National Recovery Plan for the Winged Peppercress *Lepidium monoplocoides*

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Australian Government

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This is a Recovery Plan prepared under the Commonwealth *Environment Protection and Biodiversity Conservation Act* 1999, with the assistance of funding provided by the Australian Government.

This Recovery Plan has been developed with the involvement and cooperation of a range of stakeholders, but individual stakeholders have not necessarily committed to undertaking specific actions. The attainment of objectives and the provision of funds may be subject to budgetary and other constraints affecting the parties involved. Proposed actions may be subject to modification over the life of the plan due to changes in knowledge.

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Cover photograph: Winged Peppercress *Lepidium monoplocoides* by Dale Tonkinson.

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Summary

The Winged Peppercress *Lepidium monoplocoides* is a small annual herb endemic to inland south-eastern Australia, where it occurs in Victoria and New South Wales, with an old record from South Australia. The species has suffered a decline in distribution and abundance, mostly due to destruction or degradation of habitat. Current major threats include altered flooding regimes, weed invasion and grazing. There are about 6,000 plants remaining in about 13 wild populations. The species is listed as Endangered under the Commonwealth *Environment Protection and Biodiversity Conservation Act* 1999. This national Recovery Plan for the Winged Peppercress is the first recovery plan for the species and details the species' distribution and biology, conservation status, threats, and recovery objectives and actions necessary to ensure its long-term survival.

Species Information

Description

The Winged Peppercress *Lepidium monoplocoides* is a small annual herb growing to about 20 cm tall. Leaves are narrowly linear, pinnately lobed or entire, 5–10 cm long and 1–2 mm wide, and are arranged along and at the base of stems. The inflorescence is an elongating raceme with tiny green-brown flowers to 2 mm wide, with sepals 1 mm long and petals inconspicuous or absent. Fruits are broadly ovate to circular, 5 mm long and 4 mm wide, and borne on flattened pedicels to 3 mm long. The apex of the fruit is pointed, with a small notch and two smooth wings that are divided into halves that surround the entire fruiting body. Flowering occurs in the spring and summer (description from Entwisle 1996). Little is known of the biology and ecology of the Winged Peppercress. Numbers of adult plants fluctuate from year to year and, like many annual species occurring in dry environments, some seed probably remains dormant in the soil for several years. During extended wet periods, the species can behave like a short-lived perennial plant (Scarlet 2000).

Distribution

The Winged Peppercress is widely distributed on the inland plains of south-eastern Australia, occurring from northern New South Wales to western Victoria, with an old record from south-eastern South Australia (Figure 1). The species occurs in the Murray Darling Depression, Riverina, Darling Riverine Plains and Cobar Peneplain Bioregions (*sensu* DEH 2000).

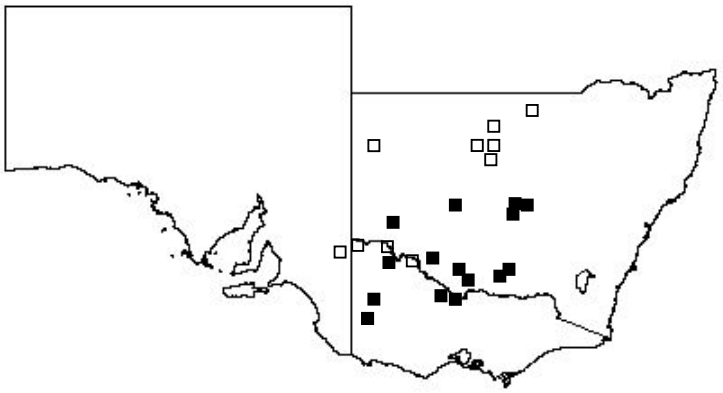

Figure 1. Distribution of the Winged Peppercress

Former (clear boxes) and current (black boxes) distribution

Maps showing the distribution of Winged Peppercress are available from the Department of Environment and Sustainability (DSE) (for Victoria) and the Department of Environment, Climate Change and Water (DECCW) (for New South Wales).

Population Information

The Winged Peppercress is currently known from 13 locations, six in Victoria and seven in New South Wales (Table 1). These are all important populations required for the conservation of the Winged Peppercress.

In Victoria, the species occurs in the Hattah-Kulkyne National Park (between Lake Hattah and Lake Bulla), on the Murray River floodplain in Barmah State Park and near Reedy Lagoon in the Gunbower Reserve, in the Stony Plain Bushland Reserve near Sealake, in Wyperfeld National Park and in the West Wail Flora and Fauna Reserve, north-west of Horsham.

In New South Wales, the species is known from several locations on the Hay Plain, including the Booberoi regeneration area/railway siding, Urana Nature Reserve, along the Cobb Highway south of Ivanhoe, Lake Cargelligo, Micabil and the Morundah property owned by the Department of Defence.

Total population size is estimated at <3,000 plants each in Victoria and New South Wales. However, it should be noted that population sizes fluctuate markedly in response to drying and wetting cycles, resulting in difficultly in obtaining an accurate total population size for the species. The species is more readily observable following significant rainfall, and virtually disappears in dry years, when only a small proportion of the total population may be visible above ground at any one time. The inconspicuous nature of the plant (except when seeding) may have also lead to an under-estimation of population sizes. The magnitude of the soil seed store is also unknown, but is likely to be large.

Habitat

The Winged Peppercress occurs in open, sparsely vegetated sites in a range of habitats on heavy clay or clay-loam soils, usually on sites that are seasonally flooded or prone to waterlogging, in arid to semi-arid areas with an average rainfall range of 200–450mm per year. Vegetation communities in which the species occurs include grasslands, wetlands and floodplain woodlands dominated by *Eucalyptus coolabah* and *Eucalyptus largiflorens*, and chenopod shrublands dominated by *Atriplex, Maireana* and/or *Nitraria* species. It has also been recorded from samphire communities dominated by *Halosarcia* species and temperate woodlands with *Eucalyptus microcarpa* and *Allocasuarinia luehmannii* on the southern margins of its range. The Winged Peppercress occurs in association with a wide range of herbs and grasses including *Austrodanthonia* species, *Austrostipa* species, *Rumex brownii* and *Spergularia rubra*. Locations where the species occurs tend to be ephemeral, and it may be an opportunistic species able to take advantage of seasonally available habitat. Recovery actions include survey for and mapping of habitat that is critical to the survival of the species.

Decline and Threats

The Winged Peppercress has apparently suffered a widespread decline in both range and abundance since European settlement. The species was once widely distributed and probably reasonably abundant on floodplains across the inland plains of the Murray-Darling Basin regions of Victoria, New South Wales and South Australia. It once occurred from the Darling River in north-central NSW around Bourke, through the NSW Riverina near Griffith, Balranald and Deniliquin, along the Murray River from Mildura to Gunbower State Forest on NSW/Victorian border and as far south as the Wimmera in western Victoria (Scarlet 2000).

Table 1. Population and threat information for the Winged Peppercress.

Location/Site	Pop size	Manager	**Threats** (H = high level, M = medium level, L = low level)	Comments
Victoria				
Hattah-Kulkyne National Park	1991: ~1000 plants 2003: 100–150	Parks Victoria	Grazing by kangaroos and rabbits (M) Alteration to flooding regimes/site drying (M) Rising salinity levels (H)	Population in decline; occurs in area of c. 0.1 ha, between Lake Hattah and Lake Bulla
Wyperfeld National Park	1983: 225 plants 2003: no plants seen	Parks Victoria	Grazing by kangaroo, rabbits, sheep (M) Weed invasion (M) Vehicle disturbance (M) Rising salinity levels (M) Alteration to flooding regimes/site drying (M)	Uncertain if species still persist in the Park; plants occurred at three sites; block containing two stands was fenced in 1996
Barmah State Park	2001: 45 plants	Parks Victoria	Vehicle disturbance (M) Weed invasion (L) Erosion (L) Grazing by domestic stock(?) Rising salinity levels (L)	plants occur in area of c. 80 m^2
Gunbower Island Reserve	1984: 750 plants 2004: 750–1800 plants	Parks Victoria	Weed invasion esp. Horehound *Marrubium vulgare* (M) Grazing by rabbits (L) Vehicle disturbance (H) Rising salinity levels (H) Weed invasion (M)	plants occur in area of <1 ha
Stony Plain Bushland Reserve	2003: 15 plants	Parks Victoria	unknown	plants occur in area of c. 80 m^2
West Wail Flora and Fauna Reserve	1984: 35 plants 1993: 500+ plants 2003: no plants seen	Parks Victoria	Grazing by rabbits (M) Vehicle disturbance (H) Weed invasion (M) Erosion (M)	site protected from most threats; decline may be due to plants dying down to rootstock or present in seed bank following several years of drought

New South Wales				
Lake Urana Nature Reserve	1996: 600 plants 2000: 2000 plants	Dept. Env & Climate Change	Grazing by rabbits, kangaroos, stock (M) Erosion (L) Weed invasion esp. Patterson's Curse *Euchium plantagineum*, Horehound and African Boxthorn *Lycium ferocissimum*. introduced grasses (H) Alteration to flooding regimes/site drying (H)	
Cobb Highway-Oxford Bore	2000: 3 plants	Central Darling Shire Council	Grazing by stock (M) Road works (H) Weed invasion (M) Herbicide use (?)	likely that other small pops exist along roadside in depressions and drains
Cobb Highway, 33km S of Ivanhoe	2000: 'several' plants	Central Darling Shire Council	Grazing by stock (M) Road works (H) Weed invasion (M) Herbicide use (?)	plants occur in area of c. 100 m^2; site is on Travelling Stock Route
Booberoi	1973: some plants seen 2000: no plants seen	Rail Corporation of NSW	Weed invasion (H)	
Lake Cargelligo	1991: some plants seen 2000: no plants seen	?	Grazing by stock (M) Alteration to flooding regimes/site drying (M)	
Micabil	2000: 400 plants	?	Weeds (M) Alteration to flooding regimes/site drying (M)	
Morundah	1995: 1,000 plants 2000: 460 plants	Department of Defence	Future site development (H) Weeds (M) Grazing by stock (H) Alteration to flooding regimes/site drying (M)	species likely to occur elsewhere on the site

In NSW, there are old collections from Broken Hill, Bourke, Cobar, Urana, Lake Balranald, Wanganella and Deniliquin (NSW Herbarium), but the species has now apparently disappeared from northern NSW. In Victoria, it has been recorded near Mildura in 1923, east of Robinvale in 1853, and at Swan Hill in 1890. None of these populations have been relocated since and it is highly likely Winged Peppercress no longer exists at these sites. The species was also recorded in Little Desert National Park west of Horsham in the 1890s and again as recently as 1987, although it has not been seen since. In South Australia, there is only a single record, from near Berri on the Murray River in 1915, and the species is probably now extinct in that State. Currently there are estimated to be fewer than 6,000 plants occurring in about 13 wild populations in Victoria and New South Wales.

Wide-scale clearing of grassland and grassy woodland habitats across the inland plains of Victoria and New South Wales is probably the major cause of the decline of the Winged Peppercress. Changes to hydrological cycles, through both drainage of shallow freshwater marshes and prolonged flooding of sites through irrigation, have also contributed to the decline.

All remaining populations are at risk from a range of threats (Table 1), and current major threats are discussed as follows:

Altered hydrology: The Winged Peppercress grows at sites that are seasonally wet, either through periodic flooding or where rainfall runoff collects, and a regular wetting and drying regime is probably required to maintain an open habitat and facilitate seed germination. Many shallow freshwater marshes have been drained, while other sites have prolonged inundation through irrigation supply and runoff, reducing the availability of suitable habitat for the species.

Increasing salinity: The elevated levels of saline groundwater and the steady spread of saline-effected areas, especially in northern Victoria, are likely to be a threat to some populations of Winged Peppercress.

Weed invasion: Almost all sites are at risk from weed invasion, including from exotic annual grass species including *Vulpia*, *Bromus, Lolium* and *Avena* species, with Patterson's Curse, Horehound and African Boxthorn being problems at a few sites.

Grazing: The Winged Peppercress is highly palatable and as a result is very susceptible to grazing. Populations on private land, Department of Defence land and roadsides are at risk from domestic stock (roadside populations are on travelling stock routes), while high densities of kangaroos and rabbits pose a threat to populations in parks and reserves. Wild pigs may be a threat to some populations in NSW. Grazing may threaten the species by reducing the amount of seed produced by individuals through defoliation, prior to critical periods of flowering and seed production.

Physical damage: Several sites where Winged Peppercress occurs are close to vehicle tracks, and off-road vehicle movement has caused some damage to sites and drainage lines leading to sites. Road works are a major risk to roadside populations, and livestock can cause damage, especially when the soil is wet, through trampling and pugging of sites. Future development on the Department of Defence land may result in habitat degradation or loss.

Drought and climate change: Virtually the entire range of the Winged Peppercress has suffered extensive drought for over a decade now, and it is not known how long seed can remain viable in the soil between wetting periods. Climate change is likely to be a major medium to long term threat, with the predicted increased temperatures, decreased rainfall and increased evaporation rates further reducing the availability of seasonally wet habitats favoured by the species.

Existing Conservation Measures

The Winged Peppercress is the subject of ongoing conservation actions. Most remaining populations in Victoria and the Lake Urana Nature Reserve (NSW) are monitored on a semi-regular basis. Control of pest plants, rabbits and kangaroos occurs at several parks and reserves in Victoria. Fencing to exclude stock from the Winged Peppercress site has occurred at Hattah-Kulkyne National Park, while general stock fencing has been erected at Gunbower Island Reserve and Lake Urana Nature Reserve.

Recovery Information

Recovery Objectives

The Overall Objective of recovery is to minimise the probability of extinction of the Winged Peppercress in the wild and to increase the probability of populations becoming self-sustaining in the long term. Within the duration of this Recovery Plan, the Specific Objectives for the recovery of the Winged Peppercress are to:

1. Determine distribution, abundance and population structure
2. Determine habitat requirements
3. Manage threats to populations
4. Identify key biological functions
5. Determine growth rates and viability of populations
6. Establish a seed bank
7. Build community support for conservation

Program Implementation and Evaluation

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

Recovery Actions and Performance Criteria

Action	Description	Performance Criteria
Specific Objective 1: Determine distribution, abundance and population structure		
1.1	Undertake surveys to determine the area and extent of populations, the number, size and structure of populations, and inference or estimation of population change. **Responsibility: DSE, PV, DECCW**	• Ten populations mapped for population size, condition and habitat. • The location of previously recorded populations in Wyperfeld NP, West Wail FFR & Barmah revisited to assess status.
Specific Objective 2: Determine habitat requirements		
2.1	Survey known habitat and collect floristic and environmental information relevant to community ecology and condition. **Responsibility: DSE, DECCW**	• Species/habitat specific survey design prepared. • Habitat critical to survival mapped for 10 populations.
2.2	Identify and survey potential habitat, using ecological and bioclimatic information that may indicate habitat preference. **Responsibility: DSE, DECCW**	• Potential habitat in Little Desert NP and in the Riverina, Cobar Peneplain and Darling Riverine Plains Bioregions surveyed. • Predictive model for potential habitat developed & tested at five sites.
Specific Objective 3: Manage threats to populations		
3.1	Protect populations on public land. **Responsibility: DSE, DECCW**	• Development of joint management agreements under the *TSC* Act 1995 for populations (sites to be determined). • Specific management actions are identified in public land management plans and/or Actions for Biodiversity Conservation (ABC) system for all populations in Victoria.
3.2	Protect populations on private land. **Responsibility: DECCW**	• Private land owners approached to enter into voluntary conservation agreements using provisions within state legislation. • Important populations on private land have effective statutory protection. • Protection of species & habitat on DoD Morundah property.
3.3	Control threats from grazing. **Responsibility: DSE, PV, DECCW**	• Grazing regimes and fencing of populations negotiated with land owners/lease holders on private property (NSW). • Fencing constructed/maintained for Hattah-Kulkyne NP, Barmah State Park (Vic), Lake Urana NR (NSW) populations. • Measurable seedling recruitment/vegetative regeneration at all fenced sites. • Rabbit & kangaroo control programs at Hattah Kulkyne NP,

		Wyperfeld NP, West Wail FFR and Lake Urana NR.
3.4	Control threats from pest plants. **Responsibility: DSE, PV, DECCW**	• Control of Horehound near the Gunbower Island Reserve population undertaken. • Control of weeds at roadside populations and at significant populations undertaken.
3.5	Control the threat of direct damage by human activities. **Responsibility: DSE, PV, DECCW**	• Impact of human activities monitored at Gunbower Island population & pop. fenced if evidence of damage. • Access blocked to the track that runs adjacent to pop. in West Wail FFR.
3.6	Ensure relevant land managers are aware of the location of all populations. **Responsibility: DSE, DECCW, PV, CMA, LG**	• Population data incorporated on GIS and planning layers with relevant govt agencies.
Specific Objective 4: Identify key biological functions		
4.1	Evaluate current reproductive status, seed bank status, longevity, fecundity and recruitment levels. **Responsibility: DSE, DECCW**	• Reproductive ecology and regenerative potential quantified for four representative sites. • Seed bank potential quantified for 10 representative sites.
4.2	Identify key stimuli for seed germination requirements. **Responsibility: DSE, DECCW**	• Stimuli for recruitment identified. • Management strategies identified to maintain, enhance or restore processes fundamental to reproduction and survival.
4.3	Identify disturbance regimes to maintain or improve habitat. **Responsibility: DSE, DECCW**	• Management prescriptions implemented at three sites.
Specific Objective 5: Determine the growth rates and viability of populations		
5.1	Measure population trends and responses against recovery actions by collecting demographic information including recruitment and mortality, timing of life history stages and morphological data. **Responsibility: PV, DSE, DECCW**	• Techniques for monitoring developed and implemented. • Population growth rates determined and Population Viability Analysis completed for six important populations.
Specific Objective 6: Establish a seed bank		
6.1	Establish a seed bank and determine seed viability. **Responsibility: DSE**	• Seed from 10 populations in storage and seed viability and germination determined.
Specific Objective 7: Build community support for conservation		
7.1	Identify opportunities for community involvement in the conservation of Winged Peppercress. **Responsibility: DSE/DECCW**	• Community nature conservation, Landcare groups and land owners and managers aware of the species and support its conservation.

Abbreviations: CMA – Catchment Management Authority; DECCW – Department of Environment ,Climate Change and Water (NSW); DPI – Department of Primary Industries (Vic); DSE – Department of Sustainability and Environment (Victoria); LG – Local Government; PV – Parks Victoria; RBG – Royal Botanic Gardens, Melbourne

Affected Interests

All known Victorian populations occur on public land managed by Parks Victoria and the Department of Sustainability and Environment. In NSW the species occurs on public land (Lake Urana Nature Reserve) managed by the Department of Environment ,Climate Change and Water, and several roadsides (Travelling Stock Reserves) managed by Central Darling Shire Council and railway land managed by the Rail Corporation of NSW. In addition there are records from land owned by the Department of Defence and possibly private land.

Role and Interests of Indigenous People

Indigenous communities on whose traditional lands the Winged Peppercress occurs are being advised, through the relevant regional Indigenous facilitator, of this Recovery Plan. Indigenous communities will be invited to be involved in the implementation of the Recovery Plan.

Biodiversity Benefits

The Recovery Plan includes a number of potential biodiversity benefits for other species and vegetation communities. Principally, this will be through the protection and management of habitat, which will also benefit a number of other rare or threatened plant species growing in association with Winged Peppercress such as Heathy Bluebush *Maireana oppositifolia*.

Social and Economic Impacts

The implementation of this Recovery Plan is unlikely to cause significant adverse social and economic impacts. Most remaining populations of Winged Peppercress occur on public land, either in parks or reserves, where nature conservation is already a high priority for management. Any populations on private land will be protected through negotiation with landowners.

Management Practices

Management practices required to conserve the Winged Peppercress include:

- Fencing and signposting to protect and prevent inadvertent damage.
- Weed control.
- Controlling grazing pressure, both from livestock and other herbivores.
- Burning or light seasonal grazing to reduce plant competition and maintain an open sward.
- Consultation with public land managers where the species occurs or is likely to occur.
- Covenants or other conservation agreements for protection of significant private land sites, though negotiation with landowners.
- Encouraging and facilitating community participation in recovery actions.
- Surveys and publicity to locate new populations, especially on roadsides and private land.
- Research into the ecology and management of the species and its habitat, especially in disturbance regimes required to maintain populations.

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Priority, Feasibility and Estimated Costs of Recovery Actions

Action	*Description*	*Priority*	*Feasibility*	*Responsibility*	*Cost estimate*					
					Year 1	Year 2	Year 3	Year 4	Year 5	Total
1	**Distribution, abundance**									
1.1	Pop. surveys	1	100%	DSE, DECCW	$8,000	$8,000	$8,000	$8,000	$8,000	$40,000
2	**Habitat requirements**									
2.1	Survey known habitat	1	100%	DSE, DECCW	$10,000	$10,000	$10,000	$0	$0	$30,000
2.2	Identify, survey potential habitat	2	75%	DSE, DECCW	$0	$0	$10,000	$10,000	$10,000	$30,000
3	**Threat control**									
3.1	Protect public land populations	1	75%	DSE, DECCW	$5,000	$5,000	$0	$0	$0	$10,000
3.2	Protect private land habitat	1	50%	DSE,DECCW	$0	$0	$5,000	$5,000	$5,000	$15,000
3.3	Control threats from grazing	1	75%	DSE, DECCW, PV	$10,000	$10,000	$10,000	$5,000	$5,000	$35,000
3.4	Control threats from pest plants	1	75%	DSE, DECCW, PV	$10,000	$10,000	$10,000	$10,000	$10,000	$35,000
3.5	Control threats from disturbance	1	75%	DSE, DECCW, PV	$5,000	$5,000	$5,000	$0	$0	$15,000
3.6	Population locations	2	75%	DSE, DECCW, PV, CMA, LG	$0	$8,000	$0	$0	$0	$8,000
4	**Biology, ecology**									
4.1	Evaluate reproductive status	2	75%	DSE, DECCW	$10,000	$5,000	$5,000	$0	$0	$20,000
4.2	Determine seed germination	2	75%	DSE, DECCW	$0	$0	$10,000	$5,000	$5,000	$20,000
4.3	Identify disturbance regimes	2	75%	DSE,DECCW	$15,000	$10,000	$10,000	$0	$0	$35,000
5	**Population viability**									
5.1	Det. pop. growth rates, viability	3	75%	DSE, DECCW	$14,000	$10,000	$10,000	$8,000	$8,000	$50,000
6	**Cultivation**									
6.1	Establish a seed bank	3	50%	DSE	$0	$0	$5,000	$2,000	$2,000	$9,000
7	**Community support**									
7.1	Community extension	2	100%	DSE, DECCW, PV	$4,000	$4,000	$4,000	$4,000	$4,000	$20,000
				Total	**$91,000**	**$85,000**	**$102,000**	**$57,000**	**$57,000**	**$372,000**