Threatened Species Assessment

Goodenia bellidifolia subsp. *bellidifolia*
Daisy Goodenia

Taxonomy

Goodenia bellidifolia subsp. *bellidifolia* Sm.

Subsp. *argentea* Carolin from northern New South Wales and south-east Queensland differs by the corolla having mostly white cottony hairs outside rather than appressed yellowish hairs (VicFlora 2019).

Current conservation status

Categorised as Rare in the 2014 Advisory list of rare or threatened flora (DEPI 2014).

Proposed conservation status

Vulnerable in Victoria

Criterion D2

Species Information

Description and Life History

The taxon is an erect perennial herb to 60 cm high; stems glabrous to cottony hairy. Leaves mostly basal, oblanceolate to obovate, 4-10 cm long, 5-20 mm wide, acute or obtuse, pubescent to glabrescent, entire or toothed, base attenuate into obscure petiole. Inflorescences narrow terminal spikes or thyrses (initially crowded and umbel-like) to 40 cm long; pedicels articulate or not, 0-3 mm long; bracteoles linear, c. 3 mm long. Sepals linear, 1.5-4 mm long; corolla to c. 12 mm long, with appressed yellow hairs outside, villous inside, lemon-yellow to orange, abaxial lobes 2.5-4.5 mm long, wings 1-1.5 mm wide; indusium depressed-oblong; ovules 15-20. Fruit obovoid, c. 4 mm long, valves entire; seeds suborbicular to elliptic, 1-2 mm long, reticulate-pitted, brown to blackish, wing vestigial. The taxon flowers August to March (VicFlora 2019).

There is no evidence to suggest the taxon develops rhizomes, stolons or a long-persistent rootstock, with field observation suggesting it is strictly rosetted with limited lateral spread, although the stem may branch at ground level at the apex of the tap root.

Generation Length

The generation length of *Goodenia bellidifolia* subsp. *bellidifolia* is estimated to be 15 to 35 years. This is based on a plausible longevity of 10-25 years or more, and an inference that the taxon is likely to behave as a fire-sensitive obligate seed regenerator (OSR) recruiting episodically from a soil-stored seedbank following intense fire events at an estimated pre-settlement interval of 25-35 years or more. The swampy habitat of the taxon is subject to intense fire events at a lower frequency than the surrounding lowland forest. Such fires typically consume all canopy vegetation with the risk of incineration of both rootstocks and peaty substrate, as witnessed at Anglesea after the 1983 Ash Wednesday bushfires which also consumed much of the lowland forests in far East Gippsland. Under such circumstances the taxon is likely to behave as a fire-sensitive OSR. Longevity of the taxon is likely to be limited by the interval between intense fire events within its habitat range. The taxon may be capable of limited resprouting from the rootstock following low intensity fire events and may also recruit opportunistically following localised site disturbance events other than fire which create gaps in the typically low dense wet heath vegetation.

Distribution

The taxon is rare in Victoria, where it is confined to far East Gippsland in the Genoa area. It is also found in NSW (VicFlora 2019). Reliable site and specimen records indicate the taxon occurs east of the Cann River Valley with most records within 10 km of Genoa, extending almost to the NSW border at Maramingo Creek and north-west of Mt Coopracambra. In 1946 Norman Wakefield collected the taxon at Dinner Creek on the Tamboon Road south of Cann River, 44 km SW of Genoa. Victorian records, together with several immediately across the border in the Nungatta area in NSW, are highly disjunct from the closest records on the Shoalhaven River in New South Wales.

Habitat

The taxon usually occurs in damp heath (VicFlora 2019).

In 1987 Neville Walsh collected the taxon 3 km NW of Mt Coopracambra, east of the Cann Valley Highway in the Coopracambra National Park where it was locally common in damp heathland, receiving runoff from large granite boulders where it was associated with *Kunzea ambigua* (White Kunzea), *Mirbelia pungens* (Prickly Mirbelia), *Lepidosperma urophorum* (Tailed Rapier-sedge), *Platysace lanceolata* (Shrubby Platysace), and *Acacia myrtifolia* (Myrtle Wattle).

At Beehive Creek Falls, also in the Coopracambra National Park, the taxon occurs in heathy vegetation on sandy peat with clay sub-soil where associated with *Allocasuarina nana* (Stunted Sheoak), *Bauera rubioides* (Wiry Bauera), *Bossiaea obcordata* (Spiny Bossiaea), *Brachyloma daphnoides* (Daphne Heath), *Melaleuca squarrosa* (Scented Paperbark), *Prasophyllu australe* (Austral Leek-orchid), *Pultenaea retusa* (Blunt Bush-pea), *Thelionema umbellatum* (Clustered Lily), *Thelymitra ixioides* (Spotted Sun-orchid), and *Xyris operculata* (Tall Yellow-eye).

Quadrat data in the VBA and specimen records in the AVH indicate that the habitat range of the taxon includes Open and Closed Wet Heath, Grass Tree Plains dominated by *Xanthorrhoea resinosa* (Spear Grass-tree), and rarely enters peaty swamps, *Melaleuca* Swamp Thicket or grassy Lowland Forest. Associated dominant taxa include *Allocasuarina littoralis* (Black Sheoak), *A. paludosa* (Scrub Sheoak), *Angophora floribunda* (Rough-barked Apple), *Bauera rubioides* (Wiry Bauera), *Baumea rubiginosa* (Soft Twig-rush), *Callistemon citrinus* (Crimson Bottlebrush), *Empodisma minus* (Spreading Rope-rush), *Entolasia marginata* (Bordered Panic), *Eucalyptus consideniana* (Yertchuk), *E. conspicua* (Silver Swamp Stringybark), *Eurychorda complanata* (Flat Cord-rush), *Gahnia radula* (Thatch Saw-sedge), *Hakea teretifolia* subsp. *hirsuta* (Dagger Hakea), *Kunzea ambigua* (White Kunzea), *Lepidosperma filiforme* (Common Rapier-sedge), *Leptocarpus tenax* (Slender Twine-rush), *Leptospermum continentale* (Prickly Tea-tree), *L. lanigerum* (Woolly Tea-tree), *Lepyrodia muelleri* (Common Scale-rush), *Melaleuca squarrosa* (Scented Paperbark), *Patersonia fragilis* (Short Purple-flag), *Poa labillardierei* (Common Tussock-grass), *Schoenus brevifolius* (Zig-zag Bog-rush), *Selaginella uliginosa* (Swamp Selaginella), *Sprengelia incarnata* (Pink Swamp-heath), *Tetraria capillaris* (Hair Sedge), *Tetrarrhena turfosa* (Smooth Rice-grass), *Viminaria juncea* (Golden Spray), and *Xanthorrhoea resinosa* (Spear Grass-tree).

Limited quadrat data suggests that projective foliage cover of the taxon is consistently less than 1% at the quadrat scale.

Threats

Historic decline through habitat loss to agriculture is likely to have been relatively insignificant to the taxon, since the habitat range is of marginal value for grazing or cropping and all Victorian records are within national or coastal parks or state forest.

A key threat to the taxon is the increasing risk of repeat fire events at intervals below or approaching the tolerable fire interval for the taxon. Such events may result in high mortality of adults, with some risk of seedbank depletion and complete mortality of the last cohort of episodic post-fire recruits. This may be compensated, at least in the short to medium term, by some facilitation of recruitment by fire of low to moderate intensity which removes intense competition from the typically dense sward of sedges, rushes, and other graminoids, as well as shrubs and forbs which dominate wet peaty heaths, sedgelands, and grass tree plains.

Climatic drying and warming and imposed fire regimes, particularly the extensive use of planned burning across the region, operate synergistically to increase the risk of repeat fire events affecting the habitat of the taxon. Extreme drought events increase the risk of recruitment failure and potential seedbank exhaustion, particularly for post-fire recruitment. In the longer term, climatic drying is projected to lower the water table, resulting in a contraction in the local extent of the habitat range of the taxon, and the invasion of wetland sites by dryland shrubs and trees.

The taxon may also be susceptible to Sambar Deer (*Rusa unicolor*) and feral pig activity. Sambar and feral pigs target the habitat range of the taxon, with Sambar frequently rutting and wallowing in wet sites and pigs frequently excavating wetland and peaty sites.

Due to its low nutrient status, the habitat of the taxon is not considered susceptible to invasion by exotic weeds.

IUCN Criteria

Criterion 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 and the causes of the reduction are clearly reversible AND understood AND ceased.

A2 Population reduction observed, estimated, inferred or suspected in the past where the causes of the reduction may not have ceased OR may not be understood OR may not be reversible.

A3 Population reduction, projected 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, extent of occurrence and/or quality of habitat

(d) actual or potential levels of exploitation

(e) the effects of introduced taxa, hybridization, pathogens, pollutants, competitors or parasites

Evidence:

Ineligible under Criterion A

The population reduction for this taxon is below the threshold for eligibility under criterion A.

Criterion B. Geographic range in the form of either B1 (extent of occurrence) and/or B2 (area of occupancy	Critically Endangered Very restricted	Endangered Restricted	Vulnerable Limited
B1. Extent of occurrence (EOO)	< 100 km²	< 5,000 km²	< 20,000 km²
B2. Area of occupancy (AOO)	< 10 km²	< 500 km²	< 2,000 km²
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			

Evidence:

Ineligible under Criterion B

The Extent of Occurrence (EoO) across the taxon's range is estimated to be 350 to 845 km², and the Area of Occupancy (AoO) is estimated to be 32 to 36 km², but other thresholds under this criterion have not been met.

Criterion 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 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				

Evidence:

Ineligible under Criterion C as Data Deficient

There is no available estimate of population size since there is no monitoring data for the taxon, although field observation of 200 plants seen over an area about 50x50m at a single site suggests that the total population is likely to be in the thousands.

Criterion D. Very small or restricted population			
	Critically Endangered	Endangered	Vulnerable
Number of mature individuals (observed or estimated)	< 50	< 250	< 1,000
D2 Only applies to the VU category Restricted area of occupancy or number of locations with a plausible future threat that could drive the species to critically endangered or Extinct in a very short time.	-	-	D2. Typically: AoO < 20 km2 or number of locations ≤ 5

Evidence:

Eligible under Criterion D2 as Vulnerable

The taxon is estimated to be very restricted. The taxon has a restricted distribution, occurring in a single location, such that this restriction makes the taxon capable of becoming Critically Endangered or Extinct within a time frame of one or two generations. This is in response to the impact of the identified long-term threats, notably repeat fire events, climatic drying and warming, and damage to habitat by Sambar Deer and feral pigs.

Criterion E (Quantitative Analysis) was not addressed as the taxon does not have a detailed Population Viability Analysis.

References

DEPI (2014). *Advisory list of rare or threatened plants in Victoria - 2014*. Department of Environment and Primary Industries, Melbourne.

VicFlora (2019). Flora of Victoria, Royal Botanic Gardens Victoria: *Goodenia bellidifolia* subsp. *bellidifolia*. Retrieved from: https://vicflora.rbg.vic.gov.au/flora/taxon/8f27e723-aa16-48e6-bce5-c387fd228188