

**National Recovery Plan for the
Lowan Phebalium
*Phebalium lowanense***

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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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CONTENTS

Species Information	3
Description	3
Distribution	4
Population Information	4
Habitat	5
Decline and Threats	6
Recovery Information	7
Existing Conservation Measures	7
Recovery Objectives	7
Program Implementation and Evaluation	7
Recovery Actions and Performance Criteria	8
Management Practices	9
Affected Interests	9
Role and Interests of Indigenous People	9
Biodiversity Benefits	9
Social and Economic Impacts	10
Acknowledgments	10
Bibliography	10
Priority, Feasibility and Estimated Costs of Recovery Actions	12
Figure 1. Distribution of <i>Phebalium lowanense</i>	4

Summary

The Lowan Phebalium (*Phebalium lowanense*) is a small shrub endemic to south-eastern Australia, where it occurs in a small area of the mallee in south-eastern South Australia and western Victoria. There are perhaps 10 populations containing in total 100,000 plants, although the number of plants fluctuates widely, depending mostly on the time since fire. The majority of plants are found at only a few sites in the Ngarkat Conservation Park in South Australia. Altered fire regimes is probably the biggest threat, although weed invasion, disturbance and browsing (especially of small populations) are also threats. The Lowan Phebalium is listed as Vulnerable under the Commonwealth *Environment Protection and Biodiversity Conservation Act* 1999. This national Recovery Plan for the Lowan Phebalium is the first recovery plan for the species, and details its distribution, habitat, threats and recovery objectives and actions necessary to ensure its long-term survival.

Species Information

Description

The Lowan Phebalium is a small shrub growing to about 60 cm high (rarely to 90 cm) belonging to the Family Rutaceae. The branchlets are densely covered in small, silvery to rust coloured, membranous scales that become more silvery with age. The leaves are linear, 3–12 mm long and 1 mm wide, subsessile, with rounded tips, the margins strongly rolled under towards the midrib, the upper surface sparsely to moderately covered in white, stellate hairs (becoming devoid of these with age), the lower surface covered with small, membranous scales. Leaves are spreading, mostly c. 45°–90° away from stems, with leaves on younger branches more appressed to the stem. The small yellow flowers are arranged in a terminal, 1–6 flowered umbel-like cluster lacking a stalk. The pedicels are 3–7 mm long and densely covered with small, white membranous scales, while the calyx is broadly top-shaped but attached at the narrower end, 1.5–2 mm long, with silvery membranous scales toward the base and reddish-brown towards the tip. The petals are obovate, 4–5 mm long and overlap each other, the stamens project beyond the corolla tube, and the ovary is covered in small, silvery, membranous scales. Flowers appear in spring (description from Duretto 1999; Armstrong & Telford 1986).

Similar species: Silvery Phebalium (*Phebalium bullatum*) grows to 2 m tall and has flat or V-shaped leaves with prominently glandular and undulate margins, while Narrow-leaved Phebalium (*Phebalium stenophyllum*) grows to 1.5 m tall and has longer and wider leaves. A recently collected entity from Ngarkat Conservation Park (South Australia), reported as *Phebalium* sp. aff. *lowanense* (specimens held at the Adelaide Botanic Gardens) has wider leaves and a taller growth habit than *P. lowanense* (M. Jusaitis pers. comm.). Further taxonomic study is required to determine the identity of this taxon.

Fire is an important aspect of the ecology of Lowan Phebalium. While plants are killed by fire, fire is believed to be required for seed germination to occur, as non-fire related recruitment is rarely (if ever) seen. The fire-related cues for germination are unknown but may include both heat and/or smoke derivatives. Plants are not known to resprout from basal material after fire. Maturity appears to be reached in about six years, with prolific flowering and seed production occurring then, although sporadic flowering may occur earlier (Jusaitis 2000). Seeds have a hard coat and, once released from the plant, may persist in the soil for many years. The duration of seed persistence in the soil is unknown but may be 10–20 years, possibly longer. Plant longevity is about 20 years, rarely to about 40 years. Ecological studies of Lowan Phebalium have been undertaken by Jusaitis (2000); Barrie (2002); Obst (2007) and DEH (2008).

Distribution

The Lowan Phebalium is restricted to a small area in semi-arid mallee region of western Victoria and adjacent south-eastern South Australia (Figure 1), in the Murray Darling Depression IBRA bioregion (*sensu* DEH 2000). Maps showing the distribution of Lowan Phebalium are available from the Department for Environment and Heritage (for SA) and the Department of Sustainability and Environment (for Vic).

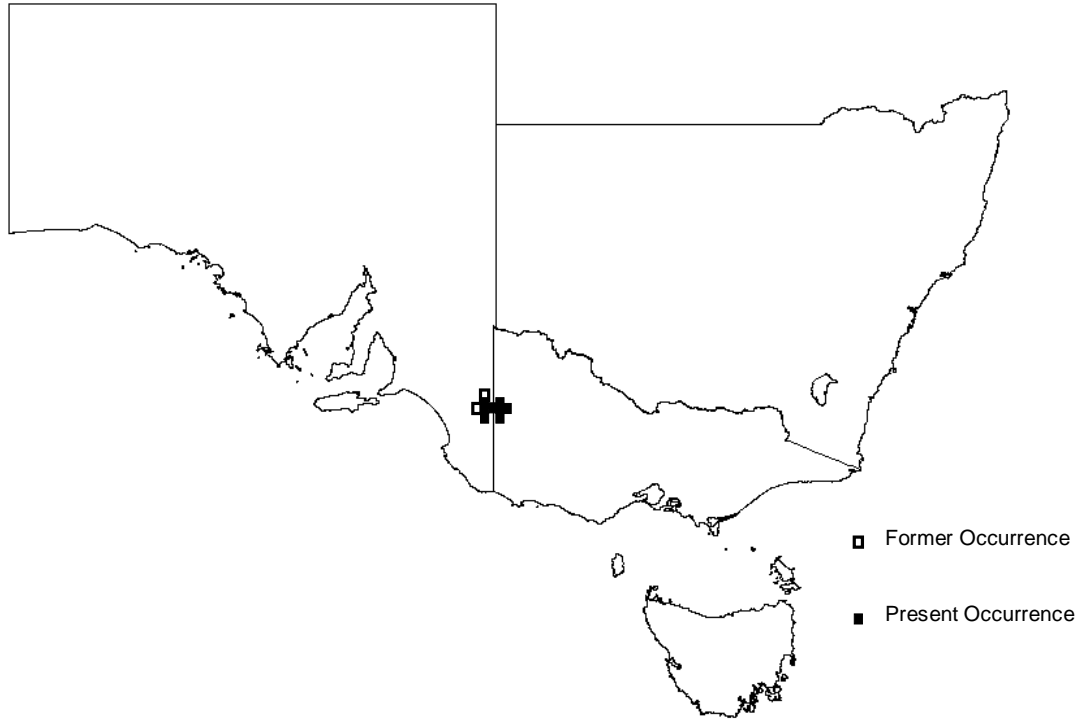


Figure 1. Distribution of *Phebalium lowanense*

Population Information

Most plants of Lowan Phebalium occur in Ngarkat Conservation Park in South Australia, with smaller numbers in the Big Desert region (encompassing Big Desert Wilderness Area, state forest and Wyperfeld National Park) in Victoria. Additional small populations are known from nearby roadsides, unreserved public land and private land in these areas. Lowan Phebalium has been recorded in three Heritage Agreement sites in South Australia, and one site has been monitored annually since 2005.

Estimating population and plant numbers for Lowan Phebalium is difficult because numbers fluctuate markedly, depending on time since fire. Following long periods without fire, there may be few extant plants present. However, after fire, mass germinations may occur, with tens of millions of seedlings estimated at one site in Ngarkat 1–2 years post-fire (Barrie 2002), although most of these disappeared within a few years. Based on the most recent (2004) assessments and other data (Jusaitis 2000; Barrie 2002), there are thought to be about 100,000 plants occurring in 10 locations ('populations'). However, the ecological isolation of many of these sites from others recorded nearby (eg. within a few kms) is often difficult to ascertain due to the likelihood of viable soil seed banks in intervening areas, which may germinate after fire. For example, the numerous recorded sites in Ngarkat may be presumed to comprise one population that has been disaggregated in the last c.100 years due to the spatial arrangement of historic fire regimes, but which may re-aggregate in future.

Populations of Lowan Phebalium occur in the following locations:

South Australia

- Ngarkat Conservation Park: est. 100,000 plants at six sites, across an area of est. 250 ha (2004). Currently monitored annually.
- Pinehill North Rd, South Australia (District Council of Tatiara): 44 mature plants (2004).
- Heritage Agreement site on Somers Rd: 12 mature plants (2004) (full extent not searched).
- Gaden's Heritage Agreement near Bordertown-Pinaroo Rd: 29 individuals monitored in 2007 (probably more than 60 plants on site; K. Dickson DEH, pers. comm.).
- Heritage Agreement site on Red Bluff Rd: unknown population size (1991).
- Private property west of the Dukes Highway/Bordertown - Pinnaroo Road junction: unknown population size (1991).

Historical records have been made in South Australia from the following locations:

- Mt Shaugh Conservation Park: unknown population size (1977).
- Mt Rescue Conservation Park: unknown population size (1977).
- Heritage Agreement north of Ngarkat CP: unknown population size (1977)
- Five properties south of Ngarkat CP, variously recorded between 1951 and 1964.

Victoria

- Wyperfeld National Park: 240 plants at two sites (16 ha & 4 ha) (1999).
- Karrangook Flora and Fauna Reserve: 37 mature plants (2004).
- Netting Fence Track (Shire of West Wimmera): 37 mature plants (2004).
- Big Desert State Forest: 243 mature plants at two sites (1999).
- Red Bluff Flora and Fauna Reserve: 'moderately common' (1985).

Habitat

Populations of Lowan Phebalium occur in open heathy mallee woodland, with sparse to absent cover of *Eucalyptus* species, but with high richness (and usually cover) of sclerophyllous shrubs and graminoids (Cyperaceae and Restionaceae). Soils in these areas are usually deep, well drained, bleached sands that are slightly acidic (pH 6.0–6.3) (Jusaitis 2000). Grasses (Poaceae) are usually sparse to absent, but may germinate after fire or heavy rain. Areas of dense *Eucalyptus* cover (e.g. *E. incrassata*, *E. arenacea*, *E. dumosa*, *E. leptophylla*) rarely support more than isolated occurrences of *P. lowanense*. Similarly, whilst *P. lowanense* has occasionally been recorded in low abundance within moderately dense *Callitris verrucosa* (Scrub Cypress-pine), *Callitris rhomboidea* (Oyster Bay Pine), *Melaleuca uncinata* (Broombush) or *Babingtonia behrii* (Broom Baeckea), it is almost certainly absent where these species form very dense mature stands. It is unclear whether *P. lowanense* becomes absent from areas of dense treed overstorey because of some competitive exclusion by the overstorey, or because *P. lowanense* has disappeared from these areas in the long term absence of fire. Plants may remain only as soil stored seed until the next fire or until seed is no longer viable.

Plant species frequently occurring with Lowan Phebalium include:

- *Adenanthos terminalis* (Gland Flower) - Proteaceae
- *Allocasuarina pusilla* s.l. (Dwarf Sheoak) – Casuarinaceae (characteristic amongst almost every significant population)
- *Astroloma conostephioides* (Flame Heath) - Epacridaceae
- *Baeckea crassifolia* (Desert Baeckea) - Myrtaceae
- *Banksia marginata* (Silver Banksia) – Proteaceae (more so in South Australian sites)
- *Banksia ornata* (Desert Banksia) - Proteaceae
- *Daviesia brevifolia* (Leafless Bitter-pea) - Fabaceae
- *Eucalyptus incrassata* (Yellow Mallee) – Myrtaceae (usually sparse in the tallest stratum)
- *Hibbertia riparia* (Erect Guinea-flower) - Dilleniaceae
- *Lepidobolus drapetocoleus* (Scale Shedder) - Restionaceae
- *Lepidosperma carphoides* (Black Rapier-sedge) - Cyperaceae
- *Philotheca pungens* (Prickly Wax-flower) - Rutaceae

- *Phyllota pleurandroides* (Heathy Phyllota) - Fabaceae
- *Spyridium subochreatum* var. *subochreatum* (Velvet Spyridium) – Rhamnaceae

Decline and Threats

There is little information available on the previous distribution and abundance of Lowan Phebalium. The former (pre-European settlement) geographic range of Lowan Phebalium is unlikely to have been far beyond the existing known range, as most of the surrounding land, which has been cleared, is on more productive soils that would have maintained different plant communities. However, the substantial clearing that has occurred, especially in South Australia, has probably fragmented populations, and distribution is likely to have been more continuous between existing populations. It is not known if the historical records of Lowan Phebalium from South Australia (Mt Rescue & Mt Shaugh CP, Heritage Agreement and private property sites adjacent to Ngarkat) represent possible losses of populations or simply long absence of fire. The Mt Rescue and Mt Shaugh sites were searched in 1989 but no plants were found (Jusaitis 2000). Further searches are warranted at these sites and in other remote areas of Ngarkat and Big Desert in *P. lowanense* habitat, especially after fire.

A variety of current and potential threats exist at the known populations of Lowan Phebalium in Victoria and South Australia:

Altered fire regimes

Unfavourable fire regimes are probably the biggest threat to Lowan Phebalium. Based on previous studies, a fire frequency of 10–30(-40) years is expected to maintain viable populations. The absence of fire at such sites for much longer may lead to local extinction of Lowan Phebalium, depending upon the length of time that seed can remain viable in the soil. Long unburnt sites with few (or even zero) plants may recover after subsequent fire if seeds remain viable in the soil. Intervals shorter than 10 years may see declines in abundance due to inadequate seed accumulation between fires. Intervals longer than about 30–40 years may see population decline where recovery is reliant solely on soil seed banks as standing plants senesce.



Basal stem (between thumb and finger) of very old (20–40 yrs) *Phebalium lowanense* on roadside near Bordertown, SA (photo by author, 2004)

Weed invasion

Several introduced weeds, notably *Amsinckia* spp. (Yellow Burrweed), *Asparagus asparagoides* (Bridal Creeper), *Briza* spp. (quaking grasses), *Echium plantagineum* (Patterson's Curse),

Ehrharta calycina (Perennial Veldt-grass) and *Marrubium vulgare* (Horehound) are present at or near many known populations and may become more invasive in the future if not controlled.

Disturbance/damage

Road or track widening or roadside vegetation slashing may threaten populations. Sites on private or unreserved public land are at risk of clearing, including areas of heathy mallee that contain *P. lowanense* only in the soil seed bank. Several sites on public and private land south of the Ngarkat and Big Desert areas require protection, including reservation for conservation purposes.

Browsing

Browsing by kangaroos, rabbits and hares may pose a seasonal threat to plants at various sites, especially in very dry years.

Recovery Information

Existing Conservation Measures

A number of conservation measures have been undertaken for the Lowan Phebalium, including:

- Placing a Heritage Agreement on the Somers Rd site (South Australia)
- Preparation of a multi-species regional recovery plan for the SA Murray-Darling Basin Natural Resource Management Board in 2005 (Obst 2005).
- Investigation of ecology, biology and conservation status in South Australia (Jusaitis 2000; Barrie 2002) and Victoria.
- Annual monitoring: ten quadrats have been monitored at seven different sites in Ngarkat CP & Gaden HA since 2005. Information collected includes the relative frequency of Lowan Phebalium and 14 other dominant plant species at the site, and specific life history data such as, height, basal diameter, number of buds and flowers, number of seed pods, plant dieback, grazing impact and distance to nearest Lowan Phebalium (Obst 2007; DEH 2008).

Recovery Objectives

The Overall Objective of recovery is to minimise the probability of extinction of the Lowan Phebalium 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 Lowan Phebalium are to:

1. Determine taxonomy, distribution, abundance and population structure
2. Determine habitat requirements
3. Ensure that all populations and their habitat are protected and managed
4. 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 the Lowan Phebalium and will be implemented and managed by the Department for Environment and Heritage (for South Australia) and the Department of Sustainability and Environment (for Victoria), 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 the Lowan Phebalium. The Recovery Plan will run for 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 taxonomy, distribution, abundance and population structure		
1.1	Clarify the taxonomic identity of a recently collected <i>Phebalium</i> sp. aff. <i>lowanense</i> from Ngarkat CP Responsibility: ABG	<ul style="list-style-type: none"> Taxonomic identity of all populations of <i>Phebalium</i> sp. aff. <i>lowanense</i> verified.
1.2	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: DEH, DSE, PV	<ul style="list-style-type: none"> 10 current population sites searched, 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: DEH, DSE, PV	<ul style="list-style-type: none"> Species/habitat specific survey design implemented. 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: DEH, DSE, PV	<ul style="list-style-type: none"> Potential habitat surveyed at five sites. Predictive model for potential habitat developed & tested at five sites. Opportunistic post-fire surveys undertaken in areas burned within the known range of <i>P. lowanense</i>.
Specific Objective 3: Ensure that all populations and their habitat are protected and managed appropriately		
3.1	Legally protect populations on unreserved public land. Responsibility: : DEH, DSE	<ul style="list-style-type: none"> Initiate Public Authority Management Agreements for Netting Fence Track site and Special Protection Zones in State Forest at Murrayville Track sites. Measure for legal protection of Pinehill North Rd public roadside site initiated. Actions to protect species incorporated in relevant management plans.
3.2	Protect populations on private land. Responsibility: DEH	<ul style="list-style-type: none"> Voluntary conservation agreement in place for private land site on Somers Rd.
Specific Objective 4: Manage threats to populations		
4.1	Control threats from pest plants. Responsibility: DEH, PV, DSE	<ul style="list-style-type: none"> Reduction in cover of weeds at and near all treated sites.
4.2	Control threats from grazing animals. Responsibility: DEH	<ul style="list-style-type: none"> No damage to current populations.
4.3	Control the threat of direct damage by human activities. Responsibility: DEH, DSE, PV	<ul style="list-style-type: none"> Reduced site disturbance from roadside maintenance activities notably within Ngarkat CP and Big Desert SF/Wyperfeld NP.
Specific Objective 5: Identify key biological functions		
5.1	Evaluate current reproductive status, seed bank status, longevity, fecundity and recruitment levels. Responsibility: DEH, DSE	<ul style="list-style-type: none"> Reproductive ecology and regenerative potential quantified for four representative sites. Seed bank potential quantified for five representative sites.
5.2	Identify key stimuli for seed germination requirements. Responsibility: DEH, DSE	<ul style="list-style-type: none"> Stimuli for recruitment identified. Management strategies identified to maintain, enhance or restore processes fundamental to reproduction and survival.
5.3	Identify optimal fire regimes to maintain habitat. Responsibility: DEH, DSE	<ul style="list-style-type: none"> Preparation and implementation of management prescriptions for ecological burning at five sites.

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: DEH, DSE, PV	<ul style="list-style-type: none"> • 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 Lowan Phebalium. Responsibility: DEH, DSE, PV	Community nature conservation and Landcare groups, land owners and land managers aware of the species and support its conservation.

Abbreviations: ABG – Adelaide Botanic Gardens; DEH – Department for Environment and Heritage (SA); DSE – Department of Sustainability and Environment (Victoria); PV – Parks Victoria

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 Lowan Phebalium. 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 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 alleviate these threats including weed control, fire management, fencing, and control of pest animals. 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.

Successful *in situ* population management will be founded on understanding the relationships between Lowan Phebalium and associated flora, and its response to environmental processes. These are directly linked to biological function and are thus vital to recovery. A demographic census 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

Important populations of Lowan Phebalium come under the jurisdiction of the Department for Environment and Heritage (SA), Department of Sustainability and Environment (Vic), Parks Victoria, Shire of West Wimmera (Netting Fence Track site) and the District Council of Tatiara (Pinehill North Rd), and various 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 Lowan Phebalium occurs are being advised, through the relevant regional Indigenous facilitator, of the preparation of this Recovery Plan and will be 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 in South Australia and Victoria. Principally, this will be through the protection and management of habitat. The adoption of broadscale management techniques

and collection of baseline data will also benefit a number of other plant species growing in association with Lowan Phebalium, particularly those species with similar life forms and/or flowering responses. Where applied fire management specifically uses Lowan Phebalium as a focal species, as may occur in Ngarkat CP South Australia or the Big Desert WA of Victoria, many associated mallee heath plants are likely to also benefit. However, over landscape scales, the requirements of all taxa, including common and threatened plants and animals, should be considered. Habitat of significant fauna such as the nationally vulnerable Malleefowl *Leipoa ocellata* and Western Whip-bird *Psophodes nigrogularis* may be maintained concurrently with implementation of recovery actions pertaining to Lowan Phebalium.

The Recovery Plan will also provide an important public education role 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. Proposed recovery actions relating to Lowan Phebalium on private land may affect landholders in a minor way, by restricting land-use types permitted under Trust for Nature (in Victoria) or Heritage Agreements (in South Australia). These agreements between landholders and government agencies are intended to set aside significant nature areas for conservation purposes. Improving productivity of sites via clearing, then cropping or otherwise is usually prohibited. For known populations of Lowan Phebalium on private land, existing landholders have either made such conservation-based agreements already, or those populations are proposed to be protected for conservation purposes, or the landholder(s) have no immediate intention to clear those areas. Retention of these private land populations for conservation purposes is unlikely to be economically damaging to the landholder(s).

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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	Taxonomy	3	75%	ABG	\$5,000	\$5,000	\$0	\$0	\$0	\$10,000
1.2	Surveys	1	75%	DEH, DSE, PV	\$5,000	\$5,000	\$5,000	\$5,000	\$5,000	\$25,000
2	Habitat requirements									
2.1	Known habitat	1	100%	DEH, DSE, PV	\$10,000	\$10,000	\$10,000	\$0	\$0	\$30,000
2.2	Potential habitat	2	75%	DEH, DSE, PV	\$0	\$0	\$10,000	\$10,000	\$10,000	\$30,000
3	Habitat protection									
3.1	Public land	1	100%	DEH, DSE	\$6,000	\$4,000	\$0	\$0	\$0	\$10,000
3.2	Private land	1	75%	DEH	\$4,000	\$4,000	\$0	\$0	\$0	\$8,000
4	Threat management									
4.1	Pest plants	1	75%	DEH, DSE, PV	\$10,000	\$10,000	\$10,000	\$8,000	\$8,000	\$46,000
4.2	Grazing animals	1	75%	DEH	\$10,000	\$10,000	\$5,000	\$5,000	\$5,000	\$35,000
4.3	Human damage	1	75%	DEH, DSE, PV	\$5,000	\$5,000	\$5,000	\$5,000	\$5,000	\$25,000
5	Biological functions									
5.1	Reproductive status	3	75%	DEH, DSE	\$10,000	\$10,000	\$10,000	\$8,000	\$8,000	\$46,000
5.2	Seed germination	3	75%	DEH, DSE	\$0	\$8,000	\$5,000	\$5,000	\$0	\$18,000
5.3	Disturbance regimes	1	75%	DEH, DSE	\$10,000	\$10,000	\$10,000	\$8,000	\$8,000	\$46,000
6	Population viability									
6.1	Censusing	2	75%	DEH, DSE, PV	\$10,000	\$10,000	\$10,000	\$8,000	\$8,000	\$46,000
7	Community support									
7.1	Community extension	3	50%	DEH, DSE, PV	\$2,000	\$2,000	\$2,000	\$2,000	\$2,000	\$10,000
TOTALS					\$87,000	\$93,000	\$82,000	\$64,000	\$59,000	\$385,000