New Zealand non-detriment finding for tree ferns

Cyathea/ Alsophila/ Sphaeropteris spp.

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1. Introduction

All seven species of *Cyathea* tree ferns native to New Zealand are listed on Appendix II of the Convention on International Trade of Endangered Species of Wild Fauna and Flora (CITES) as part of a global listing of all *Cyathea* species. CITES and many New Zealand botanists (e.g., de Lange et al. 2018) have retained them all in the genus *Cyathea*, but some authorities (e.g. the New Zealand Plant Conservation Network website: Flora search results • New Zealand Plant Conservation Network (nzpcn.org.nz)) have recently re-classified some species of *Cyathea* tree ferns as belonging to the genera *Alsophila or Sphaeropteris*. Even if these new genera names become adopted widely, the species will still be covered by the original *Cyathea* spp. listing. The seven native species and their synonyms, their **common names**, and their New Zealand threat classification (de Lange et al. 2018) are:

Cyathea (*Alsophila*) *colensoi*, **rough/ mountain tree fern** (Not Threatened)

Cyathea (*Alsophila*) *cunninghamii*, **punui, gully tree fern,** (Not Threatened)

Cyathea dealbata (*Alsophila tricolor*), **kaponga, kātote, ponga, punga, silver fern** (Not Threatened)

Cyathea (*Alsophila*) *kermadecensis,* **Kermadec tree fern** (At Risk, Naturally Uncommon)

Cyathea (*Sphaeropteris*) *medullaris,* **mamaku, black tree fern** (Not Threatened)

Cyathea (*Alsophila*) *milnei*, **Milne's tree fern** (At Risk, Naturally Uncommon)

Cyathea (*Alsophila*) *smithii*, **katote, soft/ Smith's tree fern** (Not Threatened).

Any new species described in the genera *Cyathea, Alsophila or Sphaeropteris*, will be covered by the existing Appendix II listing of *Cyathea* spp..

Also covered by the Appendix II listing is the introduced tree fern *Sphaeropteris* (*Cyathea*) *cooperi.*

The CITES convention has three Appendices (I, II and III), based largely on the level of risk that international trade could have on the viability of wild populations of the species. Trade in plant species listed in Appendix II has two requirements that must be fulfilled before permits are issued:

1. The CITES Management Authority of the exporting country (or equivalent recognised authority in the case of countries that are not Parties to the CITES Convention) must verify that the species was obtained legally.
2. The CITES Scientific Authority of the exporting country must advise that such export will not be detrimental to the survival of the species (known as a non-detriment finding (NDF).

An NDF is a science-based risk-assessment that considers the species biology and life history; the conservation status and population structure and trends; changes in the species' range; threats from other sources; levels and patterns of harvest; and management that is benefitting the species.

2. New Zealand tree ferns

None of the seven native species of New Zealand tree ferns are protected under the Wildlife Act 1953, but individual plants are protected on the over 30% of New Zealand (and over 70% of remaining indigenous forest) that is managed by the Department of Conservation or in reserves managed by local and regional government, and in permanent covenants on private land (including on land owned by Māori).

All but two species have a New Zealand Threat Classification System (Townsend et al. 2008) classification of "Not Threatened" (de Lange et al. 2018). Indeed, some species are extremely common across most of the country, especially in disturbed ecosystems, in seral forests and in high rainfall areas.

Five species (*colensoi, dealbata*, *kermadecensis*, *milnei* and *smithii*) are endemic to New Zealand, the other two species (*cunninghamii* and *medullaris*) are shared with Australia or other countries in Oceania.

Cyathea (*Alsophila*) *colensoi*, **rough/ mountain tree fern**

A small endemic tree fern found from the Waikato and Bay of Plenty in the northern North Island southwards to Stewart Island, mainly in montane to subalpine scrub and dense upland forests. It is usually without a trunk, but is rarely up to 1 m tall, and fronds are up to 1.5 m long.

The species is difficult to cultivate but is occasionally available from specialist native plant nurseries. The CITES trade database records the shipment of 1 specimen from Australia to the United States in 1995 and a shipment of 100 live specimens from New Zealand to Germany in 2010.

Cyathea (*Alsophila*) *cunninghamii*, **punui, gully tree fern,** (Not Threatened)

A tall native tree fern shared with Australia. In New Zealand, it is found in wet forests from the coast to subalpine zone in the North, South and Chatham Islands, mainly in the North Island from the Far North to Wellington, and in the north-western and western South Island. The slender trunk is up to 20 m tall, and the fronds of up to 3 m length fall off leaving just the base. Its height growth rate (8.00 cm/year) was the second highest of five co-occurring tree ferns in a lowland forest in the southern North Island and the mean lifespan of trunked individuals was estimated to be 54 years, and maximum estimated age was 155 years (Bystriakova et al. 2011).

The species is easy to cultivate and is available from specialist native plant nurseries. The CITES trade database records significant exports from the wild from New Zealand in 2001: 27000 logs (trunks) to Great Britain, 1267 logs to Japan, and 39189 logs to The Netherlands, presumably for decorative garden fencing, but no logs have been exported since then. Shipments of up to 3090, but generally in the tens or hundreds, of live plants have been exported from the wild from New Zealand to European destinations and the United States, but the exports have reduced to a total of 204 cuttings/ live plants between 2013 and 2022. Some artificially propagated specimens, and the occasional wild specimens have been exported from Australia over the past 30 years.

Cyathea dealbata (*Alsophila tricolor),* **kaponga, kātote, ponga, punga, silver fern** (Not Threatened)

A medium-sized endemic tree fern, incorrectly shown in Species+ to be also native to Australia. It is widely distributed and common from the Three Kings Islands to the southern North Island, but it occurs only in coastal and lowland forests of the northern and eastern South Island to just south of Dunedin, and is present on the Chatham Islands (Brownsey & Perrie 2015). The trunk is up to 10m tall and is covered with long-persistent stipe bases. Fronds are up to 4 m long and have very distinctive silvery white undersides. Its height growth rate (3.2 cm/year) was the slowest of five co-occurring tree ferns in a lowland forest in the southern North Island, where its mean lifespan of trunked trees was estimated to be 145 years and maximum estimated age was 250 years. Other North Island sites have estimated more rapid height growth rates, e.g., 5.0 cm/year in central North Island pine plantations (Ogden et al. 1997) and 11.0 cm/year in northern North Island podocarp-broadleaf forest (Brock et al. 2016).

The species is slow to cultivate from fresh spores, but young plants transplant easily. Young plants are available from most commercial nurseries in New Zealand. A moderate, but highly variable, number of live young plants, occasionally logs, have been exported from New Zealand to mainly the United Kingdom, Netherlands, Belgium, China, Ireland and Spain. Apart from the importer-reported importation of 4128 live plants into the United Kingdom in 2002, most transactions since 2000 have been of tens or low hundreds of specimens.

Cyathea (*Alsophila*) *kermadecensis,* **Kermadec tree fern** (At Risk, Naturally Uncommon)

A tall native tree fern confined naturally to Raoul Island in the subtropical Kermadec Islands. The slender trunk is up to 20 m tall and covered with diamond-shaped stipe scars where stipes have fallen off whole. Fronds are up to 4 m long.

The species is easy to cultivate but is cold sensitive and so not readily available outside specialist live collections. New Zealand has not exported any specimens since it joined CITES in 1989, but the CITES Trade Database records shipments of up to 30 live specimens from Australia between 1990 and 2001, but none since then.

Cyathea (*Sphaeropteris*) *medullaris,* **mamaku, black tree fern** (Not Threatened)

A tall native tree fern shared with Fiji, Samoa, French Polynesia and Pitcairn Islands. In New Zealand, it occurs from the Three Kings Islands south to Stewart Island, and on the main Chatham islands. It is especially common in lowland forest throughout the North Island and primarily in wetter coastal areas of the South Island and absent from Canterbury and Otago. The black trunk is up to 20 m tall and covered with hexagonal stipe bases after the up to 6m long fronds have fallen. Young plants may retain their spent fronds. Its height growth rate (11.5 cm/year) was the highest of five co-occurring tree ferns in a lowland forest in the southern North Island, where its mean lifespan of trunked trees was estimated to be 31 years and maximum estimated age was 100 years (Bystriakova et al. 2011). Growth rates in central North Island pine plantations were higher and estimated to be 18.0 cm/year (Ogden et al. 1997). Locally high mortality rates of this tree fern have been attributed to browsing by non-native brushtail possums (*Trichosurus vulpecula*).

The species is slow and difficult to cultivate from fresh spores, but young plants transplant easily. Young plants are available from commercial nurseries in New Zealand. A moderate, but variable, number of exports have been approved since the species was included in CITES, mainly to Europe, especially to Great Britain, France and Japan. The three main forms it is exported in are as live plants, as powdered trunks, and as tissue extracts.

Live plants have been exported mainly to Great Britain, Netherlands, United States and Japan. Often hundreds of young plants are exported each year (one exceptional shipment of 4130 plants in 2002); however Great Britain has become almost the only importer of live plants (<300) since 2015.

Since about 2008, the powdered trunks of mamaku have been exported to cosmetic companies in France for use as exfoliants. These shipments can total up to about one tonne in a calendar year.

Since about 2021, minute export quantities of fluid (generally < 10 g) extracted from live plants has been exported to Australia, China and France for use in health supplements.

Cyathea (*Alsophila*) *milnei*, **Milne's tree fern** (At Risk, Naturally Uncommon)

A medium height native tree fern confined naturally to Raoul Island in the subtropical Kermadec Islands. The trunk is up to 10 m tall and covered with numerous stub-like projecting remnants of stipes and a skirt of dead fronds. Fronds are up to 4 m long.

The species is easy to cultivate but is initially cold sensitive but once established is fast-growing. It is sometimes available from specialist native plant nurseries. New Zealand has not exported any specimens since it joined CITES in 1989, but the CITES trade database records shipments of up to 125 live specimens from South Africa to mainly European destinations in most years between 1997 and 2008, but none since then.

Cyathea (*Alsophila*) *smithii*, **katote, soft/ Smith's tree fern** (Not Threatened)

A small endemic tree fern found in dense forest widely across North, South Stewart, Chatham and Auckland Islands. In the North Island it is primarily found in montane forests, but extends locally into lowland areas, but int e South Island it occurs in lowland to montane forests, mostly west of the main divide (Brownsey & Perrie 2015). In wetter areas, this species often forms a dense canopy or subcanopy in cutover and/or deer damaged indigenous forest, and it may be common in pine plantations. The trunk is up to 8 m tall and fronds are up- to 2.5 m long. Its height growth rate (3.4 cm/year) was the second lowest of five co-occurring tree ferns in a lowland forest in the southern North Island, where its mean lifespan of trunked trees was estimated to be 118 years and maximum estimated age was 250 years (Bystriakova et al. 2011). Its height growth rates in a northern North Island forest have been estimated to be much higher (11.2 cm/year) (Brock et al. 2016).

The species is easy to propagate but needs to be kept damp. The CITES trade database records some large shipments of over 100 (and up to 4017) live plants to mainly Great Britain, The Netherlands and Japan between 1999 and 2009, but there have been only three shipments of over 100 (range 225-250) live plants between 2010 and 2022. A shipment of 348 tissue cultures was recorded in 2015.

3. Pressures on tree ferns

Since human settlement of Aotearoa New Zealand about 800 years ago, over 90% of lowland forest inhabited by tree ferns has been cleared to make way for farmland, horticulture and urban development. Nevertheless, none of the five tree fern species on the mainland of New Zealand has become threatened with extinction, and some species may have become more dominant in the composition of remaining forests of Aotearoa New Zealand as a result of forest disturbance by fire, partial forest clearance and selective browsing of palatable understorey trees and shrubs by deer. *Cyathea* (*Sphaeropteris*) *medullaris* is palatable and susceptible to brushtail possum browsing (Brock et al. 2016), and *Cyathea* (*Alsophila*) *colensoi* is susceptible to browsing by ungulates (Wardle 1991). Nevertheless, tree ferns have generally not had the population collapses that palatable trees and shrubs have suffered in the surviving New Zealand forests, and three ferns often remain very common and can represent more than 50% of the basal area and more than 20% of the biomass in some forests (Brock et al. 2016).

Tree ferns in Whirinaki Forest, North Island

Tree ferns are harvested from private land for their trunks for use as fences or other structures in landscape gardening, and young plants are transferred from the wild to be grown into feature plants.

Of particular note, tree ferns often establish well and grow to near full size in and adjacent to old growth exotic conifer plantations and are destroyed in the harvesting process at the end of each c.30 year growth cycle. In the 1980s, tree ferns (*Cyathea* (*Sphaeropteris*) *medullaris* and *Dicksonia* spp) harvested from old growth pine plantations of the central North Island, supported an industry worth $2.75 M/ year (equivalent to $10 M/year in 2023), although much of that harvest was destined for the domestic landscape gardening market (Veale 1986). Although tree ferns are protected on land managed by the Department of Conservation, it is known that tree ferns are occasionally harvested illegally for the above purposes.

The two 'At Risk' fern species*, Cyathea* (*Alsophila*) *kermadecensis* and *milnei,* are confined to Raoul Island in the Kermadecs Islands. Raoul Island is a small (2938 ha) oceanic island subject to active volcanism, and it is conceivable that a large eruption could eliminate all forest on the island, placing these species at higher risk than on other islands of similar size. Both have been successfully cultivated and are held in live plant collection on the mainland of New Zealand as an insurance policy in case of catastrophic volcanism on Raoul Island.

4. Existing management

Although tree ferns are not protected by law, those growing on the c.30% of Aotearoa New Zealand managed by the Department of Conservation and local and regional government are fully protected.

As noted above, very small 'insurance' populations of the two Raoul Island endemic species have been established on mainland New Zealand in case of a volcanic catastrophe on the island.

5. Conclusion

Although the sustainability of harvest of New Zealand tree ferns has not been evaluated in any peer-reviewed literature, five of the seven tree fern species in New Zealand have been classified as Not Threatened (de Lange et al. 2018). All of these are common or locally common and so their survival in the wild seems not to have been threatened by even the highest annual levels of international trade recorded in the 30+ years New Zealand has been a signatory of CITES.

This NDF for tree fern species is considered at the national scale rather than at the specific site where the tree ferns are harvested; this is particularly true of cases where the tree ferns are obtained in and adjacent to exotic conifer plantations, where the harvest of tree ferns takes place before they would otherwise be destroyed during the commercial harvest of timber. Harvest of tree ferns from private land may not be locally sustainable but such harvest is unlikely to be detrimental to the survival of the species in the wild at a regional or national level.

To ensure that harvest of tree ferns for international trade does not take place from protected areas, the exporters must swear that the specimens have been obtained from private land with the permission of the landowner – indeed many applications result from the harvest of tree ferns from the exporter's own land.

Positive NDFs can therefore be issued by the New Zealand Scientific Authority in cases where:

- Specimens of non-threatened species of tree ferns in the form of logs, powdered logs, or young live plants were obtained from private land, especially from old growth exotic forest plantations where the tree ferns would be destroyed as part of the harvesting (clear-felling) process.

- Specimens of live non-threatened species of tree ferns that were obtained directly from commercial native nurseries.

- Specimens of fern extract are taken from live plants obtained from commercial nurseries and grown in *ex-situ* conditions described on the permit application.

- Specimens of non-native, invasive tree fern *Sphaeropteris cooperi.*

Positive NDFs may be possible in cases where an application is made to export specimens of the two At-Risk, Naturally Uncommon species, *Cyathea* (*Alsophila*) *kermadecensis* and *Cyathea (Alsophila) milnei*. These would most likely be in the form of live plants or extracts. For applications involving these species, a closer scrutiny is needed of the possible impact on the viability of the insurance population held on the New Zealand mainland.

6. References

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