National Recovery Plan for the Enigmatic Greenhood *Pterostylis aenigma*



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Summary

The Enigmatic Greenhood is a small terrestrial orchid endemic to the mountains of eastern Victoria, where it is known from just a single site containing fewer than 100 plants. The species is listed as Endangered under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). Although the single population occurs within the Alpine National Park, it is threatened by grazing, weed invasion and sedimentation of habitat following a severe wildfire in 2003. This national Recovery Plan for the Enigmatic Greenhood is the first recovery plan for the species, and details the species' distribution and biology, conservation status, threats, and recovery objectives and actions necessary to ensure its long-term survival.

Species Information

Description and taxonomy

The Enigmatic Greenhood *Pterostylis aenigma* D. L. Jones & M. A. Clem. is a terrestrial, deciduous herb growing to 30 cm tall, with a basal rosette of 3–4 leaves and a large, leafy floral bract. The single, terminal flower is translucent white with green stripes and reddish-brown tonings on the petals and lateral sepals. The dorsal sepal and petals are combined to form a hood-like galea that is erect for three-quarters of its length before curving forward, ending in an obliquely deflexed, pointed tip. The lateral sepals are erect, the free points extending above the galea. Plants are dormant in late summer and early autumn, and emerge from spherical subterranean tubers, probably in mid-late autumn, in response to soaking rains. Flowering occurs in November and December, after which plants die back and become dormant again (description from Jones & Clements 1993; Backhouse & Jeanes 1995).

There is some uncertainty as to the correct taxonomic status of the Enigmatic Greenhood. It was originally described as a species (Jones & Clements 1993). However, there was a suspicion that it may have actually been a naturally occurring hybrid between the Leafy Greenhood *Pterostylis cucullata* and Sickle Greenhood *Pterostylis falcata* (Backhouse & Jeanes 1995), both of which grow near the *P. aenigma* population. The Enigmatic Greenhood is intermediate in appearance between the putative parent taxa, and it was subsequently relegated to hybrid status (Jones 2006). Clarification of the taxonomic status of the Enigmatic Greenhood is an action proposed in this Recovery Plan.

Distribution and population

The Enigmatic Greenhood is endemic to eastern Victoria. It is known from only a single location, about 10 km north of Omeo, at an altitude of 950 m ASL, in the Alpine National Park (Australian Alps bioregion *sensu* DEH 2000).



Figure 1. Distribution of the Enigmatic Greenhood

The population is thought to number fewer than 100 plants, confined to an area of about 0.5 ha. Estimating total population size in this species is difficult, as it cannot be reliably identified when not in flower, due to the presence of other species of *Pterostylis* that have similar-looking basal rosettes. The Enigmatic Greenhood can also reproduce vegetatively by tuber multiplication, so it is not certain how many plants actually represent separate genetic entities.

Maps showing the distribution of the Enigmatic Greenhood are available from the Department of Sustainability and Environment.

Habitat

The Enigmatic Greenhood occurs on a seasonally waterlogged alluvial flat along a small creek within grassy open forest, on grey to brown clay loam soil. The overstorey is dominated by Mountain Swamp Gum *Eucalyptus camphora* subsp. *humeana* with an understorey of Blackwood *Acacia melanoxylon*. The ground layer is dominated by grasses, lilies and sedges, including Tall Mountain Tussock-grass *Poa helmsii*, Fen Sedge *Carex gaudichaudiana*, Tasman flax-lily *Dianella tasmanica* and Mother Shield-fern *Polystichum proliferum*. Inter-tussock species include Forest Buttercup *Ranunculus plebeius*, Prickly Starwort *Stellaria pungens*, Alpine Cotula *Cotula alpina*, Kidney–weed *Dichondra repens*, Self-heal *Prunella vulgaris*, Ivy-leaf Violet *Viola hederacea* and Rough Cranesbill *Geranium* species. Introduced plants include English Broom *Cytisus scoparius*, Sweet Briar *Rosa rubiginosa*, Blackberry *Rubus fruticosus* spp. agg, thistle *Cirsium* species, Yorkshire Fog Grass *Holcus lanatus* and White Clover *Trifolium repens* var. *repens*.

Decline and threats

The Enigmatic Greenhood was only discovered within the last 20 years, and is known from just a single location, so its previous distribution and abundance are not known. Since discovery, the population has always been small, probably fewer than 100 plants, with a peak of 80 flowering plants recorded in 2002. At that time, grazing and weed invasion were considered major threats.

In January 2003, the area was burnt in a severe wildfire. One month later, 80 mm of rain fell on the catchment in just one hour, the downpour washing tonnes of soil from the still bare hillsides into the alluvial flat containing the *P. aenigma* population. Although the site was covered with 20 cm of silt, 50 flowering plants were recorded in December 2003. However, only 10 plants flowered in 2004, and none in the three years since. While the species apparently survived the short-term effects of siltation in the first year, the subsequent decline in flowering on the site. English Broom is the most serious weed threat, with other weeds including Sweet Briar, Blackberry, Yorkshire Fog Grass and White Clover also problematic. Whether the decline in flowering rate represents a real decline in plant numbers is not known. The 2003 wildfire and subsequent heavy rain clearly illustrates the vulnerability of single, small populations to stochastic events.

Grazing from native herbivores (Common Wombat, macropods and possibly invertebrates) is a problem, as flowers and fruits are frequently lost to predation. However, light grazing of the site by native herbivores is likely to be beneficial to the Enigmatic Greenhood, through reduction in competition from grasses, which otherwise quickly develop into dense swards in the absence of grazing.

The species may also be at risk from long-term drying out of its habitat. The extensive eucalypt seedling germination following the 2003 wildfire may alter site hydrology for years to come through increased transpiration leading to greatly reduced run-off. The increased temperatures, increased evaporation rates and decreased rainfall expected to affect south-eastern Australia with climate change brought about by global warming are also likely to lead to further loss of habitat, as the seasonally wet site favoured by the species gradually dries out.

Other potential threats include innappropriate fire regimes and track construction or realignment at the site.

Recovery Information

Existing conservation measures

A number of conservation measures have been undertaken to protect the Enigmatic Greenhood, including:

• Caging of some plants to protect them from grazing.

- Weed control, especially of English Broom, at the site, undertaken by Parks Victoria and assisted by the 'Friends of the Mitta Mitta' community group.
- Erosion control to protect the site from continuing soil movement from the surrounding hills.
- Annual monitoring, undertaken by the the Bairnsdale Field Naturalists Club.
- Searches of nearby suitable habitat (although no new populations have been found).

Strategy for recovery

The first issue to address in recovery of the Enigmatic Greenhood is its taxonomic status, the determination of which may influence subsequent recovery actions. Investigation of ecology of the species, including life history, flowering, fruiting, seed germination, seedling establishment, longevity, length of dormancy, population structure, demography, pollination biology, mycorrhizal relationships and response to fire, is urgently required for recovery management. As the species is known only from a small number of plants at a single location, establishing a population in cultivation for risk management is a high priority. This population will also serve as the basis for establishing new populations in the wild, which will be required for ultimate recovery of the Enigmatic Greenhood.

Recovery objectives

The overall objective of recovery is to minimise the probability of extinction of the Enigmatic Greenhood 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 Enigmatic Greenhood are to:

- Determine taxonomy, distribution, abundance and population structure
- Identify habitat requirements
- Manage threats to populations
- Identify key biological functions
- Determine growth rates and viability of populations
- Establish a population in cultivation
- Establish new populations in the wild
- Build community support for conservation

Program implementation

This Recovery Plan guides recovery actions and will be managed by the Department of Sustainability and Environment. A Threatened Flora Recovery Team, consisting of scientists, land managers and field naturalists will be established to oversee threatened flora recovery in Victoria in general. Technical, scientific, habitat management or education components of the Recovery Plan will be referred to specialist sub-committees on research, *in situ* management, community education and cultivation. Regional Recovery Teams will be responsible for preparing work plans and monitoring progress toward recovery.

Program evaluation

The Recovery Team will be responsible for annual assessments of progress towards recovery. This Recovery Plan will be reviewed within five years of the date of its adoption under the EPBC Act.

Recovery actions, performance criteria and priorities

Action	Description	Performance Criteria	P*				
Specific objective 1: Determine taxonomy, distribution, abundance and population structure							
1.1	Clarify taxonomy using genetic analysis to determine if <i>P. aenigma</i> is a species or natural hybrid.	Determination of taxonomic status.	1				
	Responsibility: RBG						
1.2	Determine the area, extent, number, size and structure of the population, and estimation of population change.	Data on area occupied/number of plants.	2				
	Responsibility: DSE, PV						
Specific	objective 2: Identify habitat requirements						
2.1	Survey habitat and collect floristic and environmental information relevant to community ecology and condition.	Habitat critical for survival identified and defined.	2				
	Responsibility: DSE, PV						
2.2	Identify and survey potential habitat, using ecological and bioclimatic information that may indicate habitat preference.	Predictive model for potential habitat developed and tested.	2				
0	Responsibility: DSE	·					
Specific	objective 3: Manage threats to populations						
3.1	Control pest plants. Responsibility: DSE, PV	Measurable reduction in area and impact of weed infestation.	1				
3.2	Investigate impact of grazing and if required protect plants from predation.	Measurable increase in flowering rate and fruit production.	1				
3.3	Protect site from erosion and soil movement.	No further movement of soil/sediment onto the <i>P. aenigma</i> site.	1				
3.4	Manage microhabitat for seedling recruitment.	Measurable increase in seedling recruitment.	1				
Specific	objective 4: Determine the growth rates and viability of p	opulations					
4 1	Measure population trends/responses against recovery	Population Viability Analysis completed	1				
	actions.	for known population.	·				
Specific	objective 5: Establish a population in cultivation						
Specific			4				
5.1	Responsibility: DSE, PV	collected.	1				
5.2	Establish a seed bank and determine seed viability. Responsibility: RBG	Seed in long term storage and viability determined.	2				
5.3	Establish plants in cultivation to safeguard against decline/extinction and for translocations.	Effective propagation techniques developed, and at least 50 mature plants	1				
	Responsibility: RBG, NOGN	in cultivation.					
Specific	objective 6: Establish new populations in the wild						
6.1	Evaluate and select suitable translocation sites for estbalishing new populations.	Criteria for site suitability identified; at least one suitable site selected;	1				
	Responsibility: DSE, Recovery Team	translocation plan prepared.					
6.2	Prepare site to receive translocated plants. Responsibility: DSE	Site is defined, protected and managed to maximise survival of seeds/plants.	1				
6.3	Introduce and monitor plants.	Survival rate of translocated plants meets	1				
	Responsibility: DSE, BFNC	defined success criteria.					
Specific	objective 7: Build community support for conservation						
7.1	Encourage and facilitate community group involement in the recovery activities.	Community group participation in recovery activites eg. monitoring, threat control.	3				

Abbreviations: BFNC–Bairnsdale Field Naturalists Club; DSE–Department of Sustainability and Environment, Victoria; NOGN–Native Orchid Growers Network; PV–Parks Victoria; RBG–Royal Botanic Gardens, Melbourne

Affected interests

The only known population of the Enigmatic Greenhood occurs within the Alpine National Park, and management of this population is the responsibility of Parks Victoria and the Department of Sustainability and Environment. The Royal Botanic Gardens Melbourne will also be involved in recovery of the species, as well as community groups including the 'Bairnsdale Field Naturalists Club', 'Friends of the Mitta Mitta' and the 'Native Orchid Growers Network'.

Role and interests of Indigenous people

Indigenous communities on whose traditional lands the Enigmatic Greenhood occurs will be advised, through the relevant DSE Regional Indigenous Facilitator, of this Recovery Plan. Indigenous communities will be invited to be involved in the implementation of the Recovery Plan.

Benefits to other species/ecological communities

The recovery plan includes a number of potential biodiversity benefits for other species and vegetation communities in Victoria. 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 *P. aenigma*, particularly those species with similar life forms and/or flowering responses.

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 species across state boundaries will better develop working relationships between state departments on a broader range of biodiversity conservation issues.

Social and economic impacts

The implementation of this recovery plan is unlikely to cause significant adverse social and economic impacts, as the single known location where the species occurs is in a national park. Protection measures for the Enigmatic Greenhood will not impact on current recreational or economic uses of the area.

Management Practices

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, erosion/sedimentation and inappropriate fire regimes. A range of strategies will be necessary to alleviate these threats including protective fencing, weed control, erosion control and fire management. 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 the mechanisms underlying recruitment and regeneration. Successful *in situ* population management will be founded on understanding the relationships between the Enigmatic Greenhood and associated flora, and its response to environmental processes. Demographic censusing will be necessary to gather life history information and to monitor the success of recovery actions.

In addition to the above, *ex situ* conservation measures will be required and will include seed storage and plant cultivation. Translocations to establish new populations will be required for ultimate recovery. Community participation in recovery actions will be sought, particularly in regard to implementation of on-ground works.

Management practices required for conservation of Enigmatic Greenhood include:

- Control of pest plants and animals.
- Investigation of the biology and ecology of the species to enable better targeted conservation management actions.
- Maintenance of ex-situ populations.
- Establishment of new populations at protected sites.

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Estimated	Cost	of	Recoverv	Actions
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Action	Description	Cost \$							
_		Year 1	Year 2	Year 3	Year 4	Year 5	Totals		
1: Det	1: Determine distribution, abundance and population structure								
1.1	Clarify taxonomy	8,000	5,000	0	0	0	13,000		
1.2	Determine area, extent, structure	7,000	7,000	7,000	7,000	7,000	35,000		
2: Ider	ntify habitat requirements	·							
2.1	Survey known habitat	10,000	10,000	0	0	0	20,000		
2.2	Identify & survey potential habitat	0	5,000	10,000	10,000	0	25,000		
3: Mar	nage threats to populations								
3.1	Control pest plants	15,000	10,000	5,000	5,000	5,000	40,000		
3.2	Investigate & control grazing	5,000	2,000	2,000	2,000	2,000	13,000		
3.3	Control erosion	5,000	5,000	2,000	2,000	2,000	16,000		
3.4	Manage microhabitat	5,000	5,000	2,000	2,000	1,000	15,000		
4: Det	ermine growth rates and viability o	of populatio	ns						
4.1	Measure population trends	10,000	10,000	10,000	10,000	10,000	50,000		
5: Esta	ablish a population in cultivation								
5.1	Hand pollinate and collect seed	2,000	2,000	2,000	2,000	2,000	10,000		
5.2	Establish a seed bank	5,000	2,000	1,000	1,000	1,000	10,000		
5.3	Establish plants in cultivation	2,000	2,000	3,000	3,000	3,000	13,000		
6: Esta	ablish new populations in the wild								
6.1	Evalutae & select suitable site	5,000	5,000	0	0	0	10,000		
6.2	Prepare site	0	1,000	5,000	1,000	0	7,000		
6.3	Introduce and monitor plants	0	0	0	5,000	5,000	10,000		
7: Bui	Id community support for conserv	ation							
7.1	Community group involvement	2,000	2,000	1,000	1,000	1,000	7.000		
	Totals	\$81,000	\$73,000	\$50,000	\$51,000	\$39,000	\$294,000		