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

Conservation Advice

Darwinia whicherensis

Abba bell

Conservation Status

Darwinia whicherensis (Abba 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). Abba bell is listed as Critically Endangered under Western Australia's *Wildlife Conservation Act 1950.*

The main factors that are the cause of the species being eligible for listing in the Endangered category are that the species is known from a single wild population comprising a very low number of mature individuals, and the very restricted area of occupancy of the species.

Description

Abba bell is an erect or sometimes spreading shrub, up to 70 cm tall x 40 cm wide. The leaves are linear, 3 - 5 mm long, triangular in cross-section, crowded at the end of branches, and bent backwards (Keighery 2009).This feature of the leaves distinguishes the species from the similar species *Darwinia oederoides*. The flowers are enclosed by red and green bracts that are arranged in several rows. The ribbed floral tube is brown, 3 mm long, with small triangular lobes. The petals are about 1 mm long, and there is a red, 10 - 16 mm long curved style. (Keighery 2009).

Distribution

Abba bell is known from a single wild population and two translocated populations at the base of the Whicher Range, east of Busselton in the south west of Western Australia. The species occurs in a winter-wet area of shrubland on shallow red clay over ironstone under a tall shrubland of *Dryandra squarrosa* (Keighery 2009). The population size was estimated to be 130 mature individuals (DEC 2007).

Abba bell is included in the 'Shrublands on southern Swan Coastal Plain ironstones' ecological community, which is listed as Endangered under the EPBC Act (TSSC 2000). The ironstone soils in which the ecological community occurs are highly restricted in distribution (Stack & English 2003). Although these areas have been extensively surveyed, it is possible that additional populations of Abba bell may occur (Stack & English 2003).

The two translocated populations were planted in 2001, comprising 354 plants that were introduced to an area of ironstone located north of the wild population (Population 1), and 68 plants were translocated to the north east of the wild population (Population 2). Survival of these plantings was poor due to the impacts of rabbits, weeds, strong winds and inundation, followed by a longer than average summer drought. Only 14 percent of Population 1 and 47 percent of Population 2 were still alive six months after planting. A further six plants were translocated to the site of Population 1 in 2002 (Stack & English 2003). Further surveys would need to be undertaken to determine current populations and abundance.

Relevant Biology/Ecology

The flowering period for Abba bell is late spring, October to November, finishing by early December (Keighery 2009). This species is pollinated by birds (Keighery 2009). *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).

Darwinia species are generally considered to be fire-sensitive with post-fire regeneration occurring mainly from soil-stored seed. The Abba bell is killed by fire, but it regenerates from seed, and flowers two years after fire (Keighery 2009). The plant is then abundant 3 - 4 years after fire and then declines to be almost absent 7-10 years post fire (Keighery 2009). Approximately 100 Abba bell seedlings germinated after a fire in 1993, and a few of these flowered in October 1995 (Stack & English 2003).

Like most *Darwinia* species, Abba bell propagates well from cuttings, with strike rates generally above 50 percent and often as high as 90 percent (Shade pers.comm., cited in Stack & English 2003).

Threats

Table 1 – Threats impacting the Abba 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*	potential	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). As is the characteristic of many Myrtaceous species, Abba bell is likely to be susceptible to dieback caused by *Phytophthora cinnamomi* which occurs in the vicinity of the species. The ironstone habitat in which Abba bell occurs is inundated over the winter months, and this favours the establishment and spread of *Phytophthora* species (Stack & English 2003).
Infection by canker (*Armillaria luteobubalina)*	potential	The susceptibility of Abba bell to the canker (*Armillaria luteobubalina*) is unknown, however this disease has been found to cause deaths of other plants at the site of the wild population (Stack & English 2003).
Fire		
High intensity	known current	It is known that fire kills most adult plants of Abba bell and regeneration is from seed, although one adult plant was recorded as surviving a fire in 1993 (Stack & English 2003).
High frequency	potential	Abba bell regenerates largely from the soil seed bank following fire. If fires recur before juvenile plants reach maturity (first flowering occurs at two years though possibly a 6 -10 year fire free interval may be necessary to reinstate the soil seed bank and/or annual seed rain), the soil seed bank would rapidly be depleted (Stack & English 2003).

Habitat loss and fragmentation		
Mineral sand exploration and extraction	potential	Mineral sand exploration and extraction in State Forest where the wild population of Abba bell occurs and in adjacent privately owned have the potential to impact population stability through modification to the hydrology of the area (groundwater quality and levels) (Stack & English 2003).
Waterlogging and salinity	potential	Waterlogging and salinity are becoming threats on the ironstone soil type on which Abba bell occurs (Tille & Lantzke 1990). Extensive clearing for agriculture in the area is likely to have increased surface runoff and recharge of the groundwater. While the groundwater in the vicinity of the Abba bell population was found to be reasonably fresh (Hirschberg 1989), levels of salinity and waterlogging should continue to be monitored (Stack & English 2003).
Land clearance	known current	Strong winds as a consequence of proximity to cleared land is a threat at one population (Stack & English 2003). Lack of native vegetation increases wind and heat exposure increasing susceptibility to desiccation and reducing plant vigour (Stack & English 2003).
Invasive species		
Weed invasion	potential	Weed levels at the wild population are low, however weeds are an established problem at the translocation sites. Weeds suppress early plant growth by competing for soil moisture, nutrients and light. They also exacerbate grazing pressure and increase the fire hazard through easy ignition of high fuel loads, which are produced annually by many grass weed species (Stack & English 2003).
Grazing by rabbits (*Oryctolagus cuniculus*)	potential	Rabbits are a threat to translocated populations through selectively grazing seedlings and young growth (Stack & English 2003).

Conservation Actions

Conservation and Management priorities

Disease

- Continue applying phosphite over areas that are currently infected with *Phytophthora cinnamomi* (Stack & English 2003) noting particularly the impact of added phosphorus on soil nutrient enrichment and consequences for greater weed impacts. Application of phosphite should be tailored for optimal success in the habitat where Abba bell occurs to ensure the persistence of the species.
- Monitor all Abba bell populations annually for the presence of *Phytophthora cinnamomi* and other *Phytophthora* species. 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 Abba bell. If any detrimental

effects are detected on the species, adapt phosphite application as necessary (Stack & English 2003).

- Install purpose-built signs advising of the dieback risk and high conservation values of the site where Abba bell occurs (Stack & English 2003).

Fire

- Maintain and continue to implement the fire response plan which has been developed for both the wild and translocated populations of Abba bell and incorporated into the Blackwood District's Fire Control Working Plan. Although fires are likely needed for reproduction, high frequency fire should be prevented from occurring in the area of populations (Stack & English 2003).
- Inform other fire fighting agencies of appropriate response to fire threatening the site, including the maintenance of firebreaks (Stack & English 2003). Provide maps of known occurrences of the species for inclusion in fire risk management plan/s, risk register and/or operation maps.
- Ensure there is a carefully planned weed management strategy to ensure that post-fire monitoring of Abba 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.
- Keep precise fire history records for the habitat and extant populations (confirmed and suspected) of Abba bell.
- Avoid any use of managed fire research and other activities that impact upon the persistence of the population of Abba bell, unless there is evidence to show the impact would be a positive and enduring effect on the species persistence.

Habitat loss disturbance and modifications

- Monitor populations of Abba bell annually for factors such as habitat degradation (including weed invasion, salinity and plant diseases such as *Phytophthora cinnamomi* and *Armillaria luteobubalina*), groundwater quality levels, population stability (expansion or decline), pollination activity, seed production, recruitment, longevity and predation.
- If salinity is found to be a major threat to Abba bell habitat, replant with deep rooted vegetation in strategic parts of the catchment where the species occurs to mitigate impacts (Meissner & English 2005).
- Prevent habitat disturbance due to development or other activities leading to habitat loss or disruption, or having other negative impacts on the Abba bell.
- Manage any other likely, potential or emerging threats to habitat quality, such as invasion of weeds.

Invasive species

- Identify and control any weeds that could threaten the Abba bell. Appropriate methods for control of weeds could include localised application of herbicide during the appropriate season and in rare instances, physical removal due to the risk of weed regrowth. Minimise the effect of slashing and herbicide on the species and any associated native vegetation (Stack & English 2003).

- Fence translocated Abba bell populations with rabbit-proof fencing to protect seedlings and young growth from grazing. Should impacts continue through grazing and digging, control rabbits using other methods as appropriate (Stack & English 2003).

Breeding, propagation and other exsitu recovery action

- Establish additional populations of Abba bell in suitable secure habitat (Stack & English 2003). Implement the national translocation protocols of Vallee et al. (2004).
- Establish populations in cultivation in appropriate institutions (such as botanic gardens). Cultivated populations can be used to propagate plants for translocations (Stack & English 2003).
- 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 wild and translocated populations.

Stakeholder Engagement

- Promote awareness of the Abba bell within the local community, including through electronic media and poster displays, and encourage formal links with local naturalist groups and interested individuals (Stack & English 2003).
- Liaise with the mining tenement holder and adjacent land managers to promote awareness of Abba bell populations and ensure that the species and its habitat is not accidentally damaged or destroyed (Stack & English 2003).
- Encourage involvement of community volunteers in further surveys of Abba bell, to be conducted during the flowering period of the species (October) (Stack & English 2003).

Survey and Monitoring priorities

- Undertake survey work in suitable habitat to determine the species presence and locate any additional populations, and use this information to determine and map areas of critical habitat (Stack & English 2003).
- Monitor impacts of any mining activities or other developments in the vicinity of Abba bell populations, and appropriate responses made if impacts are found to be a risk to the species or its habitat (Stack & English 2003).
- Monitor the progress of recovery, including the effectiveness of management actions and the need to adapt them if necessary.
- 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

- Research the ecology of Abba bell such as pollination biology, and the timing of flowering and vegetative growth (Stack & English 2003).
- Undertake research to evaluate current reproductive/regenerative status, seed bank status and longevity, fecundity and recruitment levels by conducting field-based experimental trials.
- Determine seed germination requirements by conducting laboratory and field trials aimed to identify key stimuli. Determine vegetative propagation trials to determine the requirements for successful establishment. Implement an annual census to monitor emergence and re-sprouting success.

- Improve understanding of the mechanisms of response to different fire regimes and identify appropriate fire regimes for conservation of the Abba bell by undertaking appropriately designed experiments in the field and/or laboratory.
- Where appropriate, use understanding and research on fire responses among closely related or functionally similar species to develop fire management strategies for conservation.
- Determine fire intensity and frequency that promote recruitment and population persistence of the Abba bell or surrounding native habitat.

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