National Recovery Plan for the Mueller Daisy *Brachyscome muelleroides*

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Australian Government

NSW GOVERNMENT Environment, Climate Change & Water

State Government Victoria Department of Sustainability and Environment

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Published by the Victorian Government Department of Sustainability and Environment (DSE) Melbourne, July 2010.

Authorised by the Victorian Government, 8 Nicholson Street, East Melbourne.

ISBN 978-1-74242-005-9

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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Citation: Lucas, A 2010. National Recovery Plan for the Mueller Daisy *Brachyscome muelleroides*. Department of Sustainability and Environment, Melbourne.

Cover photograph: *Brachyscome muelleroides* plants and habitat at Barmah State Forest by David Cheal.

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Summary

The Mueller Daisy *Brachyscome muelleroides* is a small annual herb restricted to the mid-Murray and Murrumbidgee Rivers region in New South Wales South and Victoria. The species occurs in seasonally wet depressions in the landscape, and appears to rely on seasonal inundation to survive. Current distribution and abundance are poorly known, but there may only be 5–6 locations where the species currently occurs, with most plants (about 20,000) occurring at a single location in New South Wales. Threats are believed to include weed invasion, grazing and altered flooding regimes. The Mueller Daisy is listed as Vulnerable under the Commonwealth *Environment Protection and Biodiversity Conservation Act* 1999, as Threatened under the *Victorian Flora and Fauna Guarantee Act* 1988 and as Vulnerable under the New South Wales *Threatened Species Conservation Act* 1995. This national Recovery Plan for *B. muelleroides* is the first recovery plan for the species, and details its distribution, habitat and threats, and the recovery objectives and actions necessary to ensure its long-term survival.

Species Information

Description

Brachyscome muelleroides G.L. Davis is a small annual herb growing to about 7 cm tall (rarely to 20 cm), with several slender, grass-like leaves to 7 cm in length arising from the base of the plant or from the lower stem. The stem bears a single white-petalled daisy flower with a yellow centre, and flowering occurs from September to November. The fruit is brown, 0.9 mm in length, with two ridges on its lateral faces, a distinct pappus consisting of a tuft of short (0.2 mm long) hairs and has cream or brown wings that are folded toward the single seed (description from Davis 1948; Stuwe 1981; Walsh & Entwisle 1999). It appears that sufficient autumn rainfall that results in localised soil waterlogging, or periodic flooding, is required to initiate seed germination and plant growth (Stuwe 1981).

Distribution

Brachyscome muelleroides is endemic to south-eastern Australia, where it is restricted to the floodplains of the Murray and Murrumbidgee Rivers and their tributaries in northern Victoria and southern New South Wales, in the Riverina and South Western Slopes IBRA bioregions (*sensu* DEH 2000) (Figure 1). Distributional limits appear to be Narrandera (NSW) in the north and Locksley (Vic) in the south. However, it is difficult to ascertain its current distribution due to lack of recent surveys, the inconspicuous nature of the plant and its probable reliance on environmental factors such as periodic flooding to grow each year. Only five sites have precise locality details, and four of these are on Morundah Station in NSW. There are unconfirmed records of *B. muelleroides* at additional sites in northern Victoria (Howard Marshall, affiliation, pers. comm.) but these require further investigation. Maps showing the distribution of *B. muelleroides* are available from the Department of Sustainability and Environment (for Vic) and the Department of Environment, Climate Change and Water (for NSW).

Habitat

Brachyscome muelleroides occurs in seasonally damp situations such as shallow depressions and around the margins of swamps, lagoons and claypans, on heavy grey cracking clays to lighter clay loam soils, in grassland, grassy woodland and open forest habitats, growing in association with various grasses and seasonal aquatic plants such as *Marsilea* species. Density of groundcover vegetation may vary, being sparser when the depressions are flooded or have dried out, and quite dense when soil moisture remains high in between wetting and drying cycles (Howard Marshall, pers. comm). Where trees are present, these are typically River Red Gum *Eucalyptus camuldulensis* or, less commonly, Grey Box *E. microcarpa* (Stuwe 1981; Geoff Robertson DECC, pers. comm.). A 1950 record from near Jerilderie may have been from *Acacia pendula* woodland. Rainfall varies from an annual average of 370 mm in the north of its distribution to 640 mm in the south. Recovery actions include survey for habitat critical to survival of *B. muelleroides*.

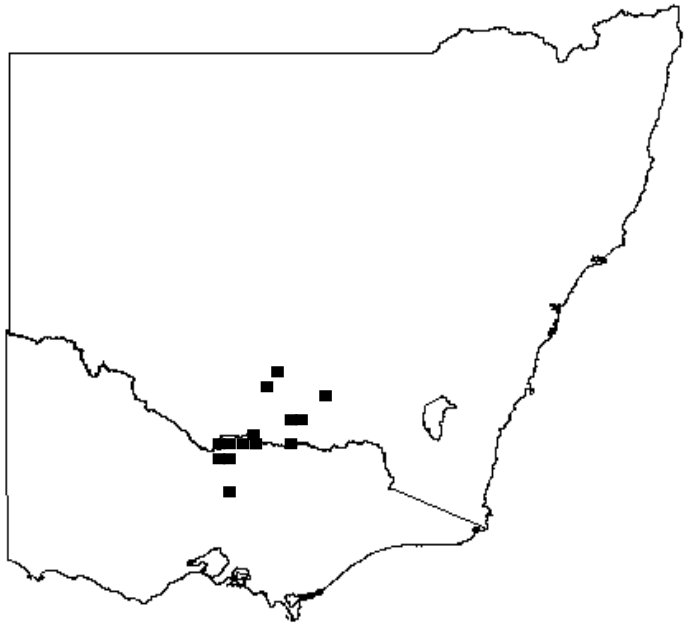

Figure 1. Distribution of *Brachyscome muelleroides*

Table 1. Population information for *Brachyscome muelleroides*

Location	Plant Nos & Year	Manager	Comments
New South Wales			
Morundah Station	~20,000 plants (2005)	DoD	property leased for farming; plants occur in wet depressions scattered over several paddocks (Boree, Shed Farm, South Dicks, West Franks)
Fagans Reserve	'plentiful' (1949)	LHPA	
Bulgandry Reserve	'not plentiful' (1949)	LHPA	
Wallandool Reserve	unknown (1951)	LHPA	
Victoria			
Barmah State Forest Grinters Ridge Tram Swamp Hammys Plain	 'abundant' (1995) unknown (1995) unknown (1995)	DSE	occurs at three dispersed areas in forest; possibly occurring over a large area at each site
Barmah State Park Ulupna Island Forcing yards Sandy Crossing	 unknown (1993) unknown (1979) ~750 plants (1980)	PV	
Lower Ovens Regional Park	unknown (1985)	PV	
River Murray Reserve	unknown (1985)	DSE	
Tocumwal Regional Park	unknown (1985)	PV	
Naringaningalook Grasslands	unknown (1996)	TfN	cover abundance estimated at <1%
Locksley Reserve	20 plants (2000)	PV	
Brooms Rd Nathalia	unknown (2004)	private	
Railway line, Picola	unknown (1930)	V/line	

Abbreviations: DoD = Department of Defence; DSE = Department of Sustainability and Environment (Vic); LHPA = Livestock Health and Pest Authority; PV = Parks Victoria; TfN = Trust for Nature

Population Information

Little is known about the current location and status of *B. muelleroides*. The species has been recorded from about 20 locations since 1900, only about 13 locations since 1930 and only eight locations since 1990 (Table 1). The most important site appears to be Morundah Station in NSW, a Commonwealth Department of Defence property leased for grazing, which has almost all currently recorded plants. One proposed recovery action is to survey for and monitor populations to gain more accurate information on distribution and abundance of *B. muelleroides*.

Decline and Threats

Little is known of the former distribution and abundance of *B. muelleroides*. Many records of the species are now several decades old, and there are few recent records, with most known plants occurring on Morundah Station in NSW. However, there are fluctuations in numbers from year to year, and the inconspicuous nature of the species may mean it has been overlooked. The extended drought covering much of its distribution over the last decade has also meant few opportunities to survey for flowering plants. It is likely that there has been a historical decline in abundance of *B. muelleroides*, with much of the area within its distribution being converted to agriculture, causing loss and degradation of habitat. Natural river flows and flooding regimes have been substantially altered through river regulation, with a consequent reduction in flooding and probably fewer opportunities for germination and growth of *B. muelleroides*.

Remaining populations of *B. muelleroides* are likely to face a number of threats, discussed in further detail below.

Altered hydrological regimes

Altered hydrological regimes, especially the reduction in flooding, are a major threat to *B. muelleroides* throughout much of its range. The exact relationship between flooding and waterlogging and *B. muelleroides* is presently unknown. However, it is clear that the species can tolerate wet environments, and that germination and growth seem to be highly dependent upon wetter years. It is not known how long seeds remain viable through extended dry periods, such as that prevailing throughout much of the Murray-Darling Basin over the last decade.

Increased flow regulation in the Murray and Murrumbidgee catchments where *B. muelleroides* occurs has lead to a substantial reduction in flow, with 98% of divertable flows diverted from the Murray River and 94% from the Murrumbidgee River catchments, leading to a significant reduction in flooding events (Crabb 1997; Kingsford 2000). Reduction in flows needed to produce spring floods is compounded by levee banks in some areas that prevent floodwaters reaching *B. muelleroides* habitat. *B. muelleroides* also grows in areas that become seasonally waterlogged. These areas may be affected by changes to local drainage patterns, such as occur when ditches are constructed.

Invasive weeds

Invasive weeds may be a threat to *B. muelleroides* if they increase the density of ground cover above the preferred sparse cover (Stuwe 1981). Weeds found at the various sites where *B. muelleroides* has previously been recorded include Marsh fox-tail *Alopecurus geniculatus*, Large Quaking-grass *Briza maxima*, Great Brome *Bromus diandrus*, Soft Brome *Bro. hordeaceus*, Patterson's Curse *Echium plantagineum*, Bastards Fumitory *Fumaria bastardii*, Cat's Ear *Hypochoeris radicata*, Wimmera Rye-grass *Lolium rigidium*, Paradoxical canary-grass *Phalaris paradoxa*, Cat's-tail *Rostraria cristata*, Rough Sow-thistle *Sonchus asper*, Sow Thistle *S. oleraceus*, Narrow-leaf Clover *Trifolium angustifolium*, Hare's-foot Clover *T. arvense*, Suckling Clover *T. dubium*, Cluster Clover *T. glomeratum*, Purple-top Verbena *Verbena bonariensis* and Squirrel-tail Fescue *Vulpia bromides*.

Grazing

The impact of grazing on *B. muelleroides* is not known. Grazing by domestic stock may be a threat to the species through consumption of plants, trampling, reducing regeneration rates, spreading weeds and soil degradation (Robertson & Rowling 2000; Rutherford *et al.* 2002). However, Stuwe (1981) suggested that some seasonally inundated habitat of *B. muelleroides* may be less vulnerable to grazing by restricting stock access to the drier months when the plant is less likely to be growing and the hard-setting topsoils lessen the risk of disturbance.

Recovery Information

Recovery Objectives

The overall objectives of recovery are to minimise the probability of extinction of *B. muelleroides* 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 are to:

1. Determine distribution, abundance and population structure
2. Determine habitat requirements
3. Ensure that all populations and their habitat are protected and managed appropriately
4. Determine and manage threats to populations
5. Identify key biological functions
6. Determine growth rates and viability of populations
7. Build community support for conservation

Program Implementation and Evaluation

This Recovery Plan guides recovery actions for *B. muelleroides* and will be implemented and managed by the relevant nature conservation agency the Department of Sustainability and Environment in Victoria 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 *B. muelleroides*. 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**	• 10 probable population sites searched during flowering season. • Where plants detected, sites mapped for population size, condition and habitat.
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 any extant populations.
2.2	Identify and survey potential habitat, using ecological and bioclimatic information that may indicate habitat preference. **Responsibility: DSE, DECCW**	• Potential habitat in four locations surveyed. • Predictive model for potential habitat developed & tested at four sites.
Specific Objective 3: Ensure that all populations and their habitat are protected and managed appropriately		
3.1	Protect populations on public Land. **Responsibility: DSE, DECCW, DoD**	• Public Authority Management Agreements or similar in place for all populations on public land (Vic). • Joint Management Agreements or similar arrangement at Fagans Reserve, Bulgandry Reserve and Wallandool Reserve (NSW) if the species is relocated at these sites.
3.2	Protect populations on private land. **Responsibility: DSE, TFN**	• Stewardship Licences negotiated for Morundah Station. • Voluntary agreements in place for four populations on private land.

Specific Objective 4: Determine and manage threats to populations		
4.1	Control threats from pest plants. **Responsibility: DSE, PV, DECCW, DoD, TFN**	• Reduction in cover of weeds at and near all treated sites.
4.2	Clarify and appropriately address threats from grazing. **Responsibility: DSE, PV, DECCW, DoD, TFN**	• Impact of grazing determined. • Fencing of populations on private property, Morundah Station, Fagans Reserve, Bulgandry Reserve and Wallandool Reserve if the species is relocated at these sites • Reduction in damage at and near all treated sites.
Specific Objective 5: Identify key biological functions		
5.1	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 six representative sites.
5.2	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.
5.3	Identify optimal flooding regimes to maintain habitat. **Responsibility: DSE**	• Preparation and implementation of management prescriptions for flooding at Barmah forest.
Specific Objective 6: Determine the growth rates and viability of populations		
6.1	Measure population trends and responses against recovery actions by collecting demographic information including recruitment and mortality, timing of life history stages and morphological data. **Responsibility: DSE, PV, DECCW**	• Techniques for monitoring developed and implemented. • Population growth rates determined and Population Viability Analysis completed for all populations.
Specific Objective 7: Build community support for conservation		
7.1	Identify opportunities for community involvement in the conservation of the *B. muelleroides*. **Responsibility: DSE, PV, DECCW**	Community nature conservation groups and Landcare groups aware of the species and support its conservation.

Abbreviations: DECCW – Department of Environment, Climate Change and Water (NSW); DoD – Department of Defence; DSE – Department of Sustainability and Environment (Victoria); PV – Parks Victoria; Trust for Nature (Vic)

Management Practices

The philosophy of the strategy for recovery is habitat conservation, restoration and management combined with an understanding of the ecological and biological requirements of *Brachyscome muelleroides*. 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 primarily structured to (i) acquire baseline data, (ii) assess habitat condition including ecological and biological function, (iii) protect populations to maintain or improve population growth and (iv) to engage the community in recovery actions.

On-ground site management will aim to clarify threatening processes and mitigate them thereby insuring against extinction. Major threats requiring management include accidental destruction, competition from pest plants, grazing by pest animals and loss of variability to habitat from changes to flooding and waterlogging regimes. A range of strategies will be necessary to alleviate these threats, including weed control, fencing, control of pest animals and increases in flood flows. Broad scale protection measures applicable to all populations include legal protection of sites, habitat retention and liaison with land managers including private landholders. In addition, searches of known and potential habitat should continue to better define the distributions and size of populations.

The Recovery Plan also advocates strategies to fill some of the major gaps in our knowledge to date. These include an understanding of the mechanisms underlying recruitment and regeneration. Successful *in situ* population management will be founded on understanding the relationships between *B. muelleroides* and associated flora, and its response to environmental processes. These are directly linked to biological function 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. Community participation in recovery actions will be sought, particularly in regard to recovery team membership and implementation of on-ground works.

Affected Interests

Brachyscome muelleroides populations occur on land managed by the Department of Environment, Climate Change and Water (NSW), Department of Sustainability and Environment (Vic), Parks Victoria, Moira Shire Council (Vic), Strathbogie Shire Council (Vic), Trust for Nature, Department of Defence, and the Livestock Health and Pest Authority (NSW) as well as private landholders. These land managers have been contacted and have approved relevant actions in this recovery plan subject to the availability of funding. Private landholders who were not contacted will be approached upon implementation of this recovery plan, where specific recovery actions are proposed on their land.

Role and Interests of Indigenous People

Indigenous communities on whose traditional lands the *B. muelleroides* occurs have been advised, through the relevant regional Indigenous facilitator, of the preparation of this Recovery Plan and invited to provide comments and be involved in the implementation of the plan.

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. 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 *B. muelleroides*, particularly those species with similar life forms and/or flowering responses. For example, the Winged Peppercress *Lepidium monoplocoides* and Slender Darling-pea *Swainsona murrayana* are found in seasonally damp or waterlogged sites, and both species have been found at Morundah Station growing near *B. muelleroides*. *Lepidium monoplocoides* is listed as endangered nationally and in both States, while *S. murrayana* is listed as endangered in Victoria and vulnerable nationally and in NSW. Other regionally threatened species such as *Leptorhynchos orientalis* and *S. sericea* grow at Morundah Station and would potentially benefit from conservation actions for *B. muelleroides*. The Recovery Plan will improve public education as threatened flora 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.

Social and Economic Impacts

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

Acknowledgements

I would like to thank the following people who provided information, critical comment or assisted with field work during the preparation of this recovery plan: David Cheal, Judy Downe, Alison King, Geoff Sutter and Rolf Weber (Department of Sustainability and Environment Vic); Martine Casey and Reg Murray (Parks Victoria); Terry Barnard, Ian Faithfull, Danny Kupsch and Kerry Roberts (Department of Primary Industries Vic); Geoff Robertson (Department of Environment, Climate Change and Water NSW); Helen Brindley (Department of Defence, NSW); Joan Harding (Nathalia) and Howard Marshall (Nathalia); Robert McKelleher (Environment Australia); Bruce Mullins (Eco Logical Australia Pty Ltd); Doug Robinson (Trust for Nature Vic); Allan Sammel (Livestock Health and Pest Authority NSW) and Keith Ward (Goulburn Broken Catchment Management Authority, Vic).

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Priority, Feasibility and Estimated Costs of Recovery Actions

Action	*Description*	*Priority*	*Feasibility*	*Responsibility*	*Cost estimate*					
					Year 1	Year 2	Year 3	Year 4	Year 5	Total
1	**Distribution, abundance**									
1.1	Surveys	1	100%	DSE, PV, DECCW	$10,000	$10,000	$10,000	$8,000	$8,000	$46,000
2	**Habitat requirements**									
2.1	Known habitat	1	100%	DSE, DECCW	$15,000	$15,000	$0	$0	$0	$30,000
2.2	Potential habitat	2	75%	DSE, DECCW	$0	$0	$15,000	$15,000	$10,000	$40,000
3	**Habitat protection**									
3.1	Public land	1	100%	DSE, DECCW, DoD	$10,000	$8,000	$0	$0	$0	$18,000
3.2	Private land	1	75%	DSE, TFN	$0	$0	$5,000	$5,000	$0	$10,000
4	**Threat management**									
4.1	Pest plants	1	75%	DSE, PV, DECCW, DoD, TFN	$8,000	$8,000	$10,000	$10,000	$10,000	$46,000
4.2	Grazing	1	100%	DSE, PV, DECCW, DoD, TFN	$0	$10,000	$10,000	$2,000	$2,000	$24,000
5	**Biological functions**									
5.1	Reproductive status	2	75%	DSE, DECCW	$10,000	$10,000	$10,000	$5,000	$5,000	$40,000
5.2	Seed germination	2	75%	DSE, DECCW	$0	$0	$0	$5,000	$5,000	$10,000
5.3	Flooding	2	50%	DSE	$0	$15,000	$15,000	$15,000	$0	$45,000
6	**Population viability**									
6.1	Censusing	1	75%	DSE, PV, DECCW	$15,000	$15,000	$15,000	$12,000	$12,000	$69,000
9	**Community support**									
9.1	Community extension	3	75%	DSE, PV, DECCW	$2,000	$2,000	$2,000	$2,000	$2,000	$10,000
				TOTALS	$70,000	$93,000	$92,000	$79,000	$54,000	$388,000