Australian Government
Department of Agriculture, Water and the Environment

Conservation Advice for *Lambertia fairallii* (Fairall's Honeysuckle)

In effect under the *Environment Protection and Biodiversity Conservation Act 1999* from 23 November 2021.

This document provides a foundation for conservation action and further planning.

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Conservation status

Lambertia fairallii (Fairall's Honeysuckle) is listed in the Endangered category of the threatened species list under the *Environment Protection and Biodiversity Conservation Act 1999* (Cwth) (EPBC Act) effective from 16 July 2000. The species is eligible for listing because prior to the EPBC Act, it was listed as Endangered under the *Endangered Species Protection Act 1992* (Cwlth).

The main factors that make the species eligible for listing in the Endangered category are the small geographic range, and past and future decline of adult subpopulations due to a combination of *Phytophthora cinnamomi* (a root-rotting oomycete pathogen), frequent fire (with recurrent events happening before adequate seed set) and protracted drought.

Species can also be listed as threatened under state and territory legislation. For information on the current listing status of this species under relevant state or territory legislation, see the Species Profile and Threat Database.

Species information

Taxonomy

Conventionally accepted as *Lambertia fairallii* G.J. Keighery (1983) and belongs to the family Proteaceae (Magnoliopsida: Plantae).

Description

Fairall's Honeysuckle is an erect, very dense compact shrub up to 1.5 m high. Young branches and leaf bases are loosely covered with long white hairs. The rigid, almost stalkless leaves, crowded on short branchlets, are linear and up to four centimetres long, with an awn-like projection on the tip. Mature leaves are hairless above, with a network of veins on the upper surface, and covered with soft hairs underneath. The foliage of long plants is much less compact, and some leaves may have several lobes at the apex. The inflorescences, on the ends of the branchlets, may be solitary or clustered in groups of two or three. Each inflorescence is composed of five to seven tubular, golden-yellow flowers, enclosed in 17–27 dry brown bracts. The dark brown fruits are about eight millimetres long and have two horns. (Harley & Barrett 2008)

Distribution

Fairall's Honeysuckle is endemic to the Stirling Range National Park, where it occurs on montane ridgelines in dense heath at and above 350 metres above sea level (asl). It grows in shallow soils on metamorphosed sandstone and shale, mid-slope on exposed rocky south-facing ridges.

Part of Fairall's Honeysuckle's distribution is within the boundaries of the Eastern Stirling Range Montane Heath and Thicket Community at the Mount Success site (Threatened Species Scientific Committee 2017).

Fairall's Honeysuckle exists in three main locations (Table 1)

Table 1. Population estimates for Fairall's Honeysuckle locations (with location altitude).

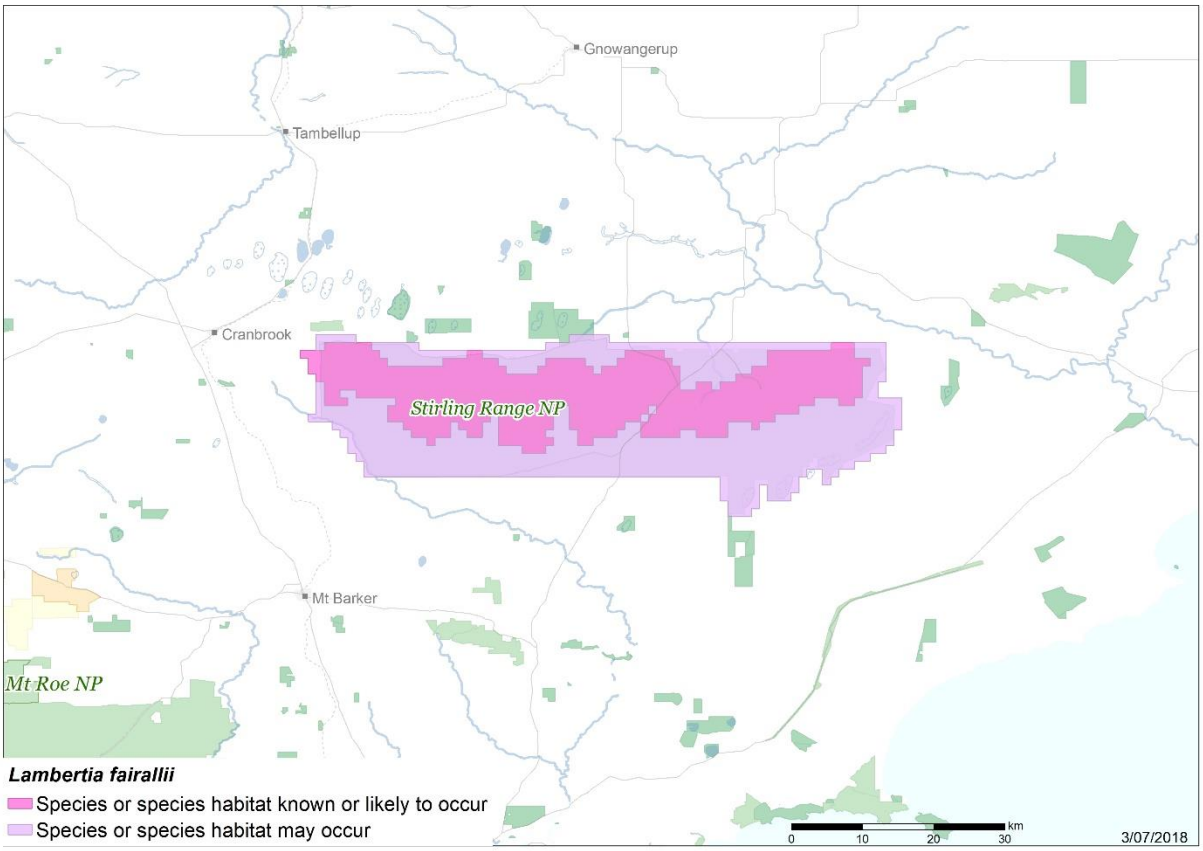
Location	Metres above sea level	2004 – 2005 subpopulation estimates (Harley & Barrett 2008)	2019-2021 subpopulation estimates (DBCA 2021)
Southwest of Mount Gog	634	3500+ mature 1000+ juveniles	1600 mature (in 2021)
Mount Success	750	300 mature 500+ juveniles	0 adults 106 juveniles (in 2021)
Yungemere	716	500+ mature	800 mature plants (pre 2019 fire) 0 mature plants (2020) 550 juveniles (2020)

A fourth subpopulation existed at Ellen Peak (1012 m asl) but has not been seen since 1999 and may have died out due to high frequency bushfires and *Phytophthora cinnamomi* dieback (Harley & Barrett 2008) .

Monitoring of Fairall's Honeysuckle at the Mount Success (site 3A) found the species decreased from an observed 2500 mature plants in 1999 to zero in 2002, due to a combination of drought, fire and *P. cinnamomi* (Harley & Barrett 2008; Barrett & Yates 2015).

Fairall's Honeysuckle has also been propagated and translocated into habitats outside of Stirling Range National Park. Sites south of the Stirling Range were found free of *P. cinnamomi* and two subpopulations were translocated there (97 and 25 individuals) in 2007 and 2009 (Cochrane et al. 2010; Monks et al. 2019). In 2009, 76 percent of all translocated Fairall's Honeysuckle had survived (Cochrane et al. 2010), some plants survived to produce seedlings, although none of the seedlings survived (DBCA 2021).

Map 1 Modelled distribution of Fairall's Honeysuckle



Source: Species distribution data Species of National Environmental Significance database, Base map Geoscience Australia
Caveat: The information presented in this map has been provided by a range of groups and agencies. While every effort has been made to ensure accuracy and completeness, no guarantee is given, nor responsibility taken by the Commonwealth for errors or omissions, and the Commonwealth does not accept responsibility in respect of any information or advice given in relation to, or as a consequence of, anything containing herein.
Species distribution mapping: The species distribution mapping categories are indicative only and aim to capture (a) the specific habitat type or geographic feature that represents to recent observed locations of the species (known to occur) or preferred habitat occurring in close proximity to these locations (likely to occur); and (b) the broad environmental envelope or geographic region that encompasses all areas that could provide habitat for the species (may occur). These presence categories are created using an extensive database of species observations records, national and regional-scale environmental data, environmental modelling techniques and documented scientific research.

Cultural and community significance

The genus *Lambertia* was named after Aylmer Bourke Lambert, a patron of botany in the 18th and 19th centuries (Cochrane 2013). Fairall's Honeysuckle was named after Arthur Fairall, the

first superintendent of King's Park and Botanic Gardens, Perth. He died while fighting a bushfire in the park. He was also responsible for introducing many native species into cultivation and was the first to record this species in 1968 (Wrigley & Fagg 1989).

The Traditional Owners are the Mineng and Koreng people of the Noongar Nation, who have inhabited the Stirling Ranges region for many thousands of years (Department of Parks and Wildlife 2016). The area is important to Indigenous Australians with cultural sites at Kojaneerup and Moingup Springs in the vicinity of Fairall's Honeysuckle (Harley & Barrett 2008). There is no published ethnobotanical data relating directly to this species.

Relevant biology and ecology

Fairall's Honeysuckle is a serotinous shrub (canopy stored seed), an obligate seeder. The pollination biology is unknown, the shrub flowers with many other species between May and September and *Phylidonyris novaehollandiae* (New Holland Honeyeaters) and *Phylidonyris nigra* (White-Cheeked Honeyeaters) are major pollen vectors for four other *Lambertia* species (Harley & Barrett 2008).

Fairall's Honeysuckle mature at approximately seven years of age; however, reproductive output remains low for this species. Observations of plant growth and reproductive effort found that the mean number of fruits will double from a single fruit per plant (at seven years post-fire) to approximately six fruit per plant (at 12–13 years post-fire). Although inter-fire recruitment has been observed for this species (Harley & Barrett 2008; Cochrane et al. 2010), it is insufficient to sustain subpopulations (DBCA 2021). The adult plants are killed by fire, and population survival relies on the seeds germinating and reaching maturity prior to the next fire event (Obbens & Coates 1998). An optimal fire frequency is thought to be 14–17 years, which is at least two times the juvenile period (Harley & Barrett 2008). Fairall's Honeysuckle seeds do not require special treatment to germinate, and studies have shown that collected seeds will germinate readily (mean germination rate of 93 percent) (Harley & Barrett 2008). In trials with other *Lambertia* species, germination was also high (mean 86 percent) however seedling mortality was also high unless specific pathogen, watering and shading treatments were met (Monks & Coates 2000).

Non-sprouting shrubs are sensitive to decline and extinction from fire-driven mechanisms, such as death of standing plants and seeds, failure of seed release and/or germination, failure of seedling establishment, interruption of maturation or developmental growth and failure of seed production (Keith & Keith 1996). Spatial simulations of plant extinction have further shown that extinction probability increases for non-sprouting perennial shrubs, with increased frequency and scale of fire events (Bradstock et al. 1998). Given the low reproductive effort, even 13 years post-fire (Harley & Barrett 2008), a much longer fire free period is needed to ensure self-sustaining subpopulations of the already restricted Fairall's Honeysuckle.

An elevated level of genetic divergence was observed between subpopulations of Fairall's Honeysuckle on Ellen Peak and Southwest Mount Gog (Obbens & Coates 1998; Harley & Barrett 2008). The physical distance between the two sites is approximately 40 km and the genetic divergence was higher than that between two sub-species of *Lambertia echinata*. This, and the reduced genetic diversity of the Ellen Peak subpopulation, suggests that isolated subpopulations should be treated as separate conservation units (Obbens & Coates 1998; Harley & Barrett 2008).

Habitat critical to the survival

Due to the species eligibility for listing (highly restricted range and decline in population size), all habitat is considered critical to the survival of the species.

No Critical Habitat as defined under section 207A of the EPBC Act has been identified or included in the Register of Critical Habitat.

Important populations

In this section, the word population is used to refer to subpopulation, in keeping with the terminology used in the EPBC Act and state/territory environmental legislation.

There is sufficient evidence through the species eligibility for listing, to declare all populations/the national population of this species under particular pressure of survival and which therefore require protection to support the recovery of the species.

Threats

Fairall's Honeysuckle is threatened by disease, fire, drought, climate change, disturbance and seed predation by birds, small mammals and insects. The species is threatened by several fire-related threats, including high frequency fire, fire-disease interactions, fire-drought interactions, and fire-granivore interactions. Although grazing by native and feral mammals has been recorded as a threat to other threatened species in the Stirling Range National Park (Cochrane et al. 2010; Rathbone & Barrett 2017) there are no published records of impacts to Fairall's Honeysuckle. Endemic subpopulations in the Stirling Range National Park are also at risk of pollinator disruption due to habitat fragmentation of the surrounding landscape (Obbens & Coates 1998; Coates et al. 2007), although no published records indicate how or whether these threats directly affect Fairall's Honeysuckle.

Table 2 Threats impacting Fairall's Honeysuckle

Threat	Status and severity	Evidence
Disease		
Dieback caused by *Phytophthora cinnamomi* (an oomycete plant pathogen*) *Molecular research has revealed that *P. cinnamomi* is not a fungus (Hardham 2005; Judelson & Blanco 2005).	• Timing: current • Confidence: observed • Consequence: major • Trend: unknown • Extent: across the entire range	*P. cinnamomi* is an introduced soil-borne pathogenic oomycete, which results in plant death through the destruction of root systems. *P. cinnamomi* is listed as a Key Threatening Process under the EPBC Act (Department of Energy and Environment 2018). The Eastern Stirling Range Montane Heath and Thicket Community and many Stirling Range threatened species are significantly affected by *P. cinnamomi* Dieback, and have been since the pathogen was found in the region in 1974 (Obbens & Coates 1998). Fairall's Honeysuckle is highly susceptible to the pathogen, and currently every subpopulation is infested with or threatened by it (Harley & Barrett 2008). The pathogen has been spread to many of the peaks in the Stirling Range through the transport of contaminated soil. Infestations at higher altitudes have led to substantial downslope spread in broad fronts (Barrett 2005). The spread of the pathogen has a few ecological flow-on effects such as increased fire fuel loads, decreased diversity and resulting loss of vertebrate pollinators, increased habitat loss and ground cover protection for small animal species (Harley & Barrett 2008; Department of Energy and Environment 2018). *P. cinnamomi* can disperse in water flowing from roots of infected plants to roots of healthy plants and via mud clinging to vehicles, animals and walkers (Barrett 2005; Department of Energy and Environment 2018). Widespread seedling deaths have been recorded for Proteaceous species due to *P. cinnamomi*. The under-developed root systems of obligate seeders may increase vulnerability to the disease. A post fire alteration in vegetative cover, soil chemistry and hydrology may amplify the mortality from *P. cinnamomi* (Moore et al. 2014). Susceptibility studies have shown that Fairall's Honeysuckle experienced high mortality on exposure to the *P. cinnamomi* pathogen (K_{max} 95%) and thus is exposed to a substantial risk of extinction in the wild (Barrett et al 2008; Shearer et al. 2010). Dieback may also interact with fire to increase the impact of the disease and accelerate collapse of obligate seeding plants as shown for the Stirling Range Dryandra (Moore et al. 2014; Barrett & Yates 2015). Serotinous non-sprouting species are highly susceptible to both fire and Dieback, with density of serotinous species, the pathogen is present in areas not affected by any recent fires (Barrett & Yates 2015). Observations show that the impact of Dieback may be worsened post-fire, due to altered hydrology and increased surface run-off (Barrett 1996), as well as increased root tissue vulnerability (Shearer et al. 2010).
Climate change		

Increased frequency of bushfires	• Timing: current • Confidence: observed • Consequence: major • Trend: increasing • Extent: across part of its range	A high-frequency fire regime (<14 years) is likely to reduce the population size and vigour of the Fairall's Honeysuckle. This species is obligate seeding and serotinous, in that adult plants die from fire, though fire releases the seeds to the soil. For this species to survive there needs to be suitable conditions for germination and recruitment, and then a fire free interval of at least two generation lengths (14-17.5 years) for adequate number of seeds to accumulate to ensure population persistence (Barrett 2005; Harley & Barrett 2008). Four major bushfire events occurred in Feb 1972, Apr 1991, Oct 2000, Dec 2019 (Harley & Barrett 2008; Department of Agriculture Water and the Environment 2020a). The Yungemere site burnt in three years 1991, 2000 & 2019 and SW of Mount Gog burnt in 1997 (Sarah Barrett 2021 per comm 3 May 2021). Each fire resulted in some of the Fairall's Honeysuckle subpopulations being burnt, with fire return times of nineteen and nine years. The 1991 and 2000 bushfires affected both the Ellen Peak and Mt Success subpopulations. At Ellen Peak, forty plants (80% of the subpopulation) were burnt in 1991 and only ten seedlings appeared following the fire. Nine years later in 2000, 100% of the plants were burnt and no further seedlings appeared. The Ellen Peak subpopulation is now thought to be extinct. After a nine-year fire interval, species regeneration on Mt Success was extremely poor and densities of Fairall's Honeysuckle fell dramatically (Harley & Barrett 2008).There have been further declines in plant densities after a bushfire in 2019 impacted the Success and Yungemere subpopulations (DBCA 2021). The life-history traits of the Fairall's Honeysuckle predispose it to high risk of population decline or extinction, resulting from short fire intervals, fire-disease interactions, high fire severity and the cumulative exposure to these and other threatening processes (Department of Agriculture Water and the Environment 2020b) In 2019-20, following years of drought, catastrophic bushfire conditions resulted in extensive bushfires across southern Australia (Department of Agriculture Water and the Environment 2020a; Gallagher 2020). Mount Success and Yungemere subpopulations were completely burnt in 2019 and germination after fire was assessed in 2020-21. Fire intensity and severity was high in all subpopulations (DBCA 2021) This type of event is increasingly likely to reoccur as a result of climate change, and the severity and frequency present a major threat of extinction for the Fairall's Honeysuckle.

Increased temperature and change to precipitation patterns	• Timing: current • Confidence: inferred • Consequence: moderate • Trend: increasing • Extent: across the entire range	Climate predictions model an increased frequency of extreme rainfall events for south-west WA, which may increase the spread of *P. cinnamomi*, although this effect may be tempered by the overall reduction in mean rainfall for the region. An increased frequency of drought is predicted along with overall increased mean temperatures (CSIRO & Bureau of Meteorology 2015). Such changes in climate may cause widespread plant mortality in plant ecosystems, as many plants are vulnerable to drought stress and hydraulic failure, particularly if fire has preceded drought (Burgman and Lamont 1992, Allen et al. 2010; Choat et al. 2012). The drier conditions amplified by climate change are predicted to cause further population contractions for Fairall's Honeysuckle and many other Stirling Range flora and fauna (Harley & Barrett 2008). Drought reduces the resilience of this species to other environmental threats. Seedling death was observed during the extended drought conditions of 2002 (Harley & Barrett 2008). Ongoing decline of the subpopulation south west of Mt Gog has been observed since 2005 with widespread limb and whole plant death. This appears to be primarily due to drought although other fungal pathogens may be implicated. Recent surveys in 2021 show a dramatic decline in population size (DBCA 2021).
Fragmentation		
Loss of genetic diversity	• Timing: current • Confidence: suspected • Consequence: moderate • Trend: unknown • Extent: across part of its range	Fragmentation and reduced population size can lead to a loss of genetic variation and increased genetic divergence among subpopulations. Decreased genetic diversity and small subpopulation sizes increase the risk of extinction by loss of fitness and reducing the species ability to adapt to short term environmental changes (Hobbs & Yates 2003). The historical loss of connectivity and evidence of reduced diversity in the Ellen Peak subpopulation of Fairall's Honeysuckle is likely a result of fragmentation caused by fire (Hobbs & Yates 2003; Harley & Barrett 2008). Small, isolated subpopulations are subject the accumulation of deleterious genes due to genetic drift and lack of allele exchange thus reducing the overall fitness of the population. There is no evidence that this is occurring in Fairall's Honeysuckle; however, future research should show if any subpopulations are at a higher risk of becoming unviable (Harley & Barrett 2008).
Grazing		

Seed predation	• Timing: current • Confidence: observed • Consequence: moderate • Trend: static • Extent: across the entire range	Seed predation is a natural occurrence but can be detrimental to plant survival for species with low seed production, or post fire when seeds are vital for repopulation. Seed predation was observed on 57% of tagged Fairall's Honeysuckle at Mount Success and similar heavy predation in Yungemere in 2004 (Harley & Barrett 2008) which was likely the results of birds, small mammals or insects as this has been observed in other post-fire habitats (Tasker et al. 2011). Seed predation is likely to reduce the reproductive potential for the Fairall's Honeysuckle, though research is needed to determine the trends, frequency and consequence of seed predation levels.

Status—identify the temporal nature of the threat;
Confidence—identify the extent to which we have confidence about the impact of the threat on the species;
Consequence—identify the severity of the threat;
Trend—identify the extent to which it will continue to operate on the species;
Extent—identify its spatial content in terms of the range of the species.

Each threat has been described in Table 2 in terms of the extent that it is operating on the species. The risk matrix (Table 3) provides a visual depiction of the level of risk being imposed by a threat and supports the prioritisation of subsequent management and conservation actions. In preparing a risk matrix, several factors have been taken into consideration, they are the life stage they affect; the duration of the impact; and the efficacy of current management regimes, if management will continue to be applied appropriately. The risk matrix and ranking of threats has been developed in consultation with and experts using available literature.

Table 3 Common Name risk matrix

Likelihood	**Consequences**				
	Not significant	**Minor**	**Moderate**	**Major**	**Catastrophic**
Almost certain	Low risk	Moderate risk	Very high risk	Very high risk **Dieback caused by *Phytophthora cinnamomi***	Very high risk
Likely	Low risk	Moderate risk	High risk **Increased temperature and change to precipitation patterns**	Very high risk **Increased frequency of bushfires**	Very high risk
Possible	Low risk	Moderate risk	High risk **Loss of genetic diversity**	Very high risk	Very high risk
Unlikely	Low risk	Low risk	Moderate risk	High risk	Very high risk
Unknown	Low risk	Low risk	Moderate risk **Seed predation**	High risk	Very high risk

Priority actions have then been developed to manage the threat particularly where the risk was deemed to be 'very high' or 'high'. For genetic based threats it may be more appropriate to identify further research to determine the likelihood of this leading to recruitment failure in some subpopulations.

Conservation and recovery actions

Primary conservation objective

By 2030, the population of Fairall's Honeysuckle will have increased in abundance and viable populations are sustained in disease-free habitats.

Conservation and management priorities

Disease

- Implement a *P. cinnamomi* management plan to ensure that the pathogen is not spread further within the subpopulation south west of Mount Gog and that the spread in areas outside of, but adjacent to subpopulation is mitigated (Department of Energy and Environment 2018).
- Ensure that appropriate hygiene protocols are adhered to when entering or exiting the known location of the threatened species, such as those outlined in O'Gara et al. (2005) and the Arrive Clean, Leave Clean guidelines (Commonwealth of Australia 2015).
- Implement a hygiene management plan and risk assessment to protect known subpopulations from further outbreaks of *P. cinnamomi*. This may include but is not limited to:
  - Contaminated water is not used for firefighting purposes
  - Contaminated soil is not introduced into the area as part of restoration, translocation, infrastructure development or revegetation activities
  - Where appropriate, ensure that Fairall's Honeysuckle sites that are free of *P. cinnamomi* are sign posted and hygiene stations are implemented and maintained.
- Implement mitigation measures in areas that are known to be infested by *P. cinnamomi*, this may include but is not limited to the application of phosphite (H_3PO_3), noting the potential deleterious effects as a fertiliser with prolonged usage.
- Refer to the national Threat Abatement Plan for *P. cinnamomi* where relevant: http://www.environment.gov.au/biodiversity/threatened/publications/threat-abatement-plan-disease-natural-ecosystems-caused-phytophthora-cinnamomi-2018

Fire

- Fires must be managed to ensure that prevailing fire regimes do not disrupt the life cycle of this species and its surrounding ecological community; that fires support rather than degrade the habitat necessary to the threatened species; that fires do not promote invasion of exotic species; and that they do not increase impacts of *P. cinnamomi*.
- Where possible, ensure that fire frequency is at least double the primary juvenile period for this species (between 14 and 17.5 years).
- Ensure fuel reduction and other planned fires outside this schedule are not implemented at Fairall's Honeysuckle sites.

Fragmentation – loss of genetic connectivity

- Prevent further clearing or detrimental modification of remnants of the Eastern Stirling Range Montane Heath and Thicket ecological community and surrounding native vegetation for tracks, management infrastructure or fire suppression. Due to the highly restricted nature of the ecological community, avoiding rather than offsetting, impacts are the highest priority and most cost-effective conservation measure.
- Prevent impacts from any developments and activities, adjacent to or near patches, that might result in further degradation, by planning for and appropriately mitigating off-site effects (for example, by avoiding disturbances to native vegetation and soil, applying recommended buffer zones around the subpopulations of Fairall's Honeysuckle and the ecological community, controlling run-off and avoiding significant hydrological changes and eutrophication).

Seed collection, propagation and other ex situ recovery action

- To manage the risk of losing genetic diversity, maintain appropriate seed collection and storage in long-term collections.
- Determine viability of stored seed and ensure best practice is followed to maximise seed viability and germinability.

Climate Change

- Using distribution modelling and potentially climate change predictive future modelling map existing habitat and identify new future habitat.

Stakeholder engagement/community engagement

- Maintain support for ongoing recovery actions specific to Fairall's Honeysuckle undertaken by the community recovery teams.
- Engage and involve local naturalists and wildflower society members to conduct surveys during the flowering season (May to September).
- Engage and involve Traditional Owners in conservation actions, including the implementation of survey, monitoring and management actions relevant for culturally important sites.

Survey and monitoring priorities

- Support and enhance existing long-term monitoring of all extant subpopulations, including any new translocated subpopulations.
- Monitor *P. cinnamomi* presence and impact.
- Monitor any translocated subpopulations to determine if successful reproduction and recruitment is occurring.
- Maintain precise spatial fire history records to integrate with subpopulation monitoring and response of subpopulations to fire events.

Information and research priorities

- Review all previous monitoring and research data and collate in a report/publication to identify critical knowledge gaps and assist with future evidenced-based decision making and research.
- Investigate options for enhancing or establishing additional subpopulations.
- Survey suitable habitat and potential habitat to locate any additional subpopulations/occurrences/remnants to assess population size and distribution more precisely.
- Review data from in situ and ex situ recovery actions and develop best practice guidelines for future seed collection, germination, juvenile and adult plant survival.
- Investigate the ecological requirements of Fairall's Honeysuckle that are relevant to persistence:
  - Critical habitat (mapped).
  - Reproductive biology and pollination.
  - Seed bank dynamics, germination and recruitment, including the role of various disturbances (particularly the interaction of fire and *P. cinnamomi*), competition and rainfall.
  - The phenology and seasonal growth of the species.
  - The population genetic structure, levels of genetic diversity and minimum viable population size.
  - Biotic interactions (e.g., competition, grazing, drought) and determine consequences for long term population survival.

Links to relevant implementation documents

Approved conservation advice for Eastern Stirling Range Montane Heath and Thicket (2017)

Fairall's Lambertia (Lambertia fairallii) Recovery Plan (2008).

Threat abatement plan for disease in natural ecosystems caused by *Phytophthora cinnamomi* (2018).

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