Threatened Species Assessment

Psychrophila introloba
Alpine Marsh-marigold

Taxonomy

Psychrophila introloba (F. Muell.) W.A. Weber

Syn *Caltha introloba*

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(i,ii,iii,iv,v)

Species Information

Description and Life History

The taxon is a small hairless perennial alpine herb, with short stout rhizomes, and forms dense mats. Its leaves have petioles of about 5 cm long with a leafblade that is oblong or lanceolate rounded triangular, 8-40 mm long, emarginate, with 2 lanceolate triangular appendages of 4-20 mm long on the upper surface. The flowering stem is 1-2 cm long, but grows to 5-10 cm when seeds are ripe. The five to eight sepals are between 10-22 mm long, white, but often tinged pink or purple, particularly at the base and the veins. Fifteen to thirty stamens with white or often pinkish filaments and yellow pollen encircle six to eighteen free carpels. When ripe, these have developed into follicles which are spreading, have short beaks and contain few seeds. Flowering occurs between November and December, often directly from under the receding snow.

DELWP's Vital Attribute database indicates that the taxon is capable of germinating from seed and vegetatively, and is able to establish with plant competition. Wardlaw et al (1989a) found that, like many alpine plants, flowering and seed set occur over two years. Wardlaw et al (1989b) found that seedlings are rarely found in the wild, and it grows very slowly.

Generation Length

The generation length of *Psychrophila introloba* is estimated to be 30 to 50 years. This is based on it being a rhizomatous perennial, its capability of germinating from seed (although doesn't necessarily do so after fire) and vegetatively, and being able to establish with plant competition. Its time-to-reproductive-maturity is 2 years, longevity is greater than 50 years, and seeds last >50 years in soil, perhaps even up to 100 years.

Fire is historically rare in alpine ecosystems, occurring perhaps once or twice a century and, on average, perennial shrubs and herbs are likely to reach the end of their reproductive life prior to another fire. In undisturbed vegetation, the average plant age is likely to be at the mid-range of the estimated lifespan, reflecting low-level seed recruitment, perhaps 40 years.

Distribution

The taxon is locally common in areas of late-lying snow and in moss-beds on the higher ranges of the Baw Baws, Snowy Range, Mt Buffalo, and the Bogong and Dargo High Plains, but is apparently absent from the Cobberas.

Habitat

Herbfields of *P. introloba* and *Oreobolus pumilio* occur on stony pavements in two different physiographic situations: on relatively steep slopes (10-20°) at the head of wetlands, and on flat ground (slope < 2°), below the head of wetlands (Wahren et al 1999). The taxon can form a community on rocky pavements, but it is also found in wet grasslands and alpine bogs. Tolsma and Wahren (2016) have confirmed 1.8 ha of FFG-listed *Caltha* Herbland community, however the taxon is also in many hundreds of ha. of alpine bog and wet grassland.

The taxon is locally common in areas of late-lying snow and in moss-beds on the higher ranges, and it usually flowers at edges of receding snow-drifts.

Threats

As the taxon flowers under melting snow it can be assumed that there is some dependence on melting snow, hence, it can be inferred that the taxon is threatened by reduction in snow melt, snow banks, and snowpatches associated with snow patch communities. Tolsma and Wahren (2016) suggest that harsh alpine conditions give *Psychrophila* a competitive advantage over less adapted plants, an advantage which could become lost as the climate becomes warmer.

Wahren et al (2001) found that the taxon may be dislodged from stony pavement habitat by cattle grazing. Tolsma and Wahren (2016) suggest that some areas of *P. introloba* herbland on the Bogong High Plains may be on pavements previously kept open by cattle grazing disturbance, and these are now being taken over by *Sphagnum* Moss. Other 'natural' pavements are not being obviously taken over, suggesting that natural processes such as cold temperatures and snowmelt irrigation are keeping them open after the removal of cattle.

The taxon is palatable to Sambar Deer (*Rusa unicolor*), as evidenced on the Bogong High Plains at Mt Nelse (Zac Walker pers. comm. to Warwick Papst early 2017), and deer, feral horses, hydrological change from infrastructure, increased frequency of fire, Willow, and Soft Rush are other threats, mostly exacerbated by climate change.

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 90 to 150 years is estimated to be 20 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 B1 as Vulnerable

The Extent of Occurrence (EoO) across the taxon's range is estimated to be 6,694 km², based on accepted, post-1970 records in the Victorian Biodiversity Atlas (VBA).

The taxon is estimated to be severely fragmented, as alpine taxa tend to exist in variable-sized 'islands' of habitat within a matrix of lower-altitude forest, which tends to isolate sub-populations reproductively. There is increased extinction risk as there is little or no probability of recolonisation should subpopulations become extinct.

It is estimated to have a continuing decline in (i), (ii), (iii), (iv) and (v) above as a result of a warming climate leading to reduction in snow melt and snow banks associated with snow patch communities, as well as bushfires, the impacts of deer, feral horses, hydrological change, and weeds.

Eligible under Criterion B2 as Endangered

The Area of Occupancy (AoO) across the taxon's range is estimated to be 224 km², based on 2 x 2 km grids derived from accepted, post-1970 records in the VBA.

As above, the taxon is severely fragmented, and has a continuing decline in (i), (ii), (iii), (iv) and (v) above.

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

It is estimated that there are 150,000 to 250,000 mature individuals, which exceeds the thresholds for criterion C.

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:

Ineligible under Criterion D

It is estimated that there are 150,000 to 250,000 mature individuals, which exceeds the thresholds for criterion D.

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.

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