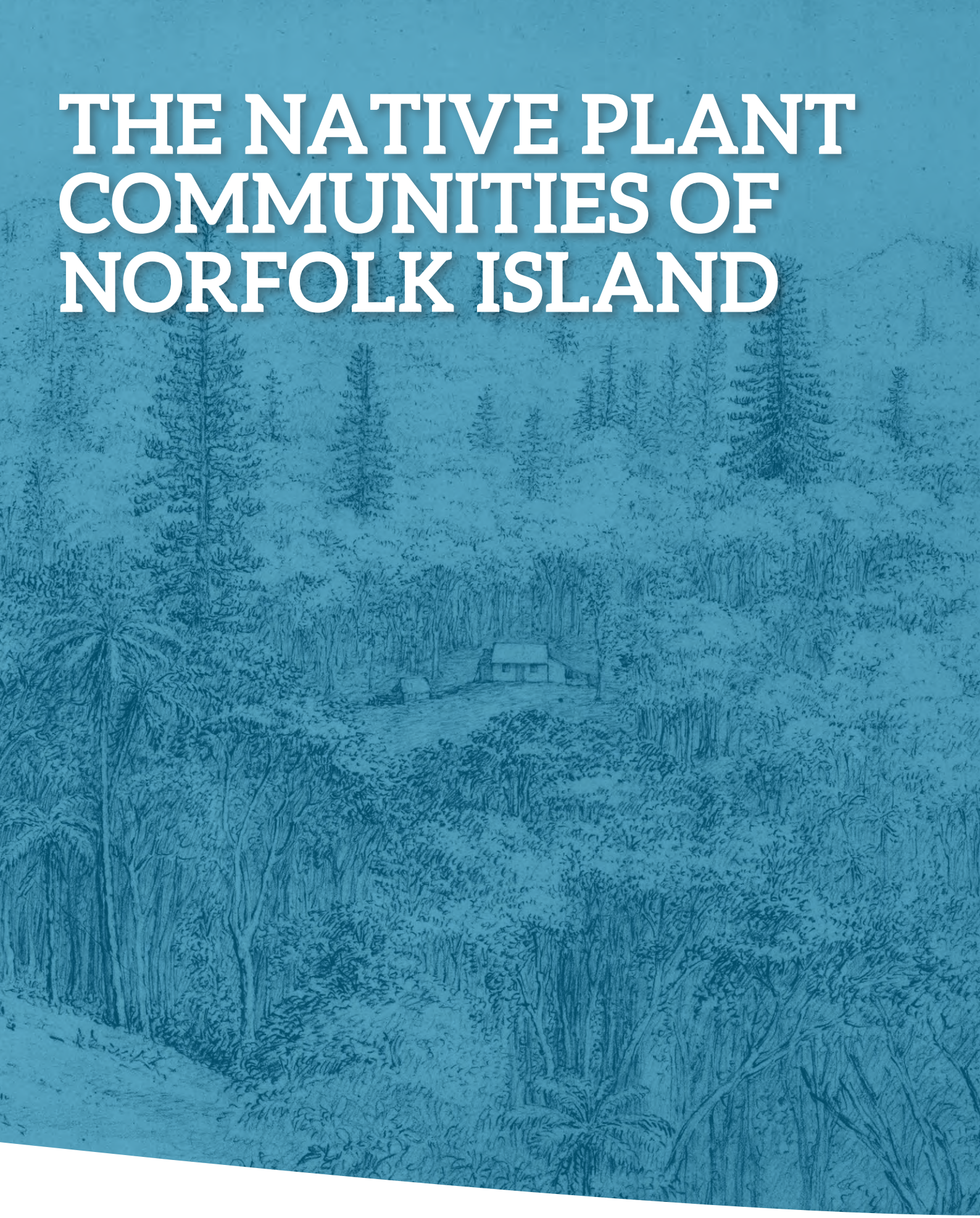
THE NATIVE PLANT COMMUNITIES OF NORFOLK ISLAND



invasive species council | TierraMar | NORFOLK ISLAND REGIONAL COUNCIL

The native plant communities of Norfolk Island

Published June 2021.

Citation

Invasive Species Council and TierraMar (2021). *The Native Plant Communities of Norfolk Island*. Invasive Species Council, Katoomba, New South Wales, Australia.

ISBN 978-0-6488809-2-9

Inquiries

Invasive Species Council, PO Box 96, Katoomba, NSW 2780

Email: contact@invasives.org.au | Web: invasives.org.au

Acknowledgements and description of the Norfolk Island Vegetation Mapping Project

Funding for this report was provided by the Norfolk Island Regional Council. The information was obtained as part of a project by the Invasive Species Council and TierraMar, funded by the Lord Mayor's Charitable Foundation through the Eldon and Anne Foote Trust.

Field surveys, analysis and mapping were conducted by Naomi Christian and Dr Kevin Mills and supported by the Norfolk Island Regional Council, Parks Australia and many generous volunteers and landholders. A detailed technical report describing the methodology used to describe the vegetation communities and map their location in 1750 and 2020 is available from the Invasive Species Council on request.

Additional information on native plant species sourced from the brochure Plants of Norfolk Island National Park and Botanic Garden. Information on weeds sourced from *Norfolk Island Region Threatened Species Recovery Plan* (2010).

The vegetation community maps are available at **www.norfolkisland.gov.nf/services/waste-and-environment/native-vegetation/native-vegetation-mapping-project and invasives.org.au/niveg**.

Editor: Carol Booth

Co-editor: Ray Nias

Research: Naomi Christian and Kevin Mills

Design: John Sampson

Photos: Kevin Mills

Intellectual property rights

Cover: Drawing by Ferdinand Bauer, dated 1804. Natural History Museum, London.

CONTENTS

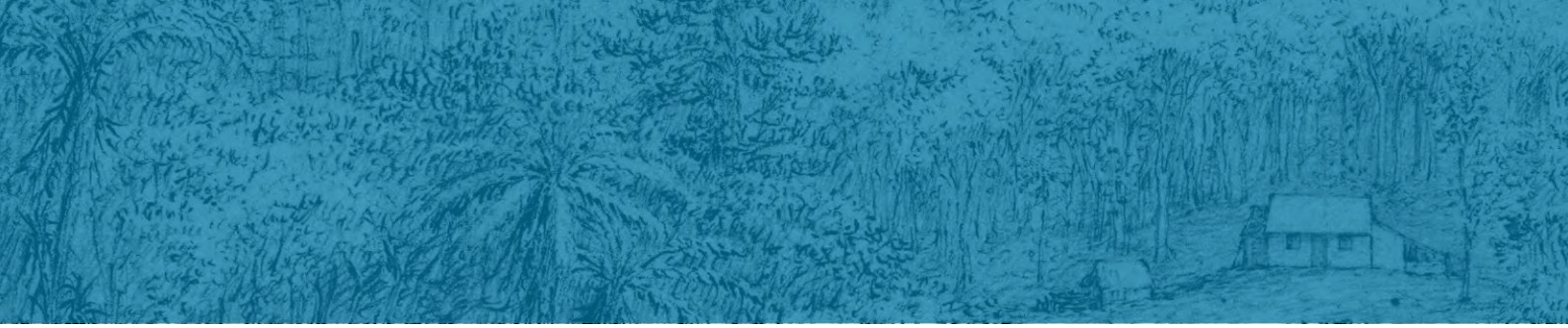
Introduction

There are 180 native plant species (of which about 25 per cent are endemic) and a further 370 naturalised species on the Norfolk Island Group (Mills 2009). However, prior to 2020, there was no comprehensive, island-wide description or map of the native plant communities present. The Norfolk Island Vegetation Mapping Project commenced in 2018 and sought to produce island-wide vegetation maps of Norfolk Island: one showing current native plant communities and another showing the native plant communities predicted to have been present in 1750. The plant community maps are available at www.norfolkisland.gov.nf/services/waste-and-environment/native-vegetation/native-vegetation-mapping-project and invasives.org.au/niveg.

A detailed report on the methodology used to describe and map the native plant communities can be obtained from the Invasive Species Council or the Norfolk Island Regional Council.

The maps and associated information in this report provide an improved technical framework for describing the island's native vegetation that can help prioritise areas for restoration and help Norfolk Island landholders obtain funding to restore their land. It can also assist in defining areas that are better suited to other land uses such as grazing, agriculture and development. As well as being of scientific and general interest, the map of the predicted 1750 vegetation helps landholders determine what the original vegetation was like at a particular location and thus serves as a guide for restoration and other land uses. This is important for the conservation of Norfolk Island's many unique and threatened species, including 46 plants listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). The mapping project is also an important contribution to the implementation of the Norfolk Island Environment Strategy 2018-2023 and Norfolk Island Regional Council Pest Management Plan 2020-2025.

Norfolk Island pine. Photo: Cathryn O'Donnell



Defining and mapping Norfolk Island's native plant communities

A native plant community is a distinct association of native plants that grow together, as determined by environmental factors including moisture availability, maritime influence, aspect, prevailing winds and soil characteristics. The 14 distinct native plant communities on Norfolk Island include forests, swamps, shrublands and grasslands.

Scoping native plant communities

The project commenced in 2018 with a review of existing vegetation maps of Norfolk Island. A comprehensive literature review was undertaken including historical accounts of the vegetation, scoping of previous vegetation mapping and searches of historical photographs and illustrations. This was to determine native vegetation communities likely to have been present prior to 1750, and to determine the type and extent of change over time. The work of Carole Helman and Philip Gilmour, including their 1989 mapping of the Norfolk Island National Park (including Original Vegetation Mapping and Remaining Vegetation as of 1989), was particularly helpful.

Gilmour and Helman (1989a and 1989b) mapped the vegetation of Norfolk Island National Park, including the 1989 extent, and predicted pre-clearing vegetation. They also mapped the 'quality plant communities' beyond the national park. A number of other maps of small areas of vegetation were also reviewed, including the Forestry Section of the Norfolk Island National Park (Byron, 2012), and some of the public reserves (Mills, 2017).

An initial review was undertaken to determine the potential 1750 native plant communities and changes to their type and extent over time. Sources included historical accounts of vegetation, previous vegetation maps and historical photographs and illustrations.

Having scoped an initial list of native plant communities during the literature review, the team compiled a series of benchmark or 'type' sites considered to provide a good representation of each plant community. A minimum of one field transect (25m x 10m) was then surveyed within each community type.

Field surveys

Field surveys were undertaken, including broadscale scoping of vegetation from roadsides, and interviewing local people as to the type and location of any remnant plant communities. The local community was helpful throughout this process and several local experts provided valuable historical references. The formal vegetation survey method was designed to characterise the composition and structure of each native plant community. A minimum of one transect was surveyed within each of the 'type sites' identified, and this provided a preliminary definition of each native plant community.

The field work was conducted during three trips, each of about two weeks duration, between November 2018 and January 2020. The field team consisted of Naomi Christian (botanist), Dr Kevin Mills (botanist), Jacqueline Jakeman (botanical field assistant) and Benjamin Christian (technical field assistant). Nicholas Christian (drone pilot) captured aerial imagery using a small, remotely piloted aircraft ('RPA' or drone) during January 2020.

Mapping the 1750 native plant communities

Given the extent of clearing of the original native vegetation, the identification of historical native plant communities on Norfolk Island required a fair amount of speculation, albeit based on reasonably firm assumptions. After 232 years of European and Pitcairn Islander presence, the vegetation of Norfolk Island is very different.

A reasonable idea of the original vegetation can be gained from early historical sources, although those authors did not set out

Figure 1. Drawing by Ferdinand Bauer, dated 1804.

Natural History Museum, London

A drawing by Ferdinand Bauer in 1804 is instructive for appreciating the forest of that time, when little had been cleared. The drawing shows the Mount Pitt-Mount Bates ridge looking towards the north-east.

to describe plant communities. From James Cook onwards, most observers described the forest as dense and thick, and various plants were mentioned as being abundant in one place or another. In some cases, such as the plant communities that still remain within the national park, the original extent may be reasonably predicted from an extrapolation of the typographical and geological conditions that still support relatively large remnants of native vegetation. In other cases, the distribution of other native plant communities can be inferred from such factors as small remnants of surviving vegetation, topography, altitude and soil types.

While we are confident that the 1750 map reflects distribution patterns, the boundaries are somewhat speculative in many instances due to a lack of evidence. However, after much field investigation over many years,

including the recent targeted studies, our confidence in the map is generally high.

A drawing by Ferdinand Bauer in 1804 is instructive for appreciating the forest of that time, when little had been cleared (Figure 1). The drawing shows the Mount Pitt-Mount Bates ridge looking towards the north-east. What we can glean from this drawing is that:

- Pines were probably mainly a coastal tree, unable to regenerate under a dense forest cover.
- Hardwood forest covered most of the island's inland areas.
- The ridges of the mountains supported pines; the plateau areas much less so.

Based on the communities identified in this report, the drawing by Bauer shows Plateau Hardwood Forest across most of the foreground, Upland Hardwood Forest on the slopes and Pine Ridge Forest on some ridges. The immediate foreground, with palms and tree ferns, is likely to be a valley with Lowland Valley Hardwood Forest. Note the very scattered nature of the pines. It seems that the prominence of pine in current Norfolk Island native plant communities is much greater than it was originally, suggesting that pines were more a coastal feature, where they dominate today in the Coastal Pine White Oak Forest.

In a report on the forests of Norfolk Island, Lane-Poole (1926) also recognised that pines were then probably more common than in the original forest:

> *"The island offers a unique example of the survival of the fittest. In its original state pine was in the minority, driven to take up its stand on the poor ridges and on the mountains, driven there by its broad-leaved and more numerous and more exigent brothers, the jungle species, that held the bulk of the deep lands and the cool gorges. Man then destroyed the forest conditions and in so doing gave the pine a tremendous advantage over the jungle types..."*

Native plant communities of Norfolk Island, 1750 and 2020

Fourteen native plant communities were classified on Norfolk Island: eight forest communities, five non-tree coastal communities and one wetland community. Each native plant community is briefly described (and illustrated) in this report, including key species (those species that are most likely to be prominent in the community and may often dominate), other species (additional species that are likely to be present and assist in defining the community), and some threatened species (Norfolk Island Region Threatened Species Recovery Plan, 2010).

Many parts of Norfolk Island are now also covered by non-remnant vegetation such as woody weed forest, cleared pastures, and exotic gardens, some of which has a high conservation value.

Map 1 (page 26) shows the distribution of plant communities predicted to have been present in 1750 and Map 2 (page 27) shows the current extent of native plant communities. All vegetation maps should be understood as showing patterns in plant community occurrence rather than exact boundaries. Plant communities occur as a continuum along environmental gradients, usually exhibiting change over a broad ecotone rather than at abrupt boundaries.

Factors affecting the distribution of native plant communities

The plant communities found on Norfolk Island have evolved over the past 2.5 to 3 million years. While close relationships exist between the island's flora and that of the closest land masses, the combination of species and the presence of a high proportion of endemic species on Norfolk Island represent unique plant communities.

Norfolk Island temperatures average 13-19°C in winter and 18-25°C in summer. The

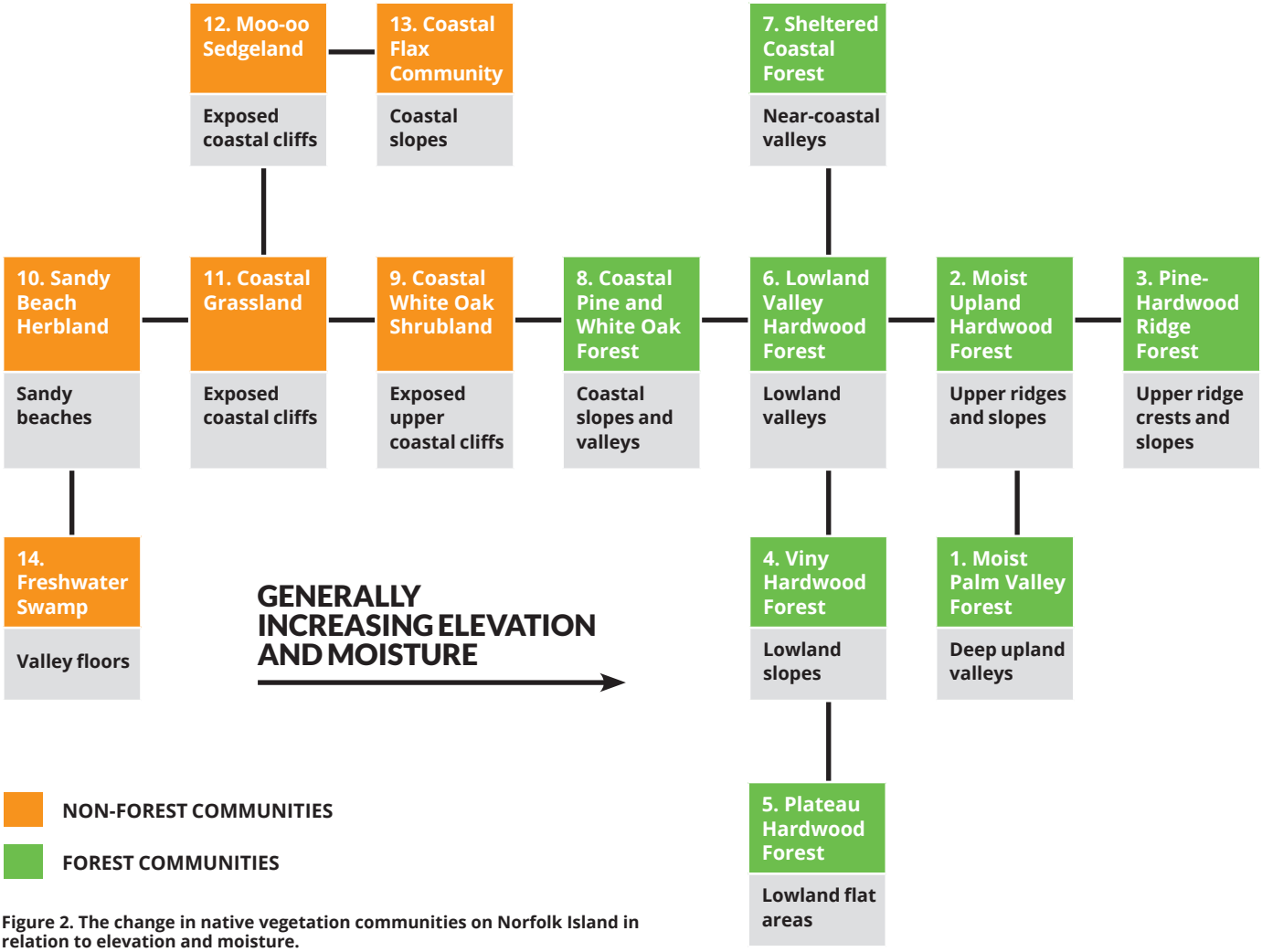


Figure 2. The change in native vegetation communities on Norfolk Island in relation to elevation and moisture.

prevailing winds are from the south; generally, south-westerly in the winter and east to south-easterly in the summer. Annual rainfall averages 1312mm, with most rain received in the winter (Norfolk Island Regional Council, 2018). However, at the time of the vegetation mapping project, Norfolk Island had experienced some of its driest weather on record. Soils vary across the island, and a soil and land-use study of the island included a soil map, which was included in the literature review that informed the project.

Many factors affect the distribution of native plant communities across Norfolk Island, primarily moisture availability and proximity to the ocean. Other influences include landform, aspect, soil type and prevailing winds. Moisture availability is linked somewhat with altitude, as the higher-altitude areas of the Mount Pitt section of Norfolk Island National Park generally receive more rainfall. Figure 2 provides a simplified picture of how these factors determine the distribution of native plant communities found on Norfolk Island.

Descriptions of Norfolk Island's native plant communities

1. Moist Palm Valley Forest

Thick nee-ow palm and tree fern forest mostly in mountain valleys.

This community occurs in the deep valleys on the mountains, almost entirely within the Norfolk Island National Park. It occurs primarily on the moister, southern side of the mountain, and historically may have extended down to deep lower valleys.

This community is usually a dense stand of nee-ow palm (*Rhopalostylis baueri*), also called Norfolk Island Palm with the two tree ferns, smooth tree fern (*Cyathea brownii*) and rough tree fern (*Cyathea australis norfolkensis*), other fern species, and scattered hardwoods including pennantia (*Pennantia endlicheri*). At lower altitudes, on upper slopes and on the northern side of the mountains, hardwoods become more common.

Nee-ow palm can reach 10 metres in height and its bright-red fruit is one of the main foods of the endemic green parrot (*Cyanorhamphus cookii)*.

Moist Palm Valley Forest in Norfolk Island National Park. Photo: Kevin Mills

Plant community	Key species	Other species	Threatened species
Moist Palm Valley Forest	• Nee-ow palm (*Rhopalostlyis baueri*) • Smooth tree fern (*Cyathea brownii*)	• Rough tree fern (*Cyathea australis norfolkensis*) • King fern (*Ptisana salicina*) • Mountain rush (*Freycinetia baueriana*)	• Norfolk water fern (*Blechnum norfolkiana*) • Mountain procras (*Elatostema montanum*) • Pennantia (*Pennantia endlicheri*) • Phreatia (*Phreatia limenophylax*)

2. Moist Upland Hardwood Forest

Thick hardwood forest mostly in the Norfolk Island National Park.

This community grows on the slopes of valleys around the mountains, between the Moist Palm Gully Forest (Community 1) and the Pine-Hardwood Ridge Forest Community (Community 3). The forest is relatively species-diverse, but generally lacks some species that occur at lower altitude and includes a few species that prefer higher (moister) altitudes.

One of the key species, sharkwood is a medium-sized tree with a distinctive strong garlic-like smell during the spring months. Flowers are yellow and the seeds form in capsules and are red when mature.

Moist Upland Hardwood Forest, Mount Bates area. Photo: Kevin Mills

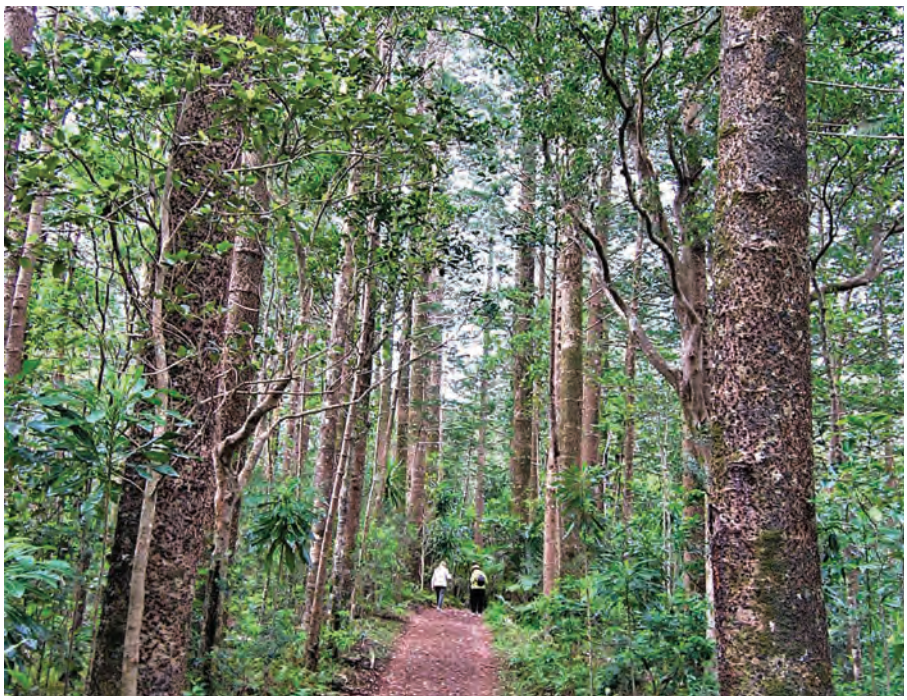
Plant community	Key species	Other species	Threatened species
Moist Upland Hardwood Forest	• Sharkwood (*Dysoxylon bijugum*) • Beech (*Myrsine ralstoniae*) • Ironwood (*Nestegis apetala*) • Native oleander (*Pittosporum bracteolatum)*	• Norfolk pine (*Araucaria heterophylla*) • Narrow leaved meryta (*Meryta angustifolia*) • Ti (*Cordyline obtecta*) • Bastard oak (*Ungeria floribunda*) • Pennantia (*Pennantia endlicheri*) • Euodia (*Melicope littoralis*)	• Mountain coprosma (*Coprosma pilosa*) • Ti (*Cordyline obtecta*) • Sharkwood (*Dysoxylon bijugum*) • Smooth shieldfern (*Lastreopsis calantha*) • Euodia (*Melicope littoralis*) • Melicytus (*Melicytus latifolius*) • Narrow leaved meryta (*Meryta angustifolia*) • Beech (*Myrsine ralstoniae*) • Pennantia (*Pennantia endlicheri*) • Native oleander (*Pittosporum bracteolatum*) • Bastard oak (*Ungeria floribunda*) • Kurrajong (*Wikstroemia australis*)

3. Pine-Hardwood Ridge Forest

Tall pine forest on ridges, mostly on drier ridges in Norfolk Island National Park.

The ridges on the mountain flanks usually support many Norfolk pine (*Araucaria heterophylla*), a species largely excluded from the Moist Upland Hardwood Forest. The forest contains a number of other hardwood species.

The Norfolk pine is an easily recognised large pine that can grow to 60 metres. Cultivated around the world as an ornamental tree, its wood is used for construction, wood turning and crafts. The seeds are a popular food for the endemic and threatened green parrot.



Pine-Hardwood Ridge Forest, Mount Bates ridge. Photo: Kevin Mills

Plant community	Key species	Other species	Threatened species
Pine-Hardwood Ridge Forest	• Norfolk pine (*Araucaria heterophylla*) • Sharkwood (*Dysoxylon bijugum*) • Beech (*Myrsine ralstoniae*) • Ironwood (*Nestegis apetala*) • Native oleander (*Pittosporum bracteolatum*)	• Norfolk pine (*Araucaria heterophylla*) • Narrow leaved meryta (*Meryta angustifolia*) • Ti (*Cordyline obtecta*) • Bastard oak (*Ungeria floribunda*) • Pennantia (*Pennantia endlicheri*)	• Mountain coprosma (*Coprosma pilosa*) • Ti (*Cordyline obtecta*) • Sharkwood (*Dysoxylon bijugum*) • Narrow leaved meryta (*Meryta angustifolia*) • Beech (*Myrsine ralstoniae*) • Pennantia (*Pennantia endlicheri*) • Native oleander (*Pittosporum bracteolatum*) • Bastard oak (*Ungeria floribunda*) • Kurrajong (*Wikstroemia australis*)

4. Viny Hardwood Forest

Thick rainforest with lots of Samson's sinew vine in the Mission Road area.

This community occurs at a low altitude on the south-western flanks of the mountains and extends towards the coast. Remnants include the Norfolk Island Botanic Garden and some north of Mission Road. While most has been cleared, several key species appear to indicate its previous limits. The key indicator species are large old whitewood trees (*Celtis paniculata*) and the robust Samson's sinew vine (*Callerya australis)*.

Whitewood is a large and spectacular tree with white to grey trunks that are often buttressed at the base. Clusters of green flowers can be seen in summer, after which a small round fruit is produced.

Viny Hardwood Forest in the Norfolk Island Botanic Garden. Photo: **Kevin Mills**

The vine, Samson's sinew, often appears as large woody coils hanging from the tops of trees. Its springtime flowers are cream-coloured, sometimes with a bluish tint. They are followed by thick bean-like velvety pods.

Plant community	Key species	Other species	Threatened species
Viny Hardwood Forest	• Whitewood (*Celtis paniculata*) • Samson's sinew (*Callerya australis*) • Bastard ironwood (*Planchonella costata*) • Bloodwood (*Baloghia inophylla*)	• Norfolk pine (*Araucaria heterophylla*) • Native oleander (*Pittosporum bracteolatum*) • Ironwood (*Nestegis apetala*) • Whiteywood (*Melicytyus ramiflorus*) • Beech (*Myrsine ralstoniae*) • Prickly shieldfern (*Arachnoides aristatum*)	• Achryanthes (*Achyranthes arborescens*) • Whiteywood (*Melicytyus ramiflorus*) • Meryta (*Meryta latifolia*) • Beech (*Myrsine ralstoniae*) • Native oleander (*Pittosporum bracteolatum*)

5. Plateau Hardwood Forest

Mixed hardwood forest found on flat areas at Steeles Point and Anson Bay.

This community is the most widespread forest on the lower parts of the island and is found on level ground in the Steeles Point and Duncombe Bay area, but was probably once widespread including through Burnt Pine.

It is the drier version of the Upland Hardwood Forest. Norfolk Island pine (*Araucaria heterophylla*) may have been rather uncommon in this forest in the past.

Old and naturally occurring birdcatcher tree (*Pisonia brunoniana)* occurs in several places and may be indicative of this forest type. Originally, the understorey may have been quite open in places, supporting the shrub Norfolk evergreen (*Alyxia gynopogon)* and the hardier ferns.

Plateau Hardwood Forest on private land at Steeles Point. Photo: Kevin Mills

White oak (*Lagunaria patersonia)* is a commonly occurring, large and spectacular tree growing to more than 20 metres. Its pink and mauve-coloured flowers fade to white with age and have a waxy texture. The seed pods contain sharp hairs that can irritate the skin.

Plant community	Key species	Other species	Threatened species
Plateau Hardwood Forest	• Maple (*Elaeodendron curtipendula*) • White oak (*Lagunaria patersonia*) • Ironwood (*Nestegis apetala*) • Bloodwood (*Baloghia inophylla*)	• Norfolk evergreen (*Alyxia gynopogon*) • Sharkwood (*Dysoxylon bijugum*) • Beech (*Myrsine ralstoniae*)	• Sharkwood (*Dysoxylon bijugum*) • Beech (*Myrsine ralstoniae*) • Melicytus (*Melicytus latifolius*)

6. Lowland Valley Hardwood Forest

Valley forest once more common in lowland areas. Includes hardwoods and tree ferns that can be seen in many lowland valleys.

This community is a drier version of the Moist Upland Hardwood Forest, which occurs higher up the mountain valleys and slopes. It has fewer species than the moister community. Largely missing are several species found in the Moist Upland Hardwood Forest, such as *Pennantia endlicheri* and *Freycinetia baueriana*. However, this forest would have been moister than the Plateau Hardwood Forest on the surrounding plateaus and ridges, resulting in the presence of many ferns, including very tall smooth treefern (*Cyathea brownii),* which are still a feature of many of these valleys today.

Lowland Valley Hardwood Forest, Forestry Section, Norfolk Island National Park. Photo: Kevin Mills

Plant community	Key species	Other species	Threatened species
Lowland Valley Hardwood Forest	• White oak (*Lagunaria patersonia*) • Smooth tree fern (*Cyathea brownii*) • Ironwood (*Nestegis apetala*) • Bloodwood (*Baloghia inophylla*) • Beech (*Myrsine ralstoniae*) • Norfolk pine (*Araucaria heterophylla*)	• Norfolk evergreen (*Alyxia gynopogon*) • Ti (*Cordyline obtecta*) • Two frond fern (*Asplenium dimorphum*) • Prickly shieldfern (*Arachnoides aristatum*)	• Ti (*Cordyline obtecta*) • Beech (*Myrsine ralstoniae*)

7. Sheltered Coastal Forest

Thick forest that only occurs close to the coast in areas protected from wind and salt. Small pockets remain at Bumboras, Ball Bay and Selwyn Reserve.

This forest is differentiated from Lowland Valley Hardwood Forest by its location in the lowest parts of lowland valleys, very close to the coast, where there is apparently a strong coastal influence. The coastal species in this community that largely do not occur in the Lowland Valley Hardwood Forest include the ferns King's brackenfern (*Pteris kingiana)* and *Asplenium difforme* and the trees *Excoecaria agallocha* and *Pisonia brunoniana*.

Ironwood (*Nestegis apetala)* is a small, relatively common tree, usually with wavy-edged leaves. Fruits are most often yellow, sometimes red or purple, and look like small olives.

Sheltered Coastal Forest in Cascade Reserve. Photo: Kevin Mills

Plant community	Key species	Other species	Threatened species
Sheltered Coastal Forest	• Ironwood (*Nestegis apetala*) • Beech (*Myrsine ralstoniae*) • Bloodwood (*Baloghia inophylla*) • White oak (*Lagunaria patersonia*)	• Maple (*Elaeodendron curtipendula*) • Norfolk pine (*Araucaria heterophylla*) • Devil's guts (*Capparis nobilis*)	• Meryta (*Meryta latifolia*) • Beech (*Myrsine ralstoniae*) • King's brakenfern (*Pteris kingiana*) • Siah's backbone (*Streblus brunonianus*)

8. Coastal Pine and White Oak Forest

Hardy open forest of Norfolk Island pines and white oaks that can be seen at Hundred Acres.

This community once occurred along the entire coast around the island, and on Nepean Island. To some extent, it is the extension of the Pine Ridge Forest found on inland ridges, both being rather drier than the adjacent vegetation and with *Araucaria heterophylla* prominent. Hardwoods are generally uncommon but often found in inland sheltered places. The understorey is often quite open, with remaining intact examples indicating a herbaceous ground cover with scattered shrubs. Near the southern coast melky tree (*Excoecaria agallocha)* may occur, and rare Norfolk Island euphorbia (*Euphorbia norfolkiana)* and coastal coprosma (*Coprosma baueri)* appear to favour this forest.

Coastal Pine and White Oak Forest in Hundred Acre Reserve. Photo: Kevin Mills

Plant community	Key species	Other species	Threatened species
Coastal Pine and White Oak Forest	• Norfolk Island pine (*Araucaria heterophylla*) • White oak (*Lagunaria patersonia*)	• Beech (*Myrsine ralstoniae*) • Native spinach (*Tetragonia implexicoma*) • Coastal twofrond fern (*Asplenium difforme*)	• Coastal coprosma (*Coprosma baueri*) • Norfolk Island euphorbia (*Euphorbia norfolkiana*) • Beech (*Myrsine ralstoniae*) • Coastal senecio/ yellow daisy (*Senecio australis*)

Coastal Complex – communities 9-13

The following five native plant communities occur on the immediate coast, primarily on exposed cliffs. These communities form a coastal complex and historically occurred with the Pine-White Oak Forest, as they do today.

9. Coastal White Oak Shrubland

Stunted, low growing white oaks and melky trees such as those near Cemetery Bay, Ball Bay and Hundred Acres.

Stunted shrubby white oak plants (*Lagunaria petersonia*) occur on very exposed coastal cliffs. This shrubland may have been quite common previously. The associated species are typical coastal species, including pigface (*Carpobrotus glaucescens)*, native spinach (*Tetragonia implexicoma)* and *Achyranthes aspera*. The rare coastal coprosma (*Coprosma baueri)* is also sometimes found in this community and in the past may have been common.

Coastal White Oak Shrubland at Hundred Acres Reserve. Photo: Kevin Mills

Plant community	Key species	Other species	Threatened species
Coastal White Oak Shrubland	• White oak (*Lagunaria patersonia*)	• Salt couch (*Sporobolus virginicus*) • Native spinach (*Tetragonia implexicomis*) • Club rush (*Ficinia nodosa*)	• Coastal senecio/yellow daisy (*Senecio australis*) • Coastal coprosma (*Coprosma baueri*)

10. Sandy Beach Herbland

Low growing, non-woody plants growing in sand at Slaughter Bay, Anson Bay and Cemetery Bay.

The upper sandy beaches at Kingston and Anson Bay support typical sandy beach species. They include salt couch (*Sporobolus virginicus)*, coastal spurge (*Euphorbia obliqua)*, native vigna (*Vigna marina)*, *Canavalia rosea* and club rush (*Ficinia nodosa)*. The creeping plant *Calystegia soldanella*, now probably extinct on the island, once occurred in this community.

Sandy Beach Herbland at Anson Bay.
Photo: Kevin Mills

Plant community	Key species	Other species	Threatened species
Sandy Beach Herbland	• Salt couch (*Sporobolus virginicus*) • Goats foot (*Ipomoea pes-caprae*) • Mile-a-minute (*Wollstonia biflora*) • Club rush (*Ficinia nodosa*) • Coastal spinifex (*Spinifex hirsuta*)	• Native spinach (*Tetragonia tetragonioides*) • Pigface (*Carpobrotus glaucescens*)	• Coastal spurge (*Euphorbia obliqua*) • *Calystegia soldanella*

11. Coastal Grassland

Thick, salt tolerant grasses and sedges growing in sandy coastal areas.

Salt couch (*Sporobolus virginicus*) dominates many exposed coastal sites on sea cliffs. Other species include pigface (*Carpobrotus glaucescens*), native spinach (*Tetragonia tetragonioides*), chaff flower (*Achyranthes aspera*), yellow daisy (*Senecio australis*) and club rush (*Ficinia nodosa*).

Coastal Grassland at Hundred Acres Reserve. Photo: Kevin Mills

Plant community	Key species	Other species	Threatened species
Coastal Grassland	• Salt couch (*Sporobolus virginicus*) • Pigface (*Carpobrotus glaucescens*) • Chaff flower, coastal achyranthes (*Achyranthes aspera*)	• Coastal senecio/ yellow daisy (*Senecio australis*) • Native lobelia (*Lobelia anceps*) • Brookweed (*Samolus repens*)	• Coastal senecio/ yellow daisy (*Senecio australis*)

12. Moo-oo Sedgeland

Common on Phillip Island and the northern islets off Norfolk Island. Also present on the hot, exposed northern coastal slopes of Norfolk Island.

This is a sedgeland dominated by moo-oo (*Cyperus lucidus*), which grows very densely, almost to the exclusion of other plants. This community covered large parts of Phillip island, as described by Phillip Gidley King.

Moo-oo is a robust perennial sedge. The stems are solid, triangular in cross-section and grow to 1.3m. The leaves, which all grow from the base of the stem to about 1m in length, are thick and glossy.

Moo-oo Sedgeland on Phillip Island. Photo: Kevin Mills

The flowers, which individually are inconspicuous, form an attractive umbrella-like head, which is bright red when young, turning red-brown as it matures. The fruit is a small, dark, angular nut.

Plant community	Key species	Other species	Threatened species
Moo-oo Sedgeland	• Moo-oo (*Cyperus lucidus*) • Chaff flower, coastal achyranthes (*Achyranthes aspera*) • Pigface (*Carpobrotus glaucescens*)	• Flax (*Phormium tenax*) • Scurvy weed (*Commelina cyania*)	

13. Coastal Flax Community

Coastal slopes with some protection, more common on the southern side of Norfolk Island, particularly where pines offer some shade.

This community is somewhat speculative as little evidence remains of its original character and distribution. Although it was present by the time of the arrival of Captain James Cook in 1774, it is also not clear if the key species flax (*Phormium tenax*) is native to Norfolk Island. *Dianella intermedia* grows to 60cm with pale violet flowers followed by turquoise berries. *Asplenium difforme* is part of the spleenwort group of ferns and its fronds are thick and waxy to protect it from sea spray.

Coastal Flax Community at Ball Bay.
Photo: Kevin Mills

Plant community	Key species	Other species	Threatened species
Coastal Flax Community	• Flax (*Phormium tenax*) • *Dianella intermedia* • Coastal coprosma (*Coprosma baueri*) • Norfolk pine (*Araucaria heterophylla*) emergent • *Asplenium difforme*	• *Senecio spp.* • White oak (*Lagunaria patersonia*)	• Coastal coprosma (*Coprosma baueri*)

14. Freshwater Swamp

Along watercourses, particularly in shallow, wide valleys and was probably once much more widespread.

Prior to convict times, a large freshwater swamp existed across the Kingston Common. While that swamp is largely gone, a few swamps occur elsewhere on broad valley floors with a very low gradient and other similar valleys probably supported swamps prior to infilling caused by erosion after clearing of the surrounding forests. These swamps would have been surrounded by dense forest. Today, many introduced species are also found in the wetland habitats.

Freshwater Swamp along valley floor at Headstone. Photo: Kevin Mills

Plant community	Key species	Other species	Threatened species
Freshwater Swamp	• Club rush (*Schoenoplectus tabernaemontani*) • Drain flax (*Typha orientalis*) • Bull rush (*Juncus continuus*) • Common spike-rush (*Eleocharis acuta*)	• Batswing fern (*Histiopteris incisa*) • Swamp hibiscus (*Hibiscus diversifolius*) • Slender knotweed (*Persicaria decipiens*)	

Conservation of native vegetation communities on Norfolk Island

A total of 46 plant taxa (26 per cent of the indigenous flora of the island) are listed as threatened under Australia's *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

As shown in Table 1, about half of the island's tree and shrub species are listed as threatened. These two plant groups also have a high proportion of endemic species. There have been eight known plant extinctions from the Norfolk Island Group, including three endemic species: *Solanum bauerianum*, *Streblorrhiza speciosa* and, if accepted as endemic, a species of corybus *(Nematoceras)*.

The *Norfolk Island Regional Threatened Species Strategy*, *Norfolk Island Environment Strategy 2018-2023* and *Norfolk Island Pest Management Plan 2020-2025* all outline actions that can be taken to conserve and restore threatened plant species and vegetation communities. In order to achieve many of the listed actions, baseline data is required to determine the extent of native vegetation present on Norfolk Island, and the vegetation communities present within it. The vegetation maps and this report provide information on the extent of native vegetation present, and the various vegetation communities present, consistent with Australian vegetation mapping guidelines. As a result, the following indicators can be established and monitored for change over time:

- Total native vegetation cover present.
- Total area of habitat for threatened plant and animal species.
- Total area of native vegetation

Growth habit	Number of species	Proportion of flora	Endemic species	Threatened species[1]
Trees	32	18%	14	*15*
Shrubs	17	9%	10	*10*
Vines/Creepers	18	10%	3	*3*
Forbs	31	17%	5	*5*
Grasses	15	8%	-	*1*
Orchids	11	6%	4	*4*
Sedges/Rushes	12	7%	1	*0*
Ferns	44	24%	7	*8*
Total Flora	180	100%	44	*46*

Note: 1. This column indicates the number of species listed under the EPBC Act. It includes extinct species. One endemic species, *Streblorrhiza speciosa* (fabaceae), is extinct on the island but not listed under the EPBC Act.

Table 1. Indigenous, endemic and threatened plants on the Norfolk Island Group

being restored. This might further be subdivided into areas of native forest that are being weeded; and areas of bare ground or weeds that have been completely revegetated.

Should vegetation restoration be undertaken in the Norfolk Island National Park, public reserves and elsewhere, monitoring of vegetation condition could then be undertaken. This could be based on the GIS mapping, with subsequent GIS mapping specifically designed to detect changes in vegetation condition. Alternatively, on-ground survey transects could be established at strategic locations for long-term monitoring.

Competition from exotic weeds is a threat to all threatened plant species on Norfolk Island and most vegetation communities are affected to some degree. A better understanding of the extent and location of weed infestations would allow land managers to prioritise areas for weed control.

There are currently 180 recognised native plants on the Norfolk Island Group and about twice this number of naturalised species, some of which have become serious weeds. Weed control is essential for the protection and preservation of Norfolk Island's vegetation communities. The *Noxious Weeds Act 1916* (NI) lists only a small number of Norfolk Island's most problematic weeds, and needs updating so that Norfolk Island Regional Council has a legislative head of power with which to implement weed control. Priority invasive weed species are shown in Appendix 1.

Preventing new invasive species arrivals is usually more cost-effective than managing them after they have become established. Biosecurity is therefore a critical tool in reducing the potential for new weed species to arrive on Norfolk Island. The biosecurity arrangements that apply for Norfolk Island have been under scrutiny in recent years and extensively investigated in 2017 (Invasive Species Council and Island Conservation, 2017).

Map 1. Norfolk Island Native Plant Communities Present in 1750

The Norfolk Island Vegetation Mapping Project 2020

Map 1 shows the predicted extent of native vegetation present in 1750 and Map 2 shows the extent of native vegetation in 2020.

Maps and project information are available at invasives.org.au/niveg.

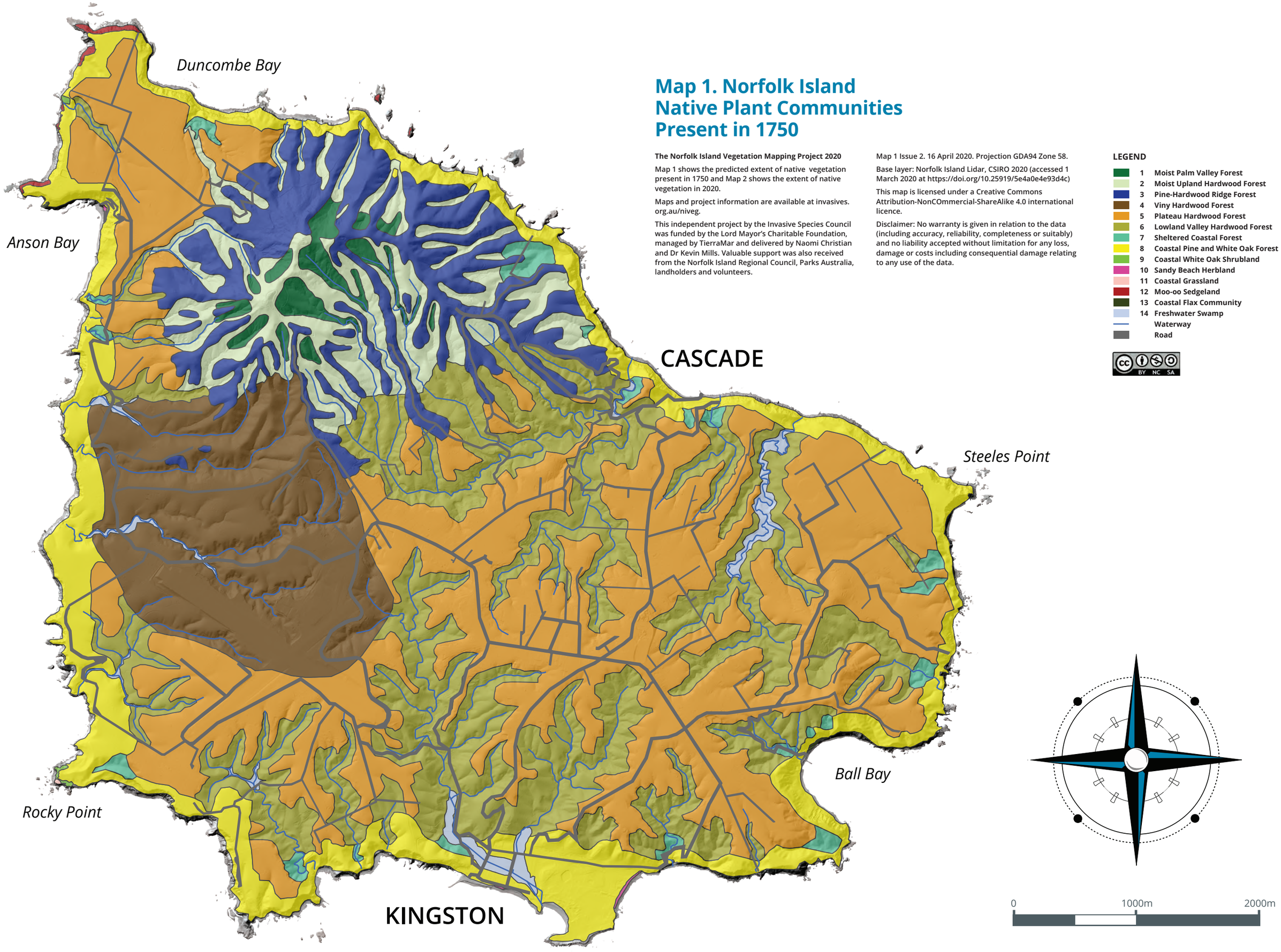
This independent project by the Invasive Species Council was funded by the Lord Mayor's Charitable Foundation, managed by TierraMar and delivered by Naomi Christian and Dr Kevin Mills. Valuable support was also received from the Norfolk Island Regional Council, Parks Australia, landholders and volunteers.

Map 1 Issue 2. 16 April 2020. Projection GDA94 Zone 58.

Base layer: Norfolk Island Lidar, CSIRO 2020 (accessed 1 March 2020 at https://doi.org/10.25919/5e4a0e4e93d4c)

LEGEND

	1	Moist Palm Valley Forest
	2	Moist Upland Hardwood Forest
	3	Pine-Hardwood Ridge Forest
	4	Viny Hardwood Forest
	5	Plateau Hardwood Forest
	6	Lowland Valley Hardwood Forest
	7	Sheltered Coastal Forest
	8	Coastal Pine and White Oak Forest
	9	Coastal White Oak Shrubland
	10	Sandy Beach Herbland
	11	Coastal Grassland
	12	Moo-oo Sedgeland
	13	Coastal Flax Community
	14	Freshwater Swamp
		Waterway
		Road



0 1000m 2000m

Map 2. Norfolk Island Native Plant Communities Present in 2020

The Norfolk Island Vegetation Mapping Project 2020

Map 1 shows the predicted extent of native vegetation present in 1750 and Map 2 shows the extent of native vegetation in 2020.

Maps and project information are available at invasives.org.au/niveg.

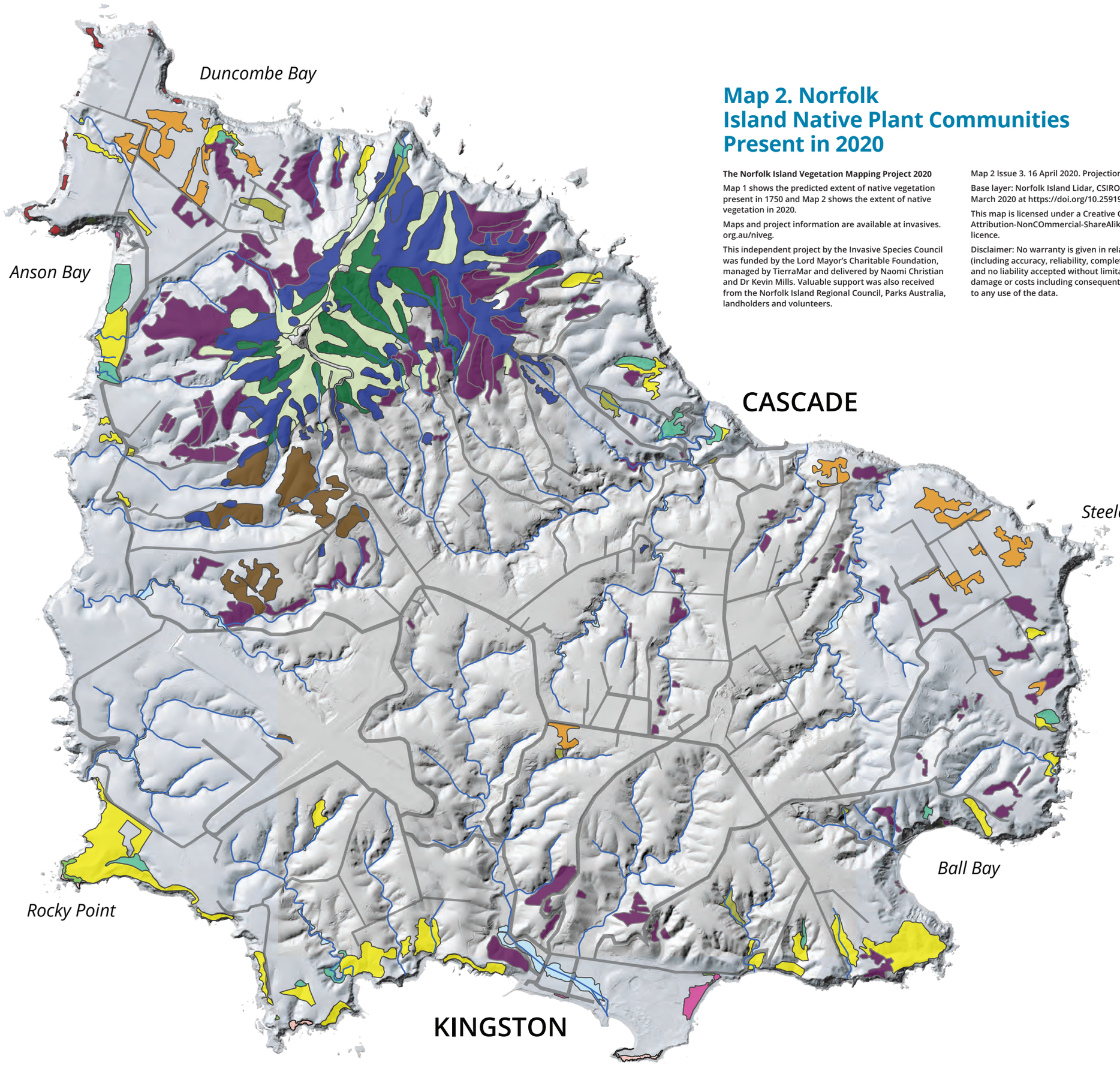
This independent project by the Invasive Species Council was funded by the Lord Mayor's Charitable Foundation, managed by TierraMar and delivered by Naomi Christian and Dr Kevin Mills. Valuable support was also received from the Norfolk Island Regional Council, Parks Australia, landholders and volunteers.

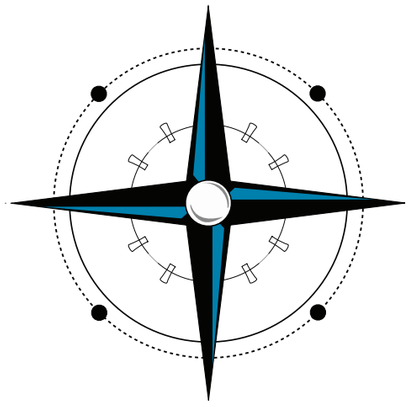
Map 2 Issue 3. 16 April 2020. Projection GDA94 Zone 58.

Base layer: Norfolk Island Lidar, CSIRO 2020 (accessed 1 March 2020 at https://doi.org/10.25919/5e4a0e4e93d4c)

LEGEND

	1	Moist Palm Valley Forest
	2	Moist Upland Hardwood Forest
	3	Pine-Hardwood Ridge Forest
	4	Viny Hardwood Forest
	5	Plateau Hardwood Forest
	6	Lowland Valley Hardwood Forest
	7	Sheltered Coastal Forest
	8	Coastal Pine and White Oak Forest
	9	Coastal White Oak Shrubland
	10	Sandy Beach Herbland
	11	Coastal Grassland
	12	Moo-oo Sedgeland
	13	Coastal Flax Community
	14	Freshwater Swamp
	NR	Non Remnant Vegetation
		Waterway
		Road





0 1000m 2000m

REFERENCES

Byron, N. (2012). *The future role of the National Park Forestry Zone in a Sustainable Forestry Sector on Norfolk Island*. https://www.environment.gov.au/system/files/resources/e0dcf03c-1ae0-4c9b-9a9a-573eae321e19/files/forestry-report-12.pdf

Commonwealth of Australia (1999). *Environment Protection and Biodiversity Conservation Act 1999*. Commonwealth of Australia, Canberra.

Director of National Parks (2010). Department of the Environment, Water, Heritage and the Arts, Canberra. *Norfolk Island Region Threatened Species Recovery Plan*.

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.

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

Invasive Species Council and Island Conservation (2017). *Norfolk Island: Protecting an Ocean Jewel*. Recommendations for stronger biosecurity for the Norfolk Island group. Invasive Species Council and Island Conservation. Fairfield, Victoria, Australia. October.

Lane-Poole, C. E. (1926) *Report on the forests of Norfolk Island*. Melbourne: Government Printer of Victoria.

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

Mills, K. (2017). *Survey of Public Reserves on Norfolk Island for Threatened Plant Species*. Nos 1 to 9. Prepared for Norfolk Island Regional Council, December.

Norfolk Island Regional Council (2018). *Norfolk Island Environment Strategy 2018–2023*. The Council, Kingston, November.

Norfolk Island Regional Council (2020) *Norfolk Island Regional Council Pest Management Plan 2020-2025*.

APPENDIX 1: KEY WEEDS ON NORFOLK ISLAND

Information from Norfolk Island Regional Threatened Species Plan with additional information from Norfolk Island Environment Strategy 2018-2023 and NSW Department of Primary Industries weed database.

Species	Notes on impacts
Red guava (*Psidium cattleianum*)	The tree rapidly forms dense thickets with extensive mats of feeder roots that make it difficult for other species to co-exist.
African olive (*Olea europaea* subsp. *cuspidata*)	Olives may exert an allelopathic (toxic) effect – where mature trees inhibit native plant germination and growth. Removal appears to result in improvement of the health and vigour of emergent native species.
Hawaiian holly (*Schinus terebinthifolius*)	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.
Lantana (*Lantana camara*)	An aggressive woody weed of open areas that suppresses regeneration of native species with its thorn covered branches and vigorous scrambling habit.
William Taylor (*Ageratina riparia*)	Also known as mist flower, it grows to one metre high with white flower heads and spreads widely, shading out small native plants.
Kikuyu grass (*Pennisetum clandestinum*)	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.
Madeira vine (*Anredera cordifolia*)	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*)	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*).
Bleeding heart (*Homolanthus populifolius*)	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*.
Morning glory (*Ipomoea cairica* and *I. indica*)	A perennial twining plant that rapidly invades open areas after fallen trees or woody weed removal.
Formosan lily (*Lilium formosanum*)	A vigorous, shade tolerant species that produces large numbers of seeds and is difficult to remove.
Coral berry (*Rivina humilis*)	An upright herbaceous plant or small shrub usually growing 0.6-1 m tall. This species prefers damp, shady sites and is a weed of closed forests, forest margins, riparian vegetation, disturbed sites, waste areas, urban bushland and gardens in tropical and sub-tropical regions.
Water hyacinth (*Eichhornia crassipes*)	Water hyacinth is a floating water weed with blue flowers. It forms dense mats that reduce water quality, block irrigation channels and affect native aquatic life.
Cascade onion (*Homeria flaccida*)	Also known as Cape tulip (*Moraea flaccida*). Grows best in open environments, such as grasslands and pasture, where it competes with and replaces desirable plants. The plant severely impedes the growth and regeneration of indigenous ground flora.
African boxthorn (*Lycium ferocissimum*)	African boxthorn is a thorny shrub with red berries and purple flowers. It forms impenetrable thickets and is poisonous to people.

Invasive Species Council
invasives.org.au
contact@invasives.org.au

TierraMar
tierramar.com.au
info@tierramar.com.au

Norfolk Island Regional Council
New Military Barracks, Kingston, Norfolk Island.
PO Box 95, Norfolk Island 2899.
T: (+6723) 22001 (ext. 144) **M:** (+6723) 52158 **W:** norfolkisland.gov.nf