

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 22 February 2019

Bruguiera hainesii

Haines's Orange Mangrove

Taxonomy

Conventionally accepted as *Bruguiera hainesii* C.G.Rogers (CHAH 2017).

Studies of Haines's Orange Mangrove in Malaysia indicate that the species is a hybrid of *Bruguiera cylindrica* and *Bruguiera gymnorhiza* (Ono et al., 2016). Similar studies have not been undertaken for the Australian population in Cairns (N Duke 2017c, pers comm). If a hybrid species is distinct or produces viable propagules it is considered a species for the purposes of the EPBC Act and is eligible for inclusion in the list of threatened species. Haines's Orange Mangrove has both of these characteristics (Cooper et al., 2016; Duke 2014, 2016, 2017b).

Summary of assessment

Conservation status

Critically Endangered: Criteria 2, 3 and 4.

The highest category for which *Bruguiera hainesii* is eligible to be listed is Critically Endangered.

Bruguiera hainesii has been found to be eligible for listing under the following categories:

Criterion 2: B1ab(v)+2ab(v): Critically Endangered

Criterion 3: C2a(i,ii): Critically Endangered

Criterion 4: D: 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 Haines's Orange Mangrove.

Public consultation

Notice of the proposed amendment and a consultation document was made available for public comment for more than 30 business days between 30 May 2018 and 20 July 2018. 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

Haines's Orange Mangrove, family Rhizophoraceae, is a tree that grows to 18 m and is evergreen in Australia (Cooper et al., 2016). It has well developed buttresses that are mostly triangular (Cooper et al., 2016). It is distinguished from other *Bruguiera* taxa by its intermediate sized mature flower buds (18-22 mm long), on 3-flowered inflorescences, petals that are longer than 5 mm (8.5-10 mm long), with 9-11 calyx lobes (sepals or outermost non reproductive parts of the flower) (Cooper et al., 2016).

Distribution

In Australia, Haines's Orange Mangrove is known from one population adjacent to Trinity Inlet in the Cairns region (Cooper et al., 2016). This area is in the Wet Tropics IBRA bioregion (ALA 2017).

Globally, the species is sparsely distributed and occurs in Indonesia, Malaysia, Thailand, Myanmar, Philippines, Papua New Guinea, Singapore (Duke et al., 2010) and the Solomon Islands (Cooper et al., 2016). It has a very limited and patchy distribution (Duke et al., 2010c, 2014, 2016, 2017b).

The diversity of mangrove species decreases poleward from the equator (Duke 2006, 2017a). Based on current understanding of the species distribution, the Cairns population appears to be an outlier. In future, Haines's Orange Mangrove may be discovered between its lowest latitude occurrences in Asia and its highest latitude occurrences in Cairns along the eastern coast of Cape York. Factors that influence this trend in the global distribution patterns of mangroves include global temperature gradients, global climate gradients and global dispersal mechanisms (Duke et al., 1998).

Distribution of putative parent species

Haines's Orange Mangrove is a putative hybrid intermediate species of *B. cylindrica* and *B. gymnorhiza* (Cooper et al., 2016; Ono et al., 2016). *Bruguiera gymnorhiza* is the more common of the two species, occurring along the coast between Darwin and north-east New South Wales (ALA 2017). Globally, it occurs in east Africa, the Middle East, south Asia and Pacific Islands (Duke 2006, 2014, 2016, 2017a, 2017b; Duke et al., 2010b). *Bruguiera cylindrica* occurs between the Torres Strait and Cairns (ALA 2017). Globally, it also occurs in southern Asia (Duke 2006, 2014, 2016, 2017a, 2017b; Duke et al., 2010a).

In Australia, these two species have an overlapping extent of 42 500 km² on the coast between the Torres Strait and Cairns (DoEE 2017). These figures are not a surrogate for the extent of occurrence or area of occupancy of Haines's Orange Mangrove, but may indicate the extent of suitable intertidal zone habitat to survey for further populations of the species.

Relevant Biology/Ecology

In Australia, Haines's Orange Mangrove occurs in the landward mangrove zone where it is inundated by only very high tides (Cooper et al., 2016; Duke 2016, 2017b). It co-occurs with *Aegiceras corniculatum*, *B. cylindrica*, *B. gymnorhiza* and *Xylocarpus granatum* (Cooper et al., 2016; Duke 2016, 2017b). Globally, the species is found in the intermediate estuarine zone in the high intertidal region (i.e. back mangrove areas) (Duke 2016, 2017b; Robertson and Alongi 1992, cited in Duke et al., 2010c).

In Australia, flowers have been recorded in January, February and March; mature germinants were observed as scarce in February and March (Cooper et al., 2016), but more common in April to June (Duke 2016, 2017b). Maturity may be reached at 2-3 years (DoEE 2016). It may be pollinated by sunbirds (Nectariniidae) (Noske 1993). The species in south east Asia reportedly has very low rates of regeneration and germination (Duke et al., 2010c). However, this stands in contrast to the Australian population, having mature trees with relatively abundant seedlings growing in the immediate vicinity of mature trees (Cooper et al., 2016).

Threats

In Australia, the known population of Haines's Orange Mangrove is threatened by habitat loss and climate change (see Table 1).

Table 1 – Threats impacting Haines's Orange Mangrove in approximate order of severity of risk, based on available evidence.

Threat factor	Threat type and status	Evidence base
Habitat loss		
Urban and associated infrastructure development	Known current	Suitable habitat in relation to tide height has been lost to development in the immediate surrounding area over the past 50 to 60 years (DoEE 2016). The land where the species occurs could be rezoned, potentially leading to further erosion of the population and its habitat. Maintenance of power lines and clearing beneath the lines

		<p>could result in tree numbers being reduced (DoEE 2016). Incidental threats associated with urban development include degradation associated with increased human visitation, cutting, trampling, oil spill pollution, herbicide spray pollution, altered hydrology (i.e. flooding and impoundment, sediment erosion and deposition) and weed invasion (Duke 2018, pers comm).</p> <p>Flood mitigation works could alter the hydrology and cause tree numbers to be reduced (DoEE 2016). Mangrove plants are very sensitive to changes in the normal and regular, inundation and ebb of tidal waters (Duke et al., 1998; Duke 2018, pers comm).</p>
Climate change		
Rising sea levels	Potential current	<p>With a rising sea-level, the habitat of the species will be disrupted, and the species will suffer mortality at present locations. To survive, the species may need to re-establish at higher elevations in areas that are currently landward flats (Ellison 2005, cited in Duke et al., 2010c). If sea-level rise continues, there will be continued mortality with or without re-establishment of the species (Duke et al., 2010c). As much of the area surrounding the Australian population is developed (DoEE 2016), it may not persist under rapid changes in sea level.</p>
Invasive species		
Invasive weeds	Potential current	<p>Invasive weeds (e.g. <i>Schinus</i> spp. and <i>Lantana</i> spp.) potentially affect the species; however, there is no referenced study to assess the impact.</p>

Assessment of available information 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>(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> <p><i>based on any of the following:</i></p>		

Evidence:**Insufficient data to determine eligibility**

No long term monitoring of the species has been undertaken: the oldest Australian voucher specimen was collected in 2016 (CHAH 2018). However, observations made onsite between 2016 to 2018 indicate that prior reduction in the species' extent is quite likely because vegetation clearing has occurred in the immediate vicinity of the population.

The Committee considers that there is insufficient information to determine the eligibility of the species for listing in any category under this criterion.

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 indicating distribution is precarious for survival:			
(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 B1ab(v)+2ab(v) for listing as Critically Endangered**

In Australia, the single known population of Haines's Orange Mangrove has an extent of occurrence of less than 4 km² and an area of occupancy of 4 km². These estimates are inferred from data associated with herbarium records. The area of occupancy was calculated using the 2x2 km grid cell method. Haines's Orange Mangrove is extremely rare. Its rarity is established from numerous botanical surveys over the last century of the key estuaries in northern Australia by Dr Norman C Duke and other botanists. No other populations of Haines's Orange Mangrove have been recorded (Duke 2006; DoEE 2016; Cooper et al., 2016; Duke 2016, 2017b).

Its distribution may be considered severely fragmented given the severity of habitat loss in the area that it occurs and the fact that it is extremely isolated from other populations of the species.

The species is known to occur at only one location in Australia (Cooper et al., 2016; Duke 2016, 2017b).

Declines are projected in the number of mature individuals based on the high risk of threats in the immediate area of the population (DoEE 2016). Threats to the species include habitat loss from urban and associated infrastructure development and sea level rise associated with climate change. Suitable habitat in the immediate surrounding area has been lost over the past 50 to 60 years (DoEE 2016). Maintenance of power lines and clearing beneath the lines could see the tree numbers further reduced (DoEE 2016).

There is no evidence of extreme fluctuations of distribution or abundance of the species.

The Committee considers that the species' extent of occurrence and area of occupancy are very restricted, and the geographic distribution is precarious for the survival of the species because its number of locations is limited, and continuing decline in number of individuals projected. 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:			
(a) (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 C2a(i,ii) for listing as Critically Endangered

In Australia, Haines's Orange Mangrove is known from a single population of about 49 individual plants (Cooper et al., 2016). Thirty-five of the plants have been observed with flowers and are considered to be mature, and two of the plants are larger trees (greater than 30 cm diameter at breast height) (Cooper et al., 2016; DoEE 2016). This is based on direct observations of the patch (DoEE 2016). Larger individuals had stem diameters up to 61 cm. This identifies the population age and occupancy of the site to be at least 100 to 200 years. Such growth form sizes are consistent with the age of trees elsewhere of comparable mangrove species and habit in northern Queensland (Duke 2018, pers comm).

Evidence presented in Criterion 2 indicates that the species is projected to undergo declines in the number of mature individuals.

There are less than 50 mature individuals in the single population and 100% of mature individuals occur in the single population.

There is no evidence of extreme fluctuations in the number of mature individuals of the species. However, the demographic profile presented in 2016 (Cooper et al., 2016) shows a population of very few older individuals with a disproportionately large number of younger sapling plants.

The Committee considers the estimated total number of mature individuals of this species is very low, with a projected continuing decline, very low number of individuals in the subpopulation and 100% of individuals occurring in one subpopulation. 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
D2 ¹ Only applies to the Vulnerable category Restricted area of occupancy or number of locations with a plausible future threat that could drive the species to critically endangered or Extinct in a very short time	-	-	D2. Typically: area of occupancy < 20 km ² or number of locations ≤ 5

¹ The IUCN Red List Criterion D allows for species to be listed as Vulnerable under Criterion D2. The corresponding Criterion 4 in the EPBC Regulations does not currently include the provision for listing a species under D2. As such, a species cannot currently be listed under the EPBC Act under Criterion D2 only. However, assessments that demonstrate eligibility for listing under other criteria may include information relevant to D2. This information will not be considered by the Committee in making its assessment of the species' eligibility for listing under the EPBC Act, but may assist other jurisdictions to adopt the assessment outcome under the [common assessment method](#).

Evidence:

Eligible under Criterion 4 for listing as Critically Endangered

Evidence presented in Criterion 3 indicates that the species has an extremely low number of mature individuals.

Given that the species is eligible for listing as Critically Endangered in this Criterion, consideration of D2 is unnecessary.

The Committee considers that the total number of mature individuals is less than 50 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

Population viability analysis has not been undertaken.

Adequacy of survey

For this assessment it is considered that the survey effort has been adequate and there is sufficient scientific evidence to support the assessment outcome.

Conservation Actions

Recovery Plan

A Recovery Plan is not recommended; an approved Conservation Advice for the species provides sufficient direction to implement priority actions, mitigate against key threats and enable recovery.

Primary Conservation Actions

Protect the known population from habitat loss. Survey for the species between the Torres Strait and Cairns. Make assessments of the viability and establishment success of mature propagules. Characterise the variation in genetic characteristics of the Australian population of Haines's Orange Mangrove compared to other species in the genus.

Conservation and Management Priorities

Habitat loss disturbance and modifications

- Protect and prevent impacts to habitat critical to the survival of the species in the planning, construction and post construction phases of developments. Important components of this action are:
 - ensuring robust field surveys are undertaken, which account for the species' detectability, to identify the habitat areas that are critical to its survival, including habitat that may become critical in the future as sea level rises.
 - educating stakeholders in the application of the assessment and approval process under the EPBC Act and their obligations under the Act to avoid significant impacts to the Haines's Orange Mangrove.
- Negotiate and implement conservation agreements or establish reserves to protect Haines's Orange Mangrove habitat. If reserves or conservation agreements are difficult to establish, the focus of conservation of the species should be protecting the species' habitat from development.
- Ensure land managers and town planners are aware of the species' occurrence and provide protection measures against key and potential threats.

Translocation

- Using habitat suitability modelling as guidance, identify suitable sites for the establishment of additional populations in the wild. Relevant policies should be referred to for guidance for undertaking translocations (e.g. Vallee et al., 2004). Translocation must be preceded by extensive surveys of the potential range in order to better understand the species' distribution and careful planning that includes a risk assessment including the risks from genetic pollution. At this stage, translocation is just about planning: action is predicated on knowing more of the range of the species.

Invasive species

- Control *Schinus* spp. and *Lantana* spp. infestations.

Survey and Monitoring priorities

- Develop habitat suitability models to determine the ecological/environmental indices responsible for the distribution of the Haines's Orange Mangrove, and how it may change due to sea level rise. Data may be gathered from populations outside of Australia.
- Using habitat suitability modelling as guidance, undertake surveys in suitable habitat and potential habitat to locate any additional occurrences. Surveys should be undertaken on private and public land. Sightings of the species should be reported to the Queensland Government WildNet Team via email on WildNet@science.dsitia.qld.gov.au
- Monitor the population dynamics and health of the known population (including other species of plants in the patch), including propagule production, recruitment, establishment and mortality.

Information and Research priorities

- Undertake seed germination and/or vegetative propagation trials to determine the requirements for successful establishment.

- Research is required to determine the:
 - demographics of the species – including abundance, life-span, reproductive age, size-class distribution, mortality and recruitment.
 - feasibility of translocation of the species, including techniques to maximise translocation success
 - genetic composition of reproductive output to improve understanding of sustainability of hybrid populations
 - feasibility of international conservation effort for the species
 - genetic character of the *Bruguiera* genus to better inform knowledge on the evolution and speciation of the genus
 - assessment of the viability of propagules of Haines's Orange Mangrove.

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:

Bruguiera hainesii

- (ii) The Committee recommends that there not be a recovery plan for this species.

Threatened Species Scientific Committee

5 September 2018

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