Australian Capital Territory

Nature Conservation (Dwarf Violet) Conservation Advice 2024

Notifiable instrument NI2024-252

made under the

Nature Conservation Act 2014, s 90C (Conservation advice)

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1 Name of instrument

This instrument is the *Nature Conservation (Dwarf Violet) Conservation Advice 2024*.

2 Commencement

This instrument commences on the day after its notification day.

3 Conservation advice for Dwarf Violet

Schedule 1 sets out the conservation advice for Dwarf Violet (*Viola improcera*).

Arthur Georges
Chair, Scientific Committee
21 May 2024

Schedule 1

(see s 3)

ACT Government
Environment, Planning and Sustainable Development

ACT Scientific Committee

DRAFT CONSERVATION ADVICE

DWARF VIOLET – *Viola improcera*

CONSERVATION STATUS

The Dwarf Violet – *Viola improcera* L.G. Adams– is recognised as threatened in the following jurisdictions:

National	**Endangered**, *Environment Protection and Biodiversity Conservation Act 1999*
ACT	**Endangered**, *Nature Conservation Act 2014*
VIC	**Endangered** (recommendation), *Flora and Fauna Guarantee Act 1988*

ELIGIBILITY

The Dwarf Violet is listed as Endangered in the ACT Threatened Native Species List under IUCN Criterion B – (B2ab(iii)) due to its restricted Area of Occupancy (AOO = 52 km^2), number of locations (2–4) and projected continued decline in area, extent and quality of habitat (DCEEW 2023; Attachment 1).

DESCRIPTION AND ECOLOGY

The Dwarf Violet is a compact perennial stoloniferous herb that grows to around 2 cm tall. Leaves tufted, spathulate, glabrous with wavy rounded or toothed edges, around 18–22 mm long on long narrowly winged petioles. The flowers have five pale blue-violet petals 10–25 mm long. Capsules are around 6 mm long and ellipsoid, and the seeds are ovoid, 2 mm long, black, glossy, smooth or rugulose. The species flowers in December (Adams 1982; Enrwisle 1996; VicFlora 2023)

Dwarf Violet (Ciaran Ernst-Russell – Canberra Nature Map)

Little is known about the reproductive ecology of the Dwarf Violet. However, many *Viola* species reproduce via seeds as well as vegetatively via stolons. Pollination studies indicate this species cannot self-pollinate and relies on cross pollination to produce seeds (Australian National Botanic Gardens (ANBG) 2023). Seed dispersal is limited for many *Viola* species (Beattie and Lyons 1975; Auge et al. 2001). Seeds of this species are physiologically dormant at dispersal and need a period of cold stratification to break dormancy and germinate (G. Hoyle 2023 pers. comm. 15 August). Smoke does not promote germination in this species (G. Hoyle 2023 pers. comm. 15 August), which might indicate fire does not promote germination of

this species' soil seed bank. The ANBG successfully propagated the Dwarf Violet from cuttings and division following surveys at the end of 2021 and found that division was the most efficient method (ANBG 2022). The ANBG also found that flowering was observed intermittently throughout the year, with a main flowering time of late spring into summer; however, this may not reflect the phenology of wild populations (ANBG 2022).

The generation time for *Viola* species is unresolved (Sata et al. 2021). However, a study suggests a generation time of 6–9 years (Eckstein et al. 2009) and a juvenile period of 2–3 years (Sata et al. 2021; Hama 2002).

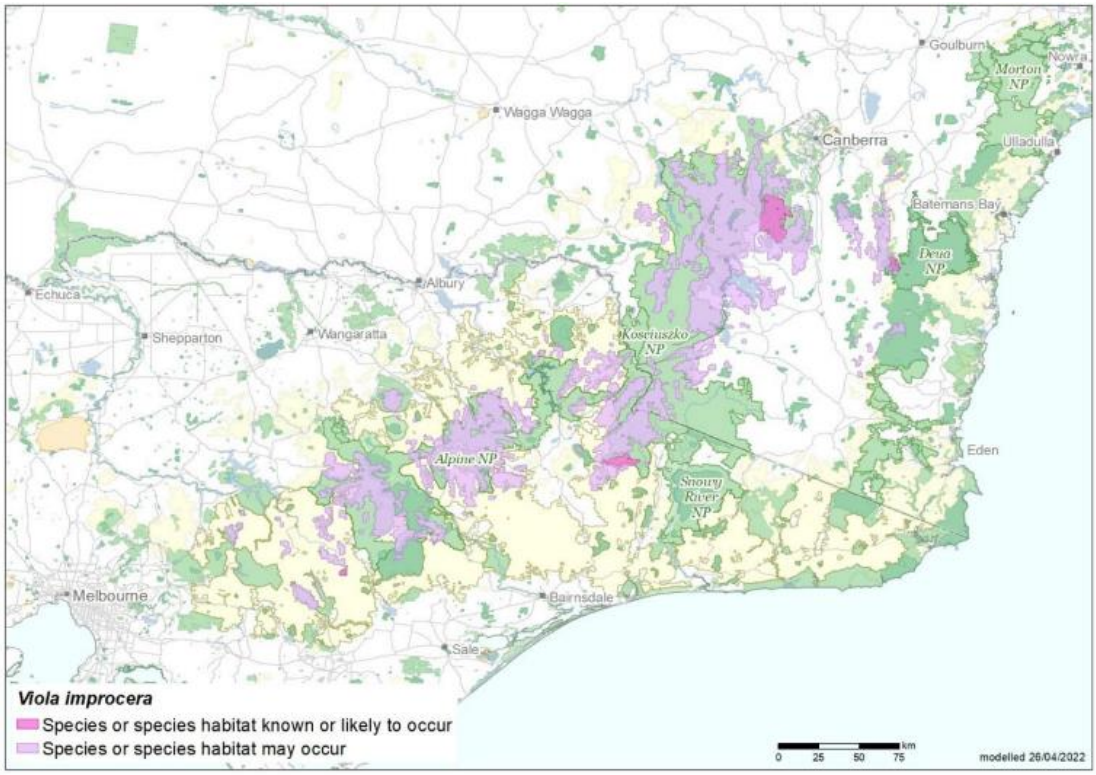
The Dwarf Violet is likely to have a persistent soil seed bank (ARI 2022), thus seeds can persist in the soil for more than one growing season. Soil disturbance might favour seed germination, as this species is readily seen along tracks. In addition, when this species was discovered in NSW, roughly 18 months post 2019–20 bushfires, individuals of the species were much larger than expected for newly emerged seedlings, suggesting this species might resprout after fire, if stolons have not been exposed to lethal temperatures (D. Albrecht pers. comm. in DCCEEW 2023). All sites were burnt in the 2019–20 bushfires and all subpopulations showed evidence of post-fire regeneration (ARI 2022; ANBG 2022).

DISTRIBUTION AND HABITAT

The Dwarf Violet occurs in alpine areas of Victoria, NSW and the ACT. In the ACT, there are only three sites within Namadgi National Park. These are at Big Creamy Flat, Scabby Range and Sentry Box (ANBG 2022; F. Ingwersen pers. comm. in DCCEEW 2023). There are multiple observations running along a transect of roughly 9 km in the Mount Scabby/Mount Kelly area of Namadgi National Park (ALA 2023). Those that are distant from the known sites may represent other subpopulations; however, collection and validation is required for these observations (F. Ingwersen pers. comm. in DCCEEW 2023). These known sites may reflect at least 3 distinct subpopulations, or one large subpopulation. The exact number of subpopulations is uncertain because the species is insect-pollinated, and the degree to which some of these sites are genetically separated is unknown. Recent discoveries of the species in previously unknown sites suggests the species may be more widespread than is currently documented. Disturbance post fire and the reduction in competition and shading could promote the reproduction of the Dwarf Violet and/or facilitate sighting populations that were hard to find pre-fire (E. Cook pers. comm. in DCCEEW 2023).

All known sites for this species occur within National Parks (NPs); including Alpine NP (Vic), Namadgi NP (ACT) and Deua NP (NSW) (ARI 2022; ANBG 2022). The Dwarf Violet occurs at high elevations between 1300–1800 m above sea level in open shrubland, snow-gum woodland (Entwisle 1996; ALA 2023; ARI 2022). The species is known to grow in open areas on or near summits and upper slopes on rocky soil and is readily seen along tracks (ARI 2022). The Dwarf Violet occurs among *Eucalyptus* spp., *Lepidospermum* spp., *Stylidium* spp., *Geranium* spp., *Banksia caneii* (Mountain Banksia), *Oxylobium ellipticum* (Shaggy-pea), *Daviesia ulicifolia* (Gorse Bitter Pea) and *Boronia algida* (Alpine Boronia) (ARI 2022; D. Albrecht pers. comm. in DCCEEW 2023). Surveys in Namadgi NP also found the species occurring near the rare, restricted and sensitive *Leptospermum namadgiense* (E. Cook 2022 pers. comm. 13 September in DCCEEW 2023). Further research is needed to define habitat critical to the survival of the Dwarf Violet (see Conservation Actions). Until such information is available, all habitat for the species in and around all known extant and historical sites should be considered important for the species' long-term survival.

Map 1: Modeled distribution of the Dwarf Violet (Source DCCEEW 2023)



Source: Base map Geoscience Australia; species distribution data Species of National Environmental Significance database.

THREATS

The Dwarf Violet is primarily threatened in the ACT by:

- increased temperatures, drought, altered precipitation and snow reduction in alpine areas that might restrict the habitat suitable for this species, already encompassing a narrow distribution range in the mountains
- habitat disturbance by humans
- herbivory by rabbits (*Oryctolagus cuniculus)*
- habitat disturbance by feral deer including Fallow Deer (*Dama dama*), Red Deer (*Cervus elaphus*) and Sambar Deer (*Cervus unicolor*)
- habitat disturbance by feral pigs (*Sus scrofa)*
- increases in fire intensity and frequency that might interfere in the capacity of the Dwarf Violet to resprout and germinate post fire
- drought and fire interactions that might cause broadscale death to seedlings
- out-of-season fire that might disrupt phenological process directly or indirectly by affecting other species such as pollinators.

MAJOR CONSERVATION OBJECTIVE

The priority management objective should be to maintain in the long term, viable, wild populations of the species as a component of the indigenous biological resources of the ACT and as a contribution to regional and national conservation of the species. This includes the need to maintain natural evolutionary processes.

CONSERVATION PRIORITIES

Conservation actions are detailed in the Commonwealth Conservation Advice (DCCEEW 2023). Conservation and management priorities for the Dwarf Violet in the ACT should be to:

- protect subpopulations near tracks, using signage (if appropriate under the ACT Sensitive Species Policy), track markers or re-route tracks
- identify and include species and habitat location and requirements specifically in the ACT Ecological Guidelines (ACT Government 2019) and on-ground management apps
- continue control of invasive plants and animals where the species is known to occur
- collect and store seeds and plant material from known subpopulations to preserve genetic material and investigate potential for translocation if required. This would require partnership with the National Seed Bank at the Australian National Botanical gardens
- monitor the species' abundance, recruitment, and plant health to determine trends in population size, survival and reproduction, especially relating to the impacts of fire and climate change
- actively seek opportunities to involve members of local indigenous communities in on ground activities
- engage with other jurisdictions to support regional and national recovery of the species
- collaborate with other institutions (e.g., ANBG, ANU) to understand more about the biology of this species and the effects that climate change poses to its persistence.

CONSERVATION ISSUES

It is recommended that quantitative targets and resourcing requirements are clearly identified in any Action Plan or other related projects/programs relevant to this species. Broader conservation issues need to be considered in developing and implementing actions arising from this advice and the listing assessment (DCCEEW 2023).

Critical Habitat

The Commonwealth Conservation Advice (DCCEEW 2023) identifies 'habitat critical to the survival' or important habitats of a species refers to areas that are necessary:

- for activities such dispersal
- for the long-term maintenance of the species (including the maintenance of species essential to the survival of the species, such as pollinators)
- to maintain genetic diversity and long-term evolutionary development
- for the reintroduction of populations or recovery of the species.

Habitat critical to the survival should not be cleared, fragmented or degraded. Any known or likely habitat (Map 1) should be considered as habitat critical to the survival of the species. Additionally, areas that are not currently occupied by the species due to recent disturbance (e.g fire, grazing or human activity), but should became suitable again in the future, should also be considered habitat critical to the survival of the species. It is essential that the highest level of protection is provided to these areas, across all tenures, and that enhancement and protection measures target these productive sites. No Critical Habitat as defined under section 207A of the EPBC Act has been identified or included in the Register of Critical Habitat under the EPBC Act.

Climate Change

Climate change impacts are inevitable and will affect the likelihood of persistence, within the ACT, of many species. Most vulnerable in this regard are those species that occupy fragmented and highly

restricted distributions, such as the Dwarf Violet. Capacity must be developed to model the impact on the Dwarf Violet and its habitat under likely climate change scenarios if we are to anticipate and manage the impacts of climate change. This will require a combination of research and the development of in-house capacity for the collection of relevant data and its application in climate change modelling.

Population Viability

If other measures are not effective in restoring populations, then *ex situ* seed banking and propagation of the existing subpopulations across the species distribution and cross pollination experiments to increase genetic diversity may be necessary for this species to recover.

Jurisdictional Collaboration

Seed collections and seed banking of seeds from several populations across jurisdictions will increase the likelihood of conserving the current genetic diversity for potential future restorations.

Ngunnawal Community Engagement

The ACT Government should actively facilitate, the inclusion of the Ngunnawal people in the conservation of this species and its habitat as part of Ngunnawal Country. Reference to the draft Cultural Resource Management Plan (ACT Government in prep.) would be useful to inform culturally appropriate resource management including of native species that aligns with achieving conservation outcomes for the species.

OTHER RELEVANT ADVICE, PLANS OR PRESCRIPTIONS

- Commonwealth Conservation Advice – Dwarf Violet (DCCEEW 2023)
- Namadgi National Park Plan of Management 2010
- Strategic Bushfire Management Plan 2019-2024

LISTING BACKGROUND

The Dwarf Violet is listed as an Endangered species under the EPBC Act, effective 7 September 2023. It is assessed as Endangered under Criterion B (B2ab(iii)) of the EPBC Act. In 2024, under the *Nature Conservation Act 2014*, the ACT Scientific Committee recommended the Dwarf Violet to be listed in the Endangered category in the ACT Threatened Native Species List to align with the EPBC Act listing.

ACTION PLAN DECISION

The ACT Scientific Committee does not recommend that the Minister for the Environment should make the decision to have an action plan for the species in the ACT under the *Nature Conservation Act 2014*. The key habitat areas of the species in the ACT are along the ACT/NSW border in Namadgi National Park (above 1400 m above sea level) and its habitat is protected there. The Commonwealth Conservation Advice (DEECCW 2023) and this Conservation Advice should be used to inform and support the priority actions identified above. This especially includes the need for monitoring and identifying and including the species and its habitat's needs in ecological guidelines for on-ground management.

A National Recovery Plan is not required to be prepared for the species (DCCEEW 2023).

REFERENCES

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FURTHER INFORMATION

Further information on the related Action Plan or other threatened species and ecological communities can be obtained from: Environment, Planning and Sustainable Development Directorate (EPSDD). Phone: (02) 132281, EPSDD Website: https://www.environment.act.gov.au/nature-conservation

ATTACHMENT A: LISTING ASSESSMENT (DCCEEW 2023)

Reason for assessment

This assessment follows prioritisation of a nomination from the TSSC.

Assessment of eligibility for listing

This assessment uses the criteria set out in the EPBC Regulations. The thresholds used correspond with those in the IUCN Red List criteria except where noted in criterion 4, sub-criterion D2. The IUCN criteria are used by Australian jurisdictions to achieve consistent listing assessments through the Common Assessment Method (CAM).

Key assessment parameters

Table 3 includes the key assessment parameters used in the assessment of eligibility for listing against the criteria. The definition of each of the parameters follows the Guidelines for Using the IUCN Red List Categories and Criteria.

Table 1 Key assessment parameters

Metric	Estimate used in the assessment	Minimum plausible value	Maximum plausible value	Justification
Number of mature individuals	unknown	unknown	unknown	The number of mature individuals of dwarf violet is currently unknown. Due to the stoloniferous nature of the species, exact population counts can be difficult. Surveys conducted in Alpine NP in Victoria found the species present at 6 sites and there were estimated to be 112 individuals, all of which were seedlings (ARI 2022). However, this may not encompass the total population at these sites as the species appeared to be scattered throughout the general area (ARI 2022). A further site along Reedy Track, a few hundred metres east of Diggers Hole Track, was estimated to have hundreds, potentially thousands of newly germinated individuals (Walsh 2022 pers com 7 March). Due to the way in which this species grows, it is possible that this is an over-estimate. Observations from November and December 2021 of the species in Namadgi NP uploaded to Atlas of Living Australia through Canberra Nature Map found thousands of individuals near the western peak of Sentry Box and another 30 close to the summit of Namadgi Mountain (ALA 2022). It is unknown how many of these were mature. Many of these individuals were growing amongst stumps of burnt shrubs (Ernst-Russel 2022 pers comm 13 September). This suggests that the 2019-20 fires removed much of the competing vegetation, and that the number of individuals present prior to the fires may have been far less than what was found during these surveys (Cook 2022 pers comm 13 September). There are insufficient data available at this time to estimate an exact number of mature individuals. The species is estimated to occur in 7 subpopulations (see below), and it is unlikely that any of these exceed the number of mature individuals found near Diggers Hole Track.

Metric	Estimate used in the assessment	Minimum plausible value	Maximum plausible value	Justification
				Due to the inconspicuous nature of the species, it is possible that it exists in undocumented sites.
Trend	Unknown			No surveys were conducted for the species prior to 2021. Therefore, there are insufficient data available to determine a trend in the number of mature individuals. However, given future threats such as increased temperature and decreased rainfall due to climate change it is likely that a loss of suitable habitat will occur, which could result in a decline in the number of mature individuals.
Generation time (years)	7.5	6	9	The generation time for dwarf violet is estimated to be 6–9 years (see 'Reproductive Ecology and Life History' above). The estimate used in this assessment takes the middle ground of the above, with a generation time of 7.5 years.
Extent of occurrence	14,722 km^2	14,722 km^2	>14,722 km^2	The minimum plausible value represents the extent of occurrence (EOO) of all historically known sites. Almost all known sites were surveyed in 2021 (ARI 2022; ANBG 2022), with the exception of Mount Useful in Victoria. This site has reliable observation records from 1970 but has not had any since. However, it is assumed that the species still persists in the area (ARI 2022). Therefore, the estimate used in this assessment reflects the minimum plausible value, as the species is not thought to be locally extinct at any previous sites. The discovery of a new subpopulation on Big Badja Hill in NSW suggests the species may be more widespread than currently documented. The true EOO of the species may in fact be greater than what is being estimated here. Therefore, the maximum plausible value is estimated to be greater than 14,722 km^2. The EOO was calculated using a minimum convex hull, based on the IUCN Red List Guidelines (IUCN 2022). All values meet the threshold for Vulnerable.
Trend	Stable			Despite the species being found at a new site in 2022, the EOO is not thought to be declining or increasing. The species is believed to be extant at all historic sites and may exist in unlocated subpopulations. However, the species may experience a future decrease in EOO due to future climate scenarios, as increased temperatures and altered rainfall may result in parts of their current range becoming unsuitable.

Metric	Estimate used in the assessment	Minimum plausible value	Maximum plausible value	Justification
Area of Occupancy	52 km^2	52 km^2	>52 km^2	The minimum plausible value represents the area of occupancy (AOO) of all historically known sites. The estimate used in this assessment reflects the minimum plausible value, as the species is not thought to be locally extinct at any previous sites. The discovery of a new subpopulation on Big Badja Hill in NSW suggests the species may be more widespread than currently documented. The true AOO of the species may in fact be greater than what is being estimated here. Therefore, the maximum plausible value is estimated to be greater than 52 km^2. All values meet the threshold for Endangered.
AOO is a standardised spatial measure of the risk of extinction, that represents the area of suitable habitat known, inferred or projected to be currently occupied by the taxon. It is estimated using a 2 x 2 km grid to enable comparison with the criteria thresholds. The resolution (grid size) that maximizes the correlation between AOO and extinction risk is determined more by the spatial scale of threats than by the spatial scale at which AOO is estimated or shape of the taxon's distribution. It is not a fine-scale estimate of the actual area occupied. In some cases, AOO is the smallest area essential at any stage to the survival of existing populations of a taxon (e.g. breeding sites for migratory species).				
Trend	Declining			Despite the species being found at a new site in 2022, there is insufficient evidence to determine whether the AOO has declined or increased in the past. The species is believed to be extant at all historic sites and may exist at additional undiscovered sites. However, the species will likely experience a decrease in AOO due to future climate scenarios, as increased temperatures and altered rainfall are expected to result in parts of their current range becoming unsuitable (see 'Continuing decline' section of 'Criterion 2 evidence' below).
Number of subpopulations	7	4	7	Dwarf violet occurs in 3 jurisdictions; NSW, ACT, and Vic (ARI 2022; ANBG 2022). In Vic, the species is known from 2 distinct sites at Mount Useful and Nunniong Plateau (ARI 2022). In NSW, the species is known from only a single recently discovered site on Big Badja Hill (ANBG 2022). In the ACT, the species is known to occur in the Mount Scabby region of Namadgi NP (ANBG 2022). The minimum plausible value assumes that the species is known from 2 subpopulations in Victoria, one in NSW, and one in the ACT. The maximum plausible value, and the estimate used for this assessment, assumes that the species occupies 2 subpopulations in Victoria, one in NSW, and 4 in the ACT.
Trend	Stable			Despite the recent discovery of a new subpopulation in NSW (ANBG 2022), there is no evidence available to suggest a decreasing or increasing trend in the number of subpopulations. However, due to the cryptic nature of the species it is likely that it occurs in further unsurveyed sites of suitable habitat. It is therefore possible that the species occurs in undiscovered subpopulations, or that those suggested here represent larger continuous subpopulations.

Metric	Estimate used in the assessment	Minimum plausible value	Maximum plausible value	Justification
Basis of assessment of subpopulation number	Dwarf violet is most likely insect pollinated, similar to other species within the genus (Beattie 1971, 1976; Freitas & Sazima 2003; Miyajima 2006). The insect species that pollinate the species are unknown; however, it is likely that they are native bees (Thiele 2022 pers comm 2 June). The types of pollinators that visit the dwarf violet would determine how separate each site is from one another. The 2 sites in Victoria and one in NSW are distant enough from all other sites (ca. 50-150 km apart) to safely say they are separate subpopulations. In the ACT, however, the species appears to occur in 4 distinct areas in Namadgi NP. These sites are estimated to occur more than 5 km apart from one another. Due to the size of dwarf violet and the available information, it is assumed that small native bees are the primary pollinators. As such, it is unlikely that these species would be able to travel this distance and each site within Namadgi NP is therefore considered to be separate subpopulations for the purpose of this assessment. Dwarf violet has a very limited seed dispersal ability, usually within 5 m of the parent plant (Beattie & Lyons 1975; Auge et al. 2001). This suggests that subpopulations may be further separated from each other than is suggested, based on pollinators. However, as the species may be more widespread than is currently known, the degree of separation is based on pollinator flight distance for the purposes of this assessment, to reflect the possibility of larger continuous subpopulations.			
No. locations	2-4	1	7	Dwarf violet is estimated to occur in one to 2 locations due to the most plausible serious threat of drought due to climate change. Increased drought conditions are expected under future climate scenarios (OEH 2014a, 2014b; DELWP 2019). This could result in widespread seedling mortality, particularly following fire, which in turn would lead to a reduced number of mature individuals and hinder the species' ability to replenish the soil stored seedbank. The minimum plausible value represents the number of locations should a drought be severe enough to affect the entire population. The maximum plausible value represents the number of locations if each subpopulation were affected differently. Given the close proximity of the subpopulations within ACT, this is unlikely to occur. The estimate used in this assessment reflects the likely scenario that drought may threaten the subpopulations of the species with local extinction, affecting 25–50% of the population, as regional climate and local factors that reduce evaporative loss likely differ across the species' distribution.
Trend	Stable			Despite the recent discovery of a new subpopulation in NSW, there is insufficient evidence to determine either a decreasing or increasing trend in the number of locations.
Basis of assessment of location number	The most serious plausible threat to dwarf violet is increased drought conditions under future climate scenarios. A drought severe enough to threaten the species, especially following fire, may be expected to impact at least 25–50 % of the population. An event such as this would result in the species occurring in 2–4 locations as it would likely result in widespread seedling mortality at all or some sites, leading to a reduced number of mature individuals and impacting the species' ability to replenish the soil-stored seedbank at those subpopulations. Indirectly, drought conditions can result in increased food consumption by herbivores (Hamman et al. 2021), which would further hinder the species ability to persist. Historically, droughts have been known to affect the entire distribution of the species (BOM n.d.), suggesting that a large enough drought could affect the entire population. However, due to regional climates and local factors that reduce evaporative loss or maintain moisture availability, it is more likely that drought conditions that would threaten the species with extinction would only impact a portion of the population. Despite this threat having a more severe impact on the species, reduced rainfall and drought conditions on a smaller scale will likely threaten the species with local extinction and is more likely to occur.			

Metric	Estimate used in the assessment	Minimum plausible value	Maximum plausible value	Justification
Fragmentation	The species is not considered to be severely fragmented. The species has a naturally fragmented, discontinuous population with seven subpopulations across three jurisdictions. Over 50% of the species' AOO occurs in habitat patches that can support a viable population and all subpopulations are suspected to be viable.			
Fluctuations	As the species appears to have obligate seeder traits it may experience booms and busts in the number of mature individuals due to fire; however, this does not meet the criteria for extreme fluctuations. The available data suggests there are no extreme fluctuations in EOO, AOO, number of locations, or number of subpopulations.			

Criterion 1 Population size reduction

Reduction in total numbers (measured over the longer of 10 years or 3 generations) based on any of A1 to A4

	Critically Endangered Very severe reduction	Endangered Severe reduction	Vulnerable Substantial reduction
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

Criterion 1 evidence

Insufficient data to determine eligibility

The generation time for dwarf violet is estimated to be 7.5 years (see Table 3). Surveys conducted in 2021 following the 2019-20 bushfires found the species present at all sites searched. Due to the stoloniferous nature of the species, population counts can be difficult, and a total estimated number of mature individuals is currently unavailable. No surveys were conducted on the species prior to the 2019-20 bushfires. Therefore, there is insufficient evidence available to estimate a decline in the number of mature individuals over the last 22.5 years (three generations).

Decline may occur into the future due to ongoing threats such as increased temperature, decreased rainfall, and increased drought due to climate change. However, there are insufficient

data available to estimate a decline in the number of mature individuals over the next 22.5 years (three generations).

Therefore, the Committee considers that there is insufficient information to determine the eligibility for dwarf violet for listing in any category under this criterion.

Criterion 2 Geographic distribution as indicators for either extent of occurrence AND/OR 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			

Criterion 2 evidence

Eligible under Criterion 2 B2ab(iii) for listing as Endangered

EOO and AOO

Dwarf violet is known from 2 subpopulations in Vic, 4 in ACT, and one in NSW. Surveys conducted in 2021 following the 2019-20 bushfires found the species present at all sites searched. Among these was the first discovery of the species in NSW (ANBG 2022). Not all previously known sites for the species were searched; however, the species is believed to persist in these sites (ARI 2022). The EOO and AOO take into account historic records for the species as well as the surveyed sites from 2021. The EOO of the species is estimated at 14,277 km², and AOO is estimated at 52 km².

Given the AOO is less than 500 km² the species meets the threshold for listing as Endangered under sub-criterion B2. The EOO is less than 20,000 km², meeting the threshold for Vulnerable under sub-criterion B1.

Severely fragmented and number of locations

Dwarf violet is not considered to be severely fragmented. Despite subpopulations occurring across a large range, all subpopulations are thought to be viable.

Dwarf violet is estimated to occur at two to four locations based on the most plausible serious threat (drought) as per IUCN Guidelines (IUCN 2022) (see Table 3). Future climate scenarios

predict increased drought conditions across the species range (OEH 2014a, 2014b; DELWP 2019). This may lead to widespread seedling mortality at all or some sites (estimated to be 25-50% of subpopulations), particularly after fire, which would result in a reduction in the number of mature individuals and hinder the species' ability to restore the soil stored seedbank, possibly leading to local extinctions at the impacted subpopulations. But it is not considered likely that a single drought would cause the extinction of the entire population of the species as regional climate and local factors reduce evaporative loss and likely differ across the species' distribution, so 1 location is not considered appropriate for this species. Therefore, the species meets the threshold for listing as Endangered under sub-criterion (a).

Continuing decline

Dwarf violet is restricted to high elevations in open shrubland, snow-gum woodland (Entwisle 1996). Given the species' altitudinal range and its widespread but highly disjunct population, it is likely that the species is a climate relic from the Pleistocene era (Ingwersen 2022 pers comm 13 September). The species is known to grow in open areas on rocky soil and is readily seen along tracks (ARI 2022). Future climate scenarios predict increasing temperatures, increasing drought conditions, and decreasing rainfall across the species' range (OEH 2014a, 2014b; DELWP 2019).

A decrease in rainfall during the species' flowering period may result in lower levels of recruitment, and a particularly dry year following fire could cause widespread seedling mortality. Similarly, decreased rainfall would likely alter the water balance of the species' habitat, potentially rendering it unsuitable.

As dwarf violet is found at high elevations in alpine environments, it may rely on cold stratification to break seed dormancy, similar to other species within the genus (Gehring et al. 2013; Kilgore et al. 2022). Increasing temperatures may therefore affect this process and may result in further declines to seedlings and mature individuals. Furthermore, competitive displacement from lowland species migrating to higher altitudes with a warming climate has the potential to cause extinctions to high altitude species (Pickering et al. 2004; Hughes 2011). Higher temperatures and increased fire frequency have been shown to increase the growth rate and recruitment of shrubs (Camac et al. 2017; Milla & Encinas-Viso 2020), which would likely result in shrubs competitively excluding dwarf violet, leading to reduced dispersal, recruitment, and survival.

Drought is estimated to be the most serious plausible threat facing the species. Drought stress, among other factors related to climate change, induce increased food consumption in herbivores (Hamman et al. 2021), suggesting increased pressure from herbivores under future climate scenarios, especially during drought conditions.

There is little direct evidence of the effects these threats have on dwarf violet and its habitat. However, the available evidence suggests that a decline in area, extent, and quality of habitat due to climate change is occurring and likely will continue. Furthermore, the continuing decline of area, extent, and quality of habitat will likely result in the species becoming locally extinct in some areas, leading to a decline in AOO. The species will be unable to move to higher elevations under future climate scenarios as temperatures and drought conditions increase, and precipitation decreases. Therefore, the species meets the threshold for Endangered under criterion (iii) with an inferred continuing decline in the area, extent and/or quality of habitat.

Fluctuations

There are no known extreme fluctuations in EOO, AOO, number of subpopulations, locations or mature individuals.

Conclusion

The Committee considers that the species' geographic distribution (AOO) is restricted, the number of locations is restricted, and continuing decline is inferred in area, extent, and quality of habitat. Therefore, the species has met the relevant elements of Criterion 2 to make it eligible for listing as Endangered.

Criterion 3 Population size and decline

		Critically Endangered Very low	Endangered Low	Vulnerable Limited
Estimated number of mature individuals		**< 250**	**< 2,500**	**< 10,000**
AND either (C1) or (C2) is true				
C1. An observed, estimated or projected continuing decline of at least (up to a max. of 100 years in future)		**Very high rate 25% in 3 years or 1 generation (whichever is longer)**	**High rate 20% in 5 years or 2 generation (whichever is longer)**	**Substantial rate 10% in 10 years or 3 generations (whichever is longer)**
C2. An observed, estimated, projected or inferred continuing decline AND its geographic distribution is precarious for its survival based on at 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				

Criterion 3 evidence

Insufficient data to determine eligibility

There are no reliable total population estimates available for the number of mature individuals of dwarf violet. There are, however, observations with estimates available for three of the subpopulations. One site within the Nunniong Plateau subpopulation was observed to have hundreds, maybe thousands of newly germinated plants in 2021 (Walsh 2022 pers comm 7 March), while another site a few hundred metres west was found to have 112 individuals during surveys in 2021, all of which were seedling ages (ARI 2022). It is unknown how many of these individuals survived to maturity. Recent observations from Namadgi NP found thousands of individuals near the western peak of Sentry Box, and another 30 close to the summit of Mount

Namadgi (ALA 2022), although it is unknown how many of these were mature individuals. Despite a lack of data on the number of individuals across the entire population, it is unlikely that the total number exceeds 10,000 mature individuals given the available data. This suggests that dwarf violet may be eligible for listing as vulnerable under this criterion. However, there is insufficient information available to determine any decline. Dwarf violet is usually killed by fire, and surveys conducted in 2021 found almost all individuals were of seedling age, with the exception of those found at Big Badja Hill which appeared to be resprouting (ARI 2022; ANBG 2022). It is possible that the number of individuals found during surveys following the 2019-20 fires were greater than pre-fire numbers as competing species were burnt. As these slower growing species recover it is likely that the number of mature individuals of dwarf violet will decrease.

Therefore, the Committee considers that there is insufficient information to determine the eligibility of dwarf violet for listing in any category under this criterion.

Criterion 4 Number of mature individuals

	Critically Endangered **Extremely low**	**Endangered** **Very Low**	**Vulnerable** **Low**
D. Number of mature individuals	< 50	< 250	< 1,000
D2.[1] *Only applies to the Vulnerable 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: area of occupancy < 20 km^2 or number of locations ≤ 5

[1] The IUCN Red List Criterion D allows for species to be listed as Vulnerable under Criterion D2. The corresponding Criterion 4 in the EPBC Regulations does not currently include the provision for listing a species under D2. As such, a species cannot currently be listed under the EPBC Act under Criterion D2 only. However, assessments may include information relevant to D2. This information will not be considered by the Committee in making its recommendation of the species' eligibility for listing under the EPBC Act, but may assist other jurisdictions to adopt the assessment outcome under the *common assessment method*.

Criterion 4 evidence

Not eligible

There are no current total population estimates for dwarf violet. However, considering one site was observed to have hundreds, maybe thousands of newly germinated plants in 2021 (Walsh 2022 pers comm 7 March), it is unlikely that the total number of mature individuals is currently less than 1000.

The AOO for dwarf violet is estimated at 52 km^2 and the species occurs at 4 locations. The species is under threat from future climate scenarios such as increased temperature, increased drought, and decreased rainfall which will likely reduce the number of mature individuals and result in a decline in suitable habitat. However, this is unlikely to occur over a very short time.

Therefore, the species not eligible for listing in any category under this criterion.

Criterion 5 Quantitative analysis

	Critically Endangered Immediate future	Endangered Near future	Vulnerable Medium-term future
Indicating the probability of extinction in the wild to be:	≥ 50% in 10 years or 3 generations, whichever is longer (100 years max.)	≥ 20% in 20 years or 5 generations, whichever is longer (100 years max.)	≥ 10% in 100 years

Criterion 5 evidence

Insufficient data to determine eligibility

Population viability analysis has not been undertaken. Therefore, there is insufficient information to determine the eligibility of the species for listing in any category under this criterion.

Adequacy of survey

The survey effort has been considered adequate and there is sufficient scientific evidence to support the assessment.

Public consultation

Notice of the proposed amendment and a consultation document was made available for public comment for 36 business days between 4 October and 22 November 2022. Any comments received that were relevant to the survival of the species were considered by the Committee as part of the assessment process and provided to the Minister for the Environment with the Committee's advice.

Listing and Recovery Plan Recommendations

The Threatened Species Scientific Committee recommends:

i) that the list referred to in section 178 of the EPBC Act be amended by **including** *Viola improcera* in the list in the Endangered category.

ii) that there not be a Recovery Plan for this species in accordance with the provisions of the EPBC Act and the Committee's conservation planning principles as follows:

- An approved conservation advice is an effective, efficient and responsive document to guide the implementation of priority management actions, mitigate key threats and support the recovery for this EPBC Act listed Endangered species.
- An approved conservation advice would support the species recovery by identifying priority actions, stakeholders for engagement, and the survey and research priorities to facilitate a better understanding of key threats as well as biological and ecological knowledge gaps.
- The threats facing the entity, and the recovery actions needed can most effectively be guided via an approved conservation advice.

- The species is affected by a range of threats, notably increases in temperature and drought conditions, and decreases in precipitation due to climate change. However, these major threats are well-known and can be managed at local and state scales without the need for a recovery plan.
- The species is known from 7 subpopulations Vic, ACT, and NSW. The key stakeholders are the Department of Environment, Land, Water and Planning (Vic), Parks Victoria, Environment, Planning and Sustainable Development Directorate (ACT), Parks and Conservation (ACT), the Department of Planning and Environment (NSW), and NSW National Parks and Wildlife Services.

iii) Having regard to the above factors, a Recovery Plan is not required as it would not provide a significant conservation planning benefit above existing mechanisms.