

DRAFT for public comment

National Recovery Plan for Twenty-one Threatened Orchids in South-eastern Australia

Mike Duncan and Fiona Coates



Government of South Australia
Department for Environment
and Heritage



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Water, Heritage and the Arts

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Prepared by Mike Duncan and Fiona Coates, Department of Sustainability and Environment,
Heidelberg, Victoria

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bottom, L to R: *Caladenia cruciformis*, *Prasophyllum fosteri*, *Caladenia pilotensis*
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Summary

This Recovery Plan covers 21 species of terrestrial orchids belonging to the genera *Caladenia* R. Br. (6 species), *Diuris* Sm. (1 species), *Prasophyllum* R. Br. (8 species), *Pterostylis* R.Br. (2 species) and *Thelymitra* J.R. Forst. & G. Forst. (4 species) that are endemic to mainland south-eastern Australia (Table 1), occurring in Victoria (21 species), South Australia (2 species) and New South Wales (3 species). The 21 species are all small deciduous herbs that emerge annually from a spherical subterranean tuber. Most species have a summer dormancy period, with growth occurring during late autumn, winter and spring, and flowering occurring from late winter to early summer. Two species from mountain habitats flower in summer and have a winter dormancy period.

Table 1. Threatened orchids included in this Recovery Plan and their conservation status

Scientific Name	Common Name	Conservation Status			
		Nat [^]	Vic [#]	SA [@]	NSW [*]
<i>Caladenia concolor</i>	Crimson Spider-orchid	VU	L	EN	
<i>Caladenia cruciformis</i>	Red Cross Spider-orchid	NL	L		
<i>Caladenia fulva</i>	Tawny Spider-orchid	EN	L		
<i>Caladenia maritima</i>	Angahook Fingers	NL	NL		
<i>Caladenia pilotensis</i>	Mt Pilot Spider-orchid	NL	L		
<i>Caladenia</i> sp. aff. <i>venusta</i> (undescribed: Jeanes & Backhouse 2006)	Kilsyth South Spider-orchid	NL	L		
<i>Diuris ochroma</i>	Pale Golden Moths	VU	L	EN	
<i>Prasophyllum fosteri</i>	Fosters Leek-orchid	NL	L		
<i>Prasophyllum hygrophilum</i>	Swamp Leek-orchid	NL	L		
<i>Prasophyllum morgani</i>	Cobungra Leek-orchid	VU	L		
<i>Prasophyllum niphopedium</i>	Marsh Leek-orchid	NL	L		
<i>Prasophyllum suaveolens</i>	Fragrant Leek-orchid	EN	L		
<i>Prasophyllum subbisectum</i>	Pomonal Leek-orchid	EN	L		
<i>Prasophyllum suttonii</i>	Buffalo Leek-orchid	NL	L		
<i>Prasophyllum uvidulum</i>	Summer Leek-orchid	NL	NL		
<i>Pterostylis despectans</i>	Lowly Greenhood	EN L		EN NL	
<i>Pterostylis</i> sp. aff. <i>boormanii</i> (undescribed: Jeanes & Backhouse 2006)	Granite Rustyhood	NL	L		
<i>Thelymitra epipactoides</i>	Metallic Sun-orchid	EN	L	EN	
<i>Thelymitra gregaria</i>	Basalt Sun-orchid	NL	L		
<i>Thelymitra hiemalis</i>	Winter Sun-orchid	NL	L		
<i>Thelymitra mackibbinii</i>	Brilliant Sun-orchid	VU	L		

Abbreviations: Nat = National; Vic = Victoria; SA = South Australia; NSW = New South Wales; EN = Endangered, VU = Vulnerable; NL = not listed; L = Listed as Threatened

[^] status under the *Environment Protection and Biodiversity Conservation Act 1999* EPBC Act (1999) FFG Act

[#] status under the *Flora and Fauna Guarantee Act 1988*

[@] status under the *National Parks and Wildlife Act 1972*

^{*} status under the *Threatened Species Conservation Act 1995*

This Recovery Plan is a revised version of the first plan for these species (Coates *et. al.* 2002), and reviews and updates the framework and guidelines and determines the objectives and actions required for recovery of these threatened orchids over the next five-year period. The Recovery Plan prepared by Coates *et. al.* (2002) covered 25 species of threatened orchids. Four species have subsequently been deleted from this revision of the plan: two species – *Corybas* sp. aff. *diemenicus* 1 and *Prasophyllum* sp. aff. *frenchii* 2 have been included in other recovery plans (Duncan in press; Duncan *et. al.* in press); *Prasophyllum fitzgeraldii* is a widely distributed but poorly known species that is not currently listed under State or Commonwealth biodiversity legislation as threatened; and taxonomic research identified *Thelymitra* sp. aff. *nuda* Laverton as *Thelymitra arenaria*, which is widespread throughout much of south-eastern Australia and is not threatened at present.

***Caladenia concolor* Fitzg. Crimson Spider-orchid**

Description

The Crimson Spider Orchid *Caladenia concolor* has single basal leaf to about 15 cm long. The erect hairy flower stem grows to 30 cm tall and has a single (occasionally two) glossy dark red flower about 60 mm wide. The sepals and petals are up to 40 mm long, the dorsal sepal erect, the petals and lateral sepals spreading and drooping, the tips thickened and channelled and covered in dark blackish red glands. The labellum is narrowly triangular, the tip rolled under, the lamina with 4–6 rows of short clubbed blackish calli, the lateral lobe margins fringed with moderately long thickened teeth decreasing in size and extending almost to the labellum tip. Flowering occurs from late August to October (description from Backhouse & Jeanes 1995).

Taxonomic definition of this species is currently under review, with evidence that there is strong population structuring in *C. concolor* (Broadhurst *et. al.* 2008), which will have an impact on proposed recovery actions such as translocation.



Caladenia concolor Tyacc, Vic © Gary Backhouse

Distribution

Caladenia concolor is widely but sporadically distributed from Albury in southern New South Wales to Melbourne and as far west as Inglewood (Vic) (Figure 1). It occurs in the South Eastern Highlands, Victorian Midlands and NSW South Western Slopes IBRA bioregions (*sensu* DEH 2000). Maps showing the distribution of *C. concolor* are available from the Department of Sustainability and Environment (DSE) for Victoria and the Department of Environment, Climate Change and Water (DECCW) for New South Wales.

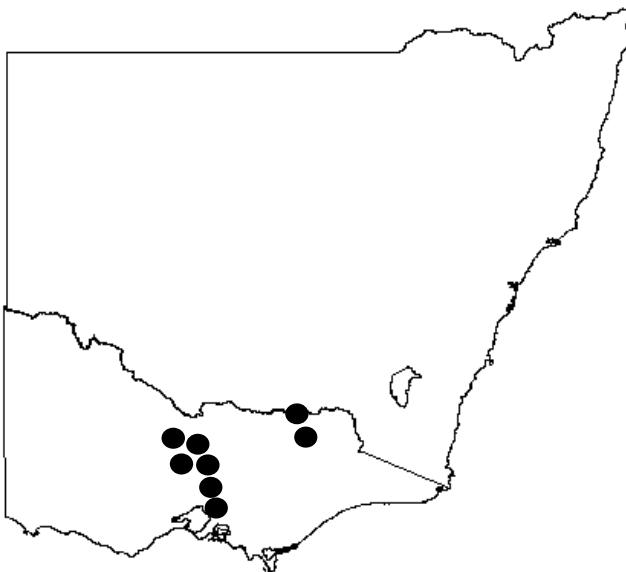


Figure 1. Distribution of *Caladenia concolor*

Table 2. Population and threat information for *Caladenia concolor*

Location	Size	Extent	Manager	Threats (High Medium Low)
<i>New South Wales</i>				
Albury	18 plants	~60 ha	Albury City, Dept. Lands, Nature Cons. Trust	<ul style="list-style-type: none"> • weed invasion (H) • disturbance/ destruction (M) • grazing/predation (H)
<i>Victoria</i>				
Castlemaine Diggings National Heritage Park (CDNHP) 1	~250 plants	~15 ha	Parks Victoria	<ul style="list-style-type: none"> • weed invasion (H) • disturbance/ destruction (M) • grazing/predation (H)
Carboor State Forest	~170 plants	~200 ha	DSE	<ul style="list-style-type: none"> • weed invasion (H) • disturbance/ destruction (M) • grazing/predation (H)
CDNHP 2	~45 plants	<5 ha	Parks Victoria	<ul style="list-style-type: none"> • weed invasion (H) • disturbance/ destruction (M) • grazing/predation (H)
Beechworth (road reserve)	12 plants	<1 ha	Wangaratta Shire	<ul style="list-style-type: none"> • weed invasion (H) • disturbance/ destruction (M) • grazing/predation (H)
Chiltern-Mt Pilot National Park	10 plants	<1 ha	Parks Victoria	<ul style="list-style-type: none"> • weed invasion (H) • disturbance/ destruction (M) • grazing/predation (H)
Mt. Jack State Forest	10 plants	<1 ha	DSE	<ul style="list-style-type: none"> • weed invasion (H) • disturbance/ destruction (M) • grazing/predation (H)
Guilford Castlemaine Diggings NHP and Upper Lodden SF	6 plants	~25 ha	Parks Victoria	<ul style="list-style-type: none"> • weed invasion (H) • disturbance/ destruction (M) • grazing/predation (H)
Murchison Gap (roadside)	6 plants	<2 ha	Murrindindi Shire	<ul style="list-style-type: none"> • weed invasion (H) • disturbance/ destruction (M) • grazing/predation (H)
CDNHP 3	5 plants	<1 ha	Parks Victoria	<ul style="list-style-type: none"> • weed invasion (H) • disturbance/ destruction (M) • grazing/predation (H)
Christmas Hills (private property)	5 plants	<1 ha	private	<ul style="list-style-type: none"> • weed invasion (H) • disturbance/ destruction (M) • grazing/predation (H)
Mandurang South (private property)	4 plants	<2 ha	private	<ul style="list-style-type: none"> • weed invasion (H) • disturbance/ destruction (M) • grazing/predation (H)
Heathcote-Graytown National Park	2 plants	<2 ha	Parks Victoria	<ul style="list-style-type: none"> • weed invasion (H) • disturbance/ destruction (M) • grazing/predation (H)
Kooyoora State Park	2 plants	<1 ha	Parks Victoria	<ul style="list-style-type: none"> • weed invasion (H) • disturbance/ destruction (M) • grazing/predation (H)
Harcourt (private property)	2 plants	<1 ha	private	<ul style="list-style-type: none"> • weed invasion (H) • disturbance/ destruction (M) • grazing/predation (H)
Barfold (private property)	1 plants	<1 ha	private	<ul style="list-style-type: none"> • weed invasion (H) • disturbance/ destruction (M) • grazing/predation (H)
Black Hill Bushland Reserve	1 plant	<1 ha	Parks Victoria	<ul style="list-style-type: none"> • weed invasion (H) • disturbance/ destruction (M) • grazing/predation (H)
Mt Disappointment State Forest	?	<1 ha	DSE	plants not seen since late 1990s
Taradale Bushland Reserve	?	<1 ha	Parks Vic	plants not seen since late 1990s
Castlemaine State Forest	?	<1 ha	DSE	plants not seen since late 1990s
Tyaak (road reserve)	?	<2 ha	Murrindindi Shire	plants not seen since late 1990s

Population Information

Caladenia concolor is currently known from about 22 populations containing about 600 plants (Table 2), with 21 populations occurring in Victoria and a single population in New South Wales.

Habitat

In Victoria, *C. concolor* occurs in box-ironbark forests (usually *Eucalyptus goniacalyx*, *Eucalyptus macrorhyncha*, *Eucalyptus polyanthemos* and/or *Eucalyptus sideroxylon*) on well drained gravelly or stony sand and clay loam soils, often on slopes of low hills. The understorey typically consists of scattered heathy shrubs and grasses such as *Brachlyoma ciliatum*, *Platylobium formosum*, *Dillwynia phyllicoides*, *Hibbertia riparia* and *Joycea pallida*. In New South Wales, *C. concolor* occurs on granite slopes and ridges in open heathy box woodland comprising *Eucalyptus blakeleyi*, *E. polyanthemos*, *E. macrorhyncha* and *Eucalyptus albens* on well drained gravelly or stony sand and clay loam soils. Recovery actions include survey and mapping of habitat that will lead to the identification of habitat critical to the survival of the species.

Decline and Threats

Although *C. concolor* remains widely distributed, there has been a decline in abundance, with the apparent loss of many populations and declines in others. There are historical records of this species from Bendigo, Elphinstone, Castlemaine, Harcourt, Loddon River, Mt. Mclvor, Rushworth and Wattle Glen, but plants have not been seen at these locations for many decades. Plants have not been seen at an additional four locations for about 10 years (Table 2) and it is not known if populations still persist there. The population at Christmas Hills once had about 30 plants (*C. Beardsall pers. comm.*) but only five have been seen in recent years.

Habitat destruction and/or disturbance is the most likely cause of the decline in abundance of *C. concolor*. Much of its foothill forest habitat has been cleared, and the remainder has suffered a long history of disturbance from grazing, mining and/or timber harvesting. In some areas, remaining patches of habitat are often small and fragmented. Although some populations are now protected in parks and reserves (Table 2), most remaining populations are small and at risk of local extinction from stochastic events. It is likely that the conditions for the maintenance of the pollinator and/or fungal activity have been adversely affected at some sites. There is evidence of illegal collection in the past (Coates *et al.* 2002), although this now seems to be less of a problem. Very low flowering rates have been observed in most populations in recent years due to the continuing drought in south-eastern Australia. Remaining populations of *C. concolor* face a variety of current and potential threats including:

Disturbance/destruction

Site disturbance is an existing or potential problem at some sites. Accidental trampling or destruction by people (orchid enthusiasts or walkers) and/or track/road maintenance activities is a threat at the Albury, Castlemaine Diggings NHP (1 & 2), Heathcote-Greytown NP, Roadside (Murchison Gap) and Carboor sites.

Grazing/predation

Grazing by kangaroos, wallabies and/or rabbits is a serious problem at almost all sites. Grazing by invertebrates is a threat at the Albury site

Weed invasion

Weed invasion is an existing or potential problem at some sites, including European Gorse *Ulex europaeus* at the Castlemaine Diggings NHP 2 and Beechworth sites, Large Quaking Grass *Briza maxima* and other annual grasses at the Albury, Castlemaine Diggings NHP 2, Murchison Gap and Tyaak sites, and Monterey Pine *Pinus radiata* at the Castlemaine Diggings NHP 2, Harcourt and Carboor sites.

Altered fire regimes

The response of *C. concolor* to fire is not known, and plants at some sites have not been seen since being burnt in the January 2003 wildfire in Victoria. Therefore fire management should be undertaken with caution, especially in New South Wales where populations are vulnerable to frequent unplanned fires.

Current Conservation Measures

A number of measures for the conservation of *C. concolor* have already been undertaken, including:

- Regular searches of the immediate vicinity/neighbouring bushland around each population since 1992. These successful searches have resulted in the discovery of many of the current populations.
- Caging of 20 plants at various sites to reduce the threat from grazing.
- Fencing of the Castlemaine Diggings NHP 2 and Tyaak sites.
- Regular demographic monitoring at the Albury, Castlemaine Diggings NHP 2 and Carboor sites, with periodic monitoring occurring at most other sites.
- Slide baiting trials for presence of mycorrhizal fungus conducted at the Albury, Castlemaine Diggings NHP 2, Guilford and Mandurang South sites.
- Hand pollination and seed collection from plants at the Albury, Castlemaine Diggings NHP 1&2 and Mandurang South sites. This seed has been variously used to establish an *ex situ* population, for baiting trials, and/or sprinkling around the base of existing plants.
- Isolation and growth of the mycorrhizal fungus associated with *C. concolor* in culture.
- Weed control at the Castlemaine Diggings NHP 2, Carboor and Harcourt sites.
- Establishment of a Special Protection Zone around the Guilford site.
- Preparation of a recovery plan for NSW population (NPWS 2001).
- Ongoing consultation and liaison with landholders, land managers, and stakeholders at all sites.

***Caladenia cruciformis* D. L. Jones Red-cross Spider-orchid**

Description

The Red-cross Spider-orchid *Caladenia cruciformis* has a narrowly lanceolate leaf to 10 cm in length. The erect hairy flower stem grows to 25 cm tall and has a single (occasionally two) uniformly red flower to 50 mm across. The slender sepals and petals are up to 40 mm long, the sepals tipped with long reddish to blackish clubs; the dorsal sepal is erect, the petals and lateral sepals stiffly spreading. The labellum is narrowly triangular, the tip only slightly rolled under, the lamina with four rows of very short, thick, glossy reddish to blackish calli, the lateral lobe margins fringed with short thickened reddish teeth decreasing in size and extending almost to the labellum tip. Flowering occurs in September and October (description from Jones 1999).



Caladenia cruciformis Stuart Mill, Vic © Gary Backhouse

Distribution

Caladenia cruciformis is endemic to Victoria, where it occurs in a small area around Stuart Mill, in the Victorian Midlands IBRA bioregion (Figure 2). Maps showing the distribution of *C. cruciformis* are available from DSE.

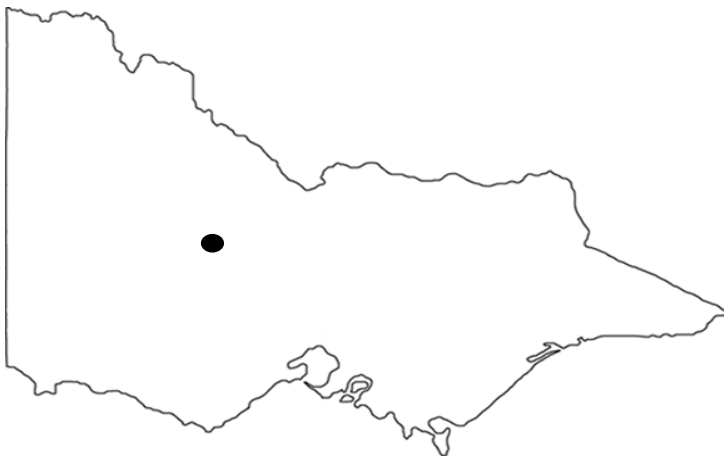


Figure 2. Distribution of *Caladenia cruciformis*

Habitat

Caladenia cruciformis occurs in *Eucalyptus leucoxyton*, *Eucalyptus microcarpa*, *Eucalyptus gonicalyx*, *Eucalyptus macrorhyncha* and/or *Eucalyptus tricarpa* low open forest or woodland with a heathy understorey typically dominated by *Calytrix tetragona*, *Brachyloma ciliata*, *Astroloma conostephioides*, *Astroloma humifusum*, *Hibbertia* sp. and *Leucopogon virgatus*, on well drained grey-brown sandy loam soils. Recovery actions include survey and mapping of habitat that will lead to the identification of habitat critical to the survival of the species.

Population Information

Caladenia cruciformis is known from seven populations containing about 1,450 plants (Table 3).

Table 3. Population and threat information for *Caladenia cruciformis*

Location	Size	Extent	Manager	Threats (High Medium Low)
Stuart Mill (private property 1)	~650 plants	~10 ha	private	<ul style="list-style-type: none"> • weed invasion (L) • disturbance/ destruction (M) • grazing/predation (H)
Little Dalyenong Nature Conservation Reserve	~250 plants	<5 ha	Parks Victoria	<ul style="list-style-type: none"> • weed invasion (L) • disturbance/ destruction (M) • grazing/predation (H)
Dalyenong Bushland Reserve & private property	~220 plants	<2 ha	Parks Victoria & private	<ul style="list-style-type: none"> • weed invasion (L) • disturbance/ destruction (M) • grazing/predation (H)
Stuart Mill (private property 2)	~180 plants	<5 ha	private	<ul style="list-style-type: none"> • weed invasion (L) • disturbance/ destruction (M) • grazing/predation (H)
Stuart Mill (private property 3)	~100 plants	<5 ha	private	<ul style="list-style-type: none"> • weed invasion (L) • disturbance/ destruction (M) • grazing/predation (H)
Dalyenong Nature Conservation Reserve	~50 plants	<2 ha	Parks Victoria	<ul style="list-style-type: none"> • weed invasion (L) • disturbance/ destruction (M) • grazing/predation (H)

Decline and Threats

The historical distribution and abundance of *C. cruciformis* is not known, and it has only ever been known from a very limited area near Stuart Mill. Although some populations are protected in reserves (Table 3), most remaining populations are small and at risk of local extinction from stochastic events. It is likely that the conditions for the maintenance of the pollinator and/or fungal activity have been adversely affected at some sites. Very low flowering rates have been observed in most populations in recent years due to the continuing drought in south-eastern Australia. Remaining populations of *C. cruciformis* face a variety of threats including:

Grazing

Grazing by kangaroos/wallabies and/or rabbits is a serious threat at most sites, and feral goats are a threat at the Dalyenong BR site (and possibly at other sites). There is low intensity stock (sheep) grazing outside the *C. cruciformis* flowering season at the Stuart Mill private property 2 & 3 sites.

Weed invasion

Weed invasion is currently only a minor problem at several sites.

Destruction/disturbance

There is a risk of development occurring at one private property site, or if these sites change ownership. Trampling by visiting orchid enthusiasts, accidentally damaging plants or unknowingly trampling any seedlings in the immediate vicinity of the plants is a serious threat at the sites on public land. It is important that exact location details remain confidential, and visitation is kept to a minimum. Plants at the Stuart Mill private property 2 site occur around the edge of a disused quarry. Reactivation of this quarry could be disadvantageous to the *C. cruciformis* population.

Current Conservation Measures

A number of measures for the conservation of *C. cruciformis* have been undertaken, including:

- Fencing at the Stuart Mill 1 site and caging of some plants at each site to reduce the threat from grazing and disturbance.
- Regular demographic monitoring at the Little Dalyenong NCR and Stuart Mill 1 sites and current-status monitoring is occurring at most other sites.
- Slide baiting trials to test for the presence of the mycorrhizal fungus at several sites.
- Hand pollination and seed collection at the Dalyenong NCR, Little Dalyenong NCR, Dalyenong BR and Stuart Mill 1 sites.
- Consultation and liaison with landholders, land managers, and stakeholders at all sites.

***Caladenia fulva* G.W. Carr Tawny Spider-orchid**

Description

The Tawny Spider-orchid *Caladenia fulva* has single basal leaf to about 15 cm long. The erect hairy flower stem grows to 25 cm tall and has a single (occasionally two) large (about 80 mm wide) creamy white to pale yellowish flower with variable red streaking, the labellum yellowish with reddish calli and marginal teeth or entirely red. The sepals and petals are up to 80 mm long, the dorsal sepal erect, the petals and lateral sepals spreading and drooping, the tips covered in dark brownish to reddish glands. The labellum is narrowly triangular, the tip rolled under, the lamina with 4-6 rows of short, curved, bluntly pointed reddish calli, the lateral lobe margins fringed with short thickened teeth decreasing in size and extending almost to the labellum tip. Flowering occurs from late August to October (description from Backhouse & Jeanes 1995).



Caladenia fulva Deep Lead, Vic © Gary Backhouse

Distribution

Caladenia fulva is endemic to Victoria, where it occurs in a small area near Stawell, in the Victorian Midlands IBRA bioregion (Figure 3). Maps showing the distribution of *C. fulva* are available from DSE.

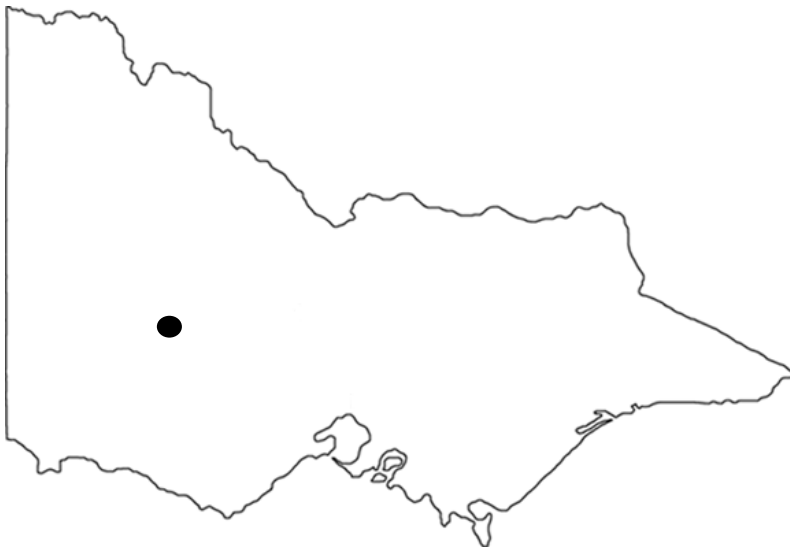


Figure 3. Distribution of *Caladenia fulva*

Habitat

Caladenia fulva occurs in generally flat or gently sloping terrain in woodlands and open forest of Yellow Gum *Eucalyptus leucoxylon* and occasionally Red Ironbark *Eucalyptus tricarpa* with a sparse heathy understorey dominated by Golden Wattle *Acacia pycnantha*, Spreading Wattle *Acacia*

genistifolia, Flame Heath *Astroloma conostephioides*, Cranberry Heath *Astroloma humifusum*, Daphne Heath *Brachyloma daphnoides*, Common Fringe-myrtle *Calytrix tetragona* and Upright Guinea-flower *Hibbertia stricta*, on well drained gravelly clay loams. Recovery actions include survey and mapping of habitat that will lead to the identification of habitat critical to the survival of the species.

Population Information

Caladenia fulva is known from just two populations containing about 650 plants; one in the Deep Lead Nature Conservation Reserve and the adjoining Three Jacks Flora and Fauna Reserve containing about 550 plants, and the second in Germania Mine Nature Conservation Reserve, containing about 100 plants. Both reserves are managed by Parks Victoria.

Decline and Threats

Little is known of the historical distribution and abundance of *C. fulva*, as it has only ever been known from the two extant populations. However, much of the woodland and forest in the region has been cleared for agriculture, with remaining patches having a long history of disturbance from grazing, gold mining and exploration, and timber production. It is likely that populations of *C. fulva* have been lost from the region. Very low flowering rates continue at many sites due to the continuing drought in south-eastern Australia. Remaining populations of *C. fulva* face a variety of current and potential threats, including:

Disturbance/destruction

Although the two populations are protected in reserves, disturbance to or destruction of plants and habitat remains the greatest threat. The two reserves are well known and attract large numbers of wildflower and orchid enthusiasts during spring. As a result, accidental trampling of plants and seedlings is a serious threat at all sites. There is the potential for accidental destruction by illegal rubbish dumping, gold prospecting, firewood collection and off-road vehicles including trail bikes.

Grazing

Grazing by kangaroos, wallabies and/or rabbits is a potential problem at both sites.

Weed invasion

Weed invasion is currently a low risk. Weeds including Bridal Creeper *Asparagus asparagoides*, hair-grass *Aira* spp., fescue *Vulpia* spp. and Large Quaking Grass *Briza maxima* occur in the vicinity of some groups of plants, but none are currently threatening the populations.

Current Conservation Measures

A number of measures for the conservation of *C. fulva* have already been undertaken, including:

- Demographic monitoring at both sites.
- Mycorrhizal fungus isolation and cultivation trials (Raleigh 2005).
- Seed viability and germination trials (Raleigh 2005).
- Slide baiting trials for the mycorrhizal fungus at the Deep Lead NCR site.
- Hand pollination and seed collection at the Deep Lead NCR site. This seed has been used to establish an *ex situ* population, for baiting trials, and long term storage.
- Increased patrols of Deep Lead NCR during the flowering season to reduce disturbance.

***Caladenia maritima* D. L. Jones Angahook Fingers**

Description

The Angahook Fingers *Caladenia maritima* has a single basal slender grass-like leaf to 10 cm in length. The slender, erect sparsely hairy stem bears grows to 20 cm tall and bears a single (rarely two) small white flower to 20 mm across. The sepals and petals are up to 15 mm long and relatively broad with blunt tips; the dorsal sepal is erect to incurved, the petals and lateral sepals spreading forward and slightly deflexed below horizontal. The column is green with reddish-purple markings; the labellum white with reddish markings and a yellowish tip and prominently trilobed, the lateral lobes erect, the mid-lobe tip slightly rolled under, the lamina with two rows of narrow curved calli. Flowering occurs in September and October (description from Jones 1999).



Caladenia maritima Anglesea, Vic © Gary Backhouse

Distribution

Caladenia maritima is endemic to Victoria, where it occurs near Anglesea on the south coast, in the South East Coastal Plain IBRA bioregion (Figure 4). Maps showing the distribution of *C. maritima* are available from DSE.

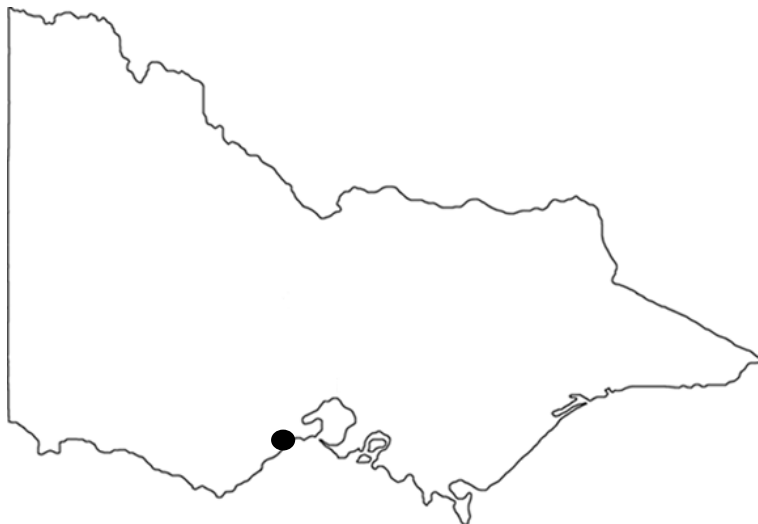


Figure 4. Distribution of *Caladenia maritima*

Habitat

Caladenia maritima occurs in Brown Stringybark *Eucalyptus obliqua* coastal woodland with a heathy understorey dominated by *Xanthorrhoea australis*, *Hibbertia sericea*, *Banksia marginata* and *Leptospermum myrsinoides* on well drained dark grey sandy loam. Recovery actions include survey and mapping of habitat that will lead to the identification of habitat critical to the survival of the species.

Population Information

Caladenia maritima is known only from a single population containing about 250 plants, growing in the Angahook-Lorne State Park managed by Parks Victoria.

Decline and Threats

Nothing is known of the previous distribution or abundance of *C. maritima*, as it has only ever been known from just the single population at Anglesea. Expanding residential development in the town over recent years has occurred close to the site where *C. maritima* grows, and it is possible some populations have been lost to development. The site is protected in the Angahook-Lorne State Park and there is considerable potentially suitable habitat nearby, so the orchid may occur at other locations, although repeated searches have so far failed to find any new populations. Although the species is protected in a park, there is a high risk of extinction due to highly restricted distribution of this species and low numbers of plants. The major current threat to the species is disturbance to or destruction of plants and habitat. The sole population occurs close to a walking/management track and there is the potential for disturbance caused by track maintenance works and for accidental trampling by walkers. The Anglesea Heathlands is a popular destination for wildflower and orchid enthusiasts during spring, so confidentiality of exact location of the *C. maritima* site is vital. Weeds such as *Watsonia meriana* var. *bulbillifera*, Boneseed *Chrysanthemoides monillifera* and Sallow Wattle *Acacia longifolia* var. *longifolia* occur within the vicinity of the population and could threaten the species if not controlled.

Current Conservation Measures

A number of measures for the conservation of *C. maritima* have been undertaken, including population monitoring and collection and long-term storage of seed.

***Caladenia pilotensis* D.L. Jones Mt Pilot Spider-orchid**

Description

The Mt Pilot Spider-orchid *Caladenia pilotensis* has a single basal leaf to about 15 cm long. The erect hairy flower stem grows to 35 cm tall and has a single (occasionally two) large (about 80 mm wide) creamy white to pale greenish-yellowish flower with variable pale reddish shading on the tepals. The sepals and petals are up to 80 mm long, the dorsal sepal erect, the petals and lateral sepals spreading and drooping, the long filamentous tips covered in reddish-brown glands. The labellum is pale yellowish with variable reddish tonings, narrowly triangular, the tip rolled under, the lamina with 4–6 rows of short, curved, bluntly pointed reddish calli, the lateral lobe margins fringed with short long thickened reddish teeth decreasing in size and extending almost to the labellum tip. Flowering occurs in September and October (description from Jones 1999).



Caladenia pilotensis Beechworth, Vic © Gary Backhouse

Distribution

Caladenia pilotensis is endemic to Victoria, where it occurs near Beechworth in the north-east of the State, in the South Eastern Highlands IBRA bioregion (Figure 5). Maps showing the distribution of *C. pilotensis* are available from DSE.



Figure 5. Distribution of *Caladenia pilotensis*

Habitat

Caladenia pilotensis occurs in *Eucalyptus polyanthemus*, *Eucalyptus goniocalyx* and *Callitris endlicheri* grassy open forest on well drained dark grey-brown granitic loam soils. Recovery actions

include survey and mapping of habitat that will lead to the identification of habitat critical to the survival of the species.

Population Information

Caladenia pilotensis is only known from about four populations containing about 90 plants (Table 4).

Table 4. Population and threat information for *Caladenia pilotensis*

Population	Size	Extent	Manager	Threats (High Medium Low)
Chiltern-Mt Pilot National Park (1)	~85 plants	~20 ha	Parks Victoria	<ul style="list-style-type: none"> • grazing/predation (H) • disturbance/destruction (L)
Chiltern-Mt Pilot National Park (2)	6 plants	<1 ha	Parks Victoria	<ul style="list-style-type: none"> • grazing/predation (H) • disturbance/destruction (L)
Beechworth (roadside)	1 plant	<1 ha	Wangaratta Shire	<ul style="list-style-type: none"> • grazing/predation (H) • disturbance/destruction (H) • weed invasion (L)
Barambogje State Forest	1 plant	<1 ha	DSE	<ul style="list-style-type: none"> • grazing/predation (H) • disturbance/destruction (L) • weed invasion (L)

Decline and Threats

The historical distribution and abundance of *C. pilotensis* is not known, but the species appears to be confined to a relatively limited area on the granite hills near Beechworth. Some of this habitat has been cleared for agriculture and residential development, although other areas of potentially suitable habitat exist, so the species may occur elsewhere in the region. However, there has been some disturbance of these areas from mining, timber production and recreational use, and repeated searches in recent years have located few new plants, so the species does appear to be quite rare.

Plants flowered well on Mt Pilot after a wildfire in early 2003, and several new plants were located. However, flowering rates have declined as the regenerating eucalypt forest now covers much of the previously bare ground. Ongoing drought in south-eastern Australia has also contributed to a reduction in flowering rates. It is likely that the conditions for the maintenance of the pollinator and/or fungal activity have been adversely affected at some sites. There is a high risk of extinction due to the tiny population sizes at three of the four sites. All populations of *C. pilotensis* face a variety of current and potential threats including:

Grazing

Grazing by kangaroos, wallabies and/or rabbits is a serious threat at all sites, particularly in the wake of the 2003 wildfire which greatly reduced the amount of available feed.

Weed invasion

Weed invasion is generally a low risk, although exotic annual grasses and flatweeds are a potential threat at some sites.

Destruction/disturbance

The Beechworth population occurs close to a road, and accidental disturbance caused by road maintenance activities is a major threat.

Current Conservation Measures

A number of measures for the conservation of *C. pilotensis* have already been undertaken, including population monitoring, weed control and hand pollination and seed collection.

***Caladenia* sp. aff. *venusta* 'Kilsyth South' Kilsyth South Spider-orchid**

Description

The Kilsyth South Spider-orchid *Caladenia* sp. aff. *venusta* 'Kilsyth South' has single basal leaf to about 15 cm long. The erect hairy flower stem grows to 35 cm tall and has a single (occasionally two) large (about 80 mm wide) creamy white flower with reddish labellum calli and teeth. The sepals and petals are up to 70 mm long, the dorsal sepal erect, the petals and lateral sepals spreading and drooping, the long filamentous tips covered in brownish glands. The labellum is narrowly triangular, the tip rolled under, the lamina with 4-6 rows of short, curved, bluntly pointed calli, the lateral lobe margins fringed with short thickened teeth decreasing in size and extending almost to the labellum tip. Flowering occurs in September and October (description from Backhouse & Jeanes 2006).

Distribution

Caladenia sp. aff. *venusta* is endemic to Victoria, where it is known only from the Kilsyth South area on the north-eastern outskirts of Melbourne, in the South Eastern Highlands IBRA bioregion (Figure 6). The exact location will remain confidential to protect the orchid. Maps showing the distribution of *C. sp. aff. venusta* are available from DSE.



Figure 6. Distribution of *Caladenia* sp. aff. *venusta* Kilsyth South

Habitat

Caladenia sp. aff. *venusta* occurs in *Eucalyptus radiata* and *Eucalyptus cephalocarpa* open forest with scattered *Exocarpos cupressiformis* and a shrubby understorey of *Banksia marginata* and *Leptospermum continentale*. The ground layer mainly consists of *Chionochloa pallida*, *Thelionema caespitosum* and *Sphaerolobium minus*. Recovery actions include survey and mapping of habitat that will lead to the identification of habitat critical to the survival of the species.

Population Information

This species is known from just a single population containing 23 plants.

Decline and Threats

Nothing is known of the original distribution and abundance of *Caladenia* sp. aff. *venusta*. It probably once occurred elsewhere in the district before widespread clearing of habitat for agriculture and residential development, and little habitat currently remains. The only known population was on private land that was the subject of a prohibition on development for many years to protect the orchid. Access to the site was denied by the landowners, so *in situ* recovery actions could not be undertaken,

and current condition of the orchid population is not known. The site was purchased in late 2009 by the City of Maroondah to protect the orchid and add to the reserve system. Site condition is still quite good, although several weed species including Sweet Pittosporum *Pittosporum undulatum* and Spanish Heath *Erica quadrangularis* are present but currently confined to a small area of the site (Carr 1998). There is some concern that the condition of the population may have deteriorated over the last decade, with very low flowering rates noted in many orchid populations due to the continuing drought in south-eastern Australia. There is a very high risk of extinction due to the small population size.

Diuris ochroma D.L. Jones Pale Golden Moths

Description

The Pale Golden Moths *Diuris ochroma* has a basal tuft of 3–5 slender, grass-like leaves to 18 cm long. The slender flower stem grows to 25 cm tall and has 1–3 pale yellow-cream flowers with variable maroon striations on the dorsal sepal and labellum. The dorsal sepal is up to 12 mm long and obliquely erect, the lateral sepals up to 15 mm long, brownish to greenish, slender and inrolled, while the petals are up to 18 mm long, with a narrow base and broadly ovate lamina, and are spreading to incurved. The labellum is up to 15 mm long, broadly wedge-shape and flat. Flowering occurs from November to January (description from Backhouse & Jeanes 1995).



Diuris ochroma Abbeyard, Vic © Gary Backhouse

Distribution

Diuris ochroma is endemic to Victoria and New South Wales, where it is known from three locations in the South Eastern Highlands IBRA bioregion (Figure 9). Maps showing the distribution of *D. ochroma* are available from DSE (for Victoria) and DECCW (for NSW).

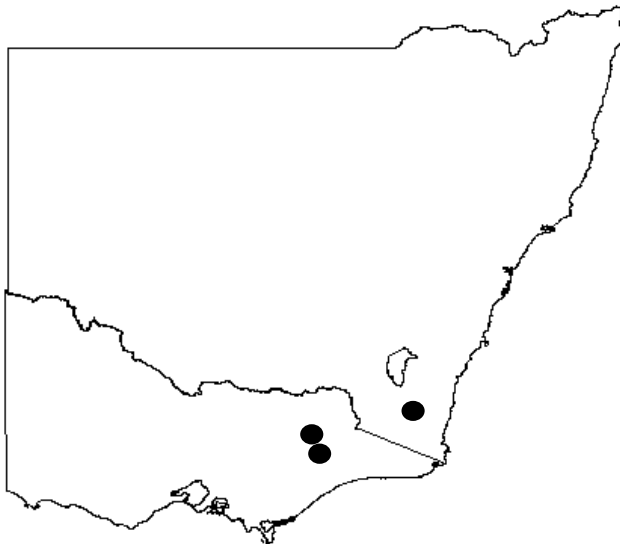


Figure 7. Distribution of *Diuris ochroma*

Habitat

In Victoria, *D. ochroma* grows at 400–500 m altitude in sub-alpine grassland/herbfields and sparse woodland with a herbaceous understorey. Common associated species include Kangaroo Grass *Themeda triandra*, Annual Meadow Grass *Poa annua*, Austral Bugle *Ajuga australis*, woodruffs

Asperula sp., Bidgee-Widgee *Acaena novae-zelandiae*, buttercups *Ranunculus* sp., early nancys *Wurmbea* sp., Suckling Clover *Trifolium dubium*, sedges *Lomandra* sp. and Soft Brome *Bromus hordeaceus* subsp. *hordeaceus* (DSE unpubl. data).

In New South Wales, one population of *D. ochroma* occurs in moist areas in grassland and sub-alpine open woodland above 900 m altitude, on brown loam over shale. Associated species include Kangaroo Grass, the tussock grasses *Poa labillardieri* and *Poa sieberiana*, wallaby-grass *Austrodanthonia* sp., Coral Heath *Epacris microphylla* and Scaly Buttons *Leptorhynchos squamatus* (NGH Environmental 2004). The other confirmed population occurs in low, diverse *Poa hookeri* dominated grassland (Community 31 of McDougall & Walsh 2007) at an altitude of about 1500 m. A third population (based on a 1960s herbarium collection) may occur in similar grassland habitat. Proposed recovery actions include survey and mapping of habitat that will lead to the identification of habitat critical to the survival of the species.

Population Information

Diuris ochroma is only known from five populations containing about 8,200 plants (Table 5).

Table 5. Population and threat information for *Diuris ochroma*

Population	Size	Extent	Manager	Threats (High Medium Low)
Alpine National Park (Wonnangatta)	~8,000 plants	~500 ha	Parks Victoria	<ul style="list-style-type: none"> • weed invasion (H) • grazing/predation (H) • disturbance/ destruction (M)
Abbeyard (roadside)	~50 plants	~10 ha	Alpine Shire	<ul style="list-style-type: none"> • weed invasion (H) • grazing/predation (H) • disturbance/destruction (H)
Kybeyan (roadside & private property)	~70 plants	6 ha	Cooma-Monaro Shire/private	<ul style="list-style-type: none"> • weed invasion (H) • grazing/predation (H) • disturbance/destruction (H)
Kosciuszko National Park (Happy Jacks)	~50 plants	50 ha	DECCW	<ul style="list-style-type: none"> • grazing/predation (H)
Kosciuszko National Park (Kiandra)	unknown	unknown	DECCW	<ul style="list-style-type: none"> • grazing/predation (H)

Decline and Threats

The historical range and abundance of *D. ochroma* is not known. Given its semi-remote habitat and the disjunct nature of current populations, the species may well occur elsewhere in suitable habitat in the region. The broad similarity to several other species such as *Diuris chryseopsis* and *Diuris subalpina* may have also lead to misidentification and subsequent under-reporting of *D. ochroma*. Remaining populations of *D. ochroma* face a variety of current and potential threats including:

Weed invasion/competition

St. Johns Wort *Hypericum perforatum* and Blackberries *Rubus fruticosus* are a serious problem at the Alpine NP site, while Paspalum *Paspalum dilatatum*, Lesser Quaking Grass *Briza minor*, Chickweed *Cerastium glomeratum*, White Clover *Trifolium repens* and Brome Grass *Bromus catharticus* are also present in significant numbers. Suckling Clover *Trifolium dubium*, flatweed *Hypochaeris radicata*, Sheep Sorrel *Acetosella vulgaris*, Rat's Tail Fescue *Vulpia* sp., and Yorkshire Fog Grass *Holcus lanatus* are a serious problem at the Kybeyan site (NGH Environmental 2004). Eucalypt regeneration may adversely affect the population at the Kybeyan site (NGH Environmental 2004).

Grazing/predation

Grazing by rabbits is a serious threat at the Alpine NP and Abbeyard sites, while grazing by cattle is a serious threat at the Abbeyard and Kybeyan site (NGH Environmental 2004). Pigs at Happy Jacks (Kosciuszko NP) preferentially dig for tubers and roots in the grassland community where *D. ochroma* grows. Although the control program has been reasonably successful in recent years, pigs remain a major threat at this site. Horse and rabbit grazing is significant in the Kiandra area.

Disturbance/destruction

There is a potential for accidental damage caused by road/track maintenance activities and fire suppression activities at all three known sites. There is a potential for accidental destruction by off-road vehicles at the Alpine NP and Abbeyard sites. Trampling and soil compaction by grazing cattle is

a threat at Abbeyard and Kybeyan. Inappropriate fire regimes including pile burning are a potential threat at the Kybeyan site (NGH Environmental 2004).

Existing Conservation Measures

A number of measures for the conservation of *D. ochroma* have been undertaken, including:

- Weed control and the erection of fencing and bollards at the Alpine NP site to control vehicles.
- Yearly monitoring at the Alpine NP site, collection of seed and placement in long-term storage.
- Ecological burning at the Alpine NP site to restore the *Themeda triandra* grassland and reduced the risk of weed invasion.
- Surveys in the Kybeyan and Happy Jacks areas.

***Prasophyllum fosteri* D.L. Jones Fosters Leek-orchid**

Description

Fosters Leek-orchid *Prasophyllum fosteri* is a small terrestrial orchid with a single hollow terete leaf to 25 cm long. The flower stem grows up through the leaf and emerges through a slit about ½ way along the leaf. The stem grows to 30 cm tall (generally much shorter), with up to 25 (usually fewer) small, non-resupinate greenish to brownish flowers with a green and white labellum. The dorsal sepal is about 7 mm long, more or less horizontal with the tip downcurved, the lateral sepals are about 7 mm long, erect, free, parallel or divergent, while the petals are strongly incurved. The labellum is relatively broad and deeply channelled, with a recurved tip. Flowering occurs in October and November (description from Jones 2000). The pollinator(s) of most *Prasophyllum* species is not known, but as the flowers produce nectar, they are visited by a wide range of potential pollinator insects (Jones 2006).



Prasophyllum fosteri Shelford, Vic © Gary Backhouse

Distribution

Prasophyllum fosteri is endemic to Victoria, where it is known from a single site near Shelford, in the Victorian Volcanic Plain IBRA bioregion (Figure 8). Maps showing the distribution of *P. fosteri* are available from DSE.

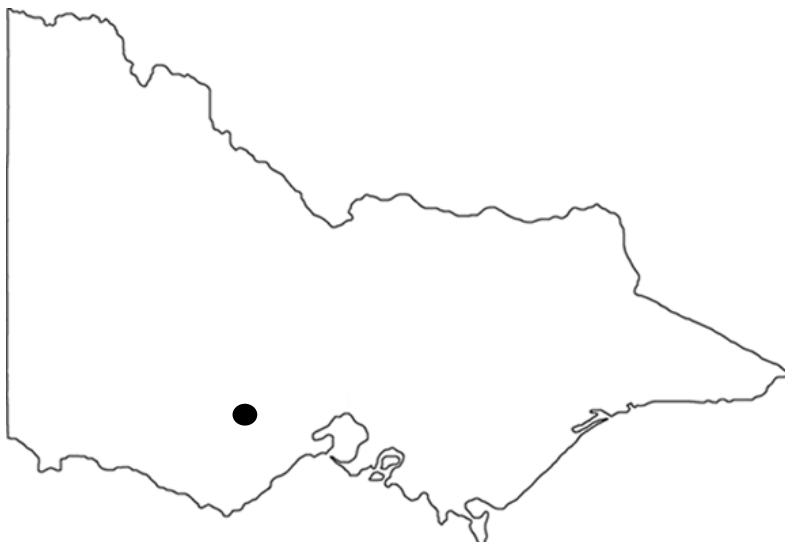


Figure 8. Distribution of *Prasophyllum fosteri*

Population Information

Prasophyllum fosteri is known only from a single population containing about 400 plants, growing on a roadside near Shelford managed by Golden Plains Shire.

Habitat

Prasophyllum fosteri occurs in herb-rich native grassland dominated by *Themeda triandra* with perennial herbs and lilies on poorly drained red-brown basalt soil. The site forms part of the 'Natural Temperate Grassland of the Victorian Volcanic Plain', which is a critically endangered ecological community under the EPBC Act, and the 'Western (Basalt) Plains Grasslands Community' which is listed as a threatened ecological community under the FFG Act. Recovery actions include survey and mapping of habitat that will lead to the identification of habitat critical to the survival of the species.

Decline and Threats

The previous distribution and abundance of *P. fosteri* is not known, although it is almost certain that unrecorded populations have been lost due to the almost total destruction of the native grassland habitat in which the species grows. Less than 1% of this habitat remains (CNR 1994), and native temperate grasslands are now some of Australia's most threatened ecosystems (Kirkpatrick *et al.* 1995). There is a high risk of extinction of the remaining population due to the low numbers of plants and small area of occupancy. With the extensive habitat loss, it is probable that some ecological functions such as conditions for the maintenance of pollinator and fungal activity have been adversely affected at these remnant sites. The sole remaining population of *P. fosteri* is at risk from a variety of current and potential threats, including:

Disturbance/destruction

Disturbance to or destruction of plants and/or habitat is a major threat to *P. fosteri*, as the only population occurs on a roadside where it is at risk from road and utilities maintenance activities, stock movement and vehicle and farm machinery movement.

Weeds invasion

Weed invasion is an ongoing threat, with weeds including *Phalaris aquatica*, *Romulea rosea* and *Cuscuta dubia* present on or near the site. Weeds will readily establish in areas suffering any soil disturbance.

Altered fire regimes

Prasophyllum fosteri probably requires periodic fire to reduce accumulation of grasses, especially Kangaroo Grass, which otherwise may suppress growth and/or flowering if grass swards become too dense. Although both sites remain relatively open, the total exclusion of fire risks the sites being eventually crowded out by Kangaroo Grass.

Current Conservation Measures

A number of measures for the conservation of *P. fosteri* have been undertaken, including:

- Annual monitoring.
- Annual ecological burning of the site to control weeds and maintain native flora diversity.
- Collection and long-term storage of seed.

***Prasophyllum hygrophilum* D.L. Jones & D.T. Rouse Swamp Leek-orchid**

Description

The Swamp-leek-orchid *Prasophyllum hygrophilum* has a single, hollow, terete leaf to 30 cm long. The erect flower stem emerges through a slit in the leaf and grows to 40 cm tall, with up to 30 small, fragrant, non-resupinate, greenish flowers with red, purple or brownish stripes and suffusions, the labellum white or pinkish with a green callus. The dorsal sepal is about 8 mm long, downward-pointing and angled forward, the lateral sepals are about 10 mm long, erect, free, parallel or divergent, while the petals only slightly spreading and deflexed. Flowering occurs from October to December (description from Jones & Rouse 2003).

The original recovery plan for this species (Coates *et al.* 2002) listed it as *Prasophyllum* sp. 'Nagambie', but it has since been formally described as *Prasophyllum hygrophilum* (Jones & Rouse 2003).



Prasophyllum hygrophilum Nagambie, Vic © Gary Backhouse

Distribution

Prasophyllum hygrophilum is endemic to central Victoria, occurring in the Riverina IBRA bioregion (Figure 9). Maps showing the distribution of *P. hygrophilum* are available from DSE.



Figure 9. Distribution of *Prasophyllum hygrophilum*

Population Information

Prasophyllum hygrophilum is known from only two populations, one in the Reedy Lake Wildlife Reserve (managed by Parks Victoria) near Nagambie and containing about 1,500 plants, and the second on private property near Bendigo and containing about 80 plants.

Habitat

Prasophyllum hygrophilum occurs in River Red Gum *Eucalyptus camaldulensis* and Grey Box *Eucalyptus microcarpa* herb-rich grassy woodland on seasonally inundated heavy brown clay gilgai soils. Plants often grow close to standing water and may be underwater during the winter and early spring, although water level is usually receding when plants are in flower. Recovery actions include survey and mapping of habitat that will lead to the identification of habitat critical to the survival of the species.

Decline and Threats

Nothing is known of the historical range or abundance of *P. hygrophilum*, but it is likely to have been widespread in swampy areas in River Red Gum - Yellow Box forest and Grey Box grassy woodlands throughout central Victoria prior to agricultural land clearing, especially draining of shallow freshwater marshes. Much of the remaining red gum woodland have been subject to a long history of disturbance, including grazing by domestic stock, timber production and high recreational use. There is a high risk of extinction due to very restricted distribution of this species and low numbers of plants at the Bendigo site. Remaining populations of *P. hygrophilum* face a variety of current and potential threats including:

Altered hydrological regimes

Prasophyllum hygrophilum grows in a seasonally wet habitat, and the species appears to rely heavily on periodic wetting and drying to flower. Alterations to current hydrology have the potential to adversely affect populations at both sites. Tracks created by vehicle movement have already altered local drainage in some areas of Reedy Lake. The continuing drought has substantially dried both sites and greatly reduced flowering rates in recent years, although it is not known if this has contributed to any increase in mortality.

Disturbance/destruction

Vehicle movement at Reedy Lake threatens several groups of plants, especially when tracks are wet and vehicles go off the tracks seeking drier ground.

Grazing

Grazing by kangaroos is a low-medium threat at the Reedy Lake site, while grazing by rabbits is a low threat at the Bendigo site.

Weed invasion

Weed invasion is a low-moderate threat, especially from Onion Grass *Romulea rosea* which is a problem in wet years at the Bendigo site. There are few weeds evident at the Reedy Lake site.

Current Conservation Measures

A number of measures have been undertaken for the conservation of *P. hygrophilum*, including:

- Annual monitoring at both sites.
- Construction of a rabbit and kangaroo-proof fence to protect plants at the Bendigo site.
- Weed control at the Bendigo site.
- Ongoing liaison with the landholder of the Bendigo site, who has been very supportive of conservation efforts to date. The continued cooperation of the landholder is essential to ensure the security of that population.

***Prasophyllum morganii* Nicholls Cobungra Leek-orchid**

Description

The Cobungra Leek-orchid *Prasophyllum morganii* has a single, hollow, terete leaf to 25 cm long. The erect flower stem emerges through a slit in the leaf and grows to 25 cm tall, with up to 80 small, fragrant, non-resupinate flowers arranged in a dense, crowded spike. Colouration is greenish with purplish stripes and tonings, the labellum white, pink or purple with a green callus. The dorsal sepal is about 5 mm long, down-ward pointing and curved forward, the lateral sepals are about 6 mm long, erect, free and widely divergent, while the petals are widely spreading with recurved tips. Flowering occurs from November to January (description from Backhouse & Jeanes 1995).

Distribution

Prasophyllum morganii is endemic to Victoria, where it is known from a single site near Cobungra in eastern Victoria, in the South Eastern Highlands IBRA bioregion (Figure 10). Maps showing the distribution of *P. morganii* are available from DSE.



Figure 10. Distribution of *Prasophyllum morganii*

Population Information

Prasophyllum morganii was known only from a single population on private property, but no plants have been seen since 1933.

Habitat

Prasophyllum morganii apparently grew in Snow Gum *Eucalyptus pauciflora* open forest at about 1,000 m altitude, on a small ridge on clay and quartz soils (Nicholls 1930).

Decline and Threats

Prasophyllum morganii is almost certainly extinct, as no plants have been seen for over 75 years despite many searches, especially since the 2003 alpine wildfires. The site where the species grew was cleared and converted to pasture many years ago. Should the species be rediscovered, the protective measures described for other threatened orchids in this recovery plan will be applied as appropriate.

***Prasophyllum niphopedium* D.L. Jones Marsh Leek-orchid**

Description

The Marsh Leek-orchid *Prasophyllum niphopedium* has a single, hollow, terete leaf to 30 cm long. The erect flower stem emerges through a slit in the leaf and grows to 40 cm tall, with up to 20 small, non-resupinate greenish flowers with reddish stripes and suffusions, the labellum white to pinkish with a green callus. The dorsal sepal is about 8 mm long and more or less horizontal, the lateral sepals are about 8 mm long, erect, partially joined near the base, the tips free and divergent, while the petals are strongly incurved. Flowering occurs from December to February (description from Jones & Rouse 2003).



Prasophyllum niphopedium Black Mountain, Vic © Gary Backhouse

Distribution

Prasophyllum niphopedium is endemic to a limited area of eastern Victoria, between Wulgulmerang and Benambra, in the Australian Alps IBRA bioregion (Figure 11). Maps showing the distribution of *P. niphopedium* are available from DSE.

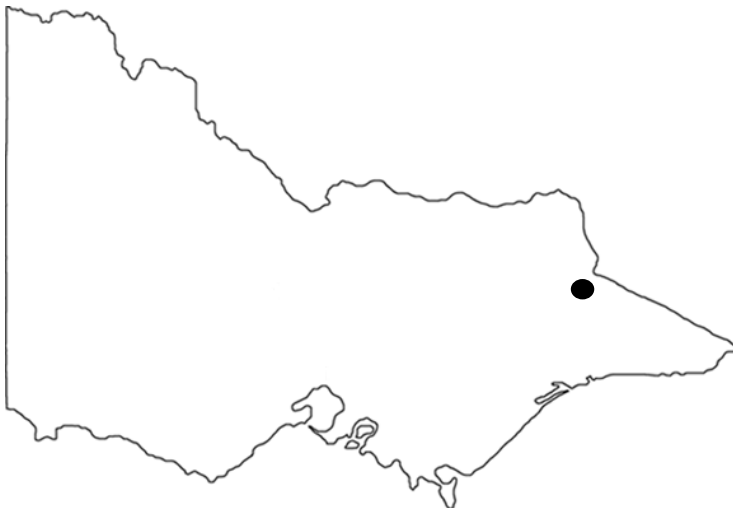


Figure 11. Distribution of *Prasophyllum niphopedium*

Population Information

Prasophyllum niphopedium is currently known from four populations containing about 180 plants, all occurring in the Alpine National Park in eastern Victoria, managed by Parks Victoria. There are records of an additional two populations in the park, but plants have not recently been seen at these sites.

Habitat

Prasophyllum niphopedium grows on snow plains above 1,000 m altitude, in grassy alpine heath dominated by *Hakea microcarpa*, *Epacris gunnii*, *Epacris brevifolia*, *Baeckea gunniana*, *Poa clivicola* and *Poa sieberiana*, usually near watercourses. Soils are seasonally damp to waterlogged dark brown organic loams. Recovery actions include survey and mapping of habitat that will lead to the identification of habitat critical to the survival of the species.

Decline and Threats

Nothing is known of the historical distribution of *P. niphopedium*, although it appears to be naturally restricted to a fairly limited area of the highlands in eastern Victoria. There has been a decline in the number of plants and populations, as plants have not been seen at two sites for over 10 years, and it is uncertain if the species still persists at these sites. The remaining four populations face a number of threats, especially from grazing and trampling by feral horses, cattle and pigs. Control of feral pigs and horses at all known sites is urgently required to remove grazing pressure and stop soil disturbance. At least one site is vulnerable to damage caused by off-road (4WD) vehicles.

Prasophyllum suaveolens D.L. Jones & R. Bates Fragrant Leek-orchid

Description

The Fragrant Leek-orchid *Prasophyllum suaveolens* has a single, hollow, terete leaf to 20 cm long. The erect flower stem emerges through a slit in the leaf and grows to 20 cm tall, with up to 15 very small, fragrant, non-resupinate, greenish to brownish flowers. The dorsal sepal is about 5 mm long, downward-pointing and angled forward, the lateral sepals are about 6 mm long, erect, free, parallel or divergent, while the petals are widely spreading. Flowering occurs in October and November (description from Backhouse & Jeanes 1995).



Prasophyllum suaveolens Darlington, Vic © Gary Backhouse

Distribution

Prasophyllum suaveolens is endemic to the basalt plains of south-western Victoria, where it occurs in the Victorian Volcanic Plains IBRA bioregion, with a single population in the Victorian Midlands bioregion (Figure 13). Maps showing the distribution of *P. suaveolens* are available from DSE.



Figure 12. Distribution of *Prasophyllum suaveolens*

Habitat

Prasophyllum suaveolens occurs in open, species-rich native grassland dominated by Kangaroo Grass *Themeda triandra* with perennial herbs and lilies on poorly drained red-brown soil derived from basalt, often with embedded basalt boulders. This vegetation is dominated by a ground layer of tussock-forming perennial grasses, with a wide variety of wildflowers and herbs growing among the tussocks. Other species present include wallaby-grasses *Austrodanthonia* species, spear-grasses *Austrostipa* species, tussock-grasses *Poa* species, *Dianella longifolia*, *Dianella revoluta*, *Tricoryne elatior*, *Pimelea humilis* and *Dichanthium sericeum* subsp. *sericeum*. The sites are part of the 'Natural Temperate Grassland of the Victorian Volcanic Plain', which is a critically endangered ecological community under the EPBC Act, and the 'Western (Basalt) Plains Grasslands Community' which is listed as a threatened ecological community under the FFG Act. Recovery actions include survey and mapping of habitat that will lead to the identification of habitat critical to the survival of the species.

Population Information

Prasophyllum suaveolens is known from eight populations containing about 1,500 plants (Table 6).

Table 6. Population and threat information for *Prasophyllum suaveolens*

Population	Size	Extent	Manager	Threats (High Medium Low)
roadside (Wingeel)	~600 plants	~2 ha	Golden Plains Shire	<ul style="list-style-type: none"> • disturbance/destruction (H) • weed invasion (H) • altered fire regimes (H) • grazing/predation (L)
roadside (Vite Vite)	~600 plants	<5 ha	Corangamite Shire	<ul style="list-style-type: none"> • disturbance/destruction (H) • weed invasion (H) • altered fire regimes (H) • grazing/predation (L)
reserve, Ballarat	~100 plants	<1 ha	City of Ballarat	<ul style="list-style-type: none"> • disturbance/destruction (H) • weed invasion (H) • altered fire regimes (H) • grazing/predation (L)
Darlington (private property)	~50 plants	<1 ha	private	<ul style="list-style-type: none"> • disturbance/destruction (L) • weed invasion (H) • altered fire regimes (H) • grazing/predation (L)
roadside (Caramut)	~50 plants	<1 ha	Moyne Shire	<ul style="list-style-type: none"> • disturbance/destruction (H) • weed invasion (H) • altered fire regimes (H) • grazing/predation (L)
roadside (Derrinallum)	~50 plants	<1 ha	Corangamite Shire	<ul style="list-style-type: none"> • disturbance/destruction (H) • weed invasion (H) • altered fire regimes (H) • grazing/predation (L)
roadside (Woorndoo)	~20 plants	<2 ha	Moyne Shire	<ul style="list-style-type: none"> • disturbance/destruction (H) • weed invasion (H) • altered fire regimes (H) • grazing/predation (L)
Yalla-Y-Poorra Grassland Reserve	10 plants	<1 ha	Parks Victoria	<ul style="list-style-type: none"> • disturbance/destruction (L) • weed invasion (H) • altered fire regimes (H) • grazing/predation (L)

Decline and Threats

Prasophyllum suaveolens has suffered a major decline in range and abundance since European settlement. There are historic records of this species west and southwest of Melbourne at Werribee, St Albans, Albion, Laverton, Lara, Tottenham and Merri Creek, and from near Creswick, suggesting that it is likely to have once been widespread across the western basalt plains. Habitat loss, largely for agriculture but also for expanding urban and industrial development in Melbourne's west, has undoubtedly been the major cause for the catastrophic decline in range and abundance of *P. suaveolens*. Less than 1% of the grasslands of the western basalt plains remain, mostly restricted to

tiny fragmented patches on roadsides, rail lines, small areas of crown land and small areas remaining on private land (CNR 1994). There has been extensive loss of grasslands and grassy woodlands in south-eastern Australia, such that these are now some of Australia's most threatened ecosystems (Kirkpatrick *et al.* 1995).

There is a high risk of extinction of remaining populations due to the small size and the tiny area of occupancy of most populations. There is only one tiny population in a reserve. It is highly probable that some ecological functions such as conditions for the maintenance of pollinator and fungal activity have been adversely affected at these remnant sites. Remaining populations of *P. suaveolens* are at risk from a variety of current and potential threats, including:

Disturbance/destruction

Accidental destruction caused by machinery is a threat at the Ballarat site. Accidental destruction caused by road and/or rail maintenance activities is a serious threat at the Caramut, Derrinallum, Vite Vite, Woorndoo and Wingeel roadside sites. Soils disturbance facilitates weed invasion and establishment, with weeds readily colonizing disturbed sites.

Weed invasion

Weed invasion, especially by pasture grasses and other weeds such as *Phalaris aquatica*, *Romulea rosea* and *Cuscuta dubia* is a major recurring problem at all sites, especially sites suffering soil disturbance or with the prolonged absence of fire. The invasive ornamental weeds *Watsonia bulbifera* and English Broom *Cytisus scoparius* are a serious problem at the Ballarat site.

Altered fire regimes

Prasophyllum suaveolens probably requires periodic fire to reduce accumulation of grasses, especially Kangaroo Grass, which otherwise may suppress growth and/or flowering if grass swards become too dense. Although both sites remain relatively open, the total exclusion of fire risks the sites being eventually crowded out by Kangaroo Grass.

Grazing

Grazing by introduced herbivores (rabbits/hares) is a minor threat at several locations. Grazing and trampling by stock is a potential threat if stock are moved along roadsides containing the species.

Current Conservation Measures

A number of measures for the conservation of *P. suaveolens* have already been undertaken, including:

- Construction of a stock -proof fence to protect the Darlington site, and continuing liaison with the landholders, who have been very supportive of conservation actions.
- Weed control (in particular to control *Watsonia* and English Broom) at the Ballarat site.
- Ecological burning of the Ballarat site on a 3–4 year rotation to promote species diversity and *P. suaveolens* flowering.
- Regular monitoring at the Caramut, Vite Vite & Wingeel roadside and Ballarat sites.
- Seed collection from five populations and placement in long-term storage.

***Prasophyllum subbisectum* Nicholls Pomonal Leek-orchid**

Description

The Pomonal Leek-orchid *Prasophyllum subbisectum* has a single, hollow, terete leaf to 30 cm long. The erect flower stem emerges through a slit in the leaf and grows to 30 cm tall, with up to 15 tiny fragrant, non-resupinate, brownish flowers, the labellum with a channelled greenish callus. The dorsal sepal is about 6 mm long, downward-pointing and angled forward, the lateral sepals are about 7 mm long, erect, free, parallel or divergent, while the petals are slightly spreading. Flowering occurs in October and November (description from Backhouse & Jeanes 1995).



Prasophyllum subbisectum Deep Lead, Vic © Gary Backhouse

Distribution

Prasophyllum subbisectum is endemic to western Victoria, where it is restricted to a small area between Stawell and the Grampians (Figure 14), in the Victorian Midlands IBRA bioregion. Maps showing the distribution of *P. subbisectum* are available from DSE.

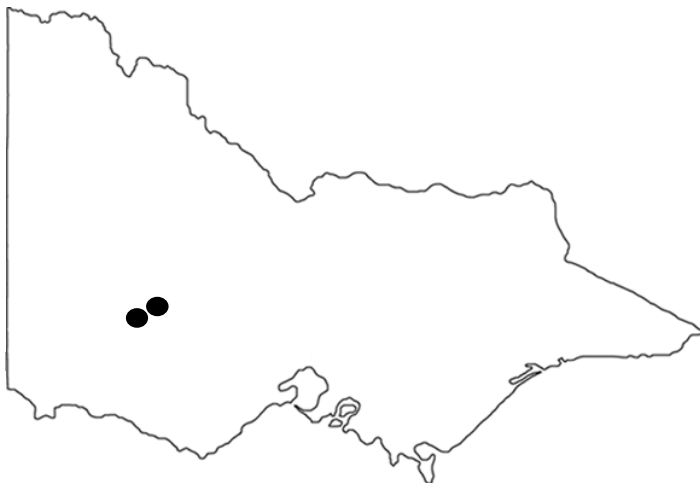


Figure 13. Distribution of *Prasophyllum subbisectum*

Habitat

Prasophyllum subbisectum grows in open forest dominated by *Eucalyptus tricarpa*, *Eucalyptus macrorhynca* and *Eucalyptus microcarpa*, with a heathy understorey typically consisting of *Ozothamnus obcordatum*, *Brachyloma ciliatum* and *Calytrix tetragona* or *Eucalyptus leucoxydon* and

Eucalyptus goniocalyx open forest on well drained sandy loam. Recovery actions include survey and mapping of habitat that will lead to the identification of habitat critical to the survival of the species.

Population Information

Prasophyllum subbisectum is known only from four populations containing about 130 plants (Table 7). All sites are managed by Parks Victoria.

Table 7. Population and threat information for *Prasophyllum subbisectum*

Population	Size	Extent	Threats (High Medium Low)
Grampians National Park (1)	~60 plants	<5 ha	• grazing/pr edation (M)
Deep Lead Nature Conservation Reserve	~45 plants	<2 ha	• disturbance/ destruction (M) • grazing/pr edation (M)
Three Jacks Flora and Fauna Reserve	~25 plants		• disturb ance/destruction (L) • grazing/pr edation (M)
Grampians National Park (2)	2 plants	<1 ha	• grazing/pr edation (M)

Decline and Threats

Little is known of the historical distribution or abundance of *P. subbisectum*, although it appears to have been restricted to a limited area in western Victoria. There is a historical record from Pomonal on a site long since cleared. Considerable areas of woodland habitat between Stawell and the Grampians have been cleared for agriculture and rural residential development, and it is possible other populations have been lost. It is likely that the conditions for the maintenance of the pollinator and/or fungal activity have been adversely affected. Very low flowering rates continue at many sites due to the continuing drought in south-eastern Australia. There is a high risk of extinction due to restricted and fragmented distribution of this species and small size of all populations. Remaining populations of *P. subbisectum* face a variety of threats including:

Grazing

There is a high risk of grazing by native and introduced herbivores. Grazing by kangaroos, wallabies and/or rabbits is a potential problem at all sites, while grazing and trampling by feral Red Deer is a problem in the Grampians NP sites.

Disturbance/destruction

Some plants at Deep Lead are close to a road and therefore are vulnerable to accidental destruction from road maintenance activities, while the population is at risk from illegal rubbish dumping, gold prospecting or firewood collection activities. The Deep Lead and Three Jacks reserves are well known wildflower reserves and attract large numbers of wildflower and orchid enthusiasts during spring. As a result, trampling or destruction by people (orchid enthusiasts or walkers) accidentally damaging plants or unknowingly trampling any seedlings in the immediate vicinity of the plants is a serious threat at both sites.

Current Conservation Measures

A number of measures for the conservation of *P. subbisectum* have been undertaken, including caging to protect some plants at the Grampians NP1 and Deep Lead/Three Jacks sites, monitoring at all sites and hand pollination and seed collection.

***Prasophyllum suttonii* R.S. Rogers & B. Rees Buffalo Leek-orchid**

Description

The Buffalo Leek-orchid *Prasophyllum suttonii* has a single, hollow, terete leaf to 25 cm long. The erect flower stem emerges through a slit in the leaf and grows to 30 cm tall, with up to 25 small, non-resupinate flowers, the sepals brownish with reddish stripes, the petals white with reddish stripes, the labellum white with a green callus. The dorsal sepal is about 6 mm long, downward-pointing and angled forward, the lateral sepals are about 7 mm long, erect, partially joined at the base and parallel, the petals spreading and curved forward. Flowering occurs from December to February (description from Backhouse & Jeanes 1995).

Distribution

Prasophyllum suttonii is endemic to Victoria, known it was known only from the type location on Mt. Buffalo in the Australian Alps IBRA bioregion (Figure 15). Maps showing the distribution of *P. suttonii* are available from DSE.



Figure 14. Distribution of *Prasophyllum suttonii*

Population Information

Prasophyllum suttonii has not been seen since the original collection in 1902, and is probably extinct.

Habitat

The natural habitat of *P. suttonii* is unknown.

Decline and Threats

Nothing is known of the original distribution or abundance of *P. suttonii*. Current and potential threats for *P. suttonii* are unknown. Searches by orchid researchers and enthusiasts over many years have failed to locate any populations in the area, and there is strong evidence to indicate that *P. suttonii* is extinct. Should the species be rediscovered, the protective measures described for other threatened orchids in this recovery plan will be applied as appropriate.

Prasophyllum uvidulum D.L. Jones & D.T. Rouse Summer Leek-orchid

Description

The Summer Leek-orchid *Prasophyllum uvidulum* has a single, hollow, terete leaf to 30 cm long. The erect flower stem emerges through a slit in the leaf and grows to 35 cm tall, with up to 25 small, fragrant, non-resupinate, greenish to reddish flowers, the labellum white or pinkish with a pale green, channelled callus. The dorsal sepal is about 9 mm long and more or less horizontal, the lateral sepals are about 10 mm long and curved upward, free, parallel or divergent, while the petals strongly incurved. Flowering occurs from October to December (description from Jeanes & Backhouse 2006; Jones & Rouse 2009).

Note: this species was only described in 2009; prior to this it was known as *Prasophyllum* species 'Shelley'.



Prasophyllum species 'Shelley' Shelley, Vic © Gary Backhouse

Distribution

Prasophyllum uvidulum is endemic to north eastern Victoria, near Shelley, in the South Eastern Highlands IBRA bioregion (Figure 12). Maps showing the distribution of *P. uvidulum* are available from DSE.



Figure 15. Distribution of *Prasophyllum uvidulum*

Population Information

Prasophyllum uvidulum is known from a single population of about 50 plants, in the Pheasant Creek Flora and Fauna Reserve, managed by Parks Victoria.

Habitat

Prasophyllum uvidulum occurs in winter-wet riparian grassland within shrubby *Eucalyptus dives* and *Eucalyptus viminalis* forest growing at about 750 m altitude. Associated understorey species include *Acacia melanoxylon*, *Daviesia latifolia*, *Derwentia derwentiana*, *Platylobium formosum*, *Pimelea linifolia* subsp. *linifolia*. The ground layer typically includes *Gonocarpus serpyllifolius*, *Glycine microphylla*, *Stellaria pungens*, *Poa* species, *Centaurea erythraea* and *Hypochaeris radicata*. Recovery actions include survey and mapping of habitat that will lead to the identification of habitat critical to the survival of the species.

Decline and Threats

Nothing is known of the historical distribution of *P. uvidulum*, although it appears to be naturally restricted to a very limited area of north-eastern Victoria. The single population faces threats including grazing and trampling by feral Fallow Deer and Sambar, both of which are common in the area, and weed invasion by introduced grasses. Some plants occur close to a road and are potentially at risk from road maintenance activities. There is a high risk of extinction due to highly restricted distribution of this species.

Current Conservation Measures

Demographic monitoring has been established at the site, and some plants have been hand pollinated to increase the seed reservoir and chances of recruitment.

***Pterostylis despectans* Nicholls Lowly Greenhood**

Description

The Lowly Greenhood *Pterostylis despectans* is a small orchid growing to only about 50 mm in height. It has a basal rosette of 6–10 narrowly ovate leaves (withered by flowering time) and 1–6 sequentially-opening, translucent, grey-green to brownish flowers on relatively long, slender, curved pedicels. The sepals are about 15 mm long and end in long, slender free points; the dorsal sepal and petals are united to form a hood or galea that encloses the column, while the lateral sepals are deflexed. The labellum is sensitive and snaps shut into the galea when the insect pollinator alights on it (description from Backhouse & Jeanes (1995). Little is known of the ecology or biology of *P. despectans*. Flowering occurs from October to January.



Pterostylis despectans Caralalup, Vic © Gary Backhouse

Distribution

Pterostylis despectans is widely but sporadically distributed in mainland south-eastern Australia, where it occurs in South Australia, Victoria and New South Wales, in the Flinders Lofty Block, Victorian Midlands and Riverina IBRA bioregions (Figure 16). Maps showing the distribution of *P. despectans* are available from the nature conservation agency in each range State.

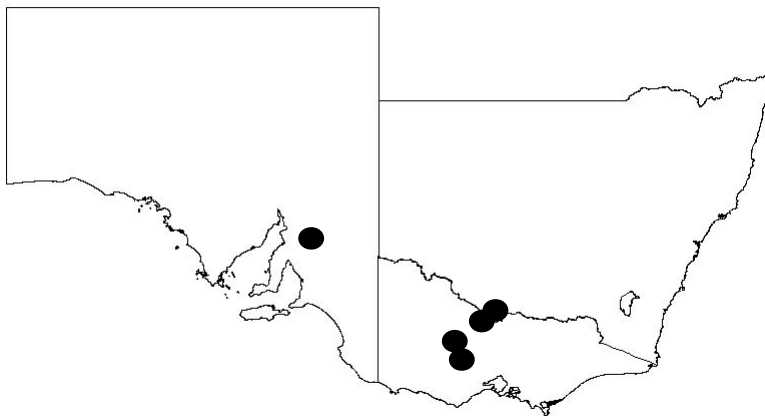


Figure 16. Distribution of *Pterostylis despectans*

Habitat

Pterostylis despectans occupies different habitats in different parts of its range. In South Australia, *P. despectans* occurs in *Eucalyptus odorata* grassy woodland, occasionally with *Eucalyptus leucoxylon* or *Eucalyptus microcarpa*; on clay loam soil (Bickerton & Robertson 2000; Quarmby 2006). Populations in the Victorian Midlands primarily occur in open forest and woodlands dominated by *E. leucoxylon* and *E. microcarpa* with an open shrubby understorey and sparse ground layer. The two populations growing in the Riverina bioregion (one each in Vic and NSW) grow in herb-rich native

grassland on heavy clay soil. Recovery actions include survey and mapping of habitat that will lead to the identification of habitat critical to the survival of the species.

Population Information

Pterostylis despectans is currently known from 16 populations containing about 7,800 plants, with 12 populations occurring in Victoria, three in South Australia and one in New South Wales (Table 8).

Table 8. Population and threat information for *Pterostylis despectans*

Population	Size	Extent	Manager	Threats (High Medium Low)
<i>South Australia</i>				
Peppermint Gully (private property and roadside)	~2,000 plants	~ 50 ha	private, Goyder Regional Council	<ul style="list-style-type: none"> • lack of pollination (H) • disturbance/ destruction (M) • weed invasion (H) • grazing/predation (H)
Yacka (Heritage Agreement private property)	~1,000 plants	~ 5 ha	private	<ul style="list-style-type: none"> • lack of pollination (H) • grazing/predation (M) • weed invasion (H)
Mt. Bryan (private property)	~150 plants	~5 ha	private	<ul style="list-style-type: none"> • Lack of pollination (H) • weed invasion (H) • grazing/predation (M)
<i>New South Wales</i>				
Moama Travelling Stock Route	~20 plants	<1 ha	LHPA	<ul style="list-style-type: none"> • disturbance/destruction (H) • weed invasion (H) • grazing/predation (H)
<i>Victoria</i>				
Caralalup Nature Conservation Reserve	~1,600 plants	150 ha	Parks Victoria	<ul style="list-style-type: none"> • disturbance/destruction (H) • grazing/predation (H)
St. Arnaud Range National Park	~1,500 plants	100 ha	Parks Victoria	<ul style="list-style-type: none"> • disturbance/destruction (H) • grazing/predation (H)
Daisy Hill State Forest	~720 plants	100 ha	DSE	<ul style="list-style-type: none"> • disturbance/destruction (H) • grazing/predation (H)
Glenmona State Forest	~250 plants	300 ha	DSE	<ul style="list-style-type: none"> • disturbance/destruction (H) • grazing/predation (H)
Maryborough 1 (private property)	~150 plants	<5 ha	private	<ul style="list-style-type: none"> • disturbance/ destruction (M) • grazing/predation (H)
Wareek	~140 plants	<5 ha	?	<ul style="list-style-type: none"> • disturbance/destruction (H) • grazing/predation (H)
Bung Bong (private property)	~120 plants	<5 ha	private	<ul style="list-style-type: none"> • disturbance/destruction (H) • grazing/predation (H)
Lillicur Nature Conservation Reserve	~70 plants	<2 ha	Parks Victoria	<ul style="list-style-type: none"> • disturbance/destruction (H) • grazing/predation (H)
Terrick Terrick National Park	~40 plants	<2 ha	Parks Victoria	<ul style="list-style-type: none"> • grazing/predation (H) • weed invasion (L)
Paddys Range State Park	~40 plants	<1 ha	Parks Victoria	<ul style="list-style-type: none"> • disturbance/destruction (H) • grazing/predation (H)
Lillicur State Forest	~10 plants	<1 ha	DSE	<ul style="list-style-type: none"> • disturbance/destruction (H) • grazing/predation (H)
Maryborough 2 (private property)	~10 plants	<1 ha	private	<ul style="list-style-type: none"> • disturbance/destruction (H) • grazing/predation (H)

Decline and Threats

Pterostylis despectans remains widely distributed across south-eastern Australia, but populations are generally small and usually well separated from one another. Given the extensive loss of and disturbance to its habitats, populations have undoubtedly been lost from within this range. Over 75% of the box-ironbark forests and woodlands across central and northern Victoria have been cleared, and almost all of the remainder has been subject to timber harvesting, grazing and mining (VNPA 1994). Remaining habitat is reduced to generally small, isolated patches, many suffering ongoing disturbance. The grassland and grassy woodland habitats of the southern Flinders Ranges and the

Riverina grasslands of northern Victoria and southern NSW have been greatly depleted, with only small remnants remaining (Lunt *et. al.* 1998; Bickerton & Robertson 2000).

However, the diminutive size and late flowering of *P. despectans* may mean it is overlooked, and the species possibly occurs elsewhere, especially in central Victoria where some suitable habitat still occurs. Several new populations were discovered in central Victoria in the late 1990s and early 2000s, the population in northern Victoria was discovered in 2003, while the only known NSW population was discovered in 2005. Remaining populations of *P. despectans* face several current and potential threats, including:

Grazing/predation

Predation of tubers by White-winged Choughs is a serious problem at many central Victorian populations. Grazing of leaves/stems by kangaroos/wallabies, rabbits/hares and/or invertebrates is a threat at all sites. The Moama TSR site is periodically intensely grazed by stock, and the Peppermint Gully site in SA is partially grazed by sheep, although the core areas have been fenced to exclude stock.

Disturbance/destruction

Disturbance to or destruction of plants and habitat is a major threat for most sites. The Peppermint Gully, St. Arnaud Range NP, Caralulup NCR, Lillicur NCR and Lillicur SF sites are located close to tracks/roads and at risk of accidental trampling caused by vehicles or walkers, or accidental destruction caused by maintenance activities. Most of the central Victorian populations occur in areas where there is ongoing amateur gold prospecting activity which has the potential to accidentally destroy plants and populations. One population on private property was partially damaged after a prospector illegally trespassed on the property and dug holes. The Moama TSR site was burnt in January 2007 and the site was scraped by bulldozers.

Weed invasion

Weed invasion is a major threat at the three South Australian sites, a minor threat at the Terrick Terrick NP site, and is currently minimal or not a concern for most other sites.

Current Conservation Measures

A number of measures for the conservation of *P. despectans* have been undertaken, including:

- Demographic monitoring at some sites and current status monitoring at all other sites.
- Searches for new populations in SA, resulting in the discovery of the Peppermint Gully population.
- Fencing of the Lillicur NCR population and caging of some plants.
- Fencing to exclude stock exclusion at the Mt. Bryan and Peppermint Gully private property sites.
- Hand pollination of some plants at sites with low natural pollination rates.
- Collection of seed and placement in long-term storage.
- Box Thorn control at Peppermint Gully and Mt Bryan.
- Ongoing consultation and liaison with landholders, land managers, and stakeholders at all sites.

***Pterostylis* sp. aff. *boormanii* 'Beechworth' Granite Rustyhood**

Description

The Granite Rustyhood *Pterostylis* sp. aff. *boormanii* 'Beechworth' grows to 20 cm tall. It has a basal rosette of 5–10 elliptical leaves (withered by flowering time) and 1–6 sequentially opening, reddish brown flowers. The sepals are about 20 mm long and end in long, slender free points; the dorsal sepal and petals are united to form a hood or galea that encloses the column, while the lateral sepals are deflexed and distinctly concave, the free points curving forward. The outer surface of the lateral sepals is covered by relatively long dense white hairs. The labellum has several pairs of long bristles along the margin, and is sensitive, snapping up into the galea when the insect pollinator alights on it (description from Backhouse & Jeanes (1995). Little is known of the ecology or biology of *P.* sp. aff. *boormanii*. Flowering occurs in October and November.



Pterostylis sp. aff. *boormanii* Beechworth, Vic
© Mike Duncan

Distribution

Pterostylis sp. aff. *boormanii* 'Beechworth' is endemic to a very limited area near the town of Beechworth in north-eastern Victoria (Figure 17), in the South Eastern Highlands IBRA bioregion. Maps showing the distribution of *P.* sp. aff. *boormanii* 'Beechworth' are available from DSE.



Figure 17. Distribution of *Pterostylis* sp. aff. *boormanii* 'Beechworth'

Habitat

Pterostylis sp. aff. *boormanii* 'Beechworth' occurs in *Eucalyptus goniocalyx*, *Eucalyptus macrorhyncha* and *Callitris endlicheri* open forest or woodland with a sparse shrubby understorey and grassy ground layer, on well drained dark brown granitic loam, usually in amongst granite boulders on ridges and slopes. Recovery actions include survey and mapping of habitat that will lead to the identification of habitat critical to the survival of the species.

Important populations

Pterostylis sp. aff. *boormanii* 'Beechworth' is currently known from only two populations containing about 65 plants, one population in Beechworth Historic Park containing about 45 plants, and a second in Chiltern-Mt. Pilot National Park containing about 20 plants. Both areas are managed by Parks Victoria.

Decline and Threats

Virtually nothing is known of the historical distribution and abundance of *P. sp. aff. boormanii* 'Beechworth', but the species appears to be confined to a relatively limited area on the granite hills near Beechworth. Some of this habitat has been cleared for agriculture and residential development. Other areas of potentially suitable habitat exist, so the species may occur elsewhere in the region. However, there has been some disturbance of these areas from mining, timber production and recreational use, and repeated searches in recent years have located few new plants, so the species does appear to be quite rare. Ongoing drought in south-eastern Australia has also contributed to a reduction in flowering rates. It is likely that the conditions for the maintenance of the pollinator and/or fungal activity have been adversely affected at some sites. There is a high risk of extinction due to the tiny population sizes at the two sites. Major threats include grazing by kangaroos/wallabies and/or rabbits/hares, and disturbance to or destruction of plants and habitat. The Beechworth Historic Park site is located close to a track and therefore is at risk of accidental destruction by track maintenance activities, and recreational use damaged this site in 2009. The species is highly vulnerable to accidental damage especially from orchid enthusiasts and photographers, so site confidentiality is vital.

Current Conservation Measures

Plants at the Beechworth Historic Park site have been monitored since 2001.

***Thelymitra epipactoides* Muell. Metallic Sun-orchid**

Description

The Metallic Sun-orchid *Thelymitra epipactoides* Muell. is a large showy sun-orchid with a single leathery, channelled and ribbed dark green to purplish basal leaf to 25 cm in length, and a stout, fleshy flower stem to 50 cm tall, with up to 20 large flowers, to 40 mm across, colour varying from bronze, pink, reddish, green to bluish, often with a metallic lustre, the column yellowish with a narrow, incurved post anther lobe and two smaller incurved auxiliary lobes, the lateral lobes with a dense tuft of long, shaggy hairs. Flowering occurs from August to November (description from Backhouse and Jeanes 1995).

Little is known of the biology or ecology of *T. epipactoides*. Some populations, especially in heathy habitats, appear to require periodic fire to initiate flowering. The pollinator of *T. epipactoides* flowers is a small native bee *Nomia* sp. that is attracted to the flowers by strong perfumes and/or rewards of nectar (Cropper 1993). The pollination rate is unknown, but it appears that *T. epipactoides* has optimised the chance of pollination by evolving a range of colour morphs (Cropper 1993).



Thelymitra epipactoides Port Campbell, Vic
© Gary Backhouse

Distribution

Thelymitra epipactoides is endemic to south-eastern Australia, where it is widely but sporadically distributed from the Eyre Peninsula in South Australia to central Gippsland in Victoria (Figure 18), in the Eyre-York Block, Murray-Darling Depression, Naracoorte Coastal Plain, and South East Coastal Plain IBRA bioregions. Maps showing the distribution of *T. epipactoides* are available from DEH (for SA) and DSE (for Vic).

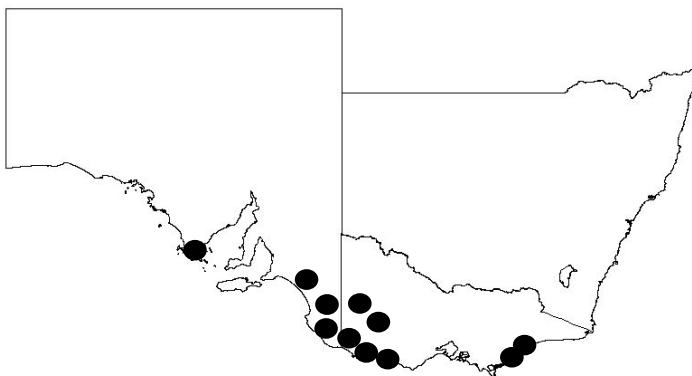


Figure 18. Distribution of *Thelymitra epipactoides*

Habitat

Thelymitra epipactoides occurs in a variety of habitats including grasslands, heathlands, heathy and shrubby woodlands and open forest. Substrates include moist to dry sandy loams, light sand over clay and heavier terra rossa soils over limestone. Recovery actions include survey and mapping of habitat that will lead to the identification of habitat critical to the survival of the species.

Population Information

Thelymitra epipactoides is currently known from 50 populations containing only about 2,300 plants (Table 9). Most populations are very small, with only four containing 50 or more plants. About 30 populations contain 20 or fewer plants, while it is not known if plants persist in another 13 populations.

Table 9. Population and threat information for *Thelymitra epipactoides*

Location	Size	Extent	Manager	Threats (High Medium Low)
<i>South Australia</i>				
roadside, Duck Lake Road, Wangary	~80 plants	<2ha	DCLEP	<ul style="list-style-type: none"> • disturbance/ destruction (M) • Ph ytophthora (L) • grazi ng/predation (H) • lack of pollination/recruitment (H)
Meningie	~75 plants	~10 ha	CDC/DEH	<ul style="list-style-type: none"> • weed invasion (M) • grazi ng/predation (H)
Coorong National Park	32 plants	<1 ha	DEH	<ul style="list-style-type: none"> • disturbance/ destruction (M) • weed invasion (L) • grazi ng/predation (H)
Eastern Eyre Peninsula island ~30	plants	<1ha	DEH	<ul style="list-style-type: none"> • disturbance/ destruction (M)
Private property, Culburra	19 plants	<2 ha	private	<ul style="list-style-type: none"> • weed invasion (M) • grazing/pr edation (M)
Tilley Swamp Conservation Park	18 plants	<5 ha	DEH	<ul style="list-style-type: none"> • disturbance/ destruction (M) • weed invasion (L) • grazi ng/predation (H)
private property, Coonalpyn (1)	17 plants	<5 ha	private	<ul style="list-style-type: none"> • disturb ance/destruction (L) • weed invasion (M) • grazi ng/predation (H)
private property, Taillem Bend (1)	16 plants	<1 ha	private	<ul style="list-style-type: none"> • disturb ance/destruction (L) • weed invasion (M) • grazi ng/predation (H)
private property, Coonalpyn (2)	12 plants	<1 ha	private	<ul style="list-style-type: none"> • disturb ance/destruction (L) • weed invasion (M) • grazi ng/predation (H)
roadside, Flinders Hwy Wangary	10 plants	<1ha	DTEI	<ul style="list-style-type: none"> • lack of pollination/recruitment (H) • disturb ance/destruction (L)
roadside, Mena Road, Coulta	10 plants	<2ha	private	<ul style="list-style-type: none"> • lack of pollination/recruitment (H) • lack of fire regime (H)
Mocambar Forest Reserve	10 plants	<10 ha	Forestry SA	<ul style="list-style-type: none"> • disturbance/ destruction (M) • weed invasion (H) • grazi ng/predation (H)
Sawers Heritage Agreement (private property)	7 plants	<1 ha	private	<ul style="list-style-type: none"> • disturbance/ destruction (M) • weed invasion (M) • grazi ng/predation (H)
roadside, Sleaford Bay Road, Port Lincoln	7 plants	<1ha	DCLEP	<ul style="list-style-type: none"> • disturbance/ destruction (M) • weed invasion (L)
Reedy Well Water Reserve, Culburra	6 plants	<1 ha	CDC	<ul style="list-style-type: none"> • weed invasion (M) • grazi ng/predation (H)
roadside, Fishery Bay Rd	5 plants	<1ha	DCLEP	<ul style="list-style-type: none"> • grazing/pr edation (M) • lack of fire regime (H) • lack of pollination/recruitment (H) • disturbance/ destruction (M)
Messent Conservation Park	4 plants	<1 ha	DEH	<ul style="list-style-type: none"> • disturbance/ destruction (M) • grazi ng/predation (H)

Location	Size	Extent	Manager	Threats (High Medium Low)
private property, Meningie	4 plants	<1 ha	private	<ul style="list-style-type: none"> • disturbance/destruction (H) • weed invasion (H) • grazing/predation (H)
Desert Camp Conservation Park	3 plants	<1 ha	DEH	<ul style="list-style-type: none"> • grazing/predation (H)
Padthaway Conservation Park	3 plants	<1 ha	DEH	<ul style="list-style-type: none"> • disturbance/destruction (H) • weed invasion (M) • grazing/predation (H)
Tintinara Scrub	3 plants	<1 ha	DEH	<ul style="list-style-type: none"> • weed invasion (L) • grazing/predation (H)
Zellerfield Heritage Agreement (private property)	3 plants	<5 ha	private	<ul style="list-style-type: none"> • disturbance/ destruction (M) • weed invasion (L) • grazing/predation (H)
roadside, Mikkira Sanctuary, Port Lincoln	3 plants	<1ha	DCLEP	<ul style="list-style-type: none"> • lack of pollination/recruitment (H) • lack of fire regime (H) • weed invasion (L)
Coonalpyn Heritage Agreement (private property)	2 plants	<1 ha	private	<ul style="list-style-type: none"> • disturbance/destruction (L) • weed invasion (M) • grazing/predation (H)
Wanilla Conservation Park	2 plants	<1ha	DEH	<ul style="list-style-type: none"> • lack of pollination/recruitment (H) • weed invasion (M)
roadside, Forest Road, Fountain	2 plants	<1ha	DCLEP	<ul style="list-style-type: none"> • disturbance/destruction (H) • lack of pollination/recruitment (H) • weed invasion (M) • grazing/predation (L)
Parnkalla trail	2 plants	<1ha	PLCC	<ul style="list-style-type: none"> • weed invasion (M) • disturbance/ destruction (M)
Murray Bridge	1 plant	<1 ha	DEH	<ul style="list-style-type: none"> • disturbance/destruction (H) • weed invasion (H) • grazing/predation (H)
private property, Taillem Bend (2)	1 plant	<1 ha	private	<ul style="list-style-type: none"> • disturbance/destruction (H) • weed invasion (H) • grazing/predation (H)
Barwell Conservation Park	?	?	DEH	• ?
roadside, Wanilla Settlement	?	<1ha	DCLEP	<ul style="list-style-type: none"> • lack of pollination/recruitment (H) • weed invasion (M) • grazing/predation (L)
roadside, Wattle Drive, Wanilla	?	<1ha	DCLEP	<ul style="list-style-type: none"> • weed invasion (H) • disturbance/destruction (H)
Wanilla Forest Reserve	?	?	PLACC	?
Wanilla Railway corridor	?		Genesee & Wyoming Aust	<ul style="list-style-type: none"> • weed invasion (H) • grazing/predation (H) • lack of pollination/recruitment (H) • disturbance/ destruction (M)
roadside, Flinders Hwy, Fountain	?	?	?	• ?
roadside, Borlase Road, Fountain	?	<1ha	DCLEP	<ul style="list-style-type: none"> • disturbance/destruction (H) • lack of pollination/recruitment (H) • weed invasion (M) • grazing/predation (L)
Marble Range North	?	<1ha	private	<ul style="list-style-type: none"> • grazing/pr edation (M) • disturbance/ destruction (M)
Marble Range South	?	?	private	• ?
Shannon Heritage Agreement (private property)	?	?	private	• ?
Sect 212 Hundred of Koppio	?	?	private	• ?
Tod Reservoir	?	?	SA Water	• ?
Murrunatta Conservation Park	?	?	DEH	<ul style="list-style-type: none"> • weed invasion (M)

Location	Size	Extent	Manager	Threats (High Medium Low)
<i>Victoria</i>				
Port Campbell National Park (1)	~1,000 plants	<20 ha	PV	<ul style="list-style-type: none"> • disturbance/destruction (L) • grazing/predation (H) • altered fire regimes (M)
Bay of Islands Coastal Park	~400 plants	~20 ha	PV	<ul style="list-style-type: none"> • grazing/predation (H) • altered fire regimes (M)
Gippsland Lakes Coastal Park	~250 plants	<1 ha	PV	<ul style="list-style-type: none"> • grazing/predation (H) • altered fire regimes (M)
Blond Bay Wildlife Reserve	~200 plants	~20 ha	PV	<ul style="list-style-type: none"> • weed invasion (L) • grazing/predation (H) • altered fire regimes (M)
Lake Mundi Wildlife Reserve	~60 plants	<2 ha	PV	<ul style="list-style-type: none"> • weed invasion (L) • grazing/predation (H) • altered fire regimes (L)
roadside, Golden Beach	~30 plants	<1 ha	WS	<ul style="list-style-type: none"> • disturbance/destruction (H) • weed invasion (H) • grazing/predation (H)
Kiata Flora and Fauna Reserve	10 plants	<1 ha	PV	<ul style="list-style-type: none"> • disturbance/ destruction (M) • weed invasion (H) • grazing/predation (H)
Port Campbell National Park (2)	10 plants	<1 ha	PV	<ul style="list-style-type: none"> • disturbance/ destruction (M) • grazing/predation (H) • altered fire regimes (M)
roadside, Strathdownie	1 plant	<1 ha	GS	<ul style="list-style-type: none"> • disturbance/destruction (H) • weed invasion (H) • grazing/predation (H)
Grampians National Park	1 plant	<1 ha	PV	<ul style="list-style-type: none"> • grazing/predation (H)
Lower Glenelg National Park	?	<1 ha	PV	?

Abbreviations: CDC=Coroong District Council; DCLEP=District Council Lower Eyre Peninsula; DTEI=Dept. Transport, Energy & Infrastructure; GS=Glenelg Shire; PLACC=PLACC Port Lincoln Aboriginal Community Council; PLCC=Port Lincoln City Council; PV=Parks Victoria; WS=Wellington Shire

Decline and Threats

Although *Thelymitra epipactoides* remains widely distributed, it has suffered a substantial decline and range and abundance. Much of its habitat, especially in South Australia and western Victoria, has been cleared for agriculture, while heathy habitat in coastal areas has been cleared for residential development. There are historical records of *T. epipactoides* close to Melbourne (Epping and Beaumaris), but these populations were lost decades ago. In the south-east of South Australia, thousands of plants were observed flowering after the native vegetation was rolled and burned during land clearing operations there in the 1960s (NOSSA 2009), but these populations were subsequently lost when pasture or crops were sown. Plants have not been seen at the Lower Glenelg NP site for about 15 years, while the population in Mocambar Forest Reserve declined from about 60 plants to just 10 plants. At 13 locations on the Eyre Peninsula, plants have not been seen for several years, and it is not known if populations still persist there. Remaining populations are mostly small (<20 plants) and highly fragmented. About 30 populations contain 20 or fewer plants. Many populations on the Eyre Peninsula occur on roadsides, where they are at great risk. Low genetic diversity and inbreeding is a risk for many South Australian populations, especially on the Eyre Peninsula (K. Pobke, pers. comm.). There is a high risk of extinction of many populations due to the tiny population sizes and the highly fragmented distribution. It is likely that the conditions for maintenance of the pollinator and/or mycorrhizal fungi have been adversely affected at some sites, especially as pollination in very small populations is almost non-existent (NOSSA 2009). Remaining populations of *T. epipactoides* face a variety of current and potential threats, including:

Grazing

Grazing by kangaroos and rabbits/hares is a serious threat at the Lake Mundi WR, Port Campbell NP (1), Blond Bay WR, Kiata FFR (now fenced), Gippsland Lakes CP (now fenced), Coorong NP, Tilley Swamp CP, Coonalpyn HA, Murray Bridge, Taillem Bend private property 1 and Bay of Islands NP sites. Eyre Peninsula populations are grazed by kangaroos, sheep, snails and caterpillars (K. Pobke pers. comm.).

Weed invasion

A large variety of weed species are an existing or potential problem at most sites, with Bridal Creeper *Asparagus asparagoides* and/or Perennial Veldt Grass *Erharta calycina* at the Wanilla and Wangary populations on the Eyre Peninsula, Tilley Swamp CP, Coonalpyn HA, Meningie, Murray Bridge, Culburra private property, Reedy Well Water Reserve and Tailern Bend private property 1 sites, Wild Turnip *Brassica rapa* var. *silvestris* at the Coorong NP site, Capeweed *Arctotheca calendula* at the Murray Bridge site, Monterey Pine *Pinus radiata*, Gazania *Gazania* sp., African Boxthorn *Lycium ferocissimum* and Flame Caper *Euphorbia terracina* at the Meningie site, Monterey Pine at the Mocambar FR site, Ragwort *Senecio jacobaea* and pasture grasses at the Bay of Islands NP site, Dogwood *Cassinia* sp. and Onion Grass *Romulea rosea* var. *australis* have appeared in large numbers since the last fire at the Port Campbell NP (1) site.

Disturbance/destruction

There is potential for accidental disturbance to or destruction of plants and/or habitat at many sites. There is the risk of accidental trampling or destruction of plants by road/track maintenance activities at the Port Campbell NP (1) and Roadside (Golden Beach & Strathdownie) sites and most populations on the Eyre Peninsula. Rubbish dumping has occurred in the vicinity of the Golden Beach roadside site. There is a risk of grazing or accidental trampling resulting from illegal stock grazing or escapees from surrounding farmland at the Bay of Islands NP site. There is a risk of accidental trampling or removal of flower spikes if a proposed walking track passes through the Port Campbell NP (1) site. Alterations to current hydrology have the potential to adversely affect populations at the Lake Mundi WR, Golden Beach roadside, Blond Bay WR, and Gippsland Lakes CP sites. Plants from some populations have been illegally picked.

Altered fire regimes

Populations growing in dense heathy habitats probably rely on periodic summer wildfire to initiate flowering by temporarily reducing competition. Too frequent fire or fire at the wrong time, especially in spring, could damage plants and/or habitat. Absence of fire may mean reduced opportunities for flowering, seed production and establishment of new plants.

Climate variation

The flowering period of *T. epipactoides* has been cut short by severe hot north winds on Eyre Peninsula in recent years (first recorded Oct & Nov 2006) (K. Pobke pers. comm.). Flowers have been observed opening once or twice and then wilting and shrivelling, instead of the traditional multiple reopening and closing of flowers throughout the flowering season. This renders the flowers unavailable for pollination and effectively finished for the year. Such interference in plant life cycle has been recorded in below average and above average rainfall years now, but seems more pronounced in below average drought years and in populations that persist in fragmented habitat.

Current Conservation Measures

A number of measures for the conservation of *T. epipactoides* have been undertaken, including:

- Demographic monitoring of the Gippsland Lakes CP, Blond Bay WR, Bay of Islands NP and Tilley Swamp CP sites, and current status monitoring at all other sites.
- Fencing and/or caging of plants at the Gippsland Lakes CP, Kiata FFR, Blond Bay WR, Coorong NP, Meningie Parklands and Tilley Swamp CP sites to protect them from grazing/disturbance.
- Weed control in the vicinity of the Tilley Swamp CP site.
- Hand pollination of flowers at some Eyre Peninsula sites in 2009 (DEH permit # 25744-1).
- Genetic testing of Eyre Peninsula and South East South Australia populations (unpublished results, Ottewell 2009).
- Collection of seed for long-term storage.
- Ecological burning at the Port Campbell NP (1) and Mocambar FR sites in autumn 2003 and 2007 respectively, to stimulate *T. epipactoides* flowering.
- Periodic slashing of the Gippsland Lakes CP site to stimulate flowering.
- Research into the ecology and pollination biology of *T. epipactoides* (Calder *et al.* 1989; Cropper & Calder 1990).
- Monitoring of population numbers and reassessment of threats undertaken for the Upper South East (SA) populations (Davies 2009).
- Prior to the implementation of a proposed change in the hydrological regime for Messent Conservation Park, a survey for *T. epipactoides* was conducted in areas that may be inundated (Cutten & Squires 2002). Since no *T. epipactoides* were recorded in the area surveyed, potential

flooding regimes were suggested for the area. Following a wildfire in the Park in 2002, another survey for *T. epipactoides* was undertaken (Cutten & Squires 2003).

- A Regional Recovery Plan was written for nine nationally threatened plant taxa in the SA Murray Darling Basin NRM Region, including *Thelymitra epipactoides* (Obst 2005).
- Preparation of a fact sheet for the SAMDB Region, hosted on the Department for Environment and Heritage website, http://www.environment.sa.gov.au/biodiversity/pdfs/metallic_sunorchid.pdf
- The recently formed Friends of Meningie Parklands Group has commissioned a management plan for the parklands and undertaken control of Gazanias, African Boxthorn and Monterey Pines

***Thelymitra gregaria* D.L. Jones & M.A. Clem. Basalt Sun-orchid**

Description

The Basalt Sun-orchid *Thelymitra gregaria* has a single dark green, linear-lanceolate, channelled basal leaf to 15 cm in length, and a slender dark green stem to 20 cm tall, with 1–6 flowers to 30 mm across, colour varying from dark blue to purplish, with darker veins, the column bluish with a curved, hooded black or brownish post-anther lobe, yellow apex and white hair tufts. The species has a distinctive, clump-forming habit. Flowering occurs in October and November (description from Backhouse & Jeanes 1995, as *Thelymitra* sp. aff. *nuda*).

Little is known of the biology or ecology of *T. gregaria*. Pollination occurs through simple food deception and, like many other sun-orchids, the species is probably capable of self-pollination as well (Jones 2006).



Thelymitra gregaria Caramut, Vic © Gary Backhouse

Distribution

Thelymitra gregaria is endemic to a limited area in south-western Victoria, in the Victorian Volcanic Plain IBRA bioregion (Figure 19). Maps showing the distribution of *T. gregaria* are available from DSE.



Figure 19. Distribution of *Thelymitra gregaria*

Habitat

Thelymitra gregaria occurs in open species-rich native grassland dominated by *Themeda triandra* with perennial herbs and lilies on poorly drained red-brown basalt soils, often at sites with embedded basalt boulders. The sites form part of the 'Natural Temperate Grassland of the Victorian Volcanic Plain', which is a critically endangered ecological community under the EPBC Act, and the 'Western (Basalt) Plains Grasslands Community' which is listed as a threatened ecological community under the FFG Act. Recovery actions include the identification of habitat critical to the survival of the species.

Population Information

Thelymitra gregaria is known from eight populations containing about 3,000 plants (Table 10).

Table 10. Population and threat information for *Thelymitra gregaria*

Location	Size	Extent	Manager
roadside, Caramut	>2,000 plants	~20 plants	Moyne Shire
roadside, Woorndoo	~300 plants	<5 plants	Moyne Shire
roadside, Nerrin Nerrin	~300 plants	<5 plants	Ararat Shire
Whitcliffe	~100 plants	<5 ha	Ararat Shire
roadside, Derrinallum	~100 plants	<5 plants	Corangamite Shire
roadside, Eucumbene	~100 plants	<20 plants	Moyne Shire
roadside, Vite Vite	~100 plants	<5 plants	Corangamite Shire
Yalla-Y-Poora Grassland Reserve	~50 plants	<1 ha	Parks Victoria

Decline and Threats

The original distribution and abundance of *T. gregaria* is not known, but it is highly likely to have been restricted to the native grasslands and grassy woodlands of the western basalt plains. This habitat has been reduced to less than 1% of its original occurrence (CNR 1994, mostly for agriculture, and many populations of *T. gregaria* have undoubtedly been lost. There has been extensive loss of grasslands and grassy woodlands in south-eastern Australia, such that these are now some of Australia's most threatened ecosystems (Kirkpatrick *et al.* 1995). Remaining populations are mostly small and all are restricted to tiny remnant patches of habitat, often in highly tenuous locations such as roadsides. There is a high risk of extinction due to the small population size at most sites and the highly disjunct distribution of the species. It is possible that some ecological functions such as conditions for the maintenance of pollinator and fungal activity have been adversely affected at these remnant sites. Remaining populations of *T. gregaria* are at risk from a variety of current and potential threats, including:

Disturbance/destruction

Accidental disturbance to or destruction of plants and habitat from vehicle and stock movement and road/utilities installation and maintenance activities is a serious ever present risk at all sites, despite some populations being sign-posted. Soil disturbance facilitates weed invasion and establishment, with weeds readily colonizing disturbed sites.

Weed invasion

Weed invasion, especially by pasture grasses and other weeds such as *Phalaris aquatica*, *Romulea rosea* and *Cuscuta dubia* is a major recurring problem at all sites, especially sites suffering soil disturbance or with the prolonged absence of fire.

Altered fire regimes

Thelymitra gregaria probably requires periodic fire to reduce accumulation of grasses, especially Kangaroo Grass, which otherwise may suppress growth if grass swards become too dense.

Grazing

Grazing by introduced herbivores (rabbits/hares) is a minor threat at several locations, while invertebrate predation on seed capsules also occurs. Grazing and trampling by stock is a potential threat if stock are moved along roadsides containing the species.

Current Conservation Measures

A number of measures for the conservation of *T. gregaria* have been undertaken, including monitoring annually at all sites and collection and long-term storage of seed from several populations.

***Thelymitra hiemalis* D.L. Jones & M.A. Clem. Winter Sun-orchid**

Description

The Winter Sun-orchid *Thelymitra hiemalis* has a single dark green, linear-lanceolate, channelled basal leaf to 15 cm in length, and a slender dark green stem growing to 35 cm tall, with 1–4 flowers to 30 mm across that have greenish sepals, spotted pale blue petals and labellum, and a white column with a reddish collar, yellow apex and white hair tufts. Flowering can occur from March to October, although most records have been between June and August (description from Backhouse & Jeanes 1995, as *Thelymitra ixioides* var. *subdifformis*).

Little is known of the biology or ecology of *T. hiemalis*. It has only ever been recorded from very few sites and plants, and on the rare occasions it has been seen in the field, it is often just a single plant. In South Australia, the species is detected about every three years, and is considered possibly a freak development of the common *Thelymitra ixioides* or a related species (NOSSA 2009). *Thelymitra hiemalis* was once known as *T. ixioides* var. *subdifformis*.

Distribution

Thelymitra hiemalis has a wide but apparently sporadic distribution in south-western Victoria and south-eastern South Australia (Figure 20). In Victoria it has recently been recorded near Anglesea (South East Coastal Plain IBRA bioregion) and Portland (Naracoorte Coastal Plain IBRA bioregion) while in South Australia there are records from near Port MacDonnell (Naracoorte Coastal Plain IBRA bioregion) and Mount Crawford and Meadows in the Adelaide Hills (Flinders Lofty Block IBRA bioregion). Maps showing the distribution of *T. hiemalis* are available from DSE (for Victoria) and DEH (for South Australia).

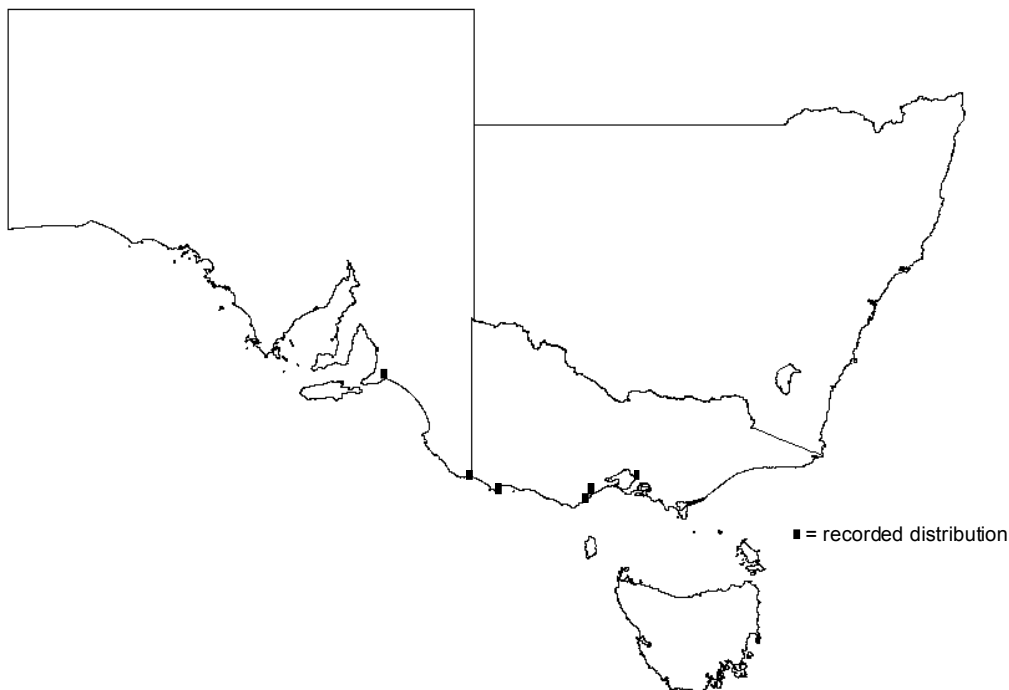


Figure 20. Distribution of *Thelymitra hiemalis*

Habitat

Thelymitra hiemalis occurs in *Eucalyptus baxteri* or *Eucalyptus willisii* woodland with an understorey typically dominated by heath species such as *Xanthorrhoea australis*, *Leptospermum myrsinoides*, *Leptospermum continentale*, *Acacia oxycedrus*, *Banksia marginata* or *Pteridium esculentum* on well

drained dark grey loamy sand. Recovery actions include survey and mapping of habitat that will lead to the identification of habitat critical to the survival of the species.

Population Information

Thelymitra hiemalis is currently known from about 10 plants occurring at six locations (Table 11).

Table 11. Population and threat information for *Thelymitra hiemalis*

Location	Size	Extent	Manager	Threats (High Medium Low)
<i>Victoria</i>				
Mount Richmond National Park	3 plants	<1 ha	Parks Victoria	<ul style="list-style-type: none"> • disturbance/destruction (H) • weed invasion (L)
Angahook-Lorne State Park	2 plants	<1 ha	Parks Victoria	<ul style="list-style-type: none"> • disturbance/destruction (H)
Portland (private property)	2 plants	<1 ha	private	<ul style="list-style-type: none"> • weed invasion (M)
Lower Glenelg National Park	1 plant	<1 ha	Parks Victoria	<ul style="list-style-type: none"> • disturbance/destruction (H) • weed invasion (L)
Bats Ridge Flora and Fauna Reserve	1 plant	<1 ha	Parks Victoria	<ul style="list-style-type: none"> • disturbance/destruction (H) • weed invasion (L)
Aireys Inlet (private property)	1 plant	<1 ha	private	<ul style="list-style-type: none"> • disturbance/destruction (L)
<i>South Australia</i>				
Port MacDonnell	?	?	?	
Mount Crawford	?	?	?	
Meadows	?	?	?	

Decline and Threats

Little is known of the historical range or abundance of *T. hiemalis*, but it seems to always have been a naturally rare plant. There are historical records from the south-east of Melbourne and from Port Campbell, which may indicate a decline in distribution and abundance of the species. There are no recent records from South Australia (NOSSA 2009). There is a high risk of extinction due to the tiny population sizes and the highly fragmented distribution. It is likely that the conditions for maintenance of the pollinator and/or mycorrhizal fungi have been adversely affected at some sites. Remaining populations of *T. hiemalis* face a variety of threats including:

Weed invasion

The Lower Glenelg NP, Mt. Richmond NP, Bats Ridge FFR, and Portland private property sites are at risk of Monterey Pine *Pinus radiata* or Coast Wattle *Acacia longifolia* invasion.

Disturbance/destruction

The Mt. Richmond NP, Bats Ridge FFR and Angahook-Lorne SP sites are at risk of accidental destruction caused by track maintenance activities. All populations are highly vulnerable to damage from trampling, and maintaining site confidentiality is important to protecting existing plants.

Current Conservation Measures

A number of measures for the conservation of *T. gregaria* have been undertaken, including monitoring annually at several sites and collection and long-term storage of seed from several populations. There is continuing liaison with the landholders of the Aireys Inlet and Portland private property sites, who have been very supportive of conservation efforts.

***Thelymitra mackibbinii* Muell. Brilliant Sun-orchid**

Description

The Brilliant Sun-orchid *Thelymitra mackibbinii* Muell. has a single slender, basal, channelled, dark green leaf growing to 10 cm long. The erect flower stem grows to 20 cm tall and bears 1–3 purple to pinkish flowers with faint darker stripes, the sepals and petals to 17 mm long, the column has a yellow apex and distinct glandular, incurved lateral lobes lacking hair tufts. Flowering occurs in September and October (description from Backhouse & Jeanes 1995).

Little is known of the biology or ecology of *T. mackibbinii*. Pollination occurs through simple food deception and, like many other sun-orchids, the species is probably capable of self-pollination as well (Jones 2006).

Distribution

Thelymitra mackibbinii is sporadically distributed across central and western Victoria, where it is currently known from only two sites between Stawell and St Arnaud, in the Victorian Midlands IBRA bioregion (figure 21). There is an unconfirmed (and doubtful) record from near Bordertown in South Australia. Maps showing the distribution of *T. mackibbinii* are available from DSE.



Thelymitra mackibbinii Deep Lead, Vic © Mike Duncan



Figure 21. Distribution of *Thelymitra mackibbinii*

Habitat

Thelymitra mackibbinii grows in open forest dominated by *Eucalyptus leucoxyton* and sometimes with *Allocasuarina verticillata*, with a heathy understorey typically consisting of *Acacia paradoxa*, *Acacia*

montana and *Pultenaea largiflorens* on well drained light brown silt with quartz and lateritic lag deposits. Recovery actions include survey and mapping of habitat that will lead to the identification of habitat critical to the survival of the species.

Population Information

Thelymitra mackibbinii is currently known from just two populations: one in Deep Lead Nature Conservation Reserve near Stawell containing 10 plants, and a second at Mt. Bolangum Nature Conservation Reserve near Marnoo containing 12 plants. Both sites are managed by Parks Victoria.

Decline and Threats

The historical range of *T. mackibbinii* is unknown, but it is likely to have been more common in central and western Victoria prior to land clearing. Plants have not been seen at the type location near Maryborough in central Victoria for over 100 years. Other reported occurrences have been near Bendigo, Ballarat and near Bordertown in South Australia (NOSSA 2009), but no plants have been seen in the last decade or so at any of these locations. Much of the woodland habitat of *T. mackibbinii* has been cleared for agriculture, with remaining patches having a long history of disturbance from gold mining and timber harvesting.

Both remaining populations occur in a relatively weed-free habitats, although face a variety of current and potential threats. There is a high risk of extinction due to the tiny population sizes and the highly fragmented distribution. It is likely that the conditions for maintenance of the pollinator and/or mycorrhizal fungi have been adversely affected at some sites. Grazing by native and introduced herbivores is a threat at both sites, with grazing of leaves and seed capsules observed at the Mt. Bolangum site. There is a high potential for disturbance/destruction by off-road vehicles and accidental trampling by people.

Current Conservation Measures

A number of measures for the conservation of *T. mackibbinii* have been undertaken, including monitoring at the Deep Lead and Mt Bolangum sites, and collection and storage of seed.

Recovery Objectives and Actions

Recovery Objectives

The overall objective of recovery is to minimise the probability of extinction of each of the 21 threatened orchid species in the wild and to increase the probability of populations becoming self-sustaining in the long term. Within the duration of this Recovery Plan, the specific objectives for the recovery of the 21 threatened orchid species are to:

1. Determine distribution, abundance and population structure
2. Determine habitat requirements
3. Ensure that all populations and their habitat are protected and managed
4. Manage threats to populations
5. Identify key biological functions
6. Determine growth rates and viability of populations
7. Establish a population in cultivation
8. Establish new populations in the wild
9. Build community support for conservation

Program Implementation and Evaluation

This Recovery Plan guides recovery actions for the 21 threatened orchid species and will be implemented and managed by the Department of Sustainability and Environment (for Victoria), the Department for Environment and Heritage (for South Australia) and the Department of Environment, Climate Change and Water (for NSW), supported by other agencies, educational institutions, regional natural resource management authorities and community groups as appropriate. Technical, scientific, habitat management or education components of the Recovery Plan will be referred to specialist groups on research, *in situ* management, community education and cultivation as required. Contact will be maintained between the State agencies on recovery issues concerning the threatened orchid species. The Recovery Plan will run for a maximum of five years from the date of its adoption under the EPBC Act, and will be reviewed and revised within five years of the date of its adoption.

Recovery Objectives, Actions and Performance Criteria

Action	Description	Species Targeted	Performance Criteria
Specific Objective 1: Determine distribution, abundance and population structure			
1.1	Undertake surveys to determine the area and extent of populations, the number, size and structure of populations, and inference or estimation of population change. Responsibility: DSE, PV, DEH, Albury City	All 21 species	<ul style="list-style-type: none"> For each species, at least five current population sites searched during flowering season (for species with <5 pops; all current population sites searched). Sites mapped for population size, condition and habitat.
1.2	Determine taxonomy of all populations to confirm identity. Responsibility: DSE	<i>Caladenia concolor</i> <i>Caladenia</i> sp. aff. <i>venusta</i> <i>Prasophyllum suaveolens</i> <i>Prasophyllum subbisectum</i> <i>Pterostylis despectans</i> <i>Pterostylis</i> sp. aff. <i>boormanii</i>	<ul style="list-style-type: none"> Taxonomy of all uncertain populations/undescribed species clarified.
Specific Objective 2: Determine habitat requirements			
2.1	Survey known habitat and collect floristic and environmental information relevant to community ecology and condition. Responsibility: DSE, DEH, DECCW	<ul style="list-style-type: none"> All 21 species 	<ul style="list-style-type: none"> Species/habitat specific survey design prepared. Habitat critical to survival mapped for at least three populations for each species (for species with <3 pops; all current population sites mapped).
2.2	Identify and survey potential habitat, using ecological and bioclimatic information that may indicate habitat preference. Responsibility: DSE, DEH, DECCW	<ul style="list-style-type: none"> All 21 species 	<ul style="list-style-type: none"> Survey potential habitat at three sites for each species. Predictive model for potential habitat developed & tested at two sites for each species.
Specific Objective 3: Ensure that all populations and their habitat are protected and managed appropriately			
3.1	Protect populations on public land. Responsibility: DSE, DEH, DoL	<i>Caladenia concolor</i> <i>Caladenia pilotensis</i> <i>Diuris ochroma</i> <i>Prasophyllum fosteri</i> <i>Prasophyllum suaveolens</i> <i>Pterostylis despectans</i> <i>Thelymitra epipactoides</i> <i>Thelymitra gregaria</i>	<p>Public Authority Management Agreements (PAMA), Special Protection Zones (SPZ) or similar in place for the following species & sites:</p> <ul style="list-style-type: none"> PAMA for Harcourt and Tyaak sites; SPZ for Carboor and Castlemaine SF sites; preparation of Fire Management Plan for Nail Can Hill, Albury SPZ for Barambogie SF site. PAMA for Abbeyard roadside site. PAMA for Sheldford roadside site. PAMA for Ballarat reserve and Caramut, Derrinallum, Vite Vite, Woorndoo & Wingeel roadside sites. SPZ for Daisy Hill, Glenmona, Lillicur and Wareek SF sites. PAMA for Golden Beach & Strathdownie roadside sites (Vic); protection agreement for Meningie, Murray Bridge and Tintinara Scrub sites (SA). PAMA for Whitcliffe & Caramut, Derrinallum, Eucumbene, Nerrin Nerrin, Vite Vite & Woorndoo roadside sites.
3.2	Protect populations on private land.		Conservation covenant (CC) or similar private land agreement in place for the

Responsibility: DSE, DEH

Caladenia concolor
Caladenia cruciformis
Prasophyllum hygrophilum
Prasophyllum suaveolens
Pterostylis despectans
Thelymitra epipactoides

Thelymitra hiemalis

following species & sites:

- Barfold, Christmas Hills & Mandurang South private property sites.
- Stuart Mill private property sites.
- Bendigo private property site.
- Darlington private property site.
- Bung Bong, Maryborough (Vic) and Mt. Bryan (SA) private property sites.
- Initiate private land management agreement at Coonalpyn 1 & 2, Meningie, & Tailern Bend 1 & 2 private land sites.
- Aireys Inlet and Portland private property sites.

Specific Objective 4: Manage threats to populations

4.1	Control threats from pest plants. Responsibility: DSE, PV, DEH, DECCW	All 21 species	<ul style="list-style-type: none"> • Measurable reduction in cover of weeds at and near all sites.
4.2	Control threats from pest animals. Responsibility: DSE, PV, DEH, DECCW	All 21 species	<ul style="list-style-type: none"> • Measurable reduction in damage by pest animals at and near all sites.
4.3	Control the threat of direct damage by human activities. Responsibility: DSE, PV, DEH, DECCW	All 21 species	<ul style="list-style-type: none"> • Impact of human activities at all sites monitored and reduced (e.g. by signage, fencing) if required.
4.4	Manage microhabitat for seedling recruitment, collect seed and restock populations with seed. Responsibility: DSE, DEH	All 21 species	<ul style="list-style-type: none"> • Measurable increase in recruitment at three treated sites for each species (for species with <3 pops; all current population sites treated).

Specific Objective 5: Identify key biological functions

5.1	Evaluate current reproductive status, seed bank status, longevity, fecundity and recruitment levels. Responsibility: DSE, DEH, DECCW	All 21 species	<ul style="list-style-type: none"> • Reproductive ecology and regenerative potential quantified for three representative sites for each species (for species with <3 pops; all current populations evaluated). • Seed bank potential quantified for four representative sites.
5.2	Identify key stimuli for seed germination requirements. Responsibility: DSE, DEH, DECCW, RBG	All 21 species	<ul style="list-style-type: none"> • Stimuli for recruitment identified. • Management strategies identified to maintain, enhance or restore processes fundamental to reproduction and survival.
5.3	Identify optimal fire regimes to maintain habitat. Responsibility: DSE, PV	<i>Diuris ochroma</i> <i>Prasophyllum fosteri</i> <i>Prasophyllum suaveolens</i> <i>Thelymitra epipactoides</i> <i>Thelymitra gregaria</i>	<ul style="list-style-type: none"> • Preparation and implementation of management prescriptions for ecological burning at key population sites.

Specific Objective 6: Determine the growth rates and viability of populations			
6.1	Measure population trends and responses against recovery actions by collecting demographic information including recruitment and mortality, timing of life history stages and morphological data. Responsibility: DSE, DEH, DECCW	All 21 species	<ul style="list-style-type: none"> • Techniques for monitoring developed and implemented. • Population growth rates determined and Population Viability Analysis completed for two populations of each species (EXCEPT for <i>Caladenia</i> sp. aff. <i>venusta</i>, <i>Prasophyllum morgani</i>, <i>Prasophyllum suttonii</i>, <i>Thelymitra hiemalis</i> where remaining populations are too small (or the species is extinct) to achieve this).
Specific Objective 7: Establish a population in cultivation			
7.1	Establish a seed bank and determine seed viability. Responsibility: RBG, DECCW	All 21 species	<ul style="list-style-type: none"> • Seed from five populations in storage.
7.2	Establish plants in cultivation to safeguard against destruction of wild populations, provide a research population and potentially for reintroductions. Responsibility: DSE, RBG, NOGN, DECCW	All 21 species	<ul style="list-style-type: none"> • Development of effective propagation and cultivation techniques. • At least 50 healthy, genetically diverse, mature plants in cultivation. • At least 500 seedlings propagated in flasks for translocation to the wild.
Specific Objective 8: Establish new populations in the wild			
8.1	Select and evaluate potential reintroduction sites that are ecologically suitable, have secure land tenure and are managed appropriately. Responsibility: DSE	All 21 species	<ul style="list-style-type: none"> • Criteria for site suitability identified and site selected. • At least one translocation site identified and prepared for each species. • Translocation plan developed and approved.
8.2	Prepare site to achieve maximum survival of plants / germination of seed, using fungal baiting techniques. Responsibility: DSE	All 21 species	<ul style="list-style-type: none"> • Successful fungal baiting, direct seeding, and translocation techniques developed.
8.3	Introduce and monitor plants from cultivation, or seed stock (sow seed and fungus mix directly into the field). Responsibility: DSE	All 21 species	<ul style="list-style-type: none"> • Measurable increase in population size at the site.
Specific Objective 9: Build community support for conservation			
9.1	Identify opportunities for community involvement in the conservation of the 15 threatened orchid species. Responsibility: DSE, PV, DEH, DECCW	All 21 species	Community nature conservation and Landcare groups aware of the species and support its conservation.

Abbreviations: DECCW=Department of Environment, Climate Change and Water (NSW); DEH=Department for Environment and Heritage (SA); DoL = Department of Lands NSW; DSE=Department of Sustainability and Environment (Vic); NOGN=Native Orchid Growers Network; PV=Parks Victoria; RBG=Royal Botanic Gardens, Melbourne

Management Practices

The philosophy of the strategy for recovery is habitat conservation, restoration and management combined with an understanding of the ecological and biological requirements of each threatened orchid taxon necessary for specific population management. The emphasis is on using knowledge to better implement *in situ* management techniques that protect populations and promote regeneration and recruitment. To achieve this, recovery actions are structured to acquire baseline data, assess habitat condition, including ecological and biological function, and maintain or improve population growth through protection and management.

On-ground site management will aim to mitigate threatening processes and thereby insure against extinction. Major threats requiring management include accidental destruction, competition from pest plants, inappropriate fire regimes and grazing by pest animals. A range of strategies will be necessary to mitigate these threats including weed control, caging / fencing, control of pest animals, and fire management. Broad-scale protection measures applicable to all populations include legal protection of sites, habitat retention and liaison with land managers including private landholders. In addition, searches of known and potential habitat should continue to better define the distributions and size of populations.

The recovery plan also advocates strategies to fill some of the major gaps in our knowledge to date. These include an understanding of seed bank dynamics and recruitment. Successful *in situ* population management will be founded on understanding the obligate relationships between each threatened orchid taxon and associated flora, as well as its response to environmental processes. These are directly linked to seed production, recruitment and regeneration and are thus vital to recovery. A demographic census will be necessary to gather life history information and to monitor the success of particular management actions. In addition to the above, *ex situ* conservation measures will be required and will include seed storage and plant cultivation. Cultivating *ex situ* populations will also aim to increase the amount of seed available for reintroduction to sites. Translocation of cultivated plants will be considered only where there is a high chance of success, and where secure sites exist.

Biodiversity Benefits

The recovery plan includes a number of potential biodiversity benefits for other species and vegetation communities in Victoria, South Australia and New South Wales. Principally, this will be through the protection and management of habitat. The adoption of broad-scale management techniques and collection of baseline data will also benefit a number of other plant species growing in association with each threatened orchids, particularly those species with similar life forms and/or flowering responses. Protecting sites of threatened orchids on the western basalt plains of Victoria will also lead to the protection of high value remnants of the threatened ecological community 'Natural Temperate Grassland of the Victorian Volcanic Plain', which supports a variety of nationally threatened animals and more than 20 threatened plants (DEWHA 2008).

The recovery plan will also provide an important public education role as orchids have the potential to act as 'flagship species' for highlighting broader nature conservation and biodiversity issues such as land clearing, grazing, weed invasions and habitat degradation. Germination and cultivation techniques developed during the recovery phase will be of use for other threatened orchids elsewhere in southeast Australia while the requirement to recover taxa across state boundaries will better develop working relationships between state departments on a broader range of biodiversity conservation issues.

Several sites support more than one nationally threatened orchid (and some sites have other nationally threatened flora present) covered by this or other recovery plans, and implementing recovery actions on-site will benefit several species. Locations with more than one threatened orchid include:

- *Caladenia cruciformis* grows with *Caladenia creatcea* at two sites near Stuart Mill.
- *Prasophyllum subbisectum* grows with *Caladenia fulva* at Deep Lead.
- *Prasophyllum fosteri* and *Thelymitra gregaria* occur together at Mt. Mercer.
- *Prasophyllum suaveolens* and *Thelymitra gregaria* occur together at Caramut, Derrinallum, Vite Vite, Woorndoo and Yalla-Y-Poora. *Pimelea spinescens* subsp. *spinescens* is also present at the Wingeel site, while *Leucochrysum albicans* subsp. *albicans* var. *tricolor* is also present at the Woorndoo site.

- *Thelymitra epipactoides* grows with *Prasophyllum frenchii* at Golden Beach, with *Caladenia lowanensis* and *Caladenia tensa* at Kiata and with *Pterostylis cucullata* at the Bay of Islands site.

Affected Interests

The 21 threatened orchids occur across a variety of land tenures, including parks and reserves, public land not specifically reserved for conservation, and private property. Consequently, their management is the responsibility of a range of organisations and individuals, including the Department of Sustainability and Environment (Vic), Parks Victoria, the Department for Environment and Heritage (SA), the Department of Environment, Climate Change and Water (NSW), local councils, local authorities, community groups and landholders (Table 12). The recovery plan has the support of government agencies, statutory authorities and community groups involved in orchid conservation in Victoria, South Australia and New South Wales, who will assist in the management and monitoring of each species. Important community groups include the Australasian Native Orchid Society (Victorian and Geelong groups) and the Native Orchid Society of South Australia.

Table 12. Organisations with a direct interest in the conservation of the 21 threatened orchid species

Species	Management Interest
<i>Caladenia concolor</i>	DSE, PV, DECCW, Albury City, Department of Lands, NSW Nature Conservation Trust; Wangaratta & Murrindindi Shires, landowner
<i>Caladenia cruciformis</i>	DSE, PV, landowner
<i>Caladenia fulva</i>	DSE, PV
<i>Caladenia maritima</i>	DSE, PV
<i>Caladenia pilotensis</i>	DSE, PV, Wangaratta Shire
<i>Caladenia</i> sp. aff. <i>venusta</i>	DSE, PV, Maroondah City
<i>Diuris ochroma</i>	DSE, PV, DECCW, Alpine & Cooma-Monaro Shires, landowner
<i>Prasophyllum fosteri</i>	DSE, Golden Plains Shire
<i>Prasophyllum hygrophilum</i>	DSE, PV, landowner
<i>Prasophyllum morganii</i>	DSE, PV
<i>Prasophyllum niphopedium</i>	DSE, PV
<i>Prasophyllum suaveolens</i>	DSE, PV, Ballarat City, Corangamite, Golden Plains & Moyne Shires, landowner
<i>Prasophyllum subbisectum</i>	DSE, PV
<i>Prasophyllum suttonii</i>	DSE, PV
<i>Prasophyllum uvidulum</i>	DSE, PV
<i>Pterostylis despectans</i>	DSE, PV, DEH, DECCW, LHPA, landowner
<i>Pterostylis</i> sp. aff. <i>boormanii</i>	DSE, PV
<i>Thelymitra epipactoides</i>	DSE, PV, DEH, FSA, Wellington Shire, landowner
<i>Thelymitra gregaria</i>	DSE, PV, Moyne, Ararat & Corangamite Shires
<i>Thelymitra hiemalis</i>	DSE, PV, DEH, landowner
<i>Thelymitra mackibbinii</i>	DSE, PV

Abbreviations: DECCW=Department of Environment, Climate Change and Water (NSW); DEH=Department for Environment & Heritage (SA); DSE=Department of Sustainability & Environment (Vic); LHPA=Livestock Health and Pest Authority (NSW); PV=Parks Victoria

Role and interests of indigenous people

Indigenous communities on whose traditional lands the 21 threatened orchids occur have been advised, through the relevant regional Indigenous facilitator, of the preparation of this Recovery Plan and invited to provide comments and be involved in the implementation of the plan.

Social and Economic Impacts

The implementation of this recovery plan is unlikely to cause significant adverse social and economic impacts. Most populations occur on public land, either crown land reserved for various public purposes, or on road reserves, managed by a variety of local and State government agencies. Any protection measures required at these sites (e.g. fencing, signage, track closures) will have minimal impact on current recreational and commercial activities. Protection of these populations has been negotiated with the relevant land manager. Protection of populations on private land or land managed by other authorities will be achieved through voluntary agreements with landowners and managers.

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Priority, Feasibility and Estimated Costs of Recovery Actions

Action	Description	Priority	Feasibility	Responsibility	Cost estimate					
					Year 1	Year 2	Year 3	Year 4	Year 5	Total
1	Distribution, abundance									
1.1	Surveys	1	100%	DSE, DECC	\$60,000	\$60,000	\$60,000	\$60,000	\$60,000	\$300,000
1.2	Taxonomy	2	100%	DSE, DECC, CPBR	\$20,000	\$20,000	\$20,000	\$0	\$0	\$60,000
2	Habitat requirements									
2.1	Known habitat	1	100%	DSE, DECC	\$100,000	\$100,000	\$0	\$0	\$0	\$200,000
2.2	Potential habitat	2	75%	DSE, DECC	\$0	\$0	\$60,000	\$60,000	\$0	\$120,000
3	Habitat protection									
3.1	Public land	1	100%	DSE	\$0	\$0	\$25,000	\$25,000	\$25,000	\$75,000
3.2	Private land	1	100%	DECC	\$30,000	\$30,000	\$30,000	\$0	\$0	\$90,000
4	Threat management									
4.1	Pest plants	1	90%	DSE, PV, DECC	\$100,000	\$100,000	\$100,000	\$100,000	\$100,000	\$500,000
4.2	Pest animals	1	90%	DSE, PV, DECC	\$50,000	\$50,000	\$50,000	\$50,000	\$50,000	\$250,000
4.3	Human damage	1	90%	DSE, PV, DECC	\$40,000	\$40,000	\$40,000	\$40,000	\$40,000	\$200,000
4.4	Seedling recruitment	1	75%	DSE, DECC	\$60,000	\$60,000	\$60,000	\$60,000	\$60,000	\$300,000
5	Biological functions									
5.1	Reproductive status	2	75%	DSE, PV, DECC	\$50,000	\$50,000	\$50,000	\$50,000	\$50,000	\$150,000
5.2	Seed germination	2	100%	DSE, DECC, RBG	\$0	\$0	\$50,000	\$50,000	\$50,000	\$150,000
5.3	Fire regimes	1	75%	DSE, PV, DECC	\$60,000	\$60,000	\$80,000	\$80,000	\$80,000	\$300,000
6	Population viability									
6.1	Censusing	1	100%	DSE, DECC	\$100,000	\$100,000	\$100,000	\$100,000	\$100,000	\$500,000
7	Cultivation									
7.1	Seed bank	2	75%	DSE, RBG, NOGN	\$15,000	\$15,000	\$15,000	\$15,000	\$15,000	\$75,000
7.2	Cultivated plants	2	100%	RBG	\$0	\$0	\$300,000	\$30,000	\$50,000	\$110,000
8	New populations									
8.1	Site selection	2	75%	DSE, RBG, NOGN	\$0	\$50,000	\$50,000	\$0	\$0	\$100,000
8.2	Site preparation	2	100%	DSE, DECC, RBG	\$0	\$0	\$50,000	\$50,000	\$0	\$100,000
8.3	Reintroduction	2	100%	RBG	\$0	\$0	\$0	\$50,000	\$50,000	\$100,000
9	Community support									
9.1	Community extension	3	100%	DSE, PV, DECC	\$15,000	\$15,000	\$15,000	\$15,000	\$15,000	\$75,000
TOTALS					\$590,000	\$750,000	\$1,155,000	\$835,000	\$695,000	\$3,755,000