RECOVERY PLAN FOR

TWENTY-FIVE THREATENED ORCHID TAXA OF VICTORIA, SOUTH AUSTRALIA AND NEW SOUTH WALES

2003 - 2007

Prepared by

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Abbreviations used in the Plan

ACC	Albury City Council
ABG	Albury Botanic Gardens, NSW
ANOS	Australasian Native Orchid Society
COM	Committee of Management
CP	Conservation Park
EH	Department of Environment and Heritage, South Australia
ESP	Endangered Species Program (Natural Heritage Trust)
FAL	Friends of Angahook-Lorne State Park
FOC	Friends of Chiltern Box-Ironbark National Park
GBG	Geelong Botanic Gardens
KES	Knox Environment Society
KPBG	Kings Park and Botanic Gardens, Western Australia
MEG	Montrose Environment Group
MFN	Maryborough Field Naturalists Club
NOGN	Native Orchid Growers Network
DSE	Department of Sustainability and Environment, Victoria
DSE – Forests	DSE, Forests Service Division
DSE– NE	DSE, North East Region
DSE – NW	DSE, North West Region
DSE – PFF	DSE, Parks Flora and Fauna Division
DSE – PP	DSE, Port Phillip Region
DSE – SW	DSE, South West Region
NSW DLWC	New South Wales Department of Land and Water Conservation
NSW NPWS	New South Wales National Parks and Wildlife Service
NSW TSCA	New South Wales *Threatened Species Conservation Act* 1995
PFN	Portland Field Naturalists Club
PV	Parks Victoria
RBG	Royal Botanic Gardens, Melbourne
RP	Research Partner
SFN	Stawell Field Naturalists Club
TSN	Threatened Species Network

1. INTRODUCTION

Context

This recovery plan includes 25 nationally threatened orchid taxa from Victoria, South Australia and New South Wales. Twenty of the threatened orchid taxa are endemic to Victoria while two taxa occur in Victoria and New South Wales and three taxa occur in Victoria and South Australia. Nomenclature followed throughout the Recovery Plan is explained below.
Victorian endemics include - *Arachnorchis cruciformis, Arachnorchis fulva, Arachnorchis pilotensis, Arachnorchis* sp. aff. *venusta* (Kilsyth South), *Petalochilus maritimus, Corysanthes* sp. aff. *diemenicus* 1 (Coastal), *Prasophyllum fosteri*, *Prasophyllum* sp. aff. *frenchii* 2/*Prasophyllum frenchii*, *Prasophyllum morganii*, *Prasophyllum* sp. (Nagambie), *Prasophyllum niphopedium*, *Prasophyllum* sp. (Shelley), *Prasophyllum suaveolens*/*Prasophyllum* sp. aff. *suaveolens, Prasophyllum subbisectum, Prasophyllum suttonii*, *Pterostylis* sp. aff. *boormanii*, *Thelymitra gregaria, Thelymitra hiemalis, Thelymitra arenaria* and *Thelymitra mackibbinii*.
Taxa which occur in Victoria and New South Wales are *Arachnorchis concolor* and *Diuris ochroma.*
Prasophyllum fitzgeraldii, Pterostylis despectans and *Thelymitra epipactoides* occur in Victoria and South Australia.
The long term objectives of this project are to minimise the threat of extinction in the wild to 25 nationally threatened orchids of south east Australia and to increase the probability of each taxon becoming self-maintaining through the staged implementation of recovery actions.

Objects of the Environment Protection and Biodiversity Conservation Act 1999

1. To provide for the protection of the environment, especially those aspects of the environment that are matters of national environmental significance; and
2. To promote ecologically sustainable development through the conservation and ecologically sustainable use of natural resources; and
3. To promote the conservation of biodiversity; and
4. To promote a co-operative approach to the protection and management of the environment involving governments, the community, land-holders and indigenous peoples; and
5. To assist in the co-operative implementation of australia's international environmental responsibilities; and
6. To recognise the role of indigenous people in the conservation and ecologically sustainable use of australia's biodiversity; and
7. To promote the use of indigenous peoples' knowledge of biodiversity with the involvement of, and in cooperation with, the owners of the knowledge.

International obligations

None of the taxa covered under this recovery plan is listed under any international agreement. Consequently, the implementation of Australia's international environmental responsibilities is not affected by this plan.
However, the implementation of the Recovery Plan will further support the principles of the following international conventions and agreements:
1992 United Nations Convention on Biological Diversity
1992 Rio Declaration on Environment and Development (Agenda 21)

Affected interests

Parties affected by implementation of the recovery Plan are identified below in sections relating to individual species (Appendix 3). All parties were consulted during recovery plan preparation.

Role and interests of indigenous people

There are no indigenous communities involved in the regions affected by this plan. Therefore no role has been identified for indigenous communities in the recovery of this species. "

Social and economic impacts

The implementation of this Recovery Plan is unlikely to cause significant adverse social and economic impacts.

Nomenclature

Orchid nomenclature follows authorities or references listed below (Table 1). Nomenclature for undescribed taxa in the genera *Arachnorchis* and *Corysanthes* follow the same authority as taxa belonging to the same taxonomic group (Jones *et al*. 2002). For all other taxa referred to in the Recovery Plan, nomenclature follows Ross 2000.

Table 1. Name changes and current nomenclature for taxa included in the Recovery plan.

Current name	Former name	Authority/Reference
Arachnorchis concolor	*Caladenia concolor*	Jones *et al.* (2001)
Arachnorchis cruciformis	*Caladenia cruciformis*	Jones *et al.* (2001)
Arachnorchis fulva	*Caladenia fulva*	Jones *et al.* (2001)
Arachnorchis pilotensis	*Caladenia pilotensis*	Jones *et al.* (2001)
Arachnorchis sp. aff. *venusta* (Kilsyth South)	*Caladenia* sp. aff. *venusta* (Kilsyth South)	Undescribed, see Jeanes & Backhouse (2000)
Petalochilus maritimus	*Caladenia maritimus*	Jones *et al.* (2001)
Corysanthes sp. aff. *diemenicus* 1	*Corybas* sp. aff. *diemenicus*	Undescribed, see Jeanes & Backhouse (2000). Includes populations at Wilsons Promontory National Park and Mornington Peninsula National Park.
Diuris ochroma	*Diuris ochroma*	Jones (1994)
Prasophyllum fitzgeraldii	*Prasophyllum fitzgeraldii*	Ross (2000)
Prasophyllum fosteri	*Prasophyllum fosteri*	Jones (2000)
Prasophyllum sp aff. *frenchii* 2	*Prasophyllum frenchii*	See Jeanes & Backhouse (2000). Includes populations at Yarram, Clyde and Wilsons Promontory National Park.
Prasophyllum morganii	*Prasophyllum morganii*	Jones (2000)
Prasophyllum niphopedium	*Prasophyllum niphopedium*	Jones (2000)
Prasophyllum sp. (Nagambie)	*Prasophyllum* sp. aff. *campestre* (Reedy Lake)	D. Jones, pers. comm.
Prasophyllum sp. (Shelley)	*Prasophyllum canaliculatum*	D. Jones, pers. comm.
Prasophyllum suaveolens, *P.* sp. aff. *suaveolens* (Basalt Plains)	*Prasophyllum suaveolens*	D. Rouse, pers. comm. Includes "clumping" and later-flowering "non-clumping" populations restricted to Western Basalt Plains Grassland.
Prasophyllum subbisectum	*Prasophyllum subbisectum*	Ross (2000)
Prasophyllum suttonii	*Prasophyllum suttonii*	Jones (1998a)
Pterostylis despectans	*Pterostylis despectans*	Ross (2000)
Pterostylis sp. aff. *boormanii*	*Pterostylis* sp. aff. *boormanii*	D. Jones, pers. comm.
Thelymitra epipactoides	*Thelymitra epipactoides*	Ross (2000)
Thelymitra gregaria	*Thelymitra gregaria*	Jones (1998b)
Thelymitra hiemalis	*Thelymitra hiemalis*	Jones (1998b)
Thelymitra mackibbinii	*Thelymitra Xmackibbinii*	Jeanes & Backhouse (2000)
Thelymitra arenaria	*Thelymitra* sp. aff. *nuda* (Laverton)	Widespread and common (Jeanes in prep)

Current Species Status

Eleven of the 25 taxa are listed under the *EPBC Act* 1999. These include one Critically Endangered taxon; six Endangered taxa, and four Vulnerable taxa (Table 2). Preliminary and final assessment of the current conservation status of all 25 taxa according to IUCN Red List criteria (IUCN 2000) criteria have increased this number to 15 Critically Endangered; five Endangered taxa; two Vulnerable taxa; two extinct taxa and one taxon not threatened (Table 2). However, the status of some of these may change with the acquisition of more detailed population data.

Table 2. Current conservation status for taxa listed under the *EPBC Act* 1999, and conservation status of all taxa according to IUCN Red List criteria (IUCN 2000).

(CR = Critically Endangered; E = Endangered; V = Vulnerable; X = Extinct; N/L = Not listed; * = preliminary assessment)

Species name	Conservation status (*EPBC Act* 1999)	Conservation status IUCN (2000)
Arachnorchis concolor	V	CR
Arachnorchis cruciformis	N/L	E*
Arachnorchis fulva	E	CR*
Arachnorchis pilotensis	N/L	CR
Arachnorchis sp. aff. *venusta* (Kilsyth South)	CR	CR
Petalochilus maritimus	N/L	CR
Corysanthes sp. aff. *diemenicus* 1	N/L	CR
Diuris ochroma	V	V
Prasophyllum fitzgeraldii	N/L	V*
Prasophyllum fosteri	N/L	CR
Prasophyllum sp aff. *frenchii* 2	E	E*
Prasophyllum morganii	V	X
Prasophyllum niphopedium	N/L	E*
Prasophyllum sp. (Nagambie)	N/L	CR
Prasophyllum sp. (Shelley)	N/L	CR
Prasophyllum suaveolens, *P.* sp. aff. *suaveolens* (Basalt Plains)	E	CR
Prasophyllum subbisectum	E	CR
Prasophyllum suttonii	N/L	X
Pterostylis despectans	E	E*
Pterostylis sp. aff. *boormanii*	N/L	CR
Thelymitra epipactoides	E	E*
Thelymitra gregaria	N/L	CR
Thelymitra hiemalis	N/L	CR
Thelymitra mackibbinii	V	CR
Thelymitra arenaria	N/L	Not threatened

Distribution and decline

Taxa occur across south-eastern Australia, from the Eyre Peninsula in South Australia to East Gippsland in Victoria, and north to near Albury in New South Wales (Table 3). Populations occur across a wide range of bioregions but are absent from the Victorian Mallee and Riverina bioregions. A comparison of the past and present ranges of taxa show that although most have not experienced a significant range contraction, the number and size of populations has been considerably reduced in all cases and most occur within severely fragmented ecosystems. Population reductions occur across all bioregions and land tenures, with some populations in parks or reserves equally diminished or declining at comparable rates to those on private property or public land not otherwise specifically reserved for conservation.

Habitat requirements and threats

Taxa occur within dry eucalypt forest, heathland, closed scrub and grassland (Table 3). All sites have experienced a range of threats since European settlement, including vegetation clearance, mining, altered fire regimes, habitat damage resulting from recreational use, illegal collection, and the spread of pest plants and animals. Additional threats include inadequate reservation and a poor understanding of management requirements. Some populations may be too small to attract pollinators, or are particularly vulnerable to depletion in the absence of significant recruitment.

The response of populations to disturbance is variable, however few populations have managed to maintain their size as habitats are increasingly depleted as a result of weed invasion, soil erosion, trampling and over grazing by pest animals. Some populations respond well to fire or biomass removal (*eg*. *Thelymitra epipactoides*, *T*. *gregaria*., *Prasophyllum fosteri*, *P*. *frenchii*, *P*. *suaveolens*) and other populations may show similar responses to appropriate disturbance regimes.

Table 3. Current distribution, abundance and habitat of twenty-five threatened orchid taxa in Victoria, New South Wales and South Australia. Specific details are included with species' actions (below).

Taxon	Abundance			Known Distribution		General habitat
	Current known abundance (approximate number of plants)	Current number of known populations	Prior abundance (approximate number of plants)	Current Past (Victorian Bioregions *sensu* NRE 1995; Thackway and Cresswell 1995)	Past (Victorian Bioregions *sensu* NRE 1997; Thackway and Cresswell 1995)	Current
Arachnorchis concolor	< 75	10	Unknown, but likely to have been many hundreds	North-east and southern central Victoria and southern NSW *Northern Inland Slopes; Central Victorian Uplands; NSW South Western Slopes*	Scattered across central and eastern parts of the goldfields between Albury and the Loddon River *Northern Inland Slopes; Central Victorian Uplands; Goldfields; NSW South Western Slopes*	Open grassy or heathy forests and woodlands, on gravelly, well drained sand and clay loams (Backhouse & Jeanes 1995).
Arachnorchis cruciformis	< 150	3	Unknown, but likely to have been many hundreds	Western central Victoria near Maryborough *Goldfields*	Western central Victoria near Maryborough *Goldfields*	Heathy forest in grey-brown sandy loam (Jones 1999).
Arachnorchis fulva	< 500	4	Unknown, but likely to have been many thousands	Western central Victoria near Stawell *Goldfields*	Western central Victoria near Stawell *Goldfields*	Flat or gently sloping terrain in woodlands on gravelly clay loams (Carr 1991, Jones 1991 as *Caladenia demissa*).
Arachnorchis pilotensis	< 5	2	Unknown, but likely to have been < 500	North-east Victoria near Beechworth. *Northern Inland Slopes*	North-east Victoria near Beechworth. *Northern Inland Slopes*	Woodland on grey, well drained gravelly loam derived from granite (Jones 1999).
Arachnorchis sp. aff. *venusta* (Kilsyth South)	< 25	1	Unknown, but likely to have been many hundreds	East of Melbourne at Kilsyth South. *Gippsland Plain*	East of Melbourne at Kilsyth South. *Gippsland Plain*	Grassy open forest.
Petalochilus maritimus	< 500	1	Unknown, but likely to have been many hundreds	Southern Victoria south-west of Melbourne. *Otway Plain*	Southern Victoria south-west of Melbourne. *Otway Plain*	Heathy low open forest on dark grey sandy loam (Jones 1999).
Corysanthes sp. aff. *diemenicus* 1	< 500	2	Unknown, but likely to have been many thousands prior to habitat clearance	Southern Victoria at Wilsons Promontory and south-east of Melbourne at Cape Schank *Gippsland Plain; Wilsons Promontory*	Southern Victoria at Wilsons Promontory and south-east of Melbourne at Cape Schank *Gippsland Plain; Wilsons Promontory*	Closed scrublands in swamps and along water-courses in moist, black, peaty, alkaline soils (Backhouse & Jeanes 1995).

Table 3. Current distribution, abundance and habitat of twenty-five threatened orchid taxa in Victoria, New South Wales and South Australia. Specific details are included with species' actions (below).

Taxon	Abundance			Known Distribution		General habitat
	Current known abundance (approximate number of plants)	Current number of known populations	Prior abundance (approximate number of plants)	Current Past (Victorian Bioregions *sensu* NRE 1995; Thack way and Cresswell 1995)	Past (Victorian Bioregions *sensu* NRE 1997; Thackway and Cresswell 1995)	Current
Diuris ochroma	< 3,000	10	Unknown, but likely to have been many thousands	Central Gippsland at Wonnangatta Valley SE New South wales at Kybean *Highlands-Southern Fall (Victoria)* *South East Highlands (NSW)*	Central Gippsland at Wonnangatta Valley SE New South wales at Kybean *Highlands-Southern Fall (Victoria)* *South East Highlands (NSW)*	Montane herbfield on silty clay to peaty soils (Jones 1994).
Prasophyllum fitzgeraldii	< 250 (Vic) Thousands (SA)	3 (Vic) Numerous (SA)	Unknown, but likely to have been many thousands prior to habitat clearance	Western central Victoria near Stawell, Maryborough, and the Grampians. Scattered across southern South Australia. *Goldfields, Eyre Yorke Block, Murray darling Depression, Flinders Lofty Block*	Western central Victoria near Stawell, Maryborough, and the Grampians. Scattered across southern South Australia. *Goldfields, Eyre Yorke Block, Murray darling Depression, Flinders Lofty Block*	Heathy woodland or heathy open forest on well-drained, gravelly, sand and clay loams (Backhouse & Jeanes 1995).
Prasophyllum fosteri	< 20	1	Unknown, but likely to have been many thousands prior to habitat clearance	Western Victoria, west of Geelong *Victorian Volcanic Plain*	Western Victoria, west of Melbourne *Victorian Volcanic Plain*	Tussock grassland on rich, water-retentive red-brown soils derived from basalt (Jones 2000).
Prasophyllum sp aff. *frenchii* 2	250 – 750	4	Unknown, but likely to have been many thousands prior to habitat clearance	Southern Victoria, south-east of Melbourne at Clyde, Yarram and Wilsons Promontory *Gippsland Plain; Wilsons Promontory*;	Southern Victoria, south-east of Melbourne at Clyde, Yarram and Wilsons Promontory; East Gippsland near Bairnsdale and Mallacoota *Gippsland Plain; Wilsons Promontory; East Gippsland Lowlands*	Grasslands, grassy woodlands and heathlands on moderately rich sandy and black clay loams (Backhouse & Jeanes 1995).

Table 3. Current distribution, abundance and habitat of twenty-five threatened orchid taxa in Victoria, New South Wales and South Australia. Specific details are included with species' actions (below).

Taxon	Abundance			Known Distribution		General habitat
	Current known abundance (approximate number of plants)	Current number of known populations	Prior abundance (approximate number of plants)	Current Past (Victorian Bioregions *sensu* NRE 1995; Thackway and Cresswell 1995)	Past (Victorian Bioregions *sensu* NRE 1997; Thackway and Cresswell 1995)	Current
Prasophyllum morganii	0	0	Unknown, but likely to have been < 100	Eastern highlands near Cobungra *Highlands-Southern fall*	Eastern highlands near Cobungra *Highlands-Southern fall*	Open Snow gum forest (Backhouse & Jeanes 1995).
Prasophyllum niphopedium	200 - 500	5	Unknown, but likely to have been < 1000	North-eastern Victorian highlands at the Cobberas *Victorian Alps*	North-eastern Victorian highlands at the Cobberas *Victorian Alps*	Alpine heath and snow plains, usually near watercourses on peaty loams(Backhouse & Jeanes 1995).
Prasophyllum sp. (Nagambie)	1,500 – 3,000	1	Unknown, but likely to have been many more thousands	Central Victoria near Nagambie *Goldfields*	Central Victoria near Nagambie and near Bendigo *Goldfields*	Sedgy or grassy woodlands seasonally inundated on water-retentive sand and clay loams (Backhouse & Jeanes 1995).
Prasophyllum sp. (Shelley)	< 15	1	Unknown, but likely to have been < 250	North-east Victoria *Highlands-Northern Fall*	North-east Victoria *Highlands-Northern Fall*	Winter-wet open riparian grassland.
Prasophyllum suaveolens, *P.* sp. aff. *suaveolens* (Basalt Plains)	< 300	5	Unknown, but likely to have been many thousands	Western Victoria, west of Geelong *Victorian Volcanic Plain*	Western Victoria, immediately west and south-west of Melbourne *Victorian Volcanic Plain; Central Victorian Uplands*	Grassland on poorly drained red-brown basalt loam (Jones 1994).
Prasophyllum subbisectum	< 75	3	Unknown, but likely to have been many hundreds	Central western Victoria near Stawell. *Goldfields*	Central western Victoria near Stawell and the Grampians. *Goldfields; Greater Grampians*	Heathy woodland and heathy open forest on gravelly clay loams(Backhouse & Jeanes 1995).
Prasophyllum suttonii	0	0	Unknown, but likely to have been < 250	Mt Buffalo *Victorian Alps*	Mt Buffalo *Victorian Alps*	Unknown

Table 3. Current distribution, abundance and habitat of twenty-five threatened orchid taxa in Victoria, New South Wales and South Australia. Specific details are included with species' actions (below).

Taxon	Abundance			Known Distribution		General habitat
	Current known abundance (approximate number of plants)	Current number of known populations	Prior abundance (approximate number of plants)	Current Past (Victorian Bioregions *sensu* NRE 1995; Thackway and Cresswell 1995)	Past (Victorian Bioregions *sensu* NRE 1997; Thackway and Cresswell 1995)	Current
Pterostylis despectans	< 1500	5	Unknown, but likely to have been many thousands	Central Victoria near Maryborough and Northern Lofty near and west of Mt Bryan *Goldfields (Vic) and Flinders Lofty Block (SA)*	Central Victoria near Maryborough and Northern Lofty near and west of Mt Bryan *Goldfields (Vic) and Flinders Lofty Block (SA)*	Open forests and woodlands (Backhouse & Jeanes 1995).
Pterostylis sp. aff. *boormanii*	< 50	3	Unknown, but likely to have been many hundreds	North-east Victoria near Beechworth *Northern Inland Slopes*	North-east Victoria near Beechworth *Northern Inland Slopes*	Woodland on well-drained granitic sand and clay loams (Jeanes & Backhouse 2000).
Thelymitra epipactoides	< 3000	8	Unknown, but likely to have been many thousands	Scattered across south-eastern Australia from the Eyre Peninsula (SA) to East Gippsland west of Bairnsdale (Vic) *Warrnambool Plain; Wimmera; Gippsland Plain, Glenelg Plain, Goldfields, Murray Darling Depression, Eyre Yorke Block, Naracoorte Coastal Plain*	Scattered across south-eastern Australia from the Eyre Peninsula (SA) to East Gippsland west of Bairnsdale (Vic) *Warrnambool Plain; Wimmera; Gippsland Plain, Glenelg Plain, Goldfields, Murray Darling Depression, Eyre Yorke Block, Naracoorte Coastal Plain*	Primarily in mesic coastal heathlands, grasslands and woodlands, but also in drier inland heathlands, open forests and woodlands. (Backhouse & Jeanes 1995).
Thelymitra gregaria	< 1500	5	Unknown, but likely to have been many thousands	Western Victoria, west of Geelong *Victorian Volcanic Plain*	Western Victoria, immediately south-west of Melbourne *Victorian Volcanic Plain*	Tussock grasslands on rich, water-retentive red-brown soils derived from basalt (Backhouse & Jeanes 1995, Jones 1998b).
Thelymitra hiemalis	< 10	5	Unknown, but likely to have been many hundreds	South-west Victoria near Portland *Glenelg Plain*	South-west Victoria near Portland and immediately east of Melbourne at Blackburn *Glenelg Plain; Gippsland Plain*	Damp heath and heathy woodland (Backhouse & Jeanes 1995)
Thelymitra mackibbinii	< 30	3	Unknown, but likely to have been many thousands	Western goldfields near St Arnaud and Stawell *Goldfields*	Central and western goldfields near Stawell, St Arnaud and Maryborough *Goldfields*	Woodland and open forest (Jeanes & Backhouse 2000).
Thelymitra arenaria	Widespread	Numerous	Numerous	Widespread	Widespread	Grassland, woodland, open forest and heathland (Jeanes in prep.).

Existing conservation measures

A wide range of conservation measures are currently underway. Activities include monitoring; searches for new populations; biomass reduction (ecological burning or slashing); PAMA's prepared; fencing; pest plant control; track closures; habitat monitoring; community liaison; hand pollination and seed collection; seed germination trials; trials to culture mycorrhizal fungi. Some of these activities have been in place for up to 10 years (*eg*. demographic censusing of *Thelymitra epipactoides* populations).

Representation in conservation reserves varies from well represented to not reserved. Taxa are considered reserved if they are contained within reserves established with a primary aim of nature conservation as defined by the former Victorian Land Conservation Council. Reserves which qualify under this definition include Reference Areas, National and State Parks, Flora Reserves, Flora and Fauna Reserves, Wildlife Reserves, Wildlife Management Cooperative Areas, Streamside Reserves, Bushland Reserves, Multipurpose Parks and Education Areas. In addition, Conservation Parks in South Australia are also included as reserved areas.

A number of new parks and reserves have been recommended within Box-Ironbark vegetation (ECC 2001), which will secure legal protection for some of the 25 orchid taxa, although many of these reserves will still be available for a variety of recreational uses, including bush walking, rally car driving, horse riding dog walking and orienteering. Taxa affected include *Arachnorchis pilotensis*, *A. fulva*, *Pterostylis despectans*, *Prasophyllum fitzgeraldii*, *P. subbisectum* and *Thelymitra mackibbinii*.

Taxa within local government reserves are also considered reserved if the particular reserve has a primary aim of nature conservation and there is a current agreement between local and state governments referring to conservation and management. Taxa occurring on private land protected by a conservation covenant (Victoria) or heritage agreement (South Australia) are also considered reserved. This is in line with current thinking about biodiversity conservation that suggests a range of tenures and protection mechanisms are required to adequately address reservation objectives across bioregions (Bedward *et al.* 1992, Pressey *et al*. 1995).

Benefits to other species/ecological communities

The recovery of the twenty-five threatened taxa has 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 the threatened taxa, particularly those species with similar life forms and/or flowering responses.
All of the threatened orchids occur in highly threatened habitats, such as box-ironbark forests, coastal heathlands, plains grassy woodlands and grasslands and montane/alpine grasslands and herbfields. The identification and implementation of recovery actions will also benefit these threatened habitats where threatened orchids occur.

The recovery of the twenty-five threatened taxa will also form 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 taxa 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.

Links and relationships

The Recovery Plan is in line with priorities under the Victorian Government Natural Heritage Trust Partnership Agreement with the Commonwealth. The implementation of recovery programs for nationally threatened species is a high priority within Victorian Government threatened species conservation programs. Similar priority is given to threatened species in the South Australian and New South Wales Governments' Partnership Agreements with the Commonwealth.
The Recovery Plan is in line with the objectives of the Victorian Biodiversity Strategy (NRE 1997) which aims to ensure that there is no further preventable decline in the viability of any rare species. It also provides baseline long-term monitoring under the Biodiversity Reporting Framework established by DSE as a key process in implementation of the State Biodiversity Strategy. The project also fits in with a number of regional vegetation strategies currently being prepared by Catchment Management Authorities across Victoria, which identify the conservation and management of rare/threatened species as being of high priority. It will also supplement requirements under various state threatened species legislation including the Victorian *Flora and Fauna Guarantee Act* 1988 and the New South Wales *Threatened Species Conservation Act* 1995 that cover issues of threat abatement and action planning for threatened species.
Recovery planning for threatened orchids will supplement habitat-based programs such as conservation programs for Box-Ironbark forests in Victoria, and grassland and grassy woodland ecosystems of Victoria, South Australia and New South Wales. It is also closely linked with existing environmental management policies currently being implemented by the Department of Sustainability and Environment and Parks Victoria. These include the preparation of guidelines for ecological burning on public land (Fire Ecology Working Group 1999); Bush Tender; vegetation condition assessments in relation to kangaroo management; Botanic Guardians; Land For Wildlife; Rabbit Busters; Good Neighbour; VrotPop (rare and threatened plant database and monitoring).

Recovery plans have been prepared for *Arachnorchis concolor* (NSW NPWS 2000) and *Pterostylis despectans* (Bickerton and Robertson 2000). The former was prepared under NSW State legislation (NSW *Threatened Species Conservation Act* 1995) and does not include Victorian populations. However, as required under the *EPBC Act* 1999, actions included in this recovery plan are adopted here. Victorian populations of *Pterostylis despectans* are not included in the existing recovery plan as these populations were unknown to the authors at the time of writing. Actions for South Australian populations are adopted here.

Landowner incentives

There are various incentives available to private landowners in Victoria, South Australia and New South Wales. These agreements are developed in consultation with the relevant landowners and designed to meet landowner and conservation objectives. Voluntary, binding nature conservation agreements are available in Victoria under the *Victorian Conservation Trust Act* 1972, the *Conservation Forests and Lands Act* 1987 and the *Wildlife Act* 1975. Threatened flora management by landowners may also be supported with small cash contributions towards management costs by DSE under the Botanic Guardians grants.

Landowners can enter into binding Heritage Agreements in South Australia under the *Heritage Act* 1978. In New South Wales, landowners may enter into Voluntary Conservation Agreements and can negotiate for rate concession with local government authorities. After a negotiated management agreement is reached with the New South Wales National Parks and Wildlife Service, a covenant is created and is passed on with the title to the property.

Monitoring, performance and review

The recovery plan will run for five years from the time of implementation and will be managed by the Department of Sustainability and Environment (Parks, Flora and Fauna Division) and overseen by the Threatened Orchid Recovery Team (TORT), a steering committee consisting of scientists,

land managers and field naturalists (*Action 10.1*). Technical, scientific, habitat management or education components of the Recovery Plan will be referred to specialist sub-committees on cultivation, research *in situ* management and community education for ratification.

Existing regional Recovery Teams will be expanded to facilitate interstate co-operation (*Action 10.2*). Regional Recovery Teams will be responsible for preparing work plans and monitoring progress toward orchid recovery (*Action 10.3*).

Communication - participants and community involvement

Community involvement will continue to be encouraged for all threatened populations. This will include maintaining links with orchid societies and field naturalists where they already exist for particular taxa and building a statewide network of organisations and individuals for the conservation of all taxa.

The Recovery Plan has the support of government agencies, statutory authorities and community groups involved in orchid conservation in Victoria (Parks Victoria; National Herbarium of Victoria; Australasian Native Orchid Society – ANOS; various field naturalists clubs), who will assist in orchid survey and monitoring efforts.

Damage to orchid populations by visitors and illegal collection has occurred in Victoria, South Australia and New South Wales and for this reason community involvement will be restricted to groups and individuals having demonstrated ability and commitment to orchid conservation. Landholders will also be encouraged to protect and manage populations of threatened taxa where these occur on private land.

Tools for implementation

The Recovery Plan draws from the knowledge and experiences accumulated from the Victorian Threatened Orchid Recovery program, which has been proceeding with joint State and Commonwealth support since 1998, with prior State experience dating back to the 1980s.

The Victorian experience in orchid recovery have shown that successful recovery of populations is heavily reliant on sound information practised by a strong and communicative network of organisations and individuals from within State Government, Universities, Botanic and Zoological Gardens and Orchid Societies. To this end, an integrated approach has been developed using a team of talented and committed field naturalists, scientists and on-ground natural resource managers. Examples of the effectiveness of this approach include training landowners, members of nature conservation societies and regional Government agency staff in the implementation of *in situ* techniques such as hand pollination and censusing; the use of molecular techniques to define the genetic relationships of orchids and their mycorrhizae; the development of techniques for cultivation of a wide range of species, and the use of fire to promote regeneration and flowering.

Estimated Cost of Recovery

The Recovery Plan is fully costed to meet recovery objectives, and benefits to biodiversity values are inherent in its whole-habitat management philosophy.

Average cost of recovery is $20,000 per species per year over 5 years. Threatened flora management by community groups and educational institutions may be supported with small cash contributions from DSE under the Botanic Guardians grants. Parks Victoria will provide fencing, weed control, pest animal control and track management at a number of sites supporting threatened orchids. Commitment of regional staff time by DSE and Parks Victoria totals many thousands of hours. Interstate agency staff in SA and NSW will also contribute resources to the recovery plan. Community volunteers will exceed 500 people per year.

Action	2003	2004	2005	2006	2007	Total
1	$35,941	$34,109	$20,000	$20,000	$20,000	**$130,050**
2	$31,875	$42,321	$57,782	$60,202	$66,984	**$259,164**
3	$63,748	$42,321	$0	$0	$0	**$106,069**
4	$159,875	$221,107	$222,880	$110,550	$117,500	**$831,912**
5	$0	$28,214	$31,380	$35,100	$38,492	**$133,186**
6	$20,937	$33,214	$47,070	$70,150	$73,238	**$244,609**
7	$24,937	$35,607	$41,106	$67,406	$64,557	**$233,613**
8	$0	$48,000	$36,332	$59,712	$50,622	**$194,666**
9	$35,937	$45,107	$75,690	$99,150	$107,238	**$378,122**
10	$9,000	$9,000	$9,000	$9,000	$9,0009,000	**$45,000**
Total	**$382,250**	**$539,000**	**$541,240**	**$531,270**	**$547,631**	**$2,541,391**

(Note: the year refers to the financial year, not calendar year ie. 2003 refers to the 12 months from July 2003 until June 2004).

Strategy For Recovery

The strategy for recovery of these orchids is based on habitat protection and enhancement combined with an understanding of the ecological and biological requirements of the threatened orchids necessary for specific population management. The framework for information acquisition is based on the approach outlined by the Australian and New Zealand Environment and Conservation Council an Biological Diversity Advisory Committee (2001). 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 (i) acquire baseline data, (ii) assess habitat condition including ecological and biological function, and (iii) protection to maintain or improve population growth.

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, fire management, fencing, and control of pest animals.

The strategy includes tested techniques where there is strong evidence to indicate a high level of reliability and effectiveness. For example, there have been excellent results using on ground techniques such as fine scale habitat manipulation and direct seeding. Census data have now been used to determine optimal fire frequencies in grassland supporting threatened orchids. Exclusion of pest animals promotes flowering and fruit development, as well as being highly likely to be beneficial for seedling establishment by arresting ground layer disturbance and retaining soil moisture.

Broadscale 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 investigation of new strategies to fill some of the major gaps in our knowledge to date. Most significantly, these include an understanding of mutualistic relationships. Successful *in situ* population management will be founded on understanding the obligate relationships between orchids and their mycorrhizal fungi and pollinators, their relationships with associated flora, and their response to environmental processes. These are directly linked to seed production, recruitment and regeneration and are thus vital to recovery.

Demographic censusing 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 for populations under threat of extinction either at present or in the future (E and CR taxa). Such measures may include storage of seed and mychorrizal fungi, and plant cultivation. Cultivating *ex situ* populations will primarily aim to increase the amount of seed available for reintroduction to sites. Translocation of cultivated plants will be considered only in special cases where there is a high chance of success and where secure sites exist.

A number of taxa included in this plan have only been recently described. Some taxa have been the subject of intensive interest over a number of decades while for other taxa, only basic distribution, habitat and morphological data exist. As a result, the recovery plan details a range of recovery actions considered necessary for the recovery of twenty-five threatened orchid taxa in Victoria and South Australia. Not all actions will be necessary for each taxon, or possible owing to small population size, and the importance of particular actions will vary between populations.

2. OBJECTIVES:

The **overall objective** of recovery is to minimise the probability of extinction of the twenty-five threatened orchid taxa in the wild and to increase the probability of each population of each taxon becoming self-sustaining in the long term.

Within the life span of this Recovery Plan (2003-2007), the specific objectives of recovery for the twenty-five threatened taxa are to:

- Acquire accurate information for conservation status assessments.
- Identify key biological functions.
- Identify important, common and potential habitat.
- Ensure that all existing populations and their habitat are protected and managed appropriately.
- Increase the size of populations in the wild.
- Determine the growth rates and viability of populations.
- Establish populations in cultivation.
- Establish cultivated plants in the wild.
- Build a network of government and non-government organisations and individuals.
- Co-operate in bioregional policy implementation and manage recovery plan implementation.

3. PERFORMANCE CRITERIA

The ***criteria*** for assessing the achievement of the **specific objectives** are:

- Determination or update of conservation status for all taxa for inclusion on state and national threatened species lists
- Preparation of management prescriptions that will maintain, enhance or restore biological relationships fundamental to reproduction and survival.
- Preparation of management prescriptions that will maintain, enhance or restore appropriate habitat.
- Reduce plant mortality due to predation, damage and weed invasion in key populations.
- Increase the number of flowering plants in key populations.
- Establish a private and public land protected area network for threatened taxa.
- Seedling recruitment in all key populations.
- Population Viability Analysis in all key populations.
- Appropriate management strategies in place for all key populations.
- Seed from key populations of all taxa in long term storage.
- Fungal symbionts for Endangered and Critically Endangered taxa in long term storage.
- **Development of effective propagation and cultivation techniques.**
- At least 10 plants of each endangered taxon in cultivation.
- An increase in the size of targeted wild populations by up to 50%.
- Preparation of a technical handbook and video.
- Increased involvement from orchid society members in on-ground works and collection of information.
- Successful funding applications for a PhD scholarship and Postdoctoral fellowship.
- Conduct of regular recovery team meetings and maintainance of regular communication with State and Interstate agencies and organisations and at other times as necessary.
- Preparation of annual work plans for all taxa.

4. ACTIONS

1. Determine current conservation status

Objective:

Acquire accurate information for conservation status assessments.

Performance criterion:

Determination or update of conservation status for all taxa for inclusion on state and national threatened species lists.

1.1 Clarify taxonomy

There are a number of taxa that are poorly delimited and in need of taxonomic clarification before accurate conservation status assessments can be finalised. Some taxa included under *Prasophyllum* are particularly difficult to identify with certainty.

Some taxa or complexes of taxa that are currently subject to taxonomic review, whilst others are in need of clarification or description. Examples include *Arachnorchis concolor, C*. sp. aff. *venusta* (Kilsyth South); *Corysanthes* sp. aff. *diemenicus*; *Prasophyllum suaveolens* (Jones in prep.), *Prasophyllum* sp. (Nagambie) (Jones in prep.); *P. frenchii* (Jones in prep.); *P. canaliculatum* (Jones in prep.); *Pterostylis* sp. aff. *boormanii*; and *Thelymitra* sp. aff. *nuda* (Laverton) (Jeanes in prep.). A new classification has been proposed for the genus *Arachnorchis* (Jones *et al*. 2001) and a number of genera erected, reinstated or raised.

In light of these recent changes or anticipated changes, clarification of the taxonomic status of the above taxa are needed before an accurate determination of their conservation status can be completed.

1.2 Acquire baseline population data

Accurate base line data from detailed surveys is required to determine the current conservation status of various taxa according to IUCN Red List criteria (2000), to guide decision-making as required by the *EPBC Act* 1999 and to prioritise recovery actions. This action will also provide information for the identification of key populations for recovery and will also be a component of developing a sound knowledge base (Actions 3 and 4).

Identify the area of extent and area of occupancy of populations: The geographic range size of populations is a critical component for assessing extinction risk (Keith 2000) and is required to determine current conservation status using IUCN Red List criteria (IUCN 2000). There is a good broad understanding of the current and former ranges of most taxa, especially where herbarium records exist. For others, such as recently described or poorly defined taxa, there is a limited understanding of former and current ranges. The known, potential or projected distributions of populations (extent of occurrence) and the smallest area occupied that is essential to the survival of populations (area of occupancy) will be determined from existing information (Jeanes 2000), field survey and targeted searches.

Estimate the number, size and structure of populations: Decisions relating to risk assessment and recovery are strongly reliant on knowledge of IUCN Red List criteria (IUCN 2000). Current estimates of population sizes are reasonably comprehensive for all taxa (Jeanes 2001; Coates unpub. data; Pritchard unpub. Data; ANOS conservation group unpub. data) but need updating and verifying during flowering seasons. Interim censusing of some populations has already been undertaken as part of the preparation of this recovery plan but further work will be required, particularly if new populations are discovered. In many cases highly accurate data from individual counts will be possible. Alternatively, a random, stratified sampling approach can be used.

Inference and estimation of population change: Where possible, herbarium records, field data held by individuals, VrotPop database records and existing maps will be used to estimate changes in population size and habitat loss as required for conservation status assessments against IUCN Red

List (IUCN 2000) criteria. In some cases (eg *Arachnorchis concolor*, *Thelymitra epipactoides*, *Diuris ochroma*), populations have been censused for 3-10 years and accurate data are available.

***Implementation Action 1*:**

Taxonomic work is currently underway at the Centre for Plant Biodiversity Research Canberra (Jones in prep.) and at the National Herbarium of Victoria (Jeanes in prep.). Completion of the work is expected by 2002 for *Thelymitra* and estimated to be completed by 2007 for remaining taxa.

Survey and collection of baseline information for conservation assessments will be undertaken primarily by two ecologists, with assistance from ANOS members, field naturalists and other volunteers in Victoria, New South Wales and South Australia. Cost estimates below relate to labour and associated expenses to prepare work plans, manage the work, undertake field work, collect, collate and analyse data. Volunteers will be eligible to apply for additional support through the DSE Botanic Guardians grants to cover expenses. Data collection from existing sources such as databases and Herbarium records will be the responsibility of DSE scientific staff.

Year	2003	2004	2005	2006	2007
Total	$35,941	$34,109	$20,000	$20,000	$20,000

2. Investigate population biology

Objective:

Identify key biological functions.

Performance criterion:

Preparation of management prescriptions that will maintain, enhance or restore biological relationships fundamental to reproduction and survival.

Many orchid taxa are known to have mutually dependent relationships with soil fungi for regeneration and with invertebrate pollinators for fertilisation (Cropper & Calder 1990; Rasmussen 1995; Bower 1997-2000). Biological processes fundamental to reproduction and survival need to be identified and conditions to facilitate their functioning included in critical habitat determinations and management prescriptions. Management prescriptions and recovery actions need to consider species' biology to increase the likely success of recovery and to ensure the long term viability of populations.

2.1 Describe life histories

The response of many orchids to management actions is known or suspected to be related to life history strategies, particularly in regard to recruitment. For example *Thelymitra epipactoides* is a disturbance dependent taxon (Calder *et al.* 1989); a reduction in flowering has been recorded in *Prasophyllum* where there have been increased levels of biomass accumulation (Coates & Lunt 2001). Although the life histories of most of the 25 taxa have not been recorded, this information can be readily extracted from population surveys (Action 1) and census data (Action 6). A functional groups classification incorporating morphological and life history traits will be developed for the 25 species. Future analysis will explore whether there is a relationship between functional traits and site attributes. This will contribute to a better understanding of function in relation to environmental factors.

2.2 Evaluate natural pollination levels and/or causes of pollinator limitation

Pollination failure has been observed at a number of threatened orchid populations in Victoria (Todd 2000). Although the reasons are not clear, it is widely believed by orchid enthusiasts that pollinators are absent from populations. Explanations for these disappearances include loss of habitat vital to invertebrate life history stages, pesticide drift, and the general consequences of habitat disturbance. Natural pollination levels will be quantified for all taxa during censusing (Action 6) and pollination levels will be compared between different populations.

Other causes of pollinator limitation, such as size of floral display, nectar reward, density dependent intraspecific competition or competition for pollinators with associated vegetation have not been considered for any Victorian orchids. Many of the 25 taxa appear to regularly set seed, particularly in the genera *Prasophyllum* and *Thelymitra*, and closer examination of population sizes, associated vegetation, habitat and life history traits of these more successful taxa (see Actions 1, 3 and 6) might provide models to understand lack of pollination elsewhere. Research into causes of pollination limitation will be encouraged (Action9.5).

2.3 Determine the effects of artificial pollination on growth, survival and reproduction

At present, a number of threatened orchid populations are hand pollinated in Victoria to maximise seed production. Although hand pollination leads to increased fruit production in the same year, the cost of successive artificial pollinations to plants is not known, although there is evidence in the literature that in some species artificial pollination can result in reduced fruit set in following years (Vitt 2001). This action will investigate changes in reproductive output (capsule size and weight) after varying levels of hand pollination in multi-flowered taxa (*eg*. *Prasophyllum* spp.). Trials will be restricted to a small number of taxa and compared with information gathered as part of the *Caladenia* Recovery plan (Todd 2000) for which implementation is currently underway.

2.4 Determine spatial distribution of mycorrhizal fungi

Expansion of existing wild populations and translocation of cultivated plants to field sites rely on the availability of suitable fungal symbionts for regeneration and recruitment. Seed baiting (Rasmussen & Whigham 1993) is a simple method that can be used to detect the presence of mycorrhizal fungi in the field by burying orchid seeds in the soil and examining them at a later date for infection. It is currently being used successfully in the recovery of orchid populations in Victoria and Western Australia (Batty *et al*. 2000; A. Pritchard unpub. data; Raleigh in prep). This technique will be used to determine the presence and distribution of mycorrhizal fungi at a selected number of sites, where direct seeding and/or translocation is planned, or where seedling recruitment is absent.

2.5 Determine optimal conditions for growth of mycorrhizal fungi *in situ*

Maintaining and promoting soil mycorrhizal fungi is a vital component of habitat management. At present there is no information on fungal habitat requirements or conditions that promote levels of fungal activity.

Soil characteristics will be described from field data (see Action 3) and correlated with infection success from seed baiting trials (above). There is evidence in the literature (Rasmussen & Whigham 1998) and from anecdotal accounts (C. Beardsell pers. comm.) that fungal growth is correlated with increased organic matter, soil moisture, or with increased bryophyte cover. Results will be incorporated in Action 3 (Determining habitat requirements).

Implementation Action 2:

Collection of information will be undertaken primarily by two ecologists, with assistance from ANOS members, field naturalists, and other volunteers in Victoria, New South Wales and South Australia. Cost estimates below are for labour and associated expenses to manage the work, undertake field work, collect, collate and analyse data. Volunteers will be eligible to apply for additional cash funding to the DSE Botanic Guardians scheme to cover expenses. Data collection from existing sources such as databases and Herbarium records will be the responsibility of DSE scientific staff. Specialist research into mutualisms for selected species will be done as part of postgraduate or Postdoctoral work in years 3, 4 and 5 (see Action 9.5), and co-supervised by DSE scientific staff. The techniques adopted will be based on similar work undertaken elsewhere in Australia (Bower 1996) and overseas (Jersakova and Kindlmann 2001; Vitt 2001). Funds are required as leverage for collaborative grant applications to support research scholarships.

Year	2003	2004	2005	2006	2007
Total	$31,875	$42,321	$57,782	$60,202	$66,984

3. Determine habitat requirements of key populations

Objective:

Identify critical, common and potential habitat.

Performance criterion:

Preparation of management prescriptions that will maintain, enhance or restore appropriate habitat.

Broad descriptions of habitat supporting taxa have been compiled during preparation of this recovery plan (Jeanes 2000; Coates unpub. data) but there is no specific information available for identification of critical habitat as required by Section 7.09 of the *EPBC Act* 1999. Neither has there been any systematic assessment of the ecological processes associated with threatened orchid habitats in south-eastern Australia. Knowledge acquired from this action and from Actions 1 and 3 will provide better information necessary for determination of critical, common and potential habitat.

3.1 Identify key populations

From the data collected in Action 1, key populations of threatened taxa will be determined as priorities for recovery. Selection of key populations will be based on population size, habitat condition, likely effectiveness of management actions, and site security. Requisite information will be collected during, but in addition to activities undertaken in Action 1.

3.2 Conduct surveys

Vegetation and environmental characteristics associated with key populations will be surveyed and used to document causes or potential causes of decline, identify disturbance requirements, for designing surveys for potential populations, and to prepare habitat descriptions. Information collected will include associated vegetation composition and condition, species abundance, environmental variables including soil properties, specific threats and site topographic variables. Bioclimatic variables will be derived from site data.

3.3 Identify ecological correlates of key populations

Understanding the functional roles of vegetation and site environmental characteristics are fundamental to the preparation of management prescriptions, particularly in relation to fire and pest animal control. One aim of habitat management is to enhance ecosystem health and to facilitate mutualistic relationships that exist between orchid populations and other organisms. A better understanding of the community ecology of orchid habitat can be achieved by conducting detailed analyses of the environmental attributes of habitats where orchids are abundant, sparse or absent. In particular, analysis of the condition of the ground layer, the role of soil physical properties and the implications for soil moisture retention will be addressed.

3.4 Prepare habitat descriptions

Descriptions of critical, common and potential habitat will be prepared using environmental and bioclimatic data collected from sites supporting key populations, and additional information where required. Criteria for critical habitat will comprise identification of environmental conditions that foster mutualistic relationships between orchids and other organisms that promote flowering, seed set and recruitment.

Implementation Action 3.

Cost estimates below are for labour and associated expenses to develop survey methods and prepare survey plans, coordinate and undertake the collection and analysis of key population assessment and ecological data across Victoria, New South Wales and South Australia. The work will be conducted in conjunction with implementation of Action 1.2 and costs shared between Actions 1 and 3.

Year	2003	2004	2005	2006	2007
Total	$63,748	$42,321	$0	$0	$0

4. Manage risks to populations

Objective:

Ensure that all existing populations and their habitat are protected and managed appropriately

Performance criteria:

Reduce plant mortality due to predation, damage and weed invasion in key populations;

Increase the number of flowering plants in key populations; establish a private and public land protected area network for threatened taxa.

Identification and management of threats is the cornerstone of recovery and management. Threats to most populations have been assessed and more specific information will be recorded during population surveys (Action 3). Predation, ground disturbance and compaction from over-abundant macropod populations, reduced soil moisture resulting from loss of litter and bryophyte cover and disruption to soil drainage are all strongly implicated in population decline but have not been documented although there is evidence from existing recovery programs that grazing pressure from pest animals is a major threat to population survival (Coates and Lunt 2001; DSE unpub. data).

4.1 Identify and implement strategies to control threats

Protection of populations from high-risk threatening processes will require a combination of broad-scale habitat management practices and finer-scale plant protection strategies. Wherever possible, the strategies adopted should aim to complement and support any other nature conservation objectives where these have been clearly defined as part of a current park or site management plan.

Control high-priority weed species. Weed invasions represent a high risk threatening process to a number of populations, and associated indigenous vegetation. Generally, the risk posed by weeds is related to the size of the population, the number of sites at which the taxon is known and the biology, life form and population size of the weed species present.

In some cases, weed control will be achieved by adopting broad-scale habitat management approaches such as the seasonal use of fire. In other cases, target species will need to be controlled using more direct methods including herbicide application and hand-pulling. Weed identification and control plans will be prepared for each key population in the second year of recovery.

Control animal pests and predators: There are a number of animal pests and predators that pose a risk to populations in Victoria, New South Wales and South Australia. Grazing by introduced and over-abundant native herbivores is a significant threat to ground layer vegetation, including the majority of the 25 taxa. Plant protection, using caging or fencing has already been undertaken for some of these taxa. Vegetation condition assessments in relation to kangaroo over-browsing are underway in a number of national parks in Victoria, however small reserves remain vulnerable to the impacts of excessive macropod numbers. Reserves containing particularly vulnerable populations will be brought to the attention of the Parks Victoria's Kangaroo Technical Advisory Committee for inclusion in pest animal management planning.

The threat posed by bird species and invertebrate species will need to be assessed on a site by site basis and control measures undertaken accordingly. Exclusion of slugs and snails using specially designed cages and baits are techniques that have been used for threatened plant species elsewhere in Victoria and these techniques will be adopted where necessary.

Control the likelihood of accidental damage: Recreational use of parks and reserves, as well as unreserved public land pose one of the greatest threats to orchid populations. Closure or re-routing of tracks at a number of sites will direct four wheel drive traffic away from sensitive populations. Walking tracks also need to be realigned in some cases.

4.2 Identify disturbance regimes to promote regeneration and recruitment

The relationship between population resilience and disturbance is also poorly understood. Exceptions are *Thelymitra epipactoides* and *Prasophyllum correctum* where environmental disturbance is known to promote seedling recruitment or flowering (Calder *et al*. 1989; Coates and Lunt 2001). However, the response of populations to fire is poorly known for most taxa but there is evidence that the population biology of some species may be heavily influenced by fire frequencies, season of burning, time since fire and fire intensity (Backhouse and Jeanes 1995).

Draft Guidelines for Ecological Burning on Public Land (Fire Ecology Working Group 1999) have been jointly prepared by Parks Victoria and Department of Sustainability and Environment. Ecological burn plans derived from analysis of vegetation and area fire histories have also been prepared at a number of locations across Victoria by DSE and PV and are suitable for application to sites supporting some threatened orchids, particularly in southwest Victoria.

At other sites, plants are regularly slashed for fuel reduction, grazed by domestic stock and/or pest animals, or experience natural disturbance such as exposure to salt spray. The response of threatened orchid populations to disturbance needs to be assessed on a case by case basis and management adjusted as required. Implementation of this action can be achieved by analysis of survey and census data (Actions 1, 3 and 6).

4.3 Protect key public land populations and habitat

As nationally threatened taxa under the provisions of the **Environment Protection and Biodiversity Conservation Act 1999**, all populations of the twenty-five taxa are legally protected, wherever they occur, under section 18 of that Act. Persons proposing to carry out activities which threaten or are likely to threaten populations of these taxa must refer the proposal to Environment Australia for assessment and possible approval.

All twenty-five taxa are also protected on public land in Victoria under section 47 of the **Flora and Fauna Guarantee Act 1988**. Prior authorisation must be obtained under section 48 to kill, injure, disturb or collect any member of these taxa.

In addition to this legal protection, a number of populations are protected within Victorian parks and reserves. These are *Arachnorchis concolor*, *A. cruciformis*, *A. fulva*, *Petalochilus maritimus*, *A. pilotensis*, *Corysanthes* sp. aff. *diemenicus*, *Diuris ochroma*, *Prasophyllum canaliculatum*, *P. frenchii*, *P. morganii*, *P. niphopedium*, *P.* sp. (Nagambie), *P. suaveolens*, *P. subbisectum*, *P. suttonii*, *P. fitzgeraldii*, *Pterostylis despectans*, *Thelymitra epipactoides*, *T. hiemalis* and *T. mackibbinii*. Where the current level of protection afforded by the reserve is considered inadequate, additional protection will be sought by negotiation with reserve managers.

Protection through the development of formal agreements will be sought for populations on public land reserved for other purposes, such as road and rail reserves. This is of particular importance for populations of *Prasophyllum suaveolens*, *P. frenchii*, *P. fosteri* and *Thelymitra gregaria*.

The Victorian Government has introduced new or expanded conservation reserves in central Victoria as a result of the Environment Conservation Council review of public land use in the Box-ironbark Region. Taxa affected are *Arachnorchis fulva*, *A. pilotensis*, *Prasophyllum fitzgeraldii*, *P. subbisectum*.

Additional public land populations not protected under the above mechanisms will be identified and negotiations initiated for their protection. Potentially threatening processes include timber harvesting, domestic stock grazing and various recreational activities. Solutions include conservation zoning and implementation of management guidelines to deal with issues such as control of gold prospecting, pest plant and animal control and fire management. Identified habitat within commercial forest areas in Victoria will be protected within Special Protection Zones, which remain in perpetuity as long as conservation values are maintained. Taxa affected include *Pterostylis despectans* and *Arachnorchis concolor*.

4.4 Protect key private land populations and habitat

Key populations on private land identified in Action 3.1 will be protected under various private land management agreements. These will be developed in consultation with the relevant landholders and will be designed to meet landholder and threatened orchid recovery planning objectives. Voluntary, binding nature conservation agreements are available in Victoria under the *Victorian Conservation Trust Act* 1972, the *Conservation Forests and Lands Act* 1987 and the *Wildlife Act* 1975 while landholders can enter into binding Heritage Agreements in South Australia under the *Heritage Act* 1978 and in New South Wales as part of Voluntary Conservation Agreements.

Voluntary acquisition is being considered to protect *Arachnorchis* sp. aff. *venusta* (Kilsyth South), which is confined to a single site. Negotiations are currently underway between Maroondah Shire, DSE and the landowner.

Consultation and negotiation with private landholders will be the responsibility of State departments and other relevant statutory authorities. Various incentive packages will be offered to landholders based on their preparedness to enter into long-term management agreements such as those already identified. Such incentives may include fencing, local government rate relief, water rate relief and the provision of habitat management advice and management plans to private landholders. The range of incentives available will be negotiated by the relevant state department and statutory or local government authorities and will be decided upon on a case-by-case basis.

Implementation Action 4:

Cost estimates below relate to labour and associated expenses to collate available information, to assist land managers with preparing weed and pest animal control strategies, prepare briefings and/or background information, make recommendations to the relevant state reserve planning and land management agencies, and liaise with DSE, PV, EH and NSW NPWS regional staff.

The Department of Sustainability and Environment (DSE), the South Australian Department of Environment and Heritage (EH), and the New South Wales National Parks and Wildlife Service will be responsible for initiating protection mechanisms for populations on public and private land (if required and where State Government policy applies) in years 2 and 3 of recovery, or advising relevant statutory authorities. Implementation of this action is subject to negotiation between DSE and other State agencies, pending availability of population status, distribution and other necessary information. The cost of incentives offered to landholders will be borne by the relevant agencies in years 2 and 3 of recovery. Private landholders in Victoria will also be eligible to apply to DSE for Botanic Guardians funding.

Cost estimates below also include the cost of fencing to exclude pest animals at a number of sites. Land managers will be responsible for undertaking pest animal control. State government departments will cover the costs regional staff time to assist with the development of pest animal management plans and to erect fencing at some sites.

Weed data already held on the Victorian Flora Information System will be made available as part of DSE contribution to the project. The cost of weed control will be borne by the relevant land managers in years 1 to 5 inclusive. In some cases, volunteer labour through Friends Groups and orchid societies will be used, where suitable skills exist.

Collection of vital attributes (Noble and Slatyer 1980) data will be undertaken as part of Victorian fire management planning and funded by DSE and Parks Victoria as part of existing ongoing projects. Funding for the preparation and implementation of burn plans will be negotiated with Parks Victoria. Environmental Programs staff for sites within parks and reserves supporting key populations, and with DSE Fire Management Branch for other public land sites in line with annual budget cycles, starting in year 1.

Year	2003	2004	2005	2006	2007
Total	$159,875	$221,107	$222,880	$110,550	$117,500

5. Promote *in situ* recruitment

Objective:

Increase the size of populations in the wild.

Performance criteria:

Seedling recruitment in all key populations.

5.1 Prepare habitat for seedling recruitment

Recent trials indicate that good seedling germination of endangered *Arachnorchis* taxa have been achieved by microhabitat management. A number of techniques for have been developed and tested as part of existing Recovery Plans (Hill *et al*. 1999; Berwick *et al*. 1999; Todd 2000; Govanstone *et al*. 2001; C. Beardsell unpub. data) that will be used with other threatened taxa as part of this recovery plan.

Tested methods include caging, careful hand weeding, seed bed establishment, establishing safe sites for recruitment by building up ground cover around plants, and watering during critical periods. The techniques adopted will be decided on a case-by-case basis according to habitat and further techniques will be developed and implemented through an experimental approach.

5.2 Re-stock populations with seed

Seed will be collected from wild populations and from cultivated plants where available (Action 7). Populations will be re-stocked in autumn and in some cases prior baiting to test for presence of mycorrhizal fungi will be carried out.

Implementation Action 5:

Cost estimates for years 2-5 of recovery relate to labour and associated expenses to prepare sites and collect seed. Field based workshops will be held to train state department staff and volunteers (Actions 9.2, 9.3, 9.4) who will be responsible for on-going management.

Year	2003	2004	2005	2006	2007
Total	$0	$28,214	$31,380	$35,100	$38,492

6. Measure population trends and responses against recovery actions

Objective:

Determine the growth rates and viability of populations.

Performance criterion:

Population Viability Analyses for key populations; appropriate management strategies in place for key populations.

Risk assessment is critical to successful conservation management by identifying important factors for species' persistence and enabling managers to plan and work toward achievable targets (Hopper 1998). Understanding the response of populations to environmental variables and management practices will identify single or multiple factors most likely to lead to recovery of populations. It will evaluate optimal conditions for promoting flowering and seed production, identify stages where management efforts should be concentrated and provide a quantitative method to measure the efficacy of recovery actions. Consequently, recent management regimes can be quantitatively assessed, and adjusted if necessary to account for variables which may be identified as critical to survivorship.

6.1 Conduct annual censusing of populations

Demographic information such as recruitment and mortality, dormancy periods and the timing of life history stages will be collected for key populations. Additional information will include measurements of leaf or rosette size, population fecundity and predation levels. The response of populations to hand pollination, pest animal exclusion and other management actions will be evaluated from these data (see Actions 2 and 4). Variation in flowering between years and dormancy periods dictates that longer-term monitoring beyond the life of this recovery plan will be required before population trends for any taxon can be easily determined. However, it is anticipated that initial trends will be detected after three years.

6.2 Collate, analyse and report on census data

There are a substantial amount of data that have been collected for some species, with some records since the early 1990s. Management histories, including fire histories, are well known for at least three *taxa (Thelymitra epipactoides, Arachnorchis concolor, Diuris ochroma*) but the response of these populations to management has not been quantified. These data may be also be suitable for Population Viability Analyses (IUCN 2000). Censusing of populations of the remaining taxa will require annual collation and analysis of data, to evaluate the effectiveness of census techniques and to contribute information to assist with implementation of other actions (*eg*. Action 1, 3, 4).

6.3 Re-prioritise and adjust recovery actions and/or threat management

In line with the theory and practice of adaptive or experimental management (Hopkins and Saunders 1987), the results of recovery actions will need to be assessed against recovery goals to determine whether objectives are being achieved. Recovery criteria have been established to assess the success of recovery actions. A critical part of this process will be a review of recovery actions and threat management so that fine-tuning of recovery actions can be made if required. Review will be conducted after five years (or earlier if necessary), when sufficient data have been acquired.

Implementation Action 6:

Volunteers (eg. ANOS conservation group) and agency staff (DSE, PV) have begun monitoring a number of populations, directed by DSE scientific staff.

Costs estimates below relate to labour and associated expenses to collect, collate and analyse census data from key populations. Part of the travel costs will be covered by Actions 1 and 3. Ongoing assistance and advice, and training to agency staff and volunteers who will be responsible for longer-term censusing will also be undertaken (see Action 9).

Year	2003	2004	2005	2006	2007
Total	$20,937	$33,214	$47,070	$70,150	$73,238

7. Increase populations *ex situ*

Objective:

Establish populations in cultivation.

Performance criteria:

Seed from key populations of all taxa in long term storage; fungal symbionts for endangered taxa in long term storage; development of effective propagation and cultivation techniques; at least 10 plants of each Endangered or Critically Endangered taxon in cultivation.

There is a need to establish *ex situ* populations, for inclusion into living collections in Botanic Gardens in Melbourne and Geelong, to safeguard species in the event of any unforeseen destruction of wild populations. However, there are still difficulties associated with propagation of large numbers of plants and establishment of plants in the wild. For these reasons, efforts to establish orchids *ex situ* will focus primarily on producing populations of sufficient size to provide a seed

source for re-stocking of existing populations *in situ*, with a limited number of taxa considered for translocation (Action 8).

Cultivation of threatened orchid species subject to ongoing recovery programs (*eg*. Todd 2000) has been undertaken by the Royal Botanic Gardens Melbourne, Melbourne Zoo, amateur and professional growers using symbiotic and asymbiotic methods, generally good success. However, fungal isolates have been shown to improve germination and/or progression through plantlet developmental stages, more rapidly than asymbiotic methods in a range of orchid species (Clements *et al*. 1986; Smreciu and Currah 1989, Zettler and Mc Innis 1992, Zettler and Hofer 1998, A. Batty, KPBG, unpub. data; Raleigh in prep.). For these reasons, symbiotic propagation techniques are the preferred option, although inoculated asymbiotically grown plants may be considered pending the outcome of trials currently in progress.

7.1 Hand pollinate plants

Flowering in orchid populations varies annually and is influenced by a number of environmental factors so that seed set cannot be reliably predicted from year to year (Hutchings 1987; Light and MacConaill 1994; Kindlmann & Balounova 1999). Rates of natural pollination can be particularly low in some *Arachnorchis* species (Peakall and Beattie 1996, DSE unpubl. data). To maximise seed production and hence the potential for recruitment during critical years, hand pollination of plants will be necessary for some taxa with critically low population numbers. This will be determined in the late spring during censusing. The longer term impact of hand pollination will be assessed as part of Actions 2 and 6.

7.2 Establish a threatened orchid seed bank and determine seed viability

Capsules from key populations will be harvested annually where possible in late spring and re-released back onto the collection site (in the vicinity of existing plants) in late summer-early autumn (Action 5) or used to establish *ex situ* populations. The number of capsules harvested will depend upon total capsule numbers and will be assessed on an annual basis when population monitoring occurs. Seed viability testing using the most suitable seed germination protocols will be carried out pre- and post-storage where sufficient seed is available.

7.3 Establish a mycorrhizal fungi bank

Techniques have been developed by a number of different institutions for isolating and culturing mycorrhizal fungi species associated with *Diuris*, *Prasophyllum*, *Pterostylis* and *Arachnorchis* taxa. In particular, the Victorian Orchid Recovery Program has facilitated highly successful collaborative research at RBG, RMIT and the University of Melbourne to isolate and culture the fungi associated with a number of threatened and non-threatened Victorian orchid taxa (Marven, 1996, Lucas, 1997, Huynh *et al*. 2001; Raleigh *et al*. 2001, Wright 2001). Work on isolating and culturing mycorrhizal fungi associated with threatened orchid taxa will continue as part of the current recovery plan.

Opportunities to produces fungal cultures tends to rely on student availability, as well as thesis aims and timelines, and may not always be available when needed. Some initially poor performing isolates have been shown to improve when re-isolated from infected protocorms and re-cultured at a later date. Seed availability may also fail to coincide with availability of fungal isolates. Cryostorage of fungi for future use is a vital component of recovery so that opportunities for seed germination at critical times are maximised. Fungal isolates will be stored used in *ex situ* propagation (Actions 7 and 8) and in fungal translocation to promote seed germination *in situ.*

7.4 Establish and maintain cultivated populations

There has been significant progress made in the area of de-flasking and establishing seedlings in pots for Victorian species of *Arachnorchis* (Huynh in prep.; Raleigh in prep). Further work is needed to develop propagating techniques for *Prasophyllum*, *Diuris*, *Thelymitra*, *Corysanthes* and *Pterostylis*. However, it is highly likely that techniques developed during implementation of existing recovery plans (*eg*.Todd 2000) thus far can be applied to these genera.

Some commercial nurseries and private growers also have an excellent record in keeping orchid species in cultivation. The involvement of NOGN in the recovery effort for various threatened orchid taxa will be instrumental in achieving this objective. The role of members will be both practical and advisory role, including close involvement the RBG, and the Melbourne Zoo where their expertise is currently being used, especially in regard to de-flasking, tuber division and watering regimes. The Geelong Botanic Gardens will also be closely involved with maintaining cultivated plants.

7.5 Maintain a database of threatened orchids in cultivation

A central database of threatened orchids in cultivation has been established by NOGN. The purpose of the database is to maintain all records of cultivated plants, including seed source, locations, numbers and movements of plants, growing conditions and other information. Individual growers contribute their own records to the central database. The information is available on request to other organisations or agencies.

Implementation Action 7:

Cost estimates below include labour and associated expenses to hand pollinate plants, collect seed and plant material, place and collect fungal slide baits, interpret and report on results, and to provide training to State department staff and volunteers. Travel and accommodation costs are included under Actions 1,2 and 3.

Seed collection will be the responsibility of DSE staff and/or volunteers, however funds are required for the life of the recovery plan to cover the cost of cryogenic storage consumables. Where short term storage (< 6 months) is required, seeds will be dried and stored at 4^0C at the Royal Botanic Gardens, Melbourne. Additional capsules will be collected for long term storage in liquid nitrogen to optimise viability (Batty *et al*. 2001).

The work will also require specialist expertise in mycology, particularly the identification and culture of fungi in the laboratory. The RBG will undertake the work for all taxa. Costs estimates below relate to the purchase of laboratory consumables and labour to collect, culture, store and supply fungal replicates, prepare fungal slide baits and cultivate plants. Postgraduate and Honours projects will be encouraged (see Action 9). Laboratory facilities will be donated in kind by the RBG as part of their contribution to the recovery of threatened orchid taxa. Project management, scientific and technical advice will be provided by DSE, senior RBG staff, the University of Melbourne and the Royal Melbourne Institute of Technology as required.

NOGN/RBG will be responsible for maintaining the database.

Year	2003	2004	2005	2006	2007
Total	$24,937	$35,607	$41,106	$67,406	$64,557

Translocate cultivated plants

Objective:

Establish cultivated plants in the wild.

Performance criterion:

An increase in the size of targeted wild populations by up to 50%.

For many endangered orchid taxa known in low numbers from single or very few populations, the risk of extinction in the wild from lack of population vigour or from accidental damage remains very high. Unreserved taxa are at particularly high risk. Wherever possible, *in situ* techniques and threat management will be used to promote regeneration and recruitment and to increase population resilience. However, in order to reduce risk it may be necessary to re-stock existing populations or re-introduce populations for some taxa.

At present the ecological and biological requirements of translocated orchid populations are poorly understood. There have been very few known attempts to establish cultivated populations of terrestrial orchids at sites anywhere in Australia, and it is highly unlikely that successful re-introductions or re-stocking of existing populations will be possible without appropriate knowledge and skills, or in the absence of adequate resources. However, techniques are currently being developed at KPBG that are expected to greatly improve the probabilities of success of plant transfer into new areas (K. Dixon, KPBG, pers. comm.). It is intended that these techniques will be further developed as part of ongoing recovery plans (Hill *et al*. 1999; Todd 2000).

Although *in situ* recovery techniques will be the preferred approach in this recovery plan, translocation will be considered where there is a reasonable chance of success (> 50%), based on populations meeting specific criteria (ANPC Translocation Working Group 1997), including the acquisition of appropriate knowledge, development of suitable techniques, or where existing recovery plans exist that stipulate translocation. Translocation will be considered for taxonomically clearly defined taxa where adequate material exists to harvest viable seed and organs for fungal isolation, and where *in situ* recovery has failed or is likely to fail.

8.1 Determine criteria for re-stocking/re-introduction

Criteria for re-stocking or re-introduction will be primarily based on the likelihood of survival of cultivated plants in the wild in relation to habitat condition, intactness of ecological processes and site security. It will not necessarily target populations where there are very few plants, owing to genetic considerations and the current lack of understanding of the true conservation status of some taxa (see Action 1). However, taxa confined to single populations large enough to harvest ample seed and plant organs for fungal isolation will be considered, especially where current site security is compromised (*eg*. *Pterostylis despectans*). Previous experience in Victoria has shown that the likely success of re-introductions of very small populations is extremely low, mainly due to the difficulty of obtaining sufficient material. Choice of population will be balanced against a number of factors including financial costs and biodiversity benefits of translocation (see below).

8.2 Evaluate site suitability

The selection of suitable sites for introduction will need to consider a range of variables including site size, habitat condition, availability of pollinators, presence of mycorrhizal fungi, threats, existing management, land tenure, security and accessibility. This information will be collected during implementation of Action 3 and will also draw on existing resources such as statewide vegetation maps (1:100,000) which exist for the sites containing populations of threatened orchids where translocation may be required.

8.3 Determine long term cost-benefits and feasibility of translocating cultivated plants

Translocation requires significant allocation of resources to cultivate sufficient numbers of plants, to maintain collections, to prepare reintroduction plans, to determine whether pollinators and fungal symbionts are present, and to maintain translocated populations in the wild. Ongoing augmentation of translocated populations with additional plant material, as well as ongoing hand pollination and addition of fungal symbionts are also highly likely. An analysis of the financial costs associated with reintroducing plants will be compared to consequent biodiversity benefits at short term and long term time scales.

8.4 Prepare and implement translocation plans

A reintroduction plan will be prepared for each selected taxon, detailing any preparation of cultivated plants prior to reintroduction, methods of reintroduction (including using seed, tubers, seedlings or mature plants), timing, numbers of plants, experimental design, permanent marking systems, monitoring methods, and other information as required (ANPC Translocation Working Group 1997).

8.5 Maintain translocated populations

Ongoing management of translocated populations is likely to include pest animal and plant control, watering and monitoring (ANPC Translocation Working Group 1997). In some instances, populations may require regular addition of mycorrhizal fungi, hand pollination and maintenance of site security. Operational management plans will be prepared for translocated populations and actions will be specified as required.

Implementation Action 8:

Cost estimates below relate to labour and associated expenses to collect and collate key data for the selection of introduction sites for each taxon, undertake cost-benefit analyses and prepare translocation plans, facilitate site protection works such as weed control, pest animal control and/or fencing, and assist with population maintenance as required. Labour will also be required to fully consult with all relevant land management agencies (eg. Parks Victoria) and interest groups. Land management agencies will cover the cost of regional staff involved with the selection of appropriate sites. Extensive consultation with a range of individuals including ANOS members will be included as part of these actions.

The action also requires expert contribution from a horticultural project officer, based at the RBG. Cost estimates below include provision for labour and associated expenses to cultivate large numbers of plants, to prepare sites and to oversee the establishment of new populations. Costs for reintroduction of *Arachnorchis concolor*, which is subject to an existing recovery plan (NSW NPWS 2000) will be borne by the New South Wales National Parks and Wildlife Service if reintroduction criteria are met (NSW NPWS 2000). Relevant land management agencies and regional community groups will be involved where appropriate in site preparation, planting, future monitoring and management of sites as detailed in translocation plans.

Year	2003	2004	2005	2006	2007
Total	$0	$48,000	$36,332	$59,712	$50,622

9. Implement an education and communication strategy

Objective:

Build a network of government and non-government organisations and individuals.

Performance criteria:

Preparation of FFG Action Statement for 25 threatened orchids; preparation of a technical handbook and video; increased involvement from orchid society members in on-ground works and collection of information; preparation of funding applications for a PhD scholarship and Postdoctoral fellowship.

The recovery of threatened orchid taxa in south-eastern Australia in the short-term will rely heavily on input from a network of expert botanists, ecologists, horticulturists and the community.

Involving the community in key stages of the recovery process will dramatically increase the chances of survival of these taxa in the wild. A number of orchid societies and field naturalist groups are actively involved in the recovery of threatened orchid taxa in Victoria. Skills in census techniques, hand pollination, survey and cultivation are progressing as a result of existing recovery efforts. Increased information and technical skills can be further developed through dissemination of technical material and workshops. Greater awareness in the wider community will need to be fostered through the production and delivery of threatened orchid public education and community extension programs.

9.1 Prepare technical educational material on *in situ* recovery techniques

A handbook of cultivation techniques (Victorian Threatened Orchid Recovery Team in prep.) has been prepared with extremely positive feedback from government and non-government organisations and individuals. There is a need to expand this to include a other tools for conservation management such as monitoring methods and fine scale site management techniques, suitable for a wider range of practitioners. A video to demonstrate hand pollination of *Diuris fragrantissima* has also been produced and is regularly used by community groups. This now needs to be expanded to include *Arachnorchis*, *Corysanthes*, *Prasophyllum*, *Pterostylis* and *Thelymitra*.

9.2 Undertake community extension

Individuals will be encouraged to report sightings of threatened taxa to local state agency personnel for verification. Information on where to access further information or how to make contact with interest groups and regional recovery teams will also be provided. Educational material will also be used as part of on-going community extension work conducted by state government departments and to generate regional media interest as a way of promoting orchid conservation and raising public awareness in regional areas. Public education and community extension projects will endeavour to build on existing activities already being conducted in regional areas by other organisations.

9.3 Conduct workshops and symposia on *in situ* recovery techniques

Practical demonstration is an effective means of conveying information to a wide range of people. Field-based workshops on *in situ* recovery methods will be used to teach simple techniques to individuals from government and non-government organisations. It is particularly important for DSE and PV regional staff and community groups to develop skills in fine-scale population and habitat management techniques such as hand pollination, censusing and direct seeding, that are consistent, repeatable and comparable across the State.

Three regional workshops will be conducted by two DSE staff in western, central and eastern Victoria, to demonstrate recovery techniques to regional DSE and PV staff, as well as interstate agency staff, field naturalists, friends groups and members of orchid societies involved in orchid recovery. One day workshops will be conducted at field sites, so that practical, site specific problems can be addressed.

There is also a need to communicate results of research projects and recovery activities across a wide range of organisations. It is particularly important to demonstrate the value of consistent data collection and the application of recovery actions to management (*eg*. demographic censusing), and to facilitate communication between practitioners. A two symposium will be held with participation by Postgraduate and Honours students, DSE scientific staff and other scientists or academics involved in orchid recovery.

9.4 Encourage and support research by higher education Institutions and existing research partners

Honours and PhD projects addressing various aspects of threatened orchid recovery have been completed or are underway (*eg*. Anthony in prep.; Huynh 1999; Huynh in prep.; Kimpton in prep.; Raleigh in prep.). Research partnerships have been developed between DSE, the RBG, RMIT University, the University of Melbourne and Charles Sturt University, with students co-supervised by University, DSE and RBG scientific staff. Results have been disseminated as theses and as conference papers at national and international symposia, or are currently being prepared as articles for scientific journals (*eg*. Coates & Lunt 2001; Govanstone *et al*. 2001)

Much of the knowledge required for threatened orchid recovery will be acquired through further research into the ecological and biological requirements of orchids, particularly in the realms of habitat and management, pollination, plant-fungal relationships and cultivation techniques relevant to recovery actions. Research scholarships and fellowships provide a real opportunity to conduct one to three year projects necessary to understand processes underpinning successful *in situ* and *ex*

situ management. Students initiate or further develop links with state and interstate government organisations, as well as with members of orchid societies and field naturalists. The overall aim of research partnerships is to further expand the skill base for applied orchid conservation and to encourage interest and awareness in young scientists.

Implementation Action 9:

DSE will cover the cost of developing electronic information on department web pages and implementing on-going community extension programs.

Cost estimates below include provision for labour and associated expenses to communicate the threatened orchid education program in Victoria, South Australia and southern New South Wales to the wider community.

Costs are also included to leverage a research scholarship or fellowship in years 3-5 to further expand applied research into conservation biology of threatened orchids, particularly in the area of mutualisms. Additional in-kind support will be provided by University technical staff, DSE regional staff and negotiated with Parks Victoria where applicable. Further in-kind support will be provided to students through co-supervision of projects by University, DSE and RBG scientists. Joint funding applications with interstate agencies will be considered where possible. DSE scientific staff will collaborate with University staff to develop funding applications.

The responsibility of conducting workshops, symposia, preparing scientific and technical reports, and producing a video will be borne by DSE.

Year	2003	2004	2005	2006	2007
Total	$35,937	$45,107	$75,690	$99,150	$107,238

10. Consolidate orchid recovery and extend community networks

Objective:

Co-operate in bioregional policy implementation and manage recovery plan implementation.

Performance criteria:

Maintain regular recovery team meetings and maintain regular communication with State and interstate agency organisations at other times as necessary; preparation of annual workplans for all taxa.

10.1 Maintain the Threatened Orchid Recovery Team

DSE formed the Threatened Orchid Recovery Team in 1999 to oversee orchid recovery in Victoria. The group is made up of individuals or organisations with an active role in threatened orchid conservation and management in Victoria, including monitoring and review of recovery plan implementation. Representatives are from DSE, Universities, RBG, ANOS and PV. TORT also consists of three sub-committees responsible for development strategic directions in ecological and taxonomic research, horticultural research and community education.

10.2 Establish and facilitate regional Recovery Teams

Regional threatened orchid recovery teams will be established for groups of taxa with similar geographic distributions. Where necessary, these will include taxa which are already subject to recovery plan implementation. Teams will be facilitated by DSE/EH/NSW NPWS and will include representatives from State government agencies; non-government organisations, orchid societies, and individuals. Each regional recovery team will have delegated custodial and on-ground action responsibilities.

10.3 Co-ordinate recovery and exchange knowledge with interstate agencies

Positive working relationships within Victoria and with State conservation agencies in Tasmania, New South Wales and South Australia have already been established as part of the Victorian Orchid Recovery Program. Maintenance of these links and regular communication is important to enact legislation and policies, to set workplans and to monitor progress toward orchid recovery.

Implementation Action 10:

Bi-annual meetings between State Government staff involved in orchid recovery will be necessary to manage recovery for taxa occurring in more than one State. Meeting outcomes should include development of annual workplans and should address progress toward achieving recovery criteria. Communication of research results and other information, as well as outcomes from existing recovery plan implementation should also be addressed.

Meetings will be held at times and venues of mutual convenience, in conjunction with recovery team meetings and will include site inspections when necessary. Meetings will be scheduled in late summer to agree to tasks and to prepare workplans, and in late Spring to evaluate progress toward achieving criteria.

Government agencies will be responsible for covering their own costs of participation in meetings within their state. Cost estimates in years 1-5 of recovery include the cost of interstate travel for agency staff and community representatives attending regional recovery team meetings.
Community group members will provide their labour 'in kind' as their contribution to threatened orchid recovery.

Year	2003	2004	2005	2006	2007
Total	$9,000	$9,000	$9,000	$9,000	$9,000

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Appendix 1: Implementation Schedule

Action	*Description*	*Priority*	*Feasibility*	*Responsibility**	*Cost estimate*					
					2003	2004	2005	2006	2007	Total
	Conservation status									
1.1	Clarify taxonomy	3	100%	RBG, CPBR	**$20,000**	**$20,000**	**$20,000**	**$20,000**	**$20,000**	**$100,000**
1.2	Collect baseline data	1 or 2	100%	DSE	**$15,941**	**$14,109**	**$0**	**$0**	**$0**	**$30,050**
2	**Population biology**									
2.1	Describe life histories	2	100%	DSE	**$21,250**	**$21,161**	**$0**	**$0**	**$0**	**$42,411**
2.2	Evaluate natural pollination	2	75%	DSE/RP	**$10,625**	**$10,580**	**$14,447**	**$15,050**	**$16,746**	**$67,448**
2.3	Evaluate hand pollination	2	75%	DSE/RP	**$0**	**$10,580**	**$14,447**	**$15,050**	**$16,746**	**$56,821**
2.4	Fungal distributions	2	50%	DSE/RP	**$0**	**$0**	**$14,445**	**$15,050**	**$16,746**	**$46,241**
2.3	*In situ* fungal growth	2	50%	DSE/RP	**$0**	**$0**	**$14,445**	**$15,052**	**$16,746**	**$46,243**
3	**Habitat requirements**									
3.1	Identify key populations	1	100%	DSE	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**
3.2	Conduct surveys	1 or 2	100%	DSE	**$42,500**	**$21,160**	**$0**	**$0**	**$0**	**$63,660**
3.3	Identify ecological correlates	1 or 2	75%	DSE	**$10,624**	**$10,580**	**$0**	**$0**	**$0**	**$21,205**
3.4	Prepare habitat descriptions	2 or 3	100%	DSE	**$10,624**	**$10,580**	**$0**	**$0**	**$0**	**$21,204**
4	**Manage risks to populations**									
4.1	Control threats	1	100%	DSE/PV/OO	**$139,875**	**$197,000**	**$191,500**	**$80,500**	**$117,500**	**$726,375**
4.2	Identify disturbance regimes	1 or 2	75%	DSE	**$10,000**	**$0**	**$12,500**	**$30,050**	**$0**	**$52,550**
4.3	Protect public land habitat	1	75%	DSE/PV	**$5,000**	**$12,053**	**$9,480**	**$0**	**$0**	**$26,533**
4.4	Protect private land habitat	1	75%	DSE/PL	**$5,000**	**$12,054**	**$9,400**	**$0**	**$0**	**$26,454**
5	**Promote *in situ* recruitment**									
5.1	Prepare habitat for seed	1 or 2	75%	DSE/CG	**$0**	**$14,107**	**$15,690**	**$22,00**	**$21,203**	**$73,000**
5.2	Re-stock seedbank	1 or 2	75%	DSE/CG	**$0**	**$14,107**	**$15,690**	**$14,000**	**$16,389**	**$60,186**
6	**Population trends**									
6.1	Conduct annual censusing	2	100%	DSE/CG	**$15,937**	**$14,107**	**$21,035**	**$40,075**	**$40,619**	**$13,773**
6.2	Collate, analyse and report	2	100%	DSE	**$0**	**$14,107**	**$21,035**	**$20,075**	**$22,619**	**$77,836**
6.3	Adjust management	1	75%	DSE/OO	**$5,000**	**$5,000**	**$5,000**	**$10,000**	**$10,000**	**$35,000**

Action	*Description*	*Priority*	*Feasibility*	*Responsibility**	*Cost estimate*					
7	**Increase populations *ex situ***									
7.1	Hand pollinate plants	1 or 2	100%	DSE/CG	**$16,937**	**$9,536**	**$3,000**	**$27,000**	**$21,899**	**$78,372**
7.2	Establish a seed bank	1 or 2	75%	DSE/RBG	**$2,000**	**$10,536**	**$9,202**	**$7,000**	**$7,500**	**$36,238**
7.3	Establish a fungi bank	1 or 2	75%	DSE/RBG	**$2,000**	**$10,536**	**$11,202**	**$9,100**	**$11,000**	**$48,838**
7.4	Cultivate plants	1 or 2	50%	DSE/RBG/GBG	**$5,000**	**$5,000**	**$17,202**	**$20,906**	**$21,557**	**$70,165**
7.5	Database	3	100%	CG/RBG	**$0**	**$0**	**$0**	**$2,500**	**$2,500**	**$5,000**
8	**Translocation**									
8.1	Determine criteria	2	100%	DSE	**$0**	**$10,750**	**$0**	**$0**	**$0**	**$10,750**
8.2	Evaluate site suitability	1	75%	DSE	**$0**	**$10,750**	**$0**	**$0**	**$0**	**$10,750**
8.3	Cost-benefit analysis	2	100%	DSE	**$0**	**$10,750**	**$0**	**$0**	**$0**	**$10,750**
8.4	Prepare and implement translocation plans	1	100%	DSE	**$0**	**$15,750**	**$31,332**	**$13,212**	**$10,622**	**$70,916**
8.5	Maintain populations	1	50%	DSE	**$0**	**$0**	**$5,000**	**$46,500**	**$40,000**	**$91,500**
9	**Education strategy**									
9.1	Prepare educational material	3	100%	DSE	**$10,000**	**$0**	**$15,000**	**$25,050**	**$31,746**	**$81,796**
9.2	Community extension	3	100%	DSE	**$15,937**	**$45,107**	**$40,690**	**$30,050**	**$31,746**	**$163,530**
9.3	Workshops and symposia	3	100%	DSE	**$0**	**$0**	**$0**	**$29,050**	**$23,746**	**$52,796**
9.4	Support research	3	50%	DSE/RP	**$10,000**	**$0**	**$20,000**	**$15,000**	**$20,000**	**$65,000**
10	**Networks**									
10.1	Maintain TORT	3	100%	DSE	**$3,000**	**$3,000**	**$3,000**	**$3,000**	**$3,000**	**$15,000**
10.2	Regional recovery teams	3	100%	DSE/EH/NSW NPWS	**$5,000**	**$5,000**	**$5,000**	**$5,000**	**$5,000**	**$25,000**
10.3	Interstate liaison	3	100%	DSE/EH/NSW NPWS	**$1,000**	**$1,000**	**$1,000**	**$1,000**	**$1,000**	**$5,000**
				Grand Totals	**$382,250**	**$539,000**	**$541,240**	**$531,270**	**$547,631**	**$2,541,391**

*** OO – Other government organisation; CG – Community Group; PL – Private landowner; RP – Research partner**

Appendix 2: Relationship between Specific Objectives, Progress Criteria and Actions

Objective	Performance criteria	Actions
1. Acquire accurate information for conservation status assessments.	▪ Determination or update of conservation status for all taxa for inclusion on state and national threatened species lists.	*1. Determine current conservation status* ▪ Clarify taxonomy ▪ Acquire baseline population data
2. Identify key biological functions	▪ Preparation of management prescriptions that will maintain, enhance or restore biological relationships fundamental to reproduction and survival	*2. Investigate population biology* ▪ Describe life histories ▪ Evaluate natural pollination levels and/or causes of pollinator limitation ▪ Determine the effects of artificial pollination on growth, survival and reproduction ▪ Determine spatial distribution of mycorrhizal fungi ▪ Determine optimal conditions for growth of mycorrhizal fungi *in situ*
3. Identify critical, common and potential habitat	▪ Preparation of management prescriptions that will maintain, enhance or restore appropriate habitat	*3. Determine habitat requirements of key populations* ▪ Identify key populations ▪ Conduct surveys ▪ Identify ecological correlates of key populations ▪ Prepare habitat descriptions
4. Ensure that all existing populations and their habitat are protected and managed appropriately	▪ Reduce plant mortality due to predation, damage and weed invasion in key populations ▪ Increase the number of flowering plants in key populations ▪ Establish a private and public land protected area network for threatened taxa	*4. Manage risks to populations* ▪ Identify and implement strategies to control threats ▪ Identify disturbance regimes to promote regeneration and recruitment ▪ Protect key public land populations and habitat ▪ Protect key private land populations and habitat
5. Increase the size of populations in the wild	▪ Seedling recruitment in all key populations	*5. Promote in situ recruitment* ▪ Prepare habitat for seedling recruitment ▪ Re-stock populations with seed
6. Determine the growth rates and viability of populations	▪ Population Viability Analyses for key populations ▪ Appropriate management strategies in place for all key populations	6. Measure population trends and responses against recovery actions ▪ Conduct annual censusing of populations ▪ Collate, analyse and report on census data ▪ Re-prioritise and adjust recovery actions and/or threat management

Appendix 2 (cont.): Relationship between Specific Objectives, Progress Criteria and Actions

Objective	Performance criteria	Actions
7. Establish populations in cultivation	▪ Seed from key populations of all taxa in long term storage ▪ Fungal symbionts for Critically Endangered and Endangered taxa in long term storage ▪ Development of effective propagation and cultivation techniques ▪ At least 10 plants of each endangered taxon in cultivation	*7. Increase populations ex situ* ▪ Hand pollinate plants ▪ Establish a threatened orchid seed bank and determine seed viability ▪ Establish a mycorrhizal fungi bank ▪ Establish and maintain cultivated populations ▪ Maintain a database of threatened orchids in cultivation
8. Establish cultivated plants in the wild	▪ An increase in the size of targeted wild populations by up to 50%.	*8. Translocate cultivated plants* ▪ **Determine criteria for re-stocking/re-introduction** ▪ Evaluate site suitability ▪ Determine long term cost-benefits and feasibility of translocating cultivated plants ▪ Prepare and implement translocation plans ▪ Maintain translocated populations
9. Build a network of government and non-government organisations and individuals	▪ Preparation of a technical handbook and video ▪ Increased involvement from orchid society members in on-ground works and collection of information ▪ Preparation of funding applications for a PhD scholarship and Postdoctoral fellowship	*9. Implement an education and communication strategy* ▪ Prepare technical educational material on *in situ* recovery techniques ▪ Undertake community extension ▪ Conduct workshops and symposia on *in situ* recovery techniques ▪ Encourage and support research by Higher Education Institutions and existing research partners.
10. Co-operate in bioregional policy implementation and manage recovery plan implementation	▪ Attend 5 recovery team meetings and maintain regular communication with State and Interstate agencies and organisations at other times as necessary. ▪ Preparation of annual workplans for all taxa	***10.*** *Consolidate recovery and extend networks* ▪ Maintain the Threatened Orchid Recovery Team ▪ Establish and facilitate regional Recovery Teams ▪ Co-ordinate recovery and exchange knowledge with interstate agencies

Appendix 3: Summary sheets for each taxon.