The Minister's delegate approved this Conservation Advice on 15/07/2016.

Conservation Advice

Darwinia oxylepis

Gillam's bell

Conservation Status

Darwinia oxylepis (Gillam's bell) is listed as Endangered under the *Environment Protection and Biodiversity Conservation Act 1999* (Cwlth) (EPBC Act) effective from the 16 July 2000.

The species was eligible for listing under the EPBC Act at that time as, immediately prior to the commencement of the EPBC Act, it was listed as Endangered under Schedule 1 of the *Endangered Species Protection Act 1992* (Cwlth).

Species can also be listed as threatened under state and territory legislation. For information on the listing status of this species under relevant state or territory legislation, see http://www.environment.gov.au/cgi-bin/sprat/public/sprat.pl

The main factors that are the cause of the species being eligible for listing in the Endangered category are that it has a restrictred area of occupancy that is continuing to decline due to the small population size of the species and impacts from disease, tourist activities and fire (Phillimore et al., 2001).

Description

Gillam's bell is a small upright shrub with erect branches and short branchlets. Its leaves are scattered, smooth and linear, approximately 1 cm x 0.1 cm in size, initially erect and often spreading to curve backwards when mature. The hanging flower bracts, which are on short, backward curving branchlets, are bell-shaped, 3 cm by 2 – 3 cm in size. Flowers are predominantly red with some white (Elliot & Jones 1984, cited in Phillimore et al., 2001).

Distribution

Gillam's bell is endemic to Western Australia where it is confined to the gullies near the lower slopes of mountains in the Stirling Range National Park (Phillimore et al., 2001).

Gillam's bell grows in mallee heathland on acid, stony, peaty sand, in rocky gullies (Keighery & Marchant 1993, cited in Phillimore et al., 2001; Spooner 1999).

The species is known from four populations containing a total of approximately 6000 plants. A major fire burnt all populations in October 2000 (Phillimore et al., 2001). Two of the populations were not located again in surveys following the fire. Further surveys are necessary to determine current populations and abundance.

Relevant Biology/Ecology

Darwinia species regenerate after fire from soil-stored seed, forming dense, local stands. The Stirling Range *Darwinia* species flower two to four years after germination and reach maturity in seven to ten years (Keighery & Marchant 1993, cited in Phillimore et al., 2001).

The flowering period of Gillam's bell is August to November (Phillimore et al., 2001). This species is likely pollinated by nectar-feeding birds although ants have also been seen on flowers (Barrett pers.comm. [undated], cited in Phillimore et al., 2001). The flowers are large and pendulous. Birds can probe the flowers by perching on them or accessing them from the ground (Phillimore et al., 2001). *Darwinia* seeds have no specialised means of dispersal and remain

stored in the soil below adult plants until the next fire (Keighery & Marchant 1993, cited in Phillimore et al., 2001). Occasional predation of seed by insects has been observed (Cochrane A, personal observation [undated], cited in Phillimore et al., 2001).

Gillam's bell propagates easily from cuttings and is available at some nurseries (Phillimore et al., 2001).

Threats

Table 1 – Threats impacting the Gillam's bell in approximate order of severity of risk, based on available evidence.

Threat factor	Threat type and status	Evidence base
Disease		
Infection by *Phytophthora cinnamomi*	known current	More than 40 percent of Western Australian native plants are susceptible to infection by *Phytophthora cinnamomi*, particularly those in the state's south-west (DPaW undated). Gillam's bell is known to be susceptible to dieback caused by *Phytophthora cinnamomi* (Keighery 1992, cited in Phillimore et al., 2001). All populations of the species occur in habitat that is susceptible to this pathogen (CALM, 1999). *Phytophthora cinnamomi* has been confirmed from the area occupied by one of the populations (Phillimore et al., 2001).
Fire		
High frequency	potential	If fires occur before seedlings have reached maturity, there is a significant risk of depleting the soil seed store (Phillimore et al., 2001). It would be detrimental to the species if fire re-occurs within a 1 - 5 year period (Phillimore et al., 2001).
High intensity	known current	Monitoring of two populations following a 1983 fire showed that most adult plants of this species are killed by hot fire, with recruitment occurring from seed (Phillimore et al., 2001).
Habitat loss, disturbance and modifications		
Tourist activities	current	Two populations of Gillam's bell occur at popular scenic and wildflower view points, and tourist activities may result in trampling/disturbance of the habitat and illegal picking of the species (Phillimore et al., 2001).
Invasive species		
Weed invasion	potential	A total of 93 different weed species has been recorded in the Stirling Range National Park. Weeds are largely confined to road verges, amenity areas and some drainage lines (CALM 1999). Weeds can suppress early plant growth by competing for soil moisture, nutrients and light. They can also increase the fire hazard given the higher fuel loads.

Conservation Actions

Conservation and Management priorities

Disease

- Continue applying phosphite to areas that are currently infected with *Phytophthora cinnamomi* (Phillimore et al., 2001), on a biennial basis (Barrett pers. com., 2016) and ensuring that potential impacts of the additional phosphorus on weed incursion is controlled.
- Monitor all Gillam's bell populations for the presence of *Phytophthora cinnamomi* and other *Phytophthora* species at least bienially (Barrett pers. com., 2016), or preferably on an annual basis. Where detected, minimise the spread of the pathogen by implementing appropriate vehicle and footwear hygiene protocols where possible, and mitigate impacts with phosphite treatments, fumigants, specific vegetation destruction, and containment barriers (Department of the Environment 2014).
- Following the application of phosphite to affected areas, annually monitor its impact on *Phytophthora cinnamomi* and any detrimental effects on Gillam's bell (Phillimore et al., 2001, Barrett pers. comm., 2016). If any detrimental effects are detected on the species, adapt phosphite application as necessary.

Fire

- Develop and implement a fire management strategy in consultation with relevant authorities and land managers that defines fire control measures for the species. Fire kills most adult plants of the species with regeneration mainly occurring from germination of soil stored seed. Frequent fire may result in few plants reaching maturity leading to insufficient soil stored seed for regeneration. Although occasional fires are likely needed for reproduction, fire should be prevented from occurring again in areas containing Gillam's bell for at least six years or more. (Phillimore et al., 2001). Note that planned fires need to ensure that no unplanned wildfires occur within the >6 year fire free interval necessary for the species to recover a soil seed bank. Also planned fires do not occur from mid-Autumn until after seed has been produced.
- Ensure there is a carefully planned weed management strategy to ensure that post-fire monitoring of Gillam's bell, and actions for controlling weeds are implemented.
- Avoid physical damage to the habitat and individuals of Gillam's bell during and after fire operations. This includes avoiding the use of retardant foams as they increase soil nutrients leading to weeds.
- Once a suitable fire management strategy becomes known, provide maps of known occurrences of the species to local and state Rural Fire Services and seek inclusion of mitigation measures in bush fire risk management plan/s, risk register and/or operation maps.
- Keep precise fire history records for the habitat and extant populations (confirmed and suspected) of Gillam's bell.

Habitat loss, disturbance and modifications

- Manage impacts from park visitor activities through the development and implementation of a management strategy. The strategy is to be developed,

implemented and maintained in liaison with relevant visitors to the site, such as tourist operators. Possible actions could include (from Phillimore et al., 2001):

  - Re-routing tracks to discourage park visitors walking into populations of Gillam's bell, including a track up Red Gum Hill.
  - Placing signs that highlight the sensitivities of these sites.
  - Development of a conservation plan for Baby Barnett Hill where the largest population of the species occurs, and which is subject to the effects of *Phytophthora* disease, fire and trampling.
  - Liaising with relevant tourist companies.
  - Including information on hygiene protocols to prevent infection or the spread of *Phytophthora* species.

- Prevent habitat disturbance due to development or other activities leading to habitat loss or disruption, or having other negative impacts on Gillam's bell.
- Manage any other likely, potential or emerging threats to habitat quality, such as invasion of weeds.

Invasive species

- Control of weeds entering the Park along roads and boundaries is the major requirement (CALM 1999). When found, identify and control any weeds that could threaten the Gillam's bell using appropriate methods, such as careful use of herbicides or digging and removal. Ensure that the disturbance/overspray associated with these control methods are minimised.

Breeding, propagation and other exsitu recovery action

- Establish living collections in appropriate institutions such as botanic gardens.
- To manage the risk of losing genetic diversity, undertake appropriate seed collection and storage in national seed banks and determine viability of stored seed. Seeds to be collected from each of the natural populations.
- Establish additional populations in suitable secure habitat. Implement the national translocation protocols of Vallee et al. (2004).

Stakeholder Engagement

- Promote awareness of the Gillam's bell within the local community, including through a publicity campaign in the local print and electronic media and poster displays. Due to the susceptibility of the habitat of this species to *Phytophthora* dieback, include hygiene procedures in information provided to visitors to sites where the species occurs (Phillimore et al., 2001).
- Establish formal links with local naturalist groups and interested individuals including wildflower societies and encourage these stakeholders to contribute to the implementation of conservation management actions (Phillimore et al., 2001).
- Develop and maintain an information sheet, which includes a description of Gillam's bell, its habitat type, threats, appropriate management actions and photos (Phillimore et al., 2001), and which includes information about managing fire for the benefit of the species. Provide this information to relevant land managers.

Survey and monitoring priorities

- Monitor the sites of the known populations of Gillam's bell on an annual basis to determine the species presence (Phillimore et al., 2001). If the species is found, investigate and put into place the most appropriate actions necessary for the conservation and recovery of the species.
- Undertake survey work in suitable habitat and potential habitat, to determine the currect status of all historic records, and to locate any additional populations (Phillimore et al., 2001).
- Monitor other factors, such as habitat degradation (including the impact of *Phytophthora cinnamomi*), population stability (expansion or decline), weed invasion, pollinator activity, recruitment, seed production, longevity and predation, on an annual basis (Phillimore et al., 2001), and put into place the most appropriate actions necessary for the conservation and recovery of the species.
- Monitor the size and structure and reproductive status of populations at different stages in the fire cycle, taking opportunities to monitor after fires occur (planned and unplanned) and improve understanding of the fire response of the species.

Information and research priorities

- Determine reproductive strategies, the timing of flowering, recruitment and seasonal growth (Phillimore et al., 2001).
- Study the soil seed bank dynamics and the role of various factors including disturbance (such as fire), competition, rainfall and grazing in recruitment and seedling survival (Phillimore et al., 2001).
- Investigate germination requirements for the species.
- Investigate population genetic structure, levels of genetic diversity and minimum viable population size (Phillimore et al., 2001).
- Investigate impacts of *Phytopthora* dieback disease and control techniques on Gillam's bell and its habitat (Phillimore et al., 2001).

References cited in the advice

CALM (Department of Conservation and Land Management) (1999). *Stirling Range and Porongurup National Parks Management Plan.* Department of Conservation and Land Management, Western Australia.

Elliot, W.R., & Jones, D.L. (1984). *Encyclopaedia of Australian Plants, Volume 3.* Lothian Publishing Company Pty Ltd, Melbourne.

Keighery, G. (1992). *The Impact of* Phytopthora *Species on Rare Plants,*in *Dieback – What is the Future?* The Northern Sandplains Dieback Working Party, Muchea.

Keighery, G. & Marchant, N. (1993). *Mountain Bells*, in *Mountains of Mystery: a natural history of the Stirling Range*. Department of Conservation and Land Management, Perth, Western Australia.

Phillimore, R., Evans, R. & Brown, A. (2001). *Gillham's Bell (Darwinia oxylepis) Interim Recovery plan 2001-2003.* Department of Conservation and Land Management, Western

Australia. Available on the Internet at: http://www.environment.gov.au/resource/interim-recovery-plan-gillhams-bell-darwinia-oxylepis-2001-2003

Vallee, L., Hogbin, T., Monks, L., Makinson, B., Matthes, M. & Rossetto, M. (2004). Guidelines for the translocation of threatened plants in Australia, 2nd edition. Australian Network for Plant Conservation, Canberra.

Other sources cited in the advice

Barrett, S. Personal communication (undated), Conservation Officer, CALM Albany District, Albany, Western Australia.

Barret, S. Personnal communication by email, 1 April 2016. Threatened Flora Conservation Officer, Western Australian Department of Parks and Wildlife.

Department of the Environment (2014). Threat abatement plan for disease in natural ecosystems caused by *Phytophthora cinnamomi*.
Viewed: 24 March 2016.
Available on the Internet at:
http://www.environment.gov.au/system/files/resources/bad95d05-3741-4db3-8946-975155559efb/files/threat-abatement-plan-disease-natural-ecosystems-caused-phytophthora-cinnamomi.pdf

Department of the Environment (2016). *Darwinia oxylepis* in Species Profile and Threats Database, Department of the Environment, Canberra.
Viewed: 18 March 2016.
Available on the Internet at: http://www.environment.gov.au/cgi-bin/sprat/public/sprat.pl

Department of Parks and Wildlife (DPaW) (undated). *Phytophtora dieback.*
Viewed: 5 April 2016.
Available on the Internet at: https://www.dpaw.wa.gov.au/management/pests-diseases/phytophthora-dieback

Spooner, A. (1999). *Darwinia oxylepis*, Gillam's bell. In FloraBase: The Western Australian Flora. Western Australian Herbarium, Department of Parks and Wildlife.
Viewed: 6 April 2016.
Available on the Internet at: https://florabase.dpaw.wa.gov.au/browse/profile/5521