

## 8 Flora

### Terminology

The terms 'flora' and 'vegetation' are often used interchangeably, but strictly they refer to quite different topics. Flora refers to the species of plants to be found in an area, usually divided into various botanical categories, such as "herbs" "coniferous trees" or "ferns". Vegetation on the other hand refers to the quantitative mix of plants in different locations on the landscape. Again, it is often divided into broad categories, such as "forest", "wetland" or "grassland". The flora of Great Barrier Island comprises a list of the species to be found on the Island, while the vegetation comprises the vegetative cover of the landscape, comprising scrub, forest, swamp or pasture etc.

Flora can also be divided into vascular and non-vascular plants. The vascular plants are those with an internal vascular system – most evident in the veins of the leaves - including all the trees, ferns, grasses, and other herbs. Fungi, lichens, mosses, liverworts and algae are non-vascular. Algae include marine seaweeds.

These botanical categories can be further divided according to whether they are native to New Zealand, or adventive - introduced from outside New Zealand, intentionally or accidentally by man. This latter category is sometimes referred to as "exotic". Such plants may or may not be naturalised (able to grow and reproduce without human assistance). Many of the latter are the plants of agriculture or forestry, pasture or gardens, including many weeds.

The most recent list of the native plants (vascular flora) of Great Barrier Island was compiled in 2008<sup>i</sup>. This list comprises 591 different plants ("taxa"; referring to species or sub-species), compared with 560 known in 2001, and 575 in 2004. This increase (31 new taxa in eight years) is partly through the 'splitting' of former species<sup>ii</sup>, but it indicates that even in the best-known category of plants (native vascular), there are still new species to find and much to be learned: the flora is not simply a static list.

**The Great Barrier Island total of nearly 600 plants is approximately one quarter of the native vascular flora of New Zealand. This is a remarkably large number; a consequence perhaps of diverse habitats, and the position of the Island in relation to past fluctuations in climate and sea-level, which have periodically connected it to the mainland.**

A large number of species (12% of the total Island flora) are nationally noteworthy due to their endangered, vulnerable or declining status, or because, taken throughout New Zealand, they are regarded as rare (Table 8.1). Two species formerly present, the mistletoe *Trilepidia adamsii* (Left), and the root parasite *Dactylanthus taylorii*, are now probably extinct on the island – the former being globally extinct. A further 13 species once recorded on Great Barrier Island are thought to be now extinct on the Island (Cameron *pers comm.* regards 17 species as "presumed extinct"). Two species (*Daucus glochidiatus* and *Senecio scaberulus*) are regarded as close to extinction nationally, and a further 24 plants are at risk to some degree.



Fig 8.1. The Mistletoe, *Trilepidia Adamsii*. Painted on Great Barrier Island by Fanny Osborne c. 1916. Now extinct worldwide<sup>iii</sup>.



Other species present on Great Barrier Island are regarded as rare plants nationally, though a few of these are fairly common on the Island. For example, two of the three species endemic to Great Barrier Island (*Kunzea sinclairii* and *Olearia allomii*) are small shrubs quite common on the Windy Canyon – Hirakimata track.

Table 8.1. Status Of Extinct, Endangered and Rare Plants on Great Barrier Island: **Dark grey** - extinct on Great Barrier Island; **light grey** - probably extinct on Great Barrier Island (Lewington 2008); **Yellow** - species at risk or declining nationally. National threat status 1 = Nationally critical; 2 = Nationally endangered; 3 = Nationally vulnerable; 4 = Declining; 5 = Relict – ie already suffered a decline; 6 = Naturally rare species. E = Nationally extinct. (de Lange et al. 2009<sup>iv</sup>). Species in **bold** are endemic to Great Barrier Island.

Species	Family	Extinct Great Barrier Is	Probably extinct Great Barrier Is	National threat Status
<i>Trilepidea adamsii</i>	Loranthaceae	1		E
<i>Dactylanthus taylorii</i>	Balanophoraceae	1		3
<i>Prasophyllum hectorii</i>	Orchidaceae		1	
<i>Leptinella squalida</i> subsp <i>squalida</i>	Asteraceae		1	
<i>Vittadinia australis</i>	Asteraceae		1	
<i>Polygonum phlebeium</i>	Polygonaceae		1	
<i>Rorippa palustris</i>	Brassicaceae		1	
<i>Rumex flexuosus</i>	Polygonaceae		1	
<i>Clianthus maximus</i>	Fabaceae		1	1
<i>Phylloglossum drummondii</i>	Lycopodiaceae		1	1
<i>Atriplex hollowayi</i>	Chenopodiaceae		1	3
<i>Euphorbia glauca</i>	Euphorbiaceae		1	4
<i>Ptisana (Marattia) salicina</i>	Marattiaceae		1	4
<i>Pimelea arenaria</i>	Thymelaeaceae		1	4
<i>Lindsaea viridis</i>	Dennstaedtiaceae		1	6
<i>Centipeda minima</i>	Asteraceae			1
<i>Daucus glochidiatus</i>	Apiaceae			1
<i>Senecio scaberulus</i>	Asteraceae			1
<i>Amphibromus fluitans</i>	Poaceae			2
<i>Picris burbidgaea</i>	Asteraceae			2
<i>Schoenus carsei</i>	Cyperaceae			2
<i>Dichelachne micrantha</i>	Poaceae			3
<i>Geranium retrorsum</i>	Geraniaceae			3
<i>Lepidium oleraceum</i>	Brassicaceae			3
<i>Pimelea tomentosa</i>	Thymelaeaceae			3
<i>Rorippa divaricata</i>	Brassicaceae			3
<i>Spiranthes novae-zelandiae</i>	Orchidaceae			3
<i>Austrofestuca littoralis</i>	Poacea			4
<i>Brachyglottis kirkii</i> var <i>kirkii</i>	Asteraceae			4
<i>Coprosma acerosa</i>	Rubiaceae			4
<i>Eleocharis neozelandica</i>	Cyperaceae			4
<i>Leptinella tenella</i>	Asteraceae			4
<i>Paspalum orbiculare</i>	Poaceae			4
<i>Pittosporum kirkii</i>	Pittosporaceae			4
<i>Pterostylis paludosa</i>	Orchidaceae			4
<i>Scandia rosifolia</i>	Apiaceae			4



*Pimelea tomentosa* on cliffs at Windy Hill

Species	Family	Extinct Great Barrier Is	Probably extinct Great Barrier Is	National threat Status	
<i>Solanum aviculare</i> var <i>aviculare</i>	Solanaceae			4	
<i>Colensoa physaloides</i>	Lobeliaceae			5	
<i>Desmochoenus spiralis</i>	Cyperaceae			5	
<i>Pellaea falcata</i>	Pteridaceae			5	
<i>Streblus banksii</i>	Moraceae			5	
<i>Utricularia delicatula</i>	Lentibulariaceae			5	
<i>Ascarina lucida</i>	Chloranthaceae			6	
<i>Botrychium australe</i>	Ophioglossaceae			6	
<i>Celmisia major</i> var <i>major</i>	Asteraceae			6	
<i>Danhatchia</i> ( <i>Yoania</i> ) <i>australis</i>	Orchidaceae			6	
<i>Dichelachne inaequiglumis</i>	Poaceae			6	
<i>Doodia mollis</i>	Blechnaceae		6		
<i>Dracophyllum patens</i>	Ericaceae		6		
<i>Fimbristylis velata</i>	Cyperaceae		6		
<i>Fuchsia procumbens</i>	Onagraceae		6		
<i>Grammitis rawlingsii</i>	Grammitidaceae		6		
<i>Halocarpus kirkii</i>	Podocarpaceae		6		
 <i>Hebe pubescens</i> subsp <i>rehuarum</i>	Plataginaceae				6
<i>Hypolepis dicksonioides</i>	Dennstaedtiaceae				6
<i>Korthalsella salicornioides</i>	Loranthaceae				6
<b><i>Kunzea sinclairii</i></b>	Myrtaceae			6	
<i>Libocedrus plumosa</i>	Cupressaceae			6	
<i>Myosotis spathulata</i>	Boraginaceae			6	
<i>Myriophyllum votschii</i>	Haloragaceae			6	
<b><i>Olearia allomii</i></b>	Asteraceae			6	
<i>Petalochilus alatus</i>	Orchidaceae			6	
<i>Petalochilus bartlettii</i>	Orchidaceae			6	
<i>Pittosporum ellipticum</i>	Pittosporaceae			6	
<i>Pittosporum virgatum</i>	Pittosporaceae			6	
<i>Pomaderris hamiltonii</i>	Rhamnaceae			6	
<i>Schizea dichotoma</i>	Schizeaceae			6	
<i>Senecio marotiri</i>	Asteraceae			6	
<i>Sicyos australis</i>	Cucurbitaceae			6	
<i>Stegostyla atradenia</i>	Orchidaceae			6	
<i>Tetragonia tetragoioides</i>	Aizoaceae			6	

**Note:** Quite a number of plants not regarded as endangered nationally, are so within the Auckland Region<sup>v</sup> and several of these are present on Great Barrier Island but not included in Table 8.1.

Photos: Ewen Cameron.

The flora as a whole is dominated by forest plants – trees, shrubs, climbers and ferns (Table 8.2, green) – rather than herbaceous species. However, the diversity of orchids, sedges, and native grasses and rushes is also remarkable, indicating that open areas on cliffs and in swamps have preserved a rich floristic heritage with many rare species.

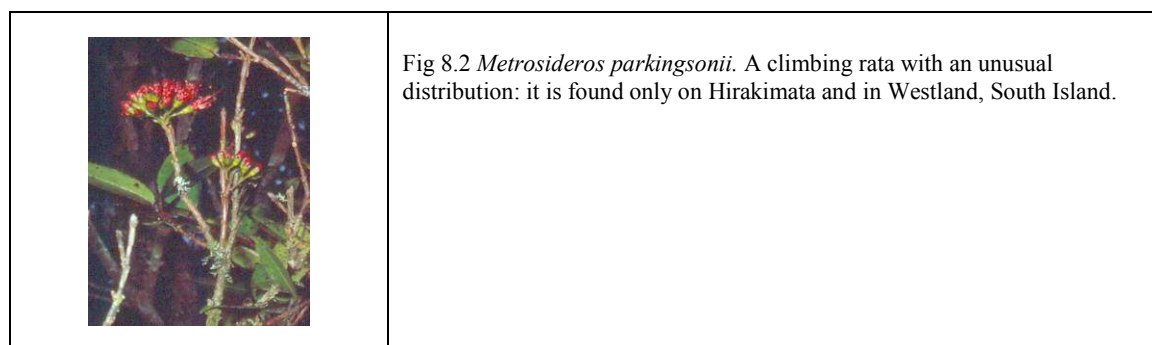
Table 8.2. The Native Flora of Great Barrier Island. (After Lewington 2008)

Category	Number of species	Percentage of total Great Barrier Is flora	Percentage threatened or rare
Trees, shrubs and climbers	189	32.0	8.5
Ferns and related plants	123	20.8	7.3
Dicotyledonous herbs	111	18.8	24.3
Sedges, grasses and rushes	101	17.1	8.9
Orchids	48	8.1	14.6
Others	19	3.2	0.0
Totals:	591	100	11.5

In addition to numerous nationally or regionally threatened plants, and three endemics, seventeen species reach their northern limits on the Island, compared to only two at their southern limits<sup>vi</sup>. Some rare species are confined to the 40 hectares of unburned unlogged forest around the summit of Hirakimata.

Besides swamps and dunes, the herbaceous flora is found on rocky coastlines, offshore stacks and Islands. Many, such as *Pimelea tomentosa* at Windy Hill, are hanging on as tiny populations on coastal cliffs where stock, goats and pigs have failed to reach them. Competition with weedy alien plants might also be a factor. Recent work<sup>vii</sup> on the flora of Motu Kaikoura Island (535 ha) found 379 vascular plant species, of which 69% are native and the remainder naturalised. Eleven nationally<sup>viii</sup> and 19 regionally<sup>ix</sup> threatened or rare native plants occur at Motu Kaikoura.

The Northern Block, Te Paparahi, has been botanically studied in more detail than the remainder of the Island, with species lists given in both Wright & Cameron (1988) and Eadie & Broome (1990). The former included Rakitu Island, and recorded 334 native species, including 84 ferns and fern allies, and 107 (24%) naturalised adventive plants. The latter recorded 340 native species, including 91 ferns, and 101 (23%) naturalised.



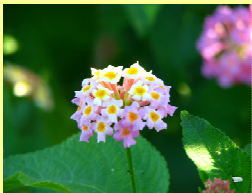
Photos: Ewen Cameron.


### Adventive vascular flora and weeds

A complete list of the adventive (introduced) flora of Great Barrier Island, including those naturalised (i.e. living in the wild without human care), has not yet been made. Cameron (2004) estimates that there are ‘several hundred’ such species. Most are herbaceous and

form a minor component of the vegetation, except in paddocks and gardens. However, a few are serious ‘environmental weeds’, meaning that they have the capacity to invade and persist in native ecosystems. The Regional Pest Management Strategy (RPMS 2007 – 2012) lists 192 weed species, and categorises them according to their degree of severity and the legal requirements relating to their control. It is not known exactly how many of these weeds are present on Great Barrier Island. The lists in Tables 8.3 and 8.4 are derived in part from Cameron (2004), and in part from personal observations. They include species currently weeds in parts of Great Barrier Island (eg *Pinus* spp.) or which appear to have the capacity to become weeds in future (eg *Prunus* spp.), but which are not listed in the RPMS.

Table 8.3. Environmental weeds on Great Barrier Island. rpms refers to the Regional Pest Management Strategy (RPMS. 2007-2012); the policy categories are: **1**= total control; **2** = containment; **3** = community initiative; **4** = surveillance (see text for explanation of these terms). Plants on the National Pest Plant Accord List (ACCORD) and the “Eliminate on Great Barrier Island” (2008) list of the Department of Conservation are given under “Other Policy”. Department of Conservation Policy: (a) eliminate Island wide; (b) contain to existing sites; (c) control on Department of Conservation estate; (d) control at selected Department of Conservation reserves (not all species in this category are included). **Yellow** indicates category 1 and 2 plants, which legally require Auckland Regional Council, or landowners/occupiers, to undertake control.

Common Name	Form	Latin Name	RPMS Category	Other Policy	Comment
Madeira vine	climber	<i>Anredera cordifolia</i>	1	ACCORD Eliminate (a)	Uncommon on Great Barrier Island
Lantana	shrub	 <i>Lantana camara</i>	1	ACCORD (b)	Gardens on Great Barrier Island.  Wilding on the bush margins
Smilax	climber	<i>Asaragus asparagoides</i>	2	ACCORD Eliminate	Uncommon on Great Barrier Island
Woolly nightshade	shrub	<i>Solanum mauritianum</i>	2	Eliminate	Uncommon on Great Barrier Island
Moth plant	climber	<i>Araujia sericifera</i>	2	ACCORD (b)	Present on Great Barrier Island Uncommon but scattered locations
Gorse	shrub	<i>Ulex europeaus</i>	2		In manuka scrub. N-fixer. Bio control Auckland region
Ragwort	herb	<i>Senecio jacobaea</i>	2		Pasture
Grey Willow	tree	<i>Salix cinerea</i>	3	ACCORD Eliminate	Serious wetland weed but uncommon on Great Barrier Island

Common Name	Form	Latin Name	RPMS Category	Other Policy	Comment
Blue morning glory	climber	<i>Ipomoea indica</i>	3	ACCORD	Garden escape. Rampant climber.
Tree privet	tree	<i>Ligustrum lucidum</i>	3	ACCORD <i>Eliminate</i>	Uncommon
Climbing asparagus	climber	<i>Asparagus scandens</i>	3	ACCORD <i>Eliminate</i>	Uncommon
Japanese honeysuckle	climber	<i>Lonicera japonica</i>	3	ACCORD (b)	Garden escape Roadsides
Ladder fern	fern	<i>Nephrolepis cordifolia</i>	3	ACCORD	Gardens and old garden sites
Pampas	grass	<i>Cortaderia jubata, C. selloana</i>	3	ACCORD (d)	Wetlands, dunes, coastal cliffs and forest margins
Jasmine	climber	<i>Jasminium polyanthum</i>	3	(b)	Garden escape
Boneseed	shrub	 <i>Chrysanthemoides monifera</i>	4	ACCORD <i>Eliminate</i>	Present on Great Barrier Island.  Very occasionally occurs, no current sites known
Kahili ginger	herb	<i>Hedychium gardnerianum</i>	4	ACCORD <i>Eliminate</i>	Garden escape and seeding in wild
Tradescantia	herb	<i>Tradescantia fluminensis</i>	4	ACCORD (b)	Garden escape
Mexican daisy	herb	<i>Erigeron karvinskianus</i>	4	ACCORD	Garden escape and seeding in wild
Plectranthus spp.	herb	<i>Plectranthus ciliatus, P. ecklonii, P. grandis.</i>	4	ACCORD	Garden escapes
Coast banksia	tree	<i>Banksia integrifolia</i>	4	Research needed. (b)	Provides bird food, seeding in wild
Brush wattle	shrub	<i>Paraserianthes lophantha</i>	4		Probably an N-fixer, seeding
Sweet-pea shrub	shrub	<i>Polygala myrtifolia</i>	4	(b)	Garden escape. Spreading on Great Barrier Island
Spanish heath, Pink bell heather.	shrubs	<i>Erica lusitanica, E. baccans</i>	4		In manuka scrub and roadsides
Reed sweet grass	grass	<i>Glyceria maxima</i>	4	(b)	Threatens Whangapoua wetland



Common Name	Form	Latin Name	RPMS Category	Other Policy	Comment
Mist flower	herb	<i>Ageratina riparia</i>	4		Wetlands. Bio control in Auckland region.
Periwinkle	climber	<i>Vinca major</i>	4	(b)	Garden escape
Ivy	climber	<i>Hedera helix</i>	4		Shade tolerant, garden escape
Climbing dock	climber	<i>Rumex saggitatus</i>	4		Spreading in open areas
Blackberry	climber	<i>Rubus fruticosus</i>	4		Plants near Claris

“About 75 per cent of land plant pests and 50 per cent of freshwater weeds are garden escapes. On average, eight garden plant species each year become naturalised in the wild”. *Department of Conservation Website.*

Table 8.3 lists seven weeds for which there are statutory control requirements (categories 1 and 2). None of these except gorse and ragwort are common on Great Barrier Island. A further 22 species are in categories 3 and 4, respectively indicating that the Council will support community initiatives for their control or will at least maintain surveillance of their status. The Auckland Regional Council (Biosecurity) and the Department of Conservation are currently working together to eliminate eight weed species (indicated in Table 8.3) before they become strongly established on Great Barrier Island. The weed control work undertaken by Department of Conservation staff is focused on minimising the impacts of weeds on the highest priority habitats (eg. wetlands, dunes, estuaries, coastal slopes, cliffs, offshore islands and regenerating kauri forest).<sup>x</sup> Some taxa (not all listed in Tables 8.3 and 8.4) are not included as ‘weeds’ in the RPMS, but have the potential to become weeds in future on Great Barrier Island. Pines, *Acacia*, *Hakea*, *Banksia* and even Eucalypts, while not generally regarded as ‘weeds,’ have the potential to alter successional pathways and change the structure of natural ecosystems, and in this respect they are quite serious environmental weeds on the island. Some garden plants, such as *Agapanthus*, could also become serious weeds.

Table 8.4. Some plants not listed in the Regional Pest Management Strategy but with the potential to become environmental weeds on Great Barrier Island. Those which are currently a problem on Department of Conservation land are highlighted in yellow. Department of Conservation policy: (c) control on all Department of Conservation land; (d) control at selected Department of Conservation reserves (not all weeds on Department of Conservation’s list are shown). Trees and climbers which are not currently a problem but are known to be weeds elsewhere are highlighted in green.

Name	Latin name	Plant form	Notes
Monterey pine <sup>(1)</sup>	<i>Pinus radiata</i>	tree	Invading manuka scrub and dunes. Provides food for kaka. (d)
Maritime pine <sup>(1)</sup>	<i>Pinus pinaster</i>	tree	Invading manuka scrub and dunes. Kaka food. (d)
Dally pine	<i>Psoralea pinnata</i>	shrub	Wetlands and forest margins; spreading on Great Barrier Island. Blue flowers. (not a ‘pine’)

Name	Latin name	Plant form	Notes
Hakea	<i>Hakea gibbosa</i> , <i>H. sericea</i>	 Shrubs to c. 5m tall.	In manuka scrub, probably N fixer. Fire risk – highly inflammable. Coloniser – short lived  <i>Photo shows the thick woody 'nuts' which protect the seeds from fire.</i>
Kikuyu grass <sup>(2)</sup>	<i>Pennisetum clandestinum</i>	grass	Paddocks and open areas. (d)
Mexican devil	<i>Ageratina adenophora</i>	 Herbaceous. c. 1m tall.	Kaitoke and Whangapoua Wetlands, Tryphena roadsides. Spreading
Black pine <sup>(1)</sup>	<i>Pinus nigra</i>	tree	Not common on Great Barrier Island Dunes. (d)
Acacia (sometimes placed in genus <i>Racosperma</i> )	<i>Acacia melanoxylon</i> , <i>mearnsii</i> , <i>longifolia</i> <i>sophorae</i> <i>verticillata</i> .	trees or shrubs	Short lived fast growing trees useful for firewood and in restoration, but potentially serious fire-risk plants, and invasive especially on coastal sands. <i>Melanoxylon</i> suckers from roots. N-fixing.
Eucalyptus	<i>Eucalyptus spp.</i>	tree	Planted for firewood etc. Flowers provide bird food. (d)
Marram	<i>Ammophila arenaria</i>	grass	Planted for dune control Claris airport – being controlled
Loquat	<i>Eriobotrya japonica</i>	tree	Cultivated for fruit
Ornamental cherries	<i>Prunus spp.</i>	trees	Garden escape
Cotoneaster (3)	<i>Cotoneaster spp.</i>	Shrub	Garden escape. Berries spread by birds, common in regenerating bush south Great Barrier Island. (c).
Guava	<i>Psidium cattleianum</i>	tree	Fruit tree. Bird food - especially New Zealand pigeon
Grapevine	<i>Vitis vinifera</i>	climber	Escapes – few but capable of smothering trees

**Notes:** (1) Pines are controlled on some Department of Conservation administered areas. (2) kikuyu grass is excluded from the RPMS. (3) A useful booklet, entitled “Plant me Instead”, gives alternatives to garden plants liable to become pests and is available from Jacqueline Davidson, Information Resources, Auckland Regional Council, and Auckland.



Weeds or potential weeds in the ‘tree and shrub’ category comprise two main ecological types: shade tolerant, and intolerant. The shade tolerant species usually have fleshy fruits likely to be dispersed by birds, and are capable of getting into, and surviving, in mature native forest communities, thus altering their long-term composition. Tree privet is potentially the most serious in this category in Table 8.3, but the cherries or woolly nightshade are capable of colonising tree-fall gaps and thus preventing native trees from regenerating in them.

The shade intolerant trees such as *Pinus*, *Eucalyptus* and *Acacia* spp, and shrubs such as *Hakea* spp., gorse and heathers generally invade open areas, especially young areas of manuka (*Leptospermum scoparium*) arising after fire. These species are more flammable than most native species, thus increasing the fire-risk in communities they invade. They also alter the litter, and hence the soil-dwelling fauna and nutrient cycling. Although some are long-lived (> 100 years for *Pinus* and *Eucalyptus*) they are essentially early successional species and, *in the absence of fire*, will ultimately be out-competed by native forest trees, which grow taller and/or live longer. Long-term control of this group involves preventing fires in the extensive scrub-lands. Pines are currently being felled on vulnerable Department of Conservation land, such as on the Kaitoke dunes. Some of these woody weed species may however have potential benefits in providing food for birds, and in some cases may facilitate succession to a native forest cover. They are a longer term threat where the natural vegetation is of low stature and maybe overtopped by these taller species irreversibly.

Within the ‘grass’ and ‘herb’ category are some plants capable of altering the character of a landscape (eg. pampas, *Cortaderia* spp.) and some capable of altering forest regeneration patterns by shading the forest floor (eg *Tradescantia* and kahili ginger). Mist flower and Mexican devil (Fig 8.3) invade wetlands, where they totally change the appearance and ecology of the native sedge and rush communities. These species, and some others, might be capable of being biologically controlled by fungal pathogens. However, most of the herbaceous weeds do not invade closed native forest; their impact is mainly on coastal cliffs, wetlands, dunes and other open areas.



Fig 8.3. Mexican devil invading and altering swamp community structure – Kaitoke swamp.

The photo is taken in the habitat of the rare spotless crane.

It is not known what effect this weed has on the worms, spiders, beetles, snails and insect larvae which probably constitute the main food of this rare species.

Photo: John Ogden

Although one of the worst climbing weeds, old man’s beard (*Clematis vitalba*), is not known to be present on Great Barrier Island, many climbing plants with potentially disastrous impacts on regenerating forest are present. Moth plant, Japanese honeysuckle, climbing asparagus and jasmine are all potentially serious. Grapes (and passion flowers)

are cultivated for fruit but have gone wild in some locations, rapidly overwhelming adjacent trees. Abandoned gardens are a source of several environmental weeds on Great Barrier Island including ivy and blue morning glory.

### Threats to the vascular flora

Probably 17 species of vascular plant have become extinct on Great Barrier Island during the period of European settlement, including *Trilepidia adamsii* and (probably) *Dactyloctenium aegyptium*. The former species may have been lost due to habitat change (and collecting), while the latter is probably a result of pig rooting, although loss of native bats (its main pollinator) may also be a factor. Six small herbaceous plants and one shrub given a National Threat Status rank of 1 or 2 (Table 8.1) must be regarded as either extinct or at serious risk of extinction on Great Barrier Island.

While such plants could disappear without notice, except by a few botanists, the growing lists of losses of native plants, and the rising tide of invasive species, indicate changes in the vegetation. These are 'ecosystem level' changes; as the vegetation forming the base of the trophic pyramid changes so also must other components of the system from invertebrates to reptiles and birds.

The main immediate threats to the flora are probably from fire and introduced mammals, although the possible roles of introduced birds and invertebrates are not known. Rats alone have eliminated some species (*Streblus banksii*, *Carmichaelia williamsonii* and parapara - *Pisonia brunoniana*) from off-shore islands through seed and seedling predation. Parapara is present on the Mokohinau Islands, and on Rakitu Island off Great Barrier Island, though the place name, Whangaparapara, hints at a wider coastal distribution in the past. On Great Barrier Island rats have been observed to eat the underground bulbs of the rare *Prasophyllum* orchid on Kaitoke swamp. Pigs and fallow deer were regarded as a serious threat to the flora of Motu Kaikoura, but have now been eliminated. Pig rooting undoubtedly comprises a risk to vegetation establishment on steep scrub covered slopes on much of Great Barrier Island. Soil movement increases down-slope nutrient loss and creates bare areas in which woody weeds (e.g. *Hakea* spp.) can establish. This in turn increases fire risk. Pigs may also spread forest pathogens such as the agent for kauri dieback (*Phytophthora taxon Agathis*).

### Other components of the flora

*Algae* - No data appear to be available on the freshwater algae. The macroscopic marine algae ('seaweeds') are generally divided into three main groups: Chlorophyta (green algae), Phaeophyta (brown algae including kelps), and Rhodophyta (red algae). Microscopic forms, diatoms, desmids etc. are not covered here.

Various studies have been published on the marine algae of Great Barrier Island (Dellow 1955)<sup>xi</sup>, described sites at Whangaparapara, Port Fitzroy, Needles Point and Oruawharo Bay. A study of the Hauraki Gulf<sup>xii</sup> gives an account of the algae from the north-eastern coast, including sub-tidal communities. Benthic reef surveys have been reported on the north-eastern coast<sup>xiii</sup> and the inter-tidal seaweed flora on Motu Kaikoura<sup>xiv</sup>.

The marine algae of the Auckland Region are currently being inventoried by Mike Wilcox; his draft review (November 2007) lists over 300 species. This figure is sure to rise as more collections are made. A recent article on the marine algae of Great Barrier Island<sup>xv</sup> describes the algal zonation (Fig 8.4) at various localities and lists 136 species, which is

almost half the entire list for the (better known) shores of the Hauraki Gulf. Moreover, very high diversity can occur within quite small areas: Ogden has listed over 100 species from the Awana area. One species collected at Awana (*Rhodymenia sonderi*) has not been recorded elsewhere in the Auckland Region.

Fig 8.4. Algal zonation on rocks at Rangiwahakea bay. Dark green = *Gigartina alveata*; yellow-green = *Pachymenia lusoria*; brownish = *Ahmfeltia torulosa*.



Photo: Mike Wilcox

Table 8.3. Marine Algae Of Great Barrier Island: Number Of Species Recorded In The Three Traditional Taxonomic Groupings.

<b>Taxonomic group</b>	<b>Hauraki Gulf Wilcox 2007</b>	<b>Great Barrier Island Wilcox 2009</b>	<b>Awana Great Barrier Island. Ogden 2008</b>
<b>Rhodophyta (red algae)</b>	184	87	62
<b>Phaeophyceae (brown algae)</b>	62	33	25
<b>Chlorophyta (green algae)</b>	44	15	16
<b>Others</b>	15	3	
<b>Totals</b>	<b>305</b>	<b>138</b>	<b>102</b>

The distribution or abundance of many of the species listed by Wilcox is not known in any detail. However one of the largest species, the Bull Kelp (*Durvillea antarctica*) (Fig 8.5) is of special interest. This plant occurs at the Needles in the far north of Great Barrier Island<sup>xvi</sup>. This is the only known site of this large brown alga from the Hauraki Gulf, or anywhere on the east coast north of East Cape and south of the Three Kings Islands.



Fig 8.5. Bull Kelp (*Durvillea Antarctica*). These massive plants can be up to 10m long.

Photo: Mike Wilcox

Algae are well known as sensitive indicators of water pollution. The extensive blooms of *Microdictyon mutabile* in the Tryphena region after heavy rains could indicate contamination of the bay with high nutrient run-off from unfenced waterways and overflowing sewage tanks<sup>xvii</sup>. The invasion of the large exotic brown seaweed *Undaria pinnatifida* onto mussel beds in Port Fitzroy harbour is a source of concern (Fig 8.6b). This species was first reported in New Zealand in 1987<sup>xviii</sup> and could alter the floristic composition of the seaweed communities on rocky shores around the island, with serious effects on the marine food chain, including many species of fish.

Fig 8.6. a. *Microdictyon mutabile* – microscopic structure. (See also Fig 1.3a) b. *Undaria pinnatifida* is invading mussel farm in Fitzroy Harbour 2008

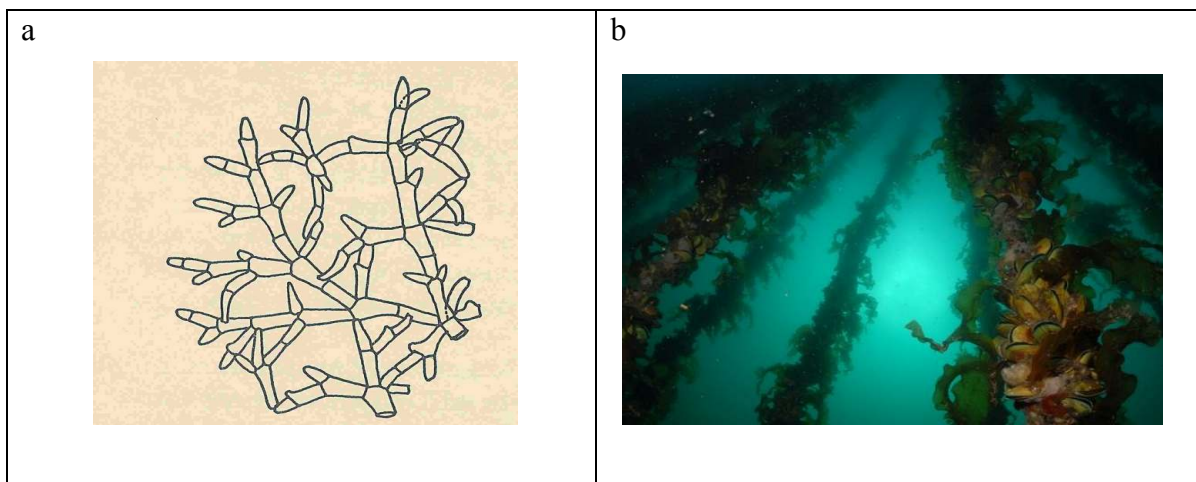
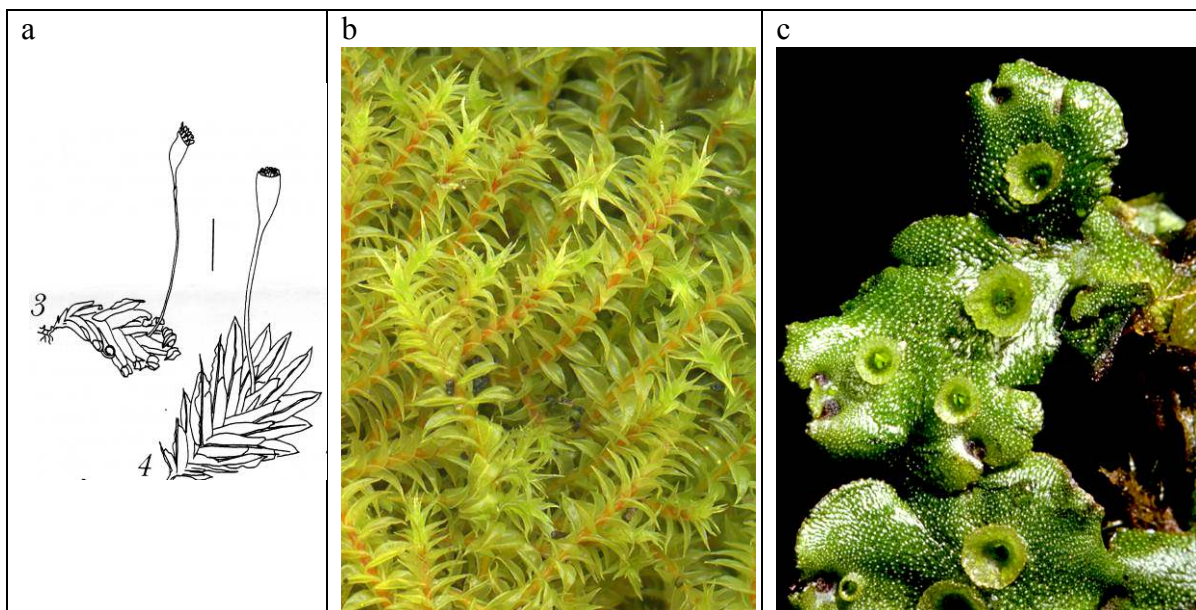


Photo: Roger Grace.

**Mosses and Liverworts (Bryophytes):** The Auckland War Memorial Museum Herbarium holds 358 specimens of mosses, belonging to 115 species, from Great Barrier Island. Eighty-four species from 32 families have been recorded from Miners Cove catchment

alone<sup>xix</sup>. This study includes an account of the main features of the moss communities in the area, and notes several mosses with tropical affinities: *Fissidens hyophilus*, *Thuidium cymbifolium*, *Macromitrium brevicaulis*, and *Syrrhopodon armatus*. The latter species is considered to be ‘at risk’. Another Great Barrier Island moss rarity is *Ischyrodon lepturus*, known only from two of the Broken Islands. *Distichophyllum kraussei* is at its northern limit on Great Barrier Island. This plant has a sub-antarctic disjunct distribution, occurring only in New Zealand and Patagonia. *Dawsonia superba* – the world’s largest moss - also occurs in damp forest on Hirakimata<sup>xx</sup>. Thirteen species were recorded for Motu Kaikoura, although a complete survey was not attempted<sup>xxi</sup>.

Fig 8.7. Great Barrier Island Bryophytes. (a) The rare moss *Fissidens hyophilus*. Drawings by Jessica Beever showing spore capsules (Rec. Auckland Inst. Mus. 27: 155-164. 1990). Vertical bar in (a) is 1mm. (b) Typical moss – *Triquetrella papillata* (c) Typical thallose liverwort: *Marchantia foliosa*. The small green ‘cups’ on the surface contain tiny ‘buds’ which are splashed out by rain drops and reproduce the plant



Drawings by Jessica Beever; Photos: Bill Malcolm

The Auckland War Memorial Museum also holds liverworts from Great Barrier Island belonging to at least 55 species. In ‘thallose’ liverworts the photosynthetic tissue forms a lobed plate (Fig 8.7), but many liverworts have tiny leaves and look superficially like mosses. Amongst these leafy liverworts, Great Barrier Island has at least two rare species with tropical linkages (*Drapanolejeunea* spp.: Matt Renner, personal communication). Overall, the Bryophyte flora of Great Barrier Island is not well known: the total list must exceed 170 species.

*Lichens and Fungi:* Lichens (Fig 8.8) are a symbiotic or ‘dual’ structure, composed in part of fungus and in part of algal cells. All lichens are small, but they are abundant in forest, scrubland and on ‘bare’ rock surfaces, even in the intertidal zone. Two hundred and forty seven (247) species from 81 genera have been recorded from Great Barrier Island, almost a quarter of New Zealand’s lichens<sup>xxii</sup>. This richness reflects the diversity of habitats on the Island. At least four species were recognised for the first time from collections made on Great Barrier Island<sup>xxiii</sup>.

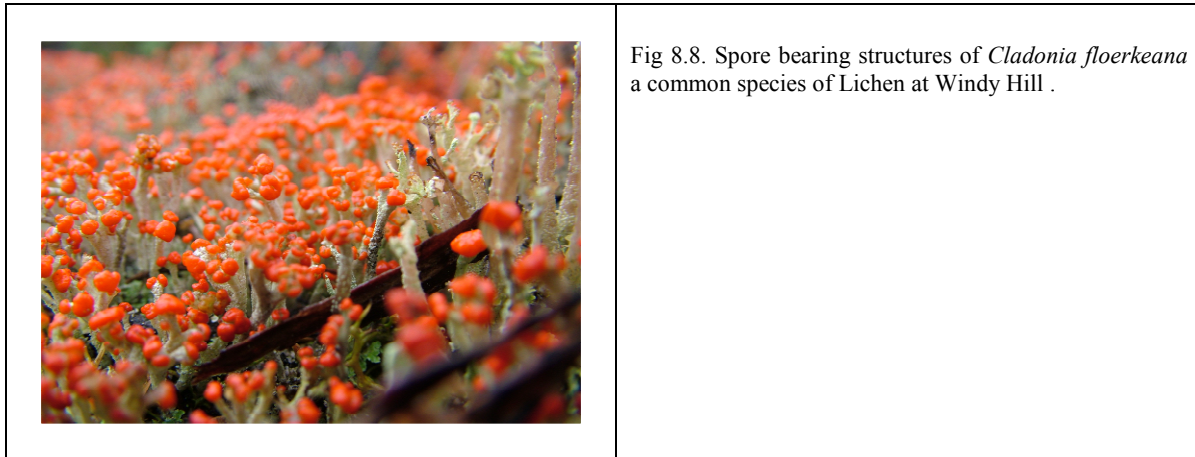


Fig 8.8. Spore bearing structures of *Cladonia floerkeana* a common species of Lichen at Windy Hill .

Photo: Kevin Parsons.

Fungi comprise both macroscopic and microscopic forms. The ‘higher’ fungi include mushrooms, toadstools, bracket fungi etc. These “fruit bodies’ occur periodically, but the majority of the fungus comprises an underground network of fine feeding threads (‘hyphae’), which may permeate dead wood or form mycorrhizal relationships with photosynthetic plants. The three main groups are: Basidiomycetes (mushrooms, toadstools, bracket fungi etc.), Ascomycetes (mostly small ‘cup’ or disc shaped fungi) and Phycomycetes (“moulds”). There is also a wide range of microscopic forms parasitic on plants or saprophytic on dead biomass. Many plant diseases; leaf spots, rusts, smuts, blights etc., fall into this category (Fig 8.9). Two fungi causing leaf spots on kumeraho (*Pomaderris kumeraho*) on Great Barrier Island have only rarely been found elsewhere, while one species (*Cercospora tetragoniae*), causing leaf spot and stem blight of New Zealand spinach (*Tetragonia tetragonioides*) is known in New Zealand only from one collection at Blind Bay, Great Barrier Island.

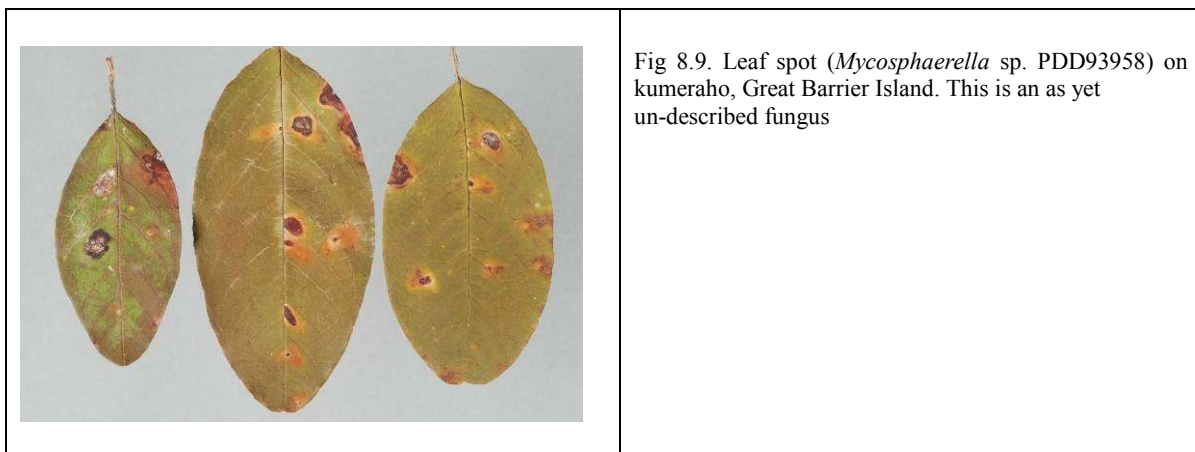


Fig 8.9. Leaf spot (*Mycosphaerella* sp. PDD93958) on kumeraho, Great Barrier Island. This is an as yet un-described fungus

Photo: Peter Johnson, Landcare Research.

Fungal diseases have been used in the ‘biological control’ of other organisms, especially weeds. Two biological control agents released on the mainland found their way to Great Barrier Island very quickly – *Puccinia myrsiphylla*, a rust disease of smilax (*Asparagus asparagoides*), and *Entyloma ageratinae*, a foliar smut disease of mistflower (*Ageratina riparia*). The latter appears to have been very effective in reducing the spread of

mistflower, but, unfortunately, is not effective against the related Mexican devil (*Ageratina adenophora*).

The Plant Diseases Division of Landcare Research has a collection of 39 different fungal species from Great Barrier Island. This is far from comprehensive; for example, when the series of photographs taken by Kevin Parsons at Windy Hill<sup>xxiv</sup> (Fig 8.10) and some other identifications made by John Ogden, are added, the number more than doubles to 82 species. Even this is only the tip of the iceberg; based on the vascular species (fungal host) diversity on Great Barrier Island compared to the Waitakere Ranges, Peter Johnston estimates that there are c. 3000 species of fungi on the Island. Clearly, with only c. 3% of the probable species collected so far, this is a fertile area for further study.

## Summary - flora

### Vascular flora

- The native vascular flora of Great Barrier Island comprises nearly 600 species, approximately one quarter of the New Zealand total.
- The flora is predominantly composed of forest plants (146 trees and shrubs) and ferns (111 species).
- Thirteen native coniferous trees and shrubs are known, mainly from the summit of Hira-kimata.
- The island contains at least 75 nationally or regionally endangered plant species.
- One species, the mistletoe *Trilepidia adamsii*, formerly present on Great Barrier Island, is thought to be extinct globally, while another - *Dactylanthus taylorii* - is probably extinct on the Island, and is endangered throughout New Zealand.
- Two shrub species are endemic to the Island (*Kunzea sinclairii*, *Olearia allomii*) and there is at least one endemic subspecies (*Hebe pubescens* subsp *rehuarum*).
- No comprehensive list of adventive species is available, but it is thought that there are between two and three hundred species.
- Some weed species are a threat to native plant communities. Some of these are currently being targeted for control in a joint Department of Conservation and Auckland Regional Council (Biosecurity) programme.

### Algae

- There appear to be no data on the freshwater algae.
- One hundred and thirty-eight species of marine algae (seaweeds) have been collected from Great Barrier Island, but it is likely that more will be discovered.
- Changes in marine algae populations ('blooms') have been observed, but their significance is unknown.
- The invasion of Mussel farms in Port Fitzroy by the large alga *Undaria pinnatifida* poses a possible threat to the whole coastal ecology.

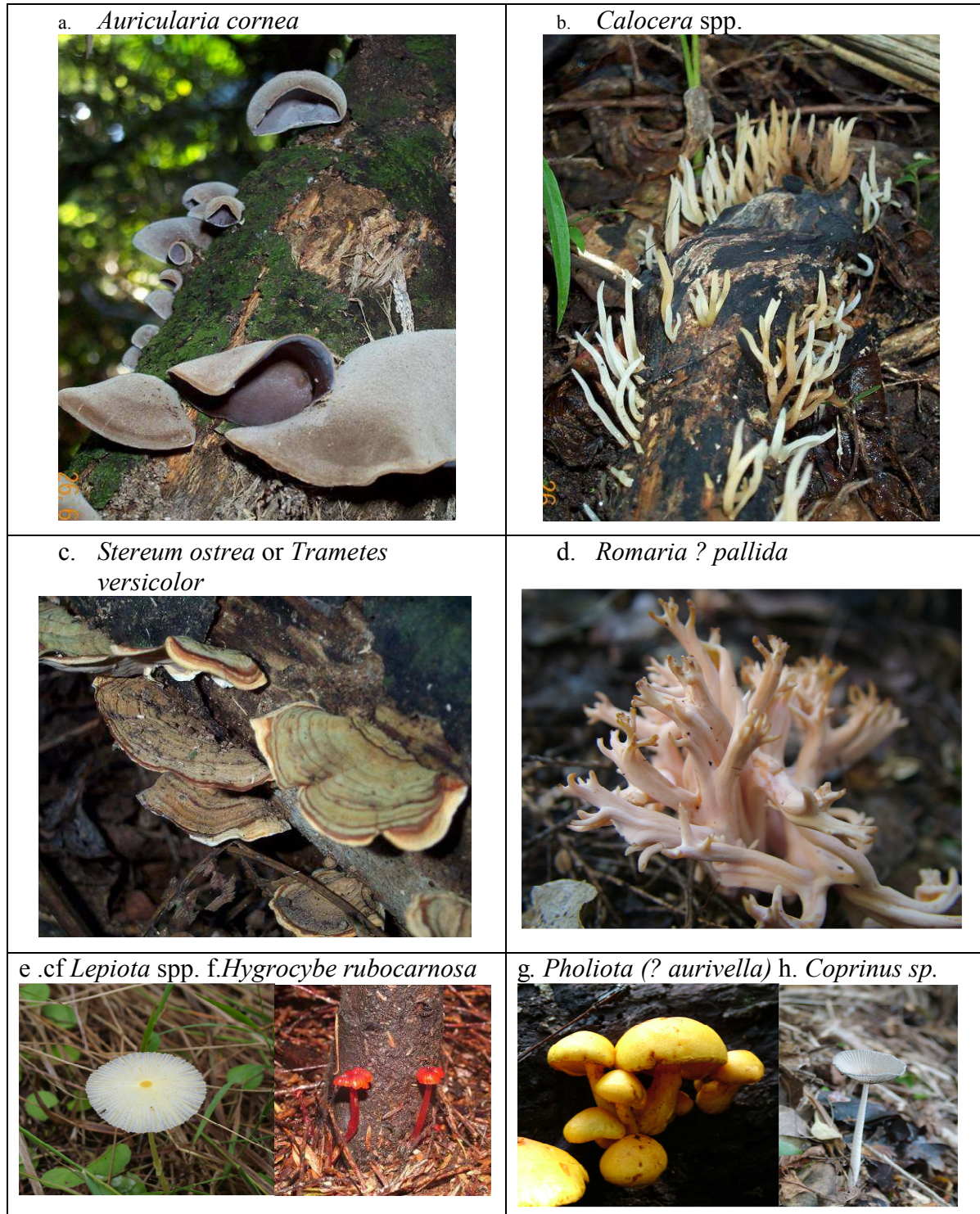
### Bryophytes

- The Bryophytes (mosses and liverworts) have been collected only from the northern half of Great Barrier Island – c. 170 species are known.
- At least three mosses and two liverworts with tropical affinities reach their southern limits on or close to Great Barrier Island, and at least one species is considered to be 'at risk' (*Ischyrodon lepturus*),

**Lichens and fungi**

- The lichen flora is comparatively well known , with 247 species recorded – approximately a quarter of the New Zealand total.
- The Great Barrier Island fungi are very little studied or collected, with only 39 species from Great Barrier Island in the national collection, and c. 80 species identified, from an Island total likely to be c.3000 species.

Fig 8.10. Selected fungi from Windy Hill.. Provisional identifications by P. Buchanan, P. Johnston, Landcare Research.



Photos: Kevin Parsons



- 
- i Rodney Lewington, [rodneyjl@clear.net.nz](mailto:rodneyjl@clear.net.nz) for the Wellington Botanical Society.
- ii Taxonomic research sometimes indicates that a species varies so much throughout its range that it can be regarded as comprising two or more related species.
- iii Goulding, J.H. 1983 *Fanny Osborne's Flower Paintings*. Heinemann Pp84 (ISBN: 0868633968)
- iv De Lange, P.J., Norton, D. A., Courtney, S. P., Heenan, P. B., Barkla, J. W. and Cameron E. K. 2009. *Threatened and uncommon plants of New Zealand (2008 revision)*. *New Zealand Journal of Botany*, 47: 61-96.
- v Stanley, R., de Lange, P. & Cameron, E.K. 2005. Auckland regional threatened and uncommon plants list. *Auckland Botanical Society Journal* 60 (2):152-157.(ISBN: 0013-4132).
- vi Cameron, E.K. 2004. flora. In: Armitage, D *Great Barrier Island*. Pp82 -103. Canterbury University Press. Christchurch. (ISBN:1-877257-00-1).
- vii Cameron, E.K. 2007: The Vascular Flora of Motu Kaikoura, Port FitzRoy Harbour, Great Barrier Island. *Auckland Botanical Society Journal* 62(1): 78-95.
- viii cf. de Lange et al. 2004 (see iv above)
- ix Stanley et al. 2005 (see v above)
- x Weed Control Reports and maps are available from Department of Conservation.
- xi Dellow, V. 1955. Marine algal ecology of the Hauraki Gulf, New Zealand. *Transactions of the Royal Society of New Zealand*. 83: 1-91.
- xii Francis, M.P. & Grace 1986. Marine algal survey north eastern Great Barrier Island, New Zealand. *Journal of the Royal Society of New Zealand* 16(4): 335-346.
- xiii Kelly, S. & Haggitt, T.J. (2002) Benthic reef survey of Waikaro Point to Needles Point - Great Barrier Island. *Report to the Department of Conservation*. Auckland
- Haggitt, T.R. & Mead, S. (2008) Great Barrier Island (Aotea) benthic monitoring programme: May 2008 survey. *Report to the Department of Conservation*. *Coastal and Aquatic Systems Ltd*.
- xiv Wilcox, M.D. 2007 Seaweeds of Kaikoura Island. *Kaka Comments, Motu kaikoura Trust Supporters' Newsletter* 3:5-6
- xv Wilcox, M 2009. Seaweeds of Great Barrier Island. *Auckland Botanical Society Journal* 64(1): 46-49. (ISBN: 0013-4132)
- xvi Dellow, V. 1955. Marine algal ecology of the Hauraki Gulf, New Zealand. *Transactions of the Royal Society of New Zealand*. 83: 1-91. Irving, P. & Jeffs, A. 1993. The north-eastern coast of Great Barrier Island. A report on surveys of the coastal environment and a review of existing information. Department of Conservation: Auckland Conservancy Technical Report Series No. 5. Auckland.
- xvii Ogden, J. 2009. The seaweed saga continues. *GBI Environmental News*: 20: 7-8
- xviii Hay, C.H. & Luckens, P.A. 1988. The Asian kelp *Undaria pinnatifida* (Phaeophyta: Laminariales) found in a New Zealand harbour. *New Zealand Journal of Botany* 25(2): 329-332
- xix Beever, J. 1990. The mosses of Miners Cove, Great Barrier Island, northern New Zealand. *Records of the Auckland Institute and Museum* 27: 155-164
- xx Information from Jessica Beever (Landcare Research), Allan Fife (Christchurch Herbarium CHR), Patrick Brownsey (Wellington Herbarium WELT), Ewen Cameron, Chris Jones and Matt Renner (Auckland Herbarium AKU).
- xxi Cameron, E.K. 2007: (see vii above)
- xxii Hayward, B.W., Hayward, G.C. & Galloway, D.J. 1986. Lichens of Great Barrier Island and adjacent islands, northern New Zealand, *Journal of the Royal Society of New Zealand* 16(2): 121-137
- xxiii Hayward et al. 1986 (see above)
- xxiv Provisionally identified by Peter Buchan and Peter Johnston at Landcare Research.