

Goodenia lineata Grampians Goodenia

Taxonomy

Goodenia lineata J.H. Willis

Current conservation status

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

Proposed conservation status

Vulnerable in Australia

Criterion D2

Species Information

Description and Life History

The taxon is an erect perennial to 50 cm high; stems glandular-pubescent to glabrescent. Leaves mostly basal, linear to narrow-oblongate, 3-8 cm long, 3-9 mm wide, acute, thick, almost glabrous, margins sparsely toothed, base attenuate into obscure petiole. Inflorescences terminal racemes to 30 cm long, few-flowered, much longer than leaves; pedicels articulate, 3-6 mm long; bracteoles linear, 2.5-4 mm long. Sepals linear-lanceolate, 4-7 mm long; corolla 15-25 mm long, almost glabrous outside and inside, orange-yellow with purplish stripes in lower half, abaxial lobes 8-10 mm long, wings c. 2 mm wide; indusium broad-elliptic; ovules 15-20. Fruit ovoid, c. 3 mm long; seeds elliptic, c. 0.5 mm long, pitted, pale brown, wing vestigial. The taxon flowers mainly from October to February (VicFlora 2019).

Generation Length

The generation length of *Goodenia lineata* is estimated to be 15 to 35 years (midpoint 25 years). This is based on a plausible longevity of 15-30 years, the likelihood that soil-stored seedbanks degrade rapidly in wet habitats, and that the generational turnover rate is unlikely to greatly exceed the longevity of the taxon. The taxon is poorly understood and appears to occupy a bimodal habitat range, which complicates any attempt to infer longevity and recruitment mode from scant field observations. The estimate of generation time is therefore inferred from observations regarding related taxa in similar habitats.

Distribution

The taxon is endemic to Victoria, and is known only from the Grampians, Mt Clay, and the lower Glenelg River area. Bioregions include Wimmera, Glenelg Plain, Victorian Volcanic Plain, Greater Grampians, and Dundas Tablelands (VicFlora 2019).

Habitat

According to VicFlora (2019), the taxon is usually found in heathland on sandy soils. However, the habitat range of this taxon is perplexing since a significant proportion of occurrences are apparently associated with habitats somewhat divergent from those noted in VicFlora (2019). Additionally, they suggest a bimodal biology and potentially, distinct ecotypes or taxonomic entities that currently not taxonomically recognised.

Collectors' notes record habitat in the Kentbruck Heath in the Lower Glenelg National Park as 'growing in a peaty swamp' and as 'in swamp, in mud'. At Mount Clay north-east of Portland, the taxon is recorded on the 'wet west

slopes' and 'along fire track in damp sand and black peaty soil with *G. geniculata*'. West of Digby the taxon is recorded in wet heathland, and at the eastern foot of the Victoria Range, near the headwaters of the Glenelg River, the taxon is recorded 'amongst sedges on swampy ground against thickets of burnt *Melaleuca squarrosa*' and 'in bogs associated with *Boronia parviflora*, *Sprengelia incarnata*, *Hakea nodosa*, and *Leptocarpus tenax*.' Elsewhere in the Victoria Range the taxon is recorded in moist heathland.

By contrast, at Kalimna Falls, south of Mt William in the Grampians, the taxon is recorded in heathy woodland on grey sandy loam, and north of Mt William the taxon is recorded in 'low heathy woodland on light brown sandy loam over emergent sandstone'.

The only instance of an apparently intermediate habitat is near the summit of Mt William where the taxon is recorded 'on damp sandy ground among low ericoid shrubberies'.

The type collection was taken at the summit of Mt William 'where locally frequent among sandstone rocks' at an elevation of 1180 m (Willis 1967).

Threats

Threats are difficult to identify for this taxon, since its bimodal habitat range suggests that quite distinct threats may apply in each of the reported habitat types, which may be occupied by ecotypes with contrasting reliance on seedbanks and fire-promoted episodic recruitment.

The majority of the circumstantial comments provided by collectors suggest wet oligotrophic habitats, which are inherently vulnerable to hydrological change such as drainage of swamps, frequent burning of surrounding vegetation resulting in drying of catchments and reduced ground water availability and recharge, and, in the longer term, climatic drying and warming. Ecotypes in such habitats are likely to be at increasing risk of adult mortality and recruitment failure in response to extreme drought stress and, eventually, to seedbank depletion, exhaustion and local extinction. Stands in wet habitats are also threatened by the activity of exotic herbivores such as deer and pigs which pug, wallow, and dig up wetland habitats in addition to targeted browsing of large stands.

A smaller proportion of collectors' comments are consistent with the VicFlora (2019) assertion that the taxon occurs in heathland on sandy soils, implying better drainage and a greater likelihood that the taxon recruits episodically following fire events from a more persistent soil-stored seedbank less susceptible to degradation by mould and water. Ecotypes in such habitats are less likely to be threatened by increasing fire frequency, increasing drought stress, and the risk of recruitment failure and seedbank depletion and exhaustion.

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%
<p>A1 Population reduction observed, estimated, inferred or suspected in the past and the causes of the reduction are clearly reversible AND understood AND ceased.</p> <p>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.</p> <p>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]</p> <p>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.</p>			
<p><i>based on any of the following:</i></p> <ul style="list-style-type: none"> (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

There is insufficient evidence to determine whether there has been or will be a reduction in population sufficient to meet any threshold for Criterion A.

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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 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			

Evidence:

Ineligible under Criterion B

The Extent of Occurrence (EoO) across the taxon's range is estimated to be 4 km² and the Area of Occupancy (AoO) is estimated to be 4 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 <u>C1</u> or <u>C2</u>				
<u>C1</u>	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)
<u>C2</u>	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, although field observations of several occurrences in drier heathland habitats on sandy soils record large stands of thousands of individuals at the hectare scale.

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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 km ² or number of locations < 5

Evidence:

Eligible under Criterion D2 as Vulnerable

The taxon is estimated to be very restricted. It has a restricted distribution, occurring in 2 locations, 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 hydrological changes, frequent burning, and climatic warming and drying.

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. Retrieved from: https://www.environment.vic.gov.au/__data/assets/pdf_file/0021/50448/Advisory-List-of-Rare-or-Threatened-Plants-in-Victoria-2014.pdf

VicFlora (2019). Flora of Victoria, Royal Botanic Gardens Victoria: *Goodenia lineata*. Retrieved from: <https://vicflora.rbg.vic.gov.au/flora/taxon/bd347531-bcb4-443d-a178-85919e0f0d03>

Willis, J. H. (1967). Systematic Notes on the Indigenous Australian Flora. *Muelleria*, 1(3), 117-163.