

# NSW Threatened Species Scientific Committee

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## Conservation Assessment of *Isopogon prostratus* McGill. (Proteaceae)

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### *Isopogon prostratus* McGill. (Proteaceae)

Distribution: NSW and Victoria  
Current EPBC Act Status: Not listed  
Current NSW BC Act Status: Not listed  
Current Victoria FFG Act status: Critically Endangered  
Proposed listing on NSW BC Act: Endangered

### Summary of Conservation Assessment

*Isopogon prostratus* was found to be eligible for listing as Endangered under IUCN Criterion B2ab(iii,v).

The main reasons for this species being eligible are: (1) it has a highly restricted geographic distribution with an area of occupancy of 384 km<sup>2</sup>; (2) it is considered to be severely fragmented; and (3) continuing decline in the number of mature individuals and the area, extent and quality of habitat is estimated due to habitat clearing, fragmentation and degradation, and inferred due to adverse fire regimes (particularly high frequency fire, low frequency fire, high intensity fire, and changes in fire season) and *Phytophthora cinnamomi*.



*Isopogon prostratus* on Newnes Plateau, NSW. Photo: Matt Saunders.

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## Description and Taxonomy

*Isopogon prostratus* McGill. is a conventionally accepted species in the family Proteaceae (CHAH 2025; PlantNet 2025). *Isopogon prostratus* is described as a “prostrate shrub, occasionally ± erect, young shoots and branchlets pubescent. Leaves 4–10 cm long; ultimate segments 1–2 mm wide, at least ridged on the lower surface at the midrib and margins. Inflorescences terminal, ± globose. Flowers sessile. Perianth c. 3 mm long, yellow, glabrous except for terminal tuft of long hairs. Fruiting cones ± globose, 12–20 mm diam. Nuts 2–3 mm long and covered with hairs 5–6 mm long” (Harden 1991).

*Isopogon prostratus* may be confused with *I. anemonifolius* but can be distinguished by its typically prostrate habit, flat leaves with segments 1–2 mm wide, and the long tuft of hairs on the perianth that are conspicuous in bud (*cf.* erect habit, flat leaves with segments 3–5 mm wide, and short tuft of hairs on the perianth with *I. anemonifolius*) (Harden 1991).

*Isopogon prostratus* was previously known as *Isopogon anemonifolius* var. *tenuifolius* F.Muell. ex Benth. (CHAH 2025).

## Distribution and Abundance

*Isopogon prostratus* has a sporadic and disjunct distribution in New South Wales (NSW) and Victoria (Vic) (Benson and von Richter 2010), where it occurs in the Sydney Basin, South Eastern Highlands, and South East Corner bioregions of NSW and the South East Corner and South East Coastal Plain bioregions of Vic (Commonwealth DCCEEW 2025). The northern extent of the species occurs in Muggii Murum-Ban State Conservation Area (SCA), northwest of Newnes Plateau, with disjunct occurrences from Penrose along the southern ranges to Eden in NSW and Mallacoota in Vic, with a disjunct subpopulation in Providence Ponds Flora and Fauna Reserve (FFR) a further 200 km west-southwest. The distribution of *I. prostratus* occurs on the traditional lands of the Darkinjung, Dharug, Gundungurra, Yuin, Ngarigo, Bidwell, and Gunaikurnai peoples (AIATSIS 1996; Native Land Digital 2024).

*Isopogon prostratus* occurs across 86 known subpopulations, as defined by the IUCN (2024). Subpopulations have been delineated by a geographic separation of ≥1 km between occurrences, as gene flow from either pollination or seed dispersal is considered to be restricted over this distance. In the absence of knowledge of the specific pollinators of *I. prostratus*, generic native bee foraging distances were used to determine subpopulations. For example, the eusocial native bee *Tetragonula carbonaria* has been found to forage to a maximum distance of approximately 700 m (Smith *et al.* 2017), although it is possible larger native bee species may forage to distances greater than 1 km (Greenleaf *et al.* 2007).

The current distribution estimate is based on 329 unique and cleaned records compiled from NSW BioNet Atlas, Victorian Biodiversity Atlas, Atlas of Living Australia, herbarium specimens, and recent survey data (ANHSIR 2024; RBGDT 2024; ALA 2025; BioNet 2025a; M. Saunders pers. obs. January 2025; VBA 2025). Sixty-three records were excluded from the assessment: 16 of these were cultivated specimens, 45 had inadequate data to spatially validate, and two records from 1919 plotted out to farmland. The georeferences of seven records were revised based on their descriptions.

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## Extent of occurrence and area of occupancy

The area of occupancy (AOO) is estimated to be 384 km<sup>2</sup> and was calculated using 2 x 2 km grid cells, the scale recommended by IUCN (2024). The extent of occurrence (EOO) was calculated at 71,479 km<sup>2</sup> and is based on a minimum convex polygon enclosing cleaned mapped occurrences of the species, the method of assessment recommended by IUCN (2024). Both EOO and AOO were calculated using ArcGIS (Esri 2015).

## Population size and trends

There are insufficient data to estimate the population size of *Isopogon prostratus* as few subpopulations have abundance information available, although data from a subset of subpopulations suggest ongoing population declines.

Based on extensive fieldwork over the past two decades, the current total population size of the Newnes Plateau subpopulations (including Genowlan) is estimated to be ~200–250 individuals, having declined from ~350 since 2018 (mainly in 2022–2023) (Table 1; D. Benson and I. Baird *in litt.* April 2024). This estimate does not account for a new site that was located during targeted surveys undertaken for this assessment. The new site, located entirely within a powerline easement, was discovered ~250 m from site 1b and supported no fewer than 40 individuals, although significant habitat degradation and direct damage to plants were evident (M. Saunders pers. obs. January 2025). Subpopulations on Newnes Plateau range in size from <5 to ~100 individuals (Benson and Baird 2023).

Only 34 BioNet (2025a) records provide abundance estimates, 20 of which occur outside of the Newnes area. Most (29) provide a count of ≤5 individuals while a single record from Nadgigomar Nature Reserve (NR) indicates a subpopulation size of ~500 individuals.

The disjunct subpopulation at Providence Ponds FFR in Vic is estimated to be comprised of ~50 individuals, having declined from a 1956 estimate of 4,000 individuals after being cleared (DELWP 2021).

**Table 1.** Monitored *Isopogon prostratus* sites on Newnes Plateau. Data provided by D. Benson and I. Baird (*in litt.* April 2024). 2025 survey data from M. Saunders (January 2025).

| Site   | Count in 2018   | Count in 2023 | Count in 2025 |
|--|-----------------|---------------|---------------|
| 8.) Road island junction remnant adjacent to Glow Worm Tunnel Rd     | 11              | 2             | Not surveyed  |
| 9a.) East of Prison Camp dam / east side of road among pine wildings | 33              | 18            | Not surveyed  |
| 9b.) West side of road in bush                                       |                 | 13            | Not surveyed  |
| 7a.) East of Broad swamp, west of pine plantation                    | 25 <sup>#</sup> | 44            | ≥100*         |
| 7b.) East of Broad swamp, Camp site/vehicle track disturbance        |                 | 56            |               |

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| Site   | Count in 2018 | Count in 2023                 | Count in 2025 |
|--|---------------|-------------------------------|---------------|
| 6.) 9 Mile pine monitor site; 1 km north of Bungleboori picnic area  | 58?           | 5                             | 2*            |
| 5.) Bungleboori south, ~1 km north of Old Bells Line Rd/Glowworm Tunnel Rd junction, west side of Glowworm tunnel Rd   | 25            | 3                             | Not surveyed  |
| 4.) Upper Farmers Creek trail junction with Old Bells Line Rd, near Bald trig.<br><br>West side of Bells Line Rd on northern edge of FC trail<br><br>East side of Old Bells Line Rd in bush opposite and slightly south of above plant | 1<br><br>15   | 1<br><br>Plants not relocated | Not surveyed  |
| 1a.) Clarence, north of sawmill-between sawmill and Old Bells Line Rd  | 100? estimate | 11                            | Not surveyed  |
| 1b) Clarence Powerline corner adjacent to Old Bells Line Rd  |               | 54                            | 31*           |
| <b>TOTAL</b>   | <b>268</b>    | <b>207</b>                    | N/A           |

\* 2025 surveys were undertaken opportunistically. Given the different surveyors and probable differences in survey methods, data are not comparable between years and only provide evidence of persistence.

# Noted as an underestimate and probably closer to 120 (D. Benson and I. Baird *in litt.* April 2024).

## Ecology

### Habitat

*Isopogon prostratus* typically occurs in heath and dry sclerophyll woodland in exposed situations on sandy soils (Harden 1991; Benson and McDougall 2000; VicFlora 2025). Across its range, sites range from 50 m above sea level (a.s.l.) on the coast in the southern parts of its range to 1,100 m a.s.l. on the tablelands. Occurrences are typically localised (Benson and von Richter 2010).

*Isopogon prostratus* may occur in the following mapped Plant Community Types (PCTs): 'Allocasuarina nana heathland at Genowlan Point, Sydney Basin Bioregion' (PCT 636), 'Bungonia Tableland Scribbly Gum Shrub Forest' (PCT 737), 'Kybayan Montane Heath' (PCT 3876), and 'Far Southeast Coastal Lowland Heath' (PCT 3816) (BioNet 2025b). This list is not exhaustive, and it is likely that the species occurs in other PCTs in NSW.

Species co-occurring with *Isopogon prostratus* vary across its range and may include *Eucalyptus dives*, *E. radiata*, *E. sieberi*, *E. cephalocarpa*, *Hakea sericea*, *Daviesia latifolia*, *Acacia terminalis*, *Leptospermum polygalifolium*, *Gaudium myrsinoides*, *Allocasuarina nana*, *Grevillea laurifolia*, *Epacris pulchella*, *Monotoca scoparia*, *Brachyloma daphnoides*, *Boronia algida*, *Banksia canei*, *Dillwynia sericea*, *Lomandra*

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*glauca*, and *Euryomyrtus denticulata* (Benson and Keith 1990; Benson and von Richter 2010; DELWP 2021; ANHSIR 2024; RBGDT 2024; ALA 2025; BioNet 2025a).

*Isopogon prostratus* is known to occur in the Genowlan Point *Allocasuarina nana* Heathland EEC listed on the *Biodiversity Conservation Act 2016* (D. Benson and I. Baird *in litt.* April 2024).

## Fire and disturbance ecology

*Isopogon prostratus* produces a substantial lignotuber (Benson and von Richter 2010; VicFlora 2025), which enables the species to resprout following disturbance, such as surface vegetation clearing or fire (Benson and von Richter 2010). However, fire tolerance in *I. prostratus* is likely to a function of lignotuber size and may not occur until plants are >13 years old, based on experiments with the congener *I. anemonifolius* that found that the age of first fire tolerance was around 13–16 years of age (Bradstock and Myerscough 1988; Bradstock 1990). The species is serotinous, releasing seed post-fire (D. Benson and I. Baird *in litt.* April 2024) but is incapable of vegetative spread or rooting at the nodes (Benson and McDougall 2000). Resprouting of burnt individuals has been observed on Newnes Plateau following the 2019–2020 fires (D. Benson and I. Baird *in litt.* April 2024). *Isopogon prostratus* has been classified as a stress tolerator (Benson and von Richter 2010).

## Reproductive and seed ecology

Flowering of *Isopogon prostratus* typically occurs from October to March (Benson and McDougall 2000). The specific pollinators of the species are unknown, but it is inferred to be insect pollinated. The closely related *I. anemonifolius* is known to be visited by several species of native bee in the Apidae and Colletidae families (Bernhardt *et al.* 2019).

In germination trials with a 12 hour light/dark cycle at 20°C, *Isopogon prostratus* seed began to germinate after 20 days and continued to day 107 (Benson and von Richter 2010).

*Isopogon prostratus* seeds have hairs (Harden 1991) which may aid dispersal (Bate and Trickett 2023). Dispersal of seed is most likely localised via gravity and possibly wind or water over short distances (Benson and McDougall 2000; I. Baird *in litt.* January 2025), although the low stature of plants and surrounding density of undergrowth probably limits dispersal distances. Dispersal is likely to be limited to within a metre or so of the parent plant, resulting in long-term habitat fidelity with very little colonising potential (Benson 2024).

## Lifespan and generation length

*Isopogon prostratus* is known to live for at least 30 years and estimated to live up to 60–200 years (Benson and von Richter 2010). The primary juvenile period of the species is not known but can be inferred to be relatively long. It is thought that seedlings which recruited following the 2019–2020 fire on Newnes Plateau are unlikely to be currently reproductively mature five years later (I. Baird *in litt.* January 2025). In resprouters, the primary juvenile period is typically longer than the secondary juvenile period (Keith 1996). In 2025, individuals that were observed to have resprouted after the 2019–2020 fires were noted to be absent of any reproductive structures (M. Saunders pers. obs. January 2025). If this is assumed to be normal, then the primary juvenile period may be tentatively estimated to be at least in the order of 8–10 years.

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The generation length of *Isopogon prostratus*, which is likely to rely on a combination of resprouting and seedling recruitment after disturbance, can be estimated using the age of first reproduction +  $z$  \* length of reproductive period, where  $z$  is a number between 0 and 1 calculated on the relationship between survivorship and the relative fecundity of young versus old individuals in the population (IUCN 2024). Using a maximum lifespan of 60–200 years, a primary juvenile period of 8–10 years, and a value for  $z$  of 0.16 as calculated for other plant species with similar lifespans (Fung and Waples 2017), the generation length of *I. prostratus* is estimated at approximately 18–38.7 years.

## Cultural Significance

It is unknown whether *Isopogon prostratus* has cultural significance to Aboriginal peoples. This assessment is not intended to be comprehensive of the traditional ecological knowledge that exists for *I. prostratus*, or to speak for Aboriginal people. Aboriginal people have a long history of biocultural knowledge, 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).

## Threats

*Isopogon prostratus* is threatened by habitat clearing, fragmentation and degradation, adverse fire regimes (particularly high frequency, low frequency, and high intensity fire), and *Phytophthora cinnamomi*.

### Habitat clearing, fragmentation, and degradation

Across its range, *Isopogon prostratus* is threatened by habitat clearing, fragmentation, and degradation. Thirty-five subpopulations (82 records) occur fully or partially on non-reserved lands, defined here as private land, mine lease, Council land, and Crown land. The status of most subpopulations is unknown; however, it is inferred that many of these subpopulations are threatened by clearing for agriculture, rural or industrial developments, and the establishment and maintenance of roads. A further six subpopulations (18 records) occur fully or partially in state forests where the species may be subject to adverse effects from timber harvesting and associated activities and recreational offroad driving.

The remaining records occur on protected tenures managed by NSW National Parks and Wildlife Service (NPWS) and Parks Victoria. However, even on protected tenures, the species may still be subject to significant and irreversible habitat disturbance, fragmentation and degradation arising from offroad vehicle use and other recreational activities, the establishment and maintenance of tracks and trails, and fire management activities.

There is evidence that the Providence Ponds FFR subpopulation in Vic has undergone a serious decline in the past 40–50 years due to habitat clearing, declining from an estimated 4,000 individuals in 1956 to just 50 (DELWP 2021). No recruitment has been observed at this subpopulation since monitoring began in 1989 (SAC 1994, cited in DELWP 2021).

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Declines and extensive habitat disturbance have also occurred in and around subpopulations in Gardens of Stone SCA on Newnes Plateau. The SCA was gazetted in 2022, with much of the park previously within state forest and managed for native hardwood or plantation softwood production (DPE 2022). Forestry and recreational vehicle activities (offroad four-wheel driving and trail bike riding) have resulted in a very high density of trails, many of which are poorly constructed, are eroding or fragmenting habitat, are frequently braided or run parallel, and have resulted in significant loss or degradation of vegetation (DPE 2022). The new site located near site 1b was observed to be dissected by multiple trail bike tracks and mitre drains extended from the vehicle track through the easement, with direct damage to *Isopogon prostratus* evident (M. Saunders pers. obs. January 2025).

The Broad Swamp subpopulation (site 7a/7b), significant for its size (~100 individuals), was subjected to extensive vehicle damage when part of the area was used as an informal campsite, with around half of the subpopulation estimated to have been destroyed (Benson and Baird 2023). This area has since been closed to vehicles and is now recovering, although much of the area is still bare soil (M. Saunders pers. obs. January 2025).

*Isopogon prostratus* often occurs on or near road verges with several subpopulations on Newnes Plateau bisected by roads (Benson and Baird 2023). The Genowlan Point population is similarly bisected by a road (Benson and Baird 2023). It is probable that the original establishment of these tracks resulted in destruction of numerous plants (I. Baird *in litt.* January 2025). At Clarence on the Newnes Plateau a subpopulation has recently been mostly destroyed by roadworks on a private access track (D. Benson and I. Baird *in litt.* January 2025). Elsewhere on the Newnes Plateau an apparently isolated old plant growing adjacent to a road, and which survived the 2019–2020 fire to resprout and produce a number of seedlings, was also recently destroyed by roadworks (D. Benson and I. Baird *in litt.* April 2024). This is likely to occur elsewhere across the species' range where major roads bisect some subpopulations. It is likely that there has been considerable undocumented historical loss of subpopulations due to forestry, land clearing and road construction and maintenance (D. Benson and I. Baird *in litt.* January 2025). Roads can result in altered hydrology, by intercepting, channelising, and/or impeding flows, and increasing erosion (Raiter *et al.* 2018; Kastridis 2020). Furthermore, roads may act as barriers to pollinators, resulting in reduced pollination success for plants separated by roads (Fitch and Vaidya 2021).

Sand extraction has also occurred previously in Gardens of Stone SCA and continues near Clarence in adjacent quarries on freehold land (DPE 2022). Coal mining continues underneath the park (DPE 2022) and several collieries occur around it. Several subpopulations occur proximate or near to sand and coal mines, which may reduce habitat suitability over the long-term by altering local hydrology

Although forestry no longer occurs within Gardens of Stone SCA, the adverse effects of it are ongoing. Most of the pine plantations were harvested in the late 2010s, but some plantation areas remain unharvested, and much of the remaining former plantations now either highly degraded or partially regenerating (DPE 2022). Pine wildings pose a significant issue adjacent to standing/former plantations and are invading some *Isopogon prostratus* sites (M. Saunders pers. obs. January 2025). It is inferred similar issues are occurring in other state forests that support the species. For

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example, many records in Penrose State Forest occur in or adjacent to pine plantations and recently harvested plantation compartments.

'Clearing of native vegetation' and 'Alteration of habitat following subsidence due to longwall mining' are listed as Key Threatening Processes under the NSW *Biodiversity Conservation Act 2016*. 'Land clearance' is listed as a Key Threatening Process under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*.

## Adverse fire regimes

Adverse fire regimes (particularly high frequency fire, low frequency fire, high intensity fire, and changes in fire season) are likely to be a threat to *Isopogon prostratus*.

High frequency fire threatens *Isopogon prostratus* in several ways. As a serotinous seeder, once a fire has occurred, seed is released, exhausting the canopy-stored seedbank (D. Benson and I. Baird *in litt.* April 2024). This may result in reduced reproductive output in inter-fire intervals, as has been demonstrated in the related *I. anemonifolius* (Knox and Morrison 2005). If fire intervals are sufficiently short, the canopy seedbank may not be replenished (D. Benson and I. Baird *in litt.* April 2024). Repeated short interval fires can also lead to depressed or failed resprouting in resprouting species (Enright *et al.* 2011; Karavani *et al.* 2018; Fairman *et al.* 2019). It is inferred that *I. prostratus* requires >10 years to develop lignotubers large enough to survive fire, based on the growth rates and fire response of *I. anemonifolius* (Bradstock and Myerscough 1988; Bradstock 1990). It is plausible that recurrent fire at frequencies of <15 years could lead to long-term demographic shifts by eliminating the juvenile portion of the population.

Low frequency fire is inferred to be a threat to *Isopogon prostratus* by limiting seedling recruitment, as the species is a serotinous seeder reliant on fire to release seed from its cones. The absence of observed recruitment at the Providence Ponds FFR subpopulation may be a result on a long absence of fire (SAC 1994, cited in DELWP 2021).

High intensity fire is inferred to be a threat to *Isopogon prostratus* by disproportionately killing juvenile plants which possess smaller lignotubers. Bradstock and Myerscough (1988) found juvenile *I. anemonifolius* were killed after exposure to low and high heat (intended to simulate low and high fire intensity), with survival significantly reduced from exposure to high heat relative to low heat.

Changes in fire season may also threaten *Isopogon prostratus*. Both adult and juvenile *I. anemonifolius* exposed to heat treatments in autumn experienced higher mortality than those exposed to heat treatment in winter or spring (Bradstock and Myerscough 1988). Fires in autumn may cause high mortality as depleted carbohydrate reserves and the long gap between fire and the subsequent growth season may increase mortality risk (Bradstock and Myerscough 1988).

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). Regions across the range of *Isopogon prostratus* are projected to become hotter, 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 2025; DEECA 2025). Regionally, it is projected with high confidence that climate change will result in a harsher fire-weather climate in the future (CSIRO 2025a, 2025b, 2025c). It is

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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 *I. prostratus* 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*.

## *Phytophthora cinnamomi*

*Isopogon prostratus* is susceptible to dieback resulting from infection with the pathogenic oomycete *Phytophthora cinnamomi* (DELWP 2021; D. Benson and I. Baird *in litt.* April 2024). At monitored sites on Newnes Plateau, the total number of *I. prostratus* declined from 268 in 2018 to 207 in 2023 (Table 1). An absence of physical disturbance suggests these declines are due to *P. cinnamomi* (D. Benson and I. Baird *in litt.* April 2024). Testing of five *I. prostratus* samples from across Newnes Plateau (sites 5–9) resulted in two samples (sites 6 and 9) testing positive for *P. cinnamomi* (PlantClinic 2023). These two sites are associated with former pine plantation sites and the occurrence of the pathogen was presumably related to the unusually wet conditions during the 2020–2023 La Niña event (D. Benson and I. Baird *in litt.* April 2024).

'Infection of native plants by *Phytophthora cinnamomi*' is listed as a Key Threatening Process under the *Biodiversity Conservation Act 2016*. 'Dieback caused by the root-rot fungus (*Phytophthora cinnamomi*)' is listed as a Key Threatening Process under the *Environment Protection and Biodiversity Conservation Act 1999*.

## **Severe Fragmentation and Threat-defined Locations**

*Isopogon prostratus* is considered to be severely fragmented as it is inferred that >50% of its population occurs in habitat patches that are (1) smaller than would be required to support a viable population, and (2) separated from other habitat patches by a large distance relative to dispersal kernel of the species, as per the IUCN (2024) definition.

This assessment has defined subpopulations by dispersal distance of pollinators; however, severe fragmentation considers the dispersal distance of the diaspore (*i.e.*, potential to recolonise), as per the IUCN (2024). Therefore, for the purposes of assessing whether *Isopogon prostratus* is severely fragmented, habitat patches defined by probable seed dispersal distances are used.

To meet the definition of *severely fragmented*, the IUCN (2024) states that "more than half of the individuals (*or, more than half of the occupied habitat area*) must be in small and isolated patches" and that "distances several times greater than the (long-term) average dispersal distance of the taxon may be considered isolated". With no obvious dispersal mechanism (Benson and von Richter 2010), and a release height of a few centimetres, dispersal of *Isopogon prostratus* seed is most likely localised via gravity and possibly wind (saltation) or water over short distances (Benson and McDougall 2000; I Baird *in litt.* January 2025). Benson (2024) suggests that seed is dispersed within a metre or so of the parent plant. A very narrow tail of the dispersal kernel could extend to somewhat larger distances in rare circumstances where vortices lift seeds from the surface and expose them to lateral air movement for a longer time

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(Tackenberg *et al.* 2003), although no observations of such movements have been reported for the species. Many occurrences are isolated (by roads, forestry, mines, quarries, urbanisation, agriculture, and fine-scale topographic features, or by distances in the order of hundreds of metres to tens of kilometres). All known sites on Newnes Plateau and the Genowlan subpopulation are <1 ha in size (Benson and Baird 2023). It is inferred that this is likely to be true for most occurrences of the species. Furthermore, many habitat patches occur along the edges of roads, easements, or contiguous areas of bushland, which may limit their viability as a consequence of higher risk of human disturbance (e.g., earthworks, dumping, offroad vehicles, disease infection, and fires) and restricted options for dispersal to/from other suitable habitat. At least one subpopulation has recently been mostly destroyed by roadworks on a private access track (D. Benson and I. Baird *in litt.* January 2025). Given the species' limited dispersal ability, once an isolated habitat patch becomes locally extinct, the probability of recolonisation is low. Consequently, many of the small and isolated habitat patches are unlikely to be viable in the long-term.

*Isopogon prostratus* occurs at an estimated >10 threat-defined locations, as per the IUCN (2024) definition. The most serious plausible threat resulting in the lowest number of locations for the species is adverse fire regimes. However, the species' scattered distribution and large EOO result in a high number of locations.

## Assessment against IUCN Red List criteria

For this assessment it is considered that the survey of *Isopogon prostratus* 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.<br>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.<br>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].<br>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:<br>(a) direct observation [except A3]<br>(b) an index of abundance appropriate to the taxon<br>(c) a decline in area of occupancy (AOO), extent of occurrence (EOO) and/or habitat quality<br>(d) actual or potential levels of exploitation<br>(e) effects of introduced taxa, hybridization, pathogens, pollutants, competitors or parasites. |            |

## Outcome

*Isopogon prostratus* is considered Data Deficient under Criterion A.

## Population reductions

There are insufficient data to estimate, infer, or project the magnitude of past or future reductions in the population size of *Isopogon prostratus*.

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## Conclusion

*Isopogon prostratus* is Data Deficient under Criterion A because there are insufficient data to estimate, infer, or project the magnitude of past or future reductions of its population size.

## *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 <sup>2</sup> | < 5,000 km <sup>2</sup> | < 20,000 km <sup>2</sup> |
| B2. Area of occupancy (AOO)   | < 10 km <sup>2</sup>  | < 500 km <sup>2</sup>   | < 2,000 km <sup>2</sup>  |
| 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

*Isopogon prostratus* is Endangered under Criterion B2ab(iii,v).

## EOO and AOO

The extent of occurrence (EOO) has been estimated at 71,479 km<sup>2</sup> and the area of occupancy (AOO) has been estimated at 384 km<sup>2</sup> based on the set of cleaned occurrence records described above.

## Number of threat-defined locations

*Isopogon prostratus* is found at >10 threat-defined locations when considering the most serious plausible threat of adverse fire regimes.

## Severely fragmented

*Isopogon prostratus* is inferred to be severely fragmented, as available evidence suggests that >50% of its population occurs in habitat patches that are (1) smaller than would be required to support a viable population, and (2) separated from other habitat patches by a large distance relative to dispersal kernel of the species, as per the IUCN (2024) definition. The species has a naturally sporadic and disjunct distribution which has been further fragmented by land use change, a process ongoing in some parts of the range.

## Continuing decline

Continuing decline in the number of mature individuals and the area, extent and quality of habitat is estimated due to habitat clearing, fragmentation and degradation, and inferred due to adverse fire regimes (particularly high frequency fire, low frequency fire, high intensity fire, and changes in fire season) and *Phytophthora cinnamomi*.

## Extreme fluctuations

There is no evidence to suggest *Isopogon prostratus* undergoes extreme fluctuations and as a long-lived shrub, it is unlikely to.

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## Conclusion

*Isopogon prostratus* is eligible to be listed as Endangered as it has a highly restricted geographic distribution (an AOO of 382 km<sup>2</sup>), is considered to be severely fragmented, and is undergoing continuing decline in the number of mature individuals and the area, extent, and quality of habitat.

## *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

*Isopogon prostratus* is Data Deficient under Criterion C.

### Number of mature individuals

There are insufficient data to estimate the number of mature individuals of *Isopogon prostratus* as few subpopulations have abundance information available.

### Continuing decline

Continuing decline in the number of mature individuals is estimated and inferred as required in subcriterion C2; however, there are insufficient data to quantify the magnitude the decline as required in subcriterion C1.

### Mature individuals in each subpopulation

There are insufficient data to determine the number of mature individuals in each subpopulation.

### % of mature individuals in a single subpopulation

There are insufficient data to determine the proportion of mature individuals in each subpopulation.

### Extreme fluctuations

There is no evidence to suggest *Isopogon prostratus* undergoes extreme fluctuations and as a long-lived shrub, it is unlikely to.

## Conclusion

*Isopogon prostratus* is Data Deficient under Criterion C because there are insufficient data to estimate the number of mature individuals.

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## 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. Only applies to the VU category<br>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:<br>AOO < 20 km <sup>2</sup> or<br>number of locations ≤ 5 |

### Outcome

*Isopogon prostratus* is Data Deficient under Criterion D and ineligible to be listed under Criterion D2.

### Number of mature individuals

There are insufficient data to estimate the population size of *Isopogon prostratus*.

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

*Isopogon prostratus* occurs at >10 threat-defined locations, has an AOO estimated at 384 km<sup>2</sup>, and has no plausible future threats that could rapidly drive the species to Critically Endangered or 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 |

### Outcome

*Isopogon prostratus* is considered Data Deficient under Criterion E.

### Probability of extinction

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

### Conservation and Management Actions

*Isopogon prostratus* is currently not listed on the NSW *Biodiversity Conservation Act 2016*. Following publication of a Final Determination by the NSW Threatened Species Scientific Committee, a Biodiversity Conservation Program will be developed by the NSW Department of Climate Change, Energy, the Environment and Water.

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## Expert Communications

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Dr Ian Baird, Conservation Biologist.

## APPENDIX 1

### Assessment against *Biodiversity Conservation Regulation 2017* criteria

The Clauses used for assessment are listed below for reference.

#### Overall Assessment Outcome:

*Isopogon prostratus* was found to be Endangered under Clause 4.3(b)(d)(e i,iii).

#### 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: Endangered under Clause 4.3(b)(d)(e i,iii).

| <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,                |

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|  |       |   |
|--|-------|---|
|  | (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.**

|  |   |   |
|--|---|---|
| <b>The estimated total number of mature individuals of the species is:</b> |   |   |
| (a)  | for critically endangered species   | very low, or  |
| (b)  | for endangered species  | low, or   |
| (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 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: Data Deficient.**

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

| <b>The probability of extinction of the species is estimated to be:</b> |     |                                   |                    |
|---|-----|-----------------------------------|--------------------|
|   | (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. |
|-------------------------|--|