

THREATENED SPECIES SCIENTIFIC COMMITTEE

Established under the *Environment Protection and Biodiversity Conservation Act 1999*

The Minister approved this conservation advice and included this species in the Critically Endangered category, effective from 04/11/2020

Conservation Advice

Antrophyum austroqueenslandicum

Lamington Ox Tongue Fern

Taxonomy

Conventionally accepted as *Antrophyum austroqueenslandicum*, D.L Jones

Summary of assessment

Conservation status

Critically Endangered: Criteria 1 A2 A4; 2 B1, B2 (a) (b) (i-v); 3 C2 (a) (i) and 4 D.

The highest category for which *Antrophyum austroqueenslandicum* is eligible to be listed is Critically Endangered.

Antrophyum austroqueenslandicum has been found to be eligible for listing under the following categories:

Criterion 1: A2, A4: for listing as Critically Endangered

Criterion 2: B1, B2 (a)(b) (i-v): for listing as Critically Endangered

Criterion 3: C1, C2 (a) (i): for listing as Critically Endangered

Criterion 4: D for listing as Critically Endangered

Species can 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>

Reason for conservation assessment by the Threatened Species Scientific Committee

This advice follows assessment of information provided by a nomination from the public to list the species as Critically Endangered.

Public consultation

Notice of the proposed amendment and a consultation document was made available for public comment for 36 business days between 27/03/2020 and 15/05/2020. Any comments received that were relevant to the survival of the species were considered by the Committee as part of the assessment process.

Species information

Description

The Lamington Ox Tongue Fern is characterised by fronds with a prominent very narrowly winged strip of 2 to 7 cm in length. The blade of the leaf is narrowly elliptic to lanceolate being 4–8 cm long and 5–9 mm wide. The blade is tapered at each end, semi-erect to pendent slightly sickle-shaped, leathery, dark green and shiny above, paler beneath; margins slightly irregular; apex broadly obtuse in sterile fronds, gradually tapering to a point and sub-obtuse in fertile fronds; venation obscure, with long narrow areoles. Spores are sparse and spreading for a short distance along the main veins being absent from the central band.

The oblanceolate shape of the Lamington Ox Tongue Fern fronds, lacking lobes, and the arrangement of spore into discrete lines along the netted venation on the underside of fertile adult plants are distinctive and are unlikely to be readily confused with any other fern by an experienced observer who has seen a photograph or specimen of this plant (P. Bostock pers. comm. 2015, L. Weber pers. comm. 2015).

Distribution

The Lamington Ox Tongue Fern is known from a very narrow range near Tyalgum (in the Border Ranges NSW) and the Mount Jerusalem National Park (NSW) (Department of the Environment 2012; J. Mallee pers comm 30th March 2020).

The Lamington Ox Tongue Fern represents the most southern and only sub-tropical member of the genus *Antrophyum* in Australia with *A. callifolium* being the next most southerly, occurring south to the tropical Mackay region (HSI 2016).

The species has only been recorded within lowland subtropical rainforest within the Critically Endangered 'Lowland Rainforest of Subtropical Australia' EPBC listed ecological community and NSW listed 'Lowland Rainforest in NSW North Coast and Sydney Basin Bioregion' Endangered ecological community (NSW *Threatened Species Conservation Act 1995*) (Silcock 2019).

In 1983 a small population of an unnamed fern was found in Lamington National Park, Queensland, by Col Harman. The plants were growing on rocks and trees beside a natural water pool. There were less than 5 plants. The plant was assigned the phrase name *Antrophyum* sp. Blue Pool or *A. sp. Q1*. One of these plants was collected as the holotype specimen for the naming of the species, *Antrophyum austroqueenslandicum* by David L. Jones. This specimen is lodged in the Queensland Herbarium. Other plants from this location were thought to have been collected by enthusiasts and the single remaining plant in situ died (date unknown). Subsequent searches failed to find any other plants (L. Weber pers. comm. 2015). On 11 August 2006 it was listed as Extinct in the Wild under the *Queensland Nature Conservation Act 1992* and the *Nature Conservation (Wildlife) Regulation 2006*.

The species was re-discovered as a single population during a 2015 survey at Tyalgum in the Border Ranges region of New South Wales (NSW). The population was found on a large streamside boulder with 65 individual plants (L. Weber pers. comm. 2015). The plants were of various sizes, some were fertile, with spores found. The Queensland Herbarium visited the site confirming conclusively that the plants were Lamington Ox Tongue Ferns using microscopic comparison to the holotype. The new location is 8.5 km from the extinct sub-population at Blue Pool in Lamington National Park and is on private property subject to an in-perpetuity conservation covenant with the Nature Conservation Trust of NSW (NCT) (HSI 2016).

Following the discovery in 2015 extensive surveys were undertaken in potential habitat. One survey undertaken by Justin Mallee discovered another population at Mount Jerusalem National Park in 2017 (J. Mallee, pers. comm. 2020). Due to the habitat specificity of this species it is unlikely additional populations occur in surveyed areas (L. Weber, pers. comm. 2019).

In April 2020 a new subpopulation was found 2.5km from the Mt Jerusalem locality on private land, at the western end of the Huonbrook Valley This subpopulation is fragmented from the other two subpopulations. This subpopulation consists of five plants – two mature individuals and three juveniles on a roadside boulder. The land holder is open to conservation actions to help reduce the threats to the species (J. Mallee, pers comm 2020).

Analysis of distribution data estimates the EOO and AOO at 8km² (Silcock & Collingwood, in prep.). Fire mapping in December 2019 found that this species has not been adversely affected by the 2019 – 2020 fires (ERIN 2019). However, in September 2019 fires did occur on the edges of Lamington National Park mainly burning the drier edges of the rainforest habitat. The full extent of the fire impact on the species is not yet known. The 2019 – 2020 fires in Mount Jerusalem National Park came within 30m of the known population and may have impacted undiscovered individuals (J. Mallee, pers. comm. 30th March 2020).

Cultural significance

The cultural and community significance of the species is not known.

Relevant biology/ecology

The Lamington Ox Tongue Fern is a non-flowering plant that reproduces by spore on the underside of the leaves when the plant is mature. Like all ferns the species has two distinct stages in its lifecycle - it has sporophyte and gametophyte generations. When the spores germinate, they grow into small heart-shaped plants known as prothalli (the gametophyte generation). The gametophyte produces both male and female cells. After fertilisation occurs the adult fern (the sporophyte generation) begins to develop. Free water is required to effect fertilisation during the gametophytic stage. It is possible the moss-like (gametophyte) stage can persist for some time in the wild even if no adult plants are present at a location (P. Bostock pers.comm. 2015). Dispersal is via spore which, due to their extremely small size, are easily dispersed by wind or rain.

In addition to the above described sexually reproduction, ferns are also known to reproduce asexually including self-fertilisation, apogamy (a sporophyte grows into a gametophyte without fertilisation occurring – particularly when conditions are too dry to permit fertilisation); proliferous frond tips ferns produce small ferns -plantlets on the frond tip and via rhizomes which spread through the soil sprouting new ferns.

There is little information on the lifespan or generation length of the Lamington Ox Tongue Fern. It has been estimated to be less than 30 years with sexual maturity between 3 to 10 years, more rarely up to 15 years (L. Weber pers comm.4th September 2020). It is estimated the generation length lies between 5 to 15 years (L. Weber pers comm.4th September 2020; P. Bostock pers comm 7th September 2020; J Mallee pers comm 10th September 2020).

The Lamington Ox Tongue Fern only occurs within restricted microhabitats within lowland subtropical rainforest, specifically as a lithophyte on andesite boulders and as an epiphyte on lower parts of tree trunks (L. Weber, pers. comm. 2019). Other *Antrophyum* species occur in tropical Queensland and South-east Asia as epiphytes on all parts of trees including twigs and as lithophytes on boulders and cliffs.

The ecology of this fern is not well known but it appears to require a highly specific microclimate and microhabitat, with constant high humidity and air movement. The Tyalgum location and the former Lamington National Park location are along streams where humidity is maintained by proximity to flowing water. The Mount Jerusalem location is not on a stream, it is within a south facing patch of rainforest on a single south east facing overhung boulder that is shaded by annual plant growth during warmer months. The proximity to the humid rainforest environment and shading during part of the year is thought to provide the required habitat for the species to persist at this site (J. Mallee, pers. comm. 30th March 2020).

It is likely that the fern is not able to occupy many streamside sites on rocks and logs due to inundation from flooding that damages habitat and washes away plants. It has been observed that many plants have died after flooding (L. Weber, pers. comm 2019). It is thought that the location of the boulder with a small stream at its foot, but close to a larger stream that floods to high levels, is critical for its survival. The boulder, on which the species is found at the Tyalgum site is situated outside the zone of major flooding from the larger stream (L. Weber, pers. comm 2019).

The Lamington Ox Tongue Fern grows with other ferns including *Asplenium australasicum*, *A. harmanii*, *Psilotum nudum* and *Microsorium scandens*. Other boulders within a few hundred metres nearby to the rediscovered Tyalgum subpopulation were searched thoroughly and no additional individual plants of the Lamington Ox Tongue Fern were observed (HSI 2016). Similar searches were undertaken on likely boulder habitat in Mount Jerusalem, with no additional individuals located (J. Mallee, pers. comm. 30th March 2020).

During a 2015 survey at Tyalgum in the Border Ranges region of New South Wales (NSW) the population was 65 individual plants (L. Weber pers. comm. 2015). The total population in 2017 was 104 (46 at Tyalgum and 58 at Mount Jerusalem). Recent surveys in 2020 show a reduction in individuals at both sites (attributed to the 2019 drought) with a total population of 43 individuals comprised of 34 at Tyalgum and 9 at Mount Jerusalem (J. Mallee and L. Weber, pers. comms 2020 date). The Mount Jerusalem population was spared from the fires in 2019 – 2020 (burnt areas occurred within 30m of the plants) but as of 27th January 2020 the drought has killed approximately 43 of the plants (J. Mallee, pers. comm. 30th March 2020).

Threats

Table 1: Threats impacting the Lamington Ox Tongue Fern based on available evidence.

Number	Threat factor	Threat type and status	Evidence base
1.0	Habitat loss		
1.1	Historic logging and land clearing of habitat	Past/Known	There has been a reduction in the rainforest habitat for the species due to past logging and land clearing. The habitat conversion due to agriculture has caused changes to hydrology and the introduction and spread of weeds (HSI 2016; Silcock & Collingwood, in prep.).
1.2	Infrastructure maintenance	Current/Known	There is documented evidence that infrastructure maintenance impacts this species. The subpopulation at Mt Jerusalem occurs near a roadside and is vulnerable to road widening and associated maintenance activities. The population located in the Mount Jerusalem National Park is vulnerable to herbicide drift and roadside slashing associated with infrastructure maintenance (J. Mallee and L. Weber, pers. comm. 30 th March 2020).
1.3	Natural disturbances such as fire, flood or landslides	Past, Potential and Current/Known	Natural disturbances such as fire, floods and landslides can damage existing habitat and wash away plants. Individuals have been documented to be lost during flood events (L. Weber pers. comm 2019).
2.0	Invasive species		
2.1	Invasion by weeds	Current/Known	The invasion by weeds is a documented threat to this species. <i>Lantana camara</i> (Lantana) and other weeds have colonised the rocks and boulders which provide habitat for this fern. These weeds negatively impact the fern by changing the light environment, competing for available habitat and nutrients, and potentially smothering ferns. The invasion of Lantana into the habitat of the Lamington Ox Tongue Fern has altered fuel loads and increased the likelihood of fire (L. Weber, pers. comm 2019). There is ongoing weed management and monitoring by the landholders at

			the Tyalgum population (L. Weber, pers. comm. 2019).
3.0	Illegal collection		
3.1	Collection by fern enthusiasts	Past; suspected/potential	<p>Fern enthusiasts collect epiphytic and lithophytic ferns such as <i>Antrophyum species</i>, reducing the population size and potentially causing extinction of the population (HSI 2016).</p> <p>Illegal collection is thought to be responsible for the extinction of the population at Blue Pool Lamington National Park (HSI 2016).</p> <p>Although the known population of the Lamington Ox Tongue Fern is within a conservation area covenanted in perpetuity with the Nature Conservation Trust of NSW and within the Mount Jerusalem National Park, illegal collection remains a potential threat (HSI 2016).</p>
4.0	Climate change		
4.1	Reduced rainfall and increased severity and duration of drought	Known/Future	<p>Given the species highly specific microclimate (constant high humidity and air movement with proximity to rainforest and/ or flowing water) climate change is a potential threat to the Lamington Ox Tongue Fern. Climate change predictions indicate there will be continued increases in average temperature in all seasons, with more hot days and warm spells, the average winter and spring rainfall is projected to decrease (with increased intensity of extreme rainfall events) and longer and more extreme drought conditions as well as increased risk of fire in this species habitat (CSIRO 2020; Silcock & Collingwood, in prep.).</p>

How judged by the Committee in relation to the EPBC Act criteria and regulations

Criterion 1. Population size reduction (reduction in total numbers)			
Population reduction (measured over the longer of 10 years or 3 generations) based on any of A1 to A4			
	Critically Endangered Very severe reduction	Endangered Severe reduction	Vulnerable Substantial reduction
A1	≥ 90%	≥ 70%	≥ 50%
A2, A3, A4	≥ 80%	≥ 50%	≥ 30%
<p>A1 Population reduction observed, estimated, inferred or suspected in the past and the causes of the reduction are clearly reversible AND understood AND ceased.</p> <p>A2 Population reduction observed, estimated, inferred or suspected in the past where the causes of the reduction may not have ceased OR may not be understood OR may not be reversible.</p> <p>A3 Population reduction, projected or suspected to be met in the future (up to a maximum of 100 years) [(a) cannot be used for A3]</p> <p>A4 An observed, estimated, inferred, projected or suspected population reduction where the time period must include both the past and the future (up to a max. of 100 years in future), and where the causes of reduction may not have ceased OR may not be understood OR may not be reversible.</p>	<p>based on any of the following:</p> <p>(a) direct observation [except A3]</p> <p>(b) an index of abundance appropriate to the taxon</p> <p>(c) a decline in area of occupancy, extent of occurrence and/or quality of habitat</p> <p>(d) actual or potential levels of exploitation</p> <p>(e) the effects of introduced taxa, hybridization, pathogens, pollutants, competitors or parasites</p>		

Evidence:

Eligible under Criterion 1 A2, A4 for listing as Critically Endangered

As ferns can reproduce both sexually and asexually it is difficult to determine the exact life span of the species. There is little information on the lifespan or generation length of the Lamington Ox Tongue Fern. It has been estimated to be less than 30 years with sexual maturity between 3 to 10 years (L. Weber pers comm.4th September 2020), more rarely up to 15 years, given the ferns seem to prefer growing on boulders in humid but not drought-proof areas, and are clearly impacted by drought, though in ideal conditions it could be as short as 3 to 5 years (L. Weber pers comm.4th September 2020; P. Bostock pers comm 7th September 2020; J Mallee pers comm 11th September 2020). Therefore, it is estimated the generation length lies between 5 to 15 years (L. Weber pers comm.4th September 2020; P. Bostock pers comm 7th September 2020; J Mallee pers comm 10th September 2020).

There has been an observed continuing decline in population size since the 1980s. The species is now known from only three fragmented subpopulations. The total population in 2017 was 104 (46 at Tyalgum and 58 at Mount Jerusalem). Surveys in 2020 show a reduction in individuals at both the Tyalgum and Mount Jerusalem sites (attributed to the 2019 drought) with a total population of 43 individuals comprised of 34 at Tyalgum and 9 at Mount Jerusalem (J. Mallee and L. Weber, pers. comms March 2020). A new population comprising of five plants – two mature plants and three juveniles was found in April 2020 on private property at the west end of the Huonbrook Valley (J. Mallee pers comm September 2020).

The total population is vulnerable to the threats of loss of habitat, weed invasion, potential exploitation (illegal collection), and loss and damage due to natural events such as drought, fire, and floods. The same threats are acting at all fragmented subpopulations. The subpopulation at Blue Pool in Lamington National Park is presumed extinct.

The documented observed population decline in the Blue Pool, Tyalgum and Mount Jerusalem subpopulations is presented below.

Subpopulation name	Year 1	Population in Year 1	Year 2	Population in Year 2	Year 3	Population in Year 3	Notes
Blue Pool	1983	5	2015	0			Presumed extinct
Tyalgum	2015	65	2017	46	2020	34	On private land.
Mount Jerusalem	2017	58	2020	9			In National Park

Using the above data, the population declines equate to a 100% decline in the Blue Pool subpopulation in the past 30 years, 52% decline of the Tyalgum subpopulation, between 2015 and 2020, and an 85% decline in the Mount Jerusalem subpopulation between 2017 and 2020. There is currently no population trend data for the Huonbrook Valley subpopulation.

The data was also assessed using the IUCN Workbook for taxa with widely distributed or multiple subpopulations Criteria A to calculate the generation decline (Section 4.5.3 in IUCN 2019). This method assumes an exponential decline using two or more years of data from each subpopulation with a 15-year generation length over three generations. The calculation shows that when trends are extrapolated over a 3-generation period, the projected decline approaches 100%, regardless of whether generation length is assumed to be 5 or 15 years. This very severe population reduction, qualifying the species as Critically Endangered under criterion A2 and A4, assuming observed trends continue. The causes for the reduction are not clearly reversible or ceased, that is habitat disturbance, natural disturbances, invasion by weeds and changes in habitat suitability due to climate change.

Following assessment of the available information the Committee has determined that there is evidence of ongoing very severe population decline across all subpopulations with the causes of the decline are not clearly reversible or ceased. Therefore, the Committee considers that the species has met the relevant elements of A2 and A4 to make it eligible for listing as Critically Endangered.

Criterion 2. Geographic distribution as indicators for either extent of occurrence AND/OR area of occupancy			
	Critically Endangered Very restricted	Endangered Restricted	Vulnerable Limited
B1. Extent of occurrence (EOO)	< 100 km ²	< 5,000 km ²	< 20,000 km ²
B2. Area of occupancy (AOO)	< 10 km ²	< 500 km ²	< 2,000 km ²
AND at least 2 of the following 3 conditions:			
(a) Severely fragmented OR Number of locations	= 1	≤ 5	≤ 10
(b) Continuing decline observed, estimated, inferred or projected in any of: (i) extent of occurrence; (ii) area of occupancy; (iii) area, extent and/or quality of habitat; (iv) number of locations or subpopulations; (v) number of mature individuals			
(c) Extreme fluctuations in any of: (i) extent of occurrence; (ii) area of occupancy; (iii) number of locations or subpopulations; (iv) number of mature individuals			

Evidence:

Eligible under Criterion 2 B1, B2 (a) (b) (i-iv) for listing as Critically Endangered

The species is known from three small subpopulations – two on private properties at Tyalgum (in the Border Ranges) and Huonbrook Valley and one in Mount Jerusalem National Park. Based on available distribution data the species EOO are estimated to be 8 km², which is considered ‘very restricted’ (Silcock & Collingwood, in prep.). The EOO was calculated using a

minimum convex hull (IUCN 2019). The area of occupancy is also 'very restricted' estimated at 8km² calculated using a 2x2 km grid cell method, based on the IUCN Red List Guidelines 2019 (IUCN 2019).

There has been an observed continuing decline in the number of subpopulations since the 1980s with one of the two known subpopulations with <5 plants becoming extinct – Blue Pool in Lamington National Park. This is proposed to be partly due to collection for horticulture and natural attrition. A single juvenile plant and two detached sterile leaves of an *Antrophyum*, identified in 2002 as "possibly *A. queenslandicum*", was collected at Mt Ballow, SE Qld in 1953, and included in the Kew Herbarium collection. The specimen label indicated there was a plant in the living collection in Royal Botanic Gardens, Kew, however it is suspected that it is no longer present there (P. Bostock pers. comm. 2015). The exact collection location at Mt Ballow is unknown and there are no other records of the species' presence there; however no targeted surveys have been conducted in that area. The Mt Ballow population, if it was the Lamington Ox Tongue Fern, may have also been possibly driven to extinction through plant collection (HSI 2016).

The Tyalgum, Mount Jerusalem and Huonbrook Valley subpopulations are fragmented with a single event such as drought, flood or fire having the potential to affect all individuals of both subpopulations and potentially place this species at risk of extinction from a single event. This is in line with the IUCN guidelines which state "The term 'location' defines a geographically or ecologically distinct area in which a single threatening event can rapidly affect all individuals of the taxon present" (IUCN 2019).

Fire mapping in the Border Ranges and the Mount Jerusalem National Park (ERIN 2019) found that this species has not currently been adversely affected by the 2019 - 2020 fires however due to this continuing threat this will need to be reassessed in the future. In September 2019 fires did occur on the edges of Lamington National Park mainly burning the drier edges of the rainforest habitat. The full extent of the fire impact on the species is not yet known. The 2019 – 2020 fires in Mount Jerusalem National Park came within 30m of the known population and may have impacted undiscovered individuals (J. Mallee, pers. comm. 30th March 2020).

The extent and quality of lowland sub-tropical rainforest habitat in Queensland and NSW has been reduced through previous clearance by agriculture and urban settlement. The fragmented remnants are threatened by ongoing habitat loss for urban expansion, weeds, hydrological changes, and recreation. These cumulative impacts are causing incremental declines of species in this habitat (Silcock & Fensham 2018). In addition, climate change predictions indicate there will continue to be an increase in average temperature in all seasons, with more hot days and warm spells, the average winter and spring rainfall is projected to decrease (with increased intensity of extreme rainfall events) and longer and more extreme drought conditions as well as increased risk of fire in this species habitat (CSIRO 2020; Silcock & Collingwood, in prep.). The 2019-2020 drought killing approximately 43 of the plants (J. Mallee, pers. comm. 30th March 2020). The fires in 2019 – 2020 burnt areas within 30m of the plants at the Mount Jerusalem subpopulation (J. Mallee, pers. comm. 30th March 2020).

The Committee considers that the species has a highly restricted distribution, very low population size, severely fragmented subpopulations and has undergone declines in habitat. Therefore, the species has met the relevant elements of Criterion 2 to make it eligible for listing as Critically Endangered.

Criterion 3. Population size and decline			
	Critically Endangered Very low	Endangered Low	Vulnerable Limited
Estimated number of mature individuals	< 250	< 2,500	< 10,000
AND either (C1) or (C2) is true			
C1 An observed, estimated or projected continuing decline of at least (up to a max. of 100 years in future)	Very high rate 25% in 3 years or 1 generation (whichever is longer)	High rate 20% in 5 years or 2 generation (whichever is longer)	Substantial rate 10% in 10 years or 3 generations (whichever is longer)
C2 An observed, estimated, projected or inferred continuing decline AND its geographic distribution is precarious for its survival based on at least 1 of the following 3 conditions:			
(i) Number of mature individuals in each subpopulation	≤ 50	≤ 250	≤ 1,000
(a) (ii) % of mature individuals in one subpopulation =	90 – 100%	95 – 100%	100%
(b) Extreme fluctuations in the number of mature individuals			

Evidence:

Eligible under Criterion 3 C1, C2(a)(i) for listing as Critically Endangered

The species is known from three subpopulations – two on private property at Tyalgum (in the Border Ranges) and Huonbrook Valley; and one in Mount Jerusalem National Park. The subpopulations at Tyalgum and Mount Jerusalem have both shown a decreasing trend in the number of mature individuals. There is currently no trend data for the recently found Huonbrook Valley subpopulation. These three subpopulations represent 100% of known living mature individuals of the Lamington Ox Tongue Fern.

In 2017 the total population recorded was 104 – 46 plants at Tyalgum and 58 plants at Mount Jerusalem. Surveys in 2020 show a reduction in individuals at both sites (attributed to the 2019 drought) with a total population of 43 individuals comprised of 34 at Tyalgum and 9 at Mount Jerusalem (J. Mallee and L. Weber, pers. Comm 30th March 2020). This equates to a 52% decline of the Tyalgum subpopulation and an 85% decline in the Mount Jerusalem subpopulation between the years 2015 to 2020. The Huonbrook Valley subpopulation contains only two mature individuals in a subpopulation of five plants. Each subpopulation has less than 50 mature individuals (Silcock and Collingwood, in prep). The total number of mature individuals is considered ‘very low’ with an observed decline of mature individuals in each subpopulation.

The Committee considers that the estimated total number of mature individuals of this species is very low, with an observed continuing decline and the geographic distribution is precarious for the survival of the species because of number of mature individuals in each population is less than 50 individual mature plants. Therefore, the species has met the relevant elements of Criterion 3 to make it eligible for listing as Critically Endangered.

Criterion 4. Number of mature individuals			
	Critically Endangered Extremely low	Endangered Very Low	Vulnerable Low
Number of mature individuals	< 50	< 250	< 1,000

Evidence:

Eligible under Criterion 4 for listing as Critically Endangered

The total number of mature individual plants occurring within the three known living subpopulations of the Lamington Ox Tongue Fern is less than 50 plants including juveniles (J. Mallee pers. comm 30th March 2020). This represents 100% of known living mature individuals of this species.

The Lamington Ox Tongue Fern is a fern that reproduces by spore and vegetative means and requires specialised habitat conditions for sexual reproduction and survival of mature plants. In addition, as the species occurs in a highly restricted locations, a stochastic event such as a flood, landslide or fire could cause most or all the small population to be lost (L. Weber pers. comm. 2015).

The Committee considers that the total number of mature individuals is less than 50 mature individual plants which is extremely low. Therefore, the species has met the relevant elements of Criterion 4 to make it eligible for listing as Critically Endangered.

Criterion 5. Quantitative Analysis			
	Critically Endangered Immediate future	Endangered Near future	Vulnerable Medium-term future
Indicating the probability of extinction in the wild to be:	≥ 50% in 10 years or 3 generations, whichever is longer (100 years max.)	≥ 20% in 20 years or 5 generations, whichever is longer (100 years max.)	≥ 10% in 100 years

Evidence:

Insufficient data to determine eligibility

As population viability analysis has not been undertaken, there are insufficient data to demonstrate if the species is eligible for listing under this criterion.

Conservation actions

Recovery plan

A recovery plan is not required as an approved, updated, and detailed conservation advice for the species would provide sufficient direction to implement priority actions, mitigate against key threats and enable recovery.

Primary conservation actions

Conservation Actions

Primary Conservation Actions

- Ensure the maintenance and protection of the extant populations.
- Ensure no loss in known or potential habitat.

- If feasible, implement suitable ex-situ conservation measures via translocation into suitable habitats.
- Conduct surveys in remote areas to try and locate new populations.

Conservation and Management priorities

- Habitat loss, disturbance, and modifications
 - Protect and prevent further habitat loss by establishing, supporting, and maintaining the conservation covenants at the Tyalgum and Huonbrook Valley subpopulations.
 - Negotiate with land managers to maintain and improve the management of potential habitat.
 - Ensure retention and appropriate management of critical and potential habitat.
 - Ensure road maintenance does not have direct and indirect impacts by informing the local council on the presence of the threatened species and providing advice as to best practice management such as on road maintenance and weed spraying.
 - Implement a roadside threatened species marking system to restrict activities near the sub-populations.
- Weed invasion
 - Implement weed management actions in known and potential habitat in partnership with the private land holders and local community groups.
 - Continue to support weed management with the landholders for the Tyalgum subpopulation.
 - Ensure weed management is continued in the vicinity of the Mount Jerusalem National Park subpopulation.
 - Support the inclusion of the species into the NSW Saving Our Species Program.
 - Remove weeds using minimal disturbance methods, for example, by using hand weeding near the Lamington Ox Tongue Fern plants.
- Breeding, spore collection, propagation, and other ex situ recovery actions
 - Undertake spore germination and/or vegetative propagation trials to determine the requirements for successful establishment.
 - Establish best practice spore storage guidelines and procedures should be adhered to, to maximise spore viability and ability to germinate.
 - If spore germination and vegetative propagation is successful, establish and maintain ex-situ populations in Botanic Gardens.
 - Propagate enough individuals to augment extant populations and undertake experimental translocations to determine the conditions under which the species may be capable of re-establishment in the wild.
 - If experimental translocations are successful to plan and implement translocation program to re-establish population at Blue Pool in Lamington National Park, and other suitable habitat within the species' range. Translocations should follow the 'Guidelines for the translocation of threatened plants in Australia' (Commander et al. 2018).

- Establish and maintain plant nurseries to provide reliable sources of high quality, genetically diverse spore for use in restoration efforts, and eliminate the need to harvest spore from wild populations.
- Illegal collection
 - Develop and implement a suitable management strategy to prevent illegal collection of plants and spores from both subpopulations by enlisting the assistance of fern enthusiasts.
- Changes to hydrology
 - Using distribution modelling and potentially climate change predictive future modelling map existing habitat patches and identify new future habitat.
 - Understand the effects of climate change may have on the species and implement appropriate conservation actions accordingly.

Stakeholder Engagement

- Establish a coordinating body to oversee development and continue implementation of management activities, including tracking progress towards recovery and adaptive management.
- Engage community groups in the conservation of this species
- Review the effectiveness of management actions on a regular basis.
- Liaison between all jurisdictions and landholders is required. All landholders, interest groups and the public should be kept informed of the conservation status of the species, key threats, recovery progress and achievements.
- Continue collaborations between universities, CSIRO, Botanic Gardens, and other research institutions to undertake required research.
- Engage with the community and non-government organisations to develop a conservation strategy and assist with on-ground conservation actions including fern experts and enthusiast groups plus relevant specialists in herbaria and botanic gardens.
- Maintain the confidentiality of known population locations to prevent illegal collection of plants.
- Foster the participation of local landowners/land managers who have potential suitable translocation sites.
- Raise awareness of the species with relevant stakeholders to find more populations.
- Maintain engagement with private landholders where the species occurs to ensure management activities are appropriate for the species.

Survey and Monitoring priorities

- Undertake targeted surveys within suitable habitat to locate additional populations.
- Design, establish, implement, and/or continue programs to monitor all known sites, including regular monitoring of the species' abundance, extent and condition of populations and the extent and severity of threats.
- Monitor the progress of recovery, including the effectiveness of management actions and the need to adapt them if necessary.
- Survey all populations annually to detect any new or increased threatening processes.

Information and Research priorities

- Undertake research on the species ecology including to determine the specific habitat requirements of the species to inform management of extant populations and guide future translocation efforts.
- Undertake research to determine propagation and germination requirements to establish an ex-situ conservation collection and spore storage in preparation for future translocations.
- More precisely assess population size, distribution, and ecological requirements of the species.
- Determine conditions that promote recruitment success and improve the understanding of population dynamics.
- Undertake spore germination and planting trials to determine protocols for the most successful and least costly ex situ and in situ propagation.

Recommendations

- (i) The Committee recommends that the list referred to in section 178 of the EPBC Act be amended by **including** in the list in the Critically Endangered category:
Antrophyum austroqueenslandicum
- (ii) The Committee recommends that there not be a recovery plan for this species.

Threatened Species Scientific Committee

3 September 2020

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