



Australian Government  
Director of National Parks

NORFOLK ISLAND



# Norfolk Island Region Threatened Species Recovery Plan



Prepared by: Director of National Parks

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

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Note: This recovery plan sets out the actions necessary to stop the decline of, and support the recovery of, listed threatened species. The Australian Government is committed to acting in accordance with the plan and to implementing the plan as it applies to Commonwealth areas. The plan has been developed with the involvement and cooperation of a broad range of stakeholders, but individual stakeholders have not necessarily committed to undertaking specific actions. The attainment of objectives and the provision of funds is subject to budgetary and other constraints affecting the parties involved. Proposed actions may be subject to modification over the life of the plan due to changes in knowledge.

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Separate information on the threatened species which are the subject of this recovery plan is available at: [environment.gov.au/biodiversity/threatened/recovery](http://environment.gov.au/biodiversity/threatened/recovery)



# Norfolk Island Region Threatened Species Recovery Plan





# CONTENTS

- 1. Introduction..... 1**
  - 1.1 Background ..... 1
  - 1.2 Scope of this Plan ..... 1
  - 1.3 Legislative and Administrative Context.....6
  - 1.4 Consultation.....6
  
- 2. Description of the Norfolk Island Group ..... 9**
  - 2.1 Regional Overview.....9
  - 2.2 Geology and Geomorphology.....9
  - 2.3 Climate..... 10
  - 2.4 History ..... 10
  - 2.5 Vegetation ..... 11
  - 2.6 Fauna ..... 11
  
- 3. Threats ..... 13**
  - 3.1 Key Threatening Processes ..... 13
  - 3.2 Current and Past Threats ..... 13
  - 3.3 Future Threats ..... 18
  
- 4. Current Management ..... 20**
  - 4.1 National Park and Botanic Garden ..... 20
  - 4.2 Public Reserves.....20
  - 4.3 Other Biodiversity Conservation.....21
  
- 5. Recovery Actions..... 22**
  - 5.1 Goal and Objectives ..... 22
  - 5.2 Priority Areas for Management ..... 22
  - 5.3 Priority Threatening Processes..... 23
  - 5.4 Habitat Critical for Survival ..... 23
  - 5.5 Recommended Management Actions..... 24
  - 5.6 Performance Criteria and Timeframes..... 34
  - 5.7 Management Practices..... 37
  - 5.8 Biodiversity Benefits..... 37
  
- 6. Social and Economic Consequences ..... 38**
  - 6.1 Responsibilities and Affected Interests ..... 38
  - 6.2 Implementation and Costs ..... 38
  - 6.3 Plan Review ..... 39
  
- 7. References ..... 40**



## Appendices

A	Species Distribution Information .....	43
B	Estimated Costs of Implementing Actions.....	46
C	Review of implementation of approved recovery plans for some Norfolk Island bird species .....	49
D	Norfolk Island Flora and Fauna – Background and Species Profiles .....	51

## Tables

1	Listed threatened species covered by the recovery plan .....	2
2	Key threatening processes listed under the EPBC Act relevant to Norfolk Island Group .....	13
3	Summary of recovery actions and threatened species addressed.....	31
4	Recovery plan performance criteria and timeframes.....	34
5	Summary of costing .....	39

## Maps

1	Norfolk Island Group showing location of major reserves .....	8
2	Distribution of threatened plant species.....	43
3	Distribution of threatened bird species .....	44
4	Distribution of threatened reptile species .....	45



## 1. Introduction

### 1.1 Background

The islands of the Norfolk Island Group provide an important link between tropical and temperate oceanic island environments. Remote location, coupled with colonisation by plants and animals dispersed over vast distances of ocean, means they are important as habitats and breeding areas for endemic species, other species with limited distribution and migratory species including large colonies of breeding seabirds.

The *Norfolk Island Region Threatened Species Recovery Plan* ('the plan') has been prepared by the Director of National Parks for the Department of the Environment, Water, Heritage and the Arts. The plan:

- provides background information on the Norfolk Island region
- identifies species listed as threatened
- describes the threatening processes to which those species are subject
- recommends a set of recovery measures required to reduce or remove those threats.

Appendix D of the plan contains additional background information and species profiles of flora and fauna of the Norfolk Island region.

### 1.2 Scope of this Plan

The plan covers the Norfolk Island Group including Norfolk Island, Phillip Island, Nepean Island and surrounding rock stacks (see Map 1). The plan covers all of the threatened species in the Norfolk Island Group that are listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) comprising 46 plant species, five species of land snails, five bird species and two reptile species (Table 1).

Except where they are also listed as threatened, recovery plans are not required for species listed as migratory or marine under the EPBC Act. However, Appendix D provides an overview of the region's seabirds, identifies those which are listed as migratory and/or marine and contains species profiles (p.76) for the most significant (including details of actions to guide their management).

**Table 1: Listed threatened species covered by the recovery plan**

Species	Common name	EPBC Act Status	Range
<b>Vascular Plants</b>			
<i>Abutilon julianae</i>	Norfolk Island abutilon	Critically Endangered	Endemic
<i>Achyranthes arborescens</i>	chaff tree, soft-wood	Critically Endangered	Endemic
<i>Achyranthes margaretarum</i>	Phillip Island chaff-tree	Critically Endangered	Endemic (Phillip Is only)
<i>Blechnum norfolkianum</i>	Norfolk Island water-fern	Endangered	Norfolk Is, Kermadec Is, Vanuatu, Samoa, Society Is
<i>Boehmeria australis</i> var. <i>australis</i>	tree nettle, nettletree	Critically Endangered	Endemic
<i>Calystegia affinis</i>	a creeper	Critically Endangered	Endemic (to Norfolk Is and Lord Howe Is)
<i>Clematis dubia</i>	clematis	Critically Endangered	Endemic
<i>Coprosma baueri</i>	coastal coprosma	Endangered	Endemic
<i>Coprosma pilosa</i>	mountain coprosma	Endangered	Endemic
<i>Cordyline oblecta</i>	ti	Vulnerable	Norfolk Is, New Zealand
<i>Crepidomanes endlicherianum</i>	middle filmy fern	Endangered	Norfolk Is, New Zealand, Fiji, Vanuatu, Samoa, Tahiti
<i>Dysoxylum bijugum</i>	sharkwood	Vulnerable	Norfolk Is, New Caledonia, southern Vanuatu
<i>Elatostema montanum</i>	mountain procris	Critically Endangered	Endemic
<i>Elymus multiflorus</i> subsp. <i>kingianus</i>	Phillip Island wheat grass	Critically Endangered	Endemic (to Norfolk Is and Lord Howe Is)
<i>Euphorbia norfolkiana</i>	Norfolk Island euphorbia	Critically Endangered	Endemic
<i>Euphorbia obliqua</i>	a herb	Vulnerable	Norfolk Is, New Caledonia, Vanuatu
<i>Hibiscus insularis</i>	Phillip Island hibiscus	Critically Endangered	Endemic (Phillip Is only)
<i>Hypolepis dicksonioides</i>	downy ground-fern, brake fern, ground fern	Vulnerable	Norfolk Is, Kermadec Is, New Zealand, Samoa, Society Is, Marquesas
<i>Ileostylus micranthus</i>	mistletoe	Vulnerable	Norfolk Is, New Zealand
<i>Lastreopsis calantha</i>	shield-fern	Endangered	Endemic



Species	Common name	EPBC Act Status	Range
<b>Vascular Plants - continued</b>			
<i>Marattia salicina</i>	king fern, para, potato fern	Endangered	Norfolk Is, New Zealand
<i>Melicope littoralis</i>	shade tree	Vulnerable	Endemic
<i>Melicytus latifolius</i>	Norfolk Island mahoe	Critically Endangered	Endemic
<i>Melicytus ramiflorus</i> <i>subsp. oblongifolius</i>	whiteywood	Vulnerable	Endemic
<i>Meryta angustifolia</i>	a tree	Vulnerable	Endemic
<i>Meryta latifolia</i>	broad-leaved Meryta	Critically Endangered	Endemic
<i>Muehlenbeckia australis</i>	shrubby creeper, pohuehue	Endangered	Norfolk Is, New Zealand
<i>Myoporum obscurum</i>	popwood	Critically Endangered	Endemic
<i>Myrsine ralstoniae</i>	Beech	Vulnerable	Endemic
<i>Pennantia endlicheri</i>	pennantia	Endangered	Almost endemic (single tree on Three Kings Islands (northern tip of New Zealand) appears to be this species)
<i>Phreatia limenophylax</i>	Norfolk Island phreatia	Critically Endangered	Endemic
<i>Phreatia paleata</i>	an orchid	Endangered	Norfolk Is, New Caledonia, New Guinea, Solomon Is, Vanuatu
<i>Pittosporum bracteolatum</i>	oleander	Vulnerable	Endemic
<i>Pouteria costata</i>	bastard ironwood	Endangered	Norfolk Is, New Zealand
<i>Pteris kingiana</i>	King's brakefern	Endangered	Endemic
<i>Pteris zahlbruckneriana</i>	netted brakefern	Endangered	Endemic
<i>Senecio australis</i>	a daisy	Vulnerable	Endemic
<i>Senecio evansianus</i>	a daisy	Endangered	Endemic
<i>Senecio hooglandii</i>	a daisy	Vulnerable	Endemic
<i>Streblus pendulinus</i>	Siah's backbone	Endangered	Norfolk Is, New Guinea, Micronesia, Vanuatu, New Caledonia, Fiji, Hawaii



Species	Common name	EPBC Act Status	Range
<b>Vascular Plants - continued</b>			
<i>Taeniophyllum norfolkianum</i>	minute orchid, ribbon-root orchid	Vulnerable	Endemic
<i>Thelychiton brachypus</i>	Norfolk Island orchid	Endangered	Endemic
<i>Tmesipteris norfolkensis</i>	hanging fork-fern	Vulnerable	Endemic
<i>Ungeria floribunda</i>	bastard oak	Vulnerable	Endemic
<i>Wikstroemia australis</i>	kurrajong	Critically Endangered	Endemic
<i>Zehneria baueriana</i>	native cucumber, giant cucumber	Endangered	Norfolk Is, New Caledonia
<b>Birds</b>			
<i>Cyanoramphus cookii</i>	Norfolk Island green parrot	Endangered	Endemic
<i>Ninox novaeseelandiae undulata</i>	Norfolk Island boobook owl, morepork	Endangered	Endemic (hybrid population)
<i>Pachycephala pectoralis xanthoprocta</i>	Norfolk Island golden whistler, tamey	Vulnerable	Endemic
<i>Petroica multicolor multicolor</i>	Norfolk Island scarlet robin	Vulnerable	Endemic
<i>Pterodroma neglecta neglecta</i>	Kermadec petrel (western)	Vulnerable	South Pacific (breeds Phillip Is and Ball's Pyramid, Lord Howe Is)
<b>Reptiles</b>			
<i>Christinus guentheri</i>	Lord Howe Island gecko	Vulnerable	Endemic (to Norfolk Is and Lord Howe Is)
<i>Oligosoma lichenigera</i>	Lord Howe Island skink	Vulnerable	Endemic (to Norfolk Is and Lord Howe Is)
<i>Advena campbellii campbellii</i>	Campbell's helicarionid land snail	Critically Endangered	Endemic
<i>Mathewsoconcha grayi</i>	Gray's helicarionid land snail	Critically Endangered	Endemic
<i>Mathewsoconcha phillipii</i>	Phillip Island helicarionid land snail	Critically Endangered	Endemic
<i>Mathewsoconcha suteri</i>	a helicarionid land snail	Critically Endangered	Endemic
<i>Quintalia stoddartii</i>	Stoddart's helicarionid land snail	Critically Endangered	Endemic



As the plan covers species listed under the EPBC Act, it does not directly address some locally significant species such as the white-necked petrel (*Pterodroma cervicalis*) and the providence petrel (*Pterodroma solandri*) that are not currently listed under the EPBC Act. Under the Act, groups or individuals may nominate a species for listing as threatened, or nominate a change to the EPBC Act status of an entity which is already listed (e.g. 'downlisting' a listed species from Endangered to Vulnerable or 'uplisting' from Endangered to Critically Endangered). Recovery actions identified in the plan, such as improving and strengthening ecosystem processes through the protection and enhancement of natural habitats, are likely to benefit other non-listed species irrespective of legislative conservation status.

The plan covers only part of the Australian range of the creeper (*Calystegia affinis*), Phillip Island wheat grass (*Elymus multiflorus* var. *kingianus*), Lord Howe Island gecko (*Christinus guentheri*), Lord Howe Island skink (*Oligosoma lichenigera*) and the Kermedec petrel (*Pterodroma neglecta neglecta*). The Australian distribution of these species includes Lord Howe Island and recovery actions for that part of their range are covered under the *Lord Howe Island Biodiversity Management Plan* (DECC NSW 2007) which was adopted under the EPBC Act in 2008. All other taxa occur nowhere else in Australia.

The Norfolk Island boobook owl (*Ninox novaeseelandiae undulata*) population declined to a single individual in the 1980s, at which time two individuals of the New Zealand subspecies were introduced to the island. As the resultant island population is a hybrid one, the subspecies was exempted from requiring a recovery plan under the EPBC Act. Recovery actions are included in the plan for practical purposes.

Two recovery plans are in place under the EPBC Act covering three of the listed taxa: the Norfolk Island green parrot (*Cyanoramphus novaeseelandiae cookii*<sup>1</sup>) Recovery Plan (Hill 2002); and the Norfolk Island scarlet robin (*Petroica multicolor multicolor*) and the Norfolk Island golden whistler (*Pachycephala pectoralis xanthoprocta*) Recovery Plan (Commonwealth of Australia 2005). The implementation of these plans within the Norfolk Island National Plan has been reviewed (Director of National Parks 2009a, 2009b) and summaries of the reviews are provided at Appendix C. Key recommendations of these reviews have been included in this regional recovery plan which replaces the two recovery plans identified above.

A draft recovery plan has been developed for the two native reptiles (Cogger 2004) but has not been made under the Act. A separate recovery plan for the five land snails was identified as being unnecessary in the conservation advice on which their listing was based, in view of their occurrence in areas managed for conservation and the development of this regional recovery plan. Appropriate recovery actions for both the threatened reptiles and snails are included in the plan.

The EPBC Act also provides for the listing of ecological communities as threatened, although none are currently listed for the Norfolk Island Group. Under the Act, groups or individuals may nominate an ecological community or species for listing as threatened.

<sup>1</sup> A phylogenetic study by Boon et al. (2001) reported a high degree of genetic divergence between it and other *Cyanoramphus*, thus warranting its current treatment as the distinct species *Cyanoramphus cookii*.



### 1.3 Legislative and Administrative Context

Norfolk Island is an external territory of Australia. Under the *Norfolk Island Act 1979* (Cth) the Norfolk Island Legislative Assembly is able to enact laws on a broad range of subjects (including environmental matters) and the Norfolk Island Government is equipped with broad executive powers and responsibilities to administer and enforce those laws. The Norfolk Island Government is also primarily responsible for the delivery of government services on the Island. The Norfolk Island Parks and Forestry Service is the Norfolk Island Government body responsible for environmental and land management matters including management of reserves. The Norfolk Island Government also undertakes customs and quarantine services for the Territory.

The Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) provides for the establishment of Commonwealth reserves in areas of Commonwealth responsibility. The Norfolk Island National Park and the Norfolk Island Botanic Garden are established under both the EPBC Act and specific Norfolk Island legislation. The current management plan for the park and garden prepared under the EPBC Act came into effect in 2008 for a period of 10 years and, *inter alia*, provides for any necessary threatened species recovery actions to be undertaken, including reintroductions of species to and from the park and botanic garden (Director of National Parks 2008a).

The EPBC Act provides, *inter alia*, for the listing of threatened species, the making of recovery plans for listed species and protection for listed species in areas of Commonwealth responsibility. In the Norfolk Island National Park and Botanic Garden, the Director of National Parks will implement the recovery plan in accordance with the management plan for the park and garden.

For areas outside the national park and botanic garden, the Commonwealth is required to seek the cooperation of the Norfolk Island Government with a view to jointly implement a recovery plan. There is no legal requirement under the EPBC Act for the Norfolk Island Government to implement a recovery plan in the Territory. A recovery plan similarly does not place obligations on any individual landholder on Norfolk Island. Landholders may be supported to undertake activities to manage and protect threatened species through government-funded natural resource management programs.

Having a recovery plan will not change the need for actions that have, will have or are likely to have a significant impact on a threatened species to be referred to the Minister for Environment Protection, Heritage and the Arts for approval.

### 1.4 Consultation

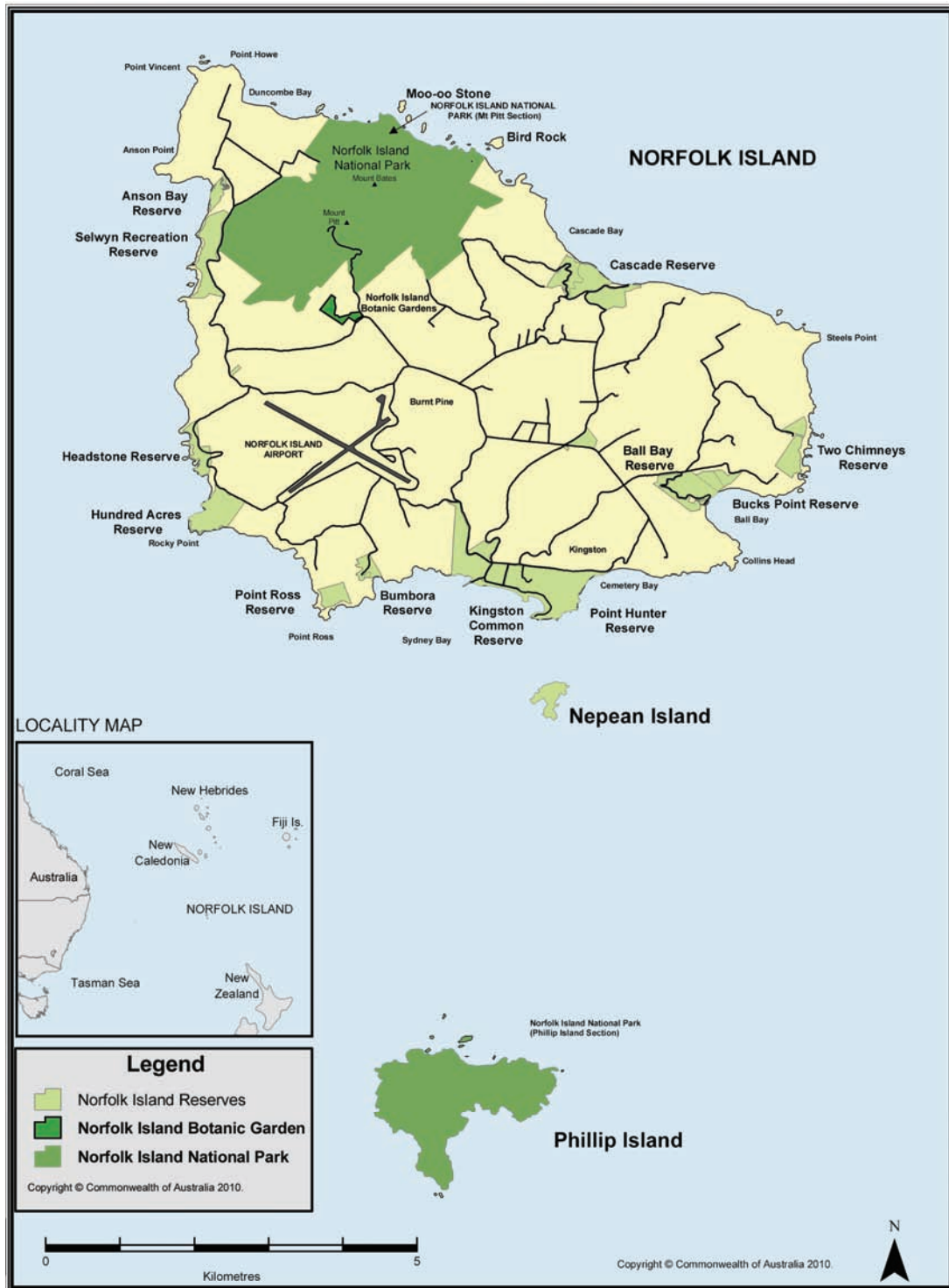
The Norfolk Island community has a strong connection to the history and management of the islands of the Norfolk Island Group and will play an important role in the delivery of this plan. Input from stakeholders and interested community members was obtained in the development of this plan. A Steering Committee consisting of representatives of the Norfolk Island Administration and Australian Government was established to provide comment on an initial issues paper. The paper was used as the basis for a series of meetings held on island in 2005 with representatives of the Norfolk Island Government and members of the Norfolk Island Administration.



Meetings were held with representatives of various community organisations including the Norfolk Island National Park Advisory Committee, the Norfolk Island Flora and Fauna Society, the Norfolk Island Conservation Society, the tourism industry and the environmental non-government organisation EcoNorfolk. Specialist input was subsequently provided by individuals familiar with Norfolk Island's threatened flora and fauna.

Consultation on the initial draft plan was undertaken on island in May 2009 with the Norfolk Island Administration and the Norfolk Island National Park Advisory Committee. The statutory three month public comment period ended on 23 April 2010. Five submissions were received and relevant comments were incorporated into the final plan.

**Map 1 Norfolk Island Group showing location of major reserves**





## 2. Description of the Norfolk Island Group

### 2.1 Regional Overview

The Norfolk Island Group is founded on a seamount of volcanic origin in the South Pacific Ocean (29° 02'S, 167° 57'E). The Group consists of the main island of Norfolk Island, the small uninhabited Nepean and Phillip Islands and numerous rocky islets dotted about the Norfolk Island coastline. The island is predominantly bounded by precipitous cliffs of basalt and tuff and is approximately 32 kilometres in length. The plateau averages around 100 metres above sea level with two peaks in the north over 300 metres. Norfolk Island is approximately 1,700 kilometres from Sydney, 1,100 kilometres from Auckland and 1,420 kilometres from Fiji. The nearest islands to Norfolk Island are New Caledonia (875 kilometres) and Lord Howe Island (900 kilometres).

The islands of the Norfolk Group are truly oceanic. Few oceanic islands occur between latitude 25°S and 35°S and therefore the Group is an important link between tropical and temperate environments.

Norfolk Island has a land area of 3,455 hectares of which approximately 75 per cent is held privately as freehold or leasehold. The remainder is Crown land designated for a range of public uses including conservation. Phillip and Nepean Islands have land areas of 190 hectares and 10 hectares respectively and are reserved for conservation.

### 2.2 Geology and Geomorphology

Norfolk and Phillip Islands are small remnants of a large volcano that developed on the Norfolk Ridge. The volcanic land-mass of which they are a part was created during several eruptions between 3.1 and 2.3 million years ago. (This compares to Lord Howe Island which is a remnant of a much earlier volcanic eruption and so is an older formation). Nepean Island, located between Norfolk and Phillip Islands, is not volcanic in origin and is composed of calcarenite (a form of limestone).

One of the two main volcanic vents was in the vicinity of Mount Bates (318 metres) and Mount Pitt (316 metres), which now stands as the two highest peaks on the main island. The other significant geological feature is the southern plateau, which occupies most of the main island and is dissected by deep narrow valleys.

Surface water is restricted on Norfolk Island with no lakes and few wetlands. The three permanently flowing streams are relatively small compared to the valleys they occupy suggesting that they were largely eroded during a wetter period. Significant groundwater systems are known to occur. Soils are nutrient rich, well structured, friable and relatively porous. The soils are prone to mass movement such as soil creep, slumps and landslips where vegetation cover has been degraded and lost after heavy rain events.

The tuff and ash beds on Phillip Island are very friable which, together with the sparse vegetation, has resulted in severe erosion of at least two metres of topsoil in some places. Jacky Jacky (280 metres) is the high point on Phillip Island with steep cliffs fringing the perimeter. There are no permanent streams and little topsoil is left on the island. Many of the valleys on Phillip Island have formed within living memory (Norfolk Island Conservation Society 1988).



## 2.3 Climate

The climate of Norfolk Island is moderated by oceanic air currents and mild sea temperatures. The average daily minimum temperature ranges from 11.0°C to 23.4°C and the average daily maximum temperature ranges from 15.8°C to 26.5°C. Annual average rainfall is 1,320 millimetres which peaks in the winter months. Prevailing sea currents are east to north-easterly (except in the highly variable north-west monsoon). Prevailing winds are east to south-easterly for most of the year, swinging to the west or south-west in mid-winter.

## 2.4 History

Norfolk Island was discovered by Captain James Cook in 1774 and settled by Europeans in 1788. At the time of European settlement the island was uninhabited although the presence of a banana grove, Polynesian rats (*Rattus exulans*) and stone axes indicate that Polynesians visited the island for short periods (Norfolk Island Conservation Society 1988, Gilmour & Helman 1989a, 1989b) and excavations have revealed evidence of a small Polynesian village (Anderson 1996).

The aim of the initial European settlement of the island was to clear land for the cultivation of native flax, as well as grains and vegetables to support the new colony at Port Jackson. The island had two periods of operation as a penal colony, the first from 1788 until 1814 after which it remained uninhabited for 10 years and the second from 1825 until 1855.

At the time of settlement the island was covered with dense forest, which now largely remains only on the highest land (Green 1994). Since settlement, land use has had a very significant impact on vegetation. Accounts by early settlers describe the vegetation as a very dense formation with complete canopy excluding light, very little growth on the forest floor and towering emergent pines being in great abundance (Hoare 1969). The early penal colonies and free settlers progressively cleared much of the natural vegetation for agriculture and timber export during the first 75 years of settlement.

During its time as a penal colony most of the island apart from the two mountains and the land to the north were cleared for crops or pasture (Benson 1980). Following the removal of convicts in 1855 the island supported a smaller agricultural community. Only about 100 hectares were under cultivation and much of the island was neglected and invaded by weeds (Gilmour & Helman 1989a, 1989b). In 1856 the inhabitants of Pitcairn Island were relocated to Norfolk Island. These settlers cultivated the land that had been cleared by the convicts and agriculture became the economic base of the island. Trade with the mainland in a number of crops developed with one crop passing to another as markets changed. Whaling was also an important commercial activity periodically for over a century from about 1850.

By the mid 1920s previously cleared land again supported pine trees but dense stands only occurred in areas where it was too steep to support grazing (Benson 1980). Introduced weeds invaded the remnant rainforest to the north of the mountains and very little of the original vegetation was left in its virgin state (Benson 1980). Following wartime construction of the airfield the economy of the island changed and tourism is now the predominant industry on Norfolk Island.



## 2.5 Vegetation

In 1788 the vegetation on the island comprised dense subtropical rainforest with Norfolk Island pine (*Araucaria heterophylla*) particularly abundant on the lower levels and slopes. The largest remnant of native forest today occurs in the national park, on the peaks of Mt Pitt and Mt Bates. A number of remnants occur sporadically in lower areas, where other native flora persists and where areas have been fenced from wandering cattle (details in Appendix D).

There are 182 native plant species (of which about 25 per cent are endemic) and a further 370 naturalised species on the Norfolk Island Group (Mills 2009a). There are two monotypic endemic genera: *Ungeria* represented by *U. floribunda*, which is listed as vulnerable and *Streblorrhiza*, represented by *S. speciosa*, endemic to Phillip Island but now extinct (Green 1994).

The distribution of vegetation species and communities is influenced by altitude, aspect, terrain, topography and proximity to the sea. Existing vegetation distribution has been used to identify ten vegetation communities that comprised the island's original vegetation (Gilmour and Helman 1989a, 1989b; Mills 2007) (details in Appendix D). Two vegetation communities (palm forest and hardwood subtropical rainforest) occur largely in the Mt Pitt section of the national park.

At the time of European settlement, Phillip Island was probably covered by a variety of vegetation types including rank grasses, dense thickets of shrubs and a dense cover of small trees with emergent pines (Cogger 2004). Phillip Island was severely eroded as a result of grazing by goats (*Capra aegagrus hircus*), pigs (*Sus domestica*) and rabbits (*Oryctolagus cuniculus*) that were introduced by the early British colonists. These introduced mammals almost completely removed the indigenous vegetation. Pigs and goats were eradicated in the early 1900's and rabbits were eradicated in 1986 (Mills 2009b). Since that time there has been significant regeneration of vegetation particularly in the gullies where soil pockets and collected precipitation provide good conditions for plant growth (Cogger 2004). Vegetation on Phillip Island is now mixture of 42 indigenous species and 60 exotic weed species. Some indigenous plant communities are developing well although the forest community of the valleys is likely to take the longest to reach stability (Mills 2009b).

## 2.6 Fauna

The fauna of Norfolk Island is notable for its endemic land birds and large numbers of seabirds. 102 species of birds have been recorded on Norfolk Island and adjacent islands in modern times. Of these, 32 species are resident breeding land or freshwater birds, 14 are regular breeding seabirds and six have become extinct since European settlement. The remainder are non-breeding migrants or vagrants (Schodde *et al.* 1983).

Many of the breeding land and freshwater birds were deliberately introduced or arrived on the island independently following European settlement, utilising newly cleared habitats (further details in Appendix D). Breeding seabirds are now largely restricted to Phillip Island and the other adjacent islands. Seabirds formerly nested on the peaks of Mt Bates and Mt Pitt in large numbers before being extirpated via hunting for food shortly after settlement.





There are two native land reptiles, the Lord Howe Island skink (*Oligosoma lichenigera*) and the Lord Howe Island gecko (*Christinus guentheri*) that are endemic to the Norfolk and Lord Howe Island groups. Neither is now found on the main island but both species occur on Phillip Island. The gecko also occurs on Nepean Island and the small rocky islets Moo'oo Stone and Bird Rock (Cogger 2004). The Asian house gecko (*Hemidactylus frenatus*) is a recent introduction to the main island (Director of National Parks 2008a).

The only native land mammals that have been recorded on Norfolk Island are the Eastern free-tail bat (*Mormopterus norfolkensis*) and Gould's wattled bat (*Chalinolobus gouldii*). Only the latter has been seen in recent years. As in many other island ecosystems, introduced mammals have been responsible for significant environmental degradation. The Polynesian rat (*Rattus exulans*) was introduced by early Polynesian visitors prior to Cook's discovery of the island. The black rat (*Rattus rattus*) was possibly introduced from a ship wreck in 1942. There is a strong likelihood that the house mouse (*Mus musculus*) and the feral cat (*Felis catus*) were introduced during early settlement on the island (Wilson 2002).

There is a rich invertebrate fauna including assemblages of endemic land snails, cockroaches and beetles and an endemic cricket and centipede. There are a number of introduced invertebrates such as the Argentine ant (*Linepithema humile*).

### 3. Threats

The threats identified below apply to the Norfolk Island Group as a whole and all populations of taxa covered by the plan.

#### 3.1 Key Threatening Processes

Seven key threatening processes listed under the EPBC Act are considered to be relevant to the Norfolk Island Group (Table 2). Table 2 indicates which of these processes has a threat abatement plan in place or not. Threat abatement plans are statutory documents aimed at lessening the impact of a key threatening process. These threats are discussed in further detail in Sections 3.2 and 3.3.

**Table 2: Key threatening processes listed under the EPBC Act relevant to Norfolk Island Group** <sup>(a)</sup>

Key Threatening Process	Threat Abatement Plan
Land clearance	No
Loss of terrestrial climatic habitat caused by anthropogenic emissions of greenhouse gases	No
Predation by exotic rats on Australian offshore islands of less than 1000 km <sup>2</sup> (100,000 ha)	Draft
Predation by feral cats	Approved
Psittacine Circoviral (beak and feather) disease affecting endangered psittacine species	Approved
Incidental catch (or bycatch) of seabirds during oceanic longline fishing operations	Approved
Injury and fatality to vertebrate marine life caused by ingestion of, or entanglement in, harmful marine debris	Draft


(a) as at May 2010

#### 3.2 Current and Past Threats

##### 3.2.1 Habitat Loss, Degradation and Fragmentation

Weed invasion, vegetation clearing and grazing by domestic animals all contribute to the loss, degradation and fragmentation of native vegetation types and the habitats they provide. Land clearance has been listed as a key threatening process under the EPBC Act.

Weed infestation and loss of mature habitat trees by natural attrition has degraded habitat for some listed bird species. Competition from weed species also threatens many listed native plants. Species with restricted distributions or specific habitat requirements, such as ferns and other species that occur on stream banks, are particularly at risk.



The loss of the large colonies of nesting seabirds on Mt Pitt and Mt Bates has resulted in a change in the nutrients available to remaining native vegetation in these areas that in turn has probably impacted negatively on the survival of particular plant species.

Outside the national park and some of the public reserves, loss of native forest through clearing, grazing and natural causes has been followed by little or no regeneration of native plant species. Grazing by cattle (*Bos taurus*) also represents a significant threat to remnant vegetation.

### 3.2.2 Introduced Vertebrate Pests

Rats and cats are significant threats to the island's native vertebrate fauna via direct predation of young and adult individuals (Director of National Parks 2008a). Baiting conducted in the national park has reduced numbers of the black rat (*Rattus rattus*) which, along with nest modification to exclude rats and cat control, has allowed green parrot (*Cyanoramphus cookii*) and boobook owl (*Ninox novaeseelandiae undulata*) numbers to increase (Olsen 1997, Hill 2002).

Predation by the black rat is identified as a specific threat to the golden whistler (*Pachycephala pectoralis xanthoprocta*), the scarlet robin (*Petroica multicolor multicolor*), the green parrot, most nesting seabirds including the Kermadec petrel (*Pterodroma neglecta neglecta*), endemic reptiles, land snails and other invertebrate species (Olsen 1997, Hill 2002, Cogger 2004, Commonwealth of Australia 2005). It is a threat to the plant species *Achyranthes arborescens*, *Melicope littoralis*, *Meryta latifolia* and *Ungeria floribunda* via consumption of seeds and fruits which has had the result of restricting regeneration.

The Polynesian rat (*Rattus exulans*) has a negative impact on the breeding productivity of petrels and shearwaters on islands in New Zealand (Pierce 2002) and probably caused the decline of both reptile species on Norfolk Island (Smith *et al.* 2001). The house mouse (*Mus musculus*) is also present on Norfolk Island and eats a range of fruits, seeds and invertebrates. While the impact on biodiversity is unknown, it is likely to adversely affect native and endemic flora and invertebrates.

Predation by the feral cat (*Felis catus*) is identified as a threat to the boobook owl, green parrot, golden whistler, scarlet robin, most nesting seabirds and the two reptiles (Olsen 1997, Hill 2002, Cogger 2004, Commonwealth of Australia 2005).

The activity of feral fowl (*Gallus gallus*) represents a threat to the land snails and endangered flora as they feed on native invertebrates. Their scratching disturbs the natural nutrient cycle and the removal of seedlings affects the regeneration of native plant species (Christian 2005).

Competition from introduced birds such as the common blackbird (*Turdus merula*), song thrush (*Turdus philomelos*) and European starling (*Sturnus vulgaris*) has been suggested as a potential threat to whistlers or robins but there is little evidence to support the claim (Robinson 1988). Competition from the crimson rosella (*Platycercus elegans*) and the European starling for nest hollows is a threat to the green parrot (Hill 2002). The species fill hollows with nesting material such that the sites cannot be used by boobook owls and green parrots (Hermes *et al.* 1986). If rat eradication is undertaken on Norfolk Island, it is expected that population numbers of Californian quail (*Callipepla californica*) will increase. Their impact on biodiversity is uncertain.



The Asian house gecko (*Hemidactylus frenatus*) which has recently been identified on Norfolk Island poses a potential threat to the indigenous gecko if it is to become established on Phillip Island or the other outlying islands. This widely distributed tramp species is commensal with humans and has been implicated in the decline of some native gecko species elsewhere in its range (Director of National Parks 2008a).

### 3.2.3 Introduced Invertebrate Pests

The Argentine ant (*Linepithema humile*) is a relatively recent introduction to Norfolk Island that is highly likely to adversely impact threatened species if not eradicated as soon as possible. The distribution of the Argentine ant is currently expanding at a number of sites across Norfolk Island. If colonies are left unabated they are likely to affect areas managed for conservation.

Other introduced invertebrates may have an impact on certain listed species. European honey bees (*Apis mellifera*) have occupied wild nest sites of the green parrot and were reported to cause injuries and fatalities to captive individuals (Hill 2002). The Asian paper wasp (*Polistes chinensis antennalis*) also occurs on Norfolk Island although the impact on threatened species is unknown.

### 3.2.4 Exotic Weeds


Competition from exotic weeds is a threat to all plant species covered by the plan and most vegetation communities are affected to some degree. Weed species often transform native habitat to the detriment of other native and endemic species. For example, weed invasion can result in a change in the forest structure, reducing the number of nesting hollows available for boobook owls or green parrots. Details of principal weed species are given below.

#### Red guava (*Psidium cattleianum*)

The red guava is native to Brazil and has been naturalized in many places on the island following introduction for its edible fruit. The weed rapidly forms dense thickets with extensive mats of feeder roots that make it difficult for other species to co-exist. Red guava is relatively shade tolerant and has very cryptic seedlings and adolescent plants. An abundant seed is produced that is dispersed by birds and cattle (Director of National Parks 2008b). When the fruits decompose they can alter downstream chemical balances in the soil. Red guava has had a devastating effect on native habitats in Mauritius and is considered the worst plant pest in Hawaii, where it has invaded a variety of natural areas (Lowe *et al.* 2000). Red guava has yet to invade Phillip Island (Mills 2009b).

#### African olive (*Olea europaea* subsp. *cuspidata*)

African olive, native to the Mediterranean region, is a widespread pest in Hawaii and New Zealand (Starr *et al.* 2003). It became established on Norfolk Island soon after settlement and as native vegetation was cleared, became a major weed and developed into monoculture closed forests. It is now widespread and occurs as isolated specimens, scattered clumps, or impenetrable thickets and is one of the worst woody weeds on Norfolk Island (Director of National Parks 2008b). Olives may exert an allelopathic effect - where mature trees inhibit native plant germination and growth - and their removal appears to result in a remarkable improvement of the health and vigour of emergent native species (Director of National Parks 2008b).



Areas that are infested with red guava and African olive tend to have lower surface soil moisture and where dense stands of the former occur along creek gullies there is little sign of regeneration of native ferns (Davidson *et al.* 1994). The impact is amplified in times of low rainfall when competition for moisture is more intense. The thick stands of weed species can result in the deaths of mature Norfolk Island pines as a result of competition for moisture (Parks Australia, unpublished data).

African olive was established on Phillip Island following the removal of rabbits and is the main weed species found at the locality. The weed forms dense clumps and threatens species such as the Phillip Island hibiscus (*Hibiscus insularis*). However, the presence of olives helps mitigate soil erosion and on the main island of Norfolk Island it provides a year round source of food for some species such as the green parrot.

#### Hawaiian holly (*Schinus terebinthifolius*)

Hawaiian holly is a native of Brazil and a pioneer of disturbed sites. Hawaiian holly is also successful in undisturbed natural environments and can displace native species. It is also a problem weed in Hawaii, Florida, New Caledonia, Fiji, Tahiti, and Mauritius (PIER 2002).

Hawaiian holly (its common name elsewhere is Brazilian pepper) was introduced to Norfolk Island in the 1920s when a resident planted some red berries that had come from Hawaii. It is a low growing evergreen deciduous tree that shades out other plants and prevents the re-establishment of other species due to the release of allelopathic substances. The fruits have been implicated in bird intoxication and death and its prolific flowers can cause allergic reactions (Director of National Parks 2008b).

#### Lantana (*Lantana camara*)

Lantana is a weed of national significance and has had serious impacts on mainland Australia. It is an aggressive woody weed of open areas that suppresses regeneration of native species with its thorn covered branches and vigorous scrambling habit (Director of National Parks 2008b). Lantana was introduced to Norfolk Island in 1905 as an ornamental, and birds now disperse the seeds widely. While it is also found on Phillip Island in low numbers, it may be completely eliminated with targeted weed control (Mills 2009b).

#### William Taylor (*Ageratina riparia*)

Also known as mist flower, the weed species was introduced to Norfolk Island as a garden plant and is a weed of open areas. It grows to one metre high with white flower heads and spreads widely, shading out small native plants. It is found in areas open to the wind and full sunlight. The weed dominates the understorey in some parts of the national park (Director of National Parks 2008b) and is found on Phillip Island (Mills 2009b).

#### Kikuyu grass (*Pennisetum clandestinum*)

Kikuyu is an exotic grass introduced to Norfolk Island for pasture and was used to stabilise open areas, roadsides and rehabilitation areas in the national park (Director of National Parks 2008b). Kikuyu severely restricts regeneration of native plant species in the national park and public reserves as it forms a thick sward that is almost impossible for seedlings to penetrate.



Competition from kikuyu and other imported grasses such as buffalo grass (*Stenotaphrum secundatum*) and couch grass (*Cynodon dactylon*) may prevent the re-establishment of pines and other species (Benson 1980). A species particularly at risk is the creeper *Calystegia affinis*. The thick sward and deep runners of kikuyu have the potential to degrade the habitat for ground nesting seabirds such as wedge-tailed shearwaters (*Puffinus pacificus*) and other burrowing petrels. The grass chokes burrows and has been reported to strangle birds on Lord Howe Island (DECC NSW 2007). Kikuyu is currently not a major weed on Phillip Island (K. Mills 2010 pers. comm.).

#### Madeira vine (*Anredera cordifolia*)

Madeira vine is becoming a significant threat on Norfolk Island in both public reserves and on private land. It is a fleshy climber with stems that can extend for 20 metres or more that invades the margins of rainforests smothering small trees and shrubs. The underground and aerial tubers make this species difficult to control.

#### Wild tobacco (*Solanum mauritianum*)

Introduced to Norfolk Island in about 1855, this is a fast growing tree that can occupy key habitats for rare species that are not very shade-tolerant such as the chaff tree (*Achyranthes arborescens*) and the nettle tree (*Boehmeria australis*) (Sykes & Atkinson 1988). As wild tobacco prefers open areas it is generally considered to be less of a threat than shade tolerant species such as red guava and African olive (Director of National Parks 2008b). It is often found in some parts of the valley bottoms in association with bleeding heart (*Homolanthus populifolius*).

#### Bleeding heart (*Homolanthus populifolius*)

Bleeding heart is a widespread but relatively insignificant weed on Norfolk Island found in association with bracken, lantana or wild tobacco. In restricted areas in the national park it can threaten light loving species such as *Achyranthes arborescens* and *Boehmeria australis* (Director of National Parks 2008b).

#### Morning glory (*Ipomoea cairica*)

Morning glory is a perennial twining plant that rapidly invades open areas after fallen trees or sudden woody weed removal (Director of National Parks 2008b).

#### Formosan lily (*Lilium formosanum*)

This is a vigorous, shade tolerant species that produces large numbers of seeds and is difficult to remove. It often grows in disturbed sites and establishes in a range of locations such as native forests, pine plantations, guava and olive thickets, kikuyu pasture and domestic gardens (Director of National Parks 2008b). Formosan lily has not yet invaded Phillip Island (Mills 2009b).

### **3.2.5 Pathogens**

Island animals and plants can be susceptible to the introduction of new diseases. Psittacine circoviral disease ('beak and feather') is listed under the EPBC Act as a key threatening process to endangered parrots and was probably responsible for the deaths of many green parrots on Norfolk Island in the 1970s (Hicks & Greenwood 1990). Root and butt rot (*Phellinus noxius*) has been associated with the death of mature Norfolk Island pines and may pose a threat to other native plant species. There is an ongoing and significant risk of introducing extremely dangerous plant pathogens on both legally and illegally imported plant material in the future.



### 3.3 Future Threats

#### 3.3.1 Potential Invasive Species

A range of invasive species not currently known to exist on Norfolk Island but found on other Pacific islands would pose a major threat to listed species if introduced. Several tramp ant species such as red imported fire ants (*Solenopsis invicta*) and yellow crazy ants (*Anoplolepis gracilipes*) have the potential to radically alter the ecology of oceanic islands. Yellow crazy ants have been intercepted on a number of occasions on cargo arriving from Yamba. Vertebrates such as the brown tree snake (*Boiga irregularis*) can also have serious impacts on island ecology (Rodda *et al.* 2002, Cogger *et al.* 2005).

The potential of introducing cane toads (*Bufo marinus*) also represents a significant risk to the fauna of the Norfolk Island Group. Cane toads are poisonous in all their life stages and are linked to a marked decline in native species wherever they are introduced.

#### 3.3.2 Introduction of Disease

A serious threat to all Norfolk Island Group birds is the introduction of new diseases. Island birds have often evolved in the absence of diseases common in continental avian faunas and the introduction of disease to island birds can be disastrous. An example is the introduction of avian malaria to Hawaii via the accidental introduction of a new species of mosquito. This event caused the extirpation of almost the entire endemic bird fauna below 600 metres altitude and was probably the main cause of the total extinction of several bird species (Hay 1986). The range of many surviving species was severely reduced and fragmented which in turn markedly increased their risk of extinction (Hay 1986).

#### 3.3.3 Climate Change

Loss of climatic habitat caused by anthropogenic emissions of greenhouse gases is listed as a key threatening process under the EPBC Act.

Predictions of climate change include an increase in temperature of between 0.4°C and 2.0°C over the next 25 years, modest to moderate increases in average and maximum cyclone intensities, increases in evaporation and rises in average sea level (Hughes 2003). The predicted impact of climate change on specific ecosystems is more uncertain. It is likely that climate change will have a profound influence on the distribution of vegetation, invertebrates and seabirds (Hughes 2003).

Possible impacts of climate change on Norfolk Island include:

- changes in seasonal rainfall patterns impacting on sensitive microclimates such as montane cloud forests
- lower soil moisture balances affecting species requiring constant damp conditions to survive such as certain insects, snails and flora
- increased erosion and runoff due to increased intensity and frequency of storm events (particularly on Phillip Island)
- increased temperatures resulting in heat stress in plants and an increased fire risk



- increased sea surface temperatures which may impact on the regional marine food chains which may have implications for top predators such as seabirds (Hyder Consulting 2008)
- increased flooding, coastal erosion and saltwater intrusion in low lying areas from more frequent and higher level storm surges (Watkins Consulting 1999).

#### **3.3.4 Chance Events**

Chance events such as extreme weather events (e.g. cyclones) may result in damage to the forest, and cause a negative impact to some species on Norfolk Island. Endemic species with restricted distributions and limited population size are particularly susceptible to such changes.



## 4. Current Management

### 4.1 National Park and Botanic Garden

The Norfolk Island National Park consists of two sections. The original component (comprised of the Mt Pitt Section and the Botanic Garden) was first established in 1985 when the *Norfolk Island National Park and Norfolk Island Botanic Garden Act 1984* (NI) came into force. These areas were subsequently proclaimed under Commonwealth legislation in 1986 following a request from the Norfolk Island Legislative Assembly. Phillip Island was added as the second component of the national park in 1996. Both had previously been public reserves under the *Commons and Public Reserves Ordinance 1936* (NI).

The total area of the national park is 650 hectares, comprising the Mt Pitt section (460 hectares including a forestry zone managed by the Norfolk Island Administration) and Phillip Island (190 hectares). The Norfolk Island Botanic Garden is a 5.5 hectares reserve established under both Commonwealth and Norfolk Island legislation to provide a place where specimens of Norfolk's unique flora can be conveniently viewed and appreciated.

The Director of National Parks (Australian Government) is responsible for administration, management and control of the national park and botanic garden under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and in accordance with a management plan prepared under the Act. The current management plan is in effect from 2008 to 2018 (Director of National Parks 2008a). In preparing the management plan relevant Norfolk Island Ordinances and Acts were considered.

The Norfolk Island National Park Advisory Committee (NINPAC) advises the Director and the Norfolk Island Government on implementation of the management plan.

### 4.2 Public Reserves

An important component of the Norfolk Island protected areas system is a network of 20 public reserves totalling 237 hectares or 6.5% of the Territory. Most are located around the coast and many are of value for nature conservation (Mosley 2001). Map 1 shows the location of major reserves and details of the reserves are provided in Appendix D. The reserves, formerly proclaimed under the *Commons and Public Reserves Ordinance 1936* (NI) and now under the *Public Reserves Act 1997* (NI), are the responsibility of the Norfolk Island Administration.

The *Public Reserves Act 1997* requires the appointment of a Conservator of Public Reserves who is responsible for the management of all public reserves, in accordance with the Plan of Management for each reserve. The Norfolk Island Parks and Forestry Service (NIPFS) is the management authority responsible for the implementation of Plans of Management in public reserves. Key activities undertaken on the public reserves include slashing, mowing, spraying of environmental weeds and the replanting of native vegetation.

Norfolk Landcare has undertaken a range of rehabilitation projects (comprising rehabilitation plantings and woody weed control) in various reserves including Cascade Reserve and Headstone Reserve. Significant works have been undertaken at Bombora Reserve by the Boardriders Club, a school group and a private individual. The Norfolk Island Flora and Fauna Society has conducted weeding and plantings in various reserves.



### **4.3 Other Biodiversity Conservation**

Biodiversity conservation works outside of the national park and public reserves have been conducted by several private landholders. Works included the planting of native trees (particularly Norfolk Island pines), water course management and weed control.



## 5. Recovery Actions

### 5.1 Goal and Objectives

The goal of the plan is to improve the conservation status of the threatened species of the Norfolk Island Group by:

- increasing the size and extent of the populations of those species through improving the health, quality and extent of the natural ecosystems of the Norfolk Island Group
- where practical, establishing additional populations of those species in and outside of the Norfolk Island Group.

To achieve this goal the plan details eight specific objectives. These are:

1. To reduce the impact of existing weeds on biodiversity
2. To improve the condition and extent of native vegetation and vegetation remnants
3. To reduce the impact of introduced fauna on biodiversity
4. To prevent the accidental introduction of exotic fauna, flora and pathogens onto Phillip Island and Norfolk Island
5. To recover flora and fauna species listed under the EPBC Act via specific actions
6. To engage the Norfolk Island community in implementing the recovery plan
7. To identify, monitor and manage the consequences of climate change on biodiversity
8. To assess the appropriateness of reintroducing locally extinct fauna after rodents have been controlled or locally eradicated.

Each objective is accompanied by a set of actions that will assist in achieving the goal of the Plan. A summary of recovery actions and the species to which they apply are in Table 3. Performance criteria and timelines are presented in Table 4.

### 5.2 Priority Areas for Management

Since all the listed species (with the exception of the two species of *Euphorbia*) occur in the Norfolk Island National Park (either the Mt Pitt or Phillip Island sections), the national park is the highest priority area for action. Other priority areas for action include the Norfolk Island public reserves that contain significant populations of threatened species (principally Ball Bay Reserve, Bumbora Reserve, Nepean Island Reserve, Cascade Reserve, Hundred Acres Reserve, Anson Bay, Anson Point Nesting Ground, Point Ross Reserve, Selwyn Reserve, Two Chimneys Reserve); and areas of private land that contain significant habitat for listed species (such as the Mission Road rainforest remnants).

Where a species only exists as a discrete isolated population then priority should be given to re-establishing that species in other locations, particularly in areas where they were known to have occurred previously.



### **5.3 Priority Threatening Processes**

A number of threatening processes have been identified as having a significant impact on the biodiversity of the Norfolk Island Group and specifically on the listed species addressed by the plan. The most significant threatening processes that impact on the most number of listed species are:

- invasion of habitat by exotic weeds
- predation by rodents
- predation by feral cats
- invasion by Argentine ants.

### **5.4 Habitat Critical for Survival**

The EPBC Act specifies that a recovery plan must identify the habitats that are critical to the survival of a threatened species, and the actions needed to protect those habitats. In view of the low numbers of all listed species to which the plan applies, all known populations are important and all areas normally occupied are considered to provide habitat critical to their survival. Habitat critical to the survival of the species/populations covered by the plan are described in Appendix D. Where information is lacking, corrective research actions are proposed.

The Territory's network of Australian Government and Norfolk Island Government protected areas, together with small parcels of privately owned areas with remnant natural vegetation, comprise the only remaining natural or near-natural areas of Norfolk Island and therefore represent critical habitat for all of the taxa in areas covered by this plan. Some areas that support potential habitats which may be currently unoccupied but present opportunities for reintroduction or expansion are also considered habitat critical to survival.

Appendix A shows the distribution of threatened flora and fauna species on Norfolk Island based on limited available information.

## 5.5 Recommended Management Actions

### **Objective 1: To reduce the impact of existing weeds on biodiversity**

#### **Action 1.1: Implement the Norfolk Island National Park Weed Control Strategy.**

Continue implementing the *Norfolk Island National Park Weed Control Strategy* and evaluate the effectiveness of the current effort. The focus of the weed control strategy on the main island is red guava, African olive, lantana, Hawaiian holly and William Taylor. The main weed on Phillip Island is African olive. Undertake weed monitoring to evaluate effectiveness of the strategy.

#### **Action 1.2: Develop and implement a weed control strategy for Norfolk Island public reserves.**

Develop and implement an overarching weed control strategy (consistent with strategies set out in Plans of Management for the Norfolk Island public reserves) to ensure regular weed control on public reserves. The strategy should identify the priority weed species to be treated and prioritise actions in each of the public reserves. A weed monitoring program should be established to evaluate the effectiveness of the strategy.

#### **Action 1.3: Provide advice to assist landholders to control environmental weeds on private land.**

Provide support to landowners and leaseholders to control environmental weeds on private land through provision of advice and financial support where available. Increase community awareness through the preparation of promotional material and workshops including information on weed identification, the threats to native vegetation, how landholders can assist in preventing the spread of existing weeds and the introduction of new weeds. Encourage the use of Norfolk Island species in local gardens.

#### **Action 1.4: Review weed control legislation and strategies for Norfolk Island National Park and Norfolk Island public reserves.**

Review current weed control legislation (in particular the Norfolk Island Noxious Weeds Act 1916) and strategies to ensure that they reflect the most up to date information regarding quarantine, new species introductions and amend or add tasks as required. The weed control strategies should be reviewed at least every five years and should consider the effectiveness of the existing legislative framework and mechanisms to support landholders to coordinate weed control strategies.



**Objective 2: *To improve the condition and extent of native vegetation and vegetation remnants***

**Action 2.1: *Undertake rehabilitation of native vegetation in Norfolk Island National Park.***

Rehabilitate areas in the Mt Pitt section of Norfolk Island National Park and Phillip Island. Revegetation work should be conducted in conjunction with weed control work and priority given to establishing resilient community types. All regeneration should use local provenance plant stock and species to ensure that appropriate habitat is established for listed flora and fauna species.

All revegetation projects undertaken should include monitoring to assess the effectiveness of the program. Monitoring should be conducted in conjunction with the weed strategy and include a suite of marked photo points in a range of project sites and also quadrat or transect sampling to determine changes in species composition, canopy cover and height.

**Action 2.2: *Review management arrangements in the Forestry Zone of Norfolk Island National Park.***

Greater clarity needs to be provided to Norfolk Island National Park staff and Norfolk Island Parks and Forestry staff on roles and responsibilities in the forestry zone in order to improve the management of conservation values in the zone. Areas of high conservation value need to be mapped, buffer zones established and habitat for threatened bird species and wildlife corridors re-established in appropriate areas.

**Action 2.3: *Undertake a strategic review of the Plans of Management for the Norfolk Island public reserves.***

The review should consider all reserves in a holistic manner. It should focus on determining the appropriate level of development and use (commercial and recreational) and prioritising management actions in each reserve to ensure consistency with the purpose of each reserve and the values to be protected.

**Action 2.4: *Undertake rehabilitation of native vegetation in Norfolk Island public reserves.***

Rehabilitation should be undertaken in Hundred Acres, Cascade, Anson Bay, Ball Bay, Bumbora, Selwyn and Two Chimney Reserves as set out in the respective Plans of Management. Revegetation work should be conducted in conjunction with weed control work and use local provenance plant stock.

**Action 2.5: *Promote the use of conservation incentives to restore and protect significant remnant vegetation and threatened species habitat on private land.***

Investigate and promote the use of conservation incentives for landholders who participate in habitat protection or predator control activities. Explore opportunities to protect remnant vegetation on private land through government-funded conservation programs (e.g. stewardship agreements, binding covenants on title, fencing agreements, conservation plans).

**Action 2.6: *Maintain existing fencing to exclude cattle from Norfolk Island National Park. Erect and/or maintain fencing to manage cattle in Norfolk Island public reserves and remnant vegetation on private land.***

Existing fences around the Mt Pitt section of the national park, public reserves and private land particularly the Mission Road rainforest remnants should be maintained and new fences erected to manage cattle.

**Objective 3: *To reduce the impact of introduced fauna on biodiversity***

**Action 3.1: *Eradicate introduced rodents.***

A comprehensive rodent eradication program for the Norfolk Island Group should be implemented as soon as possible. The program should identify costs and benefits, methods to be used, likely non-target and other environmental impacts and any changes necessary to strengthen quarantine procedures to prevent reinvasion if eradication is achieved.

Until such time that a complete rodent eradication is undertaken, the current rodent baiting and monitoring programs in the Norfolk Island National Park should continue and be extended to public reserves, particularly Hundred Acres, Cascade, Anson Bay, Ball Bay, Bumbora, Selwyn and Two Chimneys Reserves. The baiting program should be adjusted in response to the results of monitoring, including possible impact on non-target species. The potential for extending the current rodent control program to include private land should be evaluated.

**Action 3.2: *Manage feral cats to reduce impact on threatened species.***

The current feral cat trapping program in Norfolk Island National Park should continue and its effectiveness should be assessed. Methods for improved cat management should be investigated including the feasibility of a cat baiting program. While some feral cat trapping has occurred in public reserves in the past, the feral cat management program should be formally extended to public reserves, particularly Hundred Acres, Cascade, Anson Bay, Ball Bay, Bumbora, Selwyn and Two Chimneys Reserves. Continue support for responsible cat ownership practices and relevant education activities on Norfolk Island.

**Action 3.3: *Manage introduced birds to reduce impact on threatened species.***

Continue the control of crimson rosellas and European starlings in the Norfolk Island National Park to protect green parrot and boobook owl nest sites. The potential to expand this program outside of the national park should be assessed.

Develop and implement a control program in the Norfolk Island National Park for feral fowl and California quail. Investigate the potential for more widespread control and possible eradication.

**Action 3.4: *Eradicate exotic reptiles.***

Eradicate populations of the Asian house gecko on Norfolk Island while the population is contained to a relatively small area.



**Action 3.5: Control or eradicate invertebrate pests.**

Continue ongoing monitoring and management of Argentine ants to ensure that all infestations are contained. Develop and implement a comprehensive eradication program for Argentine ants.

Continue to remove European honey bees and Asian paper wasps from threatened species habitat as required. Undertake assessment of existing European honey bee and Asian paper wasp distribution to determine the need to develop an on-going monitoring and control strategy.

**Action 3.6: Quantify the impacts of native predators on biodiversity of the Norfolk Island Group.**

The impacts of some of the native predators of the Norfolk Island Group on threatened biodiversity require further understanding. The degree of threat through predation and competition posed by species such as the Australian kestrel (*Falco cenchroides*), marsh harrier (*Circus approximans*) and purple swamphen (*Porphyrio porphyrio*) should be investigated and quantified. The presence of native predators in any ecosystem is a natural evolutionary process and actions to actively intervene in population dynamics of predator populations should only be undertaken if the presence of these species is likely to result in significant negative impacts to the listed species identified in the plan.

**Objective 4: To prevent the accidental introduction of exotic fauna, flora and pathogens**


**Action 4.1: Review the quarantine procedures for Norfolk Island.**

Undertake a review of existing quarantine procedures to ensure they reflect the most up to date information regarding quarantine and species introductions and are effective at protecting the Norfolk Island Group from the introduction of invasive species and pathogens (particularly via shipping hulls and aircraft). The review should investigate whether there is a need to develop joint monitoring and rapid response capabilities and systems. The plant importation policy and lists of prohibited plant imports should also be reviewed regularly.

**Action 4.2: Develop and implement an effective quarantine strategy to protect Phillip Island and Nepean Island from exotic species introductions from Norfolk Island.**

Develop a Phillip and Nepean Island quarantine strategy to prevent rodents, exotic reptiles and other introduced pests from establishing on these islands. The strategy should identify activities to increase public awareness of the risks posed by the introduction of exotic species presently absent from the islands, regular surveillance for invasion by new exotic species and a rapid response protocol to detect and eradicate any new introductions as soon as possible. The protocol should include information to assist in the identification of priority threats, emergency contact details for relevant personnel and procedures on how to treat pest incursions.





In collaboration with tourism operators and other community groups that regularly visit Phillip Island, develop and implement a protocol to minimise the risk of the accidental introduction, through visitation, of plants and animals particularly rodents, ants, cockroaches and the Asian house gecko.

**Action 4.3: *Develop and implement a protocol to manage the negative impacts of Phellinus noxius on forests and ecosystems.***

The protocol should include methods of treating the disease, preventing further spread and identifying highest priorities areas and species for identified treatments. Investigate the appropriateness of implementing the protocol across Norfolk Island Group. Maintaining ecosystem health through weed control and managing human and feral animal impacts will also minimise damage caused by Phellinus.

**Objective 5: *To recover flora and fauna species listed under the EPBC Act via specific actions***

In addition to landscape level recovery actions that target broad biodiversity benefits across Norfolk Island, Phillip Island and Nepean Island, specific recovery actions are required for certain species.

**Action 5.1: *Identify threatened flora species in the Norfolk Island Group which require active management intervention to support recovery and implement appropriate recovery actions.***

The majority of listed flora species will benefit from weed control and forest rehabilitation activities. A small number of the populations of endangered flora in the Norfolk Island Group have a limited distribution and may benefit from active intervention such as establishing ex-situ populations, actively supporting pollination, and planting in appropriate vegetation communities to increase their distribution. The feasibility of storing seeds for all listed flora species as part of the National Seedbank Initiative and/or the Millennium Seed Bank Project should be investigated.

**Action 5.2: *Continue actions to increase breeding activity for all threatened bird species.***

Establish monitoring surveys that are adequate to indicate changes in populations of threatened endemic bird taxa. Regular audits (every 2nd month) of threatened bird populations should be undertaken to measure population trends. Audits should be easily repeatable and site specific.

Continue the existing management practice of providing predator-resistant nest sites for green parrot (to support 25 breeding pairs) and boobook owls, and continue to manage or, where possible, eradicate predators and competitors throughout the distribution of threatened bird species habitat. Minimise and manage human disturbance to nesting seabird populations.



**Action 5.3: *Identify research priorities and undertake systematic surveys of specific threatened species.***

Develop a research program for threatened flora and fauna species in the Norfolk Island National Park.

Encourage research of threatened flora where little is known on the ecology of a species. Research should include measures of the area of the population, the population structure and the threats to the population so that this information can be fed into monitoring programs.

Species specific fauna research should focus on reproductive ecology, habitat requirements, the impact of threatening processes and population monitoring. Research should identify management actions that identify reasons for change in populations and improve the long-term viability of the species.

Systematic surveys of every accessible island in the Norfolk Island Group should be undertaken to document the current range of the Lord Howe Island gecko and Lord Howe Island skink.

**Action 5.4: *Review the conservation status of flora and fauna species listed under the EPBC Act.***

The current conservation status of species listed under the EPBC Act should be reviewed and a submission prepared as required. Nomination of species or ecological communities for listing under the EPBC Act should also be prepared as required.

**Objective 6: *To engage the Norfolk Island community in implementing the recovery plan***

**Action 6.1: *Promote public awareness and involvement.***

Provide information to the local community through local media, information days and workshops on key recovery actions and strategies.

**Action 6.2: *Review implementation of the plan on an annual basis.***

The Administration of Norfolk Island and Norfolk Island National Park should review implementation of the plan on an annual basis. These reviews should identify priority actions to be addressed across the Norfolk Island Group, coordinate funding applications to implement recovery actions and monitor overall performance.

**Objective 7: *To identify, monitor and manage the consequences of climate change on biodiversity***

**Action 7.1: *Identify listed species most likely to be affected by climate change.***

Several flora and fauna groups have specific habitat requirements that are particularly vulnerable to climate change including ferns, epiphytes and seabirds. The impact of climate change on seabirds may in turn affect nutrient cycles that support terrestrial ecosystems. A risk analysis for priority species should be undertaken in conjunction with predictive modelling of projected climate change impacts. Existing monitoring programs for fauna and flora species should consider whether climate change is impacting on monitoring results.

**Action 7.2: *Develop and implement a climate change adaptation and mitigation strategy for Norfolk Island National Park.***

The strategy should identify actions aimed to increase the resilience of ecosystems and species to the effects of climate change, identify mitigation activities, promote community awareness of climate change threats to biodiversity and identify research required to fill gaps in knowledge on the impacts of climate change.

**Objective 8: *To assess the appropriateness of reintroducing locally extinct fauna after rodents have been controlled or locally eradicated***

**Action 8.1: *Investigate the conservation benefits of re-establishing populations of species that now occur on Phillip Island as viable populations on Norfolk Island.***

Determine whether it is appropriate to translocate the Lord Howe Island gecko and the Lord Howe Island skink from Phillip Island to Norfolk Island to re-establish populations of these reptiles on Norfolk Island.

**Action 8.2: *Investigate the conservation benefits of re-establishing populations of species that now occur on Norfolk Island as viable populations on Phillip Island.***

Determine whether it is appropriate to establish populations of the green parrot, golden whistler or scarlet robin on Phillip Island in the longer term.

**Action 8.3: *Investigate the conservation benefits of translocating specific threatened bird species between Norfolk and Lord Howe islands to increase their distribution.***

In conjunction with relevant New South Wales agencies, investigate the feasibility of re-introducing the green parrot and other appropriate Norfolk Island fauna species to Lord Howe Island. Investigate the conservation benefit of re-establishing the providence petrel from Lord Howe Island to Norfolk Island.



**Table 3: Summary of Recovery Actions and Threatened Species Addressed**

Species	Weed Control	Forest re-vegetation	Vertebrate pest control	Quarantine	Specific Actions	Engaging community	Climate change	Reintroductions-Fauna
<b>Vascular Plants</b>								
<i>Abutilon julianae</i>	✓	✓		✓	✓	✓	✓	
<i>Achyranthes arborescens</i>	✓	✓	✓	✓	✓	✓	✓	
<i>Achyranthes margaretarum</i>	✓	✓		✓	✓	✓	✓	
<i>Blechnum norfolkianum</i>	✓	✓		✓	✓	✓	✓	
<i>Boehmeria australis</i> var. <i>australis</i>	✓	✓		✓	✓	✓	✓	
<i>Calystegia affinis</i>	✓	✓		✓	✓	✓	✓	
<i>Clematis dubia</i>	✓	✓		✓	✓	✓	✓	
<i>Coprosma baueri</i>	✓	✓		✓	✓	✓		
<i>Coprosma pilosa</i>	✓	✓		✓	✓	✓		
<i>Cordyline obtecta</i>	✓	✓		✓	✓	✓		
<i>Crepidomanes endlicherianum</i>	✓	✓		✓	✓	✓	✓	
<i>Dysoxylum bijugum</i>	✓	✓		✓	✓	✓		
<i>Elatostema montanum</i>	✓	✓		✓	✓	✓	✓	
<i>Elymus multiflorus</i> var. <i>kingianus</i>	✓	✓		✓	✓	✓	✓	
<i>Euphorbia norfolkiana</i>	✓	✓		✓	✓	✓	✓	
<i>Euphorbia obliqua</i>	✓	✓		✓	✓	✓	✓	
<i>Hibiscus insularis</i>	✓	✓		✓	✓	✓	✓	
<i>Hypolepis dicksonioides</i>	✓	✓		✓	✓	✓	✓	
<i>Ileostylus micranthus</i>	✓	✓		✓	✓	✓	✓	
<i>Lastreopsis calantha</i>	✓	✓		✓	✓	✓	✓	
<i>Marattia salicina</i>	✓	✓		✓	✓	✓	✓	
<i>Melicope littoralis</i>	✓	✓	✓	✓	✓	✓		



Species	Weed Control	Forest re-vegetation	Vertebrate pest control	Quarantine	Specific Actions	Engaging community	Climate change	Reintroductions-Fauna
<b>Vascular Plants - continued</b>								
<i>Melicytus latifolius</i>	✓	✓		✓	✓	✓	✓	
<i>Melicytus ramiflorus</i> subsp. <i>oblongifolius</i>	✓	✓		✓	✓	✓		
<i>Meryta angustifolia</i>	✓	✓		✓	✓	✓		
<i>Meryta latifolia</i>	✓	✓	✓	✓	✓	✓	✓	
<i>Muehlenbeckia australis</i>	✓	✓		✓	✓	✓		
<i>Myoporum obscurum</i>	✓	✓		✓	✓	✓	✓	
<i>Myrsine ralstoniae</i>	✓	✓		✓	✓	✓		
<i>Pennantia endlicheri</i>	✓	✓		✓	✓	✓		
<i>Phreatia limenophylax</i>	✓	✓		✓	✓	✓	✓	
<i>Phreatia paleata</i>	✓	✓		✓	✓	✓	✓	
<i>Pittosporum bracteolatum</i>	✓	✓		✓	✓	✓		
<i>Pouteria costata</i>	✓	✓		✓	✓	✓		
<i>Pteris kingiana</i>	✓	✓		✓	✓	✓	✓	
<i>Pteris zahlbruckneriana</i>	✓	✓		✓	✓	✓	✓	
<i>Senecio australis</i>	✓	✓		✓	✓	✓		
<i>Senecio evansianus</i>	✓	✓		✓	✓	✓		
<i>Senecio hooglandii</i>	✓	✓		✓	✓	✓		
<i>Streblus pendulinus</i>	✓	✓		✓	✓	✓		
<i>Taeniophyllum norfolkianum</i>	✓	✓		✓	✓	✓	✓	
<i>Thelychiton brachypus</i>	✓	✓		✓	✓	✓	✓	
<i>Tmesipteris norfolkensis</i>	✓	✓		✓	✓	✓	✓	
<i>Ungeria floribunda</i>	✓	✓	✓	✓	✓	✓		
<i>Wikstroemia australis</i>	✓	✓		✓	✓	✓	✓	
<i>Zehneria baueriana</i>	✓	✓		✓	✓	✓		



Species	Weed Control	Forest re-vegetation	Vertebrate pest control	Quarantine	Specific Actions	Engaging community	Climate change	Reintroductions-Fauna
<b>Birds</b>								
<i>Cyanoramphus cookii</i>	✓	✓	✓	✓	✓	✓	✓	✓
<i>Ninox novaeseelandiae undulata</i>	✓	✓	✓	✓	✓	✓	✓	✓
<i>Pachycephala pectoralis xanthoprocta</i>	✓	✓	✓	✓	✓	✓	✓	✓
<i>Petroica multicolor multicolor</i>	✓	✓	✓	✓	✓	✓	✓	✓
<i>Pterodroma neglecta neglecta</i>	✓	✓	✓	✓	✓	✓	✓	✓
<b>Reptiles</b>								
<i>Christinus guentheri</i>	✓	✓	✓	✓	✓	✓	✓	✓
<i>Oligosoma lichenigera</i>	✓	✓	✓	✓	✓	✓	✓	✓
<b>Molluscs</b>								
<i>Advena campbellii campbellii</i>	✓	✓	✓	✓	✓	✓	✓	✓
<i>Mathewsoconcha grayi</i>	✓	✓	✓	✓	✓	✓	✓	✓
<i>Mathewsoconcha phillipii</i>	✓	✓	✓	✓	✓	✓	✓	✓
<i>Mathewsoconcha suteri</i>	✓	✓	✓	✓	✓	✓	✓	✓
<i>Quintalia stoddartii</i>	✓	✓	✓	✓	✓	✓	✓	✓

## 5.6 Performance Criteria and Timeframes

**Table 4: Recovery Plan Performance Criteria and Timeframes**

Objective	Performance Criteria	Timeframe from plan commencement
1. To reduce the impact of existing weeds on biodiversity.	<ul style="list-style-type: none"> <li>Norfolk Island National Park Weed Control Strategy and monitoring program is implemented.</li> </ul>	<ul style="list-style-type: none"> <li>Ongoing during life of the plan</li> </ul>
	<ul style="list-style-type: none"> <li>Weed control strategy for Norfolk Island public reserves and monitoring program is developed and implemented.</li> </ul>	<ul style="list-style-type: none"> <li>Within 2 years then ongoing during life of the plan</li> </ul>
	<ul style="list-style-type: none"> <li>Advice and support to landholders to control weeds on private land is provided.</li> </ul>	<ul style="list-style-type: none"> <li>Ongoing during life of the plan</li> </ul>
	<ul style="list-style-type: none"> <li>Weed community awareness activities such as workshops and field days are implemented.</li> </ul>	<ul style="list-style-type: none"> <li>Ongoing during life of the plan</li> </ul>
	<ul style="list-style-type: none"> <li>Weed control strategies for Norfolk Island National Park and Norfolk Island public reserves are reviewed.</li> </ul>	<ul style="list-style-type: none"> <li>Within 3 years of each strategy being developed</li> </ul>
	<ul style="list-style-type: none"> <li>Review of effectiveness of existing legislative framework and mechanisms to support landholders to coordinate weed control strategies conducted.</li> </ul>	<ul style="list-style-type: none"> <li>Within 3 years</li> </ul>
2. To improve the condition and extent of native vegetation and vegetation remnants.	<ul style="list-style-type: none"> <li>High conservation priority sites in Norfolk Island National Park re-vegetated and monitoring program established and implemented.</li> </ul>	<ul style="list-style-type: none"> <li>Ongoing during life of the plan</li> </ul>
	<ul style="list-style-type: none"> <li>Review of management of Forestry Zone in Norfolk Island National Park conducted.</li> </ul>	<ul style="list-style-type: none"> <li>Within 2 years</li> </ul>
	<ul style="list-style-type: none"> <li>Strategic review of Plans of Management for Norfolk Island public reserves conducted.</li> </ul>	<ul style="list-style-type: none"> <li>Within 2 years</li> </ul>
	<ul style="list-style-type: none"> <li>Forest rehabilitation strategy for Norfolk Island public reserves developed and implemented.</li> </ul>	<ul style="list-style-type: none"> <li>Within 2 years then ongoing during life of the plan</li> </ul>
	<ul style="list-style-type: none"> <li>Information on habitat restoration and remnant vegetation protection for private landholders is provided.</li> </ul>	<ul style="list-style-type: none"> <li>Ongoing during life of the plan</li> </ul>
	<ul style="list-style-type: none"> <li>Existing fencing around Norfolk Island National Park, public reserves and remnant vegetation on private land is maintained.</li> </ul>	<ul style="list-style-type: none"> <li>Ongoing during life of the plan</li> </ul>
	<ul style="list-style-type: none"> <li>New fencing around public reserves is completed.</li> </ul>	<ul style="list-style-type: none"> <li>Within 5 years</li> </ul>



Objective	Performance Criteria	Timeframe from plan commencement
<p>3. To reduce the impact of introduced fauna on biodiversity.</p>	<ul style="list-style-type: none"> <li>• Rodents are eradicated within Norfolk Island Group.</li> <li>• Rodent control program in Norfolk Island National Park is continued.</li> <li>• Extension of rodent control program to public reserves is undertaken.</li> <li>• Feral cat trapping program in Norfolk Island National Park is continued.</li> <li>• Extension of feral cat management program to public reserves is undertaken.</li> <li>• Introduced bird control program (crimson rosellas, European starlings and feral fowl) in Norfolk Island National Park is continued.</li> <li>• Eradication of Asian house gecko is undertaken.</li> <li>• Eradication of Argentine ants is undertaken.</li> <li>• Removal of European honey bees and Asian paper wasps from threatened species habitat is continued.</li> <li>• Assessment of existing European honey bee and Asian paper wasp distribution is undertaken.</li> <li>• The impact of native predators on listed threatened species is quantified.</li> </ul>	<ul style="list-style-type: none"> <li>• Within 5 years of commencement of eradication program</li> <li>• Ongoing during life of the plan</li> <li>• Within 2 years</li> <li>• Ongoing during life of the plan</li> <li>• Within 2 years</li> <li>• Ongoing during life of the plan</li> <li>• Within 3 years of commencement of eradication program</li> <li>• Within 3 years of commencement of eradication program</li> <li>• Ongoing during life of the plan</li> <li>• Within 5 years</li> <li>• Within 5 years</li> </ul>
<p>4. To prevent the accidental introduction of exotic fauna, flora and pathogens.</p>	<ul style="list-style-type: none"> <li>• The Norfolk Island quarantine procedures are reviewed.</li> <li>• Quarantine strategy for Phillip Island and Nepean Island developed and implemented.</li> <li>• Protocol to manage the negative impacts of Phellinus noxius on forests and ecosystems is developed and implemented.</li> </ul>	<ul style="list-style-type: none"> <li>• Within 2 years</li> <li>• Within 1 year then ongoing during life of the plan</li> <li>• Within 3 years then ongoing during life of the plan</li> </ul>





Objective	Performance Criteria	Timeframe from plan commencement
<p>5. To recover flora and fauna species listed under the EPBC Act via specific actions.</p>	<ul style="list-style-type: none"> <li>• Threatened flora species requiring active management intervention are identified.</li> <li>• Appropriate management intervention actions for threatened flora species are implemented.</li> <li>• Monitoring of population and distribution of threatened bird species is continued.</li> <li>• Predator-resistant nest sites for threatened bird species continue to be provided.</li> <li>• Control of predators and competitors in green parrot breeding areas is continued.</li> <li>• Management of human disturbance of nesting seabirds is undertaken.</li> <li>• Research program for threatened flora and fauna species is developed and guides research priorities.</li> <li>• Conservation status of species listed under the EPBC Act is reviewed.</li> </ul>	<ul style="list-style-type: none"> <li>• Within 1 year</li> <li>• Ongoing during life of the plan</li> <li>• Ongoing during life of the plan</li> <li>• Ongoing during life of the plan</li> <li>• Ongoing during life of the plan</li> <li>• Ongoing during life of the plan</li> <li>• Ongoing during life of the plan</li> <li>• Within 5 years</li> </ul>
<p>6. To engage the Norfolk Island community in implementing the recovery plan.</p>	<ul style="list-style-type: none"> <li>• Recovery plan is communicated to local community and community is engaged in the implementation of the Plan.</li> <li>• Plan is reviewed on an annual basis.</li> </ul>	<ul style="list-style-type: none"> <li>• Ongoing during life of the plan</li> <li>• Ongoing during life of the plan</li> </ul>
<p>7. To identify, monitor and manage the consequences of climate change on biodiversity.</p>	<ul style="list-style-type: none"> <li>• Species most likely to be affected by climate change are identified.</li> <li>• Climate change adaptation and mitigation strategy for Norfolk Island National Park is developed and implementation commenced.</li> </ul>	<ul style="list-style-type: none"> <li>• Within 2 years</li> <li>• Within 3 years</li> </ul>
<p>8. To assess the appropriateness of reintroducing locally extinct fauna after rodents have been controlled or locally eradicated.</p>	<ul style="list-style-type: none"> <li>• Appropriate species for re-introduction are identified and re-introduction plan developed.</li> <li>• Feasibility of establishing a green parrot population on Lord Howe Island is investigated.</li> </ul>	<ul style="list-style-type: none"> <li>• Within 5 years</li> <li>• Within 5 years</li> </ul>



## 5.7 Management Practices

Management practices and measures to address key threats other than those contained in the plan have been developed and are being implemented through: management plans for Norfolk Island public reserves and for the Norfolk Island National Park and Norfolk Island Botanic Garden; weed and predator management strategies; forest rehabilitation strategies; and quarantine operational procedures.

The EPBC Act provides protection for listed threatened species and ecological communities, migratory species, the marine environment (including the sea around Norfolk Island to 200 nautical miles) and the environment of Commonwealth land including the Norfolk Island National Park and any other land owned by or leased to or from the Australian Government. The EPBC Act also protects places with heritage significance on either the National Heritage List or the Commonwealth Heritage List.

Activities such as the development and maintenance of infrastructure and visitor activities must be conducted in ways to avoid significant impact on the species covered in the plan. Activities should be avoided if they:

- lead to a decrease in the size of a population
- reduce the area of occupancy
- fragment an existing population
- adversely affect habitat critical to the survival of a species
- disrupt the breeding cycle of a population
- modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline
- result in invasive species becoming established, or
- interfere with the recovery of a species.

## 5.8 Biodiversity Benefits

While the primary goal of the plan is to improve the conservation status of threatened species of the Norfolk Island Group, recovery actions identified in the plan are likely to benefit other species including listed marine species, listed migratory species, species considered under threat in national action plans, species on the IUCN Red List and other native species of birds, plants, and invertebrates. The actions will improve and strengthen ecosystem processes through the protection and enhancement of natural habitats.

As different species have varying habitat and management requirements, it cannot be assumed that the benefits will flow to all species. On-ground actions need to be carefully considered and undertaken with the full range of species in mind for any given habitat. Furthermore, while 'flagship' species such as the green parrot provide an important role in raising public awareness, they should not be considered to be a de facto 'umbrella' species. A case by case approach should be applied to the implementation of management actions.



## 6. Social and Economic Consequences

Implementation of the plan is expected to result in social and economic benefits for the Norfolk Island community. Restoring habitat is likely to enhance the nature tourism experience and may result in increased tourism numbers. Implementing the plan will also provide potential employment for Islanders undertaking landcare type activities.

The implementation of stricter quarantine protocols may be necessary, both for arrivals on Norfolk Island and for trips between Norfolk Island and Phillip and Nepean Islands, respectively. The restrictions may cause some inconvenience and delays to residents and visitors to the islands.

### 6.1 Responsibilities and Affected Interests

The following parties may be affected as the Plan is implemented:

- Australian Government, Director of National Parks, Parks Australia
- Australian Government, Department of the Environment, Water, Heritage and the Arts
- Australian Government, Attorney-General's Department (Territories Division)
- Norfolk Island Government and the Norfolk Island Administration, particularly the Conservator of Public Reserves, Norfolk Island Parks and Forestry Service and quarantine services
- Private landholders and leaseholders near the Norfolk Island National Park
- Kingston and Arthur's Vale Historic Area Management Board
- Norfolk Island National Park Advisory Committee.

The plan is complementary to existing plans including the *Norfolk Island National Park and Norfolk Island Botanic Garden Management Plan 2008-2018* (Director of National Parks 2008a), the *Lord Howe Island Biodiversity Management Plan* (DECC NSW 2007) and the *Norfolk Island Natural Resource Management Plan* (Parsons Brinckerhoff 2008).

### 6.2 Implementation and Costs

The total cost of the recovery program is \$6.77 million over five years (Table 5) with the major costs being for control of introduced predators and competitors (\$2.775 million), control of weeds (\$2.46 million) and vegetation restoration (\$0.895 million). Details of these costings are provided at Appendix B.



**Table 5: Summary of Costings**

Year 1	Year 2	Year 3	Year 4	Year 5	Total
\$1,574,000	\$1,639,000	\$1,714,000	\$924,000	\$919,000	\$6,770,000

Implementation of the proposed actions identified in the plan is subject to budgetary and other constraints affecting the key stakeholders of the plan.

**6.3 Plan Review**

The plan will be implemented over a five-year period and an assessment of its effectiveness should be conducted in the fourth year.

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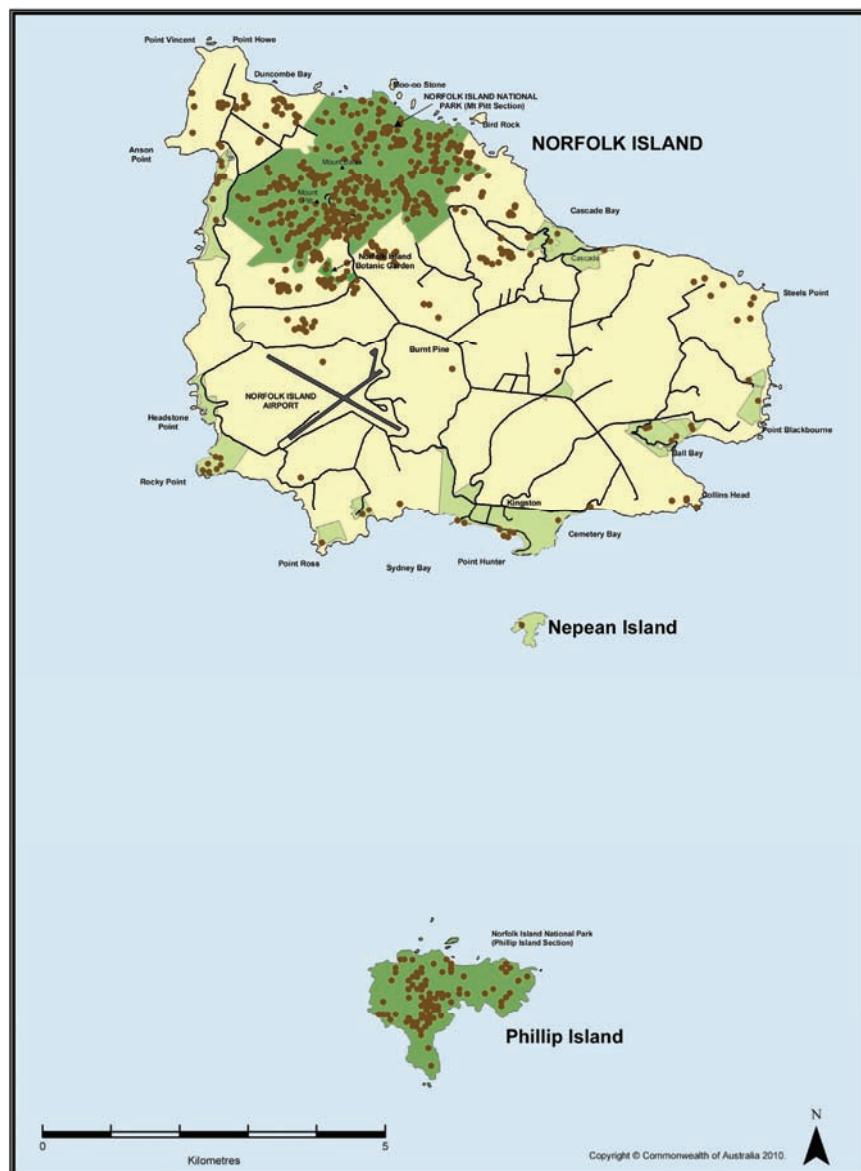


## Appendix A

### Species Distribution Information

#### Map 2 – Distribution of threatened plant species

Note: dots depict the recorded locations in the Territory of Norfolk Island of 46 threatened plant species

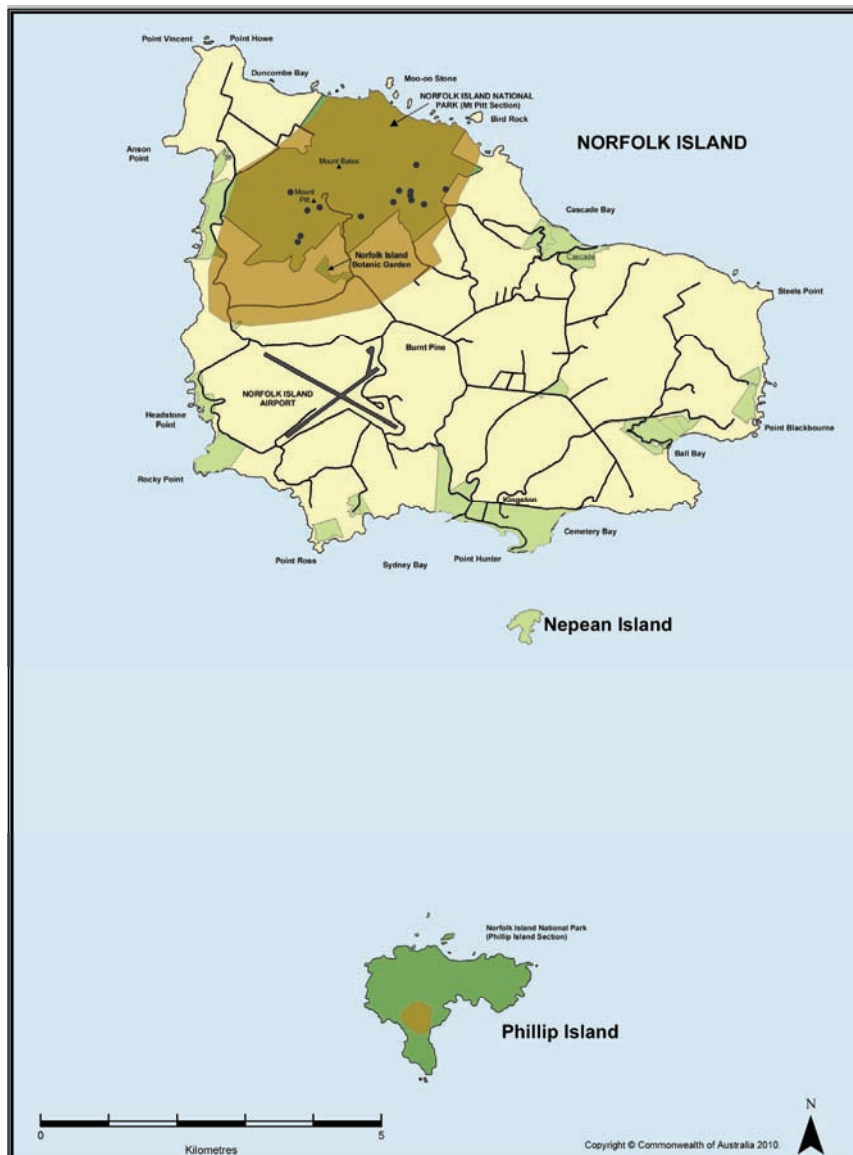




### Map 3 – Distribution of threatened bird species

Notes:

- the shaded area centering on the Mt Pitt area of Norfolk Island indicates the approximate current range of two endemic taxa of threatened forest-dependent birds (*Pachycephala pectoralis xanthoprocta*, *Petroica multicolor multicolor*)
- the breeding sites of *Cyanoramphus cookii* and *Ninox novaeseelandiae undulata* are located within the shaded area however their range extends across Norfolk Island
- the shaded area on Phillip Island indicates the approximate current breeding range in the Territory of Norfolk Island of the vulnerable seabird *Pterodroma neglecta neglecta*

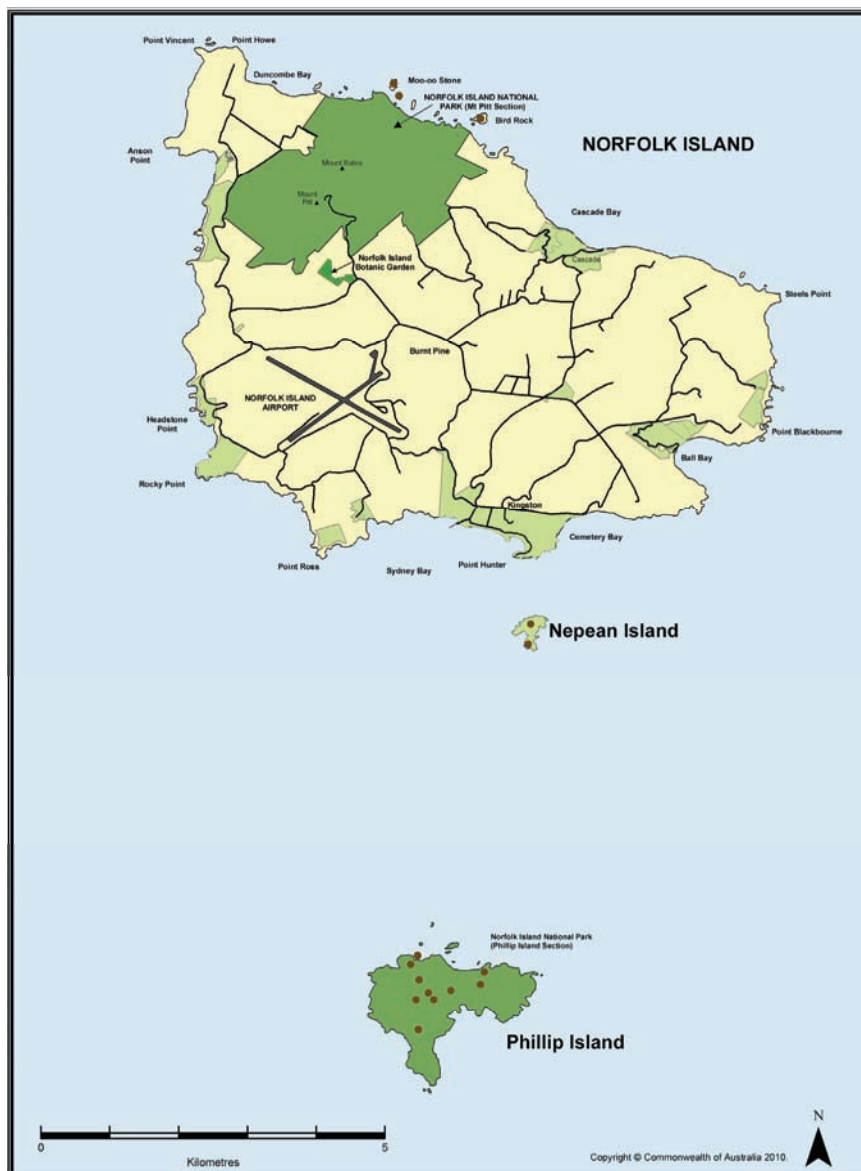




## Map 4 – Distribution of threatened reptile species

Notes:

- dots depict the recorded locations in the Territory of Norfolk Island for the vulnerable reptiles *Christinus guentheri* and *Oligosoma lichenigera*
- distribution is restricted to islands and islets offshore of Norfolk Island



## Appendix B

### Estimated Costs of Implementing Actions Identified in the Norfolk Island Region Threatened Species Recovery Plan

Actions	Priority	Location	Total Cost(\$)/5 years	Potential Partners
<b>Objective 1: To reduce the impact of weeds on biodiversity</b>				
1.1 Implement the NINP Weed Control Strategy.	1	NINP	\$1.3m (\$260,000 pa)	PA
1.2 Develop and implement a weed control strategy for Norfolk Island public reserves.	1	NI public reserves	\$1.12m (\$80,000 yr 1, \$260,000 yrs 2-5)	NIA
1.3 Provide advice to assist landholders to control environmental weeds on private land.	2	Private land	\$25,000 (\$5,000 pa)	NIA; private landholders; community
1.4 Review weed control strategies for NINP and Norfolk Island public reserves.	1	NI Group	\$15,000 (yr 5)	PA; NIA; private landholders
<b>Objective 2: To improve the condition and extent of native vegetation and vegetation remnants</b>				
2.1 Undertake rehabilitation of native vegetation in NINP.	1	NINP	\$250,000 (\$50,000 pa)	PA
2.2 Review management of the Forestry Zone in NINP.	2	NINP	\$20,000 (yr 1)	PA; NIA
2.3 Undertake a strategic review of the Plans of Management for Norfolk Island public reserves.	1	NI public reserves	\$75,000 (yr 1)	NIA
2.4 Develop and implement a forest rehabilitation strategy for Norfolk Island public reserves.	1	NI public reserves	\$225,000 (\$75,000 yr 2, \$50,000 yrs 3-5)	NIA
2.5 Promote the use of conservation incentives to restore and protect significant remnant vegetation and threatened species habitat on private land.	2	Private land	\$25,000 (\$5,000 pa)	NIA; private landholders
2.6 Maintain existing fencing to exclude cattle from NINP. Erect and maintain fencing to manage cattle in Norfolk Island public reserves and remnant vegetation on private land.	1	NINP; NI public reserves; private land	\$300,000 (\$150,000 for maintenance (\$30,000 pa) plus \$150,000 for new fencing (\$30,000 pa))	PA; NIA



Actions	Priority	Location	Total Cost(\$)/5 years	Potential Partners
<b>Objective 3: To reduce the impact of introduced fauna on biodiversity</b>				
3.1 Eradicate introduced rodents.	1	NI Group	\$1.97m (\$600,000 yr 1, \$550,000 yr 2, \$800,000 yr 3, \$10,000 yrs 4-5)	PA; NIA
3.2 Manage feral cats to reduce impact on threatened species.	1	NINP; NI public reserves	\$150,000 (\$20,000 pa yrs 1-4, \$70,000 yr 5)	PA; NIA
3.3 Manage introduced birds to reduce impact on threatened species.	1	NINP	\$230,000 (\$90,000 yr1, \$50,000 yrs 2-3, \$20,000 yrs 4-5)	PA
3.4 Eradicate exotic reptiles.	2	NI Group	\$65,000 (\$15,000 yrs 1-3, \$10,000 yrs 4-5)	PA; NIA; private landholders
3.5 Control or eradicate introduced invertebrates.	1	NI Group	\$300,000 (\$120,000 yrs 1-2, \$20,000 yrs 3-5)	PA; NIA; private landholders
3.6 Quantify the impacts of native predators on biodiversity of the Norfolk Island Group.	3	NI Group	\$60,000 (\$20,000 yrs 2-4)	PA; NIA
<b>Objective 4: To prevent the introduction of exotic fauna, flora and pathogens</b>				
4.1 Review quarantine procedures for Norfolk Island.	1	NI Group	\$50,000 (yr 2)	NIA
4.2 Develop and implement an effective quarantine strategy to protect Phillip Island and Nepean Island from exotic species introductions from Norfolk Island.	1	NI Group	\$70,000 (\$50,000 yr 1, \$5,000 yrs 2-5)	PA; NIA
4.3 Develop and implement a protocol to manage the negative impacts of <i>Phellinus noxius</i> on forests and ecosystems.	2	NI Group	\$60,000 (\$30,000 yr 3, \$15,000 yrs 4-5)	PA; NIA
<b>Objective 5: To recover flora and fauna species listed under the EPBC Act via specific actions</b>				
5.1 Identify threatened flora species in NINP which require active management intervention to support recovery and implement appropriate recovery actions.	2	NINP	\$90,000 (\$50,000 yr 1, \$10,000 yrs 2-5)	PA
5.2 Continue actions to increase breeding activity for all threatened bird species.	1	NINP	\$100,000 (\$20,000 pa)	PA



Actions	Priority	Location	Total Cost(\$)/5 years	Potential Partners
5.3 Identify research priorities and undertake systematic surveys of specific threatened species.	1	NI Group	\$100,000 (\$20,000 pa)	PA; NIA; research institutions
5.4 Review the conservation status of flora and fauna species listed under the EPBC Act.	2	NI Group	\$10,000 (\$2,000 pa)	PA; NIA; scientists; community
<b>Objective 6: To engage the Norfolk Island community in implementing the recovery plan</b>				
6.1 Promote public awareness and involvement.	2	NI Group	\$50,000 (\$10,000 pa)	PA; NIA
6.2 Review implementation of the plan on an annual basis.	1	NI Group	\$10,000 (\$2,000 pa)	PA; NIA
<b>Objective 7: To identify, monitor and manage the consequences of climate change on biodiversity</b>				
7.1 Identify listed species most likely to be affected by climate change..	2	NI Group	\$30,000 (yr 2)	PA; NIA
7.2 Develop and implement a climate change adaptation and mitigation strategy for NINP	2	NINP	\$20,000 (yr 1)	PA
<b>Objective 8: To assess the appropriateness of reintroducing locally extinct fauna after rodents have been controlled or locally eradicated</b>				
8.1 Investigate the conservation benefits of re-establishing populations of species that now occur on Phillip Island as viable populations on Norfolk Island.	3	NI Group	\$50,000 (yr 4) for actions 8.1-8.4	PA; NIA
8.2 Investigate the conservation benefits of re-establishing populations of species that now occur on Norfolk Island as viable populations on Phillip Island.	3	NINP	See action 8.1	PA
8.3 Investigate the conservation benefits of translocating specific threatened bird species between Norfolk and Lord Howe islands to increase their distribution.	3	NI Group	See action 8.1	PA; NSW DECC



## Appendix C

### Review of implementation of approved recovery plans for some Norfolk Island bird species

The following recovery plans for Norfolk Island birds were approved under the *Environment Protection and Biodiversity Conservation Act 1999*:

- Hill, R. 2002. *Recovery Plan for the Norfolk Island green parrot* *Cyanoramphus novaezelandiae cookii*. Environment Australia, Canberra (approved October 2003); and
- Commonwealth of Australia 2005. *National Recovery Plan for the Norfolk Island scarlet robin* *Petroica multicolor multicolor* and the *Norfolk Island golden whistler* *Pachycephala pectoralis xanthoprocta*. Department of the Environment and Heritage (approved August 2005).

In order to determine if the *Norfolk Island Region Threatened Species Recovery Plan* should replace the above plans, a review of each plan was undertaken (Director of National Parks 2009a, 2009b). The reviews assessed the implementation of each recovery plan within Norfolk Island National Park and made recommendations on what modifications or additional actions might be required to help conserve these three species<sup>1</sup>/subspecies. Summaries of the outcomes of the two reviews are provided below.

#### **Norfolk Island green parrot (*Cyanoramphus novaezelandiae cookii*) Recovery Plan**

The overall objective of the plan is to shift the conservation status of the Norfolk Island green parrot from 'Endangered' to 'Conservation Dependent' within 10 years. While the population within the national park does not seem to have increased, breeding pairs have been sighted outside of the national park which suggests an increased population across the Norfolk Island Group (Director of National Parks 2009a). The review recommends that continued active intervention is required to improve the conservation status of the green parrot.

The main recommendations of the review relating to specific objectives and actions in the Norfolk Island green parrot Recovery Plan are summarised as follows:

- Annual population counts should be replaced in the regional recovery plan with regular (every 2<sup>nd</sup> month) audits of the population to measure the population trends of all forest birds that are easily repeatable and site specific;
- Continue to monitor breeding populations;
- Continue to maintain sufficient nest sites to support 25 breeding pairs and investigate feasibility of establishing additional nest sites;
- Further investigation into the conservation benefit of establishing a wild population on Phillip Island is required;

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<sup>1</sup> A phylogenetic study by Boon et al. (2001) reported a high degree of genetic divergence between the Norfolk Island Green Parrot and other *Cyanoramphus*, thus warranting its current treatment as the distinct species *Cyanoramphus cookii*.

- Further investigation into the conservation benefit of translocating green parrots to Lord Howe Island is required;
- Remove action to establish captive population on Australian mainland;
- Action to restore nesting habitat should continue for the benefit of all native species. Need to improve the effectiveness of habitat monitoring to determine how much breeding habitat is being established;
- Predator proofing of all potential nest sites should be continued;
- Predator and introduced competitor control program should be continued and the feasibility of cat baiting program should be investigated; and
- Remove action to maintain the green parrot display aviary.

**Recovery Plan for Norfolk Island scarlet robin (*Petroica multicolor multicolor*) and Norfolk Island golden whistler (*Pachycephala pectoralis xanthoprocta*)**

The overall objective of the plan is to shift the status of the Robin and Whistler from 'Vulnerable' to 'Least Concern' within 20 years. Whilst an increasing number of scarlet robins and golden whistlers are observed in the national park, the review (Director of National Parks 2009b) recommends that continued active intervention is required to improve the conservation status of the two subspecies.

The main recommendations of the review relating to specific objectives and actions in the recovery plan for the Norfolk Island scarlet robin and Norfolk Island golden whistler are summarised as follows:

- Predator control within the national park should be continued and the feasibility of a cat baiting program should be investigated;
- Action to test effectiveness of, and if appropriate, expand predator control program outside the national park, should continue;
- Promotion of responsible cat ownership should be continued;
- Maintain recovery action of providing incentives and information for habitat restoration on private land;
- Translocation protocol not required at this time. Need to assess conservation benefits of translocations first. Relies on self-sustaining suitable habitat establishing on Phillip Island;
- Continue to collect biological data to guide recovery program;
- Continue to conduct multi-species monitoring of all threatened land bird species; and
- Continue promoting public awareness of threatened bird recovery programs.



## Appendix D

### Norfolk Island Flora and Fauna – Background and Species Profiles

#### CONTENTS

<b>1. Introduction .....</b>	<b>53</b>
1.1 Geology and Geomorphology .....	53
1.2 Climate .....	54
1.3 History .....	54
1.4 Vegetation.....	55
1.5 Fauna .....	56
1.6 Protected Areas and Reserves .....	57
<b>2. Overview of Species .....</b>	<b>67</b>
2.1 Flora Species .....	67
2.2 Fauna Species .....	67
2.3 Species Profiles .....	76
<b>3. Threats .....</b>	<b>153</b>
3.1 Key Threatening Processes .....	153
3.2 Current and Past Threats .....	154
3.3 Future Threats .....	161
<b>4. Current Management .....</b>	<b>167</b>
4.1 Norfolk Island National Park .....	167
4.2 Public Reserves .....	167
4.3 Other Biodiversity Conservation .....	167
4.4 Existing Management Practices .....	167
<b>5. References.....</b>	<b>174</b>

#### Tables

A Sites of significant habitat on Norfolk Island outside the national park .....	58
B Description of ten vegetation communities found on Norfolk Island .....	62
C Breeding birds of Norfolk Island and their resident status .....	65
D Flora species of Norfolk Island listed under the <i>Environment Protection and Biodiversity Conservation Act 1999</i> .....	71
E Endemic plants of Norfolk Island not listed under the <i>Environment Protection and Biodiversity Conservation Act 1999</i> .....	73
F Fauna species of Norfolk Island listed under the <i>Environment Protection and Biodiversity Conservation Act 1999</i> .....	74





G	Key Threatening Processes listed under the EPBC Act relevant to Norfolk Island Group .....	153
H	Principal and potential weed species of Norfolk Island .....	163
I	Major threats to flora and fauna species of Norfolk Island .....	165
J	Values, threats and management of public reserves on Norfolk Island .....	170
K	Properties listed on the Norfolk Island Heritage Register for their significant natural heritage .....	172



## 1. Introduction

The Norfolk Island Group is founded on a seamount of volcanic origin located in the South Pacific Ocean (29° 02'S, 167° 57'E). As well as the main island, the Territory of Norfolk Island includes Nepean and Phillip Islands (small uninhabited islands to the south of Norfolk Island) and numerous rocky islets dotted about the Norfolk Island coastline. The coastline is mainly bounded by precipitous cliffs of basalt and tuff and is about 32 kilometres in length. The plateau averages around 100 metres above sea level with two peaks in the north over 300 metres. Norfolk Island is about 1,700 kilometres from Sydney, 1,100 kilometres from Auckland and 1,420 kilometres from Fiji. The nearest land is New Caledonia (875 kilometres) and Lord Howe Island (900 kilometres).

The islands of the Norfolk Group are truly oceanic and with few oceanic islands occurring between latitude 25°S and 35°S this island group is an important link between tropical and temperate environments.


Norfolk Island has a land area of 3,455 hectares of which about 75 per cent is held privately as freehold or leasehold, with the remainder Crown land designated for a range of public uses including conservation. Phillip and Nepean Islands have land areas of 190 hectares and 10 hectares respectively and are reserved for conservation.

### 1.1 Geology and Geomorphology

Norfolk and Phillip Islands are small remnants of a large volcano that developed on the Norfolk Ridge. The volcanic land-mass of which they are a part was created during several eruptions between 3.1 and 2.3 million years ago. (This compares to Lord Howe Island which is a remnant of a much earlier volcanic eruption and so is an older formation.) Nepean Island, located between Norfolk and Phillip Islands and much smaller, is not volcanic in origin but is composed of calcarenite, a form of limestone.

One of the two main volcanic vents was in the vicinity of the peaks on the main island, Mount Pitt and Mount Bates (318 metres and the highest point in the Territory). The other main geological feature is the southern plateau which occupies most of the island, has an average height of 100 metres and is dissected by deep narrow valleys. There is a smaller plateau in the northwest near Duncombe Bay. The fourth physical region is the coastal lowland around Kingston, comprising the land formed by silting behind the dune barrier.

Surface water is restricted on Norfolk Island with no lakes and few wetlands. There are only six permanently flowing year round streams on the island; all are relatively small compared to the valleys they occupy suggesting they were eroded largely during a wetter period and only two discharge at sea level. Precipitous cliffs surround the island and most of the valleys hang over the cliffs suggesting that wave action has been the most important force in shaping the main features of the landscape. However, normal weathering of the basalt has resulted in an overburden of clay up to 40 metres deep in places, making the surface relatively even. The upper surface of the basalts and tuffs has weathered to give a red krasnozem soil rich in clay over extensive areas. Soils are nutrient rich and well structured but also friable and relatively porous. They are prone to mass movement such as soil creep, slumps and landslips if vegetation cover has been degraded and lost or after heavy rain.



Most of the water that percolates down through the soil becomes part of a deep body of freshwater situated at approximately sea level. This watertable builds up during wet periods and replaces seawater in tunnels mainly on the west side of the island and discharges into the sea.

On Phillip Island there are three and possibly four volcanic vents. The tuff and ash beds are very friable which, together with the sparsity of vegetation, has resulted in severe erosion; at least two metres of topsoil have been removed in some places. Some of the valleys on Phillip Island have formed within living memory and soil washed from the island colours the sea red following rain. Jacky Jacky (280 metres) is the high point, steep cliffs fringe the perimeter, there are no permanent streams and little topsoil left on the island (Norfolk Island Conservation Society 1988).

## 1.2 Climate

The climate of Norfolk Island is moderated by oceanic air currents and mild sea temperatures. The average daily minimum temperature ranges from 11.0°C to 23.4°C through the year and the average daily maximum temperature ranges from 15.8°C to 26.5°C, with only 6°C separating the winter and summer means. The average daily range of temperatures is also only about 6°C. Annual average rainfall is 1,320 millimetres with a maximum in the winter months. Prevailing sea currents are east to north-easterly (except in the north-west monsoon when they are highly variable) and the prevailing winds are east to south-easterly for most of the year, swinging to the west or south-west in mid-winter.

## 1.3 History

Norfolk Island was discovered by Captain James Cook in 1774 and settled by Europeans in 1788. At the time of European settlement the island was uninhabited although the presence of a banana grove, Polynesian rats (*Rattus exulans*) and stone axes showed that Polynesians visited the island for short periods (Norfolk Island Conservation Society 1988, Gilmour & Helman 1989a, 1989b) and excavations have revealed evidence of a small Polynesian village (Anderson 1996).

The aim of the initial European settlement of the island was to clear land for the cultivation of native flax, as well as grains and vegetables to support the new colony at Port Jackson. The island had two periods of operation as a penal colony, the first from 1788 until 1814 after which it remained uninhabited for 10 years and the second from 1825 until 1855.

In 1856 the inhabitants of Pitcairn Island were granted the occupancy of Norfolk Island. These settlers cultivated the land that had been cleared by the convicts and agriculture became the economic base of the island. Trade with the mainland in a number of crops developed, one crop passing to another as markets changed. Whaling was also an important commercial activity in fits and starts for over a century from about 1850. Following the wartime construction of the airfield the economy of the island changed and tourism became its mainstay.

At the time of settlement the island was covered with dense forest, which now largely remains on the highest land (Green 1994). Since settlement, land use had a very significant impact on the vegetation.



Accounts by early settlers describe the vegetation as a very dense formation with complete canopy excluding light, very little growth on the forest floor and towering emergent pines being in great abundance (Hoare 1969). The early penal colonies and free settlers progressively cleared much of the natural vegetation for agriculture and timber export during the first 75 years of settlement.

During its time as a penal colony most of the island apart from the two mountains and the land to the north were cleared for crops or pasture (Benson 1980). Following the removal of convicts in 1855 the island supported a smaller agricultural community. Only about 100 hectares were under cultivation and much of the island was neglected and invaded by weeds (Gilmour & Helman 1989a, 1989b). By the mid 1920s previously cleared land again supported pines trees but dense stands only occurred in areas where it was too steep to support grazing (Benson 1980). Introduced weeds invaded the remnant rainforest to the north of the mountains and very little of the original vegetation was left in its virgin state (Benson 1980).


#### 1.4 Vegetation

In 1788 the island was covered with dense subtropical rainforest with Norfolk Island pine (*Araucaria heterophylla*) particularly abundant on the lower levels and slopes. The major remnant of native forest today is included in the Mt Pitt section of the Norfolk Island National Park centred on the two high peaks of the island (see section 1.6). There are also a number of remnants on lower areas, some of which have been fenced from wandering cattle and where native trees and other indigenous plants persist (Table A).

There are 182 native plant species (of which about 25 per cent are endemic) and a further 370 naturalised species on the Norfolk Island Group (Mills 2009a). There are two monotypic endemic genera: *Ungeria* represented by *U. floribunda*, which is listed as vulnerable, and *Streblorrhiza* represented by *S. speciosa*, endemic to Phillip Island but now extinct (Green 1994).

The distribution of vegetation species and communities is influenced by altitude, aspect, terrain, topography and proximity to the sea. Gilmour and Helman (1989a, 1989b) identified nine vegetation communities (Table B). The first two vegetation types occur in the Mt Pitt section of the national park. Of the other groups, some are represented partly in the national park but mostly outside and others only occur outside the park as remnants. From this work they reconstructed the original vegetation and identified the following types of vegetation: palm forest, hardwood subtropical rainforest with emergent pines, drier forest with pines, viney rainforest, pine-white oak forest, coastal stunted shrub community, rocky scrub dominated by ferns (Gilmour & Helman 1989a, 1989b, Mosley 2001).

Phillip Island is sparsely vegetated and almost entirely surrounded by rocky shoreline with steep, precipitous cliffs (Cogger 2004). At the time of European settlement Phillip Island was probably covered by a variety of vegetation types including rank grasses, dense thickets of shrubs and a dense cover of small trees with emergent pines (Cogger 2004). It was probably never as heavily forested as the main island, and following the introduction of pigs and goats (both of which were eradicated in the early years of the Pitcairn settlement) and rabbits, the original vegetation was almost totally destroyed leading to severe erosion (Green 1994).



Rabbits were eradicated in 1986 and since that time there has been significant regeneration of vegetation particularly in the gullies where soil pockets and collected precipitation provide good conditions for plant growth (Cogger 2004). Weed invasion of Phillip Island has been significant, particularly by African olive (*Olea europaea* subsp. *cuspidata*).

## 1.5 Fauna

The fauna of Norfolk Island is notable for its birds, both large numbers of sea birds and a number of endemic land birds. There are 102 species of birds recorded for Norfolk Island and adjacent islands in modern times. Of these, 32 species are resident breeding land or freshwater birds, 15 are regular breeding seabirds and six have become extinct since European settlement. The remainder are non-breeding migrants or vagrants (Schodde *et al.* 1983, Christian 2005).

Many of the breeding land and freshwater birds were deliberately introduced or arrived on the island independently following European settlement, utilising newly created (cleared) habitats (Table C). Breeding seabirds are now largely restricted to Phillip Island and the other adjacent islands however seabirds formerly nested on the peaks of Mt Bates and Mt Pitt in large numbers before being extirpated via hunting for food shortly after settlement.

There are two native land reptiles, the Lord Howe Island skink (*Oligosoma lichenigera*) and the Lord Howe Island gecko (*Christinus guentheri*) that are endemic to the Norfolk and Lord Howe Island groups. Neither is now found on the main island but both species occur on Phillip Island and the gecko also occurs on Nepean Island and the small rocky islets Moo'oo Stone and Bird Rock (Cogger 2004). The Asian house gecko (*Hemidactylus frenatus*) is a recent introduction to the main island (Director of National Parks 2008a).

Two bat species are the only native land mammals that have been recorded. They are the East Coast free-tail bat (*Mormopterus norfolkensis*) and Gould's wattled bat (*Chalinolobus gouldii*) although it is likely that the former was described from Norfolk Island in error and never occurred there (Hoye *et al.* 2008). Only the latter species has been seen on the island in recent years and may now be locally extinct. Both species occur on mainland Australia.

As on many other islands, introduced mammals have been responsible for significant environmental degradation. The Polynesian rat (*Rattus exulans*) was introduced by early Polynesian visitors prior to Cook's discovery of the island. The black rat (*Rattus rattus*) was introduced from a ship wreck in 1942, while the house mouse (*Mus musculus*) and the feral cat (*Felis catus*) were probably introduced during the penal settlement era (Wilson 2002). The introduction of pigs, goats and rabbits to Phillip Island during the early settlement period destroyed most of the island's vegetation prior to their eradication.

There is also a rich invertebrate fauna including a diverse assemblage of endemic land snails, an endemic cricket and an endemic centipede, cockroaches and beetles, much of which remains to be investigated. There are also a number of introduced invertebrates. Several species of land snails are threatened and are listed under Commonwealth legislation.



## 1.6 Protected Areas and Reserves

The Norfolk Island National Park consists of two areas. The original component (referred to as the Mt Pitt section) was established when the *Norfolk Island National Park and Norfolk Island Botanic Garden Act 1984* (NI) came into force on 12 February 1985 and was also proclaimed under Commonwealth legislation in January 1986 following a request from the Norfolk Island Legislative Assembly. Phillip Island was added as the second component to the national park in 1996. Both had previously been public reserves under the *Commons and Public Reserves Ordinance 1936* (NI). The total area of the national park is 650 hectares, comprising the Mt Pitt section of 460 hectares (including a forestry zone managed in part for forestry) and Phillip Island (190 hectares).

The Norfolk Island Botanic Garden is a 5.5 hectare reserve established under both Commonwealth and Norfolk Island legislation to provide a place where specimens of Norfolk's unique flora can be conveniently seen and appreciated.

The Director of National Parks (Australian Government) is responsible for administration, management and control of the national park and botanic garden under the *Environment Protection and Biodiversity Conservation Act 1999* (Cwth) and in accordance with a management plan prepared under the Act. The current management plan is in effect from 2008 to 2018 (Director of National Parks 2008a).

The Norfolk Island National Park Advisory Committee (NINPAC) advises the Director and the Norfolk Island Government on implementation of the management plan. In preparing the management plan a number of Norfolk Island Acts must be considered. These include: *Commons and Public Reserves Act 1936*, *Timber Licenses Act 1913*, *Birds Protection Act 1913 & Amendment Act 1988*, *Migratory Birds Act 1980*, *Endangered Species Act 1980* and *Crimes Act 1914*.

An important component of the Norfolk Island protected areas system is a network of 20 public reserves totalling 237 hectares or 6.5 per cent of the Territory. Most are located around the coast and many are of value for nature conservation (Mosley 2001). The reserves, formerly proclaimed under the *Commons and Public Reserves Ordinance 1936* (NI) and now under the *Public Reserves Act 1997* (NI), are the responsibility of the Administrator and are managed by the Conservator of Public Reserves and the Norfolk Island Parks and Forestry Service. Table J lists the major public reserves with nature conservation significance and summarises their values and management actions undertaken.

Phillip Island and eight of the Norfolk Island public reserves (Anson Bay, Ball Bay, Bumbora, Hundred Acres, Nepean Island, Point Ross, Selwyn and Two Chimneys Reserves) are included on the Commonwealth Heritage List established under the EPBC Act in recognition of their nature conservation significance. Norfolk Island National Park and 10 of the public reserves including the Nepean Island Reserve are also listed on the Norfolk Island Heritage Register for their significant natural heritage (see Table K).

**Table A: Sites of significant habitat on Norfolk Island outside the national park (NB: sites described include reserves and Crown leases)**

Location	Listed Flora	Listed Fauna (a)	Description
Anson Bay-Duncombe Bay  Significant Remnant A includes 99a, 100b1, 100g1	<i>Coprosma baueri</i> <i>Melicope littoralis</i> <i>Melicytus latifolius</i> <i>Meryta angustifolia</i> <i>Meryta latifolia</i> <i>Muehlenbeckia australis</i> <i>Myoporum obscurum</i> <i>Myrsine ralstoniae</i> <i>Pittosporum bracteolatum</i> <i>Pteris kingiana</i> <i>Streblus pendulinus</i> <i>Ungeria floribunda</i>	white tern, green parrot	Anson Bay Reserve, Selwyn Reserve and the Duncombe Bay area contain small patches of pine/hardwood forest or pine/white oak coastal forest. The upper slopes and edges of the coastal cliff between Anson Bay and Duncombe Bay are important nesting habitat for the migratory birds wedge-tailed shearwater and black-winged petrel. Blocks between Anson Point and Vincent Point are listed on the Register of the National Estate. There are several remnants of native forest that contain important populations of threatened plant species as well as providing habitat for endemic land birds and white terns. The area south of Anson Beach is important white tern nesting area.
Hundred Acres Reserve	<i>Achyranthes arborescens</i> <i>Cordyline obtecta</i> <i>Melicytus ramiflorus</i> ssp <i>oblongifolius</i> <i>Myoporum obscurum</i> <i>Myrsine ralstoniae</i> <i>Pittosporum bracteolatum</i> <i>Pouteria costata</i> <i>Pteris kingiana</i> <i>Senecio australis</i>		Largest area of pine/oak forest existing on the island, regenerated due to protection from grazing.
Point Ross Reserve	<i>Pteris kingiana</i>		Some coastal headland vegetation.
Creswell Bay area (including Bumbora Reserve)	<i>Cordyline obtecta</i> <i>Euphorbia norfolkiana</i> <i>Meryta latifolia</i> <i>Pteris kingiana</i> <i>Myrsine ralstoniae</i> <i>Senecio australis</i>		Most of the area supports open pine/oak coastal forest with an understorey of introduced grasses. Where grazing has been restricted there is regeneration of native species. There is a small gully containing one of three known populations of <i>Euphorbia norfolkiana</i> . Another population is found at Bumbora Reserve.



Location	Listed Flora	Listed Fauna (a)	Description
Mission Road North  Significant Remnant B includes 145e, 149e, 145d  Significant Remnant C includes 175c, 152a, 152d5, 149q	<i>Achyranthes arborescens</i> <i>Boehmeria australis</i> <i>Crepidomanes endlicherianum</i> <i>Lastreopsis calantha</i> <i>Melicope littoralis</i> <i>Melicytus latifolius</i> <i>Melicytus ramiflorus</i> subsp. <i>oblongifolius</i> <i>Meryta angustifolia</i> <i>Meryta latifolia</i> <i>Pennantia endlicheri</i> <i>Pouteria costata</i> <i>Streblus pendulinus</i> <i>Zehneria baueriana</i>	green parrot, scarlet robin, white tern	Contains a significant remnant of viney sub-tropical rainforest that is poorly represented in the national park. Most remnants are contiguous with forest in the national park or botanic garden. Some areas were fenced and weeded by Parks Australia in 1994-95 including Significant Remnant B, while other areas have had cattle excluded for many years. Significant Remnant C forms a corridor of contiguous canopy between the national park and botanic garden. There are good populations of several listed plant species and habitat for endemic land birds (in particular green parrot and scarlet robin) and white terns. 175C provides a wildlife corridor for specific species.
Puppy's Point		white tern, wedge-tailed shearwater	The cliff top and edge of some of these blocks provide habitat for nesting wedge-tailed shearwaters and the scattered mature pines provide nesting habitat for white terns.
Mission Road South	<i>Meryta angustifolia</i> <i>Meryta latifolia</i>	white tern, land birds	A few small remnants of viney forest and pine/hardwood forest.
Mt Pitt Rd to Selwyn Pine Rd  Significant Remnant D includes 154g, 155g, 155l, 155h, 154h	<i>Blechnum norfolkianum</i> <i>Lastreopsis calantha</i> <i>Muehlenbeckia australis</i> <i>Melicytus ramiflorus</i> <i>Meryta angustifolia</i> <i>Meryta latifolia</i> <i>Pennantia endlicheri</i> <i>Streblus pendulinus</i>	green parrot, white tern	Several areas of pine over hardwood forest, mainly on the southwest slopes of the ridges. Most patches are contiguous with adjacent areas and with forest in the national park and form Significant Remnant D.
Selwyn Reserve	<i>Coprosma baueri</i> <i>Cordyline obtecta</i> <i>Pteris kingiana</i> <i>Myrsine ralstoniae</i>		Coastal vegetation on the cliffs and some rainforest in the gully.
Cascade and Quarantine Reserves, Prince Phillip Drive	<i>Boehmeria australis</i> <i>Cordyline obtecta</i> <i>Crepidomanes endlicherianum</i> <i>Muehlenbeckia australis</i> <i>Meryta latifolia</i> <i>Myrsine ralstoniae</i> <i>Streblus pendulinus</i>		Remnants of hardwood forest and pine/hardwood forest some of which is not grazed and relatively weed free. A small fenced section in the eastern part of Cascade Reserve contains coastal forest with scattered regeneration and heavy weed infestation. The southwest corner of Quarantine Reserve contains a small area of very disturbed native forest that is infested with weeds.





Location	Listed Flora	Listed Fauna (a)	Description
Two Chimneys Reserve	<i>Coprosma baueri</i> <i>Dysoxylum bijugum</i> <i>Pittosporum bracteolatum</i> <i>Myrsine ralstoniae</i> <i>Senecio australis</i>		Thinly scattered pines and coastal vegetation.
Steels Point	<i>Melicytus latifolia</i>	nesting seabirds	Remnant patches of forest including some areas that are protected from grazing.
North of Cascade	<i>Blechnum norfolkianum</i> <i>Boehmeria australis</i> <i>Clematis dubia</i> <i>Crepidomanes endlicherianum</i> <i>Lastreopsis calantha</i> <i>Melicope littoralis</i> <i>Melicytus ramiflorus</i> <i>Meryta angustifolia</i> <i>Meryta latifolia</i> <i>Pennantia endlicheri</i> <i>Pteris kingiana</i> <i>Pteris zahlbruckneriana</i> <i>Streblus pendulinus</i> <i>Ungeria floribunda</i>	black noddy, white tern, scarlet robin, green parrot  endemic land birds	Coastal blocks in this area are important nesting areas for the black noddy and white tern. There are several remnants that contain listed plant species that are not well represented in the national park. The valleys between Red Road and JE Road, although weed infested, contain some of the best populations of ferns, particularly filmy ferns.
Bloody Bridge/ Collins Head (Gannet Point)	<i>Pittosporum bracteolatum</i> <i>Pteris kingiana</i>	black noddy, white tern	Southern section contains a good example of Pine/oak coastal forest. Important nesting location for black noddy and white tern. The understorey of this coastal forest is much less weedy than at many other locations and there is regeneration of pines where they are protected from cattle grazing.
Kingston Common Reserve	<i>Abutilon julianae</i> <i>Coprosma baueri</i> <i>Cordyline obtecta</i> <i>Euphorbia obliqua</i> <i>Meryta latifolia</i> <i>Myrsine ralstoniae</i> <i>Pittosporum bracteolatum</i>		Primarily mown and grazing exotic grassland.



Location	Listed Flora	Listed Fauna (a)	Description
Ball Bay	<i>Boehmeria australis</i> <i>Cordyline obtecta</i> <i>Dysoxylum bijugum</i> <i>Euphorbia norfolkiana</i> <i>Melicytus ramiflorus</i> ssp <i>oblongifolius</i> <i>Muehlenbeckia australis</i> <i>Pittosporum bracteolatum</i> <i>Pteris kingiana</i> <i>Myrsine ralstoniae</i> <i>Senecio australis</i> <i>Streblus pendulinus</i>		Bucks Point Reserve is another area of heavily grazed pine/oak coastal forest with little regeneration. In the western end of the reserve is a small gully containing a population of <i>Euphorbia norfolkiana</i> . Rather badly weed infested.
Cemetery Reserve	<i>Euphorbia obliqua</i>		Some coastal vegetation along the fence lines and outside the cemetery proper
Point Hunter Reserve	<i>Euphorbia obliqua</i>		Coastal dune vegetation near foreshore.
Other locations 174a1 68k 47b	<i>Hypolepis dicksonioides</i> <i>Pittosporum bracteolatum</i>	white tern	Small remnants of native forest

(a) Listed under EPBC Act as threatened and/or migratory and/or marine

**Sources:** Gilmour & Helman 1989a, 1989b, 2001b; Norfolk Island Conservation Society 1988; Mills 2007b.



**Table B: Description of ten vegetation communities found on Norfolk Island**

Vegetation Community	Description	Key Species
<b>Group 1</b> Palm Forest	Palm forest community of sheltered mountain gullies and upper slopes at mid to high altitude, mainly in the southeast basin in the shelter of Mt Pitt and Mt Bates. It also occurs in high gullies and upper slopes of basins in the northern and western zones. It is dominated by Norfolk palm.	<i>Baloghia inophylla</i> (bloodwood) <i>Nestegis apetala</i> (ironwood) <i>Pittosporum bracteolatum</i> (oleander) <i>Myrsine ralstoniae</i> (beech) <i>Dysoxylum bijugum</i> (sharkwood) <i>Pennantia endlicheri</i> <i>Zanthoxylum pinnatum</i> (little yellowwood) <i>Coprosma pilosa</i> (mountain coprosma) <i>Melicytus ramiflorus</i> subsp. <i>oblongifolius</i> (whiteywood) <i>Meryta angustifolia</i> (narrow-leaved meryta) <i>Cyathea brownii</i> (tree fern) <i>Cyathea australis</i> subsp. <i>norfolkensis</i> (tree fern) <i>Freycinetia baueriana</i> (mountain rush) <i>Macropiper excelsum</i> (pepper tree) <i>Asplenium diaphanum</i> (two frond fern) <i>Blechnum norfolkianum</i> (Norfolk water fern) <i>Adiantum diaphanum</i> (three frond maidenhair) <i>Marratia salicina</i> (king fern)
<b>Group 2</b> Hardwood sub-tropical rainforest with occasional emergent pines	This group is the hardwood forest community (or sub-tropical rainforest) that generally occurs on the upper slopes of Mt Pitt–Mt Bates area and occasionally on sheltered ridges, slopes and in gullies at lower altitudes. There is usually a canopy consisting of a number of different hardwood trees and some areas have emergent Norfolk Island pine over the hardwood canopy.	<i>Araucaria heterophylla</i> (Norfolk Island pine) <i>Baloghia inophylla</i> (bloodwood) <i>Nestegis apetala</i> (ironwood) <i>Dysoxylum bijugum</i> (sharkwood) <i>Pittosporum bracteolatum</i> (oleander) <i>Myrsine ralstoniae</i> (beech) <i>Rhopalostylis baueri</i> (Norfolk palm) <i>Meryta angustifolia</i> (narrow-leaved meryta) <i>Cordyline obtecta</i> (ti) <i>Macropiper excelsum</i> (pepper tree)
<b>Group 3</b> Drier forest with pines	This is the drier forest community dominated by Norfolk Island pine that occurs mainly on middle altitude ridges and exposed slopes. It comprises emergent pines over either a hardwood or a pine/hardwood canopy.	<i>Araucaria heterophylla</i> (Norfolk Island pine) <i>Nestegis apetala</i> (ironwood) <i>Elaeodendron curtispiculum</i> (maple) <i>Lagunaria patersonia</i> (white oak) <i>Myrsine ralstoniae</i> (beech) <i>Dysoxylum bijugum</i> (sharkwood) <i>Alyxia gynopogon</i> (evergreen) <i>Arachnoides aristata</i> (prickly shieldfern) <i>Oplismenus hirtellus</i> <i>Doodia australis</i> (common raspfern) <i>Carex neesiana</i> (sedge)



Vegetation Community	Description	Key Species
<b>Group 4</b>	<p>This group represents the moderately to heavily weed infested native forest communities and is a modification of groups 1 and 2. It mainly occurs at lower altitude areas of the park where disturbance from logging, grazing and clearing has occurred. The structure of this group is variable from emergent pine over a hardwood canopy with a sub-canopy of weed species to scattered hardwood trees emergent from a low canopy of weed species. The small shrub and ground layers are also variable depending on the density of weeds.</p>	<p><i>Araucaria heterophylla</i> (Norfolk Island pine)  <i>Elaeodendron curtispiculum</i> (maple)  <i>Myrsine ralstoniae</i> (beech)  <i>Pittosporum bracteolatum</i> (oleander)  <i>Nestegis apetala</i> (ironwood)  <i>Arachnoides aristata</i> (prickly shieldfern)</p>
<b>Group 5</b>	<p>The sites in this small group lie outside the Norfolk Island National Park, with one at Duncombe Bay in the north west, one just outside the southern boundary of the national park and one at Steels Point in the east of the island. This probably represents the type of forest that was once widespread over the ridges and flats of the main plateau of Norfolk Island. It is a drier, floristically less diverse forest than that which occurs in the national park. Most of this type of forest has been grazed. There is usually emergent tall Norfolk Island pine over a continuous canopy of hardwood species, a variable shrub layer and a sparse ground layer. Native shrubs are uncommon due to grazing.</p>	<p><i>Araucaria heterophylla</i> (Norfolk Island pine)  <i>Lagunaria patersonia</i> (white oak)  <i>Nestegis apetala</i> (ironwood)  <i>Elaeodendron curtispiculum</i> (maple)  <i>Dysoxylum bijugum</i> (sharkwood)  <i>Baloghia inophylla</i> (bloodwood)  <i>Capparis nobilis</i> (Devils guts)</p>
<b>Group 6</b> Viney rainforest	<p>This group represents the dense hardwood forest community that occurs mainly outside the Norfolk Island National Park in the area between Mission Road and the national park. This area is characterised by the very dense canopy, very large tree trunk diameters, unusual canopy species and the large woody vine species.</p>	<p><i>Celtis paniculate</i> (whitewood)  <i>Pouteria costata</i> (bastard ironwood)  <i>Baloghia inophylla</i> (bloodwood)  <i>Nestegis apetala</i> (ironwood)</p>



Vegetation Community	Description	Key Species
<b>Group 7</b>	This group occurs at low altitude in the north and north west of the park, particularly in areas that were disturbed by grazing, logging or clearing, and is heavily weed infested. There are occasional emergent individuals of Norfolk Island pine or maple, and beech occurs fairly consistently in the low weedy understorey. There is little regeneration of native species with the weeds red guava and African olive dominating the ground layer.	<i>Araucaria heterophylla</i> (Norfolk Island pine) <i>Elaeodendron curtispiculum</i> (maple) <i>Myrsine ralstoniae</i> (beech)
<b>Group 8</b>	This group comprises two coastal sites one at Bird Rock in the north east of the national park and the other at Bloody Bridge in the south east of the island. It is characterised by large emergent or isolated Norfolk Island pine over white oak.	<i>Araucaria heterophylla</i> (Norfolk Island pine) <i>Lagunaria patersonia</i> (white oak)
<b>Group 9</b> Pine-oak forest	The community defined by this group is the Norfolk Island pine and white oak forest of the coastal reserves outside of the Norfolk Island National Park.	<i>Araucaria heterophylla</i> (Norfolk Island pine) <i>Lagunaria patersonia</i> (white oak)
<b>Group 10</b> Coastal vegetation	This group includes two distinct habitats (sandy beaches and coastal headlands) restricted to the fringe of the island. Headland vegetation is found mostly in the public reserves and national park and in inaccessible steep slopes. The area of beach vegetation is low due to limited distribution of sandy beaches and significant disturbance.	<i>Achyranthes aspera</i> (chaff-flower) <i>Carpobrotus glaucescens</i> (pigface) <i>Ipomoea pes-caprae</i> (goats-foot morning glory) <i>Isolepis nodosa</i> (knobby club-rush) <i>Sporobolus virginicus</i> (salt couch)

**Sources:** Gilmour & Helman 1989a, 1989b; Mills 2007c



**Table C: Breeding birds of Norfolk Island and their resident status**

Scientific name	Common Name	Status
<b>Breeding Land and Freshwater Birds</b>		
<i>Anas platyrhynchos</i>	mallard	Self-introduction? first record 1971
<i>Anas superciliosa</i>	Pacific black duck	Self-introduction
<i>Artamus personatus</i>	masked woodswallow	Self- introduction, first record 1996
<i>Callipepla californica</i>	California quail	Introduced about 1900
<i>Carduelis carduelis</i>	European goldfinch	Introduction, first record 1963
<i>Carduelis chloris</i>	European greenfinch	Introduction, first record 1939
<i>Chalcophaps indica</i>	emerald dove	Self-introduction 1800s
<i>Chrysococcyx lucidus</i>	shining bronze-cuckoo	Native
<i>Columba livia</i>	feral pigeon	Early introduction
<i>Cyanoramphus cookii</i>	Norfolk Island green parrot	Threatened endemic
<i>Egretta novaehollandiae</i>	white-faced heron	Self-introduction
<i>Eudynamys taitensis</i>	long-tailed cuckoo	Native
<i>Falco cenchroides</i>	Australian kestrel	Self-introduction, first record 1969
<i>Gallirallus phillippensis</i>	buff-banded rail	Uncertain
<i>Gallus gallus</i>	feral fowl	Early introduction
<i>Gerygone modesta</i>	grey gerygone	Endemic
<i>Hirundo neoxena</i>	welcome swallow	Self introduction, first record 1969
<i>Ninox novaeseelandiae undulata</i>	Norfolk Island boobook owl	Threatened endemic (hybrid pop)
<i>Pachycephala pectoralis xanthoprocta</i>	Norfolk Island golden whistler	Threatened endemic
<i>Passer domesticus</i>	house sparrow	Self-introduction? first record 1939
<i>Petroica multicolor multicolor</i>	Norfolk Island scarlet robin	Threatened endemic
<i>Platyercus elegans</i>	crimson rosella	Early introduction
<i>Porphyrio porphyrio</i>	purple swamphen	Self introduction
<i>Porzana tabuensis</i>	spotless crane	Uncertain
<i>Rhipidura fuliginosa pelzelni</i>	grey fantail (NI)	Endemic
<i>Sturnis vulgaris</i>	common starling	Self-introduction? first record 1913
<i>Todiramphus sanctus norfolkiensis</i>	sacred kingfisher (NI)	Endemic
<i>Turdus merula</i>	European blackbird	Introduction? first record 1920
<i>Turdus philomelos</i>	song thrush	Introduction first record 1913
<i>Zosterops lateralis</i>	silvereve	Self-introduction, first record 1904
<i>Zosterops tenuirostris</i>	slender-billed white-eye	Endemic

Scientific name	Common Name	Status
<b>Breeding Seabirds</b>		
<i>Anous minutus</i>	black noddy	Breeding resident
<i>Anous stolidus</i>	common noddy	Breeding resident
<i>Gygis alba</i>	white tern	Breeding resident
<i>Morus serrator</i>	Australian gannet	Breeding resident
<i>Phaethon rubricauda</i>	red-tailed tropicbird	Breeding resident
<i>Procelsterna cerulea albivitta</i>	grey ternlet (western Pacific)	Breeding resident
<i>Pterodroma cervicalis</i>	white-necked petrel	Breeding resident
<i>Pterodroma neglecta neglecta</i>	Kermadec petrel (western)	Breeding resident
<i>Pterodroma nigripennis</i>	black-winged petrel	Breeding resident
<i>Pterodroma solandri</i>	providence petrel	Breeding resident
<i>Puffinus assimilis</i>	little shearwater	Breeding resident
<i>Puffinus carneipes</i>	fleshy-footed shearwater	Breeding resident
<i>Puffinus pacificus</i>	wedge-tailed shearwater	Breeding resident
<i>Sterna fuscata</i>	sooty tern	Breeding resident
<i>Sula dactylatra</i>	masked booby	Breeding resident
<b>Extinct Modern Taxa</b>		
<i>Aplonis fusca fusca</i>	Norfolk Island starling	Extinct endemic
<i>Gallicolumba norfolciensis</i>	Norfolk Island ground dove	Extinct endemic
<i>Hemiphaga novaeseelandiae spadicea</i>	New Zealand pigeon (NI)	Extinct endemic
<i>Lalage leucopyga leucopyga</i>	Norfolk Island triller	Extinct endemic
<i>Nestor productus</i>	Norfolk Island kaka	Extinct endemic
<i>Turdus poliocephalus poliocephalus</i>	grey-headed blackbird	Extinct endemic
<i>Zosterops albogularis</i>	white-breasted white-eye	Extinct endemic

**Sources:** Schodde *et al.* 1983; Christian 2005



## 2. Overview of Species

Norfolk Island has 58 threatened species listed under the *Environment Protection and Biodiversity Conservation Act 1999* (Cwth) comprised of 46 plants, five birds, two reptiles and five endemic land snails. There are an additional six bird species that are known to have become extinct in historical times.

### 2.1 Flora Species

Forty six plant species are listed as threatened plant species under the EPBC Act (Table D). Of these, 30 species are endemic to Norfolk Island and Phillip Island (of which two are endemic to Phillip Island), two species endemic to the Norfolk Island and Lord Howe Island Groups and one “almost endemic” in that it is known outside of Norfolk Island from only a single individual (Green 1994). There are also 13 plant species that are endemic to Norfolk Island and Phillip Island but are not listed under the EPBC Act (Table E).

Norfolk Island has a relatively diverse and prolific lichen fauna. The areas of subtropical rainforest within the Norfolk Island National Park are the major habitat for lichens, and the higher, moister ridges support the greatest diversity of bryophytes on the island. Invasion of forested areas by weeds, particularly red guava (*Psidium cattleianum cattleianum*) and African olive (*Olea europaea* subsp. *cuspidata*), represents the major threat to the lichen fauna, while these two species and lantana (*Lantana camara*) are a threat to the bryophytes (Elix & Streimann 1985).

### 2.2. Fauna Species


Norfolk Island has 12 fauna species that are listed under the EPBC Act as threatened comprising four land birds, one seabird, two reptiles and five endemic land snails (Table F). Six species of land birds are listed as extinct under the EPBC Act (one of which may still be extant) while a further species known to have become extinct since European settlement is not listed under the Act. There are also a further 22 species of birds that are listed as migratory or marine under the EPBC Act occurring on Norfolk Island.

#### 2.2.1. Land Birds

Of the 15 species or subspecies of endemic land birds of Norfolk Island known to exist at the time of European settlement, six have become extinct (Table C) and the populations of four others have been severely reduced in size and are threatened.

The decline of the land birds occurred during two distinct periods. During the first period between settlement and about 1900, the Norfolk Island subspecies of the New Zealand pigeon (*Hemiphaga novaeseelandiae spadicea*), the Norfolk Island ground dove (*Gallicolumba norfolciensis*), the Norfolk Island kaka (*Nestor productus*), the Norfolk Island starling (*Aplonis fusca fusca*) became extinct. It is also thought that the white-breasted or white-chested white-eye (*Zosterops albogularis*) has become extinct.





In the post-1940s period the long-tailed triller (*Lalage leucopyga leucopyga*) and the grey-headed blackbird or island thrush (*Turdus poliocephalus poliocephalus*) disappeared and there were serious declines in the populations of the Norfolk Island boobook owl (*Ninox novaeseelandiae undulata*) and the Norfolk Island green parrot (*Cyanoramphus cookii*). Populations of commoner land birds such as the Norfolk Island scarlet robin (*Petroica multicolor multicolor*) and the slender-billed white-eye (*Zosterops tenuirostris*) also declined over this period.

The post-1940s period coincided with many changes to the Norfolk Island environment which contributed to these species declines. These were: the introduction of the black rat in the mid 1940s; modification to the environment through clearing, grazing and forestry activities (Smithers & Disney 1969); the replacement of native vegetation by introduced weed species such as guava, olive and lantana (Smithers & Disney 1969); the introduction or self introduction of several non-native birds (Schodde *et al.* 1983); a rapid increase in the tourist population; and increasing use of agricultural poisons such as organochlorides and dieldrin (Olsen 1997).

There are 14 species of seabirds that breed regularly on the Norfolk Island Group, all of which are listed as marine species, four of which are listed as migratory species and one of which is listed as vulnerable under the EPBC Act (Table F).

At the time of the first European settlement, Norfolk Island supported large populations of breeding seabirds, dominated by the summer nesting wedge-tailed shearwater (*Puffinus pacificus*) and the winter nesting providence petrel (*Pterodroma solandri*). Food and supplies for the settlement were in short supply and thousands of birds from the large colony of providence petrels in the Mt Pitt/Mt Bates area were eaten, destroying the breeding colony (the species now breeds largely on Lord Howe Island with several pairs on Phillip Island).

Petrels and shearwaters readily suffer from the effects of habitat disturbance. These groups were the first to disappear from the central Pacific islands following colonisation by man and predatory mammals. While predator control is an important management tool in restoring or enhancing the suitability of some habitats, the survival of these birds depends on identifying and protecting key breeding areas (Hay 1986). As many of these species migrate and spend time feeding far from the island, their populations may be influenced by factors that are far removed from their breeding location, eg climate change-induced changes to food availability in the marine environment.

Predation by rats, feral cats and dogs, degradation of breeding sites through clearing and introduction of weeds, and disturbance by humans and domestic animals means ground nesting seabirds on Norfolk Island are restricted to a few inaccessible sites. The absence of predators and permanent inhabitants on Phillip Island and Nepean Island has however enabled colonies to survive there.

### **2.2.3 Reptiles**

Two native reptile species occur in the Norfolk Island Group, the Lord Howe Island gecko (*Christinus guentheri*) and the Lord Howe Island skink (*Oligosoma lichenigera*). Both are known only from the Norfolk Island and Lord Howe Island complexes.

The introduced Asian house gecko (*Hemidactylus frenatus*) has recently been recorded at three sites on Norfolk Island. This species has been implicated in the decline of some native gecko species in other parts of its range.



#### 2.2.4 Invertebrate Fauna

Many species of invertebrates have been recorded from the Norfolk Island Group although there has never been a complete systematic survey. The Norfolk Island Group once supported many species of land snails, some of which are only known from fossil deposits and many of which were endemic. Nearly 700 species of insects have been recorded of which endemic species comprise 30 species of lepidopterans (moths), 11 species of psocopterans (booklice), 65 species of coleopterans (beetles), collembola (springtails) and one centipede (Smithers 1998). The details below include groups of invertebrates for which significant survey work has been conducted.

**Land Snails.** A major component of the biota of Pacific islands is the land snails that are recognised for their high levels of diversity and endemism (Cowie 2001). The non-marine molluscan fauna for Norfolk Island consists of 68 terrestrial species and one freshwater species and is almost entirely endemic (Smith 1992, Ponder 1997).

Many of the land snails of the Pacific islands are threatened with extinction. Surveys of land snails in Samoa demonstrated that most native species were declining, fewer of the non-indigenous and cryptogenic species were declining and some non-indigenous species are extremely abundant. Threats to the land snail fauna there include alien predators (predominantly rats and predatory snails), competitors including non-indigenous snail species, invasive plants, habitat modification and recreational, agricultural and urban development (Cowie 2001). Many of the recorded extinctions of terrestrial molluscs are those on oceanic islands (Ponder 1997). There have been some extinctions of large land snails on Lord Howe Island mostly due to rats and possibly pigs (Ponder 1997).

Of the Norfolk Island terrestrial molluscs, 20 species appear on the 2008 IUCN Red List (IUCN 2008). On this list six species are presumed extinct, including the only recorded freshwater mollusc *Posticobia norfolkensis*, four species are considered endangered, eight species are considered vulnerable and two species are data deficient. The same pressures that have resulted in the extinction of several birds and plants – environmental degradation and the introduction of feral animals – have probably affected the terrestrial snail fauna as well (Ponder 1997).

Five species, *Advena campbellii campbellii*, *Mathewsoconcha suteri*, *Mathewsoconcha phillipii*, *Mathewsoconcha grayi* and *Quintalia stoddartii* were listed as critically endangered under the EPBC Act in January 2009.

**Orthopterans (Grasshoppers and Crickets).** A survey in 1984 identified 22 native or cryptogenic species of orthopterans on Norfolk and Phillip Islands, with six species found on Phillip Island (Rentz 1988). One species (*Tathra* sp.1) was found associated with the bird rookery in Long Valley on Phillip Island but was not found on Norfolk Island. Its absence from Norfolk may be due to the presence of the introduced cockroach *Periplaneta americana* (Rentz 1988). The endemic orthopteran species are highly localised and the transportation of litter and plants between Norfolk Island and Phillip Island presents a risk of introducing pest species to Phillip Island (Rentz 1988).

The 1984 survey also identified eight species of cockroaches of which five species were introduced and three were considered native (Rentz 1988). The native species were found in the fern and palm forests on Mt Pitt and in the forest margins.



**Lepidopterans (Butterflies and Moths).** There are 263 species of lepidopterans from 29 families that have been recorded on Norfolk and Phillip Islands. These include two endemic subspecies of butterfly both derived from New Caledonia (Holloway 1977) and 14 pest species that have either been introduced or established naturally (Edwards 1985). Two moth species (*Pectinophora scutigera* and *Anisoplaea cosmia*) identified on Phillip Island are known to feed on the fruits of white oak (*Lagunaria patersonia*) and damage the seed. As one of these moths feeds on a range of plants from the family Malvaceae, it may also attack the endangered Phillip Island hibiscus (*Hibiscus insularis*). The widespread use of white oak as a pioneer plant in regeneration work may induce very high populations of these moths (Edwards 1985).

**Coleoptera (Beetles).** The coleopteran fauna of Norfolk and Phillip Islands is depauperate and disharmonic, typical of oceanic islands. There have been 304 species in 46 families identified of which 65 species were considered to be endemic (Weir 1985). There were 57 species found on Phillip Island including five species that were only found there (Weir 1985). The main habitat for many of the coleopterans on Phillip Island was dead wood and leaf litter much of which is supplied by African olive, suggesting that control of African olive should be conducted in conjunction with tree planting to ensure the supply of litter is maintained (Weir 1985).

**Hymenoptera (Bees, Wasps and Ants).** The Norfolk Island Group contains a depauperate hymenopteran fauna that is typical of oceanic islands. There are 219 species recorded from Norfolk Island or Phillip Island including nine endemic species (Naumann 1984, Smithers 1998). Many of the hymenoptera are associated with low flowering herbs and annuals that are abundant in some parts of Phillip Island but excluded by introduced grasses on Norfolk Island (Naumann 1984). Introduced grasses and other weed species such as lantana, African olive and red guava are generally not attractive to hymenoptera.

Fifteen species of ants are known from Norfolk Island including the endemic *Oligomyrmex norfolkensis* (Taylor & Brown 1985, Smithers 1998). Several of the ant species are cosmopolitan or introduced and most of the others can be attributed to the Australian element of the Norfolk fauna, although some are found on Lord Howe Island or in New Zealand (Holloway 1977). The invasive Argentine ant (*Linepithema humile*) has been reported on Norfolk Island (Davis 2008).

**Myriapoda (Centipedes).** The endemic centipede *Cormocephalus coynei* was recorded on Phillip Island by King in 1792 but was not formally described until much later. It is restricted to Phillip and Nepean Islands and grows to 150 millimetres long and 17 millimetres wide. It is found in litter, soil and under bark (Koch 1984).



**Table D: Flora species of Norfolk Island listed under the Environment Protection and Biodiversity Conservation Act 1999**

Species	Common name	EPBC Act Status	Range
<i>Abutilon julianae</i>	Norfolk Island abutilon	Critically Endangered	Endemic
<i>Achyranthes arborescens</i>	chaff tree, soft-wood	Critically Endangered	Endemic
<i>Achyranthes margaretarum</i>	Phillip Island chaff-tree	Critically Endangered	Endemic (to Phillip Is)
<i>Blechnum norfolkianum</i>	Norfolk Island water-fern	Endangered	NI, Kermadec Is, Vanuatu, Samoa, Society Is
<i>Boehmeria australis</i> var. <i>australis</i>	tree nettle, nettletree	Critically Endangered	Endemic
<i>Calystegia affinis</i>	a creeper	Critically Endangered	Endemic to NI and LHI
<i>Clematis dubia</i>	clematis	Critically Endangered	Endemic
<i>Coprosma baueri</i>	coastal coprosma	Endangered	Endemic
<i>Coprosma pilosa</i>	mountain coprosma	Endangered	Endemic
<i>Cordyline obtecta</i>	ti	Vulnerable	NI, NZ
<i>Crepidomanes endlicherianum</i>	middle filmy fern	Endangered	NI, NZ, Fiji, Vanuatu, Samoa and Tahiti but not New Caledonia
<i>Dysoxylum bijugum</i>	sharkwood	Vulnerable	NI, New Caledonia, southern Vanuatu
<i>Elatostema montanum</i>	mountain procris	Critically Endangered	Endemic
<i>Elymus multiflorus</i> var. <i>kingianus</i>	Phillip Island wheat-grass	Critically Endangered	Endemic to NI and LHI
<i>Euphorbia norfolkiana</i>	Norfolk Island euphorbia	Critically Endangered	Endemic
<i>Euphorbia obliqua</i>	a herb	Vulnerable	NI, New Caledonia, Vanuatu
<i>Hibiscus insularis</i>	Phillip Island hibiscus	Critically Endangered	Endemic (to Phillip Is)
<i>Hypolepis dicksonioides</i>	downy ground-fern, brake fern, ground fern	Vulnerable	NI, Kermadec Is, NZ, Samoa, Society Is, Marquesas
<i>Ileostylus micranthus</i>	mistletoe	Vulnerable	NZ, arrived NI 1930s
<i>Lastreopsis calantha</i>	shield-fern	Endangered	Endemic
<i>Marattia salicina</i>	king fern, para, potato fern	Endangered	NI, NZ
<i>Melicope littoralis</i>	shade tree	Vulnerable	Endemic
<i>Melicytus latifolius</i>	Norfolk Island mahoe	Critically Endangered	Endemic
<i>Melicytus ramiflorus</i> subsp. <i>oblongifolius</i>	whiteywood	Vulnerable	Endemic

Species	Common name	EPBC Act Status	Range
<i>Meryta angustifolia</i>	a tree	Vulnerable	Endemic
<i>Meryta latifolia</i>	broad-leaved meryta	Critically Endangered	Endemic
<i>Muehlenbeckia australis</i>	shrubby creeper, pohuehue	Endangered	NI, NZ
<i>Myoporum obscurum</i>	popwood	Critically Endangered	Endemic
<i>Myrsine ralstoniae</i>	beech	Vulnerable	Endemic
<i>Pennantia endlicheri</i>	pennantia	Endangered	Almost endemic (single tree on Three Kings Island (northern tip of NZ) appears to be this species)
<i>Phreatia limenophylax</i>	Norfolk Island phreatia	Critically Endangered	Endemic
<i>Phreatia paleata</i>	an orchid	Endangered	NI, New Caledonia, New Guinea, Solomon Is, Vanuatu
<i>Pittosporum bracteolatum</i>	oleander	Vulnerable	Endemic
<i>Pouteria costata</i>	bastard ironwood	Endangered	NI, NZ
<i>Pteris kingiana</i>	King's brakefern	Endangered	Endemic
<i>Pteris zahlbruckneriana</i>	netted brakefern	Endangered	Endemic
<i>Senecio australis</i>	a daisy	Vulnerable	NI, NZ
<i>Senecio evansianus</i>	a daisy	Endangered	Endemic
<i>Senecio hooglandii</i>	a daisy	Vulnerable	Endemic
<i>Streblus pendulinus</i>	Siah's backbone	Endangered	NI, New Guinea, Micronesia, Vanuatu, New Caledonia, Fiji, Hawaii
<i>Taeniophyllum norfolkianum</i>	minute orchid, ribbon-root orchid	Vulnerable	Endemic
<i>Thelychiton brachypus</i>	Norfolk Island orchid	Endangered	Endemic
<i>Tmesipteris norfolkensis</i>	hanging fork-fern	Vulnerable	Endemic
<i>Ungeria floribunda</i>	bastard oak	Vulnerable	Endemic
<i>Wikstroemia australis</i>	kurrajong	Critically Endangered	Endemic
<i>Zehneria baueriana</i>	native cucumber, giant cucumber	Endangered	NI, New Caledonia

**Sources:** Green 1994, Mills 2007a



**Table E: Endemic plants of Norfolk Island not listed under the Environment Protection and Biodiversity Conservation Act 1999**

Species Name	Common Name	Distribution	Habitat
<i>Alyxia gynopogon</i>	evergreen	Widespread shrub	Shaded forest areas
<i>Araucaria heterophylla</i>	Norfolk Island pine	Widespread	Forests and open areas at all elevations from coastal to peaks
<i>Asplenium dimorphum</i>	two-frond fern, lace fern	Common in forests	Found in forests of NI National Park
<i>Capparis nobilis</i>	Devil's guts	Common in forests	Tall climber in the forests
<i>Carex neesiana</i>	a tufted perennial	Locally common	Damp area by streams in NI National Park
<i>Cyathea australis norfolkensis</i>	rough treefern, farn	Not common	Valleys and upper slopes of Mt Pitt and Mt Bates
<i>Cyathea brownii</i>	Norfolk Island treefern, farn	Common	Occurs at all elevations
<i>Dendrobium macropus macropus</i>	Norfolk Island orchid	Fairly common	Forest areas
<i>Dianella intermedia</i>	a herb	Fairly rare	In grassy and rocky places in light forest and in coastal areas
<i>Freycinetia baueriana</i>	mountain rush, palm-lily, screw palm	Frequent in forested areas	Male plants more common than relatively rare female plants
<i>Korthalsella disticha</i>	mistletoe	Widespread	Parasitises a number of species especially <i>Baloghia inophylla</i> and <i>Citrus jambhirra</i>
<i>Melodinus baueri</i>	big creeper	Not uncommon	Forests from lowest elevations to the summits in NI National Park
<i>Streblorrhiza speciosa</i>	Phillip Island glory pea	Extinct. Was endemic to Phillip Island	

**Sources:** Green 1994, Mills 2007f

**Table F: Fauna species of Norfolk Island listed under the Environment Protection and Biodiversity Conservation Act 1999  
(NB: listed threatened species are in bold type)**

Species	Common Name	EPBC Act status
<b>Land Birds<sup>(a)</sup></b>		
<i>Aplonis fusca fusca</i>	Tasman starling	Extinct, Migratory
<i>Chrysococcyx lucidus</i>	shining bronze-cuckoo	Marine
<b><i>Cyanoramphus cookii</i></b>	<b>Norfolk Island green parrot</b>	Endangered, Migratory
<i>Eudynamys taitensis</i>	long-tailed cuckoo	Marine
<i>Falco cenchroides</i>	Australasian kestrel	Marine, Migratory
<i>Gallicolumba norfolciensis</i>	Norfolk Island ground dove	Migratory <sup>(b)</sup>
<i>Gallirallus phillippensis</i>	buff-banded rail	Marine
<i>Hemiphaga novaeseelandiae spadicea</i>	New Zealand pigeon (NI)	Extinct, Migratory
<i>Hirundo neoxena</i>	welcome swallow	Marine
<i>Lalage leucopyga leucopyga</i>	Norfolk Island triller	Extinct, Migratory
<i>Nestor productus</i>	Norfolk Island kaka	Extinct, Migratory
<b><i>Ninox novaeseelandiae undulata</i></b>	<b>Norfolk Island boobook owl</b>	Endangered, Migratory, Marine
<b><i>Pachycephala pectoralis xanthoprocta</i></b>	<b>Norfolk Island golden whistler</b>	Vulnerable
<b><i>Petroica multicolor multicolor</i></b>	<b>Norfolk Island scarlet robin</b>	Vulnerable
<i>Porphyrio porphyrio</i>	purple swamphen, tarler bird	Marine
<i>Porzana tabuensis</i>	spotless crane	Marine
<i>Todiramphus sanctus</i>	sacred kingfisher (NI), nuffka	Marine
<i>Turdus poliocephalus poliocephalus</i>	grey-headed blackbird, Island thrush	Extinct
<i>Zosterops albogularis</i>	white-breasted white-eye, white-chested white-eye, grinnell	Extinct, Migratory
<i>Zosterops lateralis</i>	silveryeye	Marine
<b>Seabirds</b>		
<i>Anous minutus</i>	black noddy	Marine
<i>Anous stolidus</i>	brown noddy, common noddy	Marine, Migratory
<i>Gygis alba candida</i>	white tern	Marine
<i>Morus serrator</i>	Australasian gannet	Marine
<i>Phaethon rubricauda</i>	red-tailed tropicbird	Marine
<i>Procelsterna cerulea albivitta</i>	grey ternlet (western Pacific)	Marine



Species	Common Name	EPBC Act status
<b>Seabirds - Continued</b>		
<i>Pterodroma cervicalis</i>	white-necked petrel	Marine
<b><i>Pterodroma neglecta neglecta</i></b>	<b>Kermadec petrel (western)</b>	Vulnerable, Marine
<i>Pterodroma nigripennis</i>	black-winged petrel	Marine
<i>Pterodroma solandri</i>	providence petrel	Marine, Migratory
<i>Puffinus assimilis</i>	little shearwater	Marine
<i>Puffinus carneipes</i>	fleshy-footed shearwater	Marine, Migratory
<i>Puffinus pacificus</i>	wedge-tailed shearwater	Marine, Migratory
<i>Sterna fuscata</i>	sooty tern, whalebird	Marine
<i>Sula dactylatra</i>	masked booby	Marine, Migratory
<b>Reptiles</b>		
<b><i>Christinus guentheri</i></b>	<b>Lord Howe Island gecko</b>	Vulnerable
<b><i>Oligosoma lichenigera</i></b>	<b>Lord Howe Island skink</b>	Vulnerable
<b>Molluscs</b>		
<b><i>Advena campbellii campbellii</i></b>	<b>Campbell's helicarionid land snail</b>	Critically Endangered
<b><i>Mathewsoconcha grayi</i></b>	<b>Gray's helicarionid land snail</b>	Critically Endangered
<b><i>Mathewsoconcha phillipii</i></b>	<b>Phillip Island helicarionid land snail</b>	Critically Endangered
<b><i>Mathewsoconcha suteri</i></b>	<b>a helicarionid land snail</b>	Critically Endangered
<b><i>Quintalia stoddartii</i></b>	<b>Stoddart's helicarionid land snail</b>	Critically Endangered

(a) Excludes non-breeding visitors and vagrants

(b) Known to be extinct but not listed as such under the EPBC Act



## *Abutilon julianae*

## Norfolk Island abutilon

### Family MALVACEAE

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#### Description

A subshrub to about 1m tall with young stems covered with dense stellate hairs. Leaves with petiole 2-8cm long, the blade of the leaf is heart shaped, hairy on the underside and almost hairless on top, and it has solitary yellow flowers.

#### Conservation Significance

Endemic to Norfolk Island Group

#### Distribution and Abundance

Originally occurred on Norfolk Island and on Phillip Island but was lost from Norfolk Island. By 1988 it was restricted to Phillip Island where there were about 100 small to medium plants and 12 medium to large plants known, mostly occurring over the inaccessible southern part of the island. There were three main patches, one of about 100 plants, another with 18 plants and one with about 10 plants (Sykes & Atkinson 1988). It is now scattered across the western half of the island and is mostly found on steep slopes and cliff edges along the northern and southern coasts (Mills 2009b). It has been extensively planted on Norfolk Island in the national park in open areas and the population is now increasing with increased management intervention and use of this species in rehabilitation works.

#### Ecology

Little known

#### Habitat

Grows in open situations among grasses.

#### EPBC Listing

Critically endangered

#### Threats

Competition from invasive weeds is a threat to this species.

#### Impact on Other Species

None known

#### Management Action

Continue re-establishing a wild population on Norfolk Island, by raising plants from seeds, planting out well-grown plants in open habitat, and regular monitoring to identify factors affecting their survival.

#### References

- Mills, K. 2009b. *The Vegetation of Phillip Island, Norfolk Island Group*. Envirofund 2007/2008. The Author, Jamberoo, NSW.
- Orchard, A. (ed.) 1994. *Flora of Australia. Vol. 49. Oceanic Islands 1*. Australian Government Publishing Service, Canberra.
- Sykes, W.R. & Atkinson, I.A.E. 1988. *Rare and Endangered Plants of Norfolk Island*. Unpublished report to the Australian National Parks and Wildlife Service, Norfolk Island.



# Flora

## *Achyranthes arborescens*

## chaff tree, soft-wood

### Family AMARANTHACEAE

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#### Description

Soft wooded trees to 9m tall

#### Conservation Significance

Endemic to Norfolk Island

#### Distribution and Abundance

Found in valleys extending southwards and southeast from Mt Pitt and Mt Bates, with 99% of the natural population in the national park (Sykes & Atkinson 1988). Only 55 individuals were located in 1988 (Sykes & Atkinson 1988), and had declined further in 1989, particularly in "Filmy Fern Gully" (Gilmour & Helman 1989). The total number of mature individuals in 2003 was 57 and the population is severely fragmented with none of the four subpopulations containing more than 40 individuals (TSSC 2003g). Outside the national park it occurs in moist valleys where there were three mature trees and natural regeneration has occurred.

#### Ecology

A canopy-gap plant requiring an opening in the forest canopy to successfully establish. Established seedlings on valley floors can be washed away by heavy rain, while the vine *Ipomoea cairica* can smother young and adult plants.

#### Habitat

It can grow in the shade of Norfolk palm (*Rhopalostylis baueri*), occasionally on ridges but most commonly in gullies on valley floors or lower valley sides.

#### EPBC Listing

Critically endangered

#### Threats

Major threat is that apparently suitable canopy gaps tend to be filled rapidly by wild tobacco

(*Solanum mauritianum*) and vines (Sykes & Atkinson 1988).

Also threatened by other weed species, cattle grazing, and is sensitive to drought (NINPAC pers. comm.). Other threats come from predation of seeds by rats and grazing (TSSC 2003g). It is difficult to propagate from seed with only about 5% of seed germinating but it propagates well from cuttings (NINPAC pers. comm.).

#### Impact on Other Species

None known

**Management Action:** Establish quality stock at specific locations in the national park, through propagating in the nursery and planting in naturally occurring canopy breaks and use suitable areas for rehabilitation following weed control. It may be possible to create canopy gaps on valley sides near reproductively mature trees by removing introduced species such as wild tobacco (*Solanum mauritianum*) and kava tree (*Homolanthus populifolius*) (Sykes & Atkinson 1988).

#### References

Gilmour, P.M. & Helman, C.E. 1989. *The Vegetation of Norfolk Island National Park*. Report to the Australian National Parks and Wildlife Service, Norfolk Island.

Orchard, A. (ed.) 1994. *Flora of Australia. Vol. 49. Oceanic Islands 1*. Australian Government Publishing Service, Canberra.

Sykes, W.R. & Atkinson, I.A.E. 1988. *Rare and Endangered Plants of Norfolk Island*. Unpublished report to the Australian National Parks and Wildlife Service, Norfolk Island.

Threatened Species Scientific Committee (TSSC). 2003g. Listing Advice - Critically Endangered *Achyranthes arborescens* (chaff tree, soft-wood). <http://www.environment.gov.au/biodiversity/threatened/species/a-arborescens.html>

## *Achyranthes margaretarum*

## Phillip Island chaff-tree

### Family AMARANTHACEAE

#### Description

A compact shrub to 2-3m high with maroon flowers

#### Conservation Significance

Endemic to Phillip Island

#### Distribution and Abundance

A single 2m tall shrub was discovered on Phillip Island in the late 1980s following the removal of rabbits, and although this specimen died in the early 1990s it left numerous seedlings of which ten or so survived to maturity (de Lange & Murray 2001). By March 1999 the wild population stood at 10 adult specimens together with numerous saplings and seedlings – there were 20 specimens on Phillip Island and a few specimens in cultivation on Norfolk Island (de Lange & Murray 2001). It is now found in the upper section of Long Valley at Owen's Camp (Mills 2009b). It has been well established back on Norfolk Island in revegetation plantings in the National Park (NINPAC pers. comm.).

#### Ecology

Little known

#### Habitat

Known from only one site at 180m altitude on a rubble-strewn, south-east facing hillside. The single individual found at this site was in association with Norfolk Island flax (*Phormium tenax*) under a dense canopy of white oak (*Lagunaria patersonia*) (NINPAC pers.comm.).

#### EPBC Listing

Critically endangered

#### Threats

The main threat to this species is the very small population size, predisposing it to an increased risk of extinction through natural events such as cyclones, slips and drought.

#### Impact on Other Species

None known

#### Management Action

This plant grows well from seed. It should be propagated at the Phillip Island nursery for planting in sheltered locations on Phillip, and at the Norfolk Island nursery for planting as part of the rehabilitation and weed control program. The gradual reforestation of Phillip Island is providing habitat conducive to this species (de Lange & Murray 2001).

#### References

- de Lange, P.J. & Murray, B.G. 2001. A new *Achyranthes* (Amaranthaceae) from Phillip Island, Norfolk Island group, South Pacific Ocean. *New Zealand Journal of Botany* 39: 1-8.
- de Lange, P.J., Gardner, R.O., Sykes, W.R., Crowcroft, G.M., Cameron, E.K., Stalker, F., Christian, M.L. & Braggins, J.E. 2005. Vascular flora of Norfolk Island: some additions and taxonomic notes. *New Zealand Journal of Botany* 43: 563-596.
- Mills, K. 2009b. *The Vegetation of Phillip Island, Norfolk Island Group*. *Envirofund* 2007/2008. The Author, Jamberoo, NSW.



# Flora

## *Blechnum norfolkianum*

## Norfolk Island water-fern

### Family BLECHNACEAE

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#### Description

A terrestrial fern with fronds growing to between 30 and 80cm long and a short erect rhizome (underground stem).

#### Conservation Significance

Found on Norfolk Island and on other Pacific Islands

#### Distribution and Abundance

Australian distribution is restricted to Norfolk Island but also occurs in the Kermadec Islands, Vanuatu, Samoa and the Society Islands (TSSC 2003b). It is listed in New Zealand as "at risk – sparse" because it exist as widely scattered, small sub-populations or has restricted ranges (de Lange *et al.* 2004). There are over 1,000 individuals located in the national park where there are about 100 individuals in west geo zone D, and the rest are located in south east geo zone C (Anderson pers. comm).

#### Ecology

It is found in damp and shady places mostly occurring in the north-facing valleys of the Mt Pitt section of the national park (Sykes & Atkinson 1988), particularly on the upper slopes of Mt Bates.

#### Habitat

It is restricted to stream bank sites but in some areas a reasonable number of plants are present (Braggins 1996).

#### EPBC Listing

Endangered

#### Threats

This species is susceptible to drought, changes to the hydrology of the national park and the impact of invasive weeds. This species would be vulnerable to a drop in the water table (Braggins 1996).

#### Impact on Other Species

None known

#### Management Action

Maintain the integrity and hydrology of the national park, and care should be taken if tracks are opened in the sensitive valley bottom (Sykes & Atkinson 1988). This species can be raised from spore and should be used for rehabilitation in wetter areas of the national park.

#### References

- Braggins, J.E. 1996. *Report on the conservation status of the ferns of Norfolk Island*. Unpublished report to the Australian Nature Conservation Agency.
- Orchard, A. (ed.) 1994. *Flora of Australia. Vol. 49. Oceanic Islands 1*. Australian Government Publishing Service, Canberra.
- Sykes, W.R. & Atkinson, I.A.E. 1988. *Rare and Endangered Plants of Norfolk Island*. Unpublished report to the Australian National Parks and Wildlife Service, Norfolk Island.
- Threatened Species Scientific Committee (TSSC). 2003b. Listing Advice - 16 Endangered Norfolk Island Flora Species.  
<http://www.environment.gov.au/biodiversity/threatened/species/norfolk-island-flora-endangered.html>

## *Boehmeria australis* var. *australis*

## tree nettle, nettletree

### Family URTICACEAE

#### Description

A small tree or large spreading shrub to 5m tall and monoecious (male and female flowers separate but found on the same tree).

#### Conservation Significance

Endemic to Norfolk Island

#### Distribution and Abundance

Found in the valleys east of Mt Bates and Mt Pitt, with only 16 individuals sighted during surveys in 1988 (Sykes & Atkinson 1988). Later surveys suggested this species was less rare than indicated with small numbers recorded at several sites on the northern side of Mt Bates, and about 30 individuals in a protected forest remnant on private land (Gilmour & Helman 1989a). By 2003 there were 33 mature individuals (TSSC 2003a), with a few healthy trees occurring in the northeast corner of the national park.

#### Ecology

This is a rapidly growing species with a short life span that is adapted to colonising extensive open sites where the ground has been bared.

#### Habitat

Grows in an open sheltered habitat on the margins of rainforest remnants (Sykes & Atkinson 1988, Gilmour & Helman 1989a).

#### EPBC Listing

Critically endangered

#### Threats

Rapid colonising weeds such as *Lantana camara* and *Solanum mauritianum* are likely to exclude *B. australis*. Competition from William Taylor (*Eupatorium riparium*) and kikuyu grass (*Pennisetum clandestinum*) prevents establishment on road edges. Plants outside the national park would be at risk from grazing as this species is very palatable to stock (Sykes & Atkinson 1988).

#### Impact on Other Species

None known

#### Management Action

Clearing of introduced species and exposure of soil in the vicinity of mature plants of *B. australis* var. *australis* at a time just before seed drop (summer and autumn), followed up with removal of competitive weeds and identification of any other factors likely to affect survival (Sykes & Atkinson 1988). This species is especially susceptible to attack by phytophagous insects (Sykes & Atkinson 1988). This species should be propagated and planted as part of the rehabilitation and weed control program where it can be used as a colonising species. It can be propagated from seed.

#### References

- Gilmour, P.M. & Helman, C.E. 1989a. *A Survey of Quality Plant Communities of Norfolk Island Outside the National Park*. Report to the Australian National Parks and Wildlife Service Norfolk Island.
- Orchard, A. (ed.) 1994. *Flora of Australia. Vol. 49. Oceanic Islands 1*. Australian Government Publishing Service, Canberra.
- Sykes, W.R. & Atkinson, I.A.E. 1988. *Rare and Endangered Plants of Norfolk Island*. Unpublished report to the Australian National Parks and Wildlife Service, Norfolk Island.
- Threatened Species Scientific Committee (TSSC). 2003a. Listing Advice - 11 Critically Endangered Norfolk Island Flora Species. <http://www.environment.gov.au/biodiversity/threatened/species/norfolk-island-flora-critically.html>



# Flora

## *Calystegia affinis*

a creeper

### Family CONVULVACEAE

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#### Description

A thin stemmed climbing or creeping vine with sparse leaves

#### Conservation Significance

Found only on Norfolk Island and Lord Howe Island (listed as endangered under the NSW *Threatened Species Conservation Act 1995*).

#### Distribution and Abundance

On Norfolk Island 95% of the natural population is found in the open higher parts of Mt Pitt and Mt Bates, and occasionally comes up from dormant seed when forest or scrub is cleared and opened up (Sykes & Atkinson 1988). The Norfolk Island population consists of about 45 mature individuals (TSSC 2003a). It is very rare on Lord Howe Island, known from only four locations with possibly only one plant at each location, sprawling over an area of some square metres.

#### Ecology

Stems take root when touching the soil. Grows prolifically in the sun under cultivation.

#### Habitat

Found on the open higher parts of mountain tops on both islands.

#### EPBC Listing

Critically endangered

#### Threats

Habitat clearance and competition from invasive weeds are a threat to this species.

#### Impacts on Other Species

Can climb vigorously over other plants in cultivation

#### Management Action

Little can be done other than ensuring that known plants have every opportunity to flower and produce seed and cultivating in the botanic garden (Sykes & Atkinson 1988). Seed should be collected where available and set out in shady areas.

#### References

Department of Environment and Climate Change (NSW) 2007. *Biodiversity Management Plan for Lord Howe Island*. Department of Environment and Climate Change (NSW) Sydney.

Orchard, A. (ed.) 1994. *Flora of Australia. Vol. 49. Oceanic Islands 1*. Australian Government Publishing Service, Canberra.

Sykes, W.R. & Atkinson, I.A.E. 1988. *Rare and Endangered Plants of Norfolk Island*. Unpublished report to the Australian National Parks and Wildlife Service, Norfolk Island.

Threatened Species Scientific Committee (TSSC). 2003a. Listing Advice - 11 Critically Endangered Norfolk Island Flora Species. <http://www.environment.gov.au/biodiversity/threatened/species/norfolk-island-flora-critically.html>

## *Clematis dubia*

## clematis

### **Family RANUNCULACEAE**

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#### **Description**

A woody vigorous climber with hairy white flowers

#### **Conservation Significance**

Endemic to Norfolk Island

#### **Distribution and Abundance**

This vine was once common in the Mt Pitt and Mt Bates area but was not seen during 1988 survey (Sykes & Atkinson 1988). The natural population is confined to the national park and in 2003 there were 15 mature individuals (TSSC 2003a).

#### **Ecology**

This species will grow in light gaps and seeds rarely (4 to 5 years) although the seeds are fertile.

#### **Habitat**

This species grows on the forest margins and in clearings.

#### **EPBC Listing**

Critically endangered

#### **Threats**

Major threat is from invasive weed species.

#### **Impact on Other Species**

None known

**Management Action:** Collect seeds when available, and grow from seeds and from cuttings. Plant out as part of forest rehabilitation and weed control work. Monitor known plants and control competing weed species as necessary.

#### **References**

Orchard, A. (ed.) 1994. *Flora of Australia. Vol. 49. Oceanic Islands 1*. Australian Government Publishing Service, Canberra.

Sykes, W.R. & Atkinson, I.A.E. 1988. *Rare and Endangered Plants of Norfolk Island*. Unpublished report to the Australian National Parks and Wildlife Service, Norfolk Island.

Threatened Species Scientific Committee (TSSC). 2003a. Listing Advice - 11 Critically Endangered Norfolk Island Flora Species.

<http://www.environment.gov.au/biodiversity/threatened/species/norfolk-island-flora-critically.html>



# Flora

## *Coprosma baueri*

## coastal coprosma

### Family RUBIACEAE

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#### Description

A shrub or small tree with light green glossy leaves, small green flowers and orange egg shaped fruit.

#### Conservation Significance

Endemic to Norfolk Island and Phillip Island

#### Distribution and Abundance

Found at Anson Bay, Mullins Bay and in locations on the coast. Historical records suggest this plant may always have been rare (Gilmour & Helman 1989b). There were 228 mature individuals present in 2003 (TSSC 2003b). Occurs mainly on the higher parts of Phillip Island where it can be co-dominant on the cliff edges (Mills 2009b). Many have been planted in rehabilitation works along the Mt Pitt Road (NINPAC pers. comm.).

#### Ecology

Dioecious. Wind pollinated flowers. Bird dispersed seeds. Able to grow in areas affected by salt spray.

#### Habitat

Grows near the coast and occurs on the cliffs and locations on the coast, can be extensively chewed by insects and is threatened. On Phillip Island it grows mainly on the coastal cliffs and the healthiest plants exist in areas of loose soil fertilised by wedge-tailed shearwaters (*Puffinus pacificus*) nesting on the cliffs (Sykes & Atkinson 1988).

#### EPBC Listing

Endangered

#### Threats

Limited distribution, competition from weeds and possible hybridisation with *C. repens*, introduced from New Zealand (Sykes & Atkinson 1988)

#### Impact on Other Species

None known

#### Management Action

Continued action to conserve the wedge-tailed shearwater is likely to promote *C. baueri* as these birds help to maintain a nutrient rich open habitat by their burrowing habit (Sykes & Atkinson 1988). Collect seeds when available, produce seedlings in both the Phillip Island and Norfolk Island nurseries and plant out in rehabilitation work. This species also requires regular monitoring of existing plants and control of competing weed species when necessary.

#### References

Gilmour, P.M. & Helman, C.E. 1989. *The Vegetation of Norfolk Island National Park*. Report to the Australian National Parks and Wildlife Service, Norfolk Island.

Mills, K. 2009b. *The Vegetation of Phillip Island, Norfolk Island Group*. Envirofund 2007/2008. The Author, Jamberoo, NSW.

Orchard, A. (ed.) 1994. *Flora of Australia. Vol. 49. Oceanic Islands 1*. Australian Government Publishing Service, Canberra.

Sykes, W.R. & Atkinson, I.A.E. 1988. *Rare and Endangered Plants of Norfolk Island*. Unpublished report to the Australian National Parks and Wildlife Service, Norfolk Island.

Threatened Species Scientific Committee (TSSC). 2003b. Listing Advice - 16 Endangered Norfolk Island Flora Species.

<http://www.environment.gov.au/biodiversity/threatened/species/norfolk-island-flora-endangered.html>



## *Coprosma pilosa*

## mountain coprosma

### Family RUBIACEAE

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#### Description

Shrub or small tree to 6m tall with small green flowers, dark green hairy leaves and cone shaped dark bluish purple fruit.

#### Conservation Significance

Endemic to Norfolk Island

#### Distribution and Abundance

The entire population is found within the Mt Pitt section of the national park. There were 260 individuals in the national park in 1995 (Anderson & Cochrane 1995) and 187 mature individuals in 2003 (TSSC 2003b).

#### Ecology

This species only seeds occasionally. Dioecious, wind pollinated flowers, bird dispersed seeds.

#### Habitat

Grows in forest habitat around Mt Pitt and Mt Bates. Began to regenerate naturally following removal of cattle from the national park.

#### EPBC Listing

Endangered

#### Threats

Limited distribution and competition from weed species. The epiphytic mistletoe (*Ileostylus micranthus*) favours *Coprosma pilosa* as its host. Heavy infestations can kill the host plant.

#### Impact on Other Species

None known

#### Management Action

Restore forest habitat and protect from weed species.

#### References

Anderson, J.G. & Cochrane, K. 1995. *Assessment of Population Numbers of Norfolk's Threatened Plants (Norfolk Island National Park)*. Report to the Australian Nature Conservation Agency, Norfolk Island.

Orchard, A. (ed.) 1994. *Flora of Australia. Vol. 49. Oceanic Islands 1*. Australian Government Publishing Service, Canberra.

Threatened Species Scientific Committee (TSSC). 2003b. Listing Advice - 16 Endangered Norfolk Island Flora Species.

<http://www.environment.gov.au/biodiversity/threatened/species/norfolk-island-flora-endangered.html>



# Flora

## *Cordyline obtecta*

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### Family AGAVACEAE

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#### Description

An erect shrub or tree to 10m tall with an erect pyramidal flower spike about 30cm long, grey bark and whitish or bluey purple fruit.

#### Conservation Significance

Found only on Norfolk Island and in New Zealand

#### Distribution and Abundance

There were 818 mature individuals in 2003 (TSSC 2003c), and 65% of the population occurs within the national park. The population is greatly improved over recent years (McCoy 2010 pers.comm.). This species propagates well and has been planted in several public areas. On Phillip Island, it has been planted in the upper part of Long Valley (Mills 2009b).

#### Ecology

Little known

#### Habitat

Grows in forest habitat.

#### EPBC Listing

Vulnerable

#### Threats

Grazing by cattle and competition from weed species.

#### Impact on Other Species

None known

#### Management Action

Restore forest habitat and protect from weed species and from cattle grazing.

#### References

de Lange, P.J., Gardner, R.O., Sykes, W.R., Crowcroft, G.M., Cameron, E.K., Stalker, F., Christian, M.L. & Braggins, J.E. 2005. Vascular flora of Norfolk Island: some additions and taxonomic notes. *New Zealand Journal of Botany* 43: 563-596.

Mills, K. 2009b. *The Vegetation of Phillip Island, Norfolk Island Group*. Envirofund 2007/2008. The Author, Jamberoo, NSW.

Orchard, A. (ed.) 1994. *Flora of Australia. Vol. 49. Oceanic Islands 1*. Australian Government Publishing Service, Canberra.

Threatened Species Scientific Committee (TSSC). 2003c. Listing Advice – 15 Vulnerable Norfolk Island Flora Species.

<http://www.environment.gov.au/biodiversity/threatened/species/norfolk-island-flora-vulnerable.html>

## *Crepidomanes endlicherianum*

## middle filmy fern

### Family HYMENOPHYLLACEAE

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#### Description

Delicate epiphytic, lithophytic or terrestrial fern with small fronds growing to 10cm long.

#### Conservation Significance

Australian distribution is restricted to Norfolk Island. Also known from New Zealand, Fiji and Vanuatu, east to Samoa and Tahiti.

#### Distribution and Abundance

There are less than 200 mature individuals in the wild on Norfolk Island. This species is present in and apparently restricted to the rocky stream banks of Broken Bridge Creek and its tributaries where in several areas there are large numbers of plants (Braggins 1996).

#### Ecology

Epiphytic (grows on, but not parasitic on other plants), lithophytic (grows on unweathered rock surfaces) or terrestrial (grows on the ground) in habit.

#### Habitat

Grows in moist, humid, shaded forest valleys, often besides waterfalls.

#### EPBC Listing

Endangered

#### Threats

This species has suffered from successive years of low rainfall, and is susceptible to changes in the hydrology of the park and competition from weed species.

#### Impact on Other Species

Can grow on branches of other plants

#### Management Action

Restore the hydrology of the park through removing weed species and forest rehabilitation. Care must be taken to avoid opening areas too quickly and this species prefers wetter shaded locations.

#### References

Braggins, J.E. 1996. *Report on the conservation status of the ferns of Norfolk Island*. Unpublished report to the Australian Nature Conservation Agency.

Orchard, A. (ed.) 1994. *Flora of Australia. Vol. 49. Oceanic Islands 1*. Australian Government Publishing Service, Canberra.



# Flora

## *Dysoxylum bijugum*

## sharkwood

### Family MELIACEAE

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#### Description

A tree growing to 7m with yellow flowers and a strong fetid or garlic like smell when bruised.

#### Conservation Significance

Australian distribution is restricted to Norfolk Island but also occurs in New Caledonia and Vanuatu (TSSC 2003c).

#### Distribution and Abundance

Norfolk Island population consists of 870 mature individuals with about 90% of the population in the national park. It also occurs in the Mission Road rainforest fragments, at Steels Point and in the Hundred Acres and Two Chimneys reserves. There are pockets in the south east and west of the national park where this species is the dominant tree. In these areas there are a lot of small seedlings. On Phillip Island, this species has been planted in the upper part of Long Valley (Mills 2009b).

#### Habitat

Grows in forest

#### Ecology

Little known

#### EPBC Listing

Vulnerable

#### Threats

Main threats are competition from weed species and grazing by cattle.

#### Impact on Other Species

None known

#### Management Action

Weed control and forest rehabilitation in the national park and protection from grazing and weeds in areas outside the park.

#### References

Mills, K. 2009b. *The Vegetation of Phillip Island, Norfolk Island Group*. Envirofund 2007/2008. The Author, Jamberoo, NSW.

Orchard, A. (ed.) 1994. *Flora of Australia. Vol. 49. Oceanic Islands 1*. Australian Government Publishing Service, Canberra.

Threatened Species Scientific Committee (TSSC). 2003c. Listing Advice – 15 Vulnerable Norfolk Island Flora Species.  
<http://www.environment.gov.au/biodiversity/threatened/species/norfolk-island-flora-vulnerable.html>

## *Elatostema montanum*

## mountain procris

### Family URTICACEAE

#### Description

A fleshy, succulent-stemmed perennial herb or low shrub growing to 1m tall with a straggling habit.

#### Conservation Significance

Endemic to Norfolk Island

#### Distribution and Abundance

Although not a detailed and comprehensive survey, 76 individuals were located in 2003 in seven populations that are severely fragmented. No population contained more than 26 individuals and only two populations contained more than six individuals (TSSC 2003f). The entire population is found within the Mt Pitt section of the national park, particularly in the upper bowl area of south east area C and the escarpment of northern area E. The largest known population declined between 1988 and 1989 (Gilmour & Helman 1989b).

#### Ecology

Monoecious

#### Habitat

This species occurs in damp shade, and it is found on cliffs behind shaded streams within the national park and is very site specific being restricted to very steep rocky bands and cliffs in shaded valley bottoms where there is always adequate moisture (Sykes & Atkinson 1988). This species is dependent on the erosion regime of the island – active down-cutting by streams might open new sites while heavy downpours might wipe out existing colonies (Sykes & Atkinson 1988).

#### EPBC Listing

Critically endangered

#### Threats

This species is vulnerable to weeds and drought conditions. The small sub-populations are threatened by competition with weeds such as *Lantana camara* and William Taylor (*Ageratina riparia*) (TSSC 2003f). Since 1984, some sub-populations have been destroyed by cattle grazing (TSSC 2003f).

#### Impact on Other Species

None known

#### Management Action

Monitoring known sites and controlling weeds as required. This species can be propagated from cuttings but it seeds only rarely. When seeds are available they should be collected and propagated. Weed control must be undertaken with care such that the habitat remains shady and not too much light is allowed in.

#### References

- Gilmour, P.M. & Helman, C.E. 1989. *The Vegetation of Norfolk Island National Park*. Report to the Australian National Parks and Wildlife Service, Norfolk Island.
- Orchard, A. (ed.) 1994. *Flora of Australia. Vol. 49. Oceanic Islands 1*. Australian Government Publishing Service, Canberra.
- Sykes, W.R. & Atkinson, I.A.E. 1988. *Rare and Endangered Plants of Norfolk Island*. Unpublished report to the Australian National Parks and Wildlife Service, Norfolk Island.
- Threatened Species Scientific Committee (TSSC). 2003f. Listing Advice - Critically Endangered *Elatostema montanum* (mountain procris, a herb). <http://www.environment.gov.au/biodiversity/threatened/species/e-montanum.html>



# Flora

## *Elymus multiflorus* var. *kingianus*

## Phillip Island wheat-grass

### Family POACEAE

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#### Description

A tufted perennial grass growing 30-100cm tall with glaucous leaves.

#### Conservation Significance

Found on Phillip Island and Lord Howe Island.

#### Distribution and Abundance

A very rare grass found only on Phillip Island, rediscovered in 1988 following removal of rabbits with several small patches growing on north facing slopes towards the upper part of the island (Sykes & Atkinson 1988). There were less than 50 mature individuals in 2003 (TSSC 2003a). Two populations were found by Mills (2009b) above the dykes area and on the cliff edge on the southern side of Stony Valley.

#### Ecology

Little known

#### Habitat

Grows on the north facing slopes of Phillip Island in higher areas in a herb community dominated by pigface (*Carpobrotus glaucescens*).

#### EPBC Listing

Critically endangered

#### Threats

The main threat is the very small population and restricted distribution on Phillip Island. This species is threatened by weed invasion and grazing.

#### Impact on Other Species

Little known

#### Management Action

Establish exact distribution and determine conditions for successful germination (Sykes & Atkinson 1988). This species is difficult to find and easily confused with other *Elymus* species. Populations should be monitored during late spring. This species should be propagated on Phillip Island and used in rehabilitation work. It should also be propagated on Norfolk Island and used to establish further populations in coastal habitat.

#### References

Mills, K. 2009b. *The Vegetation of Phillip Island, Norfolk Island Group*. Envirofund 2007/2008. The Author, Jamberoo, NSW.

Orchard, A. (ed.) 1994. *Flora of Australia. Vol. 49. Oceanic Islands 1*. Australian Government Publishing Service, Canberra.

Sykes, W.R. & Atkinson, I.A.E. 1988. *Rare and Endangered Plants of Norfolk Island*. Unpublished report to the Australian National Parks and Wildlife Service, Norfolk Island.

Threatened Species Scientific Committee (TSSC). 2003a. Listing Advice - 11 Critically Endangered Norfolk Island Flora Species. <http://www.environment.gov.au/biodiversity/threatened/species/norfolk-island-flora-critically.html>

## *Euphorbia norfolkiana*

## Norfolk Island euphorbia

### Family EUPHORBIACEAE

#### Description

A dense low shrub usually growing to 1m but sometimes to 3m tall with olive green flowers.

#### Conservation Significance

Endemic to Norfolk Island

#### Distribution and Abundance

The species is now restricted to the southern coast and is found within and near Ball Bay Reserve and Bumbora Reserve, and on private land near Bumbora Reserve (Sykes & Atkinson 1988; Mills 2007d; NINPAC pers. comm.). There were 38 mature individuals known in 2003 (TSSC 2003a). Mills (2007d) found 104 plants in 2006 and 2007 (of which 42 plants were higher than 1m tall. There are no natural populations of this species within the national park but it is now growing in the botanic garden.

#### Ecology

This species can establish on bare, loose soil but may need partial shade for most effective establishment. Most plants had established below an open cover of pine.

#### Habitat

Occurs in open areas in light shade amidst coastal cliff vegetation.

#### EPBC Listing

Critically endangered

#### Threats

This species is vulnerable because of the small, restricted populations, and is threatened by weeds such as African olive (*Olea europaea* subsp. *cuspidata*) and kikuyu (*Pennisetum clandestinum*) and from grazing by cattle.

#### Impact on Other Species

None known

#### Management Action

This species should be propagated and planted out in shaded areas under pines in suitable coastal habitat in the national park, other reserves and on private land. Increased planting of nursery grown stock is required to increase the size of the population. Plants need to be grown to a reasonable size before being planted out to increase survival rates. Planting in other public reserves should be considered if wetter conditions return. Investigate suitable habitat below pines within One Hundred Acres Reserve. Existing populations need to be monitored and competing weeds controlled.

#### References

Mills, K. 2007d. *The Flora of Norfolk Island. 5. Field Survey of the Norfolk Island Endemic Shrub Euphorbia norfolkiana (Euphorbiaceae)*. The Author, Jamberoo, NSW.

Orchard, A. (ed.) 1994. *Flora of Australia. Vol. 49. Oceanic Islands 1*. Australian Government Publishing Service, Canberra.

Sykes, W.R. & Atkinson, I.A.E. 1988. *Rare and Endangered Plants of Norfolk Island*. Unpublished report to the Australian National Parks and Wildlife Service, Norfolk Island.

Threatened Species Scientific Committee (TSSC). 2003a. Listing Advice - 11 Critically Endangered Norfolk Island Flora Species.

<http://www.environment.gov.au/biodiversity/threatened/species/norfolk-island-flora-critically.html>



# Flora

## *Euphorbia obliqua*

a herb

### Family EUPHORBIACEAE

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#### Description

A prostrate perennial herb with stems to 20cm long.

#### Conservation Significance

Australian distribution restricted to Norfolk Island. Also occurs in New Caledonia and Vanuatu.

#### Distribution and Abundance

The natural population is mostly found outside of the national park and there were 530 mature individuals known in 2003 (TSSC 2003c). The species has been reported from Emily Bay, Kingston, the rocks near the Old Salt House and The Chord at Duncombe Bay (Orchard 1994). A small number occur in Point Hunter Reserve. It is common on Nepean Island (Mills 2009a).

#### Ecology

Little known

#### Habitat

Occurs in calcarenite cracks and fissures in coralline and sometimes basaltic rocks by the sea, with a woody rootstock penetrating the fissures.

#### EPBC Listing

Vulnerable

#### Threats

This species is vulnerable because of the small populations and competition from weeds and grazing by cattle are threats.

#### Impact on Other Species

None known

#### Management Action

This species should be propagated and planted out in suitable coastal habitat in the national park, public reserves and on private land. Existing populations need to be monitored and competing weeds controlled.

#### References

Mills, K. 2009a. *The Flora of Norfolk Island. 9. The Vegetation of Nepean Island (including Errata and Addenda for Papers 1 to 8)*. The Author, Jamberoo, NSW.

Orchard, A. (ed.) 1994. *Flora of Australia. Vol. 49. Oceanic Islands 1*. Australian Government Publishing Service, Canberra.

Threatened Species Scientific Committee (TSSC). 2003c. Listing Advice – 15 Vulnerable Norfolk Island Flora Species. <http://www.environment.gov.au/biodiversity/threatened/species/norfolk-island-flora-vulnerable.html>



## *Hibiscus insularis*

## Phillip Island Hibiscus

### Family MALVACEAE

#### Description

Large shrub growing to 2.5m high. The flowers are solitary and pale yellow with a greenish tinge, with a dark magenta centre, turning purple as they age.

#### Conservation Significance

Endemic to Phillip Island

#### Distribution and Abundance

There were 13 plants in 1939 and only eight surviving in 1963 (Orchard 1994). In 1988 it was restricted to one site only with a major patch and a minor patch on the northern slopes of Phillip Island (Sykes & Atkinson 1988). In 2003 there were fewer than 50 mature plants surviving in the wild (TSSC 2003a). There are currently over 100 plants on Phillip Island. A large clump is found in the upper part of Long Valley (Mills 2009b). Some plants are under cultivation on Norfolk Island where it is grown in many private gardens.

#### Ecology

This species takes 18 years to mature from plants struck from seed, but plants mature more quickly when propagated from cuttings. The predatory moths *Pectinophora scutigera* and *Anisoplaca cosmia* may reduce reproductive success by destroying seeds (Groeneveld 1989). It is pollinated by nectar feeding birds (Groeneveld 1989).

#### Habitat

Grows on the northern slopes of Phillip Island

#### EPBC Listing

Critically endangered

#### Threats

This species is threatened because of its very restricted distribution and the existing population having been derived from two individuals. The main threat is from competition for water and nutrients from African olive (*Olea europaea* subsp. *cuspidata*). Extended dry periods may exacerbate this threat.

#### Impact on Other Species

None known

#### Management Action

Establish further stands on Phillip Island in non-drought conditions and continue olive control. Establish native tree shelter belts (eg white oaks) to replace the weed species that currently shelter the main stand on Phillip Island. Maintain a strict herbicide ban in the vicinity of the main stand.

#### References

- Groeneveld, K.M. 1989. *Conservation biology of the endangered species Hibiscus insularis*. Unpublished Report to the Australian National Parks and Wildlife Service.
- Mills, K. 2009b. *The Vegetation of Phillip Island, Norfolk Island Group*. Envirofund 2007/2008. The Author, Jamberoo, NSW.
- Orchard, A. (ed.) 1994. *Flora of Australia. Vol. 49. Oceanic Islands 1*. Australian Government Publishing Service, Canberra.
- Sykes, W.R. & Atkinson, I.A.E. 1988. *Rare and Endangered Plants of Norfolk Island*. Unpublished report to the Australian National Parks and Wildlife Service, Norfolk Island.
- Threatened Species Scientific Committee (TSSC). 2003a. Listing Advice - 11 Critically Endangered Norfolk Island Flora Species. <http://www.environment.gov.au/biodiversity/threatened/species/norfolk-island-flora-critically.html>



# Flora

## *Hypolepis dicksonioides*

## downy ground fern, brake fern

### Family DENNSTAEDTIACEAE

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#### Description

A terrestrial fern with fronds growing to 100cm or longer.

#### Conservation Significance

Australian distribution restricted to Norfolk and Phillip Islands but also occurs in Kermadec Islands, New Zealand, Samoa, Society Islands and Marquesas.

#### Distribution and Abundance

The number of mature individuals was less than 500 in 2003 (TSSC 2003c). This species occurs on Norfolk and Phillip Islands and has been recorded from Mt Bates (Orchard 1994). In a 1995 survey it was reported from only one site apart from Phillip Island and was much less common than in 1971 (Brownsey & Chinnock 1987, Braggins 1996). On Phillip Island, this fern is uncommon but widespread. It is most common in First West End Valley and the valleys across the eastern part of the island (Mills 2009b).

#### Ecology

Little known

#### Habitat

Grows in disturbed sites and open rocky places

#### EPBC Listing

Vulnerable

#### Threats

It is a fern of disturbed sites, an important colonising fern but does not persist for long periods in the same location (Braggins 1996).

#### Impact on Other Species

None known

#### Management Action

Maintain the hydrology of the forest, maintain forest health and control weeds.

#### References

- Braggins, J.E. 1996. *Report on the conservation status of the ferns of Norfolk Island*. Unpublished report to the Australian Nature Conservation Agency.
- Brownsey, P.J. & Chinnock, R.J. 1987. A taxonomic revision of the Australian species of *Hypolepis*. *Journal of the Adelaide Botanical Garden* 10: 1-30.
- Mills, K. 2009b. *The Vegetation of Phillip Island, Norfolk Island Group*. Envirofund 2007/2008. The Author, Jamberoo, NSW.
- Orchard, A. (ed.) 1994. *Flora of Australia. Vol. 49. Oceanic Islands 1*. Australian Government Publishing Service, Canberra.
- Threatened Species Scientific Committee (TSSC). 2003c. Listing Advice – 15 Vulnerable Norfolk Island Flora Species. <http://www.environment.gov.au/biodiversity/threatened/species/norfolk-island-flora-vulnerable.html>

## *Ileostylus micranthus*

## mistletoe

### Family LORANTHACEAE

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#### Description

A bushy epiphytic mistletoe with green flowers and yellow fruit.

#### Conservation Significance

It is best known from New Zealand and was first collected on Norfolk Island in the 1930s and is presumed to be a recent arrival as previous collectors had failed to find it (Orchard 1994).

#### Distribution and Abundance

On Norfolk Island the number of mature individuals was less than 500 in 2003 (TSSC 2003c). It has been reported from the upper slopes of Mt Pitt and the track leading to Red Road on Mt Bates (Orchard 1994) above the 200 metre contour.

#### Ecology

An epiphytic parasite with a wide range of host plants.

#### Habitat

Occurs scattered on a number of host species within the national park but favours *Coprosma pilosa* as its host.

#### EPBC Listing

Vulnerable

#### Threats

Main threats are threats to the general health of the forest and catastrophic events such as severe storms.

#### Impact on Other Species

Parasitic on host species and heavy infestations on *Coprosma pilosa* can kill the host plant.

#### Management Action

Maintain a healthy population of *C. pilosa*, monitor likely areas of the national park after storms, rescue any fallen specimens and attempt to cultivate these in the botanic garden. Restore forest habitat and protect host trees from weeds.

#### References

Orchard, A. (ed.) 1994. *Flora of Australia. Vol. 49. Oceanic Islands 1*. Australian Government Publishing Service, Canberra.

Threatened Species Scientific Committee (TSSC). 2003c. Listing Advice – 15 Vulnerable Norfolk Island Flora Species. <http://www.environment.gov.au/biodiversity/threatened/species/norfolk-island-flora-vulnerable.html>



# Flora

## *Lastreopsis calantha*

## shield-fern

### Family DRYOPTERIDACEAE

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#### Description

A terrestrial fern with a long creeping rhizome and fronds growing to 30cm, occasionally reaching 50cm long.

#### Conservation Significance

Endemic to Norfolk Island

#### Distribution and Abundance

There were less than 200 mature individuals in 2003 (TSSC 2003b). It occurs mainly in the national park, in damp and shady places mostly in the north-facing valleys (Sykes & Atkinson 1988). It was present at several widely scattered sites (Braggins 1996), and the species has returned in areas where cattle have been excluded.

#### Ecology

Grows in moist shaded areas.

#### Habitat

Grows in shaded forest, mainly in north-facing valleys.

#### EPBC Listing

Endangered

#### Threats

The main threats are grazing from cattle, competition from weeds species and changes to the hydrology of the park.

#### Impact on Other Species

None known

#### Management Action

Maintain the integrity of the national park. Avoid opening new tracks in the sensitive valley bottom, and control weeds.

#### References

Braggins, J.E. 1996. *Report on the conservation status of the ferns of Norfolk Island*. Unpublished report to the Australian Nature Conservation Agency.

Orchard, A. (ed.) 1994. *Flora of Australia. Vol. 49. Oceanic Islands 1*. Australian Government Publishing Service, Canberra.

Sykes, W.R. & Atkinson, I.A.E. 1988. *Rare and Endangered Plants of Norfolk Island*. Unpublished report to the Australian National Parks and Wildlife Service, Norfolk Island.

Threatened Species Scientific Committee (TSSC). 2003b. Listing Advice - 16 Endangered Norfolk Island Flora Species.

<http://www.environment.gov.au/biodiversity/threatened/species/norfolk-island-flora-endangered.html>

## *Marattia salicina*

## king fern, para, potato fern

### Family MARATTIACEAE

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#### Description

Large robust fern with fronds growing to 6m long.

#### Conservation Significance

Australian distribution restricted to Norfolk Island and it is also found in New Zealand

#### Distribution and Abundance

In 2003 there were less than 100 mature individuals all within the Mt Pitt section of the national park (TSSC 2003b). There are about 40 specimens in King Fern Valley and a large patch growing on a steep slope in western area D. It was reported from several sites within the forest and with some regeneration seen in 1996 (Braggins 1996). In New Zealand it is listed as "chronically threatened - Serious Decline" (de Lange *et al.* 2004).

#### Ecology

Little known

#### Habitat

This species grows in valleys on southeast mountain slopes (Orchard 1994).

#### EPBC Listing

Endangered

#### Threats

It is vulnerable to over-collecting and grazing by stock (Braggins 1996). It is susceptible to dry conditions and changes to the hydrology of the national park.

#### Impact on Other Species

None known

#### Management Action

This species can be propagated and planted into suitable habitat. Nursery stock could be provided to reduce pressure on collecting from the wild.

#### References

- Braggins, J.E. 1996. *Report on the conservation status of the ferns of Norfolk Island*. Unpublished report to the Australian Nature Conservation Agency.
- de Lange, P.J., Johnson, P.N., Norton, D.A., Hitchmough, R., Heenan, P.B., Courteney, S.P., Molloy, B.P.J., Ogle, C.C. & Rance, B.D. 2004. Threatened and uncommon plants of New Zealand. *New Zealand Journal of Botany* 42: 45-76.
- Orchard, A. (ed.) 1994. *Flora of Australia. Vol. 49. Oceanic Islands 1*. Australian Government Publishing Service, Canberra.
- Sykes, W.R. & Atkinson, I.A.E. 1988. *Rare and Endangered Plants of Norfolk Island*. Unpublished report to the Australian National Parks and Wildlife Service, Norfolk Island.
- Threatened Species Scientific Committee (TSSC). 2003b. Listing Advice - 16 Endangered Norfolk Island Flora Species.  
<http://www.environment.gov.au/biodiversity/threatened/species/norfolk-island-flora-endangered.html>



# Flora

## *Melicope littoralis*

## shade tree

### Family RUTACEAE

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#### Description

Tree to 5m tall, with trifoliolate leaves (having three leaflets), small creamy-white flowers and shiny black seeds.

#### Conservation Significance

Endemic to Norfolk Island

#### Distribution and Abundance

There were 273 mature individuals in 2003 with most plants occurring in the Mt Pitt section of the national park (Orchard 1994, TSSC 2003c). It is widespread within the park occurring in every catchment and 543 individuals in the SE zone.

#### Ecology

Little known

#### Habitat

Fairly common in forest

#### EPBC Listing

Vulnerable

#### Threats

The black rat (*Rattus rattus*) may contribute to the failed reproduction of this species (Bell 1990).

#### Impact on Other Species

None known

#### Management Action

This species grows well from cuttings and could be propagated and planted as part of the weed control rehabilitation program.

#### References

Bell, B.D. 1990. *The status and management of the White-breasted White-eye and other birds of Norfolk Island*. Unpublished report to the Australian Nature Conservation Agency.

Orchard, A. (ed.) 1994. *Flora of Australia. Vol. 49. Oceanic Islands 1*. Australian Government Publishing Service, Canberra.

Threatened Species Scientific Committee (TSSC). 2003c. Listing Advice – 15 Vulnerable Norfolk Island Flora Species.

<http://www.environment.gov.au/biodiversity/threatened/species/norfolk-island-flora-vulnerable.html>

## *Melicytus latifolius*

## Norfolk Island mahoe

### Family VIOLACEAE

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#### Description

A small tree usually growing to 4m tall but sometimes grows to 9m.

#### Conservation Significance

Endemic to Norfolk Island

#### Distribution and Abundance

There were 17 mature individuals in 2003 (TSSC 2003a). It is found in the valleys and slopes of the Mt Pitt section of the national park, together with a few areas outside the park in the Mission Road area, but seedlings and mature trees were rare (Sykes & Atkinson 1988). Historical records suggest this plant has been rare for some time (Gilmour & Helman 1989b). The last good flowering season was in the late 1990's/early 2000's when a good number of plants were produced in the natural forest and in the nursery plantings (McCoy 2010 pers.comm.).

#### Ecology

Little known

#### Habitat

This species requires moist shaded valley sites and broad ridges and while it can tolerate dense shade, it sometimes establishes at the edge of canopy gaps (Sykes & Atkinson 1988).

#### EPBC Listing

Critically endangered

#### Threats

Competition from weeds, particularly guava and native tobacco is the main threat. This species is dioecious and thus the number of plants capable of forming seeds is much less than the total number seen (Sykes & Atkinson 1988). It seeds only rarely and has not seeded since the drought since 1998.

#### Impact on Other Species

None known

#### Management Action

Regular monitoring to determine causes of mortality. Planting of nursery stock on moist slopes within the national park cleared of guava would be a way of increasing the numbers of this plant (Sykes & Atkinson 1988). Gather seeds in good seasons and propagate in the nursery. Ensure protection of the Mission Road rainforest remnants.

#### References

Gilmour, P.M. & Helman, C.E. 1989. *The Vegetation of Norfolk Island National Park*. Report to the Australian National Parks and Wildlife Service, Norfolk Island.

Orchard, A. (ed.) 1994. *Flora of Australia. Vol. 49. Oceanic Islands 1*. Australian Government Publishing Service, Canberra.

Sykes, W.R. & Atkinson, I.A.E. 1988. *Rare and Endangered Plants of Norfolk Island*. Unpublished report to the Australian National Parks and Wildlife Service, Norfolk Island.

Threatened Species Scientific Committee (TSSC). 2003a. Listing Advice - 11 Critically Endangered Norfolk Island Flora Species. <http://www.environment.gov.au/biodiversity/threatened/species/norfolk-island-flora-critically.html>



# Flora

*Melicytus ramiflorus*  
subsp. *oblongifolius*

whiteywood

## **Family VIOLACEAE**

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### **Description**

A slender shrub or tree to 5m tall.

### **Conservation Significance**

Endemic to Norfolk Island

### **Distribution and Abundance**

There were 436 mature individuals in 2003 (TSSC 2003c). This subspecies has been recorded from the national park on the saddle between Mt Pitt and Mt Bates and north east of the Kingston Cemetery (Orchard 1994). It is relatively widespread in the national park and some other reserves.

### **Ecology**

Little known

### **Habitat**

Forest

### **EPBC Listing**

Vulnerable

### **Threats**

Competition from weeds, grazing by cattle and drought are the main threats.

### **Impact on Other Species**

None known

### **Management Action**

Collect seed, propagate and plant out as part of the weed control and forest rehabilitation program.

### **References**

Orchard, A. (ed.) 1994. *Flora of Australia. Vol. 49. Oceanic Islands 1*. Australian Government Publishing Service, Canberra.

Threatened Species Scientific Committee (TSSC). 2003c. Listing Advice – 15 Vulnerable Norfolk Island Flora Species.  
<http://www.environment.gov.au/biodiversity/threatened/species/norfolk-island-flora-vulnerable.html>





# Flora

## *Meryta angustifolia*

a tree

### Family ARALIACEAE

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#### Description

Tree growing to 6m tall with few branches.

#### Conservation Significance

Endemic to Norfolk Island

#### Distribution and Abundance

There were 479 mature individuals in 2003 (TSSC 2003c). It is widespread within the national park (particularly in areas where woody weeds have been treated) and has been recorded from the northern and southern slopes of Mt Bates, on the saddle between Mt Pitt and Mt Bates and from outside the national park (Orchard 1994). Most of the population is within the park but there are some in the Mission Road rainforest remnants.

#### Ecology

Little known

#### Habitat

Grows in scattered wooded areas.

#### EPBC Listing

Vulnerable

#### Threats

The main threats are from grazing and competition from weeds. This species produces less seed than *M. latifolia*.

#### Impact on Other Species

None known

#### Management Action

Maintain forest health through weed control and forest rehabilitation. Maintain fencing and conservation agreements for Mission Road rainforest remnants.

#### References

Orchard, A. (ed.) 1994. *Flora of Australia. Vol. 49. Oceanic Islands 1*. Australian Government Publishing Service, Canberra.

Threatened Species Scientific Committee (TSSC). 2003c. Listing Advice – 15 Vulnerable Norfolk Island Flora Species.  
<http://www.environment.gov.au/biodiversity/threatened/species/norfolk-island-flora-vulnerable.html>



# Flora

## *Meryta latifolia*

## broad-leaved meryta

### Family ARALIACEAE

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#### Description

Tree growing to 6m tall with few branches. It has large, very broad, dark green leaves and a large yellow flower spike.

#### Conservation Significance

Endemic to Norfolk Island

#### Distribution and Abundance

While the total number of mature plants in 2003 was 149 the effective reproductive population is determined by the limited number of mature female plants – approximately 20 (TSSC 2003e). It is widespread over the island found at Ball Bay, Anson Bay, the botanic garden and Mission Road forest remnants. Only 33 plants were seen in 1988, 20 of these in the Mission Road forest remnants (Sykes & Atkinson 1988). The species is highly palatable to stock and may be susceptible to drought (Sykes & Atkinson 1988). It is found on Phillip Island where it has been planted in various places amongst Norfolk Island pine and white oak (Mills 2009b). It now occurs in most public reserves and in many private gardens.

#### Ecology

Little known

#### Habitat

This species can grow on steep slopes, coastal cliffs, and both shaded and unshaded sites, and is most commonly established at the edges of canopy gaps or along forest margins, but sometimes also beneath pines (Sykes & Atkinson 1988).

#### EPBC Listing

Critically endangered

#### Threats

Main threats are competition with invasive weeds, predation by rats, senescence of over-mature plants, and sex ratio bias. The species is adapted to moist forest conditions and is therefore susceptible to unfavourable climate change such as projected increases in the incidence of drought and extreme rainfall events that cause physical damage (TSSC 2003e).

#### Impact on Other Species

None known

#### Management Action

Raising plants from seed and planting nursery raised saplings into lowland and coastal areas that are protected from browsing (Sykes & Atkinson 1988). Maintain fencing for Mission Road rainforest remnants, and encourage further plantings in private gardens.

#### References

- Mills, K. 2009b. *The Vegetation of Phillip Island, Norfolk Island Group*. Envirofund 2007/2008. The Author, Jamberoo, NSW.
- Orchard, A. (ed.) 1994. *Flora of Australia. Vol. 49. Oceanic Islands 1*. Australian Government Publishing Service, Canberra.
- Sykes, W.R. & Atkinson, I.A.E. 1988. *Rare and Endangered Plants of Norfolk Island*. Unpublished report to the Australian National Parks and Wildlife Service, Norfolk Island.
- Threatened Species Scientific Committee (TSSC). 2003e. Listing Advice - Critically Endangered *Meryta latifolia* (Shade Tree). <http://www.environment.gov.au/biodiversity/threatened/species/m-latifolia.html>

## *Muehlenbeckia australis*

## shrubby creeper, pohuehue

### Family POLYGONACEAE

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#### Description

Perennial much-branched climber that grows to 4m high.

#### Conservation Significance

In Australia it is restricted to Norfolk Island but it also occurs in New Zealand

#### Distribution and Abundance

There were 100 mature individuals in 2003 (TSSC 2003b). This species occurs from sea level to the upper slopes of Mt Pitt and has been recorded from Mt Pitt, Mt Bates and Steels Point (Orchard 1994). It occurs mostly within the Mt Pitt section of the national park . It also occurs on Phillip Island on the cliffs east of Razorback (Mills 2009b). There may be genetic differences between the Norfolk and the Phillip Island population.

#### Ecology

This species grows well from cuttings but is difficult to grow from seed.

#### Habitat

Grows in native forests from sea level to the upper slopes of mountains.

#### EPBC Listing

Endangered

#### Threats

Main threats are competition with invasive weeds.

#### Impact on Other Species

None known

#### Management Action

Raising plants from cuttings on both Norfolk and Phillip Islands and planting saplings into appropriate areas. Research focussed on improving cultivation from seed and determining taxonomic differences between the populations from Phillip Island and Norfolk Island.

#### References

Mills, K. 2009b. *The Vegetation of Phillip Island, Norfolk Island Group*. Envirofund 2007/2008. The Author, Jamberoo, NSW.

Orchard, A. (ed.) 1994. *Flora of Australia. Vol. 49. Oceanic Islands 1*. Australian Government Publishing Service, Canberra.

Threatened Species Scientific Committee (TSSC). 2003b. Listing Advice - 16 Endangered Norfolk Island Flora Species.

<http://www.environment.gov.au/biodiversity/threatened/species/norfolk-island-flora-endangered.html>



# Flora

## *Myoporum obscurum*

## popwood

### Family MYOPORACEAE

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#### Description

Shrub or small spreading tree growing to 7m tall with shiny green foliage.

#### Conservation Significance

Endemic to Norfolk Island

#### Distribution and Abundance

The entire natural population is found in the Mt Pitt section of the national park. There were only five mature seed producing trees until planting began in 1995. It was found on the northern slopes of the national park and on Mt Bates Road but only four trees were sighted in 1988, and it was not present on Phillip Island although Cunningham recorded it there in the 1830s (Sykes & Atkinson 1988). A survey in 1989 failed to locate additional sites suggesting this species is very rare in the national park (Gilmour & Helman 1989b). The species has since been planted throughout the national park. There is one old plant at the top of Cascade Reserve, near Young's Road (K. Mills 2010 pers.comm.).

#### Ecology

Little known

#### Habitat

This species is intolerant of much shade and away from the coast grows on forest margins and in clearings or canopy gaps or open areas (Sykes & Atkinson 1988).

#### EPBC Listing

Critically endangered

#### Threats

A major threat is from competition from weed species. The small population makes it vulnerable to stochastic changes. Sykes and Atkinson (1988) indicated that there is a threat from hybridisation with *M. insulare*. However it is likely that *M. insulare* does not occur on Phillip Island (Mills 2009b) or even on the Norfolk Island Group (K. Mills 2010 pers.comm.).

#### Impact on Other Species

None known

#### Management Action

Regular systematic census for all plants. Cuttings should be grown in the nursery and planted out as part of the weed control forest rehabilitation program and a population of this species should be re-established on Phillip Island.

#### References

- Gilmour, P.M. & Helman, C.E. 1989. *The Vegetation of Norfolk Island National Park*. Report to the Australian National Parks and Wildlife Service, Norfolk Island.
- Mills, K. 2009b. *The Vegetation of Phillip Island, Norfolk Island Group*. Envirofund 2007/2008. The Author, Jamberoo, NSW.
- Orchard, A. (ed.) 1994. *Flora of Australia. Vol. 49. Oceanic Islands 1*. Australian Government Publishing Service, Canberra.
- Sykes, W.R. & Atkinson, I.A.E. 1988. *Rare and Endangered Plants of Norfolk Island*. Unpublished report to the Australian National Parks and Wildlife Service, Norfolk Island.
- Threatened Species Scientific Committee (TSSC). 2003a. Listing Advice - 11 Critically Endangered Norfolk Island Flora Species. <http://www.environment.gov.au/biodiversity/threatened/species/norfolk-island-flora-critically.html>

## *Myrsine ralstoniae*

## beech

### Family MYRSINACEAE

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#### Description

A small tree growing to 6m tall with small berries.

#### Conservation Significance

Endemic to Norfolk Island

#### Distribution and Abundance

The total number of mature plants in 2003 was 562 (TSSC 2003c). Most of the population is within the Mt Pitt section of the national park. It is widespread and has been recorded from the upper slopes of Mt Pitt, the north side of Mt Bates, Anson Bay Road near Selwyns Bridge above Jacobs Rock and north east of Kingston Cemetery (Orchard 1994). Mills (2010 pers.comm.) indicates that it is abundant in the national park and also occurs in several public reserves.

#### Ecology

Little known

#### Habitat

The species often occurs as an understorey tree in forested areas (Orchard 1994).

#### EPBC Listing

Vulnerable

#### Threats

Competition from weeds, grazing, and drought.

#### Impact on Other Species

None known

#### Management Action

Collect seed in good seasons, propagate and plant as part of weed control and forest rehabilitation program.

#### References

Orchard, A. (ed.) 1994. *Flora of Australia. Vol. 49. Oceanic Islands 1*. Australian Government Publishing Service, Canberra.

Threatened Species Scientific Committee (TSSC). 2003c. Listing Advice – 15 Vulnerable Norfolk Island Flora Species.  
<http://www.environment.gov.au/biodiversity/threatened/species/norfolk-island-flora-vulnerable.html>



# Flora

## *Pennantia endlicheri*

## pennantia

### Family ICACINACEAE

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#### Description

A large shrub or more usually a tree growing to 10m tall with small white flowers.

#### Conservation Significance

Almost endemic to Norfolk Island (single tree known from island off New Zealand).

#### Distribution and Abundance

The total number of mature plants in 2003 was 168 (TSSC 2003b). There are currently a few hundred mature trees and about 3,000 saplings in the Mt Pitt section of the national park (NINPAC pers. comm.) and it is occasionally found outside of the park (Gardner & de Lange 2002, de Lange & Murray 2003). Some large trees occur in the Mission Road remnants (K. Mills 2010 pers.comm.).

#### Ecology

Flowers functionally unisexual.

#### Habitat

This species grows in sheltered forest sites and young plants have some shade tolerance such that they are often found in gullies dominated by Norfolk Island palms (*Rhopalostylis baueri*) (Gardner & de Lange 2002).

#### EPBC Listing

Endangered

#### Threats

Competition from weeds.

#### Impact on Other Species

None known

#### Management Action

Forest restoration and removal of weeds to open up filtered light gaps.

#### References

de Lange, P.J. & Murray, B.G. 2003. Chromosome numbers of Norfolk Island endemic plants. *Australian Journal of Botany* 51: 211-215.

Gardner, R.O. & de Lange, P.J. 2002. Revision of *Pennantia* (Icacaceae), a small isolated genus. *Journal of the Royal Society of New Zealand* 32: 669-695.

Orchard, A. (ed.) 1994. *Flora of Australia. Vol. 49. Oceanic Islands 1*. Australian Government Publishing Service, Canberra.

Threatened Species Scientific Committee (TSSC). 2003b. Listing Advice - 16 Endangered Norfolk Island Flora Species.

<http://www.environment.gov.au/biodiversity/threatened/species/norfolk-island-flora-endangered.html>

## *Phreatia limenophylax*

## Norfolk Island phreatia

### Family ORCHIDACEAE

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#### Description

A small, tufted, epiphytic orchid growing to 3-6cm high with a long inflorescence of many tiny greenish-white flowers.

#### Conservation Significance

Endemic to Norfolk Island

#### Distribution and Abundance

The total number of mature plants in 2003 was five (TSSC 2003a). The species has been recorded from Anson Bay (Orchard 1994) but all currently known plants are within the Mt Pitt section of the national park.

#### Ecology

Little known

#### Habitat

Grows on the branches of trees in forested areas of the Mt Pitt section of the national park.

#### EPBC Listing

Critically endangered

#### Threats

Changes to the hydrology of the forest, and catastrophic events such as severe storms.

#### Impact on Other Species

Grows on the branches of trees.

#### Management Action

For all epiphytic orchids, monitor likely areas of the national park after storms, rescue any fallen specimens and attempt to cultivate them in the botanic garden (Sykes & Atkinson 1988). Restore and maintain the health of the forest through weed control and rehabilitation work.

#### References

Gilmour, P.M. & Helman, C.E. 1989. *The Vegetation of Norfolk Island National Park*. Report to the Australian National Parks and Wildlife Service, Norfolk Island.

Orchard, A. (ed.) 1994. *Flora of Australia. Vol. 49. Oceanic Islands 1*. Australian Government Publishing Service, Canberra.

Sykes, W.R. & Atkinson, I.A.E. 1988. *Rare and Endangered Plants of Norfolk Island*. Unpublished report to the Australian National Parks and Wildlife Service, Norfolk Island.

Threatened Species Scientific Committee (TSSC). 2003a. Listing Advice - 11 Critically Endangered Norfolk Island Flora Species.  
<http://www.environment.gov.au/biodiversity/threatened/species/norfolk-island-flora-critically.html>



# Flora

## *Phreatia paleata*

## an orchid

### Family ORCHIDACEAE

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#### Description

A tufted epiphytic orchid growing to 30cm high with 50 or more small white flowers on a drooping stem to 35cm long.

#### Conservation Significance

Australian distribution restricted to Norfolk Island, and also occurs in New Caledonia, New Guinea, Solomon Islands and Vanuatu (Orchard 1994).

#### Distribution and Abundance

Locally frequent in the Mt Pitt section of the National Park and the population in 2003 consisted of less than 200 mature plants (TSSC 2003b). It has been recorded from near the summit of Mt Pitt and Mt Bates.

#### Ecology

An epiphyte that grows on several tree species, favouring *Dysoxylum bijugum* (Mills 2007).

#### Habitat

The species grows on tree branches in native forest.

#### EPBC Listing

Endangered

#### Threats

Changes to the hydrology of the forest and stochastic events.

#### Impact on Other Species

Grows on the branches of other trees.

#### Management Action

For all epiphytic orchids, monitor likely areas of the national park after storms, rescue any fallen specimens and attempt to cultivate them in the botanic garden (Sykes & Atkinson 1988). Restore and maintain the health of the forest through weed control and rehabilitation work.

#### References

- Mills, K. 2007. *The flora of Norfolk Island 2. Epiphytes and Mistletoes*. The Author, Jamberoo (NSW).
- Orchard, A. (ed.) 1994. *Flora of Australia. Vol. 49. Oceanic Islands 1*. Australian Government Publishing Service, Canberra.
- Sykes, W.R. & Atkinson, I.A.E. 1988. *Rare and Endangered Plants of Norfolk Island*. Unpublished report to the Australian National Parks and Wildlife Service, Norfolk Island.
- Threatened Species Scientific Committee (TSSC). 2003b. Listing Advice - 16 Endangered Norfolk Island Flora Species. <http://www.environment.gov.au/biodiversity/threatened/species/norfolk-island-flora-endangered.html>



## *Pittosporum bracteolatum*

## oleander

### Family PITTOSPORACEAE

#### Description

Tree growing to 7m tall with small cream flowers and fruit in a sticky orange pulp.

#### Conservation Significance

Endemic to Norfolk Island

#### Distribution and Abundance

The total number of mature plants in 2003 was 921 (TSSC 2003c). This species is widespread with most of the population in the Mt Pitt section of the national park. It has been recorded from Mt Pitt and Mt Bates, Mission Road, Steels Point and north east of Bloody Bridge (Orchard 1994, Cayzer *et al.* 2000). This species seeds well and it has been widely planted in the national park.

#### Ecology

Little known

#### Habitat

It occurs in forested and wooded areas (Orchard 1994) and is quite common on parkland and forest slopes, particularly the sheltered south east slopes of Mt Pitt (Cayzer *et al.* 2000).

#### EPBC Listing

Vulnerable

#### Threats

Competition from weeds including the introduced *Pittosporum undulatum*.

#### Impact on Other Species

None known

#### Management Action

Continue planting as part of weed control and forest rehabilitation work. Work towards eradicating the introduced *P. undulatum*.

#### References

Cayzer, L.W., Crisp, M.D. & Telford, I.R.H. 2000. A revision of *Pittosporum* (Pittosporaceae) in Australia. *Systematic Journal of Botany* 13: 845-902.

Orchard, A. (ed.) 1994. *Flora of Australia. Vol. 49. Oceanic Islands 1*. Australian Government Publishing Service, Canberra.

Threatened Species Scientific Committee (TSSC). 2003c. Listing Advice – 15 Vulnerable Norfolk Island Flora Species.

<http://www.environment.gov.au/biodiversity/threatened/species/norfolk-island-flora-vulnerable.html>



# Flora

## *Pouteria costata*

## bastard ironwood

### Family SAPOTACEAE

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#### Description

A small tree to 15m tall with sticky white latex.

#### Conservation Significance

Distribution in Australia restricted to Norfolk Island but it also occurs in New Zealand.

#### Distribution and Abundance

There were 176 mature individuals in 2003 (TSSC 2003b). It has been recorded from the slopes of Mt Pitt (Orchard 1994). The main area where this species occurs is in the Mission Road rainforest remnants and the botanic garden and also occurs at Simons Water. In some areas where mature trees have died there are many saplings growing up (eg. there are 70 saplings where two mature trees have died between SE area A and SE area B). Mills (2010 pers.comm.) notes that the species is a lowland species that is rare to absent at higher altitudes.

#### Ecology

Little known

#### Habitat

Grows in most types of forest except extreme coastal communities (Sykes & Atkinson 1988).

#### EPBC Listing

Endangered

#### Threats

Competition from weeds.

#### Impact on Other Species

None known

#### Management Action

Treatment of weeds in areas near mature trees promotes natural regeneration.

#### References

Orchard, A. (ed.) 1994. *Flora of Australia. Vol. 49. Oceanic Islands 1*. Australian Government Publishing Service, Canberra.

Sykes, W.R. & Atkinson, I.A.E. 1988. *Rare and Endangered Plants of Norfolk Island*. Unpublished report to the Australian National Parks and Wildlife Service, Norfolk Island.

Threatened Species Scientific Committee (TSSC). 2003b. Listing Advice - 16 Endangered Norfolk Island Flora Species.

<http://www.environment.gov.au/biodiversity/threatened/species/norfolk-island-flora-endangered.html>

## *Pteris kingiana*

## King's brakefern

### Family PTERIDACEAE

#### Description

A tufted fern with a short erect rhizome and fronds growing to 90cm long.

#### Conservation Significance

Endemic to Norfolk and Phillip Islands

#### Distribution and Abundance

There were less than 200 mature plants in 2003 (TSSC 2003b). It has been collected from Ball Bay (Orchard 1994) and is known from a number of scattered sites but never with very many individuals; few populations are in the national park (Braggins 1996). It is also found on Phillip Island in a few patches in the gully of Long Valley (Mills 2009b).

#### Ecology

Wind dispersed spores. This species grows on shady forest floors.

#### Habitat

It mainly grows in coastal Norfolk Island pine (*Araucaria heterophylla*) forests and, although not common, it is more common than *P. zahlbruckneriana* (de Lange & Murray 2003).

#### EPBC Listing

Endangered

#### Threats

Competition from weeds and grazing.

#### Impact on Other Species

None known

#### Management Action

Propagate from spore and plant out in weed control and forest rehabilitation work. Establish a regular inspection program and control competing weeds as necessary.

#### References

Braggins, J.E. 1996. *Report on the conservation status of the ferns of Norfolk Island*. Unpublished report to the Australian Nature Conservation Agency.

de Lange, P.J. & Murray, B.G. 2003. Chromosome numbers of Norfolk Island endemic plants. *Australian Journal of Botany* 51: 211-215.

Mills, K. 2009b. *The Vegetation of Phillip Island, Norfolk Island Group*. Envirofund 2007/2008. The Author, Jamberoo, NSW.

Orchard, A. (ed.) 1994. *Flora of Australia. Vol. 49. Oceanic Islands 1*. Australian Government Publishing Service, Canberra.

Threatened Species Scientific Committee (TSSC). 2003b. Listing Advice - 16 Endangered Norfolk Island Flora Species.

<http://www.environment.gov.au/biodiversity/threatened/species/norfolk-island-flora-endangered.html>



# Flora

## *Pteris zahlbruckneriana*

## netted brakefern

### Family PTERIDACEAE

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#### Description

Tufted fern with a short erect rhizome and fronds growing to 1m high.

#### Conservation Significance

Endemic to Norfolk Island

#### Distribution and Abundance

There were less than 200 mature plants in 2003 (TSSC 2003b). It is not common and is less widespread than *P. kingiana* (de Lange & Murray 2003). It consists of scattered populations in forests at higher elevations and most of the population is in protected areas (Braggins 1996). Most surviving individuals are in the national park or in Cascade Reserve.

#### Ecology

Wind born spores.

#### Habitat

This species grows in forest on creek banks.

#### EPBC Listing

Endangered

#### Threats

Competition from weeds, particularly William Taylor (*Ageratina riparia*) and red guava (*Psidium cattleianum*). Threatened by grazing.

#### Impact on Other Species

None known

#### Management Action

Establish a regular inspection program and control competing weeds as necessary. Propagate from spore and plant out in weed control and forest rehabilitation work.

#### References

- Braggins, J.E. 1996. *Report on the conservation status of the ferns of Norfolk Island*. Unpublished report to the Australian Nature Conservation Agency.
- de Lange, P.J. & Murray, B.G. 2003. Chromosome numbers of Norfolk Island endemic plants. *Australian Journal of Botany* 51: 211-215.
- Orchard, A. (ed.) 1994. *Flora of Australia. Vol. 49. Oceanic Islands 1*. Australian Government Publishing Service, Canberra.
- Threatened Species Scientific Committee (TSSC). 2003b. Listing Advice - 16 Endangered Norfolk Island Flora Species. <http://www.environment.gov.au/biodiversity/threatened/species/norfolk-island-flora-endangered.html>

## *Senecio australis*

## yellow daisy

### Family **ASTERACEAE**

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#### **Description**

An erect annual or short-lived perennial growing to 90cm tall with yellow daisy flowers.

#### **Conservation Significance**

Endemic to Norfolk Island Group

#### **Distribution and Abundance**

There were less than 500 mature plants in 2003 (TSSC 2003c). The species has been recorded from Barney Duffy, Anson Bay, at the Chord at Duncombe Bay, and from the Stool, Phillip Island (Orchard 1994). It was common around the edges of Phillip Island in September 2008, particularly on the southern cliffs (Mills 2009b). It also occurs on Nepean Island.

#### **Ecology**

Little known

#### **Habitat**

Little known

#### **EPBC Listing**

Vulnerable

#### **Threats**

Competition from weeds particularly kikuyu (*Pennisetum clandestinum*).

#### **Impact on Other Species**

None known

#### **Management Action**

Control competing weeds, collect seed, propagate and plant in shaded areas.

#### **References**

Mills, K. 2009b. *The Vegetation of Phillip Island, Norfolk Island Group*. Envirofund 2007/2008. The Author, Jamberoo, NSW.

Orchard, A. (ed.) 1994. *Flora of Australia. Vol. 49. Oceanic Islands 1*. Australian Government Publishing Service, Canberra.

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# Flora

## *Senecio evansianus*

## a daisy

### Family **ASTERACEAE**

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#### **Description**

A low herb growing between 3 and 30cm tall with small yellow daisy flowers.

#### **Conservation Significance**

Endemic to Norfolk Island

#### **Distribution and Abundance**

There were less than 200 mature plants in 2003 (TSSC 2003b). It has been recorded from Rocky Point, Bumbora Reserve above Creswell Bay, Bloody Bridge and east of Bloody Bridge (Orchard 1994).

#### **Ecology**

Little known

#### **Habitat**

It is apparently restricted to well-watered clay soils beneath open stands of Norfolk Island pine (*Araucaria heterophylla*) (Orchard 1994).

#### **EPBC Listing**

Endangered

#### **Threats**

Main threat is competition from weeds, particularly kikuyu (*Pennisetum clandestinum*).

#### **Impact on Other Species**

None known

#### **Management Action**

Control competing weeds, collect seed, propagate and plant in shaded areas.

#### **References**

Orchard, A. (ed.) 1994. *Flora of Australia. Vol. 49. Oceanic Islands 1*. Australian Government Publishing Service, Canberra.

Threatened Species Scientific Committee (TSSC). 2003b. Listing Advice - 16 Endangered Norfolk Island Flora Species.

<http://www.environment.gov.au/biodiversity/threatened/species/norfolk-island-flora-endangered.html>

## *Senecio hooglandii*

## yellow daisy

### Family ASTERACEAE

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#### Description

An erect herb growing to 60cm tall with yellow daisy flowers.

#### Conservation Significance

Endemic to Norfolk Island Group

#### Distribution and Abundance

There were less than 550 mature plants in 2003 (TSSC 2003c). It has been recorded from near the cemetery on Norfolk Island and on the north side of Phillip Island although its occurrence on Phillip Island is probably due to the widespread broadcasting of seed in efforts to revegetate the island after the removal of rabbits (Orchard 1994). It is moderately common around the cliffs of Phillip Island (Mills 2009b). A small number occur in the Point Hunter Reserve on Norfolk Island. It also occurs on Nepean Island.

#### Ecology

Little known

#### Habitat

Little known

#### EPBC Listing

Vulnerable

#### Threats

Competition from weeds particularly kikuyu (*Pennisetum clandestinum*).

#### Impact on Other Species

None known

#### Management Action

Control competing weeds, collect seed, propagate and plant in shaded areas.

#### References

- Mills, K. 2009b. *The Vegetation of Phillip Island, Norfolk Island Group*. Envirofund 2007/2008. The Author, Jamberoo, NSW.
- Orchard, A. (ed.) 1994. *Flora of Australia. Vol. 49. Oceanic Islands 1*. Australian Government Publishing Service, Canberra.
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<http://www.environment.gov.au/biodiversity/threatened/species/norfolk-island-flora-vulnerable.html>



# Flora

## *Streblus pendulinus*

## Siah's backbone

### Family MORACEAE

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#### Description

Tree or shrub growing to 6m tall with fleshy red fruit and very rough leaves. It exudes a white latex when damaged.

#### Conservation Significance

In Australia it is restricted to Norfolk Island but it also occurs in New Guinea, Micronesia, Vanuatu, Rapa, and Hawaii.

#### Distribution and Abundance

There were 187 mature individuals in 2003 (Orchard 1994, TSSC 2003b). On Norfolk Island it was not generally common but widespread and not considered threatened in 1988 (Sykes & Atkinson 1988). It has been recorded from Cascade Reserve, Mt Pitt, Mt Pitt Road, and about 3km north east of the cemetery at Kingston (Orchard 1994). Most surviving individuals of this species are inside the national park (167 mature individuals in 2003) and there are some in the Mission Road rainforest remnants, near Steels Point and in the Ball Bay Reserve. This species is very palatable to stock and many trees are male and cannot produce seed (Sykes & Atkinson 1988).

#### Ecology

Usually dioecious

#### Habitat

Widespread in forest over the island.

#### EPBC Listing

Endangered

#### Threats

Competition from weeds and grazing by cattle are the main threats. A parasite appears to be stopping seed setting in many individuals.

#### Impact on Other Species

None known

#### Management Action

Determine the best method of treating the parasite (arborist study is required). Control competing weeds (broad-scale weed control should assist dormant plants in the National Park).

#### References

Orchard, A. (ed.) 1994. *Flora of Australia. Vol. 49. Oceanic Islands 1*. Australian Government Publishing Service, Canberra.

Sykes, W.R. & Atkinson, I.A.E. 1988. *Rare and Endangered Plants of Norfolk Island*. Unpublished report to the Australian National Parks and Wildlife Service, Norfolk Island.

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<http://www.environment.gov.au/biodiversity/threatened/species/norfolk-island-flora-endangered.html>



*Taeniophyllum norfolkianum*

minute orchid,  
ribbon-root orchid

## **Family ORCHIDACEAE**

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### **Description**

A small epiphytic orchid with tiny greenish yellow flowers.

### **Conservation Significance**

Endemic to Norfolk Island Group

### **Distribution and Abundance**

There were less than 500 mature plants in 2003 (Orchard 1994, TSSC 2003c). It has been recorded from Mt Bates (Orchard 1994). Mills (2010 pers.comm) has recorded the species south of Mount Pitt and in the vicinity of Red Road.

### **Ecology**

Leafless with photosynthetic roots.

### **Habitat**

Grows on the underside of branches of the Norfolk Island pine (*Araucaria heterophylla*).

### **EPBC Listing**

Vulnerable

### **Threats**

The main threats come from impacts on forest health, the small population size, and catastrophic events.

### **Impact on Other Species**

Grows on Norfolk Island pines

### **Management Action**

For all epiphytic orchids, monitor likely areas of the national park after storms, rescue any fallen specimens and attempt to cultivate them in the botanic garden (Sykes & Atkinson 1988).

### **References**

Orchard, A. (ed.) 1994. *Flora of Australia. Vol. 49. Oceanic Islands 1*. Australian Government Publishing Service, Canberra.

Sykes, W.R., & Atkinson, I.A.E. 1988. *Rare and Endangered Plants of Norfolk Island*. Unpublished report to the Australian National Parks and Wildlife Service, Norfolk Island.

Threatened Species Scientific Committee (TSSC). 2003c. Listing Advice – 15 Vulnerable Norfolk Island Flora Species.

<http://www.environment.gov.au/biodiversity/threatened/species/norfolk-island-flora-vulnerable.html>



# Flora

## *Thelychiton brachypus*

### Family ORCHIDACEAE

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#### Description

An epiphytic orchid with two or three pale cream flowers on a short stem.

#### Conservation Significance

Endemic to Norfolk Island

#### Distribution and Abundance

There were less than 200 mature individuals present on Norfolk Island in 2003 (TSSC 2003b). More than 90% of the population is in the Mt Pitt section of the national park and in the botanic garden.

#### Ecology

Little known

#### Habitat

Grows on tree branches in forest on the slopes of Mt Pitt.

#### EPBC Listing

Endangered

#### Threats

Little is known of this species but its host trees would be threatened by competition from weed species.

## Norfolk Island orchid

#### Impacts on Other Species

Grows on branches and stems of other plants but is not parasitic.

#### Management Action

For all epiphytic orchids, monitor likely areas of the national park after storms, rescue any fallen specimens and attempt to cultivate these in the botanic garden (Sykes & Atkinson 1988). Restore forest habitat and protect host trees from weeds.

#### References

Orchard, A. (ed.) 1994. *Flora of Australia. Vol. 49. Oceanic Islands 1*. Australian Government Publishing Service, Canberra.

Sykes, W.R. & Atkinson, I.A.E. 1988. *Rare and Endangered Plants of Norfolk Island*. Unpublished report to the Australian National Parks and Wildlife Service, Norfolk Island.

Threatened Species Scientific Committee (TSSC). 2003b. Listing Advice - 16 Endangered Norfolk Island Flora Species.

<http://www.environment.gov.au/biodiversity/threatened/species/norfolk-island-flora-endangered.html>

## *Tmesipteris norfolkensis*

## hanging fork-fern

### Family **PSILOTACEAE**

#### **Description**

A flimsy, pendulous epiphytic fern-like plant with branches growing to 25cm long.

#### **Conservation Significance**

Endemic to Norfolk Island

#### **Distribution and Abundance**

Relatively common but localised in distribution. There were less than 500 mature plants in 2003 (TSSC 2003c), mostly occurring in the north-facing valleys of the Mt Pitt section of the national park where it grows on the lower part of tree fern trunks (Sykes & Atkinson 1988). It has been recorded on the south east slopes of Mount Pitt and between Palm Glen and Red Road (Orchard 1994). Mills (2007e) indicates that it is restricted to moist forests and is most common on the southern side of the mountains rather than the drier northern side.

#### **Ecology**

An epiphyte that grows in damp conditions, and uses a range of native hardwoods as hosts but prefers the fibrous base of the tree ferns *Cyathea brownii* (under 1m from the ground) and *C. australis*. Most plants grow on the downhill side of the trunks (Mills 2007e).

#### **Habitat**

Grows in damp and shady places and prefers the deep moist valleys of the southern side of mountains.

#### **EPBC Listing**

Vulnerable

#### **Threats**

The main threat comes from catastrophic events but this species is dependant on the health of the forest ecosystem.

#### **Impact on Other Species**

Grows on tree ferns and on a range of hardwood hosts.

#### **Management Action**

Maintain the integrity of the national park. Care should be taken if tracks are opened in the sensitive valley bottom (Sykes & Atkinson 1988). As for the epiphytic orchids, monitor likely areas of the national park after storms, rescue any fallen specimens and attempt to cultivate them in the botanic garden (Sykes & Atkinson 1988).

#### **References**

- Mills, K. 2007e. *The Flora of Norfolk Island. 2. Epiphytes and Mistletoes*. The Author, Jamberoo, NSW.
- Orchard, A. (ed.) 1994. *Flora of Australia. Vol. 49. Oceanic Islands 1*. Australian Government Publishing Service, Canberra.
- Sykes, W.R. & Atkinson, I.A.E. 1988. *Rare and Endangered Plants of Norfolk Island*. Unpublished report to the Australian National Parks and Wildlife Service, Norfolk Island.
- Threatened Species Scientific Committee (TSSC). 2003c. Listing Advice – 15 Vulnerable Norfolk Island Flora Species. <http://www.environment.gov.au/biodiversity/threatened/species/norfolk-island-flora-vulnerable.html>



# Flora

## *Ungeria floribunda*

## bastard oak

### Family STERCULIACEAE

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#### Description

A tree growing to 15m tall with deep pink flowers.

#### Conservation Significance

Endemic to Norfolk Island. Endemic monotypic genus which could be one of Norfolk Island's most ancient plants.

#### Distribution and Abundance

The total number of mature plants in 2003 was 502 (TSSC 2003c). It is evenly distributed through the national park occurring on the broad ridges and upper valley sides, and is also found on flat sites outside the park in the northwest part of the island. Young trees are associated with secondary forest that has established following removal of the original canopy. Regeneration is restricted by predation of seeds either on the tree or on the ground, and because this species is a periodic regenerator and does not fruit every year (Sykes & Atkinson 1988). This species propagates well from seed. Mills (2010 pers.comm.) indicates that the species seems to be regenerating quite well.

#### Ecology

Little known

#### Habitat

This species grows in forested areas throughout Norfolk Island and especially in areas of dense canopy.

#### EPBC Listing

Vulnerable

#### Threats

The seed of this species is taken by rats. It sets seed only periodically and may require 20 years or more to regenerate.

#### Impact on Other Species

None known

#### Management Action

When seed is available propagate in the nursery and plant as part of weed control and forest rehabilitation program. Near the main stands of this species, control woody weed species to maximise seed germination and viability.

#### References

Orchard, A. (ed.) 1994. *Flora of Australia. Vol. 49. Oceanic Islands 1*. Australian Government Publishing Service, Canberra.

Sykes, W.R. & Atkinson, I.A.E. 1988. *Rare and Endangered Plants of Norfolk Island*. Unpublished report to ANPWS, Norfolk Island.

Threatened Species Scientific Committee (TSSC). 2003c. Listing Advice – 15 Vulnerable Norfolk Island Flora Species.  
<http://www.environment.gov.au/biodiversity/threatened/species/norfolk-island-flora-vulnerable.html>

## *Wikstroemia australis*

### Family **THYMELAEACEAE**

#### **Description**

A small tree growing to 4m or more tall with blackish stems and hard, rough bark.

#### **Conservation Significance**

Endemic to Norfolk Island

#### **Distribution and Abundance**

The total number of mature plants in 2003 was 155 (TSSC 2003d). This species was once widespread over much of Norfolk Island but since the 1930s it has been reduced to scattered pockets mostly within the national park (Tierney 1989). By 1988 it was widely distributed on the ridges and upper valley sides of the Mt Pitt section of the national park but there was a critical lack of juvenile plants (Sykes & Atkinson 1988). In 1989 young plants successfully established in gaps along the Bird Rock track with young plants relatively common close to the track in areas where weeds were not a problem (Tierney 1989). The lack of regeneration of young plants was probably caused by competition from weeds, particularly red guava (*Psidium cattleianum*), unsuitable soil conditions, drought and disease (Sykes & Atkinson 1988). A survey in 1989 suggested a continued decline, with many diseased plants (Gilmour & Helman 1989b).

#### **Ecology**

This species is probably short lived and requires high light for its establishment.

#### **Habitat**

Occurs in forests, especially in protected, sunny, moist sites.

#### **EPBC Listing**

Critically endangered

#### **Threats**

Competition from weeds, particularly guava, and possibly from disease. This species is difficult to propagate and will not grow from cuttings.

## **kurrajong**

#### **Impact on Other Species**

None known

#### **Management Action**

Study by an arborist to identify the causal agent for the disease, and to determine how best to propagate this species. Continue weed control program particularly on the ridge between Geo D and Geo E. Clearing of red guava and other woody weeds around reproductively mature trees and maintaining gaps created to facilitate establishment of young *Wikstroemia*.

#### **References**

Gilmour, P.M. & Helman, C.E. 1989. *The Vegetation of Norfolk Island National Park*. Report to the Australian National Parks and Wildlife Service, Norfolk Island.

Orchard, A. (ed.) 1994. *Flora of Australia. Vol. 49. Oceanic Islands 1*. Australian Government Publishing Service, Canberra.

Sykes, W.R. & Atkinson, I.A.E. 1988. *Rare and Endangered Plants of Norfolk Island*. Unpublished report to the Australian National Parks and Wildlife Service, Norfolk Island.

Threatened Species Scientific Committee (TSSC). 2003d. Listing Advice - Critically Endangered *Wikstroemia australis* (Kurrajong). <http://www.environment.gov.au/biodiversity/threatened/species/w-australis.html>

Tierney J.W. 1989. *Report on investigation into kurrajong (Wikstroemia australis) decline and Phellinus noxius root rot control on Norfolk Island*. Unpublished report to the Australian National Parks and Wildlife Service.



# Flora

## *Zehneria baueriana*

### **Family CUCURBITACEAE**

#### **Description**

A large perennial climber with corky rope-like stems and red, fleshy berries.

#### **Conservation Significance**

In Australia it is restricted to Norfolk Island but it also occurs in New Caledonia

#### **Distribution and Abundance**

There were 77 mature individuals in 2003 (Orchard 1994, TSSC 2003b). It has been collected from Mt Pitt (Orchard 1994) and occurs in the Mt Pitt and Phillip Island sections of the national park and in the Mission Road rainforest remnants, with 60 of the remaining mature plants outside the national park. The Mission Road rainforest remnants contain the largest clumps of this species and it is scattered through the national park as remnant individuals. On Phillip Island it occurs mainly in the highest parts of Long Valley catchment (Mills 2009b).

#### **Ecology**

Little known

#### **Habitat**

This species is a locally common climber in forests. In New Caledonia it grows on calcareous and other substrates but not on ultramafics (rocks with neither quartz nor feldspar) and in degraded vegetation types (Morat *et al.* 2001).

#### **EPBC Listing**

Endangered

#### **Threats**

Competition from weeds and grazing. The yellow ripe fruit is also taken by rats.

## **native cucumber, giant cucumber**

#### **Impact on Other Species**

Climbs on other vegetation.

#### **Management Action**

Propagate from seeds and plant out at several planting locations in the national park.

#### **References**

Mills, K. 2009b. *The Vegetation of Phillip Island, Norfolk Island Group*. Envirofund 2007/2008. The Author, Jamberoo, NSW.

Morat, P., Jaffre, T. & Beilon, J-M. 2001. The flora of New Caledonia's calcareous substrates. *Adansonia ser. 3* 23: 109-127.

Orchard, A. (ed.) 1994. *Flora of Australia. Vol. 49. Oceanic Islands 1*. Australian Government Publishing Service, Canberra.

Sykes, W.R. & Atkinson, I.A.E. 1988. *Rare and Endangered Plants of Norfolk Island*. Unpublished report to the Australian National Parks and Wildlife Service, Norfolk Island.

Threatened Species Scientific Committee (TSSC). 2003b. Listing Advice - 16 Endangered Norfolk Island Flora Species.

<http://www.environment.gov.au/biodiversity/threatened/species/norfolk-island-flora-endangered.html>



# Land Bird

## *Cyanoramphus cookii*

### Conservation Significance

Endemic to Norfolk Island. Nationally threatened. Described as critically endangered in the Action Plan for Australian Birds (Garnett & Crowley 2000).

### Distribution and Abundance

By the late 1800s the green parrot was confined to the area that is now the Mt Pitt section of the national park, since when the structure and composition of the remaining native vegetation has changed dramatically through clearing and weed invasion (Hill 2002).

In the 1960-70s the population was estimated at 10-20 pairs (Smithers and Disney 1969). In 1977-78 the population was estimated at 3-5 pairs (17-31 birds) and was restricted to the national park (Schodde *et al.* 1983). The population decreased further in the 1980s and fluctuated between 3 and 10 pairs from 1988 to 1995, as there was an acute scarcity of adult females due to high levels of predation on the nest (Hermes *et al.* 1986). In 1995 the total wild population was estimated at 44 individuals and increased to about 69 individuals and 17 breeding pairs in 1997 (Hill 2002).

There were about 13 pairs breeding in the wild in 1996, and 325 chicks banded between 1985 and 2000 (Garnett & Crowley 2000). The total population in March 2001 was estimated at 160 individuals with 14 known breeding pairs. Adult pairs are now more commonly seen suggesting that adult female survival has improved as a result of predator control (Hill 2002). In 2005 the population was estimated at between 200 and 300 birds and they are now being recorded regularly outside the park.

### EPBC Listing

Endangered, migratory

## Norfolk Island green parrot

### Ecology

Breeding: Breeds in all months of the year, peaking December to March. Clutch size is one to nine eggs. Females do all the incubation and most of the chick feeding while males provide food for nesting females.

Nesting: Nests in hollows of living native trees often within 2 m of the ground. Adults return to the same nest site each season but will also use other sites within their territory. Of 43 wild nests monitored between 1983 and 1988, all were in native species (28 in ironwood, 11 in *Cordyline*, two in Norfolk Island pine, two in white oak).

Foraging: Diet is a variety of native seeds, fruits, flowers and leaves.

### Habitat

The breeding range is now restricted to the Mt Pitt section of the national park and the species forages in the park and adjacent forested areas and orchards.

### Threats

The main factors responsible for the decline of the green parrot were habitat loss, particularly trees with suitable nesting hollows, and predation from introduced predators. Currently egg and chick predation by rats and cats, a shortage of predator free nest sites and nest hollow competition from introduced crimson rosellas, starlings and honeybees are the main factors limiting population recovery, while disease may be a significant cause of mortality in certain circumstances (Hill 2002).

### Impact on Other Species

None known

### Management Actions

Controlling predators and competitors such as feral cats, black rats, starlings, rosellas and bees. Provision and maintenance of suitable rat proof nest boxes and continuing weed control and forest rehabilitation work (particularly *Nestigus* dominant forest).



## References

- Garnett, S.T. & Crowley, G.M. 2000. *The Action Plan for Australian Birds*. Environment Australia.
- Hermes, N., Evans, O. & Evans, B. 1986. Norfolk Island birds: a review 1985. *Notornis* 33: 141-149.
- Hicks, J. & Greenwood, D. 1990. Rescuing Norfolk Island's Parrot. *Birds International* 2: 35-47.
- Hicks, J. & Preece, M. 1991. *Green Parrot. 1991 Recovery Plan*. Unpublished Report to the Australian National Parks and Wildlife Service.
- Hill, R. 2002. *Recovery Plan for the Norfolk Island Green Parrot Cyanoramphus novaezelandiae cookii*. Environment Australia, Canberra.
- Schodde, R., Fullagar, P. & Hermes, N. 1983. *A review of Norfolk Island birds past and present*. Special Publication No. 8. Australian National Parks and Wildlife Service, Canberra.
- Smithers, C.N. & Disney, H.J. 1969. The distribution of terrestrial and freshwater birds on Norfolk Island. *Australian Zoologist* 15: 127-140.



# Land Bird

## *Ninox novaeseelandiae undulata*

### Conservation Significance

Endemic to Norfolk Island. Nationally threatened. Although described as extinct in the Action Plan for Australian Birds (Garnett & Crowley 2000), the genes of the original subspecies persist in the hybrid population.

### Distribution and Abundance

The Norfolk Island boobook owl was first recorded by King in 1788-90. Since 1909 the owl has been recorded as occurring largely in the gullies surrounding Mt Pitt (Smithers & Disney 1969). A reasonable population remained in 1912-13 but by 1968 the owl was considered extremely rare and was heard only occasionally (Turner *et al.* 1968, Smithers & Disney 1969). By 1986 the population had declined to a single female.

To retain some genetics of the Norfolk subspecies two males from the closely related New Zealand subspecies were introduced in 1987. In 1989 the Norfolk female and one of the NZ males raised their first chicks. They also produced chicks in 1990 but those were the last chicks produced by the Norfolk female, and she was last recorded in October 1995. There has been subsequent second and third generation breeding with 45 "hybrid" offspring banded up to December 2005.

### EPBC Listing

Endangered, migratory

### Ecology

Breeding: Breeds September to November

Nest: Nests in tree hollows and up to four eggs are laid but the usual clutch is three. All nests of the hybrid population have been in nest boxes.

### Habitat

Recent records came from native forest or exotic plantations with a relatively clear understorey.

## Norfolk Island boobook owl

### Threats

The decline of the boobook owl was probably caused by a combination of unrelated environmental, demographic and genetic forces acting on a naturally small population. The loss of suitable nesting hollows caused by selective logging of large trees combined with competition from introduced species such as rosellas, starlings and honey bees was probably a major factor in the decline of this subspecies. Predation by rats and cats also remains a threat.

### Impact on Other Species

None known

### Management Actions

Controlling predators and competitors. Provision and maintenance of suitable nest boxes and continuing weed control and forest rehabilitation work.

### References

- Garnett, S.T. & Crowley, G.M. 2000. *The Action Plan for Australian Birds*. Environment Australia.
- Olsen, P.D. 1986. *Status and conservation of the Norfolk Island Boobook Owl Ninox novaeseelandiae undulata*. Unpublished report to the Australian National Parks and Wildlife Service.
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- Smithers, C.N. & Disney, H.J. 1969. The distribution of terrestrial and freshwater birds on Norfolk Island. *Australian Zoologist* 15: 127-140.
- Turner, J.S., Smithers, C.N. & Hoogland, R.D. 1968. *The Conservation of Norfolk Island*. Australian Conservation Foundation, Special Publication 1, Melbourne.



# Land Bird

## *Pachycephala pectoralis xanthoprocta*

### Conservation Significance

Endemic to Norfolk Island. Nationally threatened. Described as critically endangered in the Action Plan for Australian Birds (Garnett & Crowley 2000).

### Distribution

This subspecies was distributed throughout Norfolk Island (and probably Phillip Island) but is now largely restricted to the Mt Pitt section of the national park and nearby forested areas. There were about 1,000 breeding birds in 1987 but the population decreased between 1987 and 1996 (Robinson 1988, 1997). Recent estimates suggest the population has stabilised (Garnett & Crowley 2000).

### EPBC Listing

Vulnerable

### Ecology

Breeding: Breeds September to November, nest with one egg in December, young present in February.

Nesting: Nests in small trees or in hanging masses of vines.

Foraging: Diet poorly known but consists of insects and some fruit. Often ventures onto the ground to forage in leaf litter.

### Habitat

Occurs in all habitats within the national park and some forested areas outside it (Robinson 1988, 1997, Major 1989). Most abundant in palm forest (Robinson 1988), this subspecies usually inhabits the shrubby understorey in rainforest, palm forest, and pine forest. Whistlers sometimes occur in remnant forest on agricultural land but mainly occur in the largest tract of remnant forest in the national park.

### Threats

The main threats are predation from black rats (*Rattus rattus*) and cats and degradation and loss of habitat.

## golden whistler, tamey

### Impact on Other Species

None known

### Management Actions

Control of the main predators black rats and feral cats. Restore native forest inside and outside the national park.

### References

Commonwealth of Australia 2005. *National Recovery Plan for the Norfolk Island Scarlet Robin Petroica multicolor multicolor and the Norfolk Island Golden Whistler Pachycephala pectoralis xanthoprocta*. Department of the Environment and Heritage, Canberra.

Garnett, S.T. & Crowley, G.M. 2000. *The Action Plan for Australian Birds*. Environment Australia.

Major, R. 1989. *Reproductive output and recruitment of the Norfolk Island Scarlet Robin (Petroica multicolor multicolor) Phase II*. Report to the Australian National Parks and Wildlife Service, Canberra.

Robinson, D. 1988. *Ecology and Management of the Scarlet Robin, White-breasted White-eye and Long-billed White-eye of Norfolk Island*. Consultants report to the Australian National Parks and Wildlife Service.

Robinson, D. 1997. *An evaluation of the status of the Norfolk Island Robin following rat-control and weed-control works in the Norfolk Island National Park*. Report to Environment Australia, Canberra.

Schodde, R., Fullagar, P. & Hermes, N. 1983. *A review of Norfolk Island birds past and present*. Special Publication No. 8. Australian National Parks and Wildlife Service, Canberra.

Wakelin, H. 1968. Some notes on the birds of Norfolk Island. *Notornis* 15: 156-176.



# Land Bird

## *Petroica multicolor multicolor*

### Conservation Significance

Endemic to Norfolk Island. Nationally threatened. Described as vulnerable in the Action Plan for Australian Birds (Garnett & Crowley 2000).

### Distribution

Although once common and widespread over the island (and probably also on Phillip Island) its range contracted significantly since about 1960 (Schodde *et al.* 1983, Robinson 1988) and about 80% of the 800-1,000 birds are now found within the Mt Pitt section of the national park (Robinson 1988, 1997). There was little change in the density of birds inside the national park from 1987 to 1996 and the population appears secure there provided predator control continues (Robinson 1997). The last estimate of population size suggested there were about 440 pairs in 1997 of which about 50 pairs are outside the park (Robinson 1997).

Occur in all habitats within the national park and some forested areas outside it (Robinson 1988, 1997, Major 1989, Bell 1990). Important sites outside the park include the valleys between Prince Phillip Drive and Mt Pitt Road, between Douglas Drive and the park boundary and valleys near Duncombe Bay (Commonwealth of Australia 2005).

### EPBC Listing

Vulnerable

### Ecology

Breeding: Breeding season late September to March. Able to breed in the first year of life and produce two or three clutches per season. Overall each pair produces one fledgling per year (Major 1989).

Nesting: Nests placed near the top of the subcanopy or in upright fork or horizontal branch of tree.

Foraging: Feed on invertebrates, mainly insects, foraging on the ground or using low horizontal branches from which to pounce on prey.

## Norfolk Island scarlet robin

### Habitat

Mainly inhabits the cooler and damper native rainforest with lower densities in habitats dominated by Norfolk Island palm (*Rhopalostylis baueri*) or the exotic African olive (*Olea europaea* subsp. *cuspidata*) (Robinson 1988, 1997, Major 1989). They generally prefer areas such as gullies with a deep moist litter-layer, dense shrub layer 1-10 m tall to provide shelter and nests, and an open shaded layer near ground level to provide visibility for foraging (Robinson 1988, 1997).

### Threats

The main threats are predation from black rats (*Rattus rattus*) and cats, degradation and loss of habitat and vegetation management. Nests are vulnerable to predation by black rats.

### Impact on Other Species

None known

### Management Actions

Control of the main predators. Restore native forest inside and outside the national park. Weed management conducted with planting of native vegetation to avoid habitat becoming unsuitable (robins are ground feeders). Expand wildlife corridors in the forestry zone of the park.

### References

Bell, B.D. 1990. *The status and management of the White-breasted White-eye and other birds of Norfolk Island*. Unpublished report to the Australian Nature Conservation Agency.

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Robinson, D. 1997. *An evaluation of the status of the Norfolk Island Robin following rat-control and weed-control works in the Norfolk Island National Park*. Report to Environment Australia, Canberra.

Schodde, R., Fullagar, P. & Hermes, N. 1983. *A review of Norfolk Island birds past and present*. Special Publication No. 8. Australian National Parks and Wildlife Service, Canberra.



# Land Bird

## *Zosterops albogularis*

### Conservation Significance

Endemic to Norfolk Island. Nationally threatened. Described as critically endangered in the Action Plan for Australian Birds (Garnett & Crowley 2000).

### Distribution and Abundance

Early records suggest this species was common and widespread on the island before the end of the 1800s, after which the population declined dramatically to an estimate of less than 50 birds by 1962 (Schodde *et al.* 1983). By the 1970s the population had further declined and there have only been scattered sightings over the last two decades including two in 1991, four in 1994 and one in 2000 (Garnett & Crowley 2000).

This species is very rare, the last confirmed sighting was in 2004 (Christian 2005) with several unconfirmed sightings since then.

### EPBC Listing

Extinct, migratory

### Ecology

Inhabits the tree tops and is a tree-creeper feeding on small insects.

### Habitat

Occurs mainly in weed free native forest. Most recent sightings have been in the national park.

### Threats

The decline of this species was probably due to a combination of clearing of habitat, competition from the self-introduced Australian silvereye (*Z. lateralis*) and predation by cats and rats (Schodde *et al.* 1983, Garnett & Crowley 2000).

## white-breasted white-eye, grinnell

### Impact on Other Species

None known

### Management Actions

Predator control and surveys to determine status. Evaluate the potential of a captive breeding recovery program.

### References

Bell, B.D. 1990. *The status and management of the White-breasted White-eye and other birds of Norfolk Island*. Unpublished report to the Australian Nature Conservation Agency.

Christian, M. 2005. *Norfolk Island...the birds*. Green Eyes Publications. Norfolk Island.

Garnett, S.T. & Crowley, G.M. 2000. *The Action Plan for Australian Birds*. Environment Australia.

Robinson, D. 1988. *Ecology and Management of the Scarlet Robin, White-breasted White-eye and Long-billed White-eye of Norfolk Island*.

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Schodde, R., Fullagar, P. & Hermes, N. 1983. *A review of Norfolk Island birds past and present*. Special Publication No. 8. Australian National Parks and Wildlife Service, Canberra.



# Land Bird

## *Zosterops tenuirostris*

### Conservation Significance

Endemic to Norfolk Island. Described as endangered in the Action Plan for Australian Birds (Garnett & Crowley 2000).

### Distribution

A moderately abundant species originally derived from the Australian silvereve (Z. *lateralis*) that occurs primarily in rainforest, rainforest remnants, and tall secondary forest, and avoids the lower thickets and garden and forest edges (Schodde *et al.* 1983).

This species has gradually disappeared from all parts of the island that have been extensively cleared, a decline that has probably been exacerbated by the arrival of the black rat (*Rattus rattus*) (Robinson 1997). It is now largely confined to the national park.

### EPBC Listing

None

### Ecology

They forage in small groups and appear to have a different ecological niche to the self-introduced silvereve (Robinson 1988). They have a long down-curved bill and use it to probe fissures in bark for insects. They also eat fruit, including introduced species.

### Habitat

Lives in rainforest and tall secondary growth.

### Threats

The main threats are predation from black rats and feral cats and degradation and loss of habitat. This species has managed to survive due to its habit of fast movement and remote nest construction on slender branches which do not support the weight of feral animal predators (McCoy 2010 pers.comm.).

## slender-billed white-eye

### Impact on Other Species

None known

### Management Actions

Control of the main predators black rats and feral cats. Restore native forest inside and outside the national park.

### References

Christian, M. 2005. *Norfolk Island ... the birds*. Green Eyes Publications, Norfolk Island.

Garnett, S.T. & Crowley, G.M. 2000. *The Action Plan for Australian Birds*. Environment Australia.

Robinson, D. 1988. *Ecology and Management of the Scarlet Robin, White-breasted White-eye and Long-billed White-eye of Norfolk Island*.

Consultants report to Australian National Parks and Wildlife Service.

Robinson, D. 1997. *An evaluation of the status of the Norfolk Island Robin following rat-control and weed-control works in the Norfolk Island National Park*. Report to Environment Australia, Canberra.

Schodde, R., Fullagar, P. & Hermes, N. 1983. *A review of Norfolk Island birds past and present*. Special Publication No. 8. Australian National Parks and Wildlife Service, Canberra.



# Seabird

## *Anous minutus*

### Conservation Significance

Secure, widespread

### Distribution

The black noddy is the more common of the two noddy species present in the Norfolk Island region. It is a spring and summer breeding species that is well established on Norfolk and Phillip Islands. Large rookeries occur in the tall pines of Hundred Acre Reserve, Titerack Valley (in the national park at the end of McLaughlan's Lane), above Bloody Bridge and in White Oaks on Phillip Island (Christian 2005). In 1977 the breeding population on Phillip Island was estimated at between 1,000 and 10,000 breeding pairs (Fullagar 1978). The number of rookeries has fallen over the past few decades.

### EPBC Listing

Marine

### Ecology

Breeding: Breeding season is from October to March. They lay one egg.

Nesting: Nests built of leaves and twigs cemented with excreta in Norfolk Island pines (*Araucaria heterophylla*) or white oaks.

Foraging: Diet consists mainly of fish. Forages typically in flocks, swooping and snatching prey at the surface.

### Habitat

Exclusively pelagic mainly in tropical and subtropical waters. Often feeds at sea in groups.

### Threats

The main threats are changes to the marine environment and the degradation and loss of pine forest habitat through cattle grazing, weed invasion and development pressure. Other threats include predation from black rats (*Rattus rattus*) and cats.

## black noddy

### Impact on Other Species

None known

### Management Actions

Protection of nesting areas, predator control of feral pests around nesting areas on Norfolk Island and regular monitoring of the population to detect significant changes.

Encourage protection of pine forest habitat through covenants on private land. Depleted colonies in the park should be restored through enhancing pine forest habitat in the north-east corner of the park and the Cord area.

### References

Christian, M. 2005. *Norfolk Island ... the birds*. Green Eyes Publications, Norfolk Island.

Fullagar, P.J. 1978. *Norfolk Island birds*. Unpublished report to RAOU Congress, Norfolk Island.

Schodde, R., Fullagar, P. & Hermes, N. 1983. *A review of Norfolk Island birds past and present*. Special Publication No. 8. Australian National Parks and Wildlife Service, Canberra.



# Seabird

## *Anous stolidus*

### Conservation Significance

Secure, widespread

### Distribution

Widespread over subtropical and tropical seas worldwide, breeding on various islands. In Australia it breeds on the islands of the Great Barrier Reef, north west Australia and Lord Howe Island and the Norfolk Group.

It is a common spring and summer breeding species that gathers on the islands to nest then disperse out to sea. It nests in small groups on the ground or amongst rocks on Phillip Island. Estimates of breeding population on Phillip Island vary from a few hundred in 1978 and 1979 to over one thousand in 1977 (Schodde *et al.* 1983).

### EPBC Listing

Marine, migratory

### Ecology

Breeding: Breeds on Phillip Island in spring and early summer (October to December-January). On Norfolk each pair raises a single brood each year.

Nesting: Nests in a depression on the ground or in rocks

Foraging: Feeds mainly on fish foraging typically in flocks and swooping to take prey from the sea surface.

### Habitat

Marine, pelagic mainly in tropical or subtropical waters.

### Threats

The main threats are changes to the marine environment, predation from black rats, cats and dogs. As a ground nesting species the presence of cats and rats on Norfolk Island probably stop it from breeding there. This species is largely secure in Australasia but predation from rats and cats and disturbance from humans have adversely affected some populations.

## common noddy

### Impact on Other Species

None known

### Management Actions

Protection of nesting areas, and regular monitoring of the population to detect significant changes.

### References

Christian, M. 2005. *Norfolk Island ... the birds*. Green Eyes Publications, Norfolk Island.

Fullagar, P.J. 1978. *Norfolk Island birds*. Unpublished report to RAOU Congress, Norfolk Island.

Schodde, R., Fullagar, P. & Hermes, N. 1983. *A review of Norfolk Island birds past and present*. Special Publication No. 8. Australian National Parks and Wildlife Service, Canberra.





# Seabird

## *Gygis alba*

### Conservation Significance

Listed as vulnerable under the NSW *Threatened Species Conservation Act 1995*. Described as vulnerable in the Action Plan for Australian Birds (Garnett & Crowley 2000).

### Distribution

This species occurs in subtropical and tropical seas breeding on Norfolk Island, Lord Howe Island and the Cocos Keeling Islands. On Norfolk Island, white oak (*Lagunaria patersonia*) and Norfolk Island pine (*Araucaria heterophylla*) are the favoured nest trees (Schodde *et al.* 1983). The north-west coast of the island supports large rookeries as does the valley behind Bloody Bridge (Christian 2005). There are about 2,000 to 2,500 breeding pairs on Norfolk Island and this species has persisted despite predation from Australasian kestrels (*Falco cenchoides*) and marsh harriers (*Circus approximans*) (Garnett & Crowley 2000).

### EPBC Listing

Marine

### Ecology

Breeding: Spring/summer breeder with egg laying beginning in October. One egg is laid.

Nesting: No nest is built. The single egg is laid in a crevice on the horizontal branch of a tree.

Foraging: Diet consists mainly of small fish and squid. Feeds mainly by surface seizing and often feeds in small groups.

### Habitat

Marine, pelagic mostly in tropical and subtropical waters.

### Threats

The main threats are predation from rats and cats and degradation and loss of habitat.

## white tern

### Impact on Other Species

None known

### Management Actions

Protection of nesting areas, and regular monitoring of the population to detect significant changes. Restore remnant coastal pine/oak forests in the national park and in coastal reserves.

### References

Christian, M. 2005. *Norfolk Island ... the birds*. Green Eyes Publications, Norfolk Island.

Garnett, S.T. & Crowley, G.M. 2000. *The Action Plan for Australian Birds*. Environment Australia.

Marchant, S. & Higgins, P.J. (eds) 1990. *The Handbook of Australian, New Zealand and Antarctic Birds*. Vol. 1. Oxford University Press, Melbourne.

Schodde, R., Fullagar, P. & Hermes, N. 1983. *A review of Norfolk Island birds past and present*. Special Publication No. 8. Australian National Parks and Wildlife Service, Canberra.



# Seabird

## *Morus serrator*

### Conservation Significance

Described as least concern by the Action Plan for Australian Birds (Garnett & Crowley 2000).

### Distribution

The species is largely found in temperate waters with breeding colonies on rocky islands off Victoria, Tasmania and the North Island of New Zealand.

A rare summer breeding species that was first recorded nesting on Nepean Island in 1961, and breeds on Phillip Island with up to four pairs reported (Tarburton 1981). More recently, only three pairs were known to nest on Phillip Island (Christian 2005).

The continued small size of the colony reflects poor breeding success and suggests that these temperate-latitude gannets are at their ecological and physiological limits in the sub-tropical seas around Norfolk Island (Schodde *et al.* 1983).

### EPBC Listing

Marine

### Ecology

Breeding: breeds on Phillip Island in summer.

Nesting: Nest colonially on mounds of guano mixed with seaweed or earth built on rocks.

Foraging: Feeds on small fish and cephalopods.

### Habitat

A marine pelagic species whose non-breeding range extends from the seas off southern Australia to northern Queensland and the Lord Howe and the Norfolk Island groups. Juveniles may remain near breeding colonies throughout the year although most non-breeding birds disperse.

### Threats

Changes in the marine environment, may be caught in long-line fishing gear, and may suffer from competition from fishing industry. Both on Phillip Island and on Nepean Island, breeding birds are free from predators - gulls, skuas and introduced rats and cats.

## Australasian gannet

### Impact on Other Species

None known

### Management Actions

Protection of nesting areas and regular monitoring of the population to detect significant changes.

### References

Christian, M. 2005. *Norfolk Island ... the birds*. Green Eyes Publications, Norfolk Island.

Garnett, S.T. & Crowley, G.M. 2000. *The Action Plan for Australian Birds*. Environment Australia.

Schodde, R., Fullagar, P. & Hermes, N. 1983. *A review of Norfolk Island birds past and present*. Special Publication No. 8. Australian National Parks and Wildlife Service, Canberra.

Tarburton, M.K. 1981. Seabirds nesting on Norfolk Island. *Notornis* **28**: 209-211.



# Seabird

## *Phaethon rubricauda*

### Conservation Significance

Listed as vulnerable under the NSW *Threatened Species Conservation Act 1995*. Described as near threatened in the Action Plan for Australian Birds (Garnett & Crowley 2000).

### Distribution

Widespread throughout the subtropical and tropical zones of the Indian and West Pacific Oceans. In Australia it breeds on Ashmore Reef, Rowley Shoals, Cocos-Keeling islands, Christmas Island, islands of the Great Barrier Reef and islands of the Lord Howe Island and Norfolk Island Groups.

A widespread coastal summer breeding species, this species is well established on the Norfolk Group and occurs on all three islands. Numbers were apparently stable, particularly on Phillip Island where there are no predators (Schodde *et al.* 1983). Phillip Island supports one of the largest breeding populations in Australia.

### EPBC Listing

Marine

### Ecology

Breeding: Nest selection occurs in November with eggs laid through December, and eggs hatch into early February. Usually a single egg is laid.

Nesting: Nest consists of a scrape on the ground on an inaccessible ledge or under shrubs usually near the tops of coastal sea cliffs.

Foraging: Diet consists of squid and fish taken well out to sea.

### Habitat

Marine, pelagic mainly in subtropical and tropical waters. Feeds at sea during the day but is often seen flying around breeding areas in the day.

## red-tailed tropicbird

### Threats

The main threats to this species are changes to the marine environment, interference by people, and predation by cats and rats where they nest above the cliff edge or in accessible areas (Hundred Acres Reserve, Rocky Point Reserve). Most of the population is not under threat as they nest below the cliff edge.

### Impact on Other Species

None known

### Management Actions

Protection of nesting areas, and regular monitoring of the population to detect significant changes. Establish effective quarantine for Phillip Island to prevent introduction of cats and rats.

### References

- Christian, M. 2005. *Norfolk Island ... the birds*. Green Eyes Publications, Norfolk Island.
- Garnett, S.T. & Crowley, G.M. 2000. *The Action Plan for Australian Birds*. Environment Australia.
- Schodde, R., Fullagar, P. & Hermes, N. 1983. *A review of Norfolk Island birds past and present*. Special Publication No. 8. Australian National Parks and Wildlife Service, Canberra.



# Seabird

## *Procelsterna cerulea albivitta*

### Conservation Significance

Listed as vulnerable under the NSW *Threatened Species Conservation Act 1995*. Described as endangered in the Action Plan for Australian Birds (Garnett & Crowley 2000).

### Distribution

A common but not widespread summer breeding subspecies that breeds on Phillip Island, Nepean Island, and offshore stacks off Norfolk Island's north coast (Schodde *et al.* 1983, Christian 2005). It also breeds on islands in the Lord Howe complex and on New Zealand islands (Garnett & Crowley 2000). Scarcity of breeding on the main islands of Lord Howe and Norfolk suggests it is vulnerable to rat predation and the population on Norfolk may have been reduced due to predation by the self introduced Australasian kestrel (*Falco cenchroides*); marsh harriers (*Circus approximans*) visiting from New Zealand may take some birds (Garnett & Crowley 2000).

### EPBC Listing

Marine

### Ecology

Breeding: Breeds in summer

Nesting: No nest is built with eggs laid in a scrape on the ground, in a niche under a boulder or on a cliff ledge.

Foraging: Feeds on small fish and crustaceans seized at the surface; usually feeds in small flocks but sometimes alone.

### Habitat

Marine, pelagic. Seen at sea feeding in flocks or in flocks around breeding sites.

### Threats

The main threats are changes to the marine environment, predation from rats, cats, kestrels and purple swamphens (*Porphyrio porphyrio*) and degradation and loss of breeding habitat.

## grey ternlet (western pacific)

### Impact on Other Species

None known

### Management Actions

Protection of nesting areas, and regular monitoring of the population to detect significant changes.

### References

Christian, M. 2005. *Norfolk Island ... the birds*. Green Eyes Publications, Norfolk Island.

Garnett, S.T. & Crowley, G.M. 2000. *The Action Plan for Australian Birds*. Environment Australia.

Schodde, R., Fullagar, P. & Hermes, N. 1983. *A review of Norfolk Island birds past and present*. Special Publication No. 8. Australian National Parks and Wildlife Service, Canberra.



# Seabird

## *Pterodroma cervicalis*

### Conservation Significance

Described as vulnerable in the Action Plan for Australian Birds (Garnett & Crowley 2000).

### Distribution

Before 1995 this species was only known to breed at Macauley Island and Raoul Island in the Kermadec Group, but a population of about 10 breeding birds was discovered breeding on Phillip Island in 1995 (Garnett & Crowley 2000). There are now two colonies each consisting of 10-12 breeding pairs on Phillip Island (NINPAC pers. comm.).

### EPBC Listing

Marine

### Ecology

Breeding: breeds in summer

Nesting: Nest in burrows

Foraging: Feed on small squid and crustaceans taken from the open ocean.

### Habitat

Marine pelagic species that migrates to the North Pacific when not breeding.

### Threats

The main threats are changes to the marine environment, predation of chicks by purple swamphen (*Porphyrio porphyrio*) and disturbance, degradation and loss of breeding habitat.

## white-necked petrel

### Impact on Other Species

None known

### Management Actions

Protection of nesting areas and regular monitoring of the population to detect significant changes.

### References

Christian, M. 2005. *Norfolk Island ... the birds*. Green Eyes Publications, Norfolk Island.

Garnett, S.T. & Crowley, G.M. 2000. *The Action Plan for Australian Birds*. Environment Australia.

Schodde, R., Fullagar, P. & Hermes, N. 1983. *A review of Norfolk Island birds past and present*. Special Publication No. 8. Australian National Parks and Wildlife Service, Canberra.



# Seabird

## *Pterodroma neglecta neglecta*

### Conservation Significance

Nationally threatened. Listed as vulnerable under the NSW *Threatened Species Conservation Act 1995*. Described as critically endangered in the Action Plan for Australian Birds (Garnett & Crowley 2000).

### Distribution

The western subspecies of the Kermadec petrel was once far more common, breeding on islands across the southern Pacific Ocean including Lord Howe Island but its breeding range is now much smaller. It nests on the ground so is particularly vulnerable to predation (Merton 1970). In the Australian region, small numbers of pairs nest on Phillip Island and Ball's Pyramid to the south of Lord Howe Island. Black rats (*Rattus rattus*) caused their extinction from Lord Howe Island (Fullagar & Disney 1975) and probably prevent them from colonising Norfolk Island (Garnett & Crowley 2000).

### EPBC Listing

Vulnerable, marine

### Ecology

Breeding: Breed in the summer, a single egg is laid and fledging takes about 3 months.

Nesting: Nests in crevices among rocks and vegetation.

Foraging: Forages far out to sea and feeds on small squid and crustaceans.

### Habitat

Marine, pelagic in waters 15-25 C. Breeds on high islands among rocks and vegetation.

### Threats

The main threats are changes to the marine environment, predation of chicks by purple swamphen (*Porphyrio porphyrio*) and disturbance, degradation and loss of breeding habitat.

## Kermadec petrel (western)

### Impact on Other Species

None known

### Management Actions

Protection of nesting areas and regular monitoring of the population to detect significant changes.

### References

- Christian, M. 2005. *Norfolk Island ... the birds*. Green Eyes Publications, Norfolk Island.
- Fullagar, P.J. & Disney, H.J. 1975. The birds of Lord Howe Island: a report on the rare and endangered species. *ICBP Bull.* 12:187-202.
- Garnett, S.T. & Crowley, G.M. 2000. *The Action Plan for Australian Birds*. Environment Australia.
- Marchant, S. & Higgins, P.J. (eds) 1990. *The Handbook of Australian, New Zealand and Antarctic Birds*. Vol. 1. Oxford University Press, Melbourne.
- Merton, D. V. 1970. Kermadec Island expedition reports: a general account of bird life. *Notornis* 17: 147-199.
- Schodde, R., Fullagar, P. & Hermes, N. 1983. *A review of Norfolk Island birds past and present*. Special Publication No. 8. Australian National Parks and Wildlife Service, Canberra.



# Seabird

## *Pterodroma nigripennis*

### Conservation Significance

Listed as vulnerable under the NSW *Threatened Species Conservation Act 1995*. Described as least concern in the Action Plan for Australian Birds (Garnett & Crowley 2000).

### Distribution

This species has a wide oceanic range in the Tasman Sea and in the subtropical and tropical regions of the Central Pacific Ocean. It breeds on Lord Howe Island, the Norfolk Island Group, Kermadec Island, Three Kings Group, the Chatham Islands and the Austral Group. In the Norfolk Island Group it is an uncommon breeding summer migrant that is present from late November to early March, with its main breeding area being on Phillip Island (Schodde *et al.* 1983). The species has attempted to breed on the main island but mortality has been high probably due to predation from feral cats and rats (Schodde *et al.* 1983). There are between 50 and 100 pairs breeding on Phillip Island (NINPAC pers. comm.).

### EPBC Listing

Marine

### Ecology

Breeding: Summer breeder. Single egg, incubation 45 days, fledging at 85 days.

Nesting: Build burrows under rocks or in low vegetation on high ground among cliff faces.

Foraging: Feed on small fish, squid and crustaceans. Feed by surface seizing and dipping.

### Habitat

Migratory and highly pelagic. Nest colonies are usually among low vegetation on cliff faces.

### Threats

The main threats are changes to the marine environment, predation from rats and cats, and degradation and loss of habitat.

## black-winged petrel

### Impact on Other Species

None known

### Management Actions

Protection of nesting areas, and regular monitoring of the population to detect significant changes. Protection of potential nesting sites on Norfolk Island from feral cats and rats to re-establish colonies there.

### References

Christian, M. 2005. *Norfolk Island ... the birds*. Green Eyes Publications, Norfolk Island.

Garnett, S.T. & Crowley, G.M. 2000. *The Action Plan for Australian Birds*. Environment Australia.

Marchant, S. & Higgins, P.J. (eds) 1990. *The Handbook of Australian, New Zealand and Antarctic Birds*. Vol. 1. Oxford University Press, Melbourne.

Schodde, R., Fullagar, P. & Hermes, N. 1983. *A review of Norfolk Island birds past and present*. Special Publication No. 8. Australian National Parks and Wildlife Service, Canberra.



# Seabird

## *Pterodroma solandri*

### Conservation Significance

Listed as vulnerable under the NSW *Threatened Species Conservation Act 1995*. Described as vulnerable in the Action Plan for Australian Birds (Garnett & Crowley 2000).

### Distribution

This species was discovered on Norfolk Island in 1788 and was quite common with large breeding colonies on Mt Pitt and Mt Bates. The birds were an important source of food for the early settlers and more than 170,000 birds were harvested between April and July 1790. By 1796 the population had dropped to about 15,000 and by 1800 the species was exterminated from Norfolk Island (Lindsey 1986).

About 20 pairs currently breed on Phillip Island and about 100,000 birds breed on Lord Howe Island (Garnett and Crowley 2000). Feral cats and rats have prevented this species re-establishing on Norfolk Island.

### EPBC Listing

Marine, migratory

### Ecology

Breeding: Present on Phillip Island from February to November, with most breeding occurring in May. Adults share incubation and feeding of young. Individuals do not breed every year.

Nesting: Nests in a chamber at the end of a burrow.

Foraging: Diet consists of squid, fish and crustaceans. While feeding chicks, adults make foraging trips of 1 to 14 days and return to feed chicks in the late afternoon and through the night.

### Habitat

Marine, pelagic in waters 15-25 C. Breeds on the upper slopes of Phillip Island.

## providence petrel

### Threats

The main threats are changes to the marine environment, competition with wedge-tailed shearwaters (*Puffinus pacificus*) and degradation and loss of habitat. The providence petrel is a winter breeder and when chicks are almost fledged the adults only return briefly at night to feed them. Many unprotected chicks are evicted from their nests by shearwaters (Evans pers. comm.)

### Impact on Other Species

Disturbance to invertebrate fauna through excavation of burrows.

### Management Actions

Protection of nesting areas, and regular monitoring of the population to detect significant changes. Develop a method of protecting chicks in nesting burrows from wedge-tailed shearwaters such as artificial nest flaps. Assess the potential for re-establishing a colony on Mt Pitt.

### References

Christian, M. 2005. *Norfolk Island ... the birds*. Green Eyes Publications, Norfolk Island.

Garnett, S.T. & Crowley, G.M. 2000. *The Action Plan for Australian Birds*. Environment Australia.

Lindsey, T.R. 1986. *The Seabirds of Australia: the national photographic index of Australian Wildlife*. Angus and Robertson, North Ryde.

Marchant, S. & Higgins, P. J. (eds) 1990. *The Handbook of Australian, New Zealand and Antarctic Birds*. Vol. 1. Oxford University Press, Melbourne.





# Seabird

## *Puffinus assimilis*

### Conservation Significance

Listed as vulnerable under the NSW *Threatened Species Conservation Act 1995*. Described as vulnerable in the Action Plan for Australian Birds (Garnett & Crowley 2000).

### Distribution

A widespread species of the subtropical Atlantic, Indian and Pacific Oceans. Breeds on islands of the Lord Howe Group, the Kermadec Islands, the Norfolk Group, and islands off the Western Australian coast.

It breeds on Phillip and Nepean Islands and has been reported from Anson Point in the mid 1970s. Predation from feral cats and rats has apparently eliminated colonies from the main island.

### EPBC Listing

Marine

### Ecology

Breeding: Winter breeding present in the Norfolk Group from July to December (Schodde *et al.* 1983).

Nesting: Nest in a narrow burrow.

Foraging: Diet consists of small fish, squid and krill. Food captured by surface diving, pursuit plunging, and by surface seizing.

### Habitat

Marine, pelagic, breeds on subtropical and subantarctic islands and digs burrows in soft soil under mats of succulents, in grassland, under low shrubs or among loose rocks.

### Threats

The main threats are changes to the marine environment, predation from rats, cats and kestrels. Also threatened by degradation and loss of breeding habitat.

## little shearwater

### Impact on Other Species

None known

### Management Actions

Protection of nesting areas, and regular monitoring of the population to detect significant changes.

### References

Garnett, S.T. & Crowley, G.M. 2000. *The Action Plan for Australian Birds*. Environment Australia.

Marchant, S. & Higgins, P.J. (eds) 1990. *The Handbook of Australian, New Zealand and Antarctic Birds*. Vol. 1. Oxford University Press, Melbourne.

Schodde, R., Fullagar, P. & Hermes, N. 1983. *A review of Norfolk Island birds past and present*. Special Publication No. 8. Australian National Parks and Wildlife Service, Canberra.



# Seabird

## *Puffinus carneipes*

### Conservation Significance

Listed as vulnerable under the NSW *Threatened Species Conservation Act 1995*.

### Distribution

A widespread species across the southern Indian Ocean and south-eastern Pacific Ocean. Breeding and non-breeding visitor to the coastal and pelagic waters of southern Australia.

### EPBC Listing

Marine, Migratory

### Ecology

Breeding: late August to December.

Nesting: Nests in a narrow burrow.

Foraging: Diet consists of small fish and squid. Food captured by surface diving, pursuit plunging, and by surface seizing.

### Habitat

Breeding may occur on islands within the Australasian region and Indian Ocean. Nests made in burrows on gentle to steep slopes where burrowing is not restricted by dense vegetation, deep litter or bare rock. Nesting colonies require clear, elevated places to allow sufficient space for take-off.

### Threats

The main threats are changes to the marine environment, predation from rats, cats and kestrels. Also threatened by degradation and loss of breeding habitat.

## fleshy-footed shearwater

### Impact on Other Species

None known

### Management Actions

Protection of nesting areas, and regular monitoring of the population to detect significant changes.

### References

Christian, M. 2005. *Norfolk Island ... the birds*. Green Eyes Publications, Norfolk Island.

Marchant, S. & Higgins, P.J. (eds) 1990. *The Handbook of Australian, New Zealand and Antarctic Birds*. Vol. 1. Oxford University Press, Melbourne.



# Seabird

## *Puffinus pacificus*

### Conservation Significance

Listed as vulnerable under the NSW *Threatened Species Conservation Act 1995*.

### Distribution

This species is the most common and widespread shearwater in the south-west Pacific and Indian Oceans with many breeding localities. It is a common breeding summer migrant to the Norfolk Group where it breeds on all three islands (Schodde *et al.* 1983) with a total breeding population of several hundred of thousands of birds (Tarburton 1981). Black rats (*Rattus rattus*) have caused populations on some Pacific islands such as Midway to decline and feral cats severely damage shearwater colonies (Fitzherbert & Peter 1988). Another threat to this species is through entanglement in kikuyu (*Pennisetum clandestinum*).

### EPBC Listing

Marine, migratory

### Ecology

Breeding: Summer breeder returning to Norfolk in September-October and departing in March.

Nesting: Nests are in crowded colonies often concentrated among tussocks of kikuyu. The nest is at the end of a burrow that can be up to 1-2 m long.

Foraging: Diet consists of squid, fish and crustaceans taken mainly at the surface.

### Habitat

Marine, pelagic mainly in tropical and subtropical waters. Feeds at sea during the day and rafts of birds can often be seen just offshore before they return to the breeding colonies at dusk.

## wedge-tailed shearwater, ghost bird

### Threats

The main threats are changes to the marine environment, ingestion of floating plastic marine debris, predation from black rats and cats, and degradation and loss of breeding habitat particularly through weed invasion from kikuyu. Chicks can get entangled in kikuyu runners.

### Impact on Other Species

When adults return to breed they will evict unfledged providence petrel (*Pterodroma solandri*) chicks from their burrows.

### Management Actions

Protection of nesting areas, and regular monitoring of the population to detect significant changes.

### References

Christian, M. 2005. *Norfolk Island ... the birds*. Green Eyes Publications, Norfolk Island.

Fitzherbert, K. & Peter, J. 1988. *Status and movement of Australian migratory birds Vol 1. Procellariiformes Part II*. Royal Australasian Ornithologists Union.

Marchant, S. & Higgins, P.J. (eds) 1990. *The Handbook of Australian, New Zealand and Antarctic Birds*. Vol. 1. Oxford University Press, Melbourne.

Schodde, R., Fullagar, P. & Hermes, N. 1983. *A review of Norfolk Island birds past and present*. Special Publication No. 8. Australian National Parks and Wildlife Service, Canberra.

Tarburton, M.K. 1981. Seabirds nesting on Norfolk Island. *Notornis* 28: 209-211.



# Seabird

## *Sterna fuscata*

### Conservation Significance

Listed as vulnerable under the NSW *Threatened Species Conservation Act 1995*.

### Distribution

A wide distribution over tropical and subtropical seas breeding on numerous islands (including islands of the Great Barrier Reef), north-west Australia and the south-west Pacific (including the Lord Howe and Norfolk Island Groups).

Known on Norfolk Island as the whale bird, this is an abundant summer breeding species that nests on Phillip and Nepean Islands and on the north coast of the main island (Schodde *et al.* 1983). There was an estimated 80,000 to 140,000 birds breeding in the Norfolk Group (Blakers *et al.* 1984) including about 20,000 on Phillip Island and several hundred on Nepean Island (Fullagar 1978).

In 1908, 10,000 to 15,000 eggs were harvested from Nepean Island several times a week (Schodde *et al.* 1983). This species is subject to a limited annual open season for the harvesting of eggs.

### EPBC Listing

Marine

### Ecology

Breeding: Present around Norfolk from August, this species is a spring/summer breeder with most pairs starting to nest in November but the laying season is prolonged by the harvesting of eggs by islanders.

Nesting: Nest is a shallow scrape in sand or soft soil.

Foraging: Diet consists of squid, crustaceans and fish with nocturnal and diurnal foraging by swooping to snatch at the surface.

### Habitat

Marine, pelagic in tropical and subtropical waters, breeding on islands.

## sooty tern, whale bird

### Threats

The main threats are changes to the marine environment, predation from rats and cats, and degradation and loss of habitat.

### Impact on Other Species

None known

### Management Actions

Protection of nesting areas, and regular monitoring of the population to detect significant changes.

### References

Blakers, M., Davies, S.J.J.F. & Reilly, P.M. 1984. *An atlas of Australian birds*. Royal Australasian Ornithologists Union, Melbourne University Press, Melbourne.

Christian, M. 2005. *Norfolk Island ... the birds*. Green Eyes Publications, Norfolk Island.

Fullagar, P.J. 1978. *Norfolk Island birds*. Unpublished report to RAOU Congress, Norfolk Island.

Marchant, S. & Higgins, P.J. (eds) 1990. *The Handbook of Australian, New Zealand and Antarctic Birds*. Vol. 1. Oxford University Press, Melbourne.

Schodde, R., Fullagar, P. & Hermes, N. 1983. *A review of Norfolk Island birds past and present*. Special Publication No. 8. Australian National Parks and Wildlife Service, Canberra.



# Seabird

## *Sula dactylatra*

### Conservation Significance

Listed as vulnerable under the NSW *Threatened Species Conservation Act 1995*. Described as vulnerable in the Action Plan for Australian Birds 2000 (Garnett & Crowley 2000).

### Distribution

Widely distributed throughout the tropical and subtropical seas of the world. In Australia it breeds on islands off north-east and north-west Australia.

In the Norfolk Island Group it nests regularly on Nepean and Phillip Islands. Boobies have attempted to nest on rocky islets off the coast and began establishing a colony at Rocky Point on the main island, which persisted for a few years before some birds were killed and the colony dispersed. Long-term banding of this species suggests a marked decline over recent years (Christian 2005).

### EPBC Listing

Marine, migratory

### Ecology

Breeding: Protracted breeding season from August to February with the main egg laying occurring in October. Out of a clutch of two eggs only one is raised.

Nesting: Nests on the ground in high open areas.

Foraging: Diet consists of squid and fish.

### Habitat

Marine, pelagic mainly in tropical and subtropical waters. Breeds on high open areas so it can take off into the wind.

### Threats

The main threats are from changes in the marine environment, while predation from rats and cats, and disturbance from humans and dogs limits breeding on Norfolk Island.

## masked booby

### Impact on Other Species

None known

### Management Actions

Protection of nesting areas, and regular monitoring of the population to detect significant changes.

### References

Christian, M. 2005. *Norfolk Island ... the birds*. Green Eyes Publications, Norfolk Island.

Garnett, S.T. & Crowley, G.M. 2000. *The Action Plan for Australian Birds*. Environment Australia.

Schodde, R., Fullagar, P. & Hermes, N. 1983. *A review of Norfolk Island birds past and present*. Special Publication No. 8. Australian National Parks and Wildlife Service, Canberra.

Tarburton, M.K. 1981. Seabirds nesting on Norfolk Island. *Notornis* 28: 209-211.



# Reptile

## *Christinus guentheri*

### Conservation Significance

Endemic to the Norfolk Island Group and the Lord Howe Island Group. Nationally threatened. Listed as vulnerable under the NSW *Threatened Species Conservation Act 1995*.

### Distribution

This species was described from Norfolk Island and Lord Howe Island in 1885. On the Lord Howe Island complex this species was abundant on the main island until the 1930s after which it declined dramatically and is now found only in small numbers in few locations, but it has remained common on some of the other islands of the group and probably occurs on all vegetated rocky outcrops in the Lord Howe complex.

On the Norfolk Island complex, this species has been found on Nepean and Phillip Islands and on three small rocky islets – Moo’oo Stone, Bird Rock and Green Pool Stone each about 100 m from the northern cliffs of Norfolk Island. It almost certainly occurs on other rocky islets but it has not been found on the main island and became extinct there prior to European settlement (Cogger *et al.* 2005). Remains of this species have been identified on the main island from deposits dating back to 6,500 BP but early European reports expressed surprise at the absence of reptiles on the main island (Cogger *et al.* 1979).

Cogger *et al.* (1979) suggested that a conservative estimate for the gecko population on Phillip Island would be 100,000 individuals. The subsequent removal of rabbits and recovery of vegetation on Phillip Island has provided additional suitable habitat for this species. A recent survey suggests this species is at least as abundant, and probably much more abundant, than in 1978 with a population estimate of between 99,000 and 176,000 on Phillip Island (Cogger *et al.* 2005).

### EPBC Listing

Vulnerable

## Lord Howe Island gecko

### Ecology

A nocturnal species that shelters under rocks, in splits in trees, and under man made shelter during the day. It feeds on beetles, spiders, moths, ants and other insects among the leaf litter, also hunts in trees and feeds on the nectar of some flowers. It uses rock boulders and rock crevices for shelter and egg-deposition sites. Lays a clutch of 1-3 eggs, and incubation is about 80 to 90 days. Females probably have multiple clutches as gravid females have been reported in November and in March.

### Habitat

The species occurs in a range of habitats including primary forest, secondary regrowth forest and lightly grassed or bare rocky islands that are exposed to extreme climatic and physical conditions (Cogger *et al.* 2005). It has been observed at night on both shrubs and trees but especially on flowering white oak (*Lagunaria patersonia*) and Norfolk Island hibiscus (*Hibiscus insularis*) where it feeds on the nectar (Cogger *et al.* 2005). It can also be found on Norfolk Island pine (*Araucaria heterophylla*) and on the weed species African olive (*Olea europaea* subsp. *cuspidata*) but it is largely absent from all but the edges of the dense groves of immature olives. Most geckos make only relatively short journeys onto bare ground from the cover of edge vegetation or rock screes.

### Threats

The presence of black rats (*Rattus rattus*) and cats on Norfolk Island probably prevents this species from establishing there. The main threats are the introduction of predators such as rats and cats or competitors such as the Asian house gecko (*Hemidactylus frenatus*) to Phillip and Nepean Islands; and degradation and loss of habitat on those islands.

### Impact on Other Species

None known



### **Management Actions**

Continue weed control and habitat restoration work on Phillip Island, particularly removal of African olive and re-establishing stands of white oak; and establish effective quarantine protocols for Phillip Island. Should rats and cats be controlled on Norfolk Island it may be possible to re-establish a population there.

### **References**

Cogger, H.G., Cameron, E.E. & Sadler, R.A. 1979. *The terrestrial reptiles of islands in the Norfolk Island complex*. Unpublished report to the Australian National Parks and Wildlife Service, Canberra.

Cogger, H.G., Muir, G. & Shea G. 2005. *A survey of terrestrial reptiles of Norfolk Island March 2005*. Unpublished report to the Department of the Environment and Heritage, Canberra.



# Reptile

## *Oligosoma lichenigera*

### Conservation Significance

Endemic to the Norfolk Island Group and the Lord Howe Island Group. Nationally threatened. Listed as vulnerable under the NSW *Threatened Species Conservation Act 1995*.

### Distribution

This species was described in 1874 from Lord Howe Island but was first recorded on the Norfolk Island complex in 1978 (Cogger *et al.* 1993).

On the Lord Howe Island Group this species is as widely distributed as the Lord Howe Island gecko (*Christinus guentheri*). On the Norfolk Island Group this species has only been found on Phillip Island, despite considerable search effort on Nepean Island and on many of the small rocky islets (Cogger *et al.* 1979). The skink is not as abundant as the gecko, for example 10 specimens were encountered on Fisherman's Hut Rock, Phillip Island during which time 285 geckos were also found (Cogger *et al.* 1979).

The population on Phillip Island is estimated to be large and secure and the increase in suitable habitat since the removal of rabbits in 1986 suggests that they were at least as abundant in 2005 as they were in 1978 (Cogger *et al.* 2005).

### EPBC Listing

Vulnerable

### Ecology

Knowledge of the biology, ecology and conservation status of this species is fragmentary and based on few individual records. It is a nocturnal species that shelters under rocks, in splits in trees, and in holes in rocks during the day. It feeds on beetles, spiders, moths, ants and other insects among the leaf litter.

## Lord Howe Island skink

### Habitat

This species ranged across a variety of habitats from bare cliffs and eroded slopes to the narrow and heavily wooded gullies of Long Valley (Cogger *et al.* 1993). Greater densities of skinks occur where the vegetation has formed dense root mats in which they could hide and forage, sometimes of grasses but especially of Moo'oo (*Cyperus haematodes*) and native flax (*Phorium tenax*).

### Threats

The presence of rats and cats on Norfolk Island probably prevents this species from establishing there. The main threats are the introduction of rats, cats or other predators or competitors to Phillip Island and degradation and loss of habitat.

### Impact on Other Species

None known

### Management Actions

Continue weed control and habitat restoration work on Phillip Island and establish effective quarantine protocols for Phillip Island. Should rats and cats be controlled on Norfolk Island it may be possible to establish a population there.

### References

- Cogger, H.G., Cameron, E.E. & Sadlier, R.A. 1979. *The terrestrial reptiles of islands in the Norfolk Island complex*. Unpublished report to the Australian National Parks and Wildlife Service, Canberra.
- Cogger, H.G., Cameron, E.E., Sadlier, R.A. & Egger, P. 1993. *The Action Plan for Australian Reptiles*. Australian Nature Conservation Agency, Canberra.
- Cogger, H.G., Muir, G. & Shea G. 2005. *A survey of terrestrial reptiles of Norfolk Island March 2005*. Unpublished report to the Department of the Environment and Heritage, Canberra.





# Mollusc

## *Advena campbellii campbellii*

### Conservation Significance

Endemic to the Norfolk Island Group. Nationally threatened. Listed as extinct on the IUCN Red List (IUCN 2008).

### Description

Usually has a bicoloured shell with an elevated fawn spire and a black round base. Typical specimen is about 17mm in diameter and 11mm high.

### Distribution

This species was once common on Phillip Island and pre-European fossil records suggest it was found over the south east of Norfolk Island. Recent records suggest it is now restricted to Norfolk Island National Park in the area around Mt Pitt. The range contraction and rarity suggest it may be close to extinction (Varman 1998).

### EPBC Listing

Critically endangered.

### Ecology

Live bearing and the largest of the native land snails.

### Habitat

Saxicoline, under rocks (Smith 1992)

### Threats

Habitat degradation and modification by the introduction of feral animals (notably rats). Land clearing and stock grazing have probably contributed to the decline, along with predation by rodents and feral fowl.

## Campbell's helicarionid land snail

### Impact on Other Species

None known

### Management Actions

Restore native forest habitat, control introduced weeds and predators, survey to determine the extent of existing populations and consider captive breeding.

### References

- Hyman, I. 2005. Taxonomy, systematic and evolutionary trends in Helicarionida (Mollusca, Pulmonata). PhD Thesis, University of Sydney. 583pp.
- Iredale, T. 1945. The land mollusca of Norfolk Island. *Australian Zoologist* 11: 46-71.
- IUCN 2008. *2008 IUCN Red List of Threatened Species*. <[www.iucnredlist.org](http://www.iucnredlist.org)>
- Ponder, W.F. 1997. Conservation status, threats and habitat requirements of Australian terrestrial and freshwater mollusca. *Memoirs of the Museum of Victoria* 56: 421-430.
- Smith, B.J. 1992. Non-marine Mollusca. In Houston, W.W.K. (ed.) *Zoological Catalogue of Australia Volume 8*. Australian Government Publishing Service, Canberra.
- Varman, R.V.J.P. 2001. Norfolk Island Snail Species List from Dr Varman's website: <http://www.geocities.com/Paris/LeftBank/6559/index.html>



# Mollusc

## *Mathewsoconcha grayi*

### Conservation Significance

Endemic to the Norfolk Island Group. Nationally threatened.

### Description

This species has a similar shell to *M. suteri* but the spire is slightly higher and the shell distinctly larger and more inflated. Typical specimen is 15mm in diameter and 11mm in height (Hyman 2005). There is no peripheral band.

### Distribution

Fossils of this species were found from Nepean Island and it was common in sub-fossil deposits on Norfolk Island but it was not located in native forests during surveys between 1983 and 1990 (Varman 1991). The species may still survive on Phillip Island as the only non-fossil material for this species comes from two specimens collected there in 1982 (Varman 1998). Probably extinct on Norfolk and restricted to Phillip Island where, because of previous destruction of vegetation by rabbits, it is unlikely to be anything other than very rare.

### Ecology

Little known

### Habitat

Litter and woodland (Smith 1992)

### EPBC Listing

Critically endangered

### Threats

Habitat degradation and modification by the introduction of feral animals (notably rats). Land clearing and stock grazing have probably contributed to the decline, along with predation by rodents and feral fowl.

## Gray's helicarionid land snail

### Impact on Other Species

None known

### Management Actions

Restore native forest habitat, control introduced weeds and predators, survey to determine the extent of existing populations and consider captive breeding.

### References

- Hyman, I. 2005. Taxonomy, systematic and evolutionary trends in Helicarionida (Mollusca, Pulmonata). PhD Thesis, University of Sydney. 583pp.
- Iredale, T. 1945. The land mollusca of Norfolk Island. *Australian Zoologist* 11: 46-71.
- Ponder, W.F. 1997. Conservation status, threats and habitat requirements of Australian terrestrial and freshwater mollusca. *Memoirs of the Museum of Victoria* 56: 421-430.
- Smith, B. J. 1992. Non-marine Mollusca. In Houston, W.W.K. (ed.) *Zoological Catalogue of Australia Volume 8*. Australian Government Publishing Service, Canberra.
- Varman, R.V.J.P. 2001. Norfolk Island Snail Species List from Dr Varman's website: <http://www.geocities.com/Paris/LeftBank/6559/index.html>



# Mollusc

## *Mathewsoconcha phillipii*

### Conservation Significance

Endemic to the Norfolk Island Group. Nationally threatened.

### Description

Very similar to *M. grayi* but has a slightly larger shell, the spire is shorter and there is a white narrow peripheral band. Typical specimen is 16mm in diameter and 12 mm in height (Hyman 2005).

### Distribution

This species is known from non-fossil material only from the type specimens from Phillip Island. Fossils of this species were collected from the Cemetery Bay area of Norfolk Island (Varman 1991). Probably extinct on Norfolk and restricted to Phillip Island where, because of the previous destruction of the vegetation by rabbits, it is unlikely to be anything other than very rare.

### EPBC Listing

Critically endangered

### Ecology

Little-known

### Habitat

Saxicoline, under rocks (Smith 1992)

### Threats

Habitat degradation and modification by the introduction of feral animals (notably rats). Land clearing and stock grazing have probably contributed to the decline, along with predation by rodents and feral fowl.

## Phillip Island helicarionid land snail

### Impact on Other Species

None known

### Management Actions

Restore native forest habitat, control introduced weeds and predators, survey to determine the extent of existing populations and consider captive breeding.

### References

- Hyman, I. 2005. Taxonomy, systematic and evolutionary trends in Helicarionida (Mollusca, Pulmonata). PhD Thesis, University of Sydney. 583pp.
- Iredale, T. 1945. The land mollusca of Norfolk Island. *Australian Zoologist* 11: 46-71.
- Ponder, W.F. 1997. Conservation status, threats and habitat requirements of Australian terrestrial and freshwater mollusca. *Memoirs of the Museum of Victoria* 56: 421-430.
- Smith, B.J. 1992. Non-marine Mollusca. In Houston, W.W.K. (ed.) *Zoological Catalogue of Australia Volume 8*. Australian Government Publishing Service, Canberra.
- Varman, R.V.J.P. 2001. Norfolk Island Snail Species List from Dr Varman's website: <http://www.geocities.com/Paris/LeftBank/6559/index.html>



# Mollusc

## *Mathewsoconcha suteri*

### Conservation Significance

Endemic to the Norfolk Island Group. Nationally threatened. Listed (as *M. belli*) as endangered on the IUCN Red List (IUCN 2008).

### Description

Has an orange brown to fawn shell with a narrow white peripheral band, a depressed spire and is 9 to 10mm in diameter and 6 to 6.5mm high.

### Distribution

Archaeological deposits suggest this species was once common but by 1914 it was considered rare (Iredale 1945, Varman 1991). Recent records suggest it is now restricted to isolated localities including Norfolk Island National Park in the area around Mt Pitt, Hundred Acres Reserve and Point Hunter Reserve (Varman 1998).

### EPBC Listing

Critically endangered

### Ecology

Little known

### Habitat

Litter and woodland (Smith 1992)

### Threats

Habitat degradation and modification by the introduction of feral animals (notably rats). Land clearing and stock grazing have probably contributed to the decline, along with predation by rodents and feral fowl.

## a helicarionid land snail

### Impact on Other Species

None known

### Management Actions

Restore native forest habitat, control introduced weeds and predators, survey to determine the extent of existing populations and consider captive breeding.

### References

Hyman, I. 2005. Taxonomy, systematic and evolutionary trends in Helicarionida (Mollusca, Pulmonata). PhD Thesis, University of Sydney. 583pp.

Iredale, T. 1945. The land mollusca of Norfolk Island. *Australian Zoologist* 11: 46-71.

IUCN 2008. *2008 IUCN Red List of Threatened Species*. <[www.iucnredlist.org](http://www.iucnredlist.org)>

Ponder, W.F. 1997. Conservation status, threats and habitat requirements of Australian terrestrial and freshwater mollusca. *Memoirs of the Museum of Victoria* 56: 421-430.

Smith, B.J. 1992. Non-marine Mollusca. In Houston, W.W.K. (ed.) *Zoological Catalogue of Australia Volume 8*. Australian Government Publishing Service, Canberra.

Varman, R.V.J.P. 2001. Norfolk Island Snail Species List from Dr Varman's website: <http://www.geocities.com/Paris/LeftBank/6559/index.html>



# Mollusc

## *Quintalia stoddartii*

### Conservation Significance

Endemic to the Norfolk Island Group. Nationally threatened. Listed as extinct on the IUCN Red List (IUCN 2008). Sole representative of endemic genus.

### Description

Has an imperforate, depressed conical shell with dimensions of at least 14mm diameter and 8mm height.

### Distribution

Early records and sub-fossil material suggest this species once occurred on all three islands. The last specimens collected were pre-1945 in Duncombe and Ball Bays. In the early 1900s this species made up as much as 9% of total snail specimens collected. Recent surveys have failed to locate this species on Norfolk Island and it is very likely extinct there but the lack of sampling from Phillip Island provides hope that it may still be extant there.

### EPBC Listing

Critically endangered

### Ecology

Little-known

### Habitat

Saxicoline, under rocks (Smith 1992)

### Threats

Habitat degradation and modification by the introduction of feral animals (notably rats). Land clearing and stock grazing have probably contributed to the decline, along with predation by rodents and feral fowl.

## Stoddart's helicarionid land snail

### Impact on Other Species

None known

### Management Actions

Restore native forest habitat, control introduced weeds and predators, survey to determine the extent of existing populations and consider captive breeding.

### References

- Hyman, I. 2005. Taxonomy, systematic and evolutionary trends in Helicarionida (Mollusca, Pulmonata). PhD Thesis, University of Sydney. 583pp.
- Iredale, T. 1945. The land mollusca of Norfolk Island. *Australian Zoologist* 11: 46-71.
- IUCN 2008. *2008 IUCN Red List of Threatened Species*. <[www.iucnredlist.org](http://www.iucnredlist.org)>
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- Varman, R.V.J.P. 2001. Norfolk Island Snail Species List from Dr Varman's website: <http://www.geocities.com/Paris/LeftBank/6559/index.html>



### 3. Threats

Small islands are particularly susceptible to particular threatening processes, often acting synergistically, and this is reflected by the high rate of extinction of species endemic to oceanic islands. For example, although less than 20 per cent of the world’s bird species are restricted to islands, over 90 per cent of historic bird extinctions have occurred on islands (King 1985). The major threatening processes on oceanic islands are anthropogenic: habitat fragmentation and loss, invasive species, remote disruption to the food chain, and pathogens. Invasive species may soon pass habitat loss as the main cause of ecological disintegration globally and are already probably the main cause of extinctions in island ecosystems (Clout & Veitch 2002).

Typical of small oceanic islands, the Norfolk Island Group has suffered significant species loss due to the impacts of human habitation and introduction of exotic species. Since European settlement eight species of endemic land birds, several species of land snail and two plant species have become extinct (or nearly so) while some seabird species which were once abundant on Norfolk Island now only occur in small numbers on Phillip Island.

#### 3.1 Key Threatening Processes

Seven key threatening processes are listed under the EPBC Act and are considered to be relevant to the Norfolk Island Group. Table G indicates which of these processes has a threat abatement plan in place or not. Threat abatement plans are statutory documents aimed at lessening the impact of a key threatening process. These threats are discussed in further detail in Sections H and I.

**Table G: Key Threatening Processes listed under the EPBC Act relevant to Norfolk Island Group (a)**

Key Threatening Process	Threat Abatement Plan
Land clearance	No
Loss of terrestrial climatic habitat caused by anthropogenic emissions of greenhouse gases	No
Predation by exotic rats on Australian offshore islands of less than 1000 km <sup>2</sup> (100,000 ha)	Draft
Predation by feral cats	Approved
Psittacine Circoviral (beak and feather) disease affecting endangered psittacine species	Approved
Incidental catch (or bycatch) of seabirds during oceanic longline fishing operations	Approved
Injury and fatality to vertebrate marine life caused by ingestion of, or entanglement in, harmful marine debris	Draft

(a) as at May 2010



## 3.2 Current and Past Threats

Several of the threatening processes on the Norfolk Island Group have impacts on more than one species. Some threats occur widely across the islands while others are more geographically isolated. There are three main types of existing threats: (i) environmental modifications that have resulted in the loss, degradation or fragmentation of habitat; (ii) the impacts of introduced predators; and (iii) the impact of competition with introduced or self-introduced species, or with other native species.

### 3.2.1 Habitat Loss, Degradation and Fragmentation

Since European settlement the native habitat has been modified by several causes including invasion by exotic weed species, clearing, browsing and grazing, and disease such as dieback and root rot.

**Habitat clearing and modification.** Land clearance is a key threatening process under the EPBC Act. Although larger scale clearing of native vegetation on Norfolk Island no longer occurs and most present day clearing is focussed on weed infested areas, the impact of clearing on a small scale needs to be assessed.

While most of the native vegetation communities are now within the national park there are significant areas of forest that are outside the national park or the Norfolk Island reserves. The most critical areas are those that border the national park as they present a continuous corridor of native forest.

Direct loss of habitat through land clearance for homes, buildings, roads and other infrastructure was one of the causes of the previous declines of the two native reptiles (Cogger *et al.* 1993). Similarly, for terrestrial invertebrates, the modification of ecosystems through the clearance and fragmentation of native vegetation is likely to be a major threatening process. Clearing of a significant remnant of forest for the construction of the international airport may have contributed to the extinction of the Norfolk Island triller (*Lalage leucopyga leucopyga*) (Garnett & Crowley 2000).

**Trampling, Browsing and Grazing.** Cattle were introduced to Norfolk Island in the early years of settlement. Pastures maintained for grazing are predominantly cleared of native vegetation. Grazing and trampling is a serious threat to plants through the suppression of regeneration (Benson 1975) and cattle are also vectors for the transport of seeds of introduced plants. The importance of removing and excluding cattle and horses to reduce grazing pressure in forest reserves and commons has long been recognised. Since their exclusion from the Mt Pitt section of the national park by fencing, there has been a marked improvement in the condition of native forest areas.

Grazing and trampling by cattle has been reported as having an impact on *Achyranthes arborescens*, *Boehmeria australis*, *Elatostema montanum*, *Marattia salicina*, *Meryta latifolia*, and *Streblus pendulinus*, while grazing by rabbits on Phillip Island reduced and suppressed *Elymus multiflorus* (Sykes & Atkinson 1988).



Grazing occurs in nearly all the public reserves and remnant forest areas including areas with quality plant communities. The major cause of disturbance to remnant vegetation areas in 1989 was grazing cattle (Gilmour & Helman 1989a, 1989b) and this was still the case in 2000 (Mosley 2001). Nevertheless, some areas outside the national park have been fenced in efforts to improve the regeneration of native species. For example, the Mission Road rainforest remnants were fenced in the 1990s and cattle have been excluded from the Hundred Acres Reserve for many years.

Habitat loss, soil compaction and erosion caused by grazing and burrowing rabbits was one of the causes of the previous declines of the native reptiles on Phillip Island (Cogger *et al.* 1993). Unregulated human activities such as off track walking by visitor groups or trail bike riding can also result in trampling of some plant species.

**Dieback.** Dieback caused by the root-rot fungus *Phytophthora cinnamomi* is listed as a key threatening process under the EPBC Act.

There have been several incidences of dieback of various species on Norfolk Island. Investigations in the 1970s into the dieback of Norfolk Island pines concluded that adverse environmental conditions were responsible for the decline and death of mature trees and fungal root and butt rots were not considered to be a significant cause (Shepherd 1978, Benson 1980). Much of the area where severe dieback of pines occurred were covered by dense xeromorphic vegetation comprising red guava, African olive, Hawaiian holly and lantana, which form a dense cover that prevented pine regeneration (Benson 1980).

Dieback of kurrajong (*Wikstroemia australis*) near the Bird Rock track in the national park was attributed to adverse environmental conditions and not primarily caused by fungal pathogens (Tierney 1988).


Vegetation dieback can occur from the impact of salt bearing winds. The removal of protective vegetation on the seaward edge can result in canopy dieback while damage from storm events that bring in severe salt-laden winds can also produce dieback.

**Root and Butt Rot.** Plant pathology studies on Norfolk Island were conducted in the 1970s and 1980s because of concerns that planned Norfolk Island pine plantations might be subject to serious outbreaks of root rot and butt rot.

Brown (1980) associated the root and butt rot fungus *Phellinus noxius* with the death of mature Norfolk Island pine at two locations on Norfolk Island. A subsequent survey found *P. noxius* widespread on the island and responsible for the deaths of at least 40 Norfolk Island pines (Tierney 1987). This survey identified 18 sites and identified eight host species: Norfolk Island pine, whitewood (*Celtis paniculata*), maple (*Elaeodendron curtispiculum*), kentia palm (*Howea forsteriana*), white oak (*Lagunaria patersonia*), ironwood (*Nestigis apetala*), African olive and avocado (*Persea americana*).

*Phellinus noxius* occurs throughout the tropics and subtropics on a wide range of hosts and is probably native to Norfolk Island where it co-existed with hosts in the undisturbed forest. By causing patch death in natural forests, it may have played an important role in determining species composition of the forest as many plant species require large gaps to regenerate (Tierney 1987). Land clearing since European settlement appears to have favoured *Phellinus noxius* and it tends to infect stumps (something that does not occur in natural forest).





The life cycle of *Phellinus noxius* has the following features: spores are produced during long periods of rain from fruiting bodies on dead stumps and logs, new root rot patches may develop following deposition of wind-borne spores on stumps, root contact is essential for local transmission of the disease, the disease spreads when the roots of a healthy tree contact infected roots of diseased plants or stumps, the fungus spreads along the root to the root collar and girdles the butt of the tree, and while girdling the fungus spreads out along other roots (Bolland 1984).

A successful biological control method involving the inoculation of infected stumps with another fungus was developed (Tierney 1989). This increases the rate of decay of the stump and controls the spread of the disease. Inoculation of stumps was carried out when clearing occurred but ceased when the locally-sourced inoculating agent became unavailable.

### 3.2.2 Introduced Vertebrate Pests

There are several introduced vertebrate pests that pose significant threats to native species of Norfolk Island. These include rodents which threaten land birds, seabirds, reptiles, land snails and some plant species; feral cats (*Felis catus*) which threaten birds and reptiles; and feral fowl (*Gallus gallus*) which threaten land snails and some plants.

**Predation by Rodents.** There are three rodents on Norfolk Island: the black rat (*Rattus rattus*), the Polynesian rat (*R. exulans*) and the house mouse (*Mus musculus*). The Polynesian rat probably arrived on Norfolk Island about 750 years ago with Polynesian explorers (Schodde *et al.* 1983). Mice probably arrived during the time of the penal settlement 1800-1820 and the black rat probably originated from a ship in 1942 (McFadden 1991, Wilson 2002). All three species have variously affected Norfolk Island flora and fauna and may have contributed to the extinction of some endemic birds (McFadden 1991).

The black rat has a generalised diet and is known to eat seeds, green plant material, fungi, invertebrates, reptiles, birds and eggs. It poses a threat to Norfolk's endemic land birds as it preys on eggs and nestlings. During the 1990s, rats were strongly implicated in the decline of two of Norfolk Island's iconic bird species – the boobook owl and the green parrot – via predation of nests of both species (Hicks & Preece 1991). Rat predation has also been identified on the nests of threatened forest passerines (Major 1989). The extinction of the long-tailed triller is largely attributed to the black rat as the triller's disappearance coincided with its arrival on the island and with the clearing of a large remnant of native forest to facilitate the construction of the international airport (Garnett & Crowley 2000).

The black rat is also a threat to the threatened plant species *Achyranthes arborescens*, *Melicope littoralis*, *Meryta latifolia* and *Ungeria floribunda* via predation of seeds and fruits, restricting regeneration.

On both Lord Howe and Norfolk Island large rodents are the primary threat to the two native reptiles. Their extinction from Norfolk's main island is highly correlated with the arrival of the Polynesian rat (Smith *et al.* 2001, Matisoo-Smith *et al.* 2001). The total absence of lizards in areas where rats are present but the presence of geckos on small rock stacks less than 100 metres from the main island strongly supports the causal relationship between the presence of rats and decline of both reptile species (Cogger 2004).



The Polynesian rat has also been demonstrated to reduce the breeding productivity of petrels and shearwaters on islands near New Zealand (Pierce 2002) and the elimination of rats from some islands has resulted in recolonisation by burrowing seabirds (McClelland 2002a). Small ground nesting seabirds such as the common noddy (*Anous stolidus*) and the sooty tern (*Sterna fuscata*) can be exterminated from islands by black rats (Morris 2002).

Control measures for the rats are being introduced in the Mt Pitt section of the Norfolk Island National Park to protect nesting birds and help the propagation of threatened plants. It is important that Phillip and Nepean Islands are kept rat-free as they provide refuges for birds and other fauna threatened by rats.

**Predation by Feral Cats.** Cats were introduced to Norfolk Island around the time of European settlement and are now common throughout the island, seriously affecting populations of both land and seabirds. They remain one of the greatest threats to the island's native vertebrate fauna and both feral and domestic cats have been observed hunting native birds.


When feral cats were removed from Lord Howe Island, the wedge-tailed shearwater population increased and the little shearwater (*Puffinus assimilis*) began nesting on the main island after an absence due to cat predation (DECC NSW 2007).

Feral cats are considered a threat to the boobook owl and the green parrot (Greenwood 1993). Feral cats and rats have been a common factor implicated in the extinction of three *Cyanoramphus* subspecies on other islands (Hill 2002). Unidentified feathers have been recorded from the gut contents of feral cats (Major 1989).

**Predation by Other Species.** Feral fowl are found widely on Norfolk Island and their activity in scratching and turning over the leaf litter causes serious disruption to the natural nutrient cycle and to the regeneration of some native plant species. They remove significant amounts of native soil fauna that is required to break down the leaf litter in forest areas, they feed on native invertebrates such as land snails and their scratching removes seedling trees (Christian 2005). Over the last decade the population of feral fowl in the national park has become widespread.

Native predators such as the Australasian kestrel (*Falco cenchroides*) and the purple swamphen or 'tarler bird' (*Porphyrio porphyrio*) may have an impact on native birds, particularly breeding seabirds. Kestrels were first recorded on the island in 1969 and through the 1970s were regarded as rare non-breeding visitors but the first breeding pair was reported in 1978 (Schodde *et al.* 1983) and by 1990 there were five breeding pairs (Bell 1990). Kestrels have been reported feeding on scarlet robin, golden whistler, white tern (*Gygis alba*), grey ternlet (*Procelsterna cerulea*) and Kermadec petrel (Garnet & Crowley 2000).

The purple swamphen, first recorded on Norfolk Island in 1888, occurs in marsh areas where there is cover nearby (Schodde *et al.* 1983). There was probably no suitable habitat prior to European settlement (Smithers & Disney 1969). This species has recently established on Phillip Island where it has been observed taking the eggs and chicks of terns and petrels (NINPAC pers. comm.).



Several species of birds have been introduced or self introduced to Norfolk Island (Table H) which have had an impact on the native bird species. Competition from the introduced common blackbird (*Turdus merula*) the song thrush (*T. philomelos*) and the European starling (*Sturnus vulgaris*) has been suggested as a potential threat to whistlers and robins (Smithers & Disney 1969, Robinson 1988) but there is no evidence that it has been a factor in the decline of these or any other passerines (Robinson 1988). However, the common blackbird has broad habitat requirements and high productivity, suggesting that it would recover more quickly from catastrophic events than the robin and colonise previous robin habitat (Robinson 1988).

The introduced crimson rosella (*Platycercus elegans*) and the European starling compete with green parrots for nest hollows (Hill 2002) and the former are known to aggressively expel green parrots from their territory (Hicks & Preece 1991). Starlings nest outside the regular green parrot breeding season and do not compete directly for nest hollows but they can fill them with nesting material such that the sites cannot be used by boobook owls and green parrots (Hermes *et al.* 1986).

The Asian house gecko (*Hemidactylus frenatus*) is a recent introduction to Norfolk Island. This species has been implicated in the decline of some native gecko species in other parts of its range and its exclusion from Phillip Island and other offshore islands where the two native reptiles remain is an important management objective.

### **3.2.3 Introduced Invertebrate Pests**

There are several species of introduced invertebrates that may be having a significant impact. A 1993 invasion by the Asian paper wasp (*Polistes chinensis*) poses an unknown threat to the flora and fauna of Norfolk Island. European honey bees (*Apis mellifera*) have occupied wild nest sites of the green parrot and were reported to cause injuries and fatalities to captive green parrots (Hill 2002). The American cockroach (*Periplaneta americana*) may be a threat to the native orthopteran on Phillip Island and the European wasp (*Vespa germanica*) may have an impact on other native species. The invasive Argentine ant (*Linepithema humile*) is a recent colonist of the island.

### **3.2.4 Exotic Weeds Invasion**

Of the 445 species of vascular plants on Norfolk Island, 274 species are naturalised, that is they have been introduced either accidentally as seed or deliberately for cultivation (Green 1994). With the shift in the main economy of the island from agriculture to tourism, much farmland was abandoned. In these areas introduced weeds became the dominant species and crowded out other plants, preventing regeneration of native species (Green 1994). There are currently about 10 principal weed species (Table H). Some of these species have been recognised as weeds on the island for a long time – for example olive, tobacco and lantana were recorded as a weed problem in 1926 and red guava in 1968 (Haseler *et al.* 1984).

The impact of weed invasion is largely on native plant species, and most vegetation communities are affected to some degree. Weed species also transform native habitat sometimes to the detriment of native species. For example, weed invasion can result in a change in the forest structure reducing the number of nesting hollows available for endangered owls and parrots.



Within the Norfolk Island National Park, approximately 50 per cent of the Forestry Zone is infested with a dense cover of woody weeds in particular guava, olive and Hawaiian holly (*Schinus terebinthifolius*) (Davidson *et al.* 1994).

The principal and potential weed species of Norfolk Island and the threats they represent are listed in Table H. Details of principal weed species are given below.

#### Red guava (*Psidium cattleianum cattleianum*)

This species is known variously as red guava, cherry guava, strawberry guava or purple guava. It is native to Brazil, but has been naturalised in Florida, Hawaii, tropical Polynesia, Norfolk Island and Mauritius for its edible fruit. On Norfolk Island it forms thickets with dense mats of feeder roots that make it difficult for other species to co-exist and it is relatively shade tolerant. The species has very cryptic seedlings and adolescent plants and produces abundant seed that is dispersed by birds and cattle (Ziesing 1997). Red guava has had a devastating effect on native habitats in Mauritius and is considered the worst plant pest in Hawaii, where it has invaded a variety of natural areas (Lowe *et al.* 2000).


The spread of red guava poses a greater threat to the indigenous vegetation than any other adventive species and although present on Norfolk Island for over 150 years, it was still spreading into the remaining areas of indigenous forest in 1988 (Sykes & Atkinson 1988). Within the national park the only areas free of guava in 1988 were dense Norfolk palm forest in the valley bottoms and the rarity of several plant species may be due to the presence of guava (Sykes & Atkinson 1988). Red guava has yet to invade Phillip Island (Mills 2009b).

#### African olive (*Olea europaea subsp. cuspidata*)

African olive, native to the Mediterranean region, is widely cultivated throughout the world as a windbreak or hedge. It is a widespread pest in Hawaii and New Zealand (Starr *et al.* 2003). African olive has cryptic foliage, exhibits regrowth from poisoned stems and is a prolific producer of seeds that are dispersed by birds.

This species became established on Norfolk Island soon after settlement and was used by early settlers as fence post timber. As native vegetation was cleared African olive became a major weed and developed into monoculture closed forests. It is now widespread and occurs as isolated specimens, scattered clumps or impenetrable thickets and is one of the worst woody weeds on Norfolk Island (Ziesing 1997). Olives may exert an allelopathic effect - where mature trees inhibit native plant germination and growth - and their removal appears to result in a remarkable improvement of the health and vigour of emergent native species (Ziesing 1997).

Areas that are infested with red guava and African olive tend to have lower surface soil moisture and where dense stands of the former occur along creek gullies there is little sign of regeneration of native ferns (Davidson *et al.* 1994). This impact is amplified in times of low rainfall when competition for moisture is more intense and the thick stands of weed species can even result in the deaths of mature Norfolk Island pines as a result of competition for moisture (Parks Australia, unpubl. data).



African olive established on Phillip Island following the removal of rabbits and is the main weed species found there, forming dense clumps and threatening species such as the Phillip Island hibiscus (*Hibiscus insularis*). However, the presence of olives helps mitigate soil erosion and on Norfolk Island itself provides a year round source of food for some species such as the green parrot.

#### Hawaiian holly (*Schinus terebinthifolius*)

A native to South America, Hawaiian holly is a pioneer of disturbed sites but is also successful in undisturbed natural environments and can displace native species. It is also a problem weed in Hawaii, Florida, New Caledonia, Fiji, Tahiti and Mauritius (PIER 2002).

Hawaiian holly was introduced to Norfolk Island in the 1920s when a resident planted some red berries that had come from Hawaii (Ziesing 1997). It is a low growing evergreen deciduous tree that shades out other plants and prevents re-establishment of other species due to the release of allelopathic substances. The fruit is especially favoured by frugivorous birds.

#### Lantana (*Lantana camara*)

Lantana is a weed of national significance and has had serious impacts on mainland Australia. It is an aggressive woody weed of open areas that suppresses regeneration of native species. It was introduced to Norfolk Island in 1905 as an ornamental, and birds disperse its seeds widely (Ziesing 1997). While it is also found on Phillip Island in low numbers, it may be completely eliminated with targeted weed control (Mills 2009b).

#### William Taylor (*Ageratina riparia*)

Introduced to Norfolk Island as a garden plant this is a weed of open areas. It has spread widely and shades out small native plants, especially in areas open to the wind and full sunlight (Ziesing 1997). It dominates the understory in some parts of the national park and is found on Phillip Island (Mills 2009b).

#### Kikuyu grass (*Pennisetum clandestinum*)

Kikuyu is an exotic grass introduced to Norfolk Island for pasture and was used to stabilise open areas, roadsides and rehabilitation areas in the national park (Ziesing 1997).

Kikuyu severely restricts regeneration of native plant species as it forms a thick sward that is almost impossible for seedlings to penetrate. For example, competition from kikuyu and other imported grasses such as buffalo grass (*Stenotaphrum secundatum*) and couch grass (*Cynodon dactylon*) may prevent the re-establishment of pines and other species (Benson 1980). Other species particularly at risk include *Calystegia affinis*. The thick sward and deep runners of kikuyu also degrade the habitat for ground nesting seabirds such as wedge-tailed shearwaters (*Puffinus pacificus*) and other burrowing petrels. The grass chokes burrows and has been reported to strangle birds on Lord Howe Island (DECC NSW 2007).

#### Wild tobacco (*Solanum mauritianum*)

Introduced to Norfolk Island about 1855, this is a fast growing tree that is not as shade-tolerant as red guava or African olive. In restricted areas it can occupy key habitats for rare species that are also not very shade-tolerant such as *Achyranthes arborescens* and *Boehmeria australis* (Sykes & Atkinson 1988). It is often found in some parts of the valley bottoms in association with bleeding heart (*Homolanthus populifolius*).



### Bleeding heart (*Homolanthus populifolius*)

Bleeding heart is a widespread but relatively insignificant weed on Norfolk Island found in association with bracken, lantana or wild tobacco. In restricted areas in the national park it can threaten the light loving species such as *Achyranthes arborescens* and *Boehmeria australis* (Ziesing 1997).

### Morning glory (*Ipomoea cairica*)

Morning glory is a perennial twining plant that rapidly invades open areas after fallen trees or sudden woody weed removal (Director of National Parks 2008b).

### Formosan lily (*Lilium formosanum*)

This is a shade tolerant species that is persistent and difficult to remove. Formosan lily has not yet invaded Phillip Island (Mills 2009b).

### Potential weed species

Of the potential weed species, horse piss (*Caesalpinia decapetala*), cassia (*Senna septemtrionalis*) and madeira vine (*Anredera cordifolia*) have become serious invasive weeds on Raoul Island in the Kermadec Group.

## **3.3 Future Threats**

The potential threats to the flora and fauna of the Norfolk Island Group fall into three categories: (i) those resulting from long term climate change; (ii) those resulting from other irregular disturbance events; and (iii) those from the inadvertent introduction of new organisms such as pests or disease.

### **3.3.1 Potential Invasive Species**

Introduction of new exotic flora, fauna or pathogens represents a major ongoing threat to the biodiversity of Norfolk Island. There is a continual risk of introduction with every arrival by air or sea.

Introduced invertebrates, such as invasive ants, have the potential to radically alter the ecology of oceanic islands. The reduction in biodiversity of Australian native fauna and flora due to the red imported fire ant (*Solenopsis invicta*) and the loss of biodiversity and ecosystem integrity following invasion by the yellow crazy ant (*Anoplolepis gracilipes*) on Christmas Island are listed as key threatening processes under the EPBC Act.

Some introduced vertebrates such as the brown tree snake (*Boiga irregularis*) can also have serious impacts on island ecology (Rodda *et al.* 2002, Cogger *et al.* 2005). The recovery of several species of frogs from Norfolk Island including the invasive cane toad (*Bufo marinus*) demonstrates the high risk of an accidental introduction (Covacevich *et al.* 2001).

Increased risk of spreading exotic or invasive species to offshore islands through increased tourist visitation is identified as a threat to the two endemic reptiles (Cogger *et al.* 1993).



### 3.3.2 Introduction of Disease

A serious threat to all island birds is the introduction of new diseases. Island birds have often evolved in the absence of diseases common in continental bird faunas and the introduction of such diseases to island birds can be disastrous. An example is the introduction of avian malaria to Hawaii via the accidental introduction of a new species of mosquito. This event caused the extirpation of almost the entire endemic bird fauna below 600 metres altitude and was probably the main cause of the total extinction of several bird species (Hay 1986). The range of many surviving species was severely reduced and fragmented which in turn markedly increased their chances of extinction (Hay 1986).

Psittacine circoviral disease affecting endangered psittacine species is listed as a key threatening process under the EPBC Act. This disease was probably responsible for the death of many green parrots on Norfolk Island in the 1970s (Hicks & Greenwood 1990). The introduction of a new disease is a serious threat to all island birds which may have evolved in the absence of diseases common in continental birds. The introduction of such diseases can be disastrous and a disease may persist in feral populations of exotic species which are likely to have resistance to it (Hill 2002).

### 3.3.3 Climate Change

Loss of climatic habitat caused by anthropogenic emissions of greenhouse gases is listed as a key threatening process under the EPBC Act.

Predictions of climate change include an increase in temperature of between 0.4°C and 2.0°C over the next 25 years, modest to moderate increases in average and maximum cyclone intensities, increases in evaporation, and rises in average sea level (Hughes 2003). Predictions of impacts on various ecosystems are more uncertain, however it is likely that climate change will have a profound influence on the distribution of vegetation, coral reefs, invertebrates and seabirds (Hughes 2003).

Possible impacts of climate change on Norfolk Island specifically include changes in rainfall patterns, increased intensity and frequency of storms and negative impacts on marine food chains arising from increased sea surface temperatures (Hyder Consulting 2008). Species and communities most at risk on Norfolk Island include filmy ferns that might be susceptible to changes in the water table; seabirds that might be sensitive to changes in oceanic conditions; and the surrounding coral reef community. Changes to vegetation resulting from drier climates might result in conditions more susceptible to wild fire. Most sub-tropical plant species are moisture dependent and changes to the hydrology of Norfolk Island would affect most plant species.

### 3.3.4 Chance Events

Irregular disturbance events such as cyclones, severe storms, drought, fire and outbreaks of disease pose a significant threat to the biodiversity of Norfolk Island. Many species are at risk due to their small populations and restricted distributions. Particularly at risk from storm damage are epiphytic species.

There is also an increased threat of direct habitat damage to offshore islands through the impacts of human traffic and fire risk from campfires (Cogger *et al.* 1993).



**Table H: Principal and potential weed species of Norfolk Island**

<i>Common name</i>	<i>Scientific name</i>	<i>History on Norfolk</i>	<i>Species Threatened</i>
<b>Principal Weed Species</b>			
red guava	<i>Psidium cattleianum</i> var. <i>cattleianum</i>	Introduced in the early settlement for fruit cultivation	<i>Melicytus latifolius</i>
African olive	<i>Olea europaea</i> subsp. <i>cuspidata</i>	Recorded as early as 1926	<i>Hibiscus insularis</i>
Hawaiian holly	<i>Schinus terebinthifolius</i>	Introduced in 1935 from Hawaii (seeds planted out of curiosity)	
lantana	<i>Lantana camara</i>	Garden escapee, recorded in 1902	<i>Boehmeria australis</i> <i>Elatostema montanum</i>
William Taylor	<i>Ageratina riparia</i>	Introduced as a garden plant	<i>Crepidomanes endlicherianum</i> <i>Elatostema montanum</i>
kikuyu	<i>Pennisetum clandestinum</i>	Introduced as pasture or lawn	<i>Boehmeria australis</i>
wild tobacco	<i>Solanum mauritianum</i>	Recorded in 1855, a problem weed by 1926	<i>Achyranthes arborescens</i> <i>Boehmeria australis</i> <i>Melicytus latifolius</i>
Formosan lily	<i>Lilium formosanum</i>	Escaped from cultivation	
bleeding heart	<i>Homolanthus populifolius</i>		<i>Achyranthes arborescens</i> <i>Boehmeria australis</i>
eucalypts	<i>Eucalyptus</i> spp.	Introduced by foresters	
morning glory	<i>Ipomoea cairica</i>	Introduced as an ornamental	





<i>Common name</i>	<i>Scientific name</i>	<i>History on Norfolk</i>	<i>Species Threatened</i>
<b>Potential Weed Species</b>			
African boxthorn	<i>Lycium ferocissimum</i>	Introduced as a hedge plant	
asparagus fern	<i>Protasparagus aethiopicus</i>	Escaped from cultivation	
Cascade curse	<i>Polygala myrtifolia</i>	Recent escapee from cultivation	
Cascade onion	<i>Homeria flaccida</i>	Introduced with soil	
cassia	<i>Senna septemtrionalis</i>	Escaped from cultivation	
coral berry	<i>Rivina humilis</i>		
cotoneaster	<i>Cotoneaster glaucophyllus</i>	Escaped from cultivation	
duranta	<i>Duranta erecta</i>	Introduced as a hedge plant	
hakea	<i>Hakea salicifolia</i>	Introduced as a hedge plant	
horse piss	<i>Caesalpinia decapetala</i>	Introduced as a hedge plant	
honeysuckle	<i>Lonicera japonica</i>	Escaped from cultivation	
madeira vine	<i>Anredera cordifolia</i>	Escaped from cultivation	

**Sources:** Green 1994, Ziesing 1997



**Table I: Major threats to flora and fauna species of Norfolk Island**

Identified Threats	Species Impacted	Number	
Invasion of habitat by exotic weeds	<i>Abutilon julianae</i> <i>Achyranthes arborescens</i> <i>Blechnum norfolkianum</i> <i>Boehmeria australis</i> <i>Calystegia affinis</i> <i>Clematis dubia</i> <i>Coprosma baueri</i> <i>Coprosma pilosa</i> <i>Cordyline obtecta</i> <i>Crepidomanes endlicherianum</i> <i>Dysoxylum bijugum</i> <i>Elatostema montanum</i> <i>Elymus multiflorus</i> var. <i>kingianus</i> <i>Euphorbia norfolkiana</i> <i>Euphorbia obliqua</i> <i>Hibiscus insularis</i> <i>Lastreopsis calantha</i> <i>Melicytus latifolius</i> <i>Melicytus ramiflorus oblongiflorus</i> <i>Meryta angustifolia</i> <i>Meryta latifolia</i> <i>Muehlenbeckia australis</i>	<i>Myoporum obscurum</i> <i>Pennantia endlicheri</i> <i>Pittosporum bracteolatum</i> <i>Pouteria costata</i> <i>Pteris kingiana</i> <i>Pteris zahlbruckneriana</i> <i>Myrsine ralstoniae</i> <i>Senecio australis</i> <i>Senecio evansianus</i> <i>Senecio hooglandii</i> <i>Streblus pendulinus</i> <i>Thelychiton brachypus</i> <i>Wikstroemia australis</i> scarlet robin Norfolk Island boobook owl wedge-tailed shearwater providence petrel Kermadec petrel white-necked petrel land snails	42
Predation by rats	<i>Achyranthes arborescens</i> <i>Melicope littoralis</i> <i>Meryta latifolia</i> <i>Ungeria floribunda</i> scarlet robin golden whistler green parrot slender-billed white-eye black-winged Petrel grey ternlet red-tailed tropicbird	common noddy black noddy masked booby little shearwater wedge-tailed shearwater sooty tern white tern long-tailed triller (a) grey-headed blackbird (a) Lord Howe Island skink Lord Howe Island gecko land snails	23
Predation by feral cats	Scarlet robin golden whistler green parrot black-winged petrel grey ternlet red-tailed tropicbird common noddy black noddy	masked booby little shearwater wedge-tailed shearwater sooty tern white tern ground dove (a) Lord Howe Island skink Lord Howe Island gecko	16
Predation by insects	<i>Hibiscus insularis</i>		1

Identified Threats	Species Impacted		Number
Clearing of habitat	<i>Calystegia affinis</i> scarlet robin golden whistler	green parrot Norfolk Island boobook owl Tasman starling (a) land snails	7
Grazing	<i>Achyranthes arborescens</i> <i>Boehmeria australis</i> <i>Elatostema montanum</i> <i>Elymus multiflorus</i> (rabbits)	<i>Marattia salicina</i> <i>Meryta latifolia</i> <i>Streblus pendulinus</i>	7
Irregular disturbance events	<i>Achyranthes margaretarum</i> <i>Ileostylus micranthus</i> <i>Meryta latifolia</i> <i>Phreatia limenophylax</i> <i>Phreatia paleata</i> <i>Taeniophyllum norfolkianum</i>	<i>Thelychiton brachypus</i> <i>Tmesipteris norfolkensis</i> Norfolk Island sacred kingfisher Norfolk Island grey fantail Norfolk Island gerygone	11
Competition from exotic, self-introduced or other birds	green parrot boobook owl	providence petrel Tasman starling (a)	5
Water table management	<i>Blechnum norfolkianum</i>		1
Hybridisation	<i>Coprosma baueri</i>	<i>Myoporum obscurum</i>	2
Disease	green parrot		1

(a) indicates an extinct species and that the threat cited was a contributing factor to its extinction



## 4. Current Management

Management actions are conducted on Norfolk Island in the Norfolk Island National Park, the Norfolk Island Botanic Garden, Norfolk Island public reserves and by private landholders.

### 4.1 Norfolk Island National Park

The Director of National Parks is responsible for the management of the Norfolk Island National Park and the Norfolk Island Botanic Garden. The Norfolk Island National Park is managed under a plan of management (Director of National Parks 2008a). The current plan which came into effect in 2008 for a period of 10 years was prepared in accordance with the EPBC Act. It outlines management activities that include management of flora and fauna, management of introduced species, management of threatened species and restoration of natural ecosystems.

### 4.2 Public Reserves

The Conservator of Public Reserves and the Norfolk Island Parks and Forestry Service (NIPFS) is responsible for the management of 224.4 hectares of public reserves, 133.8 hectares of public roadsides and vacant crown land, and approximately 130 hectares of the Forestry Zone within the national park. Public reserves are managed in accordance with a plan of management for each reserve and the NIPFS is the management authority responsible for their implementation. The main environmental values of public reserves, the threats to these values and the proposed management strategies and actions are presented in Table J.

The Heritage Register under the *Norfolk Island Heritage Act 2002* (NI) and the Commonwealth Heritage List under the EPBC Act includes Anson Bay Reserve, Anson Point Nesting Ground, that part of Ball Bay Reserve formerly known as Bucks Point Reserve, Bumbora Reserve and Portion 96b1, Cascade Reserve, Hundred Acres Reserve, Point Ross Reserve, Selwyn Reserve, Nepean Island Reserve, Two Chimneys Reserve and the Norfolk Island National Park (including Phillip Island). Table K provides details of these listings.


### 4.3 Other Biodiversity Conservation

Biodiversity conservation works outside of the national park and public reserves has been conducted by several private landholders. This has included planting of native trees (particularly Norfolk Island pines), water course management and weed control.

### 4.4 Existing Management Practices

#### 4.4.1 Weed Control

Weed control is identified in the plans of management for the Norfolk Island National Park and the Norfolk Island Botanic Garden and for 10 of Norfolk Island public reserves.



A small number of private land owners have conducted effective weed control on their own land. The Territory measure relating to weed control on private land is the *Noxious Weeds Act 1916* which provides the Executive Member with powers to eradicate certain weeds at landowners' expense. There are 21 plants listed as noxious under the Act (Mosley 2001).

Weed control is conducted in the Norfolk Island National Park under the *Norfolk Island National Park Weed Control Strategy*. The Mt Pitt section of the national park is divided into 19 compartments and 300 man-hours of weed control is conducted in each compartment every two years. An additional 300 man-hours are spent on weed control in the Botanic Garden every two years. Activities are conducted under a priority hierarchy – emergency relief from weeds, new outbreaks, maintenance of existing areas, pioneer spreading out of the weed base, eradication. The program has been operating under this strategy since 2004. Comparing the time spent on treating new areas with that spent maintaining previously treated areas gives an indication of the level of activity required to reduce the level of weed infestation over the park.

Weed control on Phillip Island is conducted under the *Phillip Island Weed Control Strategy* and on average about 20 man days per month are spent there. The weed control program in the national park is conducted by contractors under the supervision of park staff.

#### **4.4.2 Propagation of Listed Plants**

The Norfolk Island Botanic Garden has facilities for propagating rare plants. Seeds are collected from threatened plant species when they are available and either propagated or stored until they can be propagated. Seedlings are planted in the national park as part of the weed control and forest rehabilitation program. Some seedlings are made available to the public for planting on private land.

A small shade-house has been set up on Phillip Island to assist in propagation of specimens for replanting there. Some specimens of the Phillip Island hibiscus are struck from the main area where this species occurs. The current capacity of the Phillip Island propagation operation is small although infrastructure has been built to catch and store rainwater.

#### **4.4.3 Predator Control**

Since 1993 intensive rodent control has been undertaken in the Norfolk Island National Park by the distribution of toxic baits within a bait station grid to control black rats and Polynesian rats in an attempt to reduce their impact on flora and fauna. The rat baiting grid covers most of the Mt Pitt section of the national park with stations spaced at approximately 100 metre intervals, with the perimeter of the park baited at 50 metre intervals. The bait 'Quintox' was used from 1993 to 1998 when it was replaced with 'Racumin' (McFadden 1991, Wilson 2002).

The possibility of eradicating rats from Norfolk Island has been considered previously and there have been some recent successes in eradicating rats from islands worldwide. However, the populated nature of Norfolk Island make aerial baiting impractical, necessitating intensive hand spreading of the bait and a commitment from all landholders to participate. In the absence of rats, mice could be expected to have the potential to reach plague proportions and there is also a high risk of rats reinvading in incoming cargo.



Feral cats have been trapped in the national park since 1989. In 1997 the program was reduced from a weekly round to a monthly round when it was found that the number of cats caught in one week per month was roughly the same as continuous trapping for a whole month. Since 1997, about 50 cats have been removed from the national park annually.

A review of rat and cat control in 2002 made nine recommendations to improve the rat program and seven recommendations to improve the cat program (Wilson 2002). The rat program recommendations were: (i) continue year-round baiting; (ii) begin regular monitoring of rat populations with tracking tunnels; (iii) discontinue use of 'Racumin' once current stocks run out; (iv) set up a trial of rat trapping; (v) consider trapping as a control measure subject to results of the trial; (vi) evaluate alternate toxins for use in conjunction with or instead of trapping; (vii) purchase smaller orders of bait and reduce time on the shelf to improve bait quality; (viii) clearly mark bait stations and improve access for contractors; and (ix) monitor some possible conservation outcomes of continued baiting. Most of these recommendations have been adopted.

The cat program recommendations were: (i) increase the number of cat traps; (ii) consider using cat kill traps; (iii) use cage traps in areas where domestic cats are likely to be caught and collapsible cage traps for inaccessible areas; (iv) consider using padded leg hold traps; (v) increase intensity of cat trapping in the spring; (vi) remove stomachs and livers of cats that are killed for diet analysis and toxicity tests; and (vii) continue public awareness campaign including subsidised de-sexing program. Many of these recommendations have been adopted although kill traps and leg hold traps are not used.

As a result of the predator control program, along with the provision of secure nesting hollows, numbers of green parrots and boobook owls have more than doubled (Innes 1995, Olsen 1997, Hill 2002). However, there has been no measurable increase in the population of robins and whistlers or expansion in their range outside of the national park, possibly because no predator control is undertaken there (Bell 1990, Robinson 1997). Predator control is identified as a management action in plans of management for Norfolk Island public reserves. Currently most rat and cat control outside the national park is *ad hoc*.

#### **4.4.4 Grazing Management**

Cattle have been excluded from the Mt Pitt section of the Norfolk Island National Park, the Forestry Zone and the Norfolk Island Botanic Garden since 1978 through boundary fencing and cattle grids at all road entrances. Some areas of the Mission Road rainforest remnants were fenced to protect them from cattle grazing in the early 1990s.

Grazing of cattle in parts of some public reserves is a long-established 'traditional use' of the commons. In some reserves, grazing of cattle has resulted in increased erosion, weed infestation and decreases in the number and distribution of native plants. Cattle are excluded by fencing from parts of many Norfolk Island public reserves in accordance with their Plans of Management.

#### **4.4.5 Translocation and Reintroduction of Plants and Animals**

Translocation and re-introduction programs can be expensive and risky (Lindenmayer & Burgmann 2005). There are three types of translocation and re-introduction programs for animals that have

been previously considered in the Norfolk Island Group that might have potential as recovery actions: (i) re-introducing species that once existed on Norfolk Island from Phillip Island (eg gecko and skink); (ii) establishing or re-establishing populations on Phillip Island from an existing population on Norfolk Island (eg robin and whistler); (iii) re-establishing additional populations in another part of Norfolk Island from existing populations on Norfolk Island (eg land snails).

Before embarking on any translocation or reintroduction program the recommendations of Fischer and Lindenmayer (2000) should be considered. These are: (i) examine the appropriateness of re-introduction and translocation before a program is instigated; (ii) develop rigorous and widely accepted criteria for gauging success or failure; (iii) remove the process that caused the species to decline in the first place; (iv) for animals use a wild source of individuals for release; (v) where possible release a large number of individuals (>100); (vi) employ a robust procedure to monitor populations following release; (vii) ensure appropriate measures of financial accountability are in place so that the costs of translocation and reintroduction can be assessed and their opportunity cost relative to other recovery actions can be gauged; and (viii) report the results of the efforts both successes and failures in the scientific literature so other workers can benefit.

Guidelines for the translocation of native plants have been developed by Vallee *et al.* (2004). Some Phillip Island endemic species have been established on the main island and there is potential for re-introducing or translocating plants to Phillip Island from Norfolk Island as well as to Norfolk Island from Phillip Island.

**Table J: Values, threats and management of public reserves of Norfolk Island**

Public Reserve	Area (ha)	Main Environmental Value	Threats	Management Strategies and Actions
Anson Bay Reserve	5.45	Pine/white oak forest; uncommon strand and coastal communities; cliffs to 98m; breeding seabirds; remnant forest containing <i>Meryta latifolia</i> , <i>Euphorbia norfolkiana</i> ; used by native land birds	Weed invasion; predation by feral cats and rats on birds; predation of seeds; erosion	Rehabilitate remnant native forest; planting native species; erosion, weed, predator and fungus control
Ball Bay Reserve	28.72	Coastal pine/white oak forest, population of <i>Euphorbia norfolkiana</i> ; seabird habitat	Grazing; weed invasion; pest species (rats and cats); erosion	Grazing stock excluded from two-thirds of the reserve; habitat rehabilitation and intensive management of <i>Euphorbia</i> ; weed, predator and fungus control
Bumbora Reserve	5.5	Coastal pine/white oak forest; populations of <i>Euphorbia norfolkiana</i> and <i>Cordyline obtecta</i>	Weed invasion; pest species (rats and cats); erosion; grazing	Habitat rehabilitation and plantings; monitoring of <i>Euphorbia</i> ; weed, predator and fungus control; relocation of cattle grid



Public Reserve	Area (ha)	Main Environmental Value	Threats	Management Strategies and Actions
Cascade Reserve	22.58	Mixed coastal pine/white oak forest; coastal landscapes; populations of <i>Cordyline obtecta</i> , <i>Myoporum obscurum</i> and <i>Streblus pendulinus</i>	Grazing; weed invasion; pest species (rats and cats); erosion	Habitat rehabilitation; rehabilitation plantings; weed, predator and fungus control; exclude cattle from remnant vegetation and coastal slopes and hillsides
Headstone Reserve	11.37	Coastal landscapes; perennial stream; scattered native vegetation; breeding seabird habitat	Weed invasion; grazing	Habitat rehabilitation and plantings; weed, predator and fungus control; exclude cattle from Headstone Creek and cliff top areas
Hundred Acres Reserve (renamed 28/8/98)	22.24	Large area of coastal pine/white oak forest that has been protected from grazing for over 80 years; habitat for endemic land snail; nesting area for shearwaters and noddies; contains <i>Myrsine ralstoniae</i> , <i>Senecio australis</i> and <i>S. evansianus</i>	Weed invasion; pest species (rats and cats); walkers damage shearwater burrows near walking tracks	Clearing of eucalypts and replanting native species; rehabilitation plantings; weed (esp madeira vine), predator and fungus control; monitoring land snails; protect seabird habitat by constructing walkways
Nepean Island	10	Seabird nesting; habitat for geckos; populations of <i>Euphorbia obliqua</i> and <i>Senecio hooglandii</i>	Weed invasion (kikuyu and buffalo grass)	Rehabilitation plantings to increase native herb field and weed control; encourage research on flora and fauna; management of sooty tern (whalebird) egg collection
Point Ross Reserve	7.95	Seabird nesting; shearwaters and tropicbirds; extensive area of <i>Carex</i>	Erosion; weed invasion	Restore eroded areas; weed and fungus control; enhance regeneration of native flax
Selwyn Reserve	21.21	Pine/white oak forest; <i>Meryta latifolia</i> ; nesting ground for shearwaters, white terns, tropicbirds; remnant coastal forest	Weed invasion; pest species (rats and cats); grazing	Rehabilitation planting; weed, predator and fungus control; fence maintenance
Two Chimneys Reserve (Point Blackbourne)	14.03	Pine/white oak forest; <i>Coprosma baueri</i> , <i>Dysoxylum bijugum</i> and <i>Myrsine ralstoniae</i> ; shearwaters, tropicbirds, white terns	Weed invasion; pest species (rats and cats); grazing	Restore eroded areas; weed, predator and fungus control; stock management

**Source:** Compiled from plans of management for each reserve



**Table K: Properties listed on the Norfolk Island Heritage Register and Commonwealth Heritage List for their significant natural heritage**

Property	Significant Natural Heritage	Condition, Integrity and Threats
Anson Bay Reserve	To preserve nesting grounds of seabirds, permit regeneration of native species and prevent the alienation of foreshores and headlands.	Subject to cattle grazing for many years along cliff edges resulting in weakened cliff stability and enhanced erosion. Weeds have taken over parts of the native forest in the reserve.
Anson Point Nesting Ground	To preserve nesting grounds of seabirds, permit regeneration of native species and prevent the alienation of foreshores and headlands. The point supports a large colony of wedge-tailed shearwaters, there is little native forest cover and the dominant vegetation is kikuyu grasslands.	Lack of woody weeds has enhanced this area but kikuyu remains a problem as it can smother seabird burrows, although it does reduce erosion in some areas. Cattle grazing has weakened cliff stability and increased erosion.
That part of Ball Bay Reserve formerly known as Bucks Point Reserve	To preserve nesting grounds of seabirds, permit regeneration of native species and prevent the alienation of foreshores and headlands. Remnants of native forest include a small population of <i>Euphorbia norfolkiana</i> .	Cattle have been excluded but weed invasion and erosion limit regeneration of native species.
Bumbora Reserve and Portion 96b1	To preserve native habitat and prevent the alienation of foreshores and headlands. It is the primary remaining habitat of <i>Euphorbia norfolkiana</i> and supports areas of pristine native coastal forest.	Biodiversity has improved since cattle were excluded. Erosion and woody weeds are still a problem. Efforts to conserve <i>Euphorbia norfolkiana</i> have removed many weeds and enhanced the integrity of local habitats.
Cascade Reserve	To preserve some of the original vegetation and prevent alienation of the coastal landscape. Cascade Creek is one of the few permanent streams.	Cattle continue to graze parts of this reserve, creating tracks and erosion on the slopes. Weeds are a problem in areas of remnant forest.
Hundred Acres Reserve	To preserve nesting grounds of seabirds, permit regeneration of native species and prevent the alienation of foreshores and headlands. It is one of the few areas outside of the national park to include pristine native forest with high species diversity.	Excellent native seedling regeneration and is dominated by a forest of pine and white oak. There are no significant stands of woody weeds but there is some weed invasion along the eastern valley.
Nepean Island Reserve	The seasonal and sometimes permanent habitat for significant populations of breeding seabirds. An important rookery for masked boobies, a refuge for the Lord Howe Island gecko, and valuable rat-free habitat. Habitat for rare plants including <i>Senecio hooglandii</i> and <i>Euphorbia obliqua</i> .	Nepean Island was cleared of the pine forest that once covered the island. The forests have been replaced by smaller salt and wind tolerant herbs providing a habitat suitable for breeding seabirds.



Property	Significant Natural Heritage	Condition, Integrity and Threats
Norfolk Island National Park (incl. Phillip Island)	The Mt Pitt section contains most of the surviving rainforest and palm forest on the island. Phillip Island is a valuable rodent-free habitat and supports significant populations of breeding seabirds.	Contains significant stands of native vegetation and native plant communities not found elsewhere on the island. Also contains significant woody weeds and feral animals.
Point Ross Reserve	To preserve nesting grounds of seabirds, permit regeneration of native species and prevent the alienation of foreshores and headlands.	Cattle were excluded in 1987. Erosion still a problem in exposed areas and regeneration of native species is slow. Kikuyu threatens seabird habitat.
Selwyn Reserve	To preserve nesting grounds of seabirds, permit regeneration of native species and prevent the alienation of foreshores and headlands. Contains several areas of native forest with few weeds.	Cattle grazing have weakened cliff stability and increased erosion. Some sections of the reserve are subject to grazing and weed invasion. Woody weeds have invaded parts of the forest remnants.
Two Chimney's Reserve	To preserve native habitat, permit some regeneration of native species and prevent the alienation of foreshores and headlands. Contains remnant coastal forest, stands of pine and white oak.	Cattle continue to graze this reserve exacerbating erosion of gully slopes. Weeds dominate the north of the reserve. Most of the reserve is in poor condition due to cattle grazing.




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