Flora Technical Note No. 5:

Identification and management of treeferns

FPA
FOREST PRACTICES AUTHORITY

The *Flora Technical Note Series* provides information for Forest Practices Officers on flora management in production forests. These technical notes are advisory guidelines and should be read in conjunction with the requirements of the Tasmanian *Forest Practices Code*.

Technical notes can be accessed on the Forest Practices Authority's website: www.fpa.tas.gov.au

1. Introduction

Treeferns are an integral part of the ecology of Tasmanian wet forests. They often dominate the understorey, and help to create a sheltered and moist forest floor, providing ideal habitat for many non-vascular plants and invertebrate animals. Treeferns offer a substrate for epiphytes such as mosses and filmy ferns, and a nursery site for the germination of rainforest trees. Treeferns may be a prominent component of some threatened forest communities.

The harvesting of treeferns is regulated through Tasmania's forest practices system. A Tree Fern Management Plan has been written by the Forest Practices Authority, in consultation with the Commonwealth Department of the Environment and other stakeholders. This plan applies across all land tenures.

Under the terms of the Tree Fern Management Plan, only *Dicksonia antarctica* (also known as manfern or soft treefern) can be commercially harvested. The Forest Practices Authority recently estimated that there are approximately 130 million trunked *Dicksonia* in Tasmania, based on the mapped extent of favoured forest types and the average density of the species within these forest types (Forest Practices Authority 2007). Harvesting is only permitted on a sustainable basis, and only from areas covered by a certified Forest Practices Plan. Sustainable harvesting means taking ferns only from areas to be intensively logged and where the removal of ferns will not affect the regeneration of the species. *Dicksonia antarctica* can only be harvested when such coupes are scheduled for logging within one year. Each treefern must be tagged at the point of harvest with a tag issued by the Forest Practices Authority. **Information on requirements for commercial treefern harvesting is available from the Forest Practices Authority (details at the end of this technical note).**

This technical note serves two purposes. Firstly, in light of the current regulation of treefern harvesting, notes on identification are provided to clarify the differences between the five species of treeferns that occur in Tasmania. Secondly, this note discusses the ecological significance of treeferns, and the effect of forestry operations on them, so that these factors can be considered during the preparation and implementation of Forest Practices Plans.

2. Identification

There are five Tasmanian fern species that regularly form trunks over one metre in height. These species are: *Todea barbara* (king fern), *Dicksonia antarctica* (manfern or soft treefern), *Cyathea australis* (rough treefern), *Cyathea cunninghamii* (slender treefern) and *Cyathea* X*marcescens* (skirted treefern). *Cyathea* X*marcescens* is a natural hybrid between *C. cunninghamii* and *C. australis*. Some other fern species [e.g. *Polystichum proliferum* (mother shieldfern), *Blechnum nudum* (fishbone waterfern) and *Diplazium australe* (southern ladyfern)] may also form trunks, but these rarely exceed 30 cm in height.

The Ferns of Tasmania (Garrett 1996) has good photographs and distribution maps of all of the above species.

The following key will assist identification based on characteristics of the frond. It is important to examine the base of the stipe (the basal part of the frond – see page 3). Species can be identified using dead fronds if they are in good condition and not broken off above the base.

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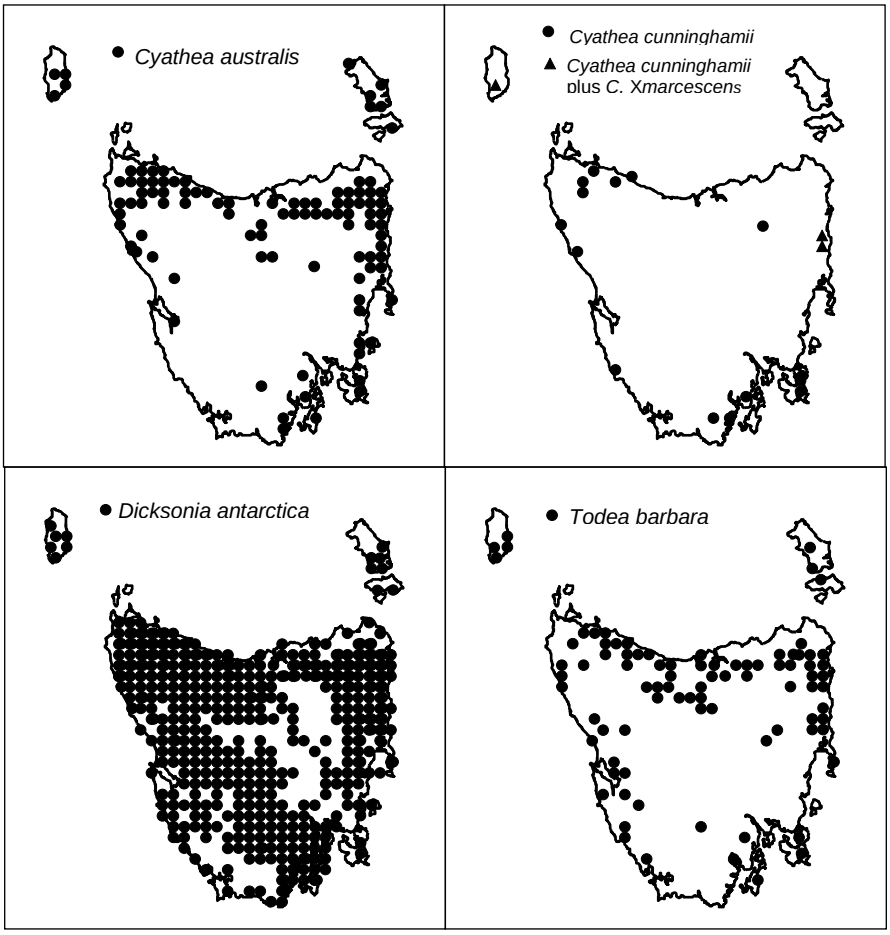
Identifications can be checked by referring to other characteristics listed in the table at the end of this technical note. A glossary of terms used in the key and table is also given.

If you want to confirm the identity of a plant, send a piece of frond (including the base of the stipe) and fertile material (if possible) to the FPA Biodiversity Program. Alternatively, a photo or scan can be sent. Other information (trunk height and diameter, habitat, location) should also be supplied.

Distribution of treefern species in Tasmania [based on Garrett (1996)].



Key to Tasmanian treeferns (adapted from Duncan and Neyland 1986)

❶ Stipe smooth near base
- ❷ Stipe base hairless ..... *Todea barbara*
- ❷ Stipe base covered with soft reddish hairs ..... *Dicksonia antarctica*

❶ Stipe rough and rasp-like near base
- ❷ Trunk of mature plant more than 20 cm diameter; scales at base of stipe varnished
  - ❸ Stipe base brown; scales brown ..... *Cyathea australis*
  - ❸ Stipe base black; scales dark brown ..... *Cyathea marcescens*❖
- ❷ Trunk of mature plant less than 20 cm diameter; scales at base of stipe often streaked (stipe base black; scales fawn to brown) ..... *Cyathea cunninghamii*
- ❷ Trunk of mature plant absent or not determined
  - ❸ Most pinnules joined to rachis; scales at base of stipe varnished
    - ❹ Stipe base brown; scales brown ..... *Cyathea australis*
    - ❹ Stipe base black; scales dark brown ..... *Cyathea marcescens*❖
  - ❸ Most pinnules petiolate; scales at base of stipe often streaked (stipe base black; scales fawn to brown) ..... *Cyathea cunninghamii*

❖*Cyathea marcescens* will only be found where both *C. australis* and *C. cunninghamii* co-occur. This hybrid is more correctly written as *Cyathea* X*marcescens.*

Terms used in the key and table

Frond ..... full leaf of fern
Stipe ..... stalk of frond, from trunk to first divisions bearing leaflets
Rhachis..... axes or framework of the frond above the stipe
Tubercles..... knobby projections on rhachis
Bipinnate..... frond is twice divided
Tripinnate.....frond is thrice divided
Pinnules..... smallest segment of the divided fronds
Petiolate.....attached to the rhachis by the mid-vein only
Sori ..... clusters containing spores on the underside of fertile pinnules
Indusia .....membranes which cover or partly cover immature sori in many ferns

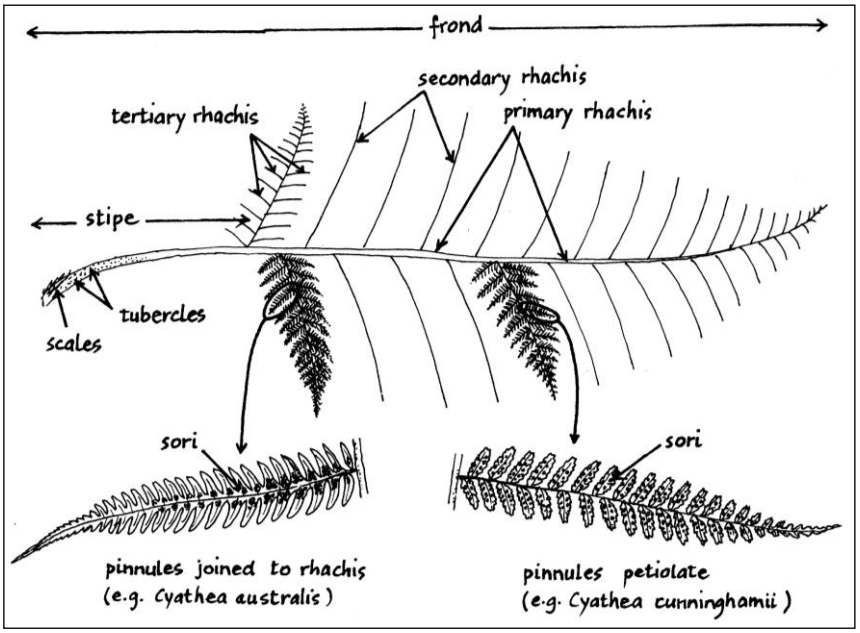
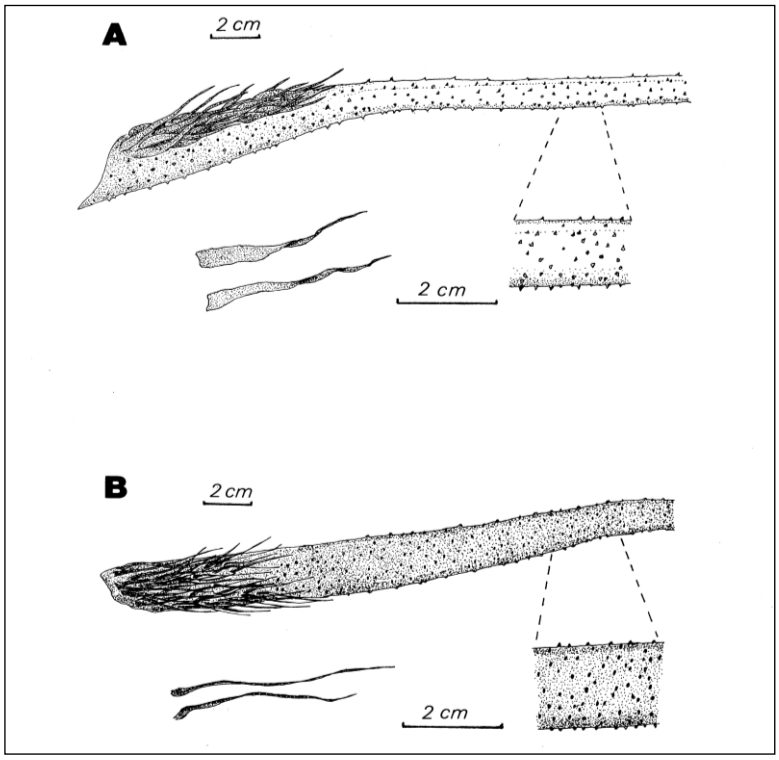


Figure 1

Stylised tripinnate frond of *Cyathea* species



Drawings: Fred Duncan.

Figure 2

Stipe base and scales of *Cyathea australis* (A) and *Cyathea cunninghamii* (B)

3. Conservation significance of treeferns

Two treefern species are of high conservation significance in Tasmania. They are *Cyathea cunninghamii* (slender treefern) and *Cyathea* X*marcescens* (skirted treefern). *Cyathea cunninghamii* is listed as an endangered species (Schedule 3) and *Cyathea* X*marce*scens is listed as a vulnerable species (Schedule 4) on the Tasmanian *Threatened Species Protection Act 1995*. Suspected occurrences of either of these species should be reported to the FPA Biodiversity Program or the Threatened Species Section of the Dept of Primary Industries, Parks, Water and Environment (see end of the technical note for contact details).

Cyathea cunninghamii is restricted to about 20 scattered populations, mostly in sheltered coastal gullies (see map). The biggest population, with over 200 individuals, was discovered by a Forest Practices Officer in Dalco Creek, in the Esperance area. Most other populations include less than 20 plants.

Cyathea X*marcescens* is a natural hybrid of *C. australis* and *C. cunninghamii*, and is known from only three sites in Tasmania (all with both hybridising parents present). The largest population of *C. Xmarcescens* is known from Little Beach Creek Forest Reserve near Scamander. Wildfires burnt much of this reserve in the summer of 2006–07 but populations of *C. Xmarcescens* and *C. cunninghamii* escaped serious damage.

None of the other treefern species are listed as threatened. The objective of the forest practices system is to maintain these species with healthy populations and to ensure that they do not themselves become threatened. They may be uncommon in some regions of the state. Even *Dicksonia antarctica*, the most abundant Tasmanian treefern, is uncommon in drier regions (e.g. Midlands) and any small populations or sporadic individuals within such regions should be protected.

Maintaining populations of mature manferns is also desirable in regions where they are common and doing so can be consistent with achieving adequate eucalypt regeneration following logging (see 'Suggested strategies for minimising disturbance' below). Treeferns are important for the survival of other species such as epiphytes, invertebrates, and even trees that use the fern trunks as a seed-bed and nursery site.

4. Treeferns as habitat

Dicksonia antarctica can host a high diversity of epiphytic species. Most epiphytes are bryophytes (mosses and liverworts) and ferns, but lichens are also frequent. Some of these epiphytic species show strong preferences for *Dicksonia* trunks over other available substrates.

Treefern trunks are made up of persistent frond bases and layers of aerial roots. These aerial roots are particularly dense and fibrous in *Dicksonia antarctica*, and are excellent at holding moisture. Trunks of treeferns, especially *Dicksonia*, provide easy anchorage for establishing epiphytes. An investigation into ferns and bryophytes occurring on *Dicksonia* trunks recorded 97 different species across just ten study sites in southeastern Tasmania (Roberts *et al*. 2005). This is a remarkably high diversity to be associated with a single host species.

While it is clear that *Dicksonia* trunks offer habitat to many species, variation in epiphytic diversity and composition from site to site suggests the ecological importance of the host is variable. Thus, the conservation value of *Dicksonia* may be greater at some sites than others – depending on how many species are using it as habitat, and whether or not it is supporting rare species. There is a complex range of factors underlying variation in epiphytic diversity, most of which are connected with microclimate or disturbance history.

Epiphytes tend to be sensitive to subtle microclimatic factors, such as humidity. This can be seen from the preference of individual species for a certain height on the trunk. Changes to microclimatic conditions, such as increased light or wind, are likely to have a great impact on the suitability of treefern trunks as habitat.

Age of trunks, and the length of time since disturbance, will also influence the diversity and composition of epiphytes on *Dicksonia*. The oldest and least disturbed trunks are more likely to support late-colonising epiphytic species, and therefore may have higher conservation value. The age of the dominant vegetation is also an important factor, as it influences microclimatic conditions (e.g. wind and light).

Amongst the Tasmanian treefern species, *Dicksonia* appears to support the greatest abundance and diversity of fern and bryophyte species, but the other treeferns may support a distinctive suite of species due to their specific trunk characteristics. This has been shown in a comparative study of *Cyathea cunninghamii* and *Dicksonia* epiphytes (Roberts et al. 2005). One species of moss showed a very strong preference for the trunks of *Cyathea cunninghamii*. Each treefern species should be considered as having a distinct ecological role because some epiphytes distinguish between them as hosts.

5. The impact of forestry operations on treeferns

Maintenance of treeferns and associated species is achieved through:

- a representative system of formal reserves that contain areas of mature forest
- a network of informal reserves (e.g. wildlife habitat strips and streamside reserves) and sites topographically protected from logging (e.g. steep slopes), which often contain treefern habitat
- sustainable management of forest outside of these formal and informal reserves.

These protected sites provide a source of seeds and spores, facilitating the recolonisation of regenerated coupes by late-successional stage species, including epiphytic species. In drier areas of Tasmania, sites that are richest in treeferns (and other fern species) are typically protected by reservation or management prescription (e.g. relict rainforest).

Cyathea cunninghamii and *C. Xmarcescens* are unlikely to be directly affected by forestry operations due to their strong association with streamside vegetation. These species are rare, and the *Forest Practices Code* requires that the FPA Biodiversity Program be contacted if they are located within a proposed coupe area, or are in an adjacent area that may be affected by proposed operations. A high priority is given to the protection of these species.

Dicksonia antarctica and *Cyathea australis* are the treeferns most directly affected by forestry operations. *Dicksonia* is clearly more widespread and prominent in production forests.

The effect of logging and regeneration treatments on *Dicksonia* is currently being researched by the Forest Practices Authority. Intensive logging and regeneration burning generally result in a dramatic decline in populations of mature *Dicksonia*, however some trunks will usually survive. A pilot study carried out in the Florentine Valley found clearfelling using cable or ground-based systems, followed by regeneration burning, resulted in about 70% mortality of *Dicksonia* within the coupe after one year (Peacock and Duncan 1994). The main factors contributing to mortality are fire, which damages the external root system, and water stress due to increased exposure to wind and sun. The decreased health of *Dicksonia* that initially survive the burn, plus the absence of a protective forest canopy, make them vulnerable to climatic extremes (e.g. high summer temperature, winter frosts and snowfalls), and there may be a continued slow decline for several months, or even years, after logging. Establishment of new plants from spores will eventually restore *Dicksonia* populations to pre-logging levels in most cases (Chuter et al. 2008).

The immediate effect of logging on epiphytic species associated with *Dicksonia* is greater than on *Dicksonia* itself. These plants are fire-sensitive and rely on the protection from sun and wind provided by the mature forest. Survival of any epiphytes during and post-logging is unlikely, and the recovery of epiphytic species occurs through the re-colonisation of surviving *Dicksonia* trunks (or *Dicksonia* that have germinated from spores once they have reached sufficient maturity) when suitable microclimatic conditions are established in the regrowth forest.

The *Dicksonia* that germinate from spores after logging take many years to develop trunks suitable for colonisation by epiphytes. *Dicksonia* typically takes about 30 years from the time of germination to develop a one-metre trunk, and 50 years to develop a two-metre trunk. The growth rate may be much slower in forests, and a two metre trunk may be well over 100 years old. Epiphytes very rarely establish on trunks less than 1.5 m tall, most likely due to the 'skirt' of persistent dead fronds around the trunk of young ferns. It probably takes about 40 years from the time a *Dicksonia* spore germinated to the time of colonisation by its typical epiphytes. Longer periods would be required for 'slow colonising' or 'late successional' epiphytes to establish in regrowth forests, depending on the changing structure of the forest as well as development of the treefern hosts. Maintaining as many live, mature *Dicksonia* as possible during and after logging will increase the available habitat for

epiphytes in regrowth forest. The final section of this technical note provides some suggestions for how to achieve this.

As a point of interest, *Cyathea cunninghamii* grows much faster than *Dicksonia* – growth rates of 30 cm/year have been recorded in a garden situation (M Garrett pers. comm.)

6. Suggested strategies for reducing disturbance to treefern sites

From an ecological perspective, it is desirable if treeferns, and their epiphytic cargoes, can be maintained in forest landscapes managed primarily for wood production.

If *Cyathea cunninghamii* and *C. Xmarcescens* are within or adjacent to a proposed coupe, the FPA Biodiversity Program must be contacted, as stated above. The likely management prescriptions will be similar to those recommended for relict rainforest (e.g. a generous buffer and measures to protect the area from fire). Refer to *Flora Technical Note 4* (Relict Rainforest Management) for further management recommendations.

When *Dicksonia antarctica* or *Cyathea australis* are present, it is not necessary to contact the FPA Biodiversity Program, but the ecological value of these species should be considered in forest practices planning. The primary aim of native forest silviculture is to achieve good establishment and growth of eucalypt regeneration, which at first appearance may conflict with maintaining treeferns on intensively logged sites. However, in some circumstances, logging techniques can be modified to reduce disturbance to treefern-rich environments within or adjacent to coupes. The main aims are to reduce mortality to treeferns (mainly from intense regeneration burns), and to maintain upright and relatively undamaged trunks, which will facilitate recolonisation by epiphytes. It may be feasible to incorporate some of the following practices into the operational plan:

- excluding sites with high densities of older treeferns or treeferns with abundant epiphytes from the operational area, particularly where treeferns are relatively uncommon in the landscape. This could be by extending streamside reserves, or including such sites in Wildlife Habitat Clumps or in island or edge aggregates where variable retention or similar silvicultural techniques are being employed
- capturing treefern-rich sites within expanded streamside reserves may create more suitable burn boundaries in coupes requiring high intensity regeneration burns
- protecting mature treeferns may be compatible with managing other values such as threatened flora, fauna or archaeological sites
- avoiding cable-yarding or ground-based skidding through dense patches of mature treeferns in coupes to be regenerated to native forest
- not locating roads and landings on dense patches of treeferns
- felling trees so that the heads land outside dense patches of treeferns
- minimising the risk of high intensity regeneration burns extending into retained fern-rich environments (in some coupes, ground disturbance from intensive logging may provide enough seedbed for eucalypt regeneration without the need for a high intensity burn) – moisture differentials around retained forest aggregates may reduce the likelihood of hot fires in these patches.

Sites supporting dense stands of treeferns and a rich epiphytic flora in drier regions of the state should be protected by a combination of the above techniques. Buffers should be designed to maintain a suitable microclimate.

References

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Contact details

Forest Practices Authority: 30 Patrick Street, Hobart, Tasmania 7000.
Phone: (03) 62337966; Fax: (03) 62337954
Email: info@fpa.tas.gov.au; Website: www.fpa.tas.gov.au

Forestry Tasmania: 79 Melville Street, Hobart, Tasmania 7000.
Phone: (03) 62358205 (Biology and Conservation Branch)
Email: info@forestrytas.com.au; Website: www.forestrytas.com.au

Threatened Species Section; Department of Primary Industries and Water
Phone: (03) 62336556 (Biodiversity Conservation Branch)
Email: wildlife.enquiries@dpiw.tas.gov.au Website: www.dpiw.tas.gov.au

Characteristics of Tasmanian treeferns

Species	Trunk dimensions	Features of trunk	Features of mature frond	Features of stipe	Reproduction	Habitat and distribution in Tasmania and elsewhere
Todea barbara Southern kingfern	Up to 2 m tall 80+ cm diam	Trunk barrel shaped, black and fibrous on outside, bearing many crowns of fronds Does not always form trunk	Length 150+ cm Leathery, bright shiny green Bipinnately divided	Stipe base smooth Bases hairless	Sori densely covering pinnules towards base of frond Indusia absent	Locally common in gullies, rock crevices and creek banks, particularly in coastal areas in the north of state Tas, Vic, NSW, Qld, SA (rare), NZ, South Africa
Dicksonia antarctica Soft treefern; manfern	UP to 12 m tall 80+ cm diam	Trunk fibrous and often buttressed, sometimes divided Old fronds persistent on upper trunk less so in older plants	Length 300+ cm Stiff, dark glossy green above, light below Tripinnately divided	Stipe base smooth Bases with soft reddish-brown hairs	Sori on margins of pinnules, protected by cup-shaped indusia and recurved leaf margin	Widespread and common in wetter forest types; more localised in gullies and protected environments in drier regions Tas, Vic, NSW, Qld, SA (extinct)
Cyathea australis Rough treefern	Up to 10 m tall 50+ cm diam	Trunk fibrous with buttress often developing in older plants Stipe bases persistent on upper trunk	Length 300+ cm Soft, light green, above, green or bluish below Tripinnately divided	Stipe base brown and rough with sharp tubercules that extend up stipe Bases with dark shiny scales	Sori in rows, adjacent to main vein on pinnules Indusia absent	Locally common in wetter forest types, gullies and creek banks particularly in the north of state Tas, Vic, NSW, Qld
Cyathea cunninghamii Slender treefern	Up to 20 m tall 15 cm diam	Trunk slender and fibrous towards base Stipe bases persistent on upper trunk, often moss covered	Length 250+ cm Soft, dark green above, lighter below. Tripinnately divided	Stipe base black and rough with short tubercules Bases with thin brown scales, often streaked	Sori in rows, adjacent to main vein on pinnules Indusia cup-shaped	Localised in very protected fern gullies, often associated with streams in coastal areas Tas, Vic, NSW (?), Qld, NZ
Cyathea Xmarcescens Skirted treefern	Up to 10 m tall 40 cm diam	Trunk fibrous with buttress often developing in older plants Often has skirt of persistent fronds	Length 300+ cm Soft, dark green above Tripinnately divided	Stipe base black and rough with short tubercules Bases with dark shiny scales	Sori in rows, adjacent to main vein on pinnules Indusia very small, saucer-shaped	Hybrid found only where *C. australis* and *C. cunninghamii* occur together. Tas, Vic