

Treefern management plan for the sustainable harvesting, transporting or trading of *Dicksonia antarctica* in Tasmania 2017

Environment Protection and Biodiversity Conservation Act 1999

(Section 303FO)

Overview

This *Treefern management plan* outlines a system to facilitate and regulate the sustainable harvesting of *Dicksonia antarctica* treeferns in Tasmania. Conditions of this plan are consistent with the long term conservation of *Dicksonia antarctica* in its natural habitat.

This *Treefern management plan* meets the Wildlife Trade Guidelines, under the provisions of the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*. The revision of this plan also meets requirements set out in the draft *National treefern harvesting guidelines* endorsed by the members of the National Flora Network and Department of Primary Industries, Parks, Water and Environment (DPIPWE).

This management plan has been prepared by the Tasmanian Government in consultation with the Australian Government to meet the requirements of the Tasmanian *Forest Practices Act 1985* and *Environment Protection and Biodiversity Conservation Act 1999*. It supersedes the *Treefern management plan* that was approved by the Australian Government in 2012.

Table of Contents

1. Introduction	3
2. Aims of this management plan	5
3. Outcomes from this management plan	5
4. Definitions	5
5. Context of treefern harvesting in Tasmania	7
6.1 Terms and conditions relating to treefern harvesting	8
6.2 Treefern harvesting under the <i>Treefern management plan</i>	9
6.3 Treefern harvesting principles	9
6.4 Situations where treefern harvesting may occur	10
6.4.1 Native forest to be converted to another land use	10
6.4.2 Native forest to be intensively logged and regenerated	10
6.4.3 Timber plantations	11
6.4.4 Treefern plantations or nursery sites	11
6.5 Monitoring of treefern harvesting	11
6.6 Treefern tags	12
6.7 Legislation and penalties	13
7. Threats to conservation status of treeferns	14
8. Issues relating to the conservation and harvesting of treeferns	15
8.1 Environmental	15
8.2 Social	15
8.3 Economic	15
8.4 Political	16
9. Monitoring of management plan implementation	16
9.1 Harvesting operations and retail outlets	16
9.2 Interstate distribution of treeferns	17
9.3 Overseas exports of treeferns	17
10. Liaison and education of stakeholders	17
11. Evaluation of performance under this management plan	18
12. Reporting of management plan implementation	18
13. Review of the management plan	18
14. References	20
Appendix 1: Background information on Tasmanian treeferns	22
Characteristics of Tasmanian treeferns	22
Life cycle of <i>Dicksonia antarctica</i>	24
Epiphytes and <i>Dicksonia antarctica</i>	25
Ecology and distribution of <i>Dicksonia antarctica</i>	25
Appendix 2: FPA Treefern research	29

1. Introduction

Dicksonia antarctica Labill. (manfern or soft treefern) is a common and widely distributed treefern found in Tasmanian wet forests. (**Note:** *For the purpose of this management plan the use of the terms ‘treefern’ and ‘Dicksonia’ will refer to Dicksonia antarctica unless otherwise stated*). The population of trunked treeferns in Tasmania is estimated to exceed 130 million, with in excess of 50% of the population occurring in Formal and Informal Reserves.

Treeferns have been long sought after for their aesthetic properties and have many horticultural applications. *Dicksonia* is a robust treefern that can be cut, stored, transported and replanted. Cut stems will continue to grow successfully if the crown is intact. The primary use of this species is as a live trunked treefern planted in gardens providing a ‘palm-like’ appearance. The trunk may be used for secondary horticultural products, such as plant pots, garden steps and mulch. Fronds are also used in floristry.

Forestry operations in Tasmania occur extensively in wet forests that support large populations of treeferns. Integration of treefern harvesting with logging operations undertaken under Tasmania’s forest practices system, provides an opportunity to utilise a resource that is widespread, well reserved and is maintained at a landscape level under current forest management. Peacock and Duncan (1995) reported high treefern mortality associated with forestry operations in wet forests. Chuter (2003) demonstrated that there is good regeneration of the species following such events. Data from ongoing research projects by the Forest Practices Authority (FPA) is being used to assess the effects of different wet forest silvicultural practices on health and survival of treeferns.

A detailed description of the distribution, conservation status, biology and regenerative properties of *Dicksonia* is given in Appendices 1 and 2. Appendix 1 also includes information about other species of trunked ferns in Tasmania – they include two species (*Cyathea cunninghamii* Hook. f. and *Cyathea Xmarcescens* Wakefield) that are considered to be threatened in Tasmania. Appendix 2 details research on the effects of logging operations on the survival and regeneration of treeferns.

The majority of treeferns harvested in Tasmania are exported to Victoria and overseas, primarily to Europe and Asia. They are particularly suitable for Europe’s temperate climate. Treeferns fill a niche market as many other fern species available on the world market are tropical species.

Commercial harvesting and export of treeferns has been taking place for many decades in Tasmania. Under provisions of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), exports of specimens for commercial purposes must be from an approved source. (**Note:** *Any references to specific Acts, codes, policies etc. applies to any subsequent amendments or versions*). One such source is a Wildlife trade management plan, approved by the Australian Government Minister for the Environment and Water Resources. In 2001, the *Treefern management plan for the harvesting, transporting or trading of Dicksonia antarctica in Tasmania* was developed by the Forest Practices Board (now the Forest Practices Authority), in consultation with Environment Australia [now the Australian Government Department of the Environment and Energy (DoEE)]; the Tasmanian Department of Primary Industries, Water and Environment [now the Department of Primary Industries, Parks, Water and Environment (DPIPWE)] and other stakeholders.

The introduction of the 2001 *Treefern management plan* and amendments to the *Tasmanian Forest Practices Act 1985* and *Tasmanian Forest Practices Regulations 2007*

incorporated commercial treefern harvesting into the forest practices system. This process was accompanied by the introduction of a tagging system for harvested treeferns and led to the complete regulation of treefern harvesting in Tasmania.

The *Treefern management plan* was subsequently revised in 2005, 2007 and 2012.

This *Treefern management plan* applies to all land tenures in Tasmania. Treefern harvesting prescriptions must be in accordance with the principles detailed in this plan and must be conducted under a certified forest practices plan (FPP).

The sustainable harvesting of treeferns under the terms of this management plan will be permitted as follows:

- salvage harvesting from native forest to be cleared permanently or converted to another use in accordance with Tasmania's legal and policy framework
- harvesting from native forest to be intensively logged and regenerated, where harvesting prescriptions will be applied to maintain local and regional populations
- harvesting in existing softwood and hardwood plantations
- harvesting of treefern plantations or nursery sites.

2. Aims of this management plan

The aims of this management plan are to:

- Facilitate the sustainable harvesting of treeferns from native forest subject to intensive forestry operations (where permitted by the landowner/manager and in accordance with the terms of this management plan) or treefern plantations and nursery sites.
- Provide effective and efficient regulation of harvesting of treeferns in Tasmania.
- Educate all stakeholders on the regulation of treefern harvesting in Tasmania.
- Foster research into the distribution, ecology and sustainable harvesting of treeferns.

3. Outcomes from this management plan

The anticipated outcomes of this management plan are to:

- Ensure that treefern harvesting is undertaken in a sustainable manner, and in accordance with current policies and legislation.
- Reduce the incidence of illegal harvest of treeferns from public and private land in Tasmania.
- Ensure that all stakeholders are aware of regulatory, operational and conservation requirements, so that treeferns are managed sustainably.
- Integrate research findings into the management and conservation of Tasmania's treefern populations.

4. Definitions

The following terms are used throughout this management plan:

- **Commercial treefern harvesting** – Harvesting of treeferns for the purposes of trade, or harvesting when more than six treeferns are taken from applicable land in a year (see the *Forest Practices Regulations 2007*).
- **Formal Reserve** – A reserve equivalent to IUCN Protected Area Management Categories I, II, III, IV, or VI as defined by the IUCN Commission for National Parks and Protected Areas (1994).
- **Informal Reserve** – A reserve on Permanent Timber Production Zone Land (PTPZL) (known as State Forest up to November 2013) comprising an area identified as a Protection Zone under the Management Decision Classification System or other administrative reserve on Public Land which is managed to protect comprehensive, adequate and representative (CAR) reserve values.
- **Landscape** – A conceptual planning unit or view field, generally of 200 – 1000 ha in area, which typically comprises a catchment of a class 2 stream (i.e. as defined by the *Forest Practices Code*), and occupies a topographic range from an upland landform (e.g hills and mountains) to lowland landforms (e.g valleys and basins).
- **Salvage harvesting** – Harvesting of a resource that would otherwise be destroyed.
- **Treefern** – *Dicksonia antarctica*.



Tall *Dicksonia* growing in Southern Tasmania



Tall wet eucalypt forest with a dense *Dicksonia* understory



Live *Dicksonia* being harvested



Dicksonia tagged and packed into a refrigerated container ready for export. **Note:** Some tags are not visible due to stacking.



Tasmanian *Dicksonia* for sale in the United Kingdom



Tasmanian Treefern Tag number 258301

5. Context of treefern harvesting in Tasmania

The distribution and attributes of treeferns, and the context of treefern harvesting in Tasmania, must be considered in assessing the sustainability of harvest and the prescriptions detailed in this plan.

The harvesting of treeferns for the period 30/6/2002 to 30/6/16 (Table 1) shows that the peak of harvesting occurred in 2002 to 2007 and then steadily declined to reach its nadir in 2012-13. The harvesting of treeferns has gradually increased as the forest industry has recovered, but is only at a quarter or less of the peak periods of a decade ago.

Table 1 - The harvesting of treeferns 2002 to 2016 (source FPA Annual Reports)

Year	Total no. of forest practices plans certified	No. (%) of plans that permit the harvesting of treeferns	No. of treefern tags issued by the FPA
2002–03	940	39 (4%)	64,182
2003–04	1,001	26 (3%)	54,886
2004–05	942	32 (3%)	61,368
2005–06	897	33 (4%)	45,131
2006–07	906	18 (2%)	54,802
2007–08	924	36 (4%)	35,352
2008–09	838	35 (4%)	17,529
2009–10	847	25 (3%)	19,905
2010–11	660	29 (4%)	10,729
2011–12	399	20 (5%)	22,177
2012–13	729	19 (3%)	8,572
2013–14	523	16 (3%)	8,982
2014–15	457*	4 (1%)	11,014
2015–16	475	11 (2%)	13,086

*excludes plans certified in 2014-15 as replacements for revoked Gunns' plans.

Under this management plan, treefern harvesting will generally be integrated with forestry activities in wet forests – either in areas that will be converted to another land use, or in areas that will be regenerated to native forest. In the latter case, logging and subsequent establishment of regeneration causes the physical removal of patches of vegetation, including treeferns. This is followed by a succession of regeneration and growth of dominant and understorey species, including treeferns. In either scenario, treefern harvesting allows for utilisation of treeferns without compromising the maintenance of the species in the landscape.

It has been estimated that there are approximately 130 million trunked treeferns in Tasmania (see Appendix 1 – ‘Ecology and Distribution of *Dicksonia antarctica*’). Trunked treeferns are those that have progressed from an immature stage to a trunk-forming stage. Approximately 74 million of these trunked treeferns are reserved in Formal and Informal Reserves. This figure includes ferns within Tasmania's public reserve system and reserves on private land. There are also substantial areas of wet

forest outside reserves that are not available for logging because of requirements under the *Forest Practices Code* e.g. topographic constraints.

In areas subject to forestry operations, treeferns are retained through existing requirements and prescriptions, including streamside reserves, habitat clumps, wildlife habitat strips, aggregates and ‘treefern islands’ (areas with high densities of treeferns that may be subject to constraints in forest practices plans). Reservation and retention of treeferns provides a substantial source of spore for regenerating the species in the logged area. Treeferns produce copious amounts of spore that are widely distributed by wind and readily develop into sporophytes that colonise regenerating forests. Treeferns in retained patches support late-successional epiphytes, hence contributing to the maintenance of biodiversity and providing a resource of propagules for recolonisation of the regenerating forests by these species.

6. Regulation of forest practices (and treefern harvesting)

Most forestry operations exceeding one hectare in Tasmania (on public or private land) require a forest practices plan (FPP) under the Forest Practices Act (**Note:** the exceptions are detailed in the Forest Practices Regulations). The Forest Practices Act is monitored and enforced by a statutory authority, the Forest Practices Authority (FPA). Forest practices plans are prepared in accordance with the *Forest Practices Code*, which details provisions for the protection of natural and cultural values. These values include flora, fauna, geomorphology, soils and water, cultural heritage and visual amenity. The FPA employs a team of specialists to provide advice in relation to natural and cultural values.

Harvesting must also take account of issues relating to hygiene and quarantine. The risk of introducing pests and diseases into the proposed harvesting area must be assessed, and hygiene measures implemented if a risk is identified. Treefern harvesting procedures also need to take account of quarantine requirements associated with the export of ferns.

All FPPs must be certified by a Forest Practices Officer (FPO) prior to the commencement of a forestry operation. Forest Practices Officers are trained and accredited by the FPA to identify and manage natural and cultural values. Compliance reports must be prepared by an FPO and lodged with the FPA within 30 days of the completion of the operation. Independent random audits are conducted on a representative sample of FPPs each year, to assess compliance with the FPP and identify problems that require corrective action.

6.1 Terms and conditions relating to treefern harvesting

Terms and conditions relating to treefern harvesting were inserted into the Forest Practices Act in 2001, as part of the approval process for the 2001 *Treefern management plan*. These terms and conditions are summarised below:

- ‘treeferns’ are defined as *Dicksonia antarctica* and harvesting is restricted to this species
- harvesting operations must be covered by a certified FPP that includes a suitable prescription for treefern harvesting (see Page 11 – ‘Situations where treefern harvesting may occur’)
- all harvested treeferns must have a Tasmanian treefern tag securely attached at the point of harvest.

The Forest Practices Regulations prescribe that the requirements for a forest practices plan and the tagging of treeferns do not apply where:

- no more than six treeferns are harvested on an area of applicable land during one year; and
- the owner of this land has given consent; and
- the treeferns are only for personal use (they must not be traded or used for commercial purposes).

6.2 Treefern harvesting under the *Treefern management plan*

This *Treefern management plan* applies across all land tenures in Tasmania. Treefern harvesting operations are regulated and enforced under the Forest Practices Act, as described above.

This *Treefern management plan* has taken into account the principles in section 6.3, taken from the draft *National treefern harvesting guidelines* for the sustainable harvesting of treeferns in states where commercial harvesting occurs. These guidelines were developed in 2006 and involved liaison between representatives of the Australian Government, and state and territory agencies involved in regulation of wild flora harvesting. Some of the principles have been modified to fit within Tasmania's legislation and regulatory framework.

6.3 Treefern harvesting principles

- Extraction of treeferns should not be the catalyst for forestry operations. Treefern harvesting must not occur prior to a final land use decision being confirmed and the approval of a forestry operation on the site.
- Treeferns may be salvage harvested where they would otherwise be destroyed by logging activities and land clearing (this includes harvesting from existing hardwood and softwood plantations).
- Treeferns may be harvested from other native forest operations if all of the following conditions apply:
 - the harvesting of treeferns and the forestry operation itself comply with appropriate regulations
 - treeferns are retained at the landscape level and in the vicinity of the coupe (e.g. in streamside reserves, habitat clumps and other sites managed by prescription)
 - treeferns will regenerate adequately on the site.
- Treeferns and their associated biodiversity should be retained at the coupe and landscape levels in formal reserves (e.g. national parks and forest reserves), informal reserves (e.g. wildlife habitat strips) and areas subject to management prescriptions through the forest practices system (e.g. streamside reserves, relict rainforest).
- Forest Practices Officers will be responsible for ensuring that areas permitted for treefern harvesting, and reserved areas, are clearly defined and marked prior to harvesting in accordance with the *Forest Practices Code*.
- Treefern harvesting operations should be managed and monitored by the responsible FPO in conjunction with the FPA. It is the responsibility of treefern harvesters, generally through the land manager, to familiarise themselves with

regulations and prescriptions applying to any treefern harvesting operation (e.g. location of boundaries of harvesting areas).

- Treefern harvesting should be undertaken in a manner that protects or maintains other forest values (e.g. soils, biodiversity, forest health, water quality), recognising that in many cases the primary determinant of prescriptions and constraints in the harvest area will be the regulation of forestry activities.

6.4 Situations where treefern harvesting may occur

Under this *Treefern management plan*, commercial harvesting of treeferns may only occur if prescribed in FPPs that cover forestry activities in the following situations:

- native forest to be converted to another land use
- native forest to be intensively logged and regenerated
- existing softwood and hardwood plantations
- treefern plantations or nursery sites.

These situations where treefern harvesting will be permitted under this management plan are discussed in more detail below (6.4.1-6.4.4).

Other situations, such as native forest to be partially (selectively) harvested may be considered provided the tree fern harvesting principles (6.3) apply. However, as noted below (7.0) there are additional constraints through the Tasmanian forest practices system, on operations in some other *Dicksonia*-rich forest communities in regions where such communities are uncommon (typically drier regions of the state). An example is the complete protection of rainforest in the Freycinet and Midlands Bioregions and drier parts of Ben Lomond, Woolnorth and D'Entrecasteaux Bioregions. While, commercial treefern harvesters have little interest in undertaking salvage harvesting from environments and forest types where *Dicksonia* is uncommon there may be some drier areas where *Dicksonia* is common and additional constraints do not apply.

A research project (see Appendix 2, project 3) will be undertaken as part of this management plan to investigate the feasibility of including such partial harvest sites as a situation where treefern harvesting may occur.

6.4.1 Native forest to be converted to another land use

Salvage harvesting of treeferns will continue to be permitted from areas of native forest to be cleared for plantations, agriculture or infrastructure (e.g. dams, roads, powerlines, pipelines and other service facilities). This also includes areas cleared for roads, landings and primary snig tracks as part of logging operations.

6.4.2 Native forest to be intensively logged and regenerated

This *Treefern management plan* permits treefern harvesting from areas which will be logged and regenerated back to native forest, under certain conditions. Wet eucalypt forest silviculture in Tasmania typically involves intensive harvesting operations that cause significant disturbance to overstorey and understorey species (including treeferns) in the timber harvesting area. Operations can comprise:

- clearfell, burn and sow (using cable-logging equipment on steep terrain, or conventional logging equipment elsewhere)

- aggregated retention, with patches of forest (normally 0.5–3 ha, which typically represents 10–20% of the operational area) retained within the intensively logged areas.

Forest Practices Officers will notify the FPA about any proposed treefern harvesting operations in native forest to be logged and regenerated. The FPA, in consultation with the FPO, will provide advice on the harvesting prescriptions to be applied. Research findings and knowledge of native forest logging and regeneration techniques will be used to develop these prescriptions. For example, no harvesting of treeferns would be permitted in areas that are retained in aggregated retention coupes.

6.4.3 Timber plantations

In some instances, established softwood and hardwood plantations contain populations of treeferns that have either survived the plantation establishment process or have regenerated from spore. There are no restrictions on the harvesting of treeferns in plantations other than the normal provisions of the *Forest Practices Code*. Harvesting of treeferns may be undertaken as a separate operation to the timber harvesting (e.g. harvesting treeferns ‘mid-rotation’ may be safer and more efficient than integrating timber and treefern harvesting operations).

6.4.4 Treefern plantations or nursery sites

Treefern plantations or nursery sites dedicated to the production of trunked treeferns may be harvested in accordance with the provisions of the forest practices system. Treefern harvesters should consult with an FPO and the FPA prior to the establishment or harvest of such sites.

6.5 Monitoring of treefern harvesting

Prior to commencement of treefern harvesting, FPOs must ensure that:

- areas designated for harvesting of treeferns must be clearly demarcated
- all other relevant marking has been completed in the coupe
- treefern harvesters receive an appropriate briefing on the FPP.

The FPO must undertake regular inspections of treefern harvesting sites and report to the FPA any breaches or concerns about the application of the FPP or *Treefern management plan*. At the completion of treefern harvesting, the FPO will inspect the operational area and report to the FPA (through a certificate of compliance) on whether the operation is compliant with the conditions in the FPP.

The FPA undertakes random audits of FPPs and harvesting operations to assess the standards of FPPs and associated operations. Forest practices plans for treefern harvesting are subject to such auditing and review.

Selective treefern harvesting operations and a proportion of salvage operations will be specifically assessed by the FPA to assess compliance with conditions of the FPP and *Treefern management plan*. This process is to obtain data for research purposes, to discuss with stakeholders the effectiveness of prescriptions and if necessary to refine prescriptions in FPPs and subsequent *Treefern management plans*. This will provide a means of adaptive management for the *Treefern management plan* by refining prescriptions.

6.6 Treefern tags

All harvested treeferns must have a Tasmanian treefern tag securely attached at the point of harvest. Attachment of tags is the responsibility of the treefern harvester, who must ensure that tags are attached to ferns before they are transported from the harvesting site (as specified in the FPP). Treefern tags must remain attached throughout the retail chain to the end consumer.

Forest practices plans proposed for treefern harvesting must have treefern numbers estimated by the FPO, in order that an appropriate number of treefern tags are issued to the treefern harvester for that FPP area. Treeferns are counted in sample plots located in different botanical communities within the FPP area, and then these numbers extrapolated to estimate the number of treeferns in the FPP area. The methods for sample plot counts are covered in FPO training.

Treefern harvesters must apply to the FPA for sufficient treefern tags for the treeferns to be harvested up to the estimated number, which is prescribed on the FPP coversheet. A copy of a certified FPP prescribing treefern harvesting, along with a treefern tag Request form (available from the FPO or FPA) and prescribed payment for the treefern tags, must be supplied to the FPA in order for treefern tags to be issued. Information required on the treefern tag Request form includes the:

- unique FPP identification number for the area from which the treeferns will be harvested
- number of treeferns which the FPO estimates can be harvested
- name of certifying FPO
- name of the treefern harvester and their current address
- business names, contact names and addresses for each other party in the supply chain
- date that compliance certification will be undertaken for treefern harvesting operational phase
- person responsible for arranging for FPO to undertake checking, and signature of responsible person.

Issued tags must only be attached to treeferns harvested from the area covered by the FPP against which the tags were obtained. Any tags that may be left over from a particular FPP area must either be transferred to another FPP (via a treefern tag request form) or returned to the FPA for a refund.

Treefern tags are issued sequentially for each FPP and will not exceed the prescribed number of treeferns identified on the FPP. Once the FPA has received a request for tags and clears payment, the required number of tags are provided to the treefern harvester. Tags are issued under section 18A(b) of the Forest Practices Act and can be obtained for two size classes of fern:

- 1) treefern stem greater than 30 cm in length (priced at one fee unit or \$1.55 as of 15 February 2017)
- 2) treefern stem 30 cm or less in length (priced at 0.5 fee units or 78c as of 15 February 2017).

The pricing of tags is adjusted annually by the Tasmanian Treasury.

A new optional multi-part tag will be made available by the FPA in 2017 for larger treefern stems at no additional cost. The parts of the tag can be separated in order to tag multiple products from a single stem. The aim of this tag is to offer another design of tag to assist the Tasmanian industry. This tag provides for chain of custody for treefern parts and enables tracing back of the product parts to the certified treefern.

Proceeds from the sale of the tags pay for:

- administration of the treefern management system
- database and record keeping
- monitoring and enforcement
- research into sustainable management of treeferns in Tasmania.

Treefern tags are printed on strong waterproof material with sequential numbers. This enables suitable monitoring, recording and reporting and minimises the risk of tags being re-used. The colour of tags is also changed regularly to prevent re-use or copying. The format of the tags is reviewed regularly to ensure that the information is appropriate and the material and method of attachment is suitable.

6.7 Legislation and penalties

Under the terms of the Forest Practices Act, the FPA may certify, refuse to certify, vary or revoke a FPP. The FPA may direct persons to comply with the *Forest Practices Code* and make good any breach or environmental harm. Alternatively, the FPA may fine or prosecute any person who does not comply with the Act or provisions of a FPP. Thus the FPA has considerable powers under the Act to control treefern harvesting to ensure that such harvesting meets the objectives of this *Treefern management plan*.

The harvesting of treeferns or possession of untagged ferns outside an approved harvest area is a contravention of the Forest Practices Act and can attract substantial fines.

The harvesting situations, requirements and constraints for treeferns are summarised in Table 2.

Table 2 - Summary of regulatory system for treefern harvesting in Tasmania under this *Treefern management plan*

Type of Treefern Harvesting	Source of Treeferns	Forestry Operation	Conditions for Treefern Harvesting	FPA Notification Required	FPP Req'd	Treefern tags Req'd	Compliance Report Required
Commercial	Native forest	Native forest to be converted or cleared	As per harvesting prescriptions	Yes, prior to harvesting	Yes	Yes	Yes
Commercial	Native forest	Native forest to be regenerated	Consultation with FPA prior to harvesting	Yes, prior to harvesting	Yes	Yes	Yes
Commercial	Existing timber plantations	Future harvesting of plantation timber	Consultation with FPA prior to harvesting	Yes, prior to harvesting	Yes	Yes	Yes

Commercial	Treefern plantations or nursery sites	Treefern harvesting	Consultation with FPA prior to establishment and harvesting	Yes, prior to harvesting	Yes	Yes	Yes
Non-commercial	Native forest or other	None	Six or less ferns harvested for non-commercial purposes*	No	No	No	No

*Consult the Forest Practices Regulations 2007 for clarification.

7. Threats to conservation status of treeferns

Dicksonia antarctica is a common and widespread species throughout Tasmania and is not at risk from any current or future management activities. It is not listed as threatened under the Tasmanian *Threatened Species Protection Act 1995* or *Environment Protection and Biodiversity Conservation Act 1999*. *Dicksonia antarctica* is not listed under the Convention on International Trade in Endangered Species (CITES) for restrictions on trade from Australia.

Dicksonia occurs in most national parks throughout the state, as well as in numerous state and other reserves. Additional formal and informal reservation of some forest communities containing *Dicksonia* has occurred or will continue to occur, as a result of policy requirements (e.g. Tasmanian RFA and *Tasmanian Community Forest Agreement*) and provisions of the *Forest Practices Code*. Such reservation will also result in the protection of other species of treeferns.

The security of formal reserves in Tasmania is high. All formal reserves, including national parks, state reserves, game reserves, nature reserves and forest reserves, are equivalent to IUCN Protected Area Management Categories I, II, III IV, or VI as defined by the IUCN Commission for National Parks and Protected Areas 1994. The status of Formal Reserves is secure, requiring approval by the Tasmanian Parliament for dedication or revocation.

Only a small proportion of the Tasmanian population of *Dicksonia* is available for commercial harvesting. Harvesting of *Dicksonia* is effectively restricted to parts of the state where the species is common, and where the species will be maintained at a landscape level. There are practical reasons for this:

- Most wet forest communities often have a relatively high density of *Dicksonia*. Such forests are well represented in formal and informal reserves (e.g. streamside reserves) and other sites generally unavailable for logging (e.g. steep shaded slopes).
- The Tasmanian RFA and subsequent policies preclude forestry operations in several forest communities on public land and in some instances preclude their conversion on private land. These include wet forest communities (e.g. *Eucalyptus brookeriana* forest, *E. viminalis* wet forest) that often contain large populations of *Dicksonia*.
- There are additional constraints through the Tasmanian forest practices system, on operations in some other *Dicksonia*-rich forest communities in regions where such communities are uncommon (typically drier regions of the state). An

example is the complete protection of rainforest in the Freycinet and Midlands Bioregions and drier parts of Ben Lomond, Woolnorth and D'Entrecasteaux Bioregions.

- Commercial treefern harvesters have little interest in undertaking salvage harvesting from environments and forest types where *Dicksonia* is uncommon.

This *Treefern management plan* will not result in a change in the conservation status of *Dicksonia* at national, state or regional levels.

8. Issues relating to the conservation and harvesting of treeferns

8.1 Environmental

The sustainable harvesting of treeferns from native forest, as described in this *Treefern management plan*, will have a negligible impact on the environment or ecology of a particular area, relative to the ecological changes resulting from the logging and regeneration practices. The retention of treeferns in formal and informal reserves ensures that ecological values are maintained in the vicinity of operational areas and at the landscape level. This also ensures that there is adequate potential for the re-colonisation of the regenerating forest by treeferns and associated epiphytes.

The current regulatory system, including requirements for the preparation of FPPs and the treefern tagging system, ensure that appropriate harvesting constraints are prescribed and monitored in FPP areas. This severely limits the potential for illegal harvesting activities or availability of untagged ferns in the marketplace.

8.2 Social

The harvesting of treeferns from native forest is a sustainable practice which supports employment in an export oriented business sector, improves resource use and reduces the incentive for illegal harvesting from other areas with high conservation value. Application of previous *Treefern management plans* has significantly reduced illegal harvesting of the species, and placed the industry on a regulated footing. This has translated into market acceptability for the product.

The harvesting of treeferns provides full-time and part-time employment in rural and regional areas. Whilst the number of people employed in this industry is relatively small, it is significant for the individuals concerned, their families and the community as a whole. Such employment can be important in rural areas with restricted alternative employment opportunities.

8.3 Economic

The vast majority of FPPs currently prepared are not within forest areas suitable for the harvesting of treeferns due to: legislative restrictions; absence or few treeferns present; or logistical/economic issues that make treefern harvesting unviable. In many coupes, time and safety constraints mean that only a fraction of the total available ferns are removed.

The treefern industry faces the normal supply and demand risks associated with any economic enterprise. However, the rapid phasing out of the only current source of supply will lead to a collapse in the industry. This will result in the loss of regional employment opportunities, unless alternative sources of treeferns can be sustainably utilised in accordance with this *Treefern management plan*.

Inconsistency of legislation and fees between Victoria and Tasmania has resulted in higher regulatory costs for Tasmanian operators.

8.4 Political

Currently, each state with treefern harvesting or distribution operations has its own *Treefern management plan* and regulations. The inconsistencies between approaches threaten some operations due to differences in regulatory costs and compliance regimes. Implementation of a national approach to treefern harvesting, using the draft *National treefern harvesting guidelines* as a basis, would result in a more consistent approach to treefern management in the different jurisdictions.

The primary source of treeferns was previously through conversion of native forest to plantation. Under the Tasmanian Permanent Native Forest Estate Policy 2016 the broadscale clearing and conversion of forest is not permitted on public land and is to be phased out on private land by 1 July 2017.¹

9. Monitoring of management plan implementation

9.1 Harvesting operations and retail outlets

Since the inception of the 2001 *Treefern management plan*, auditing and nursery inspections undertaken by the FPA(B) has revealed a decrease in illegally harvested treeferns in the market place. However, there are still infrequent, minor instances of non-compliance and illegal activity despite the efforts made to educate all stakeholders on the requirements for management and legal trading of treeferns. Therefore, continuation of monitoring and education is required. The following monitoring will be undertaken:

- Checks of treefern harvesting operations by FPOs as part of normal FPP implementation and inspections, to ensure that treefern harvesting complies with conditions in the FPP.
- Spot checks of treefern harvesting operations by FPA staff; this will show that the FPA is active and can also perform an educational role.
- FPOs will inspect the FPP area at completion of treefern harvesting, as part of the compliance checking (prior to issuing of a certificate of compliance).
- FPA auditing of a representative sample of FPPs each year (as part of reporting requirements to the Tasmanian parliament).
- Spot checks of nurseries and retail outlets by the FPA to check that required tagging procedures are being followed.
- Treefern harvesters are required to keep records of the treefern tag numbers and the names and addresses of retail outlets that are supplied with treeferns. Under the Forest Practices Act, an FPO can request that this information be provided by anyone trading in treeferns.

¹ The Tasmanian Permanent Native Forest Estate Policy was amended in 2016. The broadscale clearing and conversion of forest is not permitted on public land and is to be phased out on private land by 1 July 2017, pending completion of the review of the overall policy during 2016-17.

9.2 Interstate distribution of treeferns

According to data obtained from the FPA's and DPIPWE's databases, the majority of Tasmanian treeferns are either shipped to Victoria or exported overseas directly. The FPA liaises with the Victorian Department of Environment, Land, Water and Planning (DELWP) on the movement of Tasmanian treeferns into Victoria. Comparison of information from DPIPWE and DELWP with the FPA's FPP and treefern tag databases is used to highlight any anomalies within the regulatory system. Limited checking is done by authorities in other states on the imports of Tasmanian treeferns.

Although not within their typical ambit, the Australian Customs Service and the Australian Quarantine Inspection Service (AQIS) may undertake 'spot' inspections of containers for the FPA.

9.3 Overseas exports of treeferns

International export of treeferns requires an export permit from DPIPWE. DPIPWE needs to receive a copy of the relevant documentation i.e. the receipt for treefern tags and the FPP number or copy of the approved FPP. The process of DPIPWE issuing an export permit involves the recording of the basic details of the exporter, number of treeferns, FPP number and treefern tags issued. The FPA and DPIPWE exchange information on treefern tag numbers issued to harvesters/exporters.

The international export of treeferns requires a phyto-sanitary certificate to be issued by AQIS prior to export. Attention should be paid to phyto-sanitary requirements for pests and diseases and movement of plants with soil – this needs to be considered by harvesters and exporters at the harvesting stage, when treeferns are in storage and (particularly) in fumigation or other treatments prior to export in containers.

Detailed inspection of treeferns is required for AQIS certification, which also allows for a cursory inspection for tagging compliance. This is the last opportunity for an inspection for tagging compliance prior to the 'sealing' of the container for shipment. There is scope for AQIS to report on tagging compliance as part of the phyto-sanitary certification procedure.

10. Liaison and education of stakeholders

The review and implementation of the *Treefern management plan* should involve liaison with and education of stakeholders. The following commitments have been adapted from the draft National Treefern Harvesting Guidelines:

- The FPA will produce technical information on treeferns including regulation of treefern harvesting. These will be provided to harvesters, industry associations, retailers and other stakeholders.
- Regular liaison will occur between various stakeholders (FPA, DPIPWE, DoEE, AQIS, land managers, treefern harvesters and retailers) to ensure that the regulations for treefern harvesting and trading in Tasmania are understood, implemented and reviewed as appropriate. In addition to this, regular sharing of information will occur between stakeholders on treefern harvesting, trading and exports.
- Development of an industry association will be encouraged to facilitate: good harvesting practices; good storage and quarantine practices; and appropriate policy development to maintain a viable and sustainable industry.

11. Evaluation of performance under this management plan

The following evaluation of performance will be undertaken against the management plan.

- Feedback from landowners/managers, treefern harvesters and other stakeholders will provide a means of adaptive management working within the constraints of this *Treefern management plan* to improve the process.
- Areas where treefern harvesting has taken place will be monitored by FPOs for compliance with the FPP. Examination of harvest areas also provides a means of assessing the application of management prescriptions. This provides another means of applying the adaptive management principle based on actual experiences.
- The checking of harvest returns by harvesters to the landowner/manager against the number of treefern tags issued by the FPA will be an indicator of compliance.
- The exclusion of treefern harvesting from reserves or areas excluded by prescription represents compliance with this *Treefern management plan* at the coupe level. This can be applied to the broader environment to ascertain levels of illegal harvesting.
- Long-term monitoring of regenerated native forest sites where treefern harvesting has taken place will provide an assessment of the survival and regeneration of treeferns and the maintenance of the species relative to the management prescriptions applied.
- Research examining the sustainable management of treeferns will continue and the results of this work will be delivered to stakeholders and integrated into future reviews of the *Treefern management plan*. This may also serve to provide information for adaptive management during the life of the *Treefern management plan*.
- The Treefern Project will continue to deliver information on treefern management to stakeholders. The success of this information delivery will be reflected in particular by nursery and harvester knowledge and public enquiries about treeferns.

12. Reporting of management plan implementation

The FPA will report on the implementation of this *Treefern management plan* to the Tasmanian Parliament and to the Australian Government through its Annual Report, as required under s.4X of the Forest Practices Act. Annual reports will include details on the:

- number of FPPs that include treefern harvesting
- number of treefern tags issued
- monitoring and investigations of treefern harvesting compliance
- research projects and outcomes.

13. Review of the management plan

This management plan shall remain in force for a maximum period of five years or until amended or replaced by a plan approved by the Tasmanian and Australian Governments

prior to this. Review of the management plan will include consultation with stakeholders. Several research programs are currently being undertaken in relation to the management and sustainable harvesting of treeferns (as detailed in Appendix 2). These programs will continue to provide important information to improve the effectiveness and sustainability of treefern management in Tasmanian forests, and to integrate such information and procedures into future revisions of the Tasmanian *Treefern management plan*.

14. References

- Baker TP, Jordan GJ, Dalton PJ, Baker SC 2013. *Impact of distance to mature forest on the recolonisation of bryophytes in a regenerating Tasmanian wet eucalypt forest*. Aust. J. Bot. 61, 633-42.
- Chuter, A 2003, *Regeneration of Dicksonia antarctica after logging*, unpublished Honours thesis, University of Tasmania, Hobart, Tasmania.
- Commonwealth of Australia and State of Tasmania 1997, *Tasmanian Regional Forest Agreement*, Department of Agriculture, Fisheries and Forestry, Canberra, ACT.
- Duncan, BD, and Isaac, G 1986, *Ferns and allied plants of Victoria, Tasmania and South Australia*, Melbourne University Press in association with Monash University, Melbourne, Victoria.
- Duncan, F, and Neyland, M 1986, 'Tasmanian treeferns: a vegetative key and descriptions', *The Tasmanian Naturalist*, **85**: 2–8.
- Forest Practices Authority 2012, *Treefern management plan for the harvesting, transporting or trading of Dicksonia antarctica in Tasmania*, Forest Practices Authority, Hobart, Tasmania.
- Forest Practices Authority 2005, *Treefern management plan for the harvesting, transporting or trading of Dicksonia antarctica in Tasmania*, Forest Practices Authority, Hobart, Tasmania.
- Forest Practices Board 2001, *Treefern management plan for the harvesting, transporting or trading of Dicksonia antarctica in Tasmania*, Forest Practices Board, Hobart, Tasmania.
- Forestry Commission Tasmania 1989, *Treefern management plan*, Forestry Commission Tasmania, Tasmania.
- Fox JC, Turner PAM 2004. Chapter 6. *Veined bristle-fern (Crepidomanes venosum)*. In: Linking landscape ecology management to population viability analysis. Report 2: Population viability analyses for eleven forest dependent species. A project by the University of Melbourne prepared for Forestry Tasmania. pp 137 – 151.
- Garrett, M 1996, *The ferns of Tasmania: their ecology and distribution*, Tasmanian Forest Research Council, Hobart, Tasmania.
- Jones, DL, and Clemesha, SCC 1977, *Australian ferns and fern allies*, AH & AW Reed Pty Ltd., Sydney, NSW.
- Kirkpatrick, J, and Moscal, A 1987, *Conservation status of the vegetation and flora of the LEMONTHYME area, Tasmania – a report to the Australian Heritage Commission*, University of Tasmania, Hobart, Tasmania.
- Mueck SG, Ough K, Banks JC 1996. *How old are wet forest understoreys?* Aust. J. Ecol. 21, 345-8.
- National Flora Network 2006, *National treefern harvesting guidelines*, unpublished.
- Neyland, MG 1986, *Conservation and Management of Treeferns in Tasmania*, Wildlife Division Technical Report 86/1, National Parks and Wildlife Service Tasmania, Tasmania.

Neyland, M, 1991, *Relict Rainforest in Eastern Tasmania*, Tasmanian NRCP Technical Report No. 6, Wildlife and Heritage and Department of the Art, Sport, the Environment, Tourism and Territories, Canberra, ACT.

Ough, K, and Murphy, A, 1996, *The effect of clearfell logging on tree-ferns in Victorian wet forest*, *Australian Forestry*, **59**:178–188.

Pannell, JR, 1992, *Swamp forests of Tasmania*, Forestry Commission, Tasmania.

Peacock, R, and Duncan, F, 1995, *Effects of logging on manferns (Dicksonia antarctica) and epiphytes*, Division of Silviculture Research and Development Annual Report 1994–95, Forestry Tasmania, Tasmania.

Roberts, N 2002, *Treeferns as a substrate for bryophytes and ferns in south-eastern Tasmania*, unpublished Honours thesis, University of Tasmania, Hobart, Tasmania.

Roberts NR, Dalton PJ, Jordan GJ 2005. *Epiphytic ferns and bryophytes of Tasmanian tree-ferns: A comparison of diversity and composition between two host species*. *Austral Ecology* 30, 146 – 154.

Turner, PAM 2003, *The ecology and conservation of bryophytes in Tasmanian wet eucalypt forest*, PhD thesis, University of Tasmania, Hobart, Tasmania.

van Galen LG, Baker SC, Dalton PJ, Jordan G. 2016. *The effectiveness of streamside versus upslope reserves in conserving log-associated bryophytes of native production forests*. *For. Ecol. Manage.* 373, 66-73.

Appendix 1: Background information on Tasmanian treeferns

Characteristics of Tasmanian treeferns

There are five Tasmanian fern species that regularly form trunks over one metre in height and that are referred to as treeferns. These species are: *Dicksonia antarctica* Labill. (manfern or soft treefern), *Cyathea australis* (R. Br.) Domin (rough treefern), *Cyathea cunninghamii* Hook. f. (slender treefern), *Cyathea Xmarcescens* Wakefield (skirted treefern) and *Todea barbara* (L.) T. Moore (king fern). *Cyathea Xmarcescens* is a natural hybrid between *C. cunninghamii* and *C. australis*. Four other species of fern [*Polystichum proliferum* (R. Br.) Presl, *Blechnum nudum* (Labill.) Mett. ex Luer, *Diplazium australe* (R. Br.) Wakefield and *Pneumatopteris pennigera* (G. Forst.) Holttum] may also form trunks, but these rarely exceed 30 cm in height.

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. *Dicksonia* trunks are formed by persistent frond bases and layers of aerial roots that connect the crown to the ground. These trunks offer a substrate for epiphytes such as mosses and filmy ferns, and a nursery site for the germination of many species.

The harvesting of treeferns in Tasmania is limited to *Dicksonia*. The inclusion of a description of the other treeferns is solely for identification purposes and understanding the distribution and ecology of these ferns.

The following key will assist identification based on characters of the frond. It is important to examine the base of the stipe (the basal part of the frond).

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 rhachis; 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 Xmarcescens*.

General information pertaining to the Tasmanian treeferns not prescribed for harvest under the Tasmanian *Treefern management plan* is presented below. The Tasmanian distribution of these species (and *Dicksonia*) is represented in Figure 2. None of the five species of Tasmanian treeferns are endemic to the state. *Cyathea australis* is found in

each of the eastern mainland states. *Cyathea cunninghamii* is found in each of the eastern mainland states and in New Zealand. *Cyathea Xmarcescens* occurs in Victoria. *Dicksonia* is found in each of the eastern mainland states and in South Australia (where it may be extinct in the wild). *Todea barbara* is found in all the mainland states except Western Australia, as well as in New Zealand and South Africa.

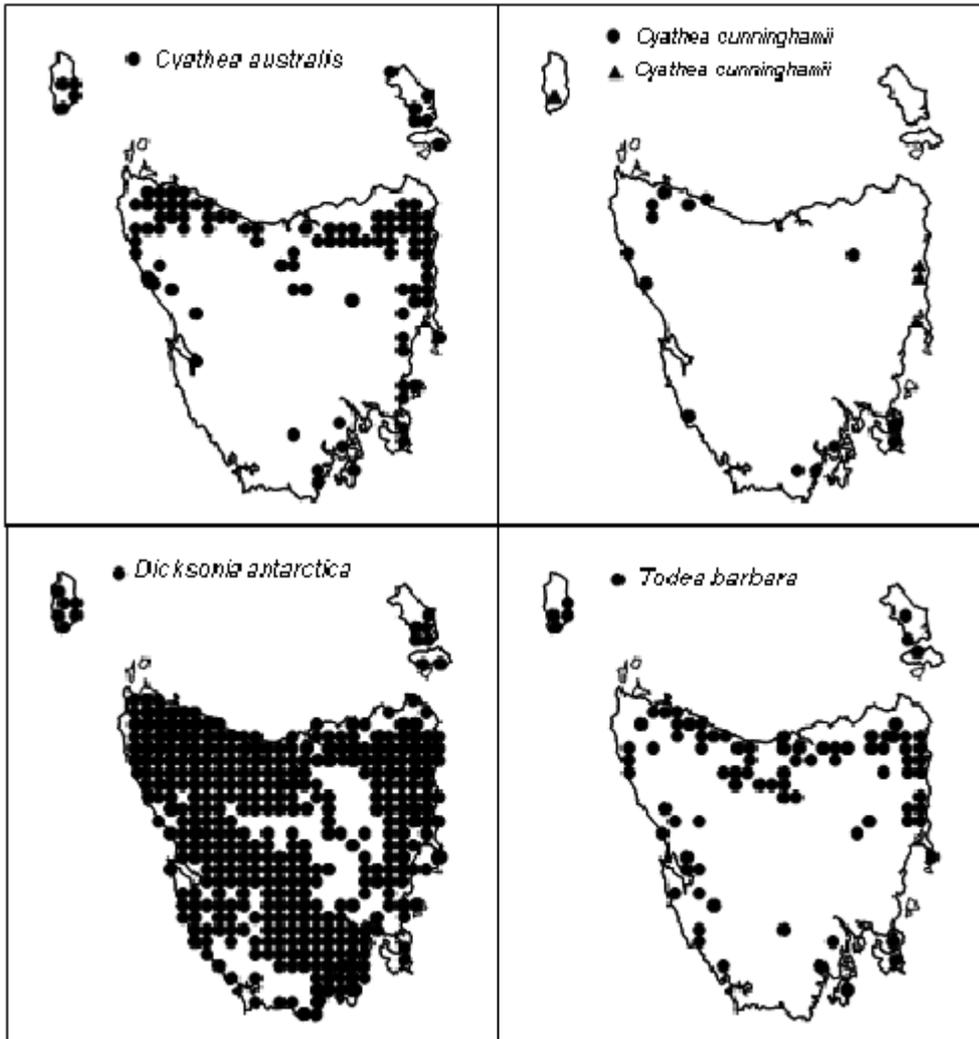


Figure 2: Distribution of treefern species in Tasmania (taken from Garrett 1996).

Cyathea australis occurs at low altitudes (0–500 m) throughout northern and eastern Tasmania. It is also found at a few scattered locations along the West Coast. The species is common but not abundant. It mainly occurs in wet eucalypt forest, extending to rainforest margins and dry sclerophyll forest. *Cyathea australis* prefers fertile, well-drained sites. It responds well to site disturbance and its clustered distribution is often a relic of past disturbance. The species is more tolerant of full sunlight than *Dicksonia*, although the two species often occur together. *Cyathea australis* is tolerant of fire. The species is unsuited to harvesting due to its relative inability to establish adventitious roots.

Cyathea cunninghamii mainly occurs at low altitudes (0–150 m) and is known from less than twenty sites around Tasmania, mainly in coastal and hinterland areas. The species is

uncommon. It occurs in mixed forest (*Eucalyptus obliqua*/*E. regnans* overstorey with a callidendrous rainforest understorey) and in gallery scrub. *Cyathea cunninghamii* is found only at sites that have apparently been protected from fire, alongside permanently flowing streams. *Cyathea cunninghamii* is listed as an endangered species on the Tasmanian *Threatened Species Protection Act 1995*.

Cyathea Xmarcescens is known from only three locations in Tasmania, with few plants at these sites. The species occurs alongside *C. australis* and *C. cunninghamii* and is recognised as a hybrid between them. *Cyathea Xmarcescens* appears to have similar ecological requirements to *C. cunninghamii*. *Cyathea Xmarcescens* is listed as a vulnerable species on the *Tasmanian Threatened Species Protection Act 1995*.

Todea barbara is largely restricted to the rivers and creeks of Tasmania's coastal and hinterland regions, reaching its best development in the north-east of the state. The species is common but not abundant. *Todea barbara* is found on infertile soils, apparently being unable to compete with the other species of treefern on more fertile sites. The species is typically found growing adjacent to watercourses that contain running water for at least part of the year.

Life cycle of *Dicksonia antarctica*

The treefern life cycle for *Dicksonia* and the other species of Tasmanian treeferns is well understood in terms of the sequence of four development stages. The sequence of developmental stages described below has been taken from Neyland (1986).

In the first stage of treefern development the spores germinate to produce a small structure called the prothallus. After a few weeks the prothallus produces male and female organs. In the presence of water the male organs (antheridia) release sperm cells that fertilise ova within the female organs (archegonia). Dehydration of the prothallus stops this process.

The second stage of development is known as the early sporophyte stage. The fertilised ova (zygotes) develop into miniature ferns that are parasitic on the prothallus until they develop their own chlorophyll and root system. The early sporophyte stage lasts for up to two years, during which time the fronds get progressively larger. During this stage the plants are highly susceptible to inadequate moisture and to either inadequate or excessive light.

The third stage of development is known as the rosette stage. During this stage, lasting for one or two years, the root system develops more fully and the base of the trunk forms.

The fourth stage of development involves the development of the trunk into the familiar treefern. This stage is thought to commence between four and six years after spore germination. The rate of height growth depends on site conditions. *Dicksonia* has been estimated to grow at between 3.5 and 5.0 centimetres in height per year on average.

Reproduction occurs for the first time at an average age of 23 years. Spore production in all five species is prolific, occurring mainly in late summer. Distribution of the five species is not limited by spore dispersal so much as by the effects of environment conditions on the first two stages of treefern development. One of these environmental conditions is the proximity of other treeferns, evidenced by the fact that young treeferns developing beneath the crowns of larger specimens are unlikely to grow to maturity.

Dicksonia is tolerant of fire and re-shoots readily following burning. When the top part of a plant is cut off, the lower part dies, but the top has a vigorous ability to produce adventitious roots and to resume growth, especially if the mature fronds are pruned.

Epiphytes and *Dicksonia antarctica*

The trunk of *Dicksonia* is particularly dense and fibrous compared to other treefern species and is excellent at holding moisture. *Dicksonia* 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. A recent study into ferns and bryophytes occurring on *Dicksonia* trunks recorded 101 different species across just ten study sites in southeastern Tasmania (Roberts, 2002). 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, many 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, wind or aspect, are likely to have a great impact on the suitability of *Dicksonia* 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 and extent of the dominant vegetation is also an important factor, as it influences microclimatic conditions (e.g. wind and light).

Ecology and distribution of *Dicksonia antarctica*

Dicksonia has a broad distribution range across southeastern Australia with natural populations occurring in Tasmania, Victoria, New South Wales and Queensland. It had a very restricted distribution in South Australia, possibly extinct in the wild (Duncan and Isaac 1986, Jones and Clemesha 1977).

In Tasmania, *Dicksonia* is the most common treefern and is a member of a wide range of plant communities. The altitudinal range for *Dicksonia* is from sea level to 1000 metres. It has been reported to prefer fertile soils, requiring regular moisture and a degree of shading (Neyland 1986). The species becomes uncommon when the canopy is dense and reaches its best development in wet gullies and forests where the canopy is partly broken (Neyland 1986).

The distribution and population size of *Dicksonia* is very much restricted by annual rainfall (see Table 1).

Table 1: Tasmanian distribution of *Dicksonia* based on rainfall (from Neyland 1986).

Average rainfall (mm/year)	Distribution of <i>Dicksonia antarctica</i>
-------------------------------	---

<600	Populations are rare, generally found in isolated stands of a few plants occurring only in the most sheltered sites.
600 – 750	Largely restricted to deeply incised south facing gullies.
750 – 1000	Restricted to moist gullies and sheltered southerly slopes.
>1000	Common where rainfall and other site factors (e.g. soil fertility) are favourable.

Forestry Tasmania estimated the Tasmanian population of trunked *Dicksonia* (i.e. specimens with established trunks) for their 1989 *Treefern management plan*. The estimate was based on limited sampling of *Dicksonia* in some favoured forest communities, then extrapolation to determined state totals using 1984 vegetation mapping (Kirkpatrick and Dickenson 1984). This estimate was re-assessed in 2001 using forest communities identified under the Tasmanian *Regional Forest Agreement 1997* (RFA). The 2001 assessment estimated that there were approximately 63 million trunked *Dicksonia* in Tasmania. This was considered to be an under-estimation of the number of trunked *Dicksonia* in the state.

For the purposes of the 2007 revision of the *Treefern management plan*, the number of trunked *Dicksonia* in Tasmania was re-estimated with the assistance of Forestry Tasmania's Conservation Planning section. This process was undertaken due to the availability of new research data on *Dicksonia* numbers and advances in GIS mapping capabilities. The process of re-estimating the number of trunked *Dicksonia* in Tasmania was undertaken in three stages:

- identification of RFA forest communities known to be favoured *Dicksonia* habitat and calculation of the extent of these communities using GIS and mapping tools
- review of past research and surveys of *Dicksonia* habitat to estimate density of trunked *Dicksonia* for these forest communities
- *Dicksonia* numbers were generated using the density estimates multiplied by the extent of that forest community mapped for the state.

The determination of suitable *Dicksonia* habitat was initially identified via personal communication with the FPA's Senior Botanist, Fred Duncan, and Forestry Tasmania's Principal Research Officer, Mark Neyland. Seven RFA forest communities (see Table 2) were identified as favoured *Dicksonia* habitat. Forestry Tasmania's Conservation Planning Branch determined the 2006 extent of favoured habitat as follows, using GIS and mapping tools:

- TASVEG mapping units encompassing the identified RFA forest communities were selected and used to calculate the extent of each favoured RFA forest community. A single RFA forest community may correspond to more than one TASVEG mapping unit. TASVEG mapping was used over RFA forest community mapping because it is more recent and is at a finer scale (1:25,000 instead of 1:250,000 for RFA mapping).
- Area analysis was run for each of the TASVEG communities by selected tenures.
- Regenerated forest that was less than 30 years old (i.e post 1977) was excluded from the analysis. This was done due to the results presented by Chuter (2003)

and anecdotal evidence that trunked *Dicksonia* is rarely found in regrowth forest less than 30 years old.

- Plantations established in recent years by conversion of favoured communities on PTPZL and private land were excluded based on the 2006 data.
- Rainforest on Precambrian substrates was excluded because *Dicksonia* is not typically found as an understorey species on this substrate.

There have been many studies that have directly or indirectly generated density estimates of trunked *Dicksonia* in various forest communities. Studies providing cover and abundance data for *Dicksonia* in quadrat or transect samples were used to generate density estimates based on conservative assumptions regarding the number of trunked ferns occurring within the sample area for a given cover/abundance value. The lower values of range data were used.

Published information or field data from the following studies were used to determine densities of trunked *Dicksonia*:

- blackwood-dominated communities – cover/abundance data from field information collected by Pannell (1992)
- rainforest communities – a synthesis of cover/abundance data collected by Neyland (1991 plus unpublished data) and frequency data from Kirkpatrick and Moscal (1987)
- eucalypt communities – figures were derived from the basal area data from Turner (2003), which was collected from 87 sites in wet eucalypt forest more than 30 years old in north-western, central and southern Tasmania.

A summary of the estimates of average number of trunked *Dicksonia* per hectare for equivalent RFA forest communities is given in Table 2. Other available data on *Dicksonia* density within wet eucalypt forest indicates densities can be much greater than the figures given in this table; with more than 1000 trunks per hectare being suggested by data from some sites (Barker 1988).

Table 2: Estimates of average trunked *Dicksonia* per hectare in favoured forest communities.

Equivalent RFA Forest Community	Trunked <i>Dicksonia</i> per Hectare (ha)
Tall Rainforest	180
<i>Acacia melanoxylon</i> on flats and <i>A. melanoxylon</i> on rises	170
<i>Eucalyptus regnans</i> forest	150
Wet <i>E. viminalis</i> on Basalt	150
Tall <i>E. obliqua</i> forest	105
<i>E. brookeriana</i> wet forest	105
Tall <i>E. delegatensis</i> forest	90

Using the parameters and methods described above, it was estimated that there is in excess of one million hectares of forest in Tasmania considered to be favoured

Dicksonia habitat. An estimate of approximately 130 million trunked *Dicksonia* in Tasmania was derived from the extent of known suitable habitat.

It can be seen from the latest tenure data analysis undertaken in 2017 shown in Table 3 that a small proportion (12%) of *Dicksonia* state-wide occurs on private land, 25% occurs on PTPZL with 13% on other public land. The total number of trunked *Dicksonia* in conservation and public reserves is approximately 66 million (50% of the estimated total).

Table 3: Estimated numbers of trunked *Dicksonia antarctica* occurring in Tasmania, broken down by land tenure, 2017.

Tenure	Wet forest	Other forest	Estimated total number of stems
Conservation and public reserves	24,949,299	40,673,152	65,622,451
Other publicly managed land	10,052,025	6,520,734	16,572,759
Permanent Timber Production Zone land	25,546,235	7,274,419	32,820,654
Private freehold land	12,932,081	3,250,159	16,182,240
Totals	73,479,640	57,718,464	131,198,104

Source: Forest Practices Authority, 2017

Appendix 2: FPA Treefern research

The introduction of the Tasmanian *Treefern management plan* and tagging system generated funding for the implementation, monitoring and enforcement of the plan by the FPA. These funds are also to be used for undertaking research into the sustainable management of treeferns.

The FPA will address questions regarding the effectiveness of the current management prescriptions on *Dicksonia*, the distribution and likely impacts of forestry on *Cyathea australis*, and assessing the likely impacts of partial harvest operations on *Dicksonia* in three projects. The following sections provide a summary of these projects.

Project 1: Influence of site and disturbance history on treefern dynamics in Tasmania and Victoria: implications for epiphyte and plant diversity.

Treeferns are a dominant understorey group in wet eucalypt forests of Victoria and Tasmania and form an integral part of the ecology providing habitat for many vascular and non-vascular plants and invertebrates. The Tasmanian population of *Dicksonia antarctica* exceeds 130 million with ~50% of the population within formal and informal reserves. The survival of *D. antarctica* is known to be affected by the logging and regeneration process associated with native forest silviculture (Chuter 2003). Only *D. antarctica* is currently approved for harvesting.

In areas subject to forestry operations, treeferns are retained through existing requirements and prescriptions, including streamside reserves, habitat clumps, wildlife habitat strips, aggregates and 'treefern islands' (areas with high densities of treeferns that may be subject to constraints in Forest Practices Plans). Streamside reserves are a known refuge for many plants, including bryophytes (van Galen et al. 2016) and treeferns (Fox and Turner 2004). Treeferns are long lived, take a long time to grow (Mueck et al. 1996) and thrive in moist environments such as streamside reserves. It is believed that reservation and retention of treeferns in these types of reserves provides a sufficient source of spores for regenerating the species in logged areas. It is also assumed that treeferns in retained patches support late-successional epiphytes, and would therefore contribute to the maintenance of biodiversity by providing a resource of propagules for recolonisation of the regenerating forests by these species.

Despite these assumptions, there are few data regarding the comparative ecology of *D. antarctica* and *C. australis* in streamside reserves and the adjacent production forestry area. Data on the identification of fern spores from within logged areas adjacent to streamside reserves is also limited due to the difficulties of identifying fern spores to genus/species level and the length of time required to grow fern spores to a size where identification of the fern sporophyte can be made with confidence (Chuter 2003).

There are few data on the temporal composition of epiphytes on the trunks of treeferns with time since disturbance. Turner (2003) recorded bryophyte composition and richness (but not abundance) on *D. antarctica* trunks from 10 – 100-year-old wet eucalypt forest regenerating after disturbance (wildfire and clearfell burn and sow silviculture); vascular plant epiphytes were recorded but not in association with substrate host. Roberts et al. (2005) recorded composition and richness of bryophytes and vascular plant epiphytes on *D. antarctica* trunks but sites were not stratified by time since disturbance or production forestry. Neither Turner (2003) nor Roberts et al. (2005) collected epiphytic data on *C. australis*. Data from Turner (2003) and Roberts et al. (2005) has been utilised to assist with site selection. This project will extend the work of Baker et al. (2013) where the

influence of unlogged forest on log and ground bryophyte establishment in harvested forest was found to occur up to 50 m into the harvested area.

This project will therefore aim to collect data to fill the gaps in knowledge outlined above and enable the effectiveness of the treefern management prescriptions and assumptions to be assessed.

Project 2: Population distribution, density and epiphytic diversity of *Cyathea australis* in the production forest landscape

Harvesting of *C. australis* is currently not permitted under the Treefern management plan due to the ecology of the species as well as lack of information on the impact of harvesting this species. The species is considered unsuited to harvesting due to its relative inability to establish adventitious roots.

There are also few data regarding the population distribution and density of the species in Tasmania, or the morphology and vascular and non-vascular plant host capability of *C. australis* in production forestry. Unlike *D. antarctica*, the caudex (trunk) of *C. australis* is rough. Non-vascular and vascular plant epiphytes have been observed and recorded on the trunk of *C. australis* (e.g. Blanks 1996, Turner and Blanks 1996 unpublished data) but few specific data exist. This study would investigate *C. australis* density and morphology, and collect data on *C. australis* as a host for vascular and non-vascular plant epiphytes (to species if possible).

Treefern harvesters have requested the *Treefern management plan* be amended to include harvesting of *C. australis*. Before any changes can be made to the management plan, more information on the potential impacts of logging on *C. australis* needs to be reviewed. The results of this project will therefore be useful in improving our knowledge of this species and assist with informing future treefern management decisions.

Project 3: The effect of partial harvest silvicultural systems on treeferns in Tasmania.

Under the current *Treefern management plan*, commercial harvesting of treeferns may only occur from native forest to be converted to another land use, or from native forest to be intensively logged and regenerated.

Salvage harvesting of *Dicksonia* is permitted from areas of native forest to be cleared for plantations, agriculture or infrastructure (e.g. dams, roads, powerlines, pipelines and other service facilities). This also includes areas cleared for roads, landings and primary snig tracks as part of logging operations.

This *Treefern management plan* permits treefern harvesting from areas which will be logged and regenerated back to native forest, under certain conditions. Wet eucalypt forest silviculture in Tasmania typically involves intensive harvesting operations that cause significant disturbance to overstorey and understorey species (including treeferns) in the timber harvesting area. Operations where *Dicksonia* is permitted to be harvested can comprise:

- clearfell, burn and sow (using cable-logging equipment on steep terrain, or conventional logging equipment elsewhere)
- aggregated retention, with patches of forest (normally 0.5–3 ha, which typically represents 10–20% of the operational area) retained within the intensively logged areas. No harvesting of treeferns would be permitted in areas that are retained in these coupes.

Treefern harvesters in Tasmania have requested the Treefern management plan be updated to permit treefern harvesting from partial harvest coupes. Due to the variety of partial harvest silvicultural systems (e.g. seedtree retention, shelterwood) and the ways these are carried out (with or without burning of high or low intensity, mechanical disturbance, surface scarification), further research into the impacts of these techniques on treefern survival is required before any changes to the current management plan is considered. The results of this project will improve our knowledge of the potential impacts of partial harvest systems on treeferns, and inform future treefern management decisions.

Document Control Log Table

Document Summary Information

Document name	Treefern management plan for the sustainable harvesting, transporting or trading of <i>Dicksonia antarctica</i> in Tasmania 2017
Version	2.0
RM record	D17/63107
Owner	FPA Biodiversity Program
Author(s)	FPA Biodiversity Program
Release date	2017
Release Approved by	CFPO
Release status	Approved

Version Control

Version	Date	Author(s)	Summary of changes
1.0	2007	FPA Biodiversity Program	Original document
1.1	Feb 2011	Nina Roberts	Updated FPA logo and added document control information.
1.2	May 2012	Tim Leaman and Chris Grove	Minor revisions to the 2007 version and style edit.
1.3	March 2016	Anne Chuter	Updated the reference to the PNFE policy in a footnote (p.15).
2.0	May 2017	Kirsty Kay	Minor revisions to the 2012 version, updated data on treefern numbers, and updated research project descriptions. Feedback received from stakeholder meeting (RM D17/75583) considered in this revision.

Stages required for release outside FPA

Category of advice	A1	
Stages	Required/not required ¹	Completed (date)
Specialist	Required	2017
Line Manager	Required	2017
Peer/FPO/stakeholder review	Required	2017
CFPO	Required	2017

¹Not required for minor updates in 2012