Threatened Species Assessment

Scaevola calendulacea
Dune Fan-flower

Taxonomy

Scaevola calendulacea (J. Kenn.) Druce

Current conservation status

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

Proposed conservation status

Endangered in Victoria

Criterion B2ab(ii,iii,iv,v)

Species Information

Description and Life History

The taxon is a prostrate or ascending shrub to 40 cm high; stems pubescent with appressed hairs. Leaves shortly petiolate, elliptic to oblanceolate or spathulate, 3-8 cm long, 5-27 mm wide, thick, obtuse, both surfaces appressed-pubescent, margins entire or obscurely toothed, usually recurved. Flowers c. sessile, in leafy terminal spikes to c. 8 cm long; bracteoles linear to narrow-elliptic, 3-6 mm long. Sepals connate in a tube, lobes minute or obsolete, ciliate; corolla 12-20 mm long, pubescent outside, bearded inside, bright blue, wings 1-2 mm wide; indusium transverse-oblong, with sparse long bristles at base and prominent white bristles around orifice. Fruit subglobose, 7-12 mm diam., glabrous, succulent, white to purplish. The taxon flowers throughout the year (VicFlora 2018).

Individual plants have been observed with runners to a circumference of at least 8-10 m at, for example, Swan Lake on Discovery Bay (Dale Tonkinson pers. obs.).

Generation Length

The generation length of *Scaevola calendulacea* is estimated to be 20 to 50 years (midpoint 30 years). This is based on an estimated longevity of 50 years or more, and the likelihood that the taxon recruits sporadically and opportunistically in response to optimal seasonal conditions or localised disturbance events from locally dispersed seed or a soil-stored seedbank. The taxon is observed to form extensive stoloniferous open mats to at least 8-10 m diameter (Dale Tonkinson pers. obs.), often forming low hummocks through accretion of windblown sand (VicFlora 2018). Prostrate stems may become deeply buried, suggesting adult plants are likely to persist for decades in the absence of gross disturbance to the substrate. Seed-based recruitment is likely to be a relatively rare event with established clones persisting indefinitely through vegetative resprouting from prostrate stems.

Distribution

The taxon is scattered and rather uncommon in Victoria, in coastal sites between the mouth of the Glenelg River and Gabo Island. It is also found in South Australia, Queensland, and New South Wales (VicFlora 2018).

Habitat

The taxon occurs on coastal dunes, often forming low hummocks through accretion of windblown sand (VicFlora 2018). It is a habitat specialist restricted to siliceous or calcareous beach sands in association with *Acacia longifolia* subsp. *longifolia* (Sallow Wattle), *A. longifolia* subsp. *sophorae* (Coast Wattle), *Actites megalocarpus* (Dune Thistle), *Banksia integrifolia* (Coast Banksia), *Carex pumila* (Strand Sedge), *Carpobrotus rossii* (Karkalla), *Correa*

alba (White Correa), *Disphyma crassifolium* subsp. *clavellatum* (Rounded Noon-flower), *Exocarpos syrticola* (Coast Ballart), *Ficinia nodosa* (Knobby Club-sedge), *Kunzea pomifera* (Muntries), *Lepidosperma gladiatum* (Coast Sword-sedge), *Leptospermum laevigatum* (Coast Tea-tree), *Leucophyta brownii* (Cushion Bush), *Leucopogon parviflorus* (Coast Beard-heath), *Monotoca elliptica* (Tree Broom-heath), *Muehlenbeckia adpressa* (Climbing Lignum), *Myoporum insulare* (Common Boobialla), *Olearia axillaris* (Coast Daisy-bush), *Ozothamnus turbinatus* (Coast Everlasting), *Poa billardierei* (Coast Fescue), *P. poiformis* (Coast Tussock-grass), *Senecio linearifolius* (Fireweed Groundsel), *S. pinnatifolius* var. *maritimus* (Coast Groundsel), *Spinifex sericeus* (Hairy Spinifex), *Stackhousia spathulata* (Coast Stackhousia), *Tetragonia implexicoma* (Bower Spinach), *Zoysia macrantha* (Prickly Couch) and the highly invasive exotics *Ammophila arenaria* (Marram Grass), *Euphorbia paralias* (Sea Spurge) and *Senecio elegans* (Purple Groundsel).

Although almost invariably restricted to strictly coastal foredunes, a single adult plant has been recorded and collected (David Cameron pers. obs.) on the sandy-gravelly road verge between Darby Saddle and Tidal River at Wilsons Promontory, some kilometres from the coast where it was potentially introduced by vehicles or machinery.

Threats

The key long-term threat to the taxon is sea level rise in response to climatic warming, resulting in an increase in the frequency and intensity of storm surge events and foreshore instability, resulting in denudation of foredunes. The taxon and its habitat are threatened by foredune and beach erosion of the seaward edge of primary dunes by storm surges, however the net impact of foreshore instability is unclear, since sea level rise and storm surges may either erode the habitat or favour recruitment in newly created habitat. Although all its coastal habitats are already saline through salt spray accumulation, projected sea level rise and increasing frequency and intensity of storm surge events may increase salinity beyond the tolerance of the taxon.

Many occurrences are threatened by weed invasion and any potential inland migration of the taxon and its habitat in response to sea level rise may be blocked by existing weed infestations. The most invasive, exotic environmental weeds include Marram Grass, Sea Spurge, and Purple Groundsel. Sea Spurge is currently progressing eastward along the coast of Victoria, forming dense monocultures which exclude all other plant taxa, as it has in Western Australia, South Australia, and northern Tasmania. Other highly competitive, invasive, exotic environmental weeds include *Cakile* taxa (Sea Rocket), *Coprosma repens* (Mirror Bush) and the grasses *Cenchrus clandestinus* (Kikuyu) and *Lagurus ovatus* (Hare's-tail Grass). Each of these exotics are classed as a transformer weed and have the capacity to transform the habitat of *S. calendulacea,* and any one of these taxa alone can successfully compete with the taxon, particularly during early recruitment. Some sites are also threatened by invasion by native taxa extending their ecological or geographic range, notably Sallow Wattle, Coast Wattle, and Coast Tea-tree.

Some occurrences are threatened by recreational activity, for example at Swan Lake on Discovery Bay, potentially by sand stabilisation works, and coastal development such as the Bastion Point development at Mallacoota. Some occurrences are likely to be threatened by visitor pressure, including the use of dune buggies, trail bikes, 4WD vehicles, and the riding of horses in the Belfast Coastal Reserve near Port Fairy. The taxon may also be threatened by the lack of dispersal agents including potentially Emus, and by small subpopulation size, natural or anthropogenic fragmentation, and inbreeding depression.

The taxon is likely to have suffered significant historic decline through habitat modification in response to coastal development, weed invasion, and grazing of stock. Circumstantial evidence of past decline is provided by the antiquity of a large proportion of specimen records despite numerous botanists visiting many coastal sites, for example Wilsons Promontory, since the early days of European settlement.

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 60 to 150 years is estimated to be 20 to 50% (midpoint 35%), based on (c) and (e) above.

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

Eligible under Criterion A3 as Vulnerable

The population reduction over the next 60 to 100 years is projected to be 25 to 45%, based on (c) and (e) above.

Eligible under Criterion A4 as Vulnerable

The population reduction over any 60 to 150 year period, including both past and future (up to 100 years in the future), is estimated to be 20 to 50% (midpoint 35%), 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 104 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 naturally at the regional and landscape scales, and anthropogenically at the landscape scale in some districts. Most occurrences are isolated from each other at spacings likely to exceed the dispersal range of the taxon, which has no specialised mechanism for long-distance dispersal parallel to the coast. This precludes the possibility of recolonisation in the event of local extinction. The taxon has small fleshy fruits which are observed to be eaten by Blue-winged Parrots (close relatives of the Orange-bellied Parrot), but migration of this vector is not longitudinally along the coast, accounting for a few inland records in South Australia.

It is estimated to have 3 locations, and has a continuing decline in (ii), (iii), (iv) and (v) above in response to the impact of the identified threats, such as sea level rise in response to climatic warming, weed invasion, and recreational activity.

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

There is no available estimate of population size for the taxon in Victoria.

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

DEPI (2014). *Advisory list of rare or threatened plants in Victoria - 2014*. Department of Environment and Primary Industries, Melbourne.

VicFlora (2018). Flora of Victoria, Royal Botanic Gardens Victoria: *Scaevola calendulacea*. Retrieved from: https://vicflora.rbg.vic.gov.au/flora/taxon/bb2afb1c-0d56-4541-97a7-f21bbf87b53a