Threatened Species Assessment

Lycopodiella serpentina
Bog Clubmoss

Taxonomy

Lycopodiella serpentina (Kuntze) B. Ollg.

Current conservation status

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

Proposed conservation status

Endangered in Victoria

Criterion B2ab(iii,v)

Species Information

Description and Life History

Stems mostly prostrate, creeping, much-branched, brittle, firmly attached to substrate by numerous roots; erect sterile branches few, short and rigid; erect fertile branches erect, up to 6 cm tall. Leaves spirally arranged, crowded and overlapping, ascending or spreading, those nearest the substrate usually appressed, linear-lanceolate, 3-4 mm long, less than 1 mm wide; apex sharp. Strobili terminal, solitary, 10-25 mm long, on leafy stalk. Sporophylls overlapping, somewhat spreading when ripe, broadly triangular; margins minutely toothed; apex rigid, sharp.

Generation Length

The generation length of *Lycopodiella serpentina* is estimated to be 15 to 20 years, based on a plausible longevity of 20-30 (-40) years and the likelihood that recruitment is a rare event occurring opportunistically in response to fire events and other localised site disturbance events such as animal digging or flood. Lycopodiaceae can reproduce vegetatively by separation of shoots through decay. Individual shoots have been aged up to 20 years in some *Lycopodium* spp. (Callaghan 1980), suggesting that this may be a common age for which shoots last.

Distribution

In Victoria the taxon has been recorded from the Grampians in the Glenelg River valley, around Chappell Vale in the Otway Ranges, on French Island and at Maramingo Creek in the far east near Genoa. It also occurs in Western Australia, South Australia, Queensland, New South Wales, Tasmania and New Zealand.

Habitat

The taxon occurs in lowland heaths on wet peaty soils (VicFlora 2020).

Threats

The taxon is likely to have suffered historic decline through habitat loss to agriculture, particularly in the western Otway Ranges. There has also been mining and forestry operations adjacent to occurrences in the Otway Ranges (though it should be noted that native forest timber harvesting on public land has been phased out in the Otway Ranges since 2008. Harvesting on private land and in plantations continues in parts of its range). The taxon is believed to have one of its eight Victorian sites occurring within the footprint of the 2019/20 bushfires. It is believed to be fire sensitive in the context of these fires and it is considered to be at some risk of post-fire impacts.

The taxon is a habitat specialist reliant on wet sites. It is threatened in the longer term by climatic drying and increasing fire frequency and intensity. It is also threatened by excavation of peaty substrates by pigs, wallowing and rutting by Sambar (*Rusa unicolor*) and, potentially, Hog Deer (*Axis porcinus*) and pugging by stock.

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:

Eligible under Criterion A2 as Vulnerable

The population reduction over the past 45 to 60 years is estimated to be 15 to 30%, based on (a), (c) and (e) above.

An estimate of past decline is based on habitat loss to agriculture, particularly in the western Otway Ranges, habitat degradation through site disturbance by stock, pigs and deer, and unquantified impacts of the 2020 bushfires.

The causes of the reduction may not have ceased, be understood or be reversible.

Eligible under Criterion A3 as Vulnerable

The population reduction over the next 45 to 60 years is projected to be 25 to 45%, based on (c) and (e) above.

An estimate of future decline is based on the projected impact of the identified threats.

Eligible under Criterion A4 as Vulnerable

The population reduction over any 45 to 60 year period, including both past and future, is estimated to be 15 to 30%, based on (c) and (e) above. The causes of reduction may not have ceased, be understood or be reversible.

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:

Eligible under Criterion B2 as Endangered

The Area of Occupancy (AoO) across the taxon's range is estimated to be 24 km², based on 2 x 2 km grids derived from accepted, post-1970 records in the Victorian Biodiversity Atlas.

The taxon is estimated to be severely fragmented. It reproduces by spores that are light weight and have the ability to be carried by air currents; hence they have the propensity for long-distance dispersal. Despite subpopulations being well separated in Victoria it is possible that this species is capable of dispersing across such distances given that the presence of this species, like most other pteridophytes, in both Australia and New Zealand is most likely a result of long-distance dispersal (Brownsey 2001). However, it is so unlikely that spores would also settle at the small areas where subpopulations once persisted, that if a subpopulation became extinct, it is unlikely it could be recolonised in that exact habitat.

It is estimated to have four locations, as it is found in four widely disjunct localities in Victoria that will likely be exposed to different sets of threats and at varying levels of severity because of their differing climate, tenure, landscape context, fire and herbivory regimes.

It has a continuing decline in (iii) above, based on the current and projected impact of the identified threats.

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

No estimates of the number of mature individuals present at sites of occurrence are available. This may in large part be due to the difficulty in estimating the number of plants of lycopods that have long creeping rhizomes, where individual plants can be spread over many metres or can break up to form new plants.

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.

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

References

Brownsey, P.J. (2001). New Zealand's pteridophyte flora-plants of ancient lineage but recent arrival? *Brittonia* 53: 284-303.

Callaghan, T.V. (1980). Age-related patterns of nutrient allocation in *Lycopodium annotinum* from Swedish Lapland: Strategies of growth and population dynamics of tundra plants 5. *Oikos* 35: 373-386.

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 (2018) Flora of Victoria, Royal Botanic Gardens Victoria. *Lycopodiella serpentina*. Retrieved from: https://vicflora.rbg.vic.gov.au/flora/taxon/c9dd80b1-c4b9-44ff-8894-6b182e0448ba