

## *Hakea macraeana* Willow Needlewood

### Taxonomy

*Hakea macraeana* F. Muell.

The taxon has been confused in Victoria with the closely related taxon, *Hakea lissosperma* (Mountain Needlewood) from which it is distinguished by the presence of a groove on the lower leaf surface (SAC 2003, VicFlora 2018).

### Current conservation status

Listed as threatened under the *Flora and Fauna Guarantee Act 1988* (SAC 2003).

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

### Proposed conservation status

Critically Endangered in Victoria

Criteria A3c; B1ab(iii)+2ab(iii); D

### Species Information

#### Description and Life History

The taxon is a shrub or small tree, 1-10 m high; branchlets drooping, appressed-pubescent when young. Leaves narrowly spreading, terete, (3-)5.5-15 cm long, 0.7-1.2 mm wide, grooved below, soon glabrous; apex straight, rarely hooked. Inflorescence 1-6-flowered; rachis c. 1 mm long, with white and or rusty hairs; perianth 3-5.2 mm long, white or cream, usually appressed-pubescent; pistil c. 7-10 mm long; pollen presenter an oblique disc. Fruit elliptic to obovate, 2.8-4 cm long, 1.8-2.4 cm wide, pale-warted; beak small, ± smooth; horns 1-3 mm long; seed not occupying whole valve face, 22-27 mm long; wing only partly down one side of seed-body, blackish brown. The taxon flowers from August to October (VicFlora, 2018).

The Victorian plant(s) have not been observed in flower or fruit. The resprouting capacity and, in particular, the presence or absence of a lignotuber, have not been established for *Hakea macraeana* in the narrow sense although a lignotuber is apparently absent in *Hakea ochroptera* which, until recently, was included within the circumscription of *Hakea macraeana* (SAC, 2003).

#### Generation Length

The generation length of *Hakea macraeana* is inferred to be 30 to 70 years. This is based on a suspected longevity of 30-50 years and plausible pulsed recruitment in response to either exceptional flood events or, for dryland occurrences elsewhere in the catchment, infrequent bushfire events.

#### Distribution

The taxon is known in Victoria from a single sterile plant in the Upper Genoa River, possibly originating from seed washed downstream from plants across the border in New South Wales. Subsequent attempts to relocate this plant have been unsuccessful, and it is likely that this individual has not persisted at that site. Also sparingly established from a planting at Mount Martha on the Mornington Peninsula. It also occurs in NSW (VicFlora 2018).

The only reliable record of the taxon for Victoria is a single collection from January 2001 from the banks of the Genoa River in far East Gippsland. The specimen was collected on the south bank of the river within the



# *Hakea macraeana* Willow Needlewood

Coopracambra National Park, approximately 1 km upstream of freehold land at the Wangarabell settlement, 6.7 km from the NSW border. The site lies between the point where Ivor Track reaches the river and a cairn which marks the end of a recently constructed walking track which also connects Ivor Track to a new point further upstream along the river. On account of the vegetative similarity to *Grevillea neurophylla* subsp. *fluviatilis*, which is scattered through the Genoa River Gorge upstream, the full extent of the *H. macraeana* population is unknown. Whilst it may be represented only by the one plant sampled, the taxon is likely to extend upstream or downstream within the riparian habitat at this site. It may also be represented by a more extensive population in drier forest habitats elevated above the riparian zone, consistent with the observed behaviour of the species in NSW (SAC 2003).

An isolated occurrence of *H. lissosperma* in the catchment of Stony Creek, 10 km north of Goongerah in East Gippsland, was discovered in November 1989 and subsequently identified as *H. macraeana*. As noted by Barker et al. (1996), who redetermined this collection as *H. lissosperma*, this plant is atypical in its weeping habit and narrow, flexible leaves, and in its dry forest habitat at the relatively low altitude of 700 m. These are all characters which suggest *H. macraeana* rather than *H. lissosperma*. In April 2001, the Stony Creek plant was relocated and it was confirmed to be a closer match to the description of *H. lissosperma* than to *H. macraeana*, particularly in the absence of a groove on the undersurface of the leaf. Paradoxically, the specimen would key to *H. macraeana* rather than to *H. lissosperma* if fruit and seed characters were emphasised over leaf morphology. Furthermore, Barker et al. (1999) note that "a collection from c. 21 km west-north-west of Nerrigundah differs from *H. macraeana* in the leaves usually lacking a groove along the lower side. More collections from the area, with flowers and fruit, are needed to establish its taxonomic significance." There remains a possibility, therefore, that the Stony Creek specimen, like the specimen from Nerrigundah in NSW, may be referable to *H. macraeana* after all. Alternatively, these two isolated populations may represent another, possibly undescribed, taxon. It was also confirmed that the Stony Creek occurrence, which is in state forest committed to hardwood production, consists only of the single mature individual, a small tree, observed and collected by Ross Peacock in 1989. Despite extensive searching of the surrounding forest by a small party of observers, there was no evidence of recruitment or other mature individuals (SAC 2003).

## Habitat

The only known habitat of the taxon in Victoria is the bank of the Genoa River, a fast-flowing perennial stream, where it is at risk of regular inundation by floodwaters. The only reliable Victorian collection of the taxon was taken from a plant growing within a metre of the water's edge where it was firmly anchored in heavy clay soil between numerous rocks and stones. The river at this point has a well formed U-shaped channel which maintains a high rate of flow adjacent to the *Hakea*. A dry sloping shingle bed composed of water-worn rocks of many sizes adjacent to the *Hakea* indicates that the river must flood regularly and that the plant must be capable of withstanding frequent and complete submergence. This plant at least could therefore be described as a rheophyte. The only woody plants which occupy similar habitats in the general vicinity are species acknowledged for their rheophytic habit and include *Grevillea neurophylla* subsp. *fluviatilis*, *Callistemon forresterae*, *Tristaniopsis laurina*, *Hakea microcarpa* and *Acacia floribunda* (SAC, 2003).

These are puzzling observations considering that Barker et al. (1999) state that, in NSW, the taxon is found in the understorey of wet or dry sclerophyll forest in skeletal soil on rocky ground from near sea-level to 1060 m. A possible explanation for the unexpected rheophytic habit of the Victorian population of *H. macraeana* is that seed may have been carried downstream, perhaps by floodwaters, from an upstream population (either in Victoria or in NSW) which occupies the rocky sclerophyll forest habitat with which the taxon is generally associated.

## Threats

The taxon is threatened in Victoria by stochastic loss on account of the extremely small population size, although the factors threatening the plant(s) at each of the known and suspected sites are somewhat different. The 2020 bushfires are believed to have impacted the general vicinity of the only confirmed occurrence in Victoria although, given the rheophytic, riparian habitat of this occurrence, it is unknown whether the plant(s) have been directly affected by this event.

The Genoa River plant(s) is/are threatened by flood (a seasonal threat to which the plant has already demonstrated considerable resilience) whilst the Stony Creek plant is threatened by fire and forestry (an extensive area has been clearfelled in the immediate vicinity since the plant was discovered in 1989). Both plants are further threatened by genetic isolation from the closest known occurrences in NSW, eventual senescence and possibly also from the

# Hakea macraeana Willow Needlewood

apparent failure to recruit since seedlings were not observed in the vicinity of either plant, one of which (Stony Creek) has flowered profusely and set seed over a number of years (SAC 2003).

The only confirmed Victorian population of *H. macraeana* comprises only one or very few plants which are threatened by stochastic events such as flood and possibly also by the failure to recruit. A second occurrence, which may yet prove to represent this taxon, also comprises a single mature individual which is threatened by stochastic events such as fire, by an apparent failure to recruit and by forestry operations in its immediate forest habitat.

The Victorian *Code of Practice for Timber Production 2014* includes general prescriptions, such as protection and buffering of old growth forests and waterways, that provide protection from timber harvesting. Since 2019, modified harvesting and forest regeneration practices have been implemented to be applied in areas of high conservation value.

## 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> <p>(a) direct observation [except A3]</p> <p>(b) an index of abundance appropriate to the taxon</p> <p>(c) a decline in area of occupancy, extent of occurrence and/or quality of habitat</p> <p>(d) actual or potential levels of exploitation</p> <p>(e) the effects of introduced taxa, hybridization, pathogens, pollutants, competitors or parasites</p>			

## Evidence:

### Eligible under Criterion A3 as Critically Endangered

The population reduction over the next 90 to 100 years is suspected to be 99 to 100%, based on (c) above.

Since the taxon is known in Victoria by a single collection in 2001, if it still exists in Victoria it is highly likely to become extinct. The 2020 bushfires are believed to have impacted the only known site.

# Hakea macraeana

## Willow Needlewood

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 B1 as Critically Endangered

The Extent of Occurrence (EoO) across the taxon's range is estimated to be 4 km<sup>2</sup>, based on accepted, post-1970 records from the Victorian Biodiversity Atlas (VBA). The EoO has been made equal to the Area of Occupancy (AoO) to ensure consistency with the definition of AoO as an area within EoO.

It is estimated to have one location, given its limited occurrence and vulnerability. It has a continuing decline in (iii) above. The only known Victorian occurrence of the taxon may be threatened by flood, however the plant has already demonstrated considerable resilience to past flood events, and it is unclear how significant is the threat of flood damage to the subpopulation.

It has a continuing decline in (iii) above.

#### Eligible under Criterion B2 as Critically Endangered

The Area of Occupancy (AoO) across the taxon's range is estimated to be 4 km<sup>2</sup>, based on 2 x 2 km grids derived from accepted, post-1970 records in the VBA. As above, it is estimated to have 1 location and has a continuing decline in (iii) above.

# Hakea macraeana Willow Needlewood

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 0 to 5 mature individuals, but other thresholds under this criterion have not been met.

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 Critically Endangered

The taxon is estimated to have 0 to 5 mature individuals. This is based on field observation (January 2001) of the suspected number of plants, noting however that there was no evidence at the time that the plants had yet reached maturity since there was no evidence of flowering or fruiting.

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.



# *Hakea macraeana* Willow Needlewood

SAC (2003). Flora and Fauna Guarantee Scientific Advisory Committee: Final Recommendation on a Nomination for Listing. Nomination No. 681 *Hakea macraeana*.

VicFlora (2018). Flora of Victoria, Royal Botanic Gardens Victoria: *Hakea macraeana*. Retrieved from: <https://vicflora.rbg.vic.gov.au/flora/taxon/e9dea4ee-59cd-4fdd-81c4-d2e13875143e>