangered

Reason for change: genuine change in extinction risk due to an inferred reduction in the extent of occurrence.

Summary of Conservation Assessment

Grevillea scortechinii subsp. *sarmentosa* was found to be Critically Endangered under IUCN Criterion B1ab(i,ii,iii,iv,v).

The reasons for the species being eligible for listing in the Critically Endangered category are: 1) it has a very highly restricted geographic distribution with an extent of occurrence of 83–775 km²; 2) it occurs in 1–3 threat-defined locations, with the estimate of one location thought to be most likely; and 3) continuing decline in the extent of occurrence, area of occupancy, area, extent and/or quality of habitat, number of subpopulations, and number of mature individuals is inferred due to adverse fire regimes (particularly high frequency fire and high severity fire), the clearing and fragmentation of habitat, weed invasion, and habitat degradation from feral pigs (*Sus scrofa*) and livestock.



Grevillea scortechinii subsp. *sarmentosa* in Warra National Park. Photo: Lachlan Copeland/DCCEEW.

Description and Taxonomy

Grevillea scortechinii subsp. *sarmentosa* (Blakely & McKie) McGill., also known as the Backwater grevillea, is an accepted subspecies (CHAH 2024a; PlantNet 2024) in the family Proteaceae. *Grevillea scortechinii* subsp. *sarmentosa* is described as a “prostrate to procumbent shrub, to 0.5 m high and 2 m across. Leaves pinnatifid or coarsely toothed, with 5–7 or rarely to 14 lobes or teeth, or rarely simple, in outline angular-ovate to oblong, 3–10 cm long, c. 2–6 cm wide, primary lobes ± triangular to rounded and sometimes again 2- or 3-toothed; lower surface subsericeous. Inflorescences secund, 2–4.5 cm long. Perianth brownish, subsericeous outside, glabrous inside. Gynoecium 19–22 mm long; ovary densely hairy; style purplish black, glabrous, pollen presenter erect to oblique. Follicle hairy with reddish brown stripes or blotches” (Makinson 1991).

Grevillea scortechinii subsp. *sarmentosa* was originally described in 1930 as *G. sarmentosa* Blakely & McKie (CHAH 2024b) and diagnosed against the Victorian species *G. aquifolium* at the time (Blakely and McKie 1930). Subsequent work placed the taxon much closer to *G. scortechinii*, and it was re-circumscribed as a subspecies of *G. scortechinii* in 1986 (McGillivray 1986). The type subspecies, *G. scortechinii* subsp. *scortechinii* is endemic to near Stanthorpe in southeast Queensland (McGillivray and Makinson 1993).

Grevillea scortechinii subsp. *sarmentosa* can be distinguished from *G. scortechinii* subsp. *scortechinii* by having leaves with primary lobes often bi- or tridentate (*c.f.* lobes usually simple); venation not conspicuous on upper surface (*cf.* venation prominent); pistil 19–22 mm long (*cf.* 28–30 mm long); and the stipe 1.0–1.6 mm long (*cf.* 2.0–2.6 mm long; Makinson 2000).

Distribution and Abundance

Grevillea scortechinii subsp. *sarmentosa* is endemic to the New England Tablelands bioregion of New South Wales (NSW; Commonwealth DCCEEW 2012) where it occurs in the Backwater area, east of Guyra (Makinson 1991). There are records of the subspecies from Baldersleigh and Mann River Nature Reserve (NR); however, it has not been relocated at these localities since 1985 and 1994, respectively (ALA 2024; BioNet 2024), despite multiple searches over the past two decades. The distribution of *G. scortechinii* subsp. *sarmentosa* spans the traditional lands of the Banbai, Gumbaynggirr, Ngarabal, and Anaiwan peoples (NIAA n.d.; AIATIS 1996; Native Land Digital 2024).

Grevillea scortechinii subsp. *sarmentosa* has 1–3 known subpopulations, as per the IUCN (2024) definition. Subpopulations are defined by gene flow and inferred from distance between records and the potential for pollination. *Grevillea scortechinii* is thought to be bird-pollinated, although the location of most flowers at ground level may limit visitation by birds (Booth and Bourne 2020). Records around Backwater are separated from records in Mann River Nature Reserve (NR) by ~29 km and records in Baldersleigh by ~44 km. Honeyeaters, such as the New Holland honeyeater (*Phylidonyris novaehollandiae*) and red wattlebird (*Anthochaera carunculata*), which have been documented moving over long distances (10–50+ km; Birdlife Australia 2023a, 2023b) have been observed feeding on other prostrate *Grevillea* species, such as *G. repens* (Holmes *et al.* 2008) and the closely related *G. ilicifolia* (Ford 1979). However, the two outlying sites are isolated and likely to be very small if they remain

NSW Threatened Species Scientific Committee

extant. Therefore, it is probable each site is a separate subpopulation. The bounded estimate for number of subpopulations (1–3) accounts for the possibility that the species no longer persists at Baldersleigh and Mann River NR (ALA 2024).

The Backwater subpopulation is the largest subpopulation of *Grevillea scortechinii* subsp. *sarmentosa* and only subpopulation currently confirmed to be extant. Records in this subpopulation are centred around Backwater, extending into Warra National Park (NP), Warra State Forest (SF), and Wattleridge Indigenous Protected Area (IPA). A significant number of records also occur on private properties, Crown land, and council land.

Three records of a single site in Mann River NR comprise the second subpopulation. The last record (NE 76335, vouchered at the N.C.W. Beadle Herbarium) of *Grevillea scortechinii* subsp. *sarmentosa* in Mann River NR was made in 1994 (ALA 2024). Over 20 years of regular flora and fauna surveys and fire management activities in Mann River NR, in which *G. scortechinii* subsp. *sarmentosa* was also searched for opportunistically, failed to relocate the species, including at the known site in the reserve (P. Croft *in litt.* November 2024). This included surveys after the fires in 2019, when regeneration should have been more conspicuous (*cf.* Warra NP where there was very conspicuous regeneration; P. Croft *in litt.* November 2024). Hunter (2004) mapped the vegetation of Mann River NR, but did not relocate *G. scortechinii* subsp. *sarmentosa*, despite the extensive traversing of the reserve required to map its vegetation). The site of the historical record was also searched in 2021, but the subspecies was not relocated (M. McKemey *in litt.* December 2024). The continued failure to relocate the subspecies at Mann River NR over the past two decades suggests it is unlikely to currently occur at this locality (Hewlett Hunter 2022a).

The single record (NE 51234) in Baldersleigh comprises the third subpopulation of *Grevillea scortechinii* subsp. *sarmentosa*. This record was made on a private property in 1985 (ALA 2024). Hunter (2004) noted the subspecies had not been relocated since it was first recorded. In 2018, the property was surveyed again, but the subspecies was not relocated (J. Hunter *in litt.* December 2024). The subspecies was also opportunistically searched for while undertaking surveys for *Asterolasia rupestris* subsp. *recurva* in 2021 (G. Phillips *in litt.* March 2025). Targeted surveys in 2022 also failed to find the subspecies (DPE unpublished data).

Extent of occurrence and area of occupancy

The extent of occurrence (EOO) of *Grevillea scortechinii* subsp. *sarmentosa* was calculated at 83–775 km² and is based on a minimum convex polygon enclosing all mapped occurrences of the species, the method of assessment recommended by IUCN (2024). The area of occupancy (AOO) is estimated to be 80–96 km² and was calculated using 2 x 2 km grid cells, the scale recommended by IUCN (2024). Plausible bounds are provided for estimates of both EOO and AOO to accommodate uncertainty around whether the species persists at Baldersleigh and Mann River NR. Both EOO and AOO were calculated using ArcGIS (Esri 2015), enclosing all confirmed survey records, and cleaned spatial datasets.

The current distribution estimate is based on 186 unique and cleaned records compiled from NSW BioNet Atlas, Atlas of Living Australia, herbarium specimens, and

NSW Threatened Species Scientific Committee

recent survey data (Hewlett Hunter 2022b; ALA 2024; ANHSIR 2024; BioNet 2024; RBGDT 2024). Thirty-seven records were excluded from the assessment: 34 records had very high location uncertainty and three were cultivated specimens. Six records had their georeferences revised based on their descriptions.

Population size and trends

Benson and Ashby (2000) found *Grevillea scortechinii* subsp. *sarmentosa* to be locally common in forest on the leucogranite outcrops north of Backwater. Hunter (2001) estimated that there were probably more than 10,000 individuals, and possibly as many as 20,000, present in the Backwater area. It is assumed this estimate was predominantly of mature individuals, as most of the Backwater subpopulation was long unburnt at the time of the estimate, with only a small portion of the subpopulation having burnt 6–7 years prior (Table 1; Hunter 2001; NPWS 2024). Following the 2019 wildfires, it was noted that there could have been tens of thousands of juveniles regenerating in the areas surveyed, with fewer than 70 mature individuals counted (McKemey *et al.* 2021b).

Table 1. Fire history for the three known subpopulations. For Mann River, where only a single site was recorded in 1974 and again in 1994, fire history within 5 km of the record is provided, with the site at the centre of this area. The Backwater subpopulation is divided into north, centre, and south sectors. Mann River NR is divided into north, south, east, west, and centre sectors. Area burnt refers to the total mapped fire extent.

Subpopulation	Fire type	Year	Subpopulation sector	Area burnt (ha)
Backwater	Wildfire	1990–1991	North	3,389
	Wildfire	1993–1994	North	553
	Wildfire	1994–1995	North	2,457
	Wildfire	2001–2002	North	2,051
	Prescribed burn	2009–2010	North	52
	Wildfire / prescribed burn	2013–2014	North	255
	Wildfire / prescribed burn	2015–2016	Centre	714
	Wildfire	2018–2019	North	22
	Wildfire	2019–2020	All	12,938
Mann River NR	Wildfire	1974–1975	East; west	783
	Wildfire	1978–1979	South	386
	Wildfire	1980–1981	All	13,595
	Wildfire	1982–1983	East	1,344
	Wildfire	1986–1987	South; west; east	1,289
	Wildfire	1991–1992	Centre; south; north	5,510
	Wildfire	1992–1993	West	324

NSW Threatened Species Scientific Committee

Subpopulation	Fire type	Year	Subpopulation sector	Area burnt (ha)
Mann River NR	Wildfire	1993–1994	Centre	147
	Wildfire	2000–2001	South	621
	Wildfire	2001–2002	East	18,480
	Wildfire	2008–2009	North	1,725
	Wildfire / prescribed burn	2009–2010	Centre; south	2,892
	Prescribed burn	2013–2014	Centre; north; east	746
	Prescribed burn	2017–2018	West	704
	Prescribed burn / wildfire	2018–2019	North	1,915
	Wildfire	2019–2020	All	57,083
Baldersleigh	-	-	-	-

The factors contributing to the possible loss of the Baldersleigh and Mann River NR subpopulations are not known and there is no information on the size or extent of either subpopulation when they were first documented. Both localities are comprised of mostly contiguous remnant vegetation (Maxar 2023). Baldersleigh has no known fire history, but Mann River NR has had relatively frequent albeit patchy fires over the past three decades, with some areas experiencing fire intervals of <8 years (Table 1; NPWS 2024). It is plausible that high frequency fire has led to the local extinction of *Grevillea scortechinii* subsp. *sarmentosa* at Mann River NR.

Ecology

Habitat

Grevillea scortechinii subsp. *sarmentosa* occurs in shrubby sclerophyll woodland, on granitic slabs and slopes and amongst low granite outcrops in sandy loam soils (Makinson 2000; OEH 2020). The subspecies is commonly found in freely draining areas with considerable water inflow, such as around the base of large outcrops and on the upper margins of swamp (Hunter 2004).

Commonly co-occurring species include *Eucalyptus radiata* subsp. *sejuncta*, *E. dalrympleana* subsp. *heptantha*, *E. pauciflora*, *E. caliginosa*, *E. campanulata*, *Petrophile canescens*, *Leptospermum polygalifolium*, *Bursaria spinosa*, *Banksia integrifolia*, *Lomatia silaifolia*, *Poa sieberiana*, and *Pteridium esculentum* (Hunter 2005; OEH 2020).

Fire and disturbance ecology

Grevillea scortechinii subsp. *sarmentosa* is predominantly an obligate seeder, occasionally capable of resprouting (Hunter 2001). Clarke *et al.* (2009) listed the subspecies as capable of resprouting from basal buds.

Hunter (2001) suggested fire intervals of less than eight years may threaten the persistence of *Grevillea scortechinii* subsp. *sarmentosa*. Lamont (2022) used

NSW Threatened Species Scientific Committee

modelling to estimate that fires at intervals in the order of multiple decades (30+ years) and covering at least 60% of the ground surface are optimal for the subspecies, as longer fire intervals allow plants to grow and produce more seed.

Reproductive and seed ecology

Grevillea scortechinii subsp. *sarmentosa* flowers from October to March (Makinson 2000). The Banbai calendar recognises December (awkendi / guginbil = water) as the flowering month and February (beambyu = eat, phatae = food) as the fruiting month (McKemey and Banbai Rangers 2020; Aunty Lesley pers. comm. December 2024). *Grevillea scortechinii* is thought to be bird-pollinated (Booth and Bourne 2020). Honeyeaters, such as the New Holland honeyeater and red wattlebird, have been observed feeding on the closely related *G. ilicifolia* (Ford 1979) and *G. acanthifolia* (Celebrezze *et al.* 2006), as well as the prostrate *G. repens* (Holmes *et al.* 2008). It is possible that *G. scortechinii* subsp. *sarmentosa* is self-compatible, as the closely related congeners *G. acanthifolia* subsp. *stenomera* and *G. beadleana* are known to be self-compatible (Smith 1997, cited in Smith and Gross 2002); however, further research is required to verify this.

Grevillea scortechinii subsp. *sarmentosa* seeds are inferred to have a physiological dormancy mechanism which delays spontaneous germination. One experiment found 40% germination with the seed coat removed, staggered over 60 days, indicative of a physiological seed dormancy (G. Errington *in litt.* December 2024). Auld *et al.* (2000) found *G. caleyi* produced both dormant and non-dormant seed. However, experiments on seed buried in the field indicated that non-dormant seed did not germinate readily, and suggested the physiological dormancy may involve a seasonally regulated mechanism (*e.g.*, temperature) (Auld *et al.* 2000).

Grevillea scortechinii subsp. *sarmentosa* shares the seed morphology of most species in the Asplenifolia/Hookeriana sub-group (*sensu* Makinson 2000), *i.e.*, seed lacking a wing, seed body usually ellipsoidal and usually with a terminal elaiosome, and sometimes waxy-bordered or ornamented along one or both margins (which may be presented on the 'inner face' of the seed; B. Makinson *in litt.* December 2024). The definite presence or absence of a terminal elaiosome on the seed of *Grevillea scortechinii* is yet to be determined, as is the associated possibility of ant-facilitated seed dispersal (B. Makinson *in litt.* December 2024).

The longevity of the *Grevillea scortechinii* subsp. *sarmentosa* seedbank is not known. Seed of the related *G. caleyi* is estimated to have a half-life of 7.6 years (Auld *et al.* 2000). However, *Grevillea* species in NSW are generally considered to have short-lived seeds unless demonstrated otherwise (G. Errington *in litt.* December 2024).

Lifespan and generation length

In the absence of fire, *Grevillea scortechinii* subsp. *sarmentosa* is likely to live for at least 30 years and may live for as long as 60–70 years (B. Makinson *in litt.* December 2024). The primary juvenile period is not known precisely but is inferred to be 4–5 years for most plants. Three years after the cultural burn in Wattleridge IPA in 2015, a small number of post-fire recruits were found to be flowering (McKemey 2021a) and a single post-fire recruit was found flowering 15 months after the 2019 wildfire in Warra NP (McKemey 2021b). However, in both cases, most individuals observed were not flowering, suggesting that a primary juvenile period of at least 4–5 years is more typical.

NSW Threatened Species Scientific Committee

The IUCN (2024) recommends that for plants with seedbanks, generation length should be calculated by using the juvenile period + either the half-life of seeds in the seedbank or the median time to germination, whichever is known more precisely. The half-life of seeds in the seedbank is not known for *Grevillea scortechinii* subsp. *sarmentosa*. However, median time to germination can be estimated by calculating the median time between fires that would occur if there was no intervention. Fire history in the Backwater population is patchy, with areas experiencing repeat fires as little as 4 years apart and other areas only having burnt once in ~30+ years (NPWS 2024). Based on the fire history, the median time to germination is calculated at 17 years (although given that some recorded fires are likely to have been ignited artificially, 17 years is likely to be an underestimate). With an inferred primary juvenile period of 4–5 years, the minimum generation length of *G. scortechinii* subsp. *sarmentosa* is estimated to be 21–22 years.

Cultural significance

From 2014–2020 a project involving collaboration between the Indigenous Banbai rangers, who manage the 480 ha Wattleridge IPA, with non-Indigenous scientists, was undertaken to implement cultural burning and monitoring of *Grevillea scortechinii* subsp. *sarmentosa* (McKemey *et al.* 2021). The following has been excerpted from McKemey *et al.* (2021):

Prior to the project, the Banbai rangers considered that they had limited knowledge about the grevillea and they were not aware of any traditional use or cultural significance for this plant. Their interest in the grevillea emerged because it was brought to their attention as a threatened species. When the Banbai rangers applied a cultural burn, they observed that it had some benefit for the grevillea, which they confirmed through cross-cultural monitoring. Through their monitoring of the grevillea, the Banbai rangers have become more confident with the application of cultural burning and concluded that cultural burning is the best fire management approach at Wattleridge IPA...While interest in the grevillea may have been triggered by its scientific listing as Vulnerable, and the project progressed within a Western positivist-science framework, the decision to assume stewardship of the grevillea and apply a low intensity fire regime was a cultural decision made by the Banbai based on burning having traditionally been part of a cultural approach to land management (even if it is not known how that was implemented). Through that process and through participating in an academic monitoring approach as a community, the Banbai have reconnected with the grevillea. They are now observing and understanding the grevillea's lifecycle (i.e. they are understanding its kinship), interacting with its needs and applying cultural burning (i.e. as part of their responsibilities for Country) and making decisions about the rule sets they will apply in future management (i.e. they are relearning and applying Backwater grevillea lore)...While this process may have been triggered and motivated by science, it nonetheless will be continued through a cultural paradigm that is motivated by the connection of Banbai with Country and the grevillea.

The Banbai do not hold traditional cultural knowledge of *Grevillea scortechinii* subsp. *sarmentosa* as there are no Elders to pass this knowledge on (Aunty Lesley pers. comm. December 2024).

This assessment is not intended to be comprehensive of the traditional ecological knowledge that exists for *Grevillea scortechinii* subsp. *sarmentosa*, or to speak for Aboriginal people. Aboriginal people have a long history of biocultural knowledge,

NSW Threatened Species Scientific Committee

which comes from observing and being on Country, and evolves as it is tested, validated, and passed through generations (Woodward *et al.* 2020). Aboriginal peoples have cared for Country for tens of thousands of years (Bowler *et al.* 2003; Clarkson *et al.* 2017). There is traditional ecological knowledge for all plants, animals and fungi connected within the kinship system (Woodward *et al.* 2020). Traditional ecological knowledge referenced in this assessment belongs to the relevant knowledge custodian and has been referenced in line with the principals of the NSW Indigenous Cultural and Intellectual Property protocol (ICIP) (Janke and Company 2023).

Threats

Grevillea scortechinii subsp. *sarmentosa* is threatened by adverse fire regimes (particularly high frequency fire, high severity fire and out-of-season fires), the clearing and fragmentation of habitat, weed invasion, and habitat degradation from feral pigs. Reduced pollination success due to pollen removal by European honeybees (*Apis mellifera*) is a potential threat.

Adverse fire regimes

Grevillea scortechinii subsp. *sarmentosa* is threatened by adverse fire regimes, particularly high frequency fire and high severity fire. As an obligate seeder, the subspecies requires inter-fire intervals sufficient to enable replenishment of the soil seedbank. Climate change drives interval squeeze effects and increases plant “immaturity risk”, in part by slowing accumulation of seed banks (the basis for post-fire regeneration in obligate seeders) while also reducing the interval between successive fires (Enright *et al.* 2015). Fire frequencies sufficient to kill recruits prior to maturity and seed bank accumulation threaten obligate seeders with ongoing decline and local extinction (Bowman *et al.* 2014; von Takach Dukai *et al.* 2018; McColl-Gausden *et al.* 2022). It has been suggested that fire frequencies of less than eight years pose a threat to *G. scortechinii* subsp. *sarmentosa* (Hunter 2001), with optimal frequencies in the order of several decades (Lamont 2022).

In 2015, a cultural burn was undertaken as part of the cross-cultural monitoring project with the Banbai, followed by post-fire cross-cultural monitoring of the subspecies' population dynamics. In 2019, wildfires burnt almost the entire *G. scortechinii* subsp. *sarmentosa* population (McKemey *et al.* 2021a, 2021b), providing an opportunity to compare early population responses in areas burnt in each different fire type and areas burnt by both fires. Monitoring after the wildfires of 2019 found 99.6% of mature shrubs in monitoring plots had been killed by the wildfire, compared to 43% following the cultural burn (McKemey *et al.* 2021a). From an initial count of 1.7 seedlings per 20 m² transect prior to cultural burning, seedlings increased to 79.0 per 20 m² transect one year after the cultural burning, before decreasing to 29.8 seedlings per 20 m² transect three years after the cultural burning (McKemey *et al.* 2021a). After all plots were affected by the 2019 wildfire, the mean count of seedlings in control transects increased to 210.0 per 20 m², and to 100.8 in the previously burnt cultural burning transects (McKemey *et al.* 2021a).

Targeted surveys in 2021 identified adverse fire regimes as the most serious threat to *Grevillea scortechinii* subsp. *sarmentosa* (McKemey *et al.* 2021b). At the time of these surveys, it was noted that there were possibly tens of thousands of post-fire seedlings (McKemey 2021b), resulting in much of the population being comprised of

NSW Threatened Species Scientific Committee

even-aged stands of reproductively immature plants. It is possible that a substantial proportion of these plants are now reaching reproductive maturity; however, seedbank input is likely to be minimal for several years to come. Auld and Denham (1999) reported annual seed crop losses of 82–95% in *Grevillea* seeds without an elaiosome in vegetation unburnt for greater than 8 years, as ants did not remove seeds from where they were dropped, allowing for higher rates of seed predation by mammals. While it is unknown whether *G. scortechinii* subsp. *sarmentosa* seeds possess an elaiosome which facilitates dispersal by ants, it is possible they do not, which could result in increased levels of seed predation further limiting replenishment of the seedbank.

A population viability analysis of *Grevillea caleyi* undertaken by Regan and Auld (2004) showed i) under fixed burning intervals of 10 years, risk of decline was much greater when prescribed burning did not account for unplanned wildfires; and ii) risks of population decline were greater when the population was burnt every 10 years compared to every 15 years.

The risk of recurrent fire is increased by frequent asset protection hazard reduction burns and escaped private property fires (OEH 2020).

For species like *Grevillea scortechinii* subsp. *sarmentosa* that have physiologically dormant seeds, out-of-season fire may be a threat. Delayed or reduced germination may occur due to mismatches between the seasonal timing of fire and dormancy and germination phenology (Mackenzie *et al.* 2021).

Climate change projections indicate a future trend of increased frequency of severe fire weather and more frequent fires (Abatzoglou *et al.* 2019; Dowdy *et al.* 2019; Jones *et al.* 2022). The New England and North West region is projected to become hotter, have fewer cold nights under 2°C, have more hot days over 35°C, have more dangerous fire weather days, and have a longer fire season by 2079 (BOM and CSIRO 2024; AdaptNSW 2024). Regionally, it is projected with high confidence that climate change will result in a harsher fire-weather climate in the future (CSIRO 2024). It is plausible that these changes will lead to more frequent, intense, and severe fires, and changes in fire season, which will in turn adversely affect the *Grevillea scortechinii* subsp. *sarmentosa* population in the future.

'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 Processes under the *Biodiversity Conservation Act 2016*. 'Fire regimes that cause declines in biodiversity' is listed as a Key Threatening Processes under the *Environment Protection and Biodiversity Conservation Act 1999*.

Clearing and fragmentation of habitat

Significant parts of the *Grevillea scortechinii* subsp. *sarmentosa* distribution occur on non-reserved lands, including private properties, Crown land, and council land. Where the subspecies occurs on these land tenures it is threatened by the clearing and fragmentation of habitat for agriculture and rural subdivision, road maintenance, and private native forestry (OEH 2020). Timber harvesting may also adversely affect the subspecies where it occurs in Warra SF, (OEH 2020), noting that this species is

NSW Threatened Species Scientific Committee

protected under the mechanisms prescribed in the Coastal Integrated Forestry Operations Approval (EPA 2018).

Clearing of woody vegetation is ongoing and significant areas have been cleared over the past several decades. Changes in vegetation cover are evident in satellite imagery taken in the 2020s compared to aerial imagery taken in the 1990s (DCS 2022; Maxar 2023). Clearing of vegetation proximate to records made in 2019 occurred sometime between 2020–2023, indicating that the subspecies continues to be threatened by habitat loss on non-reserved lands.

Surveys in 2021 documented vegetation clearing occurring on private properties adjacent to Warra NP and road maintenance activities on council land impacting mature individuals which had survived the 2019 fires (McKemey *et al.* 2021b; M. McKemey pers. comm. December 2024).

‘Clearing of native vegetation’ is listed as a Key Threatening Process under the *Biodiversity Conservation Act 2016*. ‘Land clearance’ is listed as a Key Threatening Process under the *Environment Protection and Biodiversity Conservation Act 1999*.

Weed invasion

Weed invasion, particularly by exotic *Rubus* spp. (blackberry) is a recognised threat to *Grevillea scortechinii* subsp. *sarmentosa* (DEWHA 2008; OEH 2020; McKemey 2021b), with seedlings particularly vulnerable to being outcompeted by weeds such as blackberry (OEH 2020). Blackberry establishes mostly in disturbed areas, including pasture and areas naturally disturbed by fire and once established, can outcompete native plants (Bruzzese *et al.* 2000). With significant parts of the subspecies’ distribution occurring on agricultural land and almost all of its range around Backwater within the mapped 2019 fire extent, it is plausible blackberry will expand its distribution locally at the expense of the regenerating *G. scortechinii* subsp. *sarmentosa* population.

‘Loss and degradation of native plant and animal habitat by invasion of escaped garden plants, including aquatic plants’ are listed as a Key Threatening Processes under the *Biodiversity Conservation Act 2016*. ‘Loss and degradation of native plant and animal habitat by invasion of escaped garden plants, including aquatic plants’ is listed as a Key Threatening Processes under the *Environment Protection and Biodiversity Conservation Act 1999*.

Habitat degradation by feral pigs and livestock

Habitat degradation by feral pigs and domestic cattle is a recognised threat to *Grevillea scortechinii* subsp. *sarmentosa* (DEWHA 2008; OEH 2020). In 2021, localised pig damage was noted in some areas of the Backwater subpopulation (McKemey *et al.* 2021b). Plants have been observed to be grazed by cattle (OEH 2020).

‘Predation, habitat degradation, competition and disease transmission by feral pigs (*Sus scrofa*)’ is listed as a Key Threatening Processes under the *Biodiversity Conservation Act 2016*. ‘Predation, habitat degradation, competition and disease transmission by feral pigs’ is listed as a Key Threatening Processes under the *Environment Protection and Biodiversity Conservation Act 1999*.

NSW Threatened Species Scientific Committee

Reduced pollination success due to pollen removal by European honeybees

While it is probable that *Grevillea scortechinii* subsp. *sarmentosa* flowers are primarily bird-pollinated, it is likely that European honeybees also visit its flowers. Several studies have found honeybees are often the only other floral visitors to bird-adapted *Grevillea* flowers, including *G. macleayana* (Whelan *et al.* 2009), *G. acanthifolia* (Celebrezze *et al.* 2006), and *Grevillea x gaudichaudii* (a natural hybrid of *G. acanthifolia* and *G. laurifolia*; Taylor and Whelan 1988). In all cases, it was found honeybees remove pollen without transferring it to other flowers. It is plausible this is also occurring in *G. scortechinii* subsp. *sarmentosa* and resulting in reduced pollination success.

'Competition from feral honey bees, *Apis mellifera* L.' is listed as a Key Threatening Processes under the *Biodiversity Conservation Act 2016*.

Number of locations

Grevillea scortechinii subsp. *sarmentosa* occurs at 1–3 threat-defined locations, as per the IUCN (2024) definition, due to the most serious plausible threat that results in the lowest number of locations, being adverse fire regimes. Concurrent fires in 2019 burnt almost the entirety of the Backwater subpopulation, with only a small number of records occurring outside of the mapped fire extent. The farthest of these records is only 1.5 km from the edge of the burn area. It is plausible a future fire could burn at a scale sufficient to affect the entire Backwater subpopulation. The low end of the range of number of locations assumes the subspecies no longer persists at Baldersleigh and Mann River NR, which would result in a single threat-defined location. The high end of the range includes all three known subpopulations, which each subpopulation a separate threat-defined location.

Assessment against IUCN Red List criteria

For this assessment it is considered that the survey of *Grevillea scortechinii* subsp. *sarmentosa* has been adequate and there is sufficient scientific evidence to support the listing outcome.

Criterion A

Population size reduction

A. Population size reduction. Population reduction (measured over the longer of 10 years or 3 generations) based on any of A1 to A4			
	Critically Endangered	Endangered	Vulnerable
A1	≥ 90%	≥ 70%	≥ 50%
A2, A3 & A4	≥ 80%	≥ 50%	≥ 30%
A1 Population reduction observed, estimated, inferred, or suspected in the past where the causes of the reduction are clearly reversible AND understood AND have ceased. A2 Population reduction observed, estimated, inferred, or suspected in the past where the causes of reduction may not have ceased OR may not be understood OR may not be reversible. A3 Population reduction projected, inferred or suspected to be met in the future (up to a maximum of 100 years) [(a) cannot be used for A3]. A4 An observed, estimated, inferred, projected or suspected population reduction where the time period must include both the past and the future (up to a max. of 100 years in future), and where the causes of reduction may not have ceased OR may not be understood OR may not be reversible.		based on any of the following: (a) direct observation [except A3] (b) an index of abundance appropriate to the taxon (c) a decline in area of occupancy (AOO), extent of occurrence (EOO) and/or habitat quality (d) actual or potential levels of exploitation (e) effects of introduced taxa, hybridization, pathogens, pollutants, competitors or parasites.	

Outcome

Grevillea scortechinii subsp. *sarmentosa* is Data Deficient under Criterion A.

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Population reductions

Uncertainty remains around whether *Grevillea scortechinii* subsp. *sarmentosa* persists at Baldersleigh and Mann River NR, where it has not been recorded since 1985 and 1994, respectively, despite multiple surveys and searches over the past two decades. It is possible that, despite this survey effort, the subspecies persists at one or both localities undetected. If inferring the loss of these subpopulations, there has been a reduction in EOO of 89% over the last ~40 years, within the three-generation timeframe of 63–66 years. However, there is considerable uncertainty about whether the reduction in EOO has led to a commensurate population reduction, as the size of the putatively extinct subpopulations is unknown. Both subpopulations inferred to have been lost were disjunct, with the historical EOO including significant swathes of land converted to agriculture prior to c. 1960, more than three generations ago (DCS 2022). Furthermore, the historical Baldersleigh and Mann River NR subpopulations appear to have occupied smaller areas than the extant Backwater subpopulation. Thus, while the EOO is inferred to have been reduced by 89%, there are insufficient data to quantify the population reduction, which, based on the information above, may not be of a similar magnitude to the reduction in EOO.

Conclusion

Despite a potential quantifiable loss of EOO, there are insufficient data to estimate, infer, or project the magnitude of past or future reductions in the population size of *Grevillea scortechinii* subsp. *sarmentosa*. As such, it is considered Data Deficient under Criterion A.

Criterion B

Geographic range

B. Geographic range in the form of either B1 (extent of occurrence) AND/OR B2 (area of occupancy)			
	Critically Endangered	Endangered	Vulnerable
B1. Extent of occurrence (EOO)	< 100 km ²	< 5,000 km ²	< 20,000 km ²
B2. Area of occupancy (AOO)	< 10 km ²	< 500 km ²	< 2,000 km ²
AND at least 2 of the following 3 conditions:			
(a) Severely fragmented OR Number of locations	= 1	≤ 5	≤ 10
(b) Continuing decline observed, estimated, inferred or projected in any of: (i) extent of occurrence; (ii) area of occupancy; (iii) area, extent and/or quality of habitat; (iv) number of locations or subpopulations; (v) number of mature individuals			
(c) Extreme fluctuations in any of: (i) extent of occurrence; (ii) area of occupancy; (iii) number of locations or subpopulations; (iv) number of mature individuals			

Outcome

Grevillea scortechinii subsp. *sarmentosa* is Critically Endangered under Criterion B1ab(i,ii,iii,iv,v).

EOO and AOO

The EOO was calculated at 83–775 km² and the AOO at 80–96 km². A range for both EOO and AOO is provided to accommodate uncertainty around whether the species persists at Baldersleigh and Mann River NR. Given the unsuccessful outcomes of multiple searches, however, it seems unlikely that the subspecies persists at these localities, warranting a precautionary approach to the estimates. It is therefore appropriate to use the lower bounds, with an EOO of 83 km² below the threshold for Critically Endangered.

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Number of threat-defined locations

Grevillea scortechinii subsp. *sarmentosa* is found at 1–3 threat-defined locations, with the estimate of one location thought to be most likely. As noted above, the continued failure to relocate the subspecies around Baldersleigh and Mann River NR, despite multiple surveys over the past two decades, suggests it no longer persists at either of these localities. Consequently, it appears likely that a single threat-defined location persists around Backwater.

Severely fragmented

Grevillea scortechinii subsp. *sarmentosa* is not considered to be severely fragmented, as >50% of the subspecies' AOO is inferred to be comprised of habitat patches large enough to support a viable population.

Continuing decline

Continuing decline in the extent of occurrence, area of occupancy, area, extent and/or quality of habitat, number of subpopulations, and number of mature individuals is inferred due to adverse fire regimes (particularly high frequency fire and high severity fire), the clearing and fragmentation of habitat, weed invasion, and habitat degradation from feral pigs and livestock. The inferred loss of two subpopulations has resulted in a reduction in EOO and AOO and an inferred decline in the number of mature individuals and the area and extent of habitat. Wildfires in 2019 burnt almost the entire extent of the Backwater subpopulation (NPWS 2024). Monitoring after the wildfires found 99.6% of mature shrubs in monitoring plots had been killed by the wildfire (McKemey *et al.* 2021a). It is highly likely that most of the population is now composed of even-aged stands nearing or having recently completed their primary juvenile periods that may compensate mortality that occurred in the 2019 fire, if future fires do not interrupt recovery of the population. However, another fire in the near future would threaten the population with population declines as the seedbank is likely to be largely depleted and not yet re-accumulated. Where the subspecies occurs on non-reserved lands, it continues to be threatened with habitat clearing and fragmentation, with ongoing vegetation clearing visible in recent satellite imagery around the Backwater area.

Extreme fluctuations

There is no evidence to suggest *Grevillea scortechinii* subsp. *sarmentosa* undergoes extreme fluctuations in its EOO, AOO, number of locations or subpopulations, or number of mature individuals, and being a relatively long-lived shrub, it is unlikely to.

Conclusion

Grevillea scortechinii subsp. *sarmentosa* is eligible to be listed as Critically Endangered under Criterion B as it has a very highly restricted geographic distribution with an EOO of 83–775 km², occurs in 1–3 threat-defined locations, with the estimate of one location thought to be most likely, and is undergoing continuing decline in the extent of occurrence, area of occupancy; area, extent and/or quality of habitat, number of subpopulations, and number of mature individuals.

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Criterion C Small population size and decline

C. Small population size and decline			
	Critically Endangered	Endangered	Vulnerable
Number of mature individuals	< 250	< 2,500	< 10,000
AND at least one of C1 or C2			
C1. An observed, estimated or projected continuing decline of at least (up to a max. of 100 years in future):	25% in 3 years or 1 generation (whichever is longer)	20% in 5 years or 2 generations (whichever is longer)	10% in 10 years or 3 generations (whichever is longer)
C2. An observed, estimated, projected or inferred continuing decline AND at least 1 of the following 3 conditions:			
(a) (i) Number of mature individuals in each subpopulation	≤ 50	≤ 250	≤ 1,000
(ii) % of mature individuals in one subpopulation =	90–100%	95–100%	100%
(b) Extreme fluctuations in the number of mature individuals			

Outcome

Grevillea scortechinii subsp. *sarmentosa* is Data Deficient under Criterion C1 and ineligible to be listed under Criterion C2.

Number of mature individuals

Hunter (2001) estimated there to be $\geq 10,000$ and up to 20,000 *Grevillea scortechinii* subsp. *sarmentosa* in the Backwater area. At the time this estimate was made, most of the subpopulation was long unburnt, with the most recent fire in a small subset of the population having occurred around seven years prior (NPWS 2024). This suggests the most plants present at that time were mature individuals. McKemey (2021b) estimated that >99% of the plants surveyed in 2021 were post-fire recruits. This suggests the current number of mature individuals is likely to be low. However, the IUCN (2024) states that “in the case of taxa that naturally lose all or a subset of mature breeding individuals at some point in their life cycle, the estimate should be made at the appropriate time, when mature individuals are available for breeding”. *Grevillea scortechinii* subsp. *sarmentosa* is an obligate seeding shrub, typically killed outright by fire and recruiting from seed, meaning that fluctuations in standing plant numbers immediately before and after fire may not equate to declines. The IUCN (2024) also states “where the population size fluctuates, use a lower estimate. In most cases this will be much less than the mean.” With a previous population estimate of >10,000 and up to 20,000 plants, most of which were inferred to be mature, it is probable that, on average, there is >10,000 mature individuals in the population.

Continuing decline

Continuing decline in the number of mature individuals is inferred due to adverse fire regimes (particularly fire frequency and high severity fire) and the clearing and fragmentation of habitat. The inferred loss of two subpopulations would have resulted in a decline in the number of mature individuals. However, there are insufficient data to quantify the decline.

Mature individuals in each subpopulation

Current evidence suggests that *Grevillea scortechinii* subsp. *sarmentosa* is now limited to the Backwater area, where it occurs in a single subpopulation. It is probable that the population typically supports >10,000 mature individuals.

% of mature individuals in a single subpopulation

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Current evidence suggests that *Grevillea scortechinii* subsp. *sarmentosa* is now limited to the Backwater area, where it occurs in a single subpopulation supporting 100% of the mature individuals of the population. The subspecies may persist at one or both other two known subpopulations at undetectably low numbers; however, on the balance of evidence this is thought to be unlikely.

Extreme fluctuations

There is no evidence to suggest *Grevillea scortechinii* subsp. *sarmentosa* undergoes extreme fluctuations in the number of mature individuals and as a long-lived tree, it is unlikely to. As an obligate seeder, fires are expected to periodically result in stand replacement; however, the presence of a persistent soil seedbank negates this being considered an extreme fluctuation (IUCN 2024).

Conclusion

Grevillea scortechinii subsp. *sarmentosa* is Data Deficient under Criterion C1 due to there being insufficient data to quantify decline over the required timeframes. *Grevillea scortechinii* subsp. *sarmentosa* is ineligible to be listed under Criterion C2, as it is inferred that the population size is typically >10,000 mature individuals.

Criterion D Very small or restricted population

D. Very small or restricted population			
	Critically Endangered	Endangered	Vulnerable
D. Number of mature individuals	< 50	< 250	D1. < 1,000
D2. <i>Only applies to the VU category</i> Restricted area of occupancy or number of locations with a plausible future threat that could drive the taxon to CR or EX in a very short time.	-	-	D2. typically: AOO < 20 km ² or number of locations ≤ 5

Outcome

Grevillea scortechinii subsp. *sarmentosa* is ineligible to be listed under Criterion D.

Number of mature individuals

The population size of *Grevillea scortechinii* subsp. *sarmentosa* is inferred to typically be >10,000 mature individuals, above the threshold of 1,000 for Vulnerable under Criterion D.

Risk of future extinction in a very short amount of time (D2)

Grevillea scortechinii subsp. *sarmentosa* occurs at one threat-defined location and has an estimated AOO of 80–96 km². There are no plausible future threats that could rapidly drive the subspecies to Extinct in a very short time.

Criterion E Quantitative Analysis

E. Quantitative Analysis			
	Critically Endangered	Endangered	Vulnerable
Indicating the probability of extinction in the wild to be:	≥ 50% in 10 years or 3 generations, whichever is longer (100 years max.)	≥ 20% in 20 years or 5 generations, whichever is longer (100 years max.)	≥ 10% in 100 years

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Outcome

Grevillea scortechinii subsp. *sarmentosa* is considered Data Deficient under Criterion E.

Probability of extinction

No quantitative analysis has been undertaken to assess the extinction probability of this species and there are currently insufficient data to undertake one.

Conservation and Management Actions

Grevillea scortechinii subsp. *sarmentosa* is currently listed on the NSW *Biodiversity Conservation Act 2016* and a conservation project has been developed by the NSW Department of Climate Change, Energy, the Environment and Water under the Saving our Species program. The conservation project identifies priority locations, critical threats and required management actions to ensure the species is extant in the wild in 100 years. *Grevillea scortechinii* subsp. *sarmentosa* sits within the 'site-managed species' management stream of the SoS program and the conservation strategy can be viewed [here](#).

At the time of writing, key actions in the conservation strategy included: Developing and maintaining *ex situ* germplasm collections of the subspecies, maintaining appropriate fire regimes, reducing the adverse effects of grazing, reducing weed densities, minimising the clearing of habitat, ensuring land management is compatible with long-term conservation of the subspecies, and tracking the subspecies' abundance and condition over time.

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NSW Threatened Species Scientific Committee

APPENDIX 1

Assessment against *Biodiversity Conservation Regulation 2017* criteria

The Clauses used for assessment are listed below for reference.

Overall Assessment Outcome:

Grevillea scortechinii subsp. sarmentosa was found to be Critically Endangered under Clause 4.3(a)(d)(e i,ii,iii,iv).

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: Critically Endangered under Clause 4.3(a)(d)(e i,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:			
	(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,

NSW Threatened Species Scientific Committee

	(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: Data Deficient.

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.

NSW Threatened Species Scientific Committee

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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