

*Metrosideros perforata*  
*Parsonsia heterophylla*  
*Rubus cissoides*

#### Dicotyledonous Herbs

*Euchiton collinus*  
*Haloragis erecta*  
*Nertera dichondrifolia*  
*Ranunculus reflexus*

#### Monocotyledonous Trees and Shrubs

*Cordyline australis*  
*Cordyline pumilio*  
*Rhopalostylis sapida*

#### Monocotyledonous Lianes

*Freycinetia banksii*  
*Ripogonum scandens*

#### Lilies and Allied Plants

*Astelia banksii*  
*Astelia trinervia*  
*Collospermum hastatum*  
*Dianella nigra*

#### Orchids

*Acianthus sinclairii*  
*Cyrtostylis oblonga*  
*Diplodium brumalium*  
*Pterostylis agathicola*  
*Nematoceras trilobum*  
*Winika cunninghamii*

#### Sedges

*Carex lambertiana*  
*Carex virgata*  
*Gahnia lacera*  
*Gahnia pauciflora*  
*Gahnia setifolia*  
*Gahnia xanthocarpa*  
*Lepidosperma laterale*  
*Schoenus maschalinus*  
*Schoenus tendo*  
*Uncinia banksii*  
*Uncinia uncinata*

#### Grasses

*Microlaena avenacea*  
*Oplismenus hirtellus*

## Norfolk Island - A record of the Auckland Botanical Society's visit, 4-11 September 2010

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### Introduction

Norfolk Island is New Zealand's nearest neighbour – just 740 km away. It is close enough and sufficiently temperate to share several native plants with northern New Zealand, and numerous adventives, yet distant and isolated enough to have its own, mostly endemic native flora, as well as its fair share of exotic introductions. We eagerly anticipated our visit, the objective being to see as much as possible of the 3529 ha island's vegetation, flora and fauna, to learn about the history and geology, and to meet some of the 1800 locals.

### Programme

**Saturday 4 Sep:** Flight from Auckland to Norfolk Island, 1120 km (Fig. 1). Accommodation at Hibiscus Crown Motel, New Cascade Road – more or less in the centre of the Island. Initial botanical exploration on foot along New Cascade Road, Cascade Road, and Harpers Road.

**Sunday 5 Sep:** Visited the Sunday morning market at Burnt Pine. By bus to the Mt Pitt Section of the National Park (460 ha) with Margaret Christian, Mt Pitt and Mt Bates Track, ending at the Botanic Garden.

**Monday 6 Sep:** Visited Phillip Island (Phillip Island Section of the National Park, 190 ha) for the morning on a boat operated by Dave Bigg (Charter Marine), with guides Karlene Christian and Peter Cassidy. In

the afternoon explored the coral reef at Slaughter Bay, Lone Pine, Emily Bay, Kingston, the Cemetery, and Bumbora (Cresswell Bay).

**Tuesday 7 Sep:** In the morning, a conducted bus tour (Baunti Escapes) of the island, with driver Eddie Hooker: Oakridge School, Kingston, Emily Bay, Cascade, St Barnabas Chapel (Melanesian Mission), Anson Bay. In the afternoon we met Coral Rowston, Manager of the National Park. Explored the Botanic Garden (5.5 ha), which features impressive boardwalks through bush. In the evening, a progressive dinner comprising nibbles (Byron "Truck" Adams, "Bedrock", Duncombe Bay); soup (Darren & Shari Bates, "Wildwood", Stockyard Road – Darren also does wood turning, producing bowls and ornaments from Norfolk pine wood, and operates a fishing charter business); main course (Eddie Christian, Mill Road); dessert (Rachael Nobbs, 91 Ferny Road).

**Wednesday 8 Sep:** A wettish day. In the morning visited Anson Bay, followed by inspection of eucalypt plantations and the giant banyan on Bullocks Hut Road. In the afternoon visited the Hundred Acres Reserve and Rocky Point.

**Thursday 9 Sep:** In the morning visited the National Park in the Palm Glen area. In the afternoon visited the garden of Kaye Wood at Silky Oak Stables, Mission Road. Some people later visited Ball Bay, and

others took a trip in the glass bottom boat operated by John Christian.

*Friday 10 Sep:* Our final day took us to the National Park again, this time beginning at Red Rock Track from the end of J.E. Road. We followed along McLachlans Lane to the Bird Rock Lookout, and then along the Bridle Track to the Captain Cook Monument, returning by car back to the base. Doug Sheppard and John Millett visited Howard Christian, who operates the island's only sawmill. Our finale was a Polynesian fish fry in the evening, held at Anson Bay.

*Saturday 11 Sep:* Returned to Auckland.

### Geology and history

Norfolk and Phillip Islands are located on the Norfolk Ridge which extends from New Caledonia to New Zealand. The ridge, a piece of ancient Gondwana, is now largely 1000-1500 m below sea level although Norfolk and Phillip Islands sit on a shallow plateau that was formed by volcanic activity between 26-20 million years ago. At this time a large basaltic island was created but subsequent erosion reduced the island to shallow sea-floor on which coral reefs flourished (Coyne 2009a, Mills 2009b).

About 3 million years ago a further series of eruptions of basalt commenced and, with intervening periods of quiescence, volcanism continued for 700,000 years creating Norfolk and Phillip Islands. Brightly coloured soft tuffs, formed when violent eruptions of lava mixed with seawater, are particularly prominent on Phillip Island today. Otherwise lava flowed quietly from vents producing the thick sheets of basalt seen in the high cliffs and coastal platforms of both islands.

Erosion again has greatly reduced the size of both islands so that Norfolk Island is now only a 7 km<sup>2</sup> minus a northeast corner and Phillip Island a straggle 2 km long with the remains of one vent forming an island pinnacle at the landing place. However during the ice ages of the last 2.6 million years when sea levels were lowered by 50-150 m for extended periods, much of the 100 km long Norfolk Plateau would have been above sea level thus connecting Norfolk and Phillip Islands and providing a large land area and variety of habitats for colonising plants. The prevailing soil type is a well-drained, reasonably fertile red clay soil (krasnozem) derived from basalt.

The low sea levels exposed the extensive coral reef areas. The prevailing southerly winds carried eroded fragments of coral and calcareous algae towards the southern coast of Norfolk Island where it cemented together with sand to form a cross-bedded limestone known as "calcareenite". Nepean Island is formed of calcarenite which also outcrops along the coast at Emily and Slaughter Bays.

For 200 years Norfolk Island was inhabited by Polynesian people 600 years before Captain Cook encountered the island in 1774. British settlers arrived 14 years later and the first penal colony was established. Norfolk Island was abandoned in 1814 but only 11 years later a second period of convict settlement occurred lasting until 1855. In 1856 the population of Pitcairn Island, almost all descendents of the 1790 Bounty mutineers, arrived, and although a number subsequently returned to Pitcairn, the majority of today's Norfolk Islanders trace their ancestry to this migration.



Fig. 1. Map of Norfolk Island. Australian Government, National Parks, 2010.

During the first settlement pigs, goats, rabbits and domestic fowl were introduced to Phillip Island to serve as a source of food and provide sport for the officers; at the same time many trees were removed. Banishment to the island was used as a severe punishment for convicts but the island has never had permanent inhabitants owing to the lack of water. The pigs, goats and chickens were removed from the island at the beginning of last century but the rabbits were not eradicated until 1988. Ship rats (*Rattus rattus*) and kiore (*Rattus exulans*) remain. The heavy browsing over centuries resulted in severe loss of original vegetation which in turn accelerated the massive erosion of the friable tuff soils. Phillip Island was designated as part of Norfolk Island National Park under which its rehabilitation is being managed.



Fig. 2. Kingston area of Norfolk Island in the foreground, with Nepean Island and Phillip Island in the distance. All Figure photos are by Mike Wilcox, unless otherwise stated.

### A brief introduction to the botany of Norfolk Island

The plants of Norfolk Island have been fairly well studied and recorded. The paper by Bill Sykes (Sykes 1980) is a good start as it remains probably the most readable, yet comprehensive, account of what the botanical visitor is likely to see. The vegetation has been more fully and formally described by Gilmour & Helman (1989), and a succinct description of the flora and vegetation has been presented by Mueller-Dombois & Fosberg (1998) in their encyclopaedic survey of Pacific Islands botany, and also in Mueller-Dombois (2002). Three intergrading forest community types have been recognised: (1) an *Araucaria* dominated forest in drier, more wind-exposed positions, (2) a *Rhopalostylis* palm and *Cyathea* tree fern-dominated forest in moister positions, and (3) a mixed-species hardwood forest with *Araucaria* overstory in intermediate positions.



Fig. 3. Our group on Mt Pitt. From left: Louise Cotterall, Doug Sheppard, Peter Scott, John Millett, Maureen Young, Diana Whimp, Bev Davidson, Geoff Davidson, Christine Major (leader), Alison Wesley, Margaret Christian, Anne Fraser, Stella Rowe, Mike Wilcox, John Rowe, Rosslyn Pritchard, John Hobbs. Photo: Mike Wilcox's camera.

There is a "Flora" (Green 1994), which can serve as a field guide and reference, and there are useful additional observations and research by visiting New Zealanders (de Lange & Murray 2003; de Lange et al. 2005; Gardner 2006). No pictorial field guide is available along the lines of Hutton (2002) for Lord Howe Island – though this book is useful for Norfolk Island too, as there are several indigenous plants common to both islands. More recently there have been thorough studies made of the numerous threatened plants, including those on Phillip Island (Coyne 2009; Mills 2009b, 2009c; Anon. 2010).

Ferdinand Bauer from Austria made the first comprehensive collection of plants from Norfolk Island in 1804-1805, and local plants honouring him are *Cephalomanes bauerianum*, *Coprosma baueri*, *Freycinetia baueriana*, *Melodinus baueri*, *Rhopalostylis baueri* and *Zehneria baueriana*.

The history of the timber exploitation and forestry activities has been documented by Lennon (2005), and insights into the prehistory, including early pre-European plant introductions, have been presented by Anderson & White (2001).

There is a book about mosses (Streimann 2002), a catalogue of lichens (Elix & McCarthy 1998), Bannister & Blanchon (2003) have studied the lichen genus *Ramalina*, and there is a list of seaweeds (Millar 1999). The Australian Government has produced four brochures for visitors which we found very handy: "Birds of Norfolk Island National Park and Botanic Garden", "Plants of Norfolk Island National Park and Botanic Garden", "Norfolk Island National Park and Botanic Garden: walking tracks", and "Norfolk Island National Park and Botanic Garden: Phillip Island".

These are the latest statistics on Norfolk Island's vascular plant flora (Mills 2009c):

Indigenous plants	181 species
Introduced naturalised plants	<u>363 species</u>
TOTAL	544 species

Of the 181 indigenous species, 43 are endemic, of which 33 are threatened. There are also 13 species of non-endemic natives that are threatened (2010). The National Park (Mt Pitt section and Phillip Island section) is vital for the survival of the indigenous flora as much of Norfolk Island is settled and now lacking in habitat and viable populations for most of the indigenous plants.

There are two monotypic endemic genera: *Ungeria floribunda*, Malvaceae, and Phillip Island glory pea (*Streblorrhiza speciosa*), Fabaceae, endemic to Phillip Island but now extinct (Green 1994), and probably most closely related to *Carmichaelia* (Heenan 2001). During the week we got to see most of the indigenous plants, including the very rare and threatened ones as

cultivated plants in the Botanic Garden and at various places in the National Park. Our introduction to the Norfolk Island flora began with an abundance of unfamiliar plants, mixed with some that were strangely familiar. With local botanist Margaret Christian to guide us, we began our programme with a crash course on the Norfolk Island flora, atop the highest ridge on the island joining Mounts Pitt (320m) and Bates (321m).

Native trees, shrubs and woody climbers

*Trees also native to New Zealand:* Several Norfolk Island trees intrigued us by their general similarity, yet with subtle differences, to their New Zealand counterparts. Akeake (*Dodonaea viscosa* subsp. *viscosa*), (Plate 1), was common and clearly recognisable, yet rather unlike our local form placed in the same subspecies. The Norfolk Island tree has glossy dark green leaves contrasting with vivid red membranous wings on the fruit and, to confuse us further, the locals call it 'tea-tree'. It seemed to be the only tree in the flora with a peeling, papery bark, and is a vigorous short-lived coloniser of open, disturbed sites, and a probable nurse for regeneration of other trees. Equally widespread was ironwood (*Nestegis apetala*), and from the heavy seed crops many trees bore, it was apparent it was as fruitful as its weedy Mediterranean cousin, the wild olive *Olea europaea* subsp. *cuspidata*.

Nettle tree (*Pouzolzia australis*) was only sparsely seen in the National Park, its leaves often distorted and pimped by some kind of disorder or mite attack. The Kermadec Islands form of this tree was distinguished as *Boehmeria australis* subsp. *dealbata*, from the Norfolk Island form subsp. *australis*. De Lange et al. (2005) noted that "The petioles of subsp. *australis* can be up to 170 mm long whereas they are at most 70 mm long in subsp. *dealbata*. Also, the indumentum on young shoots and leaves is not as dense in subsp. *australis* so the leaf lamina under surface is pale grey and not white as in subsp. *dealbata*." Subsequently, both subspecies were sunk into *Pouzolzia australis* by Wilmot-Dear & Friis (2006).

Bastard ironwood (*Planchonella costata*), was seen only a few times and seemed to be uncommon. Its leaves looked to be somewhat larger than those of New Zealand's tawapou. Norfolk Island pepper tree or what we would call kawakawa (*Macropiper excelsum*) showed its off-shore island connections, being the same subspecies, subsp. *psittacorum* as found on the Kermadec Islands. It was common in the understorey throughout the National Park, and much admired. Wai-wai or birdcatcher (*Pisonia brunoniana*), is the same as the New Zealand parapara. We saw it as just a small subcanopy tree in the National Park, but it is also present in Hundred Acres Reserve (Anon. 2003). Whiteywood (*Meliccytus ramiflorus*), was seen on Mt Pitt, but was not very common. The form on Norfolk Island is recognised as subsp. *oblongifolius*.

Other species shared with New Zealand were *Hibiscus diversifolius*, *Muehlenbeckia australis*, *Peperomia urvilleana*, *P. tetraphylla*, and *Ileostylus micranthus*. Only one plant of *Hibiscus diversifolius* was seen, growing in a damp thicket beside Douglas Drive. It was in flower, and had the characteristic harshly spiny stems. To our delight we found both species of *Peperomia*, growing together on shaded rock outcrops in the bush along the Palm Glen track. *Muehlenbeckia australis* was sighted a couple of times in the Mt Pitt area, but *Ileostylus micranthus* eluded us, despite us searching on one its favoured hosts, *Coprosma pilosa* (Plate 1), which in turn was very local in its occurrence as we only saw it along parts of the track between Mt Pitt and Mt Bates. It was aptly named and, although new to us, easily recognised by the velvety hairs on all parts of its leaves and stems, rather like a hairy *Coprosma macrocarpa*. One shrub we thought we recognised, *Coprosma repens*, only to learn that the Norfolk Island plant is *C. baueri*. It was seen at its best on Phillip Island, growing on the crests of high coastal ridges and cliffs (Plate 1), and also much planted at places such as Mt Pitt summit and the Captain Cook Memorial. Plants fully in the open have markedly inrolled leaf margins, though shade leaves are flat.



Fig. 4. White oak (*Lagunaria patersonii*), Cascade Road.

Ni'au (*Rhopalostylis baueri*), is Norfolk Island's only indigenous palm. It is now regarded as the same species as the Kermadec Island nikau (de Lange et al. 2005) and looked much like the nikau palm we are familiar with in New Zealand. It is prominent along gullies around the National Park, but uncommon elsewhere. In the absence of the extinct wood pigeon, the main dispersal agent of the fruit is the green parrot for which ni'au is a favoured food. Ti or Norfolk Island cabbage tree (*Cordyline oblecta*), is now thought to be the same as New Zealand's Three Kings cabbage tree (formerly *Cordyline kaspar*) (de Lange et al. 2005). It is a handsome plant and common throughout the National Park in the forest understorey and also on the margins. It is frequently planted, too.

*Trees shared with Lord Howe Island and/or Australia and New Caledonia:* White oak (*Lagunaria patersonii*), Malvaceae, is Norfolk Island's commonest and most characteristic broadleaved tree, growing to 20 m in height (Fig. 4). We call it the Norfolk Island hibiscus in New Zealand and on Lord Howe it is known as sally wood, where, interestingly, it is one of the rarest trees (Mueller-Dombois 2002). It is plentiful throughout the National Park. It grows on nearly every farm, and has survived well on Phillip Island. It has a good tolerance of coastal winds, being very prominent at Rocky Point in the Hundred Acres Reserve. In the early days the wood was burnt with calcarenite to make cement. Note that we have used *patersonii* rather than *patersonia* as the specific name, as recommended by Gardner (2006).

Bloodwood (*Baloghia inophylla*), Euphorbiaceae, is a handsome tropical-looking tree growing up to 15 m tall with bold medium-large, thick leaves. Up to 12 cm long, the leaves are in opposite pairs with a pair of glands near the base. The bark bleeds when wounded, but the latex rapidly turns red on exposure to the air, hence the common name scrub bloodwood. Early settlers used it for firewood as it has sufficient resin that it will burn while still green. Older gnarled trees provide nest sites for the green parrot. We saw it throughout the National Park, and planted on Phillip Island, and it was commonly bearing fruit (Fig. 5).

Maple (*Elaeodendron curtispiculum*), Celastraceae, was among the commoner native trees we saw. It is a straight-stemmed, tidy tree, its compound leaves having a distinctive crenulate margin. Fine crops of ripe fruit were seen along the Palm Glen track (Plate 1). Birds must spread the seed effectively as the tree was commonly seen coming up in hedgerows. Sharkwood (*Dysoxylum bijugum*), was fairly common in the National Park. It is only a small subcanopy tree (<7 m), unlike our *D. spectabile*, and could be recognised by its compound pinnate leaves, and unusual oval-shaped stem. Apparently the leaves have a bad smell when bruised. It was not yet in flower, but several flower buds were observed – they are borne among the leaves, and are not cauliflorous as in *D. spectabile*. Whitewood (*Celtis paniculata*), Cannabaceae, was one of our favourite trees. White buttressed trunks were a clear indicator that we had found this large spreading tree (Fig. 6). If small specimens confused us, the leaf blade in two unequal halves was another indicator. It grows to 40 m (making it the tallest of the local broadleaved trees) and older trees can fall, re-root, and form copses, so it is thought the remnant pre-European trees on Phillip Island may be just two or three plants that have spread vegetatively. We noticed that it was one of the trees commonly left on farmland properties after the bush was cleared. It has been planted in small groves in the Hundred Acres Reserve, and appears to have quite rapid early growth, coupled with good, straight form.



Fig. 5. Bloodwood (*Baloghia inophylla*), Silky Oak Stables.

Big yellow wood (*Sarcomelicope simplicifolia*) and yellow wood (*Zanthoxylum pinnatum*), Rutaceae, were two small trees we saw in the National Park, but only rarely. Big yellow wood was heavily exploited in the early days for its durable timber. Isaacwood (*Exocarpos phyllanthoides*), is Norfolk Island's only representative of the sandalwood family, which are root parasites. It is also found on New Caledonia. It is an unusual-looking tree, with its flat, lop-sided leaves, and was seen most commonly along the Red Road Track in the National Park. Some trees were 6 m tall. Sia's backbone (*Streblus pendulinus*) was not commonly seen, but captured our attention with its sandpapery leaves. Beach hibiscus (*Hibiscus tiliaceus*), is abundant on tropical Pacific coasts, though on Norfolk Island it is very scarce, our only sightings being on slopes above Anson Bay, and near Captain Cook Monument, these latter probably planted. Melky tree (*Excoecaria agallocha*), Euphorbiaceae, hangs on at Ball Bay and Rocky Point (Hundred Acres Reserve), where it grows in wind-swept, spreading copses.

*Norfolk Island endemic trees and shrubs:* Norfolk Island euphorbia (*Euphorbia norfolkiana*) is confined to Norfolk Island, with a population fluctuating between 40 – 100 individuals. We saw several seedlings growing naturally on the southern coast at Bumboras and a more mature 1.5 m specimen (possibly planted) alongside the track near the Captain Cook Monument. It reputedly can grow to 3 m and has blue-green foliage with distinctively whorled leaves.

There are three endemic members of the Malvaceae. Bastard oak (*Ungeria floribunda*) is a monotypic endemic genus, so it was a plant we had to see, which we did on our last day in the bush, on Red Road Track. Joel Christian pointed out some to us, and we later saw a fair amount of it in the National Park towards Bird Rock. Phillip Island hibiscus (*Hibiscus insularis*), barely survives in the wild on Phillip Island, but has been successfully propagated

and planted, so its survival now seems secure. It has a curious small-leaved juvenile form. The flowers are instantly recognisable hibiscus flowers opening creamy-green coloured with a magenta centre before turning totally red-purple with age. The nectar is much sought after by the indigenous gecko. Norfolk Island abutilon (*Abutilon julianae*) was thought to be extinct until its rediscovery in 1985 when one plant was found growing on a cliff on Phillip Island as the last rabbits were being eradicated. Now on a pest-free island it is fast recolonizing Phillip Island assisted by plantings, and is commonly planted also on Norfolk Island. The soft, grey tomentum on the leaves give the plant an attractive velvety look and texture. Alas, the flowers do not provide the flamboyant colours of its more tropical cousins. Indeed if it has petals at all, they appear to be much reduced and overwhelmed by the enclosing sepals, with a single structure protruding with the stigma surrounded by numerous stamens. However, the seeds are contained in a fascinating 2 cm capsule with about 16 concertina-like ribs. It was last seen in the wild on Norfolk Island around 1910 atop Mt Bates. Now classified as 'Critically Endangered' it appears to be spreading naturally in the absence of predators. Growing on cliffs it prefers not to be shaded so probably never grew widely across either Norfolk or Phillip Islands.



Fig. 6. Whitewood (*Celtis paniculata*), Botanic Garden.

Beech (*Myrsine ralstoniae*), Myrsinaceae  $\approx$  Primulaceae, was formerly in the genus *Rapanea*, but recently got absorbed into *Myrsine* (Jackes 2005). We saw a lot of this small tree in the forest understorey

and on forest margins, commonly with abundant crops of developing fruit. It must be one of the least threatened of the local trees. Evergreen (*Alyxia gynopogon*), Apocynaceae, is one of the more distinctive, recognisable endemic shrubs in the forest, and we found it along all the tracks in the National Park. It is a small shade-tolerant, understorey shrub, with small dark green leaves in sparse whorls which show to advantage the delicately whorled white flowers, rather like miniature frangipani flowers. The fruit is an orange drupe. Popwood (*Myoporum obscurum*), Scrophulariaceae, which we called Norfolk Island ngaio, had the dark-coloured leaf buds as in most New Zealand ngaio (*Myoporum laetum*). It occurred in the National Park, beside some of the tracks, but we suspect much of it had been planted. Narrow-leaved meryta (*Meryta angustifolia*) and broad-leaved meryta (*M. latifolia*), Araliaceae (Plate 1), are two dramatically tropical trees that are amongst Norfolk's rarer endemic species, although the visitor would not think so as they were commonly seen in the National Park and in cultivation around the town. Planting has evidently been highly successful. They were in flower at the time of our visit. *Meryta* is dioecious, so when numbers become low this can be a critical factor, if trees of both sexes are not growing close enough for the female flowers to be pollinated by the male. *Meryta latifolia* is a monocaulous treelet with a single stem 3 – 4 m tall with very few or no branches and bearing its leaves in a clump at the end. *Meryta angustifolia*, differs in having narrower leaves, though there is a suggestion that hybridisation may be blurring the distinction. Convicts are recorded as having used the large leaves of *Meryta* to wrap up dough to bake in the ashes.

Oleander (*Pittosporum bracteolatum*), was generally abundant. It grew all through the National Park, particularly on margins, was common in the Hundred Acres Reserve, and was present on Phillip Island. The leaves are neatly whorled (Fig. 7). Chrissen Gemmill (University of Waikato) indicated in her talk to our society in 2009 that its closest relative is New Zealand lemonwood (*Pittosporum eugenioides*), though we found this surprising as they have markedly different foliage and fruit. Shade tree (*Melicope littoralis*), has large, trifoliate leaves, and occurred sparingly in the National Park. *Pennantia endlicheri*, is fairly similar to *P. baylisiana* from the New Zealand's Three Kings Islands (Gardner & de Lange 2002) and like many of Norfolk Island's native trees, largely confined to higher ground of the National Park. Mistletoe (*Korthalsella disticha*), greatly impressed us all, as it is quite a large, robust plant compared with the puny New Zealand species (Plate 1). We saw it in the National Park on several occasions, including growing on wild lemon trees.

Chaff trees (*Achyranthes*), Amaranthaceae, were among the "stars of the show", and we saw three species, of which the smallest, *A. velutina*, is a coastal

sub-shrub, widespread in the Pacific, and the largest two, *A. arborescens* and *A. margaretae* are endemic, threatened shrubs. Regarding *A. aspera* as listed in Green (1994), de Lange et al. (2004) and Barkla et al. (2008) have suggested that this woody subshrub be treated as *A. velutina*. It is commonly called chaff flower and was fed to cattle and horses when other feed was scarce. A rapid coloniser, it dominates cliffs and coastal herbfields providing a low grey-green edge to taller scrubland on both Phillip and Norfolk Island (Plate 3). *Achyranthes arborescens* is a small tree confined to Norfolk Island itself, while the newly recognised *A. margaretarum* is a shrub and is confined to Phillip Island (de Lange & Murray 2001). We felt a particular fondness for *A. margaretarum* as it was named after its discoverer Margaret "Honey" McCoy, as well as our guide Margaret Christian. Recognised in the late 1980s, it was thought at first to be the larger-growing *A. arborescens* but several distinctive features convinced firstly the two Margarets, and then Peter de Lange, that it was a new species. *Achyranthes margaretarum* grows only about 2 m tall, it generally has fewer flowers per inflorescence than *A. arborescens*, a much shorter but erect fruiting inflorescence and the individual fruit are smaller. There are also differences in leaf colour, perianth colour and seed shape and size. With the original plant setting quantities of seed in the early 1990s, and the resulting seedlings establishing readily on Phillip Island, there is now a flourishing population that is rapidly out-growing the 'Critically Endangered' qualification it was given when first described. However, there are still risks that must be managed – not just the threats of drought, fire, and other natural events – but the possibility of hybridising with its bigger cousin, *A. arborescens*, from Norfolk Island. This was expressed by Mills (2009b): "To protect the Phillip Island endemic shrub *Achyranthes margaretarum*, its close relative *Achyranthes arborescens* should not be planted on Phillip Island. Similarly, *Achyranthes margaretarum* should not be planted on Norfolk Island. There is a possibility that if these species hybridise, then the rarer Phillip Island species could be genetically diluted and possibly lost as a distinct species." It is a concern we felt when seeing them in the Botanic Garden where the two species are now planted in close proximity.

Dr Coral Rowston, Park Manager, Norfolk Island National Park and Botanic Garden, explained that kurrajong (*Wikstroemia australis*), Thymelaeaceae, is the most critically endangered of all Norfolk Island's endemic trees, and they are seriously worried about it. It was once common (Green 1994), but has died out alarmingly to the extent that < 100 individuals are presently known, and its recovery plan is uncertain as it is proving very difficult to propagate because seed germination is poor. We saw just one small specimen in Kaye Wood's garden at Silky Oak Stables.

**Woody vines:** Big creeper (*Melodinus baueri*), Apocynaceae, has attractive opposite leaves, with much milky sap in the petioles. It is a robust plant, either scrambling on the ground or climbing up trees, and was common throughout the National Park. Hoya (*Tylophora biglandulosa*), Apocynaceae, was seen only a couple of times, though in flower, along the Red Road Track towards Bird Rock. Devil's guts (*Capparis nobilis*), Capparaceae, is an endemic scrambler that earns its rather colourful name from the sharp recurved thorns on the stem which can easily tear one's flesh. For such an unpleasantly named plant, it has a large white flower in the spring and summer made conspicuous by the tuft of large white stamens which are 2-3 cm long. Several plants were seen in the National Park.



Fig. 7. Oleander (*Pittosporum bracteolatum*), Red Road Track, National Park.

Native cucumber (*Zehneria baueriana*), must take the prize as Norfolk Island's most abundant and vigorous climber. It scrambles and climbs over trees, wherever there is plenty of light, and is so smothering as to be a nuisance in revegetation areas, including on Phillip Island (Fig. 8). We saw plentiful flowers and fruit.



Fig. 8. Native cucumber (*Zehneria baueriana*), Botanic Garden.



Fig. 9. Samson's sinews (*Callerya australis*), Botanic Garden.

Samson's sinews (*Callerya australis*), Fabaceae, is Norfolk Island's largest liane, the thick and twisted cables climbing into the tree tops in disturbed forest, such as in the Botanic Garden (Fig. 9). It was formerly *Milletia australis* (Gardner 2006). Jasmine (*Jasminum simplicifolium* subsp. *australiense*), Oleaceae, was most prominent in the National Park along the Red Road track; Norfolk Island passionfruit (*Passiflora aurantia*), was seen on Mt Pitt; and clematis (*Clematis dubia*), was seen just once on the track from Mt Pitt to Mt Bates.

Mountain rush, screw-pine (*Freycinetia baueriana*), was prominent in the National Park. It looks fairly similar in general habit to New Zealand's kiekie (*F. banksii*), but the leaf margins are entire whereas in kiekie they are scabrid, and there are other differences too, including the colour of the spathes – salmon pink to orange in *F. baueriana* and white to purplish in *F. banksii* (de Lange et al. 2005).

#### Norfolk Island pine

Norfolk Island pine (*Araucaria heterophylla*) is such a dominant and magnificent tree in the landscape that it deserves to be separately discussed here. It is endemic, being found on Norfolk Island and Phillip Island, and a considerable distance from its nearest relatives in New Caledonia. It grows all over the island, from coastal cliffs (Fig. 10) to the slopes of Mt Bates and Mt Pitt, in its natural setting emerging tall above a canopy of broadleaved trees on the moister

sites, or in dense pure stands on more exposed places. The biggest trees are a metre or more through and reach heights of 40 -50 m. There are plantations too, of various ages from very fine 80-year-old trees to more youthful, uniformly-spaced trees at 5 m x 6 m spacing in the Hundred Acres Reserve (Fig. 11), and just about every private farm has a scattering of this noble conifer. The Hundred Acres Reserve was fenced off from stock in 1925, and many of the big pines there today resulted from self-sown seedlings (Lennon 2005).



Fig. 10. Norfolk Island pine (*Araucaria heterophylla*), Ball Bay.

From the very beginnings of settlement Norfolk Island pine was felled and milled for its easily-worked utility timber, finding application in house-building, boat-building, interior work, and fruit cases during the banana export days, and there was particularly heavy exploitation during World War II (Lennon 2005). It did, however, have shortcomings, and because it was too heavy and knotty for masts it did not become the important resource for the British Navy that Captain Cook envisaged when he came ashore in 1774 (Glencross-Grant 2009). Nowadays all the trees  $\geq 4.5$  m high are legally protected under the *Trees Act 1997*, and only a few are permitted to be felled each year. Howard Christian runs the local sawmill in Mill Road. It is a small, mobile-style "Mahoe" mill manufactured in Kerikeri, New Zealand, and supplies Norfolk pine timber for local carpentry, joinery, and woodcrafts (Christian-Bailey 2009).

Norfolk Island pine seems to naturally regenerate readily. 'Flowering' occurs in early September, and seed is ripe the following June. Germinants, with their characteristic four cotyledons, were commonly seen in the forests (Fig. 12), and in several places we noticed dense thickets of saplings that had sprung up to fill a gap. It is a long-lived species and by its symmetrical shape and regular growth rate gives the impression of being genetically very uniform. Large, old trees near the airport with odd-looking tops are not genetic deviants, or in senile decline, but have been decapitated for aircraft safety.

Plate 1: Natives trees & shrubs



*Coprosma baueri*, Phillip Island.



Mistletoe (*Korthalsella disticha*), Mt Pitt, Christine Major.



*Coprosma pilosa*, Mt Pitt, Christine Major.



Maple (*Elaeodendron curtispiculum*), Palm Glen, National Park.



Tea tree, hopwood (*Dodonaea viscosa*), Red Road Track.



Broadleaved meryta (*Meryta latifolia*), Mt Pitt.

Plate 2: Norfolk Island exotica



Hawai'ian holly, Brazilian pepper tree (*Schinus terebinthifolius*), Mill Road.



Red guava, porpieh, porpay (*Psidium cattleianum*), Bridle Track, National Park.



Mysore thorn (*Caesalpinia decapetala*), Douglas Drive.



African Olive (*Olea europaea* subsp. *cuspidata*), Harpers Road.



Wild lemon (*Citrus jambhiri*), Mt Pitt.



Blackbutt (*Cryptocarya triplinervis*), Hundred Acres Reserve.

Plate 3: Phillip Island coastal herbs



Ice plant (*Carpobrotus glaucescens*).



Mile-a-minute (*Wollastonia biflora*).



Chaff flower (*Achyranthes velutina*).



*Senecio hooglandii*, Christine Major.



*Senecio australis*, Christine Major.



Native spinach (*Tetragonia implexicoma*),  
Christine Major

Plate 4: Norfolk Island ferns



Two-leaf fern (*Asplenium dimorphum*), Mt Pitt, National Park, Bev Davidson.



*Christella parasitica*, Anson Bay Road beside forestry plantations, Bev Davidson.



Small filmy fern (*Crepidomanes saxifragoides*), Palm Glen, National Park, Christine Major.



Prickly shield fern (*Arachniodes aristata*), Red Road Track, National Park.



Norfolk Island water fern (*Blechnum norfolkianum*), Palm Glen, National Park.



Netted brakefern (*Pteris zahlbruckneriana*), Palm Glen, National Park.



Fig. 11. Norfolk Island pine plantation, Hundred Acres Reserve.

On Phillip Island the few remaining original pine trees were showing the stresses they have been subjected to through exposure and erosion. The count in 1961 was six trees. In 1980 exclosure plots proved the recovery potential of the vegetation, including the pines, if rabbits were eliminated. The last rabbit was



Fig. 12. Germination of Norfolk pine, Hundred Acres Reserve.

shot in 1988. In 1992 large scale aerial seeding of *Araucaria* occurred and now there are valleys where the pines are gaining ascendancy over the forests of weedy olives. It was pleasing to see the good growth of pines on Phillip Island, planted there as part of the vegetation restoration programme, as very few natural trees have survived the spectacular soil erosion there. But perhaps one of the best highlights of our daily encounters with this great tree was seeing the seabirds – white terns and noddies – swooping and gathering in the trees in Hundred Acres Reserve.

#### Introduced trees and shrubs

Norfolk Island has been infamously invaded by a number of introduced naturalised trees and shrubs to the extent that they dominate much of the wild woody vegetation, especially outside the National Park. The three dominant invasive trees are African

olive (*Olea europaea* subsp. *cuspidata*), red guava (*Psidium cattleianum*) and Hawai'ian holly (*Schinus terebinthifolius*). They were introduced early to the island, and now form thickets on roadsides and in gullies. One can surmise that their success has been due to the attractiveness of their fruit to birds and the availability of disturbed sites.

African olive (Plate 2) can be a large tree under cultivation, as we saw at the Hibiscus Crown Motel, and it readily forms thickets on coastal headlands, providing useful vegetative cover for the protection of the soil. On Phillip Island these spreading thickets are proving to be a valuable nurse for underplanted native trees, though ultimately they are poisoned out as the natives become fully established (Fig. 13). Red guava grows throughout Norfolk Island, the fruit being highly regarded by the islanders for jelly. It forms dense, pure stands, the slender trunks with orange-coloured smooth bark being particularly noticeable (Plate 2). Hawai'ian holly abounds in roadside thickets and hedgerows, its bright red fruit being much in evidence during our visit (Plate 2).



Fig. 13. African olive, Phillip Island.

Other naturalised trees and shrubs seen, but which were not so widespread, were wild lemon (*Citrus jambhiri*), swan plant (*Gomphocarpus physocarpus*), willow-leaved hakea (*Hakea salicifolia*), bleeding heart (*Homalanthus populifolius*), lantana (*Lantana camara*), tree privet (*Ligustrum lucidum*), boxthorn (*Lycium ferocissimum*), white cedar (*Melia azedarach*), Kermadec pohutukawa (*Metrosideros kermadecensis*), Mickey Mouse bush (*Ochna serrulata*), brush wattle (*Paraserianthes lophantha*), sweet pittosporum (*Pittosporum undulatum*), pea bush or Cascade curse (*Polygala myrtifolia*), wild peach (*Prunus persica*), castor oil plant (*Ricinus communis*), white guava (*Psidium guajava*), cassia bush (*Senna septentrionalis*) and tobacco weed or woolly nightshade (*Solanum mauritianum*).

Wild lemon is a particularly interesting weed. It is highly spinose, with large, warty fruit (Plate 2), and has the ability to fully penetrate into the rainforest of

the National Park (Mt Pitt section). Lantana and woolly nightshade are both serious environmental weeds. We encountered swan plant or wild cotton in several places, including open sites on Phillip Island.

In the Hundred Acres Reserve can be found a number of woody weeds not seen elsewhere on the island. Lord Howe Island blackbutt or three-veined cryptocarya (*Cryptocarya triplinervis*) – a native of Lord Howe Island, coastal northern NSW and south-east Queensland – has become well established in the understorey of Norfolk Island pine forest (Plate 2). With it can be found Surinam cherry (*Eugenia uniflora*). Illawarra flame tree (*Brachychiton acerifolius*) is regenerating itself there to a limited extent.

Naturalised woody climbers and scramblers seen were Mysore thorn (*Caesalpinia decapetala*), scrambling up trees on roadsides (Plate 2); morning glory (*Ipomoea indica* and *I. cairica*), the former a nuisance in the Botanical Garden and the latter widespread and treated as an “honorary” native; honeysuckle (*Lonicera japonica*), sparsely naturalised in the National Park; rambler rose (*Rosa sempervirens*) and blackberry (*Rubus fruticosus*), present on some roadsides; and chalice vine (*Solandra maxima*) on the edge of Mission Road. Another climber, Madeira vine (*Anredera cordifolia*), was not seen by us, but is considered a reasonably serious threat (Anon. 2010), and has been declared a priority weed for control in the Hundred Acres Reserve (Anon. 2003). Periwinkle (*Vinca major*), is scarcely woody, but is fairly common on Norfolk Island in hedgerows.

Numerous other exotic trees cultivated for amenity, fruit, nuts, shelter or timber have not become naturalised, or only insignificantly so. Broad-leaved trees and shrubs seen were feijoa (*Acca sellowiana*), redleaf (*Acalypha wilkesiana*), blackwood (*Acacia melanoxylon*), Queensland silver wattle (*Acacia podalyriifolia*), cherimoya (*Annona cherimola*), orchid tree (*Bauhinia variegata*), Cape chestnut (*Calodendron capense*), papaya (*Carica papaya*), black bean (*Castanospermum australe*), swamp she-oak (*Casuarina glauca*), camphor laurel (*Cinnamomum camphora*), fiddlewood (*Citharexylum spinosum*), coffee (*Coffea arabica*), New Zealand karaka (*Corynocarpus laevigatus*), royal poinciana (*Delonix regia*), golden dewdrop (*Duranta erecta*), coral tree (*Erythrina caffra*), Moreton Bay fig (*Ficus macrophylla*), Lord Howe Island banyan (*Ficus macrophylla* subsp. *columnaris*), deciduous fig (*Ficus virens*), silky oak (*Grevillea robusta*), hibiscus (*Hibiscus rosa-sinensis*), jacaranda (*Jacaranda mimosifolia*), sweet gum (*Liquidambar styraciflua*), brush box (*Lophostemon confertus*), macadamia nut tree (*Macadamia tetraphylla*), evergreen magnolia (*Magnolia grandiflora*), mango (*Mangifera indica*), Mexican tree daisy (*Montanoa hibiscifolia*), mulberry (*Morus alba*), oleander (*Nerium oleander*), avocado

(*Persea americana*), frangipani (*Plumeria rubra*), umbrella tree (*Schefflera actinophylla*), turpentine (*Syncarpia glomulifera*), rose apple (*Syzygium jambos*), another *Syzygium*, possibly magenta lilly pilly (*Syzygium paniculata*), lilly pilly (*Syzygium smithii*), Cape honeysuckle (*Tecomaria capensis*), red cedar (*Toona ciliata*) and coast rosemary (*Westringia fruticosa*).

Special mention must be made of the Lord Howe Island banyans. We saw two very spectacular trees covering large areas and with a maze of stems and aerial roots. These were at the airport and at Margaret Adam's place on Bullocks Hut Road.

Sheltering hedges and windbreaks are a common feature of Norfolk Island, and fiddlewood, Kermadec pohutukawa, Cape honeysuckle, hibiscus and oleander have been commonly used for this purpose, though have usually become infiltrated and overgrown with Hawai'ian holly, red guava, golden dewdrop, and native trees too, especially *Dodonaea viscosa*, *Nestegis apetala* and *Pittosporum bracteolatum*.

Several eucalypts have been planted on the island, including some in timber plantations. These plantations are mainly in the north-west corner of the island, and date back to a planting programme by the island's Forestry Department (Lennon 2005). The main commercial species are grey ironbark (*Eucalyptus paniculata*), tallow wood (*E. microcorys*), blackbutt (*E. pilularis*) and spotted gum (*Corymbia maculata*). These plantations seem to be little utilised, and other stands of eucalypts formerly in Hundred Acres Reserve have been removed and replaced with native trees. Bangalay (*Eucalyptus botryoides*) seemed to be the commonest eucalypt on private farms, but there are also examples of Sydney bluegum (*E. saligna*), southern blue gum (*E. globulus*), red ironbark (*E. fibrosa*), and a fine specimen of river red gum (*E. camaldulensis*) in Burt Pine village.

Norfolk Island pine is the dominant tree on Norfolk Island, and the only native conifer. Very few exotic conifers are present, being used only as shelter or ornamental trees in gardens and parks. Mexican cypress (*Cupressus lusitanica*) was the commonest exotic conifer, and others seen were Arizona cypress (*Cupressus arizonica*), golden macrocarpa (*Cupressus macrocarpa* var. *aurea*), pencil cypress (*Cupressus sempervirens* var. *stricta*), Chinese juniper (*Juniperus chinensis*), arbor-vitae (*Thuja orientalis*), Japanese cedar (*Cryptomeria japonica*), and a *Podocarpus* (possibly *P. subtropicalis*).

Monocot trees are of some interest on Norfolk Island, by far the most important being Lord Howe Island kentia palm (*Howea forsteriana*), and to a lesser extent, *H. belmoreana*. Kentia palms are extensively grown for seed, which is sold to a nursery in

Wauchope in New South Wales for production of seedlings for export to Europe, particularly the Netherlands, as indoor tub plants. Metal protectors are placed on each tree to prevent rats from eating the seed (Fig. 14).

The only other exotic monocots seen which could be called trees were cabbage palm (*Livistona australis*), phoenix palm (*Phoenix canariensis*), queen palm (*Syagrus romanzoffiana*), dragon tree (*Dracaena draco*), giant bird of paradise (*Strelitzia nicotia*), and bananas are still grown commercially in a few places. Spanish dagger (*Yucca aloifolia*) grows in an extensive colony at Ball Bay.

#### Native and introduced herbs

Dicot herbs probably make up the highest proportion of the flora, reinforced considerably by numerous exotic weeds. Starting with composites (Asteraceae), mist flower or what is here called William Taylor (*Ageratina riparia*) is seen all over the island on roadside banks. A certain William Taylor introduced it and it is now amongst the worst environmental weeds as it has penetrated well into the National Park. Thickhead or redflower (*Crassocephalum crepidioides*) is an African plant very well established on Norfolk Island, being abundant on almost any disturbed ground in settlements, and in Hundred Acres Reserve. It is recognised by its nodding red flower head (without ray florets). With it we commonly saw grab-a-leg (*Bidens pilosa*), *Sigesbeckia orientalis*, gallant soldier (*Galinsoga parviflora*), and fleabane (*Conyza sumatrensis*). The very familiar sow thistle or puha in New Zealand (*Sonchus oleraceus*) and Cape weed (*Arctotheca calendula*) were two of the commonest plants, growing abundantly in open, disturbed places, and especially vigorous on Phillip Island and in Hundred Acres Reserve where seabirds provide a nutritious aerial fertilizer. *Facelis retusa*, catsear (*Hypochaeris radicata*), *Erechtites valerianifolia*, and variegated thistle (*Silybum marianum*) were other composite weeds we recorded.

Native composites noted were cudweed (*Pseudognaphalium luteoalbum*), abundant near the coast at Rocky Point; *Cotula australis*, common on open sites; *Wollastonia biflora*, right on the coast and particularly prominent on Phillip Island (Plate 3); and probably the highlight in the herb department, two coastal species of *Senecio*, *S. australis* and *S. hooglandii*. *Senecio australis* (Plate 3) has noticeable ray florets, and it was growing in a big colony at Rocky Point, and also on Phillip Island where *S. hooglandii* was recorded (Plate 3).

Turning now to native herbs other than composites, the list is rather small. We were very pleased to find both *Peperomia tetraphylla* and *P. urvilleana* growing together on rock outcrops in the shade along the Palm Glen track. Pellitory (*Parietaria debilis*), was another to benefit from bird fertilizer, and good-sized patches

were seen on Phillip Island and Hundred Acres Reserve. Pigface or iceplant (*Carpobrotus glaucescens*), was the commonest coastal herb (Plate 3), being present on steep slopes of both Norfolk and Phillip Islands, and in the same family we widely recorded both New Zealand spinach (*Tetragonia tetragonioides*) and beach spinach (*T. implexicoma*) (Plate 3). Other native herbs noted were *Ipomoea pes-caprae*, *Dichondra repens*, *Vigna marina*, *Samolus repens*, and *Lobelia anceps*, but generally there were no native rainforest herbs to speak of.



Fig. 14. Kentia palm (*Howea forsteriana*), Ferny Road.

There were numerous non-composite exotic weeds, and these are mostly just summarily listed here. Creeping buttercup (*Ranunculus repens*) was common on road edges and in wet places, while *R. parviflorus* was particularly common on Phillip Island. A large poppy with yellow flowers caught our attention on the coast at Lone Pine, and it turned out to be Mexican poppy (*Argemone subfusiformis*). Opium poppy (*Papaver somniferum*) was recorded, too. Two weeds of the Phytolaccaceae were prominent, with inkweed (*Phytolacca octandra*) favouring open areas with fertile soil, and coral berry (*Rivina humilis*) being particularly common in the understorey in Hundred Acres Reserve. Small-flowered nightshade (*Solanum nodiflorum*) was among the most common and widespread herbs, both on Norfolk and Phillip Islands, and another plant to thrive beneath a rain of seabird fertilizer. Cape gooseberry (*Physalis peruviana*) and

apple of Peru (*Nicandra physalodes*) were only occasionally seen.

Nettle-leaved fat-hen (*Chenopodium murale*), was widely abundant, as were chickweed (*Stellaria media*), mouse-ear chickweed (*Cerastium glomeratum*), and allseed (*Polycarpon tetraphyllum*). *Rumex brownii* was the common dock. Scarlet pimpernel (*Modiola caroliniana*), mallow (*Malva parviflora*), and *Malvastrum coromandelianum* were the commonest herbaceous Malvaceae seen, the latter being somewhat woody.

A herb that took us some time to sort out was *Frankenia pulverulenta*, Frankeniaceae, the sea heaths. It is a salt-tolerant herb naturalised from the Mediterranean, and we found it near Kingston jetty and also at Rocky Point. Spurges (Euphorbiaceae) were represented by prostrate sandmat (*Chamaesyce prostrata*) in gravelly places, and milkweed (*Euphorbia peplus*), spectacularly abundant on road verges – cattle will not eat it. Hen and chickens (*Phyllanthus tenellus*) of the related family, Phyllanthaceae, is an introduction from Madagascar, and it was seen in Hundred Acres Reserve.

Several familiar legumes were widely seen, among which the common ones were King Island mellilot (*Melilotus indicus*), the vetches *Vicia hirsuta* and *V. sativa*, black medick (*Medicago lupulina*), slender birdsfoot trefoil (*Lotus angustissimus*) and white clover (*Trifolium repens*). A splendid-looking lupin, *Lupinus cosentinii*, was a new plant for most of us. It has blue flowers, and is an introduction from the Mediterranean region.

*Geranium gardneri* was of particular interest as it was formally named in an article that otherwise dealt with Norfolk Island plants (de Lange et al. 2005). We saw this during our walk from Mt Pitt towards Mt Bates, and also on Phillip Island. As in New Zealand, it is regarded as an adventive.

There were at least two species of *Oxalis* present. One was a plant of forest margins. This was the pink shamrock (*Oxalis debilis*), abundant along forest tracks. The other was a yellow-flowered species occurring on Phillip Island and in other coastal places, and may well have been *Oxalis chnoodes* (see de Lange et al. 2005).

Some commonplace weeds were catchfly (*Silene gallica*) purslane (*Portulaca oleracea*), twin cress (*Lepidium didymum*), blue pimpernel (*Anagallis arvensis* var. *caerulea*), Primulaceae, hedge parsley (*Torilis nodosa*), broad-leaved plantain (*Plantago major*); purple-top (*Verbena bonariensis*) and *Verbena littoralis*, field madder (*Sherardia arvensis*), broom rape (*Orobanche minor*), yellow flax (*Linum trigynum*), the speedwells (*Veronica persica*, *V. plebeia*).

Grasses and sedges & other herbaceous monocots

Grass is the dominant vegetation over much of Norfolk Island, providing grazing for cattle, which keep the roadsides neatly manicured. Kikuyu grass (*Pennisetum clandestinum*) is one of the commonest, along with ratstail (*Sporobolus africanus*), redlegs (*Bothriochloa macra*) and paspalum (*Paspalum dilatatum*) on the less fertile margins and banks. Perennial ryegrass (*Lolium perenne*) and prairie grass (*Bromus willdenowii*) were prominent, and on Phillip Island and the Hundred Acre Reserve were growing very lushly thanks to the ready supply of aerial nitrogenous nutrients provided by seabirds. Hair grass (*Vulpia bromoides*), shivery grass (*Briza minor*), annual poa (*Poa annua*), Bermuda grass (*Cynodon dactylon*) and bristle grass (*Setaria pumila*) were all fairly common, while a tall love grass, possibly *Eragrostis tenuifolia*, and Rhodes grass (*Chloris gayana*) were encountered along the track towards Captain Cook Monument. Rhodes grass was also on Phillip Island. Buffalo grass (*Stenotaphrum secundatum*) was prominent on the track down to Anson Bay and in Hundred Acres Reserve. Elephant grass (*Pennisetum purpureum*) is a tall cane-like species grown as a windbreak on properties in the north-west corner of the island. At Emily Bay there are areas of marram grass (*Ammophila arenaria*) and beach spinifex (*Spinifex sericeus*), introduced as sandbinders.

Native grasses of note were meadow grass (*Microaena stipoides*) and *Oplismenus hirtellus*, seen in the Mt Pitt area, *Sporobolus virginicus* on the coast (e.g. Lone Pine, Emily Bay and Phillip Island), *Dichelachne micrantha*, very prominent on Phillip Island, and *Paspalum orbiculare* scattered along some of the bush tracks. However, we did not see Phillip Island wheat grass (*Elymus multiflorus* subsp. *kingianus*), a critically endangered plant (Anon. 2010).

The most impressive sedge we saw was moo-oo grass (*Cyperus lucidus*). It seemed to be confined to Phillip Island, and there grew tall and robust (Fig. 15). *Carex breviculmis*, *C. inversa* and *C. neesiana* were seen in forest, while *Schoenoplectus tabernaemontani* was seen in a wetland near the cemetery at Kingston. Knobby sedge (*Ficinia nodosa*) was prominent on Phillip Island, and at coastal sites on Norfolk Island such as Anson Bay and Lone Pine.

Three other wetland monocots of note were flags (*Typha orientalis*), water hyacinth (*Eichhornia crassipes*), and taro (*Colocasia esculenta*) – the latter present when Captain Cook arrived in 1774, so deemed to be a Polynesian introduction.

We commonly came across the local native wandering Jew (*Commelina cyanea*) on Norfolk and Phillip Islands, its blue flowers being attractive, and we saw

a fair amount of *Dianella intermedia* (commonly planted in restoration projects). Climbing lily (*Geitonoplesium cymosum*) was seen in just a few places on the way to the Bird Rock lookout and towards Captain Cook Monument.



Fig. 15. Moo-oo grass (*Cyperus lucidus*), Phillip Island.

A few other weedy monocots of note were curse of the island (*Alstroemeria pulchella*) along New Cascade Road, Mauritius hemp (*Furcraea foetida*) looking naturalised on Douglas Drive, one-leaved Cape tulip or Cascade onion (*Homeria flaccida*) along Cascade Road, wild gladiolus (*Gladiolus ×hortulanus*) with orange flowers, near the start of the Palm Glen track, tiger lily (*Lilium formosanum*) of rather common occurrence, and a small pink-flowered iris, *Anomatheca laxa*, in hedgerows along Cascade Road and Mission Road.

And we must not forget flax (*Phormium tenax*), one of the most controversial monocots as it is not completely clear whether it is a true native or an ancient Polynesian introduction (Coyne 2009b, Mills 2009a). It is common in coastal and open sites on both Norfolk Island and Phillip Island, and Geoff Davidson thought it was smaller than the normal New Zealand form and looking more like the yellow-flowered Chatham Island form.

#### Orchids

The orchids of Norfolk Island have affinities with: tropical Asia (*Tropidia* and *Oberonia*); sub-tropical Australia (*Dendrobium*, *Phreatia*, *Bulbophyllum* and *Taeniophyllum*); and temperate New Zealand (*Microtis* (Green 1994) and *Thelymitra* (de Lange *et al.* 2005). Nine species were listed by Green (1994), four of which are endemic and four listed as rare and local or endangered.

*Dendrobium macropus* subsp. *macropus*, with its pencil-like pseudobulbs, was seen in most localities in the National Park. Margaret Christian pointed out a plant in flower, lithophytic on a rock at the side of Red Road. Margaret had previously pointed out a plant of

the less common *D. brachypus* and plants were seen on Bird Rock Track, one on a fallen Norfolk Island pine tree. This is a smaller plant and the pseudobulbs are conical and shorter than the subspecies *macropus* and it is an endemic species (Green 1994).



Fig. 16. Anne Fraser photographing *Taeniophyllum norfolkianum*, with help from Geoff Davidson, National Park. Photo: Christine Major.

At the junction of Bridle Track with Red Road Margaret found us *Tropidea viridifusca*, looking very much like a seedling of nikau palm. This is one of the terrestrial species on Norfolk Island. Another is *Microtis* which was looked for constantly in habitat that looked inviting for it, but without us finding any – it is not considered common on Norfolk Island. Mills (2009b) agreed and reported *Microtis* in two localities on Phillip Island. Again, although the habitat looked ideal, reminiscent of Northland's red weathered basalt soils, we failed to see it there. A primary record of *Thelymitra longifolia* was made in 1998 on a Norfolk Island roadside and reported by de Lange *et al.* (2005) but it eluded discovery this trip.

The rare endemic species *Phreatia limenophylax* and *Oberonia titania* and the native but rare *Bulbophyllum argyropus* were not seen. Margaret said to look for *Bulbophyllum* on the *Araucaria* "armpits", where the branches left the trunk, and she also mentioned that we would not see *Oberonia* unless an *Araucaria* had fallen. With a definite crick in her neck, Anne found the "armpits" all too high to see any small orchids therein. The more common but local *Phreatia paleata*

was seen on the Palm Glen Track, high on a nikau palm in the National Park. This species has small pseudobulbs, and *P. limenophylax* does not have these, but it was still not easy to see them in the mossy habitat. The name *limenophylax* is from the Greek and refers to the species' locality where it was found, as "harbour watcher" or "coast guard" (Green 1994).

The rare and local leafless epiphyte *Taeniophyllum* was located near the car park at the beginning of Red Rock Track, on an *Araucaria*. Although out of reach of photographers, and since we had no ladder, a photograph was obtained with innovation and much hilarity, thanks to Geoff Davidson (Fig. 16). The recent discovery of this orchid growing on gorse in Northland is most remarkable, adding as it does a new species to the New Zealand native flora (Beadel, Renner & Brandes 2010). An enjoyable trip and exciting to be among the more sub-tropical and largely epiphytic orchids, in contrast to our predominantly terrestrial species.

#### Ferns

Norfolk Island ferns range in size from the tiny, almost circular filmy fern, *Crepidomanes saxifragoides*, at c. 5 mm in length, which we were excited to find along the Palm Glen track (Plate 4), to the tree fern reputed to be the tallest in the world, the endemic *Cyathea brownii*, though maybe New Zealand's mamaku (*C. medullaris*) would give it a run for its money. This tree fern is a beautiful species, with a clean trunk and bright green fronds and is planted widely in gardens, as well as growing naturally in the forest. We learned to differentiate it from the other, less common, endemic tree fern, *C. australis* subsp. *norfolkensis*, which has an untidier appearance, hanging on, as it does, to some of the dead fronds.

Undoubtedly the prima donna of the fern world on Norfolk Island must be the elegant *Asplenium dimorphum*. Living up to its specific name it has two forms of fronds (Plate 4). The fertile fronds are finely divided and lacy in appearance; the sterile fronds have broader, glossy pinnules. Quite a large fern, maybe 50-60 cm in height, it amazed us on first viewing, as it looked as if there were two different species growing together. DNA work by Leon Perrie and Lara Shepherd has proved it to be one of the parents, together with *A. bulbiferum*, of the fern sold in New Zealand plant nurseries as hen and chickens fern. The name *A. x lucrosum* has now been given to this hybrid (Perrie, Shepherd & Brownsey 2005).

In the rather similarly named *Asplenium difforme* the difference between the fertile and sterile fronds was not at all obvious (Fig. 17). Whereas *A. dimorphum* is a forest species, *A. difforme* grows in a similar coastal habitat to our *A. haurakiense*. The thick, leathery-textured fronds were most often seen peeping from

rock crevices near the shore, both on the main island and on Phillip Island. An exception to this was in the Hundred Acre Reserve, where, probably due to the enrichment of the soil by bird droppings, it thrives as a ground cover. The sicklefern (*Asplenium polyodon*), was one we instantly recognised, and it was fairly common throughout the National Park.

It is noticeable in the National Park that there are few epiphytes in the forest, and this also applies to the usually epiphytic bird's nest fern, *Asplenium australasicum*. In all cases this was seen growing on the ground. The other form of this species, *A. australasicum* f. *robinsonii*, is now only found in gardens. We saw it in the garden at the Silky Oak Stables, and noted the narrower, deeply lobed fronds. It is presumed to be a hybrid (Margaret Christian, pers. comm.).



Fig. 17. *Asplenium difforme*, Anson Bay.

Some similar pairs of species puzzled us at first, but we learned that *Pteris kingiana* (*P. tremula* complex) has simple or forked veins, and the wondrously named *P. zahlbruckneriana* (in the *P. comans* complex) has netted veins (Plate 4). In *Christella dentata* the lowest pinnae on the fronds gradually reduce in size, whereas in *C. parasitica* (not a parasite at all), they do not. Following directions from Margaret Christian we located a good patch of the latter on the side of the road by a eucalyptus plantation on the way to Anson Bay (Plate 4), and more was seen at the Hundred Acre Reserve. *Pteris tremula* as well – a common New Zealand fern – was seen in a few places.

*Histiopteris incisa* and *Hypolepis dicksonioides*, and *Diplazium assimile* and *D. australe* were seen at the Botanic Garden, and *Arthropteris tenella* was also growing there, and throughout the National Park, mainly on rocks. King fern (*Ptisana salicina*), is a rare plant on Norfolk Island and we had to be content with seeing some splendid cultivated ones in the Botanic Garden.

The commonest ferns in the forest were the glossy *Arachniodes aristata* (Plate 4) and the maidenhair, *Adiantum diaphanum*: the latter covers large areas and the fronds are slightly more robust than those in New Zealand. The other maidenhair present on the island is *A. pubescens*, which is quite common on roadside banks as well as in the forest. It is hard to separate this fern from *A. hispidulum*, but the undersides of the pinnae are covered with longer, paler hairs. Pending an examination of the variability of hairs in *A. hispidulum* throughout its considerable worldwide range it is practical in the interim to include both names under *A. hispidulum* (Barbara Parris *pers. comm.*). Two members of the Polypodiaceae, *Microsorium pustulatum* and *Pyrrosia confluens*, grow on rocks and trees. The sori on the latter species coalesce with age around the tip of the fertile fronds. It was rather unusual to see *Doodia australis* growing in deep shade in the forest, and bracken (*Pteridium esculentum*) was seen occasionally in open sites.

In the gullies were occasional plants of the endemic *Lastreopsis calantha*. *Psilotum nudum* (Psilotaceae) was seen quite frequently on both the main island and Phillip Island, and we were thrilled to see, at only one place in the forest along the Palm Glen track, the endemic *Tmesipteris norfolkensis* growing prolifically on the fibrous bases of a few tree ferns (*Cyathea brownii*). Although the aerial stems are longer than in *T. lanceolata*, this is the New Zealand species that it most reminded us of. It was very pleasing to see about a dozen plants of *Blechnum norfolkianum* growing in a dark gully (Plate 4), as this fern is rare on the island, and is always a good subject for an argument when seen on islands in northern New Zealand. No fertile fronds were present.

The bare red soil of Phillip Island is not conducive to fern growth, and apart from *Asplenium difforme* on the coastal rocks, and a patch of *Psilotum nudum*, *Cheilanthes distans* and *C. sieberi* were the only ferns seen there. As they are "hot rock" ferns, this was really not surprising. A mixed population was found when our guide took us off track to search for geckos hiding under a stack of boards.

Some introduced ferns were seen to be naturalised. Fishbone fern (*Nephrolepis cordifolia*), was cultivated and naturalising vigorously in gardens, but we did not come across the native pop rock fern (*Nephrolepis flexuosa*) which apparently is close to extinction on Norfolk Island (de Lange et al. 2005). *Selaginella kraussiana* was seen at the glasshouse at the Silky Oak Gardens. *Pteris vittata* (Pteridaceae), which is growing robustly where it has been planted around the Mission Chapel, was also spotted growing in crevices in the lime kiln at Kingston. Also at Kingston, growing in a wall at No. 9 Quality Row, is the holly fern, *Cyrtomium falcatum*. Only one plant had survived the recent drought, though it could be seen that many plants had previously thrived there. The

elkhorn fern (*Platycterium bifurcatum*), is very commonly seen in gardens, especially on the kentia palm (*Howea forsteriana*), and has become naturalised (de Lange et al. 2005; Gardner 2006). Both of these plants have been introduced from Lord Howe Island.

#### Seaweeds

Seaweeds were observed in only two places – Slaughter Bay at Kingston, and on Phillip Island. A good account of the marine algae of Norfolk Island has been compiled by Millar (1999), and his collecting assistant for that project was none other than Karlene Christian, one of our guides to Phillip Island. Her herbarium collections are housed at the National Park office. As mentioned by Millar (1999), the shores of Norfolk Island are mostly vertical basaltic rocks, very difficult for seashore study except by SCUBA diving, the best accessible intertidal reef platforms being in Slaughter Bay, Garnett Point (at Collins Head in Ball Bay), and The Chord (in Duncombe Bay).

The calcarenite reefs and lagoon in Slaughter Bay (Fig. 18) had several conspicuous green seaweeds. The upper shore was clothed in dense growth of a small, foliose species of sea lettuce (*Ulva*), and in the reef pools was an abundance of sea grapes (*Caulerpa racemosa*), together with the highly distinctive alga comprising dark green spheres known as sailor's eye balls (*Valonia ventricosa* syn. *Ventricaria ventricosa*), at least two species of *Codium* (possibly *C. arabicum* and *C. geppiorum*) and the calcified alga *Halimeda cuneata* (or something like it). *Caulerpa racemosa* is on Lord Howe Island (Kraft 2007) and is also abundant at the Kermadecs (Nelson & Adams 1984).



Fig. 18. Calcarenite reefs and lagoon at Slaughter Bay, Kingston.

Only three brown algae were seen. *Endarachne binghamiae* occurred on Phillip Island on the mid intertidal basalt wave-cut platforms (as it does in New Zealand, e.g. at Muriwai), *Colpomenia sinuosa* was seen occasionally in reef pools, and *Lobophora variegata* was found on Phillip Island. This latter species is a common pantropical seaweed, including

Lord Howe Island (Kraft 2009), but is not in New Zealand except at the Kermadecs (Nelson & Adams 1984). Karlene Christian mentioned that *Hormosira banksii* occurs on top of the low intertidal rocks near the outer part of Slaughter Bay lagoon.

Several species of red algae were prominent in the Slaughter Bay lagoon, and there was a dense red algal covering on the low intertidal rocks on Phillip Island. Coralline algae recorded were *Corallina officinalis* and *Jania verrucosa*, while the order Nemaliales was particularly prominent, represented by *Liagora howensis*, *Galaxaura rugosa* and *Tricleocarpa cylindrica*.

Animal life was to the fore in the Slaughter Bay lagoon, with numerous reef corals (39 species according to Morton 2004), sea urchins and fish easily observed. Louise checked out the underwater world from a glass-bottom boat, and Peter did some snorkeling in Emily Bay. Two familiar invertebrates, both well-known from New Zealand shores, were the rock crab (*Leptograpsus variegatus*) and the black snail (*Nerita atramentosa*). John Morton mentions these in his brief account of a Norfolk Island seashore at Point Ross (Morton 2004).

#### Norfolk Island birds

Although our visit to Norfolk Island occurred between seasons – winter breeding seabirds had departed, most waders had yet to arrive – there were enough species seen to keep the birders in the group happy. We were particularly interested in the eight endemic species, reduced from fifteen since the arrival of Europeans and associated pests (Christian 2005).

- The Norfolk Island parakeet or “green parrot” (*Cyanoramphus cookii*), closely related to our red-crowned parakeet (*C. novaeseelandiae*), was reduced to an estimated 15 pairs in the early 1980s. A successful captive breeding programme, begun in 1983, has brought numbers up to around 250 birds (Christian 2005), several of which we saw (and heard) in the National Park.
- The sacred kingfisher or “nuffka” (*Todiramphus sanctus norfolkiensis*) was commonly seen. It is noticeably smaller than our similar species.
- The Norfolk Island gerygone or “peurty” (*Gerygone modesta*) is also tinier than our grey warbler. Its tremulous song was heard wherever there were trees and shrubs.
- The golden whistler (*Pachycephala pectoralis xanthoprocta*) is called “tamey” by the islanders. It was seen and heard anywhere there was bush or scrub in forest or gardens.
- The Norfolk Island fantail (*Rhipidura albiscapa pelzelni*) was another easily-recognised species that was abundant and widespread.
- John Millett was the first to spot the glowing scarlet breast and black and white upperparts of the male Norfolk Island robin (*Petroica multicolor*

*multicolor*). Most managed to see this delightful little bird and his more subtly-coloured mate.

- The remaining two endemics are the white-breasted white-eye (*Zosterops albogularis*), which is seldom seen, and the long-billed white-eye (*Zosterops tenuirostris tenuirostris*), of which we had one possible sighting. Non-endemic silvereyes (*Zosterops lateralis*), however, were commonly found.

Mention must be made of the introduced crimson rosella (*Platycercus elegans*), which we saw everywhere and which is regarded by islanders as a pest species. It competes with the Norfolk Island parakeet for nest sites and territories. More unobtrusive is the emerald dove (*Chalcophaps indica*) that we often saw quietly feeding on the ground in bushland. According to Hermes et al. (1986) it feeds regularly on olive seed. The emerald dove probably colonised in the late 19<sup>th</sup> or early 20<sup>th</sup> century, though Holocene fossil bones have been reported from Nepean Island (Gill et al. 2010).

Nankeen kestrel (*Falco cenchroides cenchroides*) was another nice sighting both on Norfolk Island at Lone Pine and around the cliffs of Phillip Island. Purple swamphen (*Porphyrio melanotus*) inhabited swampy areas but it was a surprise to see two on arid Phillip Island. Mike spotted what were probably the first returning northern hemisphere waders when he saw five ruddy turnstones (*Arenaria interpres*) on the shore platform at Slaughter Bay.

On our visit to Hundred Acres Reserve it was delightful to watch white tern (*Gygis alba*) and black noddies (*Anous minutus*) courting and pair-flying through the Norfolk Island pines. Many noddies were already on their one-egg nests spaced out along the horizontal branches. It was difficult to see if the terns were breeding yet as they lay their single egg in a small depression on the bare branch. A red-tailed tropic bird (*Phaethon rubricauda*) was seen at sea from the western coastline near the Captain Cook Monument.

We had a taste of what living on a seabird island is like on the night of 7 September. Rain and mist enveloped the island, ideal conditions for seabirds to avoid their enemies when coming ashore to court and breed. All night sooty terns (*Onychoprion fuscatus*) could be heard flying in the darkness overhead, their ululating cries filling the sky. Once many more seabird species would have made the nights loud with their calls, some contributing nutrients to the health of the forest with their guano, right up until the Second World War (Christian 2005).

Our main seabird sightings occurred on the boat trip to Phillip Island and around the cliffs of both Phillip and Nepean Islands: sooty tern, Norfolk Island little shearwater (*Puffinus assimilis assimilis*), grey ternlets

(*Procelsterna cerulea albivitta*) and Tasman (masked) boobies (*Sula dactylatra tasmani*) were flying and feeding in constant movement between the islands. Once landed on Phillip Island we saw the boobies incubating on well-spaced out nests all over the island (Fig. 19).



Fig. 19. Masked booby, Phillip Island.

Other birds noted were Californian quail (*Callipepla californica*), feral fowl (*Gallus gallus*), feral geese and ducks, mallard (*Anas platyrhynchos*), white-faced heron (*Ardea novaehollandiae*), little black shag, feral pigeon (*Columba livia*), blackbird (*Turdus merula*), song thrush (*Turdus philomelos*), common starling

(*Sturnus vulgaris*), welcome swallow (*Hirundo neoxena*), and house sparrow (*Passer domesticus*). Mike believed he heard a Norfolk Island boobook owl (*Ninox novaeseelandiae undulata*) calling in the Mill Road area during the progressive dinner. The New Zealand morepork was brought to the rescue of this subspecies when in 1987 two male moreporks were introduced and released to partner the one known remaining boobook – a female (Olsen 1989). This seems to have done the trick.

Two reptiles, a skink and a gecko, are known from Phillip Island. We were shown the cryptically-marked gecko *Christinus guentheri*, several of which were sheltering in a stack of building material near the Evans's camp.

#### Authorship

The writers of this report were:

*Anne Fraser*: orchids; *Christine Major*: geology and history; *Geoff Davidson*: native trees, shrubs & woody climbers; Norfolk Island pine; *Maureen Young*: ferns *Mike Wilcox*: introduction; programme; brief introduction to the botany of Norfolk Island; native trees, shrubs & woody climbers; introduced trees and shrubs; Norfolk Island pine; grasses and sedges & other herbaceous monocots; native & introduced herbs; seaweeds; general editing; literature references; *Stella Rowe*: Norfolk Island birds.

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## Some small-leaved coprosmas (Rubiaceae)

Rhys Gardner

### Introduction

It seems fair to say that while NZ's large-leaved coprosmas (*Coprosma*, Rubiaceae) are almost too easy to identify (e.g., Gardner 2003) the small-leaved ones, especially those of the South Island, are rather too hard (e.g., Jane 2006). This article then deals only with the small-leaved North Island species. It is based on previous accounts (Oliver 1935; Allan 1961; Taylor 1961; Poole & Adams 1963; Webb & Simpson 2001; Gardner 2002; Eagle 2006) together with observations of my own on the collections in AK (Auckland War Memorial Museum herbarium).

These notes apply mainly to dried material, and their use on live plants should be done with caution, since characters such as texture and vein visibility can change during drying. Floral characters do not feature (pace Oliver), but those of the ripe fruit, particularly colour (in life) and shape (live or dry), are very informative. We can be glad that coprosma fruits are not any smaller, but unfortunately their colour and shape change in drying, and, since these species are dioecious, female plants can be expected to turn up only half the time. The stipule, small and soon distorted by the urgencies of stem growth, has been referred to as little as possible (pace Druce); for an appreciation of its diversity see especially Nancy Adams' representations (Allan 1961; Poole & Adams

1963).

First here is a list of 49 "spot-characters", the features shown by relatively few taxa and hence with higher diagnostic value. Fig. 1 illustrates a few of them. A key follows to a particularly troublesome group, the higher altitude coprosmas of the Volcanic Plateau. Leaf silhouettes are shown in Figs. 2-4. For information on distribution and habitat see Eagle (2006).

Twenty-eight taxa are considered. Omitted are: *C. brunnea* and *C. distantia* (considered part of *C. acerosa* and *C. obconica* respectively); *C. atropurpurea* (one dubious North Island locality, Volcanic Plateau); *C. pseudociliata* (in North Island, Tararua Range only). Also omitted are the forms of *C. neglecta* other than the typical one (that of the Surville Cliffs; see Eagle 2006). *Coprosma cheesemani* is treated in the broad sense to include the taxon known informally as *C. "oreophila"* (Druce, mss.; treated in (Eagle 2006: (750) as *C. aff. cheesemani*).

### Spot-characters

Use fully developed leaves for texture characters. Use stipule at penultimate or antepenultimate node, preferably on a vigorously growing shoot. Brackets