

Action Statement

Flora and Fauna Guarantee Act 1988

No. 149

Grampians Pincushion-lily

Borya mirabilis

Description

Grampians Pincushion-lily *Borya mirabilis* is a clump forming, herbaceous lily up to about 15 cm high. It has brown erect or ascending stems, covered with the remains of leaf sheaths which have the appearance of fine scales, and on their lower parts support aerial roots. Leaves are spiky, linear, 10-16 mm long, and approximately 0.5 mm wide, tapering gradually from the persistent sheath. Growth of new shoots and inflorescences is terminal. Flowers are white, borne on scapes 3-7 cm long, 4-12 together in ovoid heads surrounded by several sharp, involucre bracts (Churchill 1985, 1987; Cropper 1993; Conran 1994).

Grampians Pincushion-lily was recognised by Churchill (1985, 1987) as a narrow Victorian endemic, having been previously included under *B. nitida* Labill., a species restricted to the southwest of Western Australia. *B. mirabilis* is distinguished by its bracteoles being longer than the floral bracts.

Distribution

Borya Labill. is a genus of about 10 species, mainly confined to southwestern Australia but with one species known from northern Queensland and one from northern Western Australia and the Northern Territory (Churchill 1985). In Victoria, it occurs in the Greater Grampians Bioregion (NRE 1997), but has only been recorded with certainty from a single population in the Wonderland Range, Grampians National Park. There is one unconfirmed report of another population in the Victoria Range (S. Cropper *pers. comm.*), but otherwise no firm evidence of a previously more widespread distribution.

C. W. Dalton collected the first *B. mirabilis* specimens in 1924 from the Grampians National Park but the site was thought to have become



Grampians Pin-cushion Lily *Borya mirabilis*
(Photo: John Eichler)



Distribution in Victoria (DSE 2004)

extinct (Gaff and Churchill 1976) until 1983, when it was re-discovered (Cropper 1994). Its location was made known to the National Parks and Wildlife Service in 1992, but otherwise is largely kept confidential

Habitat

The site supporting Grampians Pincushion-lily in the Wonderland Range consists of low open shrubland on a ferruginous sandstone outcrop consisting of a series of rocky terraces (Cropper 1993). Colonies are distributed over an area approximately 60 m x 20 m. Soils are seasonally moist by virtue of seepage, which has also caused erosion of the bedrock and contributed to the accumulation of fine sandy loam soil, a relatively rare occurrence in rocky environments which may have favoured the persistence of the population at this site. Soil depth ranges from just a few centimetres up to one metre. Slopes supporting *B. mirabilis* colonies are about 15° on average, facing northeast. Charcoal particles distributed across the site suggest that it has been burnt in the past, although there are no records of fire.

Dominant species are *Grevillea aquifolium*, *Kunzea parvifolia*, *Calytrix tetragona*, *Melaleuca decussata* and *Dodonaea viscosa* spp. *spatulata*. Associated species include *Lepidosperma viscosa*, *Gonocarpus mezeianus*, *Phyllanthus hirtellus*, *Leptospermum scoparium* and *Austroanthonia setacea*. *Callitris rhomboidea* and *Eucalyptus alaticaulis* are occasional emergents. A number of annual herbs appear in spring, associated with bryophyte and lichen communities, including *Siloxerus multiflora*, *Drosera whittakeri* subsp. *aberrans*, *D. peltata* subsp. *auriculata*, *Centrolepis strigosa*, and *C. aristata*.

One other rare species (DSE 2003), *Austrostipa hemipogon* has been recorded from the site.

Life History

Grampians Pincushion-lily is a perennial herb. Plants flower between September and October, although no fruit or seed development has been observed. Plants gradually change from green to orange over summer, until fully desiccated by February, although a return to moist conditions can reverse this process (D. Handscombe *pers. comm.*). Further discolouration to a yellowish straw-like appearance continues until early autumn, when leaves rehydrate and gradually become green once more. Leaves may also be shed during the desiccation period. Buds probably develop in June, although the complete life history of the species has not been observed.

Ecology and Biology

Grampians Pincushion-lily is a resurrection plant, having the ability to tolerate desiccation over summer and rehydrate after the onset of autumn rains. However, disturbance to soils or litter cover, or unseasonal weather patterns which restrict or disrupt moisture levels may in turn disrupt physiological processes critical to revival.

In general, resurrection plants such as *Borya* are unable to recover from a quiescent state which extends beyond a couple of years, after which time a proportion of cells fail to regenerate and ultimately the plant dies (D. Gaff *pers. comm.*). Resurrection plants tend to be poor competitors, depending on shallow soils where more deep rooted, vigorous species are unable to establish.

Reproduction is vegetative, presumably by adventitious roots which occur on stems, or by separation of sections of the colony. On more vertical sections of rock, *B. mirabilis* colonies appear to be part of lithoseral stages, where bare rock is colonised by algae and crustose lichens, followed by bryophytes, herbs and geophytes which facilitate soil accumulation, and subsequent colonisation by more deep rooted or woody species. At a critical stage, when the substrate is no longer able to support their weight, parts or the whole of the colonising community will break away.

The response of Grampians Pincushion-lily to fire is unclear, although the site does appear to have been burnt at some time in the past. *B. mirabilis* is likely to be insect pollinated. However, the population is thought to consist of only one genotype and plants may be unable to breed because of genetic restrictions (Cropper 1994).

Population structure and condition

Approximately 70 ramets are distributed within five colonies over an area approximately 60 m x 20 m, although all except one colony occur within 20 m of each other. Ramets in each colony appear as irregular shaped 'clumps', but are not always easy to separate into individual plants.

Leaf shedding and a gradual decline in the ability of plants to produce new growth or resurrect fully from a desiccated state has been observed by Parks Victoria Rangers since 1996 (D. Handscombe, J. Read *pers. comm.*). Although some Western Australian *Borya* species are known to avoid drought by shedding leaves during periods of stress (Churchill 1987), this has not been observed in *B. mirabilis* and the current cause of leaf loss is unknown. Some basal resprouting was observed in early summer, 1997, but seemed to be restricted to plants growing in deeper soils protected from disturbance and moisture loss, beneath shrubs and in crevices between boulders.

Plants confined to more open sites are generally in poor health and often rooted in raised mounds of soil, suggesting that there has been a significant amount of erosion of soil within the population. There are a number of dead shrubs at the site, although the species affected suggest that this is most likely a result of drought or natural senescence, rather than infection by fungal pathogens such as *Phytophthora cinnamomi*.

Thus, it is likely that the current observed decline can be attributed to inadequate moisture supplies throughout autumn and winter since 1996, exacerbated by additional soil drying related to habitat disturbance. As a consequence, plants may be desiccated for too long a period and have been unable to fully recover, or the period and degree of rehydration between long spells of dryness is inadequate to sustain them in the following season.

Propagation potential

Grampians Pincushion-lily can be cultivated from cuttings but appears to require a reasonably specific watering regime, including wet and dry periods (N. Walsh *pers. comm.*).

A large collection of Australian *Borya* spp., including *B. mirabilis*, was maintained at the Royal Botanic Gardens, Melbourne, but has declined in recent years. There is some anecdotal evidence of a private collection of *B. mirabilis* grown from material collected in the Victoria Range by Dr Ross McDonald (S. Cropper *pers. comm.*).

Three to four plants were also held in cultivation at Monash University, established from a single plant donated by David Churchill in the early 1980s. During their cultivation, it was apparent that well watered, flourishing plants gradually lost their ability to desiccate and rehydrate. However, had they been given sufficient water stress so that the green appearance of leaves diminished gradually before full air drying, resurrection may have been more successful (Dr Don Gaff *pers. comm.*). Plants also tended to get long and leggy in cultivation and probably need occasional pruning (D. Gaff *pers. comm.*).

Current conservation status

National conservation status

Grampians Pincushion-lily is listed as endangered under the **Environment Protection and Biodiversity Conservation Act 1999**.

Victorian conservation status

Grampians Pincushion-lily is listed as a threatened taxon under the **Flora and Fauna Guarantee Act 1988**.

Grampians Pincushion-lily is considered 'endangered' in Victoria (DSE 2003)

Decline and threats

The site is prone to erosion due to slope and soil characteristics, and hydrology of the area (S. Cropper, DSE file 89/2950-1). However, this is likely to have been exacerbated in recent periods by prolonged drought, sometimes followed by sudden episodes of unseasonal heavy rainfall in western Victoria in 1997 and 1998.

Other factors contributing to soil disturbance and erosion are digging by animals, in particular rabbits, but also echidnas; trampling by black wallabies which have increased in numbers in the Grampians in recent years (P. Menkhorst *pers. comm.*), and possibly damage by goats.

Vegetation at the site may be becoming more open with dying back of associated shrubs, with the consequence of reduced shading and increased soil drying.

The Grampians is an extremely popular National Park, and the site is close to areas used by rock climbers and bushwalkers. Broken glass at the site suggests site visits, and therefore trampling, has occurred in the past. Illegal collection of plants, or damage to the site from naturalists also threaten the long term survival of the population.

Wildfire may threaten the population's persistence (Churchill 1987), although there is evidence that the site has been burnt in the past. However, fire fighting activities including use of retardant and raking are potential threats.

The population lacks genetic variability and fails to set seed, and its small size and single occurrence suggests it is particularly vulnerable to extinction. Neither the biology nor ecology of *B. mirabilis* or other members of the genus is particularly well understood, so that population management may be hampered by lack of knowledge.

Existing conservation measures

Ground searches have been conducted by Field Naturalists and National Parks Officers (S. Cropper *pers. comm.*), and searches to identify broadly similar habitat were conducted by helicopter in 1993. Three distinct areas were identified. The feasibility of using fine resolution remote sensing techniques to locate other populations or similar habitat was investigated in 1993 (Cropper 1994).

A large *ex-situ* collection of *Borya* spp., including *B. mirabilis* was established at the Royal Botanic Gardens, Melbourne by David Churchill in the 1970s and 1980s. These were included with wild material in an allozyme analysis of *Borya*, conducted at La Trobe University in 1992 (Dr

Yvonne Fripp), to determine the genetic variation within the population (Cropper 1993).

The walking track near to the existing population will be realigned by Parks Victoria and the location of the site is kept confidential to reduce the likelihood of illegal collection and site damage.

Funding was received from Environment Australia to implement interim recovery actions in 1999 and 2000. Work includes identifying *B. mirabilis* habitat by comparing its floristic and environmental attributes with adjacent habitat to assess its potential to support translocated plants, and to determine whether the population might have been larger in the past. Permanent transects have also been established through individual plants to measure the proportion of resurrected or new shoots. Identification of life history stages and an assessment of population health is also underway.

Major conservation objectives

Long-term objectives

The long term goal is to prevent extinction or further decline in numbers of *B. mirabilis*, by maintaining and augmenting the existing population, and by managing existing habitat for the future self sustainability of the species.

Objectives of this Action Statement

1. Protect the existing population and its habitat from known threats.
2. Survey suitable habitat for undiscovered populations.
3. Establish a representative *ex-situ* collection.

Intended Management Actions

The intended management actions listed below are further elaborated in DSE's Actions for Biodiversity Conservation database. Detailed information about the actions and locations, including priorities, is held in this system and will be provided annually to land managers and other authorities.

Habitat management and restoration

1. Immediately commence remedial work at the site, to prevent further soil loss and to minimise further soil drying. Measures to reduce erosion should be investigated and trialed. These might include mulching around *Borya* plants using litter from taxa known to occur at the site, translocated bryophyte mats or translocated soil which has been suitably tested for physical and chemical properties and screened for *Phytophthora cinnamomi*. Work should be maintained annually.

Responsibility - Parks Victoria.

Control browsers

2. Control rabbit populations within and nearby the *B. mirabilis* site, while preventing further soil disturbance. An intensive program might include establishing bait stations. Rocky terrain and the need to maintain site security will preclude fencing. Baiting should be carried out quarterly.

Responsibility - Parks Victoria.

3. Conduct surveys to determine abundance and assess the impact of introduced goats and native animals on the plants or their habitat.

Responsibility - Parks Victoria.

Fire response plan

4. Prepare and circulate fire control guidelines to fire crews prior to planned burns, and in the event of unplanned fires, so that the risk of accidental damage to the population is reduced. These should include guidance on the use of retardant, use of rakes and clearing of vegetation for fire breaks. The location of the *B. mirabilis* population should also be made known to fire crews and its significance explained.

Responsibility - Parks Victoria.

5. Liaise with NRE to include guidelines in the Horsham District Fire Plan

Responsibility - Parks Victoria.

Monitoring

6. Revise current monitoring protocols for Grampians Pincushion-lily to ensure that monitoring activity does not affect the plants or the site while maintaining sufficient rigour to ensure that significant changes in the health, biomass and other key factors are detected.

Responsibility - Parks Victoria, DSE (Biodiversity & Natural Resources Division), Recovery Team

7. Implement the revised monitoring protocols.

Responsibility - Parks Victoria.

Surveys

8. Design surveys of suitable habitat to be undertaken seasonally or in response to unseasonal high rainfall events.

Responsibility - Parks Victoria, DSE (Biodiversity & Natural Resources Division), Recovery Team

9. Conduct surveys according to the specified design.

Responsibility - Parks Victoria.

Ex-situ conservation

10. Establish a representative ex-situ collection using material collected in late autumn or winter from all plants in the population.

Responsibility - Parks Victoria, Royal Botanic Gardens

11. Develop propagating techniques to maintain and expand ex-situ populations, for use in genetic work, translocation and to safeguard the species in the event of any unforeseen destruction of the wild population.

Responsibility - Parks Victoria, Royal Botanic Gardens

References

- ANZECC (1999) *Threatened Australian Flora*. Australian and New Zealand Environment and Conservation Council Report prepared by the ANZECC Endangered Flora Network, Canberra.
- Churchill, D. M. (1985) Three new species of *Borya* Labill. (Liliaceae). *Muelleria* **6**(1):1-8.
- (1987) *Borya*. *Flora of Australia*. Vol. **45**, *Hydatellaceae to Liliaceae*, pp. 268-277. Australian Government Publishing Service: Canberra.
- Conran, J. G. (1994) Liliaceae. In: *Flora of Victoria. Volume 2, Ferns and Allied Plants, Conifers and Monocotyledons* (Eds N. G. Walsh & T. J. Entwisle). Inkata Press: Melbourne.
- Cropper, S. (1993) *Management of Endangered Plants*. CSIRO, Melbourne.
- DSE (2003) *Advisory List of Rare or Threatened Plants in Victoria - 2003*. Department of Sustainability and Environment: East Melbourne. (available on the DSE web site)
- DSE (2004) *Flora Information System* (electronic flora database). Department of Sustainability and Environment: Melbourne.
- Gaff, D. F. & Churchill, D. M. (1976) *Borya nitida* Labill. - an Australian Species in the Liliaceae with Desiccation-tolerant Leaves. *Australian Journal of Botany* **24**: 209-224.
- NRE (1997) *Victoria's Biodiversity: Directions in Management*. Department of Natural Resources and Environment, Melbourne.
- SAC (1995) Final Recommendation on a nomination for listing: Grampians Pincushion Lily *Borya mirabilis*. (Nomination no. **206**). Scientific Advisory Committee, Flora and Fauna Guarantee. Department of Natural Resources & Environment: Melbourne.
- Walsh, N. G. and Entwisle, T. J. (1994) *Flora of Victoria. Volume 2, Ferns and Allied Plants, Conifers and Monocotyledons*. Inkata Press: Melbourne.

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Further information can be obtained from Department of Sustainability and Environment Customer Service Centre on 136 186.

Flora and Fauna Guarantee Action Statements are available from the Department of Sustainability and Environment website: <http://www.dse.vic.gov.au>

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