

## *Goodenia arguta* Grassland Goodenia

### Taxonomy

*Goodenia arguta* (R.Br.) K.A. Sheph

This taxon was previously known as *Velleia arguta*.

### Current conservation status

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

### Proposed conservation status

Endangered in Victoria

Criteria A2ce+3ce; B2ab(i,ii,iii,iv,v)

### Species Information

#### Description and Life History

The taxon is a rosetted, c. glabrous perennial herb with ascending flowering scapes to 40 cm high. Leaves shortly petiolate, oblanceolate to narrow-elliptic, 4-12 cm long (including petiole), 5-12 mm wide, acute to obtuse, virtually glabrous, margins toothed and sometimes lobed. Inflorescence a dichasium; bracteoles free, lanceolate to ovate, 1-3 cm long, often toothed or deeply incised. Sepals 5, usually 8-12 mm long, free, glabrous or pubescent near margins; corolla 12-22 mm long, spurred, pubescent outside, almost glabrous inside, deep yellow, often brownish near throat, wings 1-1.5 mm wide; indusium oblong, with short hairs around base, orifice very curved and with short bristles. Capsule ovoid, 6-9 mm long, pubescent; seeds elliptic, c. 4 mm long, smooth, wing 1-2 mm wide. The taxon flowers from September to January (VicFlora 2020).

#### Generation Length

The generation length of *G. arguta* is estimated to be 5 to 50 (possibly 15 to 25) years. The taxon is likely to recruit more or less continuously from a soil-stored seedbank, in response to optimal seasonal conditions determined by alternating El Niño and La Niña events at intervals of 5-10 years, supplemented by episodic pulse recruitment following fire events at pre-settlement intervals of 5-25 years. There is also likely to be some opportunistic trickle recruitment in response to localised site disturbance events. Longevity is plausibly in the 5-25 year range depending on local disturbance regimes and site conditions. If the taxon is capable of resprouting from a subterranean rootstock like its congener *Goodenia paradoxa* (Spur Goodenia), then longevity may extend to 50 years or more.

#### Distribution

This taxon is rare in Victoria, apparently confined to the far north-west and the Dimboola district. Site data suggests the current stronghold of the taxon in Victoria is the Sunset Plains north of Pink Lakes in the Murray Sunset National Park. The taxon extends north to the Murray River at Lake Cullulleraine, and from the South Australian border east to Wood Wood on the Murray River between Boundary Bend and Swan Hill, with southern outliers at Pine Plains in Wyperfeld National Park and near Jeparit. The taxon is likely to be extinct in the Dimboola district, where it was last collected in 1901, and in the Sea Lake district, where it was last collected in 1917.

It is also found in WA, SA and NSW (VicFlora 2020).

## Habitat

The taxon is usually associated with mallee or grassland (VicFlora 2020). Most sites are open grassland, herbfield, chenopod shrubland, or Belah Woodland, which are usually eucalypt-free. But when present, usually at low density, eucalypts include *Eucalyptus dumosa* (Dumosa Mallee), *E. gracilis* (Yorrel) and *E. oleosa* (Oil Mallee), typically in open Chenopod Mallee in grassy swales between dunes in the Murray Mallee bioregion rather than the Lowan Mallee bioregion. Soils include reddish-brown clay loam with sheet calcrete at depth belonging to the Woorinen formation.

Quadrat data indicates that the habitat of the taxon is typically dominated, with at least 5-25% projective foliage cover at the quadrat scale, by *Acacia ligulata* (Small Cooba), *Allocasuarina luehmannii* (Buloke), *Angianthus tomentosus* (Hairy Angianthus), *Aristida contorta* (Sand Wire-grass), *Atriplex vesicaria* (Bladder Saltbush), *Austrostipa eremophila* (Desert Spear-grass), *A. scabra* (Rough Spear-grass), *Brachyscome lineariloba* (Hard-head Daisy), *Callitris gracilis* (Slender Cypress-pine), *Casuarina pauper* (Belah), *Dodonaea viscosa* subsp. *angustissima* (Slender Hop-bush), *Goodenia pusilliflora* (Small-flower Goodenia), *Hyalosperma semisterile* (Orange Sunray), *Lawrencina squamata* (Thorny Lawrencina), *Leptorhynchos tetrachaetus* (Beauty Buttons), *L. waitzia* (Button Immortelle), *Maireana pyramidata* (Sago Bush), *Minuria leptophylla* (Minnie Daisy), *Podolepis aristata* subsp. *affinis* (Grey Podolepis), *Pogonolepis muelleriana* (Stiff Cup-flower), *Rhagodia spinescens* (Hedge Saltbush), *Rhodanthe pygmaea* (Pygmy Sunray), *Roepera aurantiaca* (Shrubby Twin-leaf), *Rytidosperma caespitosum* (Common Wallaby-grass), *Sclerolaena diacantha* (Grey Copperburr), *Sida intricata* (Twiggy Sida), *Vittadinia cervicalis* (Annual New Holland Daisy) and *V. gracilis* (Woolly New Holland Daisy).

Most sites are at least moderately weedy, with the following taxa becoming dominant with at least 5-25% projective foliage cover at the quadrat scale: *Bromus diandrus* (Great Brome), *B. rubens* (Red Brome), *Carrichtera annua* (Ward's Weed), *Foeniculum vulgare* (Fennel), *Medicago minima* (Little Medic), *M. polymorpha* (Burr Medic), *M. truncatula* (Barrel Medic), *Moraea setifolia* (Thread Iris) and *Schismus barbatus* (Arabian Grass).

Quadrat data indicates that the taxon typically occurs at low density, with projective foliage cover less than 1%, and only rarely exceeding 5%, at the quadrat scale.

## Threats

Given its consistent association with grassy habitats on fertile clay loam soils, the taxon is likely to have suffered as much as a 90-95% historic decline through habitat loss to agriculture. This is further supported by the association of the taxon with Buloke and Belah, signature taxa dominating woodlands on fertile plains targeted for intensive agriculture. Incremental habitat loss and degradation through agricultural intensification continues to threaten small and isolated occurrences in remnant stands of native vegetation in highly fragmented agricultural landscapes.

Current and future threats include weed invasion, noting that all occurrences including those now protected in national parks and other reserves are at least moderately weedy, with a suite of invasive exotic weeds sometimes dominating the vegetation, often as a legacy of past grazing of public land in both the Murray Sunset and Wyperfeld National Parks.

The taxon is also likely to be threatened by browsing by both native and exotic herbivores including rabbits, goats, kangaroos and domestic stock, although stock are no longer a threat within national parks and other reserves. Rabbits in particular are likely to be a key threat, depending on the success of rabbit control programs. The threat posed by herbivory is equivocal, however at least one congener, *Goodenia discophora* (Cabbage Poison), is a plant of bitter and disagreeable taste, not readily eaten by stock and potentially implicated in cases of sheep poisoning in Western Australia (Gardner and Bennetts 1955).

It is unclear whether the taxon is currently threatened by climatic drying since the taxon is likely to be reasonably tolerant of drought stress. In the longer term however, extreme and protracted drought events are likely to result in both adult mortality and recruitment failure, leading to seedbank depletion, exhaustion, and local extinction.

Projected increases in fire frequency and intensity in the region are not likely to be a major threat to the taxon, since fuel loads in the habitat range of the taxon are unlikely to support fire at greater frequency than is already imposed through fuel reduction burning.

### 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 A2 as Endangered

The population reduction over the past 15 to 150 years is estimated to be 40 to 55% (midpoint 50%), based on (c) and (e) above.

The taxon is estimated to have suffered as much as 90-95% historic decline through habitat loss to agriculture. Up to half of this decline is estimated to have occurred within the last three generations which is nominally estimated to be 75-100 years.

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

#### Eligible under Criterion A3 as Endangered

The population reduction over the next 15 to 100 years is suspected to be 30 to 80% (midpoint 50%), based on (c) and (e) above.

Future decline cannot be estimated with confidence since the identified threats operate incrementally or stochastically with unpredictable intensity.

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 152 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, and anthropogenically at the landscape scale. The only plausible vectors are likely to be ants (myrmecochory) which operate at the metre scale only.

It is estimated to have 2 locations, and has a continuing decline in (i), (ii), (iii), (iv) and (v) 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				

# Goodenia arguta

## Grassland Goodenia

### Evidence:

#### Ineligible under Criterion C as Data Deficient

In the absence of any longitudinal population monitoring data, there is no available estimate of population size for the taxon in Victoria.

Criterion D - Very small or restricted population <sup>Ⓜ</sup>			
<sup>Ⓜ</sup>	Critically Endangered <sup>Ⓜ</sup>	Endangered <sup>Ⓜ</sup>	Vulnerable <sup>Ⓜ</sup>
Number of mature individuals (observed or estimated) <sup>Ⓜ</sup>	<50 <sup>Ⓜ</sup>	<250 <sup>Ⓜ</sup>	<1,000 <sup>Ⓜ</sup>
D2 - Only applies to the VU category <sup>Ⓜ</sup> 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. <sup>Ⓜ</sup>	- <sup>Ⓜ</sup>	- <sup>Ⓜ</sup>	D2 - Typically: <sup>Ⓜ</sup> AoO < 20 km <sup>2</sup> or number of locations ≤ 5 <sup>Ⓜ</sup>

### 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.

Gardner, C.A. and Bennetts, H.W. (1955) Poison Plants of Western Australia - Cabbage poison (*Velleia discophora* F. Muell.). *Journal of the Department of Agriculture, Western Australia, Series 3: 4(2):*Article 13.

VicFlora (2020) Flora of Victoria, Royal Botanic Gardens Victoria: *Goodenia arguta*. Retrieved from: <https://vicflora.rbg.vic.gov.au/flora/taxon/92c508be-b9e4-4cbe-bc3f-3f1896e035e1>