



## *Lycopodium scariosum* Spreading Clubmoss

### Taxonomy

*Lycopodium scariosum* G. Forst.

### Current conservation status

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

### Proposed conservation status

Critically Endangered in Victoria

Criterion C2a(i)

### Species Information

#### Description and Life History

Main stem prostrate, branched, with very small, narrow, appressed scales; rooted at intervals. Lateral stems much-branched, ascending or spreading. Leaves firm, yellow-green; upper leaves in 2 rows and flattened into one plane, lanceolate, asymmetrical, slightly curved, 3-5 mm long, with short points; lower leaves in 2 rows, scale-like, appressed, narrow and pointed. Strobili terminal and solitary, 1-3 cm long, on short stalk bearing small scales. Sporophylls straw-coloured, closely overlapping, broadly ovate to triangular; margins membranous; apex long-pointed (VicFlora 2017).

#### Generation Length

The generation length of *Lycopodium scariosum* is observed to be 15 to 20 years. Lycopodiaceae can reproduce vegetatively by separation of shoots through decay. Individual shoots have been aged up to 20 years in some *Lycopodium* (Callaghan 1980) suggesting that this may be a common age that shoots last for.

#### Distribution

In Victoria the taxon is confined to high altitude sites at Lake Mountain, Baw Baw Plateau and the Bogong High Plains. Also Tas. New Zealand.

#### Habitat

This taxon occurs in alpine and subalpine areas in Sphagnum bogs, wet heathland and gravelly creeksides.

#### Threats

Increases in fire frequency and severity, drought and higher temperature (that will cause less snow cover and more evaporation and less moisture content in the soil through summer) are all threats to this taxon, which is heavily reliant on damp sites.

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## 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 style="text-align: center;"><i>based on any of the following:</i></p> <ul style="list-style-type: none"> <li>(a) direct observation [except A3]</li> <li>(b) an index of abundance appropriate to the taxon</li> <li>(c) a decline in area of occupancy, extent of occurrence and/or quality of habitat</li> <li>(d) actual or potential levels of exploitation</li> <li>(e) the effects of introduced taxa, hybridization, pathogens, pollutants, competitors or parasites</li> </ul>			

## Evidence:

### Eligible under Criterion A3 as Vulnerable

The population reduction over the next 45 to 60 years is suspected to be 5 to 36%, based on (c) above.

Future decline is most likely to be in subpopulations in more exposed and drier sites, such as on the Bogong High Plains. There are four sites at this locality that are not in bogs or are covered by a series of canopies that are more susceptible to drying. This is roughly 36 % of the subpopulation.

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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 <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			

## Evidence:

### Eligible under Criterion B2 as Endangered

The Area of Occupancy (AoO) across the taxon's range is estimated to be 80 km<sup>2</sup>, 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 naturally at the subregional and landscape scales. Details provided with herbarium specimens indicate that some subpopulations comprise only single individuals and it is likely that many other subpopulations are small. Although spores are wind-dispersed, dispersal range is unlikely to exceed the kilometre scale given the lowly stature of the plant in small isolated stands of a densely stocked community, restricted to the lowest elevations within the landscape.

It is estimated to have 1 to 4 locations. Up to four locations can be identified: Lake Mountain, the Baw Baw Plateau, Mt Stirling and the Bogong High Plains, on the assumption that these areas are highly disjunct (50 or more kilometres apart), vary in their habitat (especially the Bogong High Plains compared to the other three locations) and altitude and therefore may not be affected by a single threatening event in the same way. If, however, the key long-term threats of climatic drying and increasing frequency and intensity of fire operate consistently across the Victorian range of the taxon then a single location is identified.

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

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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:

#### Eligible under Criterion C2 as Critically Endangered

The taxon is estimated to have 70 to 500 mature individuals. It is difficult to estimate the number of individuals due to a lack of data on the number of individuals at sites and due to its prostrate growth habit which makes determining what comprises an individual often difficult, especially given lycopods' propensity for vegetative propagation. The lower number is based on the 64 records in the Atlas of Living Australia from herbaria or quadrat data, with at least some of these suggesting more than one plant was present, hence 70. The 500 value assumes an average of around 8 plants per subpopulation.

It has an inferred continuing decline, and the number of mature individuals in each subpopulation is fewer than 50.

Criterion D. Very small or restricted populations		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 <sup>2</sup> or number of locations ≤ 5

### Evidence:

#### Eligible under Criterion D as Endangered

The taxon is estimated to have 70 to 500 mature individuals.

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



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## References

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.

VicFlora (2017) Flora of Victoria, Royal Botanic Gardens Victoria: *Lycopodium scariosum*. Retrieved from: <https://vicflora.rbg.vic.gov.au/flora/taxon/074d60e4-a448-4e07-a67c-a2e73ba81c1b>