

plant that I've only seen at Te Henga and Mercer Bay. Bec Stanley undertook a survey for *Myosotis petiolata* var. *pansa* along the west coast of the Waitakeres in 2004 and found 22 sites with 548 plants in total – clearly not as rare as we had initially

assumed. I've seen the sand buttercup, *Ranunculus acaulis* only once, on a Bot Soc field trip in 1981 at Kakamatua. I live in hope of finding it again one day.

Auckland lichens

Dan Blanchon

Introduction

Lichens are often overlooked in ecological surveys, yet they have an essential part to play in ecosystems. Some lichen species are involved in the formation of the first soils on rocky substrates and subsequently aid in soil stabilization. Other lichen species contain cyanobacteria and can therefore fix atmospheric nitrogen, making them highly important in the nitrogen cycle of grassland and forest ecosystems. Lichens are also important habitat for invertebrates, which in turn are food for birds and reptiles. Most lichen species are sensitive to air pollution, and as a general rule, the more species of lichens in an area, the cleaner the air.

New Zealand has a particularly rich lichen flora, with 1799 taxa currently accepted (de Lange et al. 2012b), which is around 10% of the total lichen species recognized in the world (Galloway 2007). All New Zealand lichens are considered to be native, although many are also found in other parts of the world.

What do we know about lichens in Auckland?

There is actually a great deal of information available on the lichens of Auckland and Northland, but much of it is hidden away in old journals and newsletters, or unfortunately unpublished. Two of the most valuable sources of information, *Tane* and the *Auckland Botanical Society Journal*, are now available online.

Tane, the journal of the Auckland University Field Club, provides a rich resource of information about lichens in the upper North Island (Fig.1). The very first issue (as the "Field Club Record") records a short list of six lichens from the Huia Field Club camp (Butler 1948). This was followed by Chambers (1952), who discussed the bryophyte and lichen ecology at a site near Swanson, although only a handful of lichens were actually identified. The real strength of the articles in *Tane* is in the records of the lichens of offshore islands of the Hauraki Gulf, eastern Northland and the Bay of Plenty, with a series of articles by Glenys Hayward (under her former name Puch), Bruce Hayward, Anthony Wright and David Galloway. Species lists and descriptive accounts were provided for Whale Island (Puch 1971,

13 taxa); Red Mercury Island (Puch 1972, 29 species); parts of Great Barrier Island (Hayward & Hayward 1973, 40 species); Shoe Island and the Slipper group (Hayward & Hayward 1974a, 112 species); Great Mercury Island (Hayward et al 1976, 104 species); Moturoa Island group (Hayward & Wright 1977, 21 species); Hen Island (Hayward & Hayward 1978, 99 species); Cavalli Islands (Hayward & Hayward 1979, 85 species); Fanal Island (Wright et al. 1980, 58 species); eastern Bay of Islands (Hayward & Hayward 1980, 111 species); Cuvier Island (Hayward et al. 1981, 51 species), Rakitu Island (Hayward & Hayward 1982, 124 species); Chickens Islands (Hayward & Hayward 1984, 125 taxa); Whale (Motuhora) and Rurima Islands (Hayward & Hayward 1990, 144 and 47 species); Poor Knights Islands (Hayward & Wright 1991, 144 species); Ruamahua-iti (Hayward 1973, 35 species), and a comparison of part of Great Barrier Island, Red Mercury Island, Ruamahua-iti and Whale Island (Hayward & Hayward 1973b). A handful of lichens were recorded by Cameron (1999) for a rocky islet at Waikawau Bay, Coromandel Peninsula.

Detailed studies were done on the lichens on Kawerua, western Northland, with an initial list of 126 species (Hayward & Hayward 1974b) and an update to 174 species in 1991 (Hayward & Hayward 1991a). Permanent quadrats were also set up in the same area and monitored (Grace & Hayward 1978). Hayward et al. (1975) listed 107 species for the northern Coromandel Peninsula. Hayward & Hayward (1983) also provided a useful account of the common lichens of Auckland City.

Over the same time period as *Tane*, and carrying on to the present day, the *Auckland Botanical Society Journal* and occasional bulletins have continued to add to our knowledge of the lichens of the northern North Island (Fig. 1). The main contributors have been Mike Wilcox, Doug Rogan, Rick Kooperberg, Carol Elliott (Lockett), Glenys Hayward, Bruce Hayward, Dan Blanchon and Enid Asquith. The information published by the Auckland Botanical Society has complemented that published in *Tane*, plugging gaps in accounts of offshore islands and concentrating more on mainland sites. The tradition of elucidating the lichen floras of distant offshore

islands has continued with the publication of lichen species lists for Motu Kaikoura (Blanchon et al. 2011, 114 species) and Tuhua/Mayor Island (de Lange et al. 2012a, 103 taxa). Closer to home, the inner Hauraki Gulf Islands have had some attention, with a few lichens included in articles on Whakanewha Regional Park (Wilcox et al. 2002, 11 species) and Kuakarau Forest Reserve (White 2002, 5 species) on Waiheke Island, and more detailed studies of Rangitoto (Blanchon et al. 2007, 194 species); Rotoroa Island (Lockett, 2007, 35 species); Motutara, Motu Kareka, Kohatutara (Cameron 1999, 33 taxa); Kawau Island (North Cove, Sandy Bay and Vivian Bay, Wilcox et al. 2004, 45 species). Coastal and inner harbour areas have also been investigated, with 3 species recorded for the Okura walkway and reserve (Asquith 1999); 49 species noted for Smith's Bush (Blanchon et al. 2010) and 4 taxa listed for Pollen (Motumanawa) Island (Cameron 1990). The lichens of the Auckland isthmus are less well known in print, with an article on Mt Eden rock forests listing 3 species (Cameron 1999c) and a general article on the mural flora of Auckland covering 24 species (Wilcox & Rogan 1999). The lichens of the Waitakere Ranges were last covered by Bartlett (1988), who listed 372 taxa. South Auckland is poorly covered, with only a partial account of Murphy's Bush (Blanchon et al. 2004, 22 taxa) and Ihumatao 'islet' (de Lange & Crowcroft 1995, 3 taxa). The Awhitu Peninsula has two partial species lists; one for Craig's Bush (Aspin 2004, 5 species) and Taitua Forest (Cameron 2000, 16 taxa). The Hunua Ranges have been visited twice; the Wairoa Valley (McCraith 1997, 24 species) and the Whakatiwai Stonefields (Rogan 2000, 36 taxa). Further north, Young (2004) listed 5 species for McElroy's Scenic Reserve, Mahurangi; Haines & Lockett (2004) noted 18 taxa for a property at Horseshoe Bush Rd, Waitoki; Hayward & Hayward (1991b) recorded 80 lichen species for Tapu Bush, Pouto, on the north head of the Kaipara Harbour, and Rogan (1997) listed 24 lichen taxa for Maungaraho Rock, near Dargaville.

Several accounts of the lichens of the northern North Island have been published in other journals, including a paper on the lichens of Great Barrier and adjacent islands (Hayward et al. 1986) and one on the Three Kings Islands (Galloway & Hayward 1987). Detailed monographs of particular lichen genera usually include information on distribution and ecology of particular species. This can be useful if a species of interest is from the Auckland/Northland region. Monographs with useful information for the greater Auckland region include those on *Sticta* (Galloway 1997), *Pseudocyphellaria* (Galloway 1988), *Ramalina* (Blanchon et al. 1996) and *Leptogium* (Galloway 1999). The *Flora of New Zealand* series (Galloway 1985, 2007) also contains important distributional and ecological data for individual species.

Other sources of information about lichens in the Auckland / Northland region are unfortunately unpublished, which makes them more difficult to access. Several 'BioBlitz' events have been held, and while the lichen species lists for several of these have been published, most have not. Events were held in Dingle Dell and Meadowbank School, 2004 (56 taxa); Auckland Domain in 2005 (82 taxa); Henderson Park in 2006 (85 taxa); Smiths Bush in 2008 (updated and published as Blanchon et al 2010, 49 taxa); Auckland Domain again in 2010; the Auckland Botanic Gardens and Totara Park in 2012 (60 species) and Miranda, Firth of Thames in 2013 (33 taxa).

There has been some research done in Auckland using lichens as bioindicators of air pollution. Kooperberg (2002; 2004) surveyed lichen diversity on Auckland urban street trees and compared this with air pollution data. Kularatne and de Freitas (2013) used a small selection of lichens to investigate air pollution across the Auckland isthmus.

A visit to the Auckland Museum herbarium (AK) and other large herbaria in New Zealand will uncover information on collections of lichens from the Auckland region. Simple searches of New Zealand herbaria can now be done online via the New Zealand Virtual Herbarium database (www.virtualherbarium.org.nz). This database is becoming more useful as more records become available online.

Are any lichens in Auckland/Northland threatened with extinction?

Work is currently underway to review the conservation status of Auckland and Northland lichens. While we do not even exactly know how many lichen species are present in the region, it is useful to discuss those species occurring in northern New Zealand which are considered threatened nationally (Table 1). For example, it is possible that *Cladia muelleri*, previously known from Ninety Mile Beach, the Karekare Peninsula and the Chatham Islands is now extinct in Northland, as it has not been recently collected. It is currently listed as 'Nationally Critical' (de Lange et al. 2012b). Another species with a stronghold in Auckland and Northland is *Ramalina pacifica*, which is mysteriously disappearing from mangrove and pohutukawa sites, earning it the designation of 'Nationally Endangered' (Fig. 2). One Auckland/Northland species, *Teloschistes flavicans* is considered to be 'Declining', in particular from mainland sites (Fig. 3), but does remain in reasonable numbers on northern offshore islands. Comparing the New Zealand lichen Flora (Galloway 2007) with the recent threat classification for lichens (de Lange et al. 2012b) indicates that 52 species from Auckland and Northland are 'Naturally Uncommon', although it is likely that this is an underestimate as the distributions of some species are not well known.

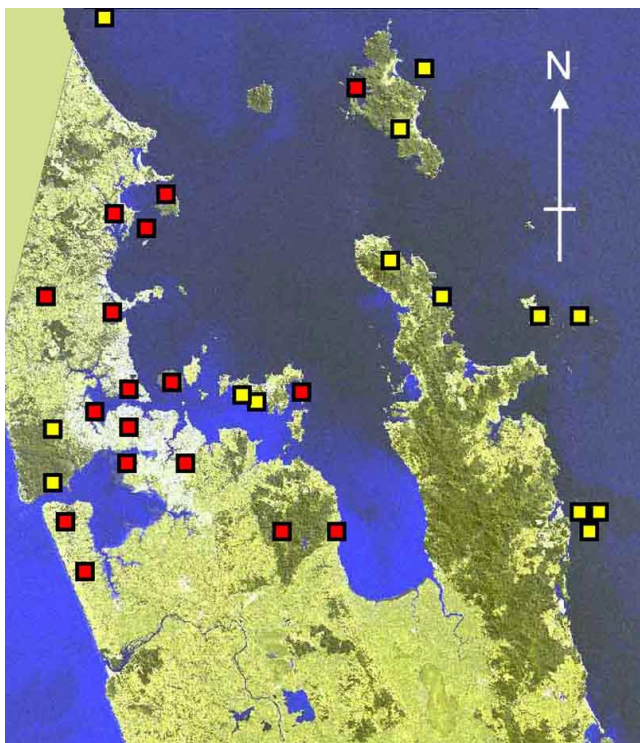


Fig. 1. Sites for which lichen species lists exist. Dark squares: *Auckland Bot. Soc. Journal* and *Bulletin* accounts. Light squares: records from *Tane*.



Fig. 2. *Ramalina pacifica*, on mangrove branch, Mataia, Kaipara Harbour. Photo: D. Blanchon, 19 February 2013.



Fig. 3. *Teloschistes flavicans*, on mangrove trunk, Mahurangi River. Photo: M. Galbraith.



Fig. 4. *Crocodia (Pseudocyphellaria) poculifera*, on fallen kanuka branch, Motu Kaikoura. Photo: D. Blanchon, July 2008.



Fig. 5. *Caloplaca mooreae* on mangrove trunk, Mataia, Kaipara Harbour. Photo: D. Blanchon, 13 December 2012.



Fig. 6. Foliose lichens on mangrove trunk, Mataia, Kaipara Harbour. Photo: D. Blanchon, 19 February 2013.



Figure 7. *Pertusaria psoromica* and *Porina exocha* on trunk of kahikatea, Smith's Bush. Photo: D. Blanchon, 29 September 2010.

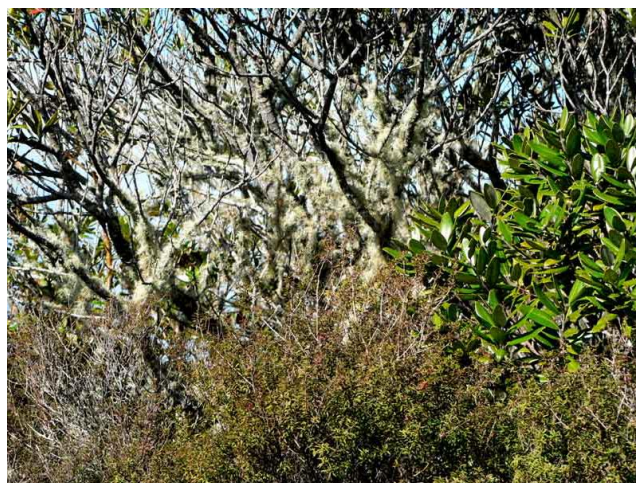


Figure 8. *Usnea rubicunda* on pohutukawa. Rangitoto. Photo: D. Blanchon, May 2005.



Figure 9. *Caloplaca allanii* on matrix of volcanic conglomerate, Piha. Photo: D. Blanchon & J. Sparkes, September 2012.



Figure 10. *Sticta* sp. on kanuka trunk, Motu Kaikoura. Photo: D. Blanchon, July 2008.



Figure 11. *Strigula delicata* on fallen tarairé leaf, Motu Kaikoura. Photo: D. Blanchon, December 2009.



Figure 12. Lichens on trunk of *Melia azeradach* tree, Sandringham, Auckland. Photo: D. Blanchon, June 2003.

Table 1: State of knowledge of the conservation status of the lichens of Auckland and Northland (adapted from de Lange et al. 2012b)

	Number of taxa, New Zealand (de Lange et al. 2012b)	Number of taxa, Auckland and Northland
Total	1799	?
Extinct	0	1?
Nationally Critical	4	1?
Nationally Endangered	4	1
Nationally Vulnerable	3	0
Declining	4	1
Naturally Uncommon	173	52
Data Deficient	975	?
Not Threatened	636	?
Endemic	375	?

Examples include *Crocodia* (*Pseudocyphellaria*) *poculifera*, a large conspicuous yellow-green foliose lichen of coastal forest (Fig. 4), and *Ramalina meridionalis*, a characteristic northern volcanic rocky shore lichen. It is not known how many species in the region are 'Data Deficient', but it is likely to be several hundred.

Important habitats for lichens in the Auckland Region

Old mangrove forests in Auckland and Northland are particularly important reservoirs of lichen biodiversity. A number of lichen species are known to occur commonly or mainly on the trunks and branches of older mangroves. In particular, species such as *Caloplaca mooreae* (Fig. 5) and species of *Ramalina* such as *R. australiensis*, *R. pacifica* and *R. geniculata* (Blanchon et al. 1996) and species of *Pseudocyphellaria* (Galloway 1988) are richly represented in New Zealand mangrove forest (Fig. 6). Old mangroves are an important habitat for threatened lichens such as *Teloschistes flavicans* and *Ramalina pacifica*. Little is published specifically about lichen diversity on New Zealand mangroves and a study is currently being carried out on this.

Podocarp forest can be very rich in lichens but little has been published specifically recording which lichens are found on particular podocarp species or forests in Auckland and Northland. Blanchon et al. (2010) briefly mention specific lichens growing on kahikatea (*Dacrycarpus dacrydioides*) trees at Smith's Bush (Fig. 7).

Coastal pohutukawa forest lichens are reasonably well known, with useful accounts from Rangitoto (Blanchon et al. 2007), Motu Kaikoura (Blanchon et al. 2011) and Tuhua/Mayor Island (de Lange et al. 2012a). Pohutukawa is an important substrate tree for large foliose lichen species such as *Pseudocyphellaria coriacea* and *Crocodia aurata* (Galloway 1988), and fruticose species such as *Ramalina australiensis* (Blanchon et al. 1996), *Usnea nidifica* and *U. rubicunda* (Fig. 8) (Galloway 2007).

Volcanic outcrops and coastal rocks support a diverse range of lichen species, but are often overlooked. Detailed accounts are available for a number of volcanic offshore islands such as the Hen and Chickens Islands (Hayward & Hayward 1984a & b), The Poor Knights Islands (Hayward & Wright 1991), Motu Kaikoura (Blanchon et al. 2011) and Tuhua/Mayor Island (de Lange et al. 2012a). Species of *Buellia*, *Caloplaca*, *Heterodermia*, *Parmotrema*, *Physcia*, *Xanthoparmelia* and *Xanthoria* are all commonly found. Marine lichens such as *Lichina pygmaea* and species of *Verrucaria* can be found if you know what to look for. Rarer lichens such as *Ramalina meridionalis* are restricted to northern coastal volcanic rocks (Blanchon & Bannister 2002), and several lichen species designated as 'Data Deficient' by de Lange et al. (2012b) have only been collected from coastal volcanic rocks (Fig. 9).

Younger manuka and kanuka forests can be depauperate in lichens, but older trees will often support a diverse range of species, particularly large foliose species of *Pseudocyphellaria* and *Sticta* (Fig. 10). Some information is available on the diversity of manuka and/or kanuka forest for Motu Kaikoura (Blanchon et al. 2011), Tapu Bush (Hayward & Hayward 1991b) and Tuhua/Mayor Island (de Lange et al. 2012a).

Leaves of certain native trees can be important habitat for some lichen genera. In particular, long-lived leaves such as those of totara (*Podocarpus totara*), nikau (*Rhopalostylis sapida*), tawa (*Beilschmiedia tawa*) and taraire (*B. tarairi*) all support lichens (Galloway 2007). In particular, many species of *Strigula* are found on leaves of tawa and taraire (Fig. 11), and have been recorded from Smith's Bush (Blanchon et al. 2010), Motu Kaikoura (Blanchon et al. 2011), Kirk's Bush and Titirangi (Galloway 2007).

Urban street trees in Auckland can be very rich in lichens, usually native forest edge species, such as *Dirinaria applanata*, *Heterodermia speciosa*,

Parmotrema perlatum, *P. reticulatum*, *Ramalina celastri* and *Usnea rubicunda*. Street trees such as Indian bead tree (*Melia azederach*) (Fig. 12), oak (*Quercus robur*) and pohutukawa are all good substrate tree species.

Where to from here?

- de Lange et al (2012b) listed 975 lichen taxa as 'Data Deficient'. It is not known exactly how many of these are found in Auckland, Northland and Coromandel, but it is likely to be several hundred. Some of these species have only been collected once, often 50+ years ago. Most of the lichens in this category are poorly known. Work is underway to slowly remedy this situation, but it is likely to take some time.
- Species listed as 'Threatened' should be monitored over time. Surveys of population trends and any threats need to be carried out, and we need to improve our knowledge of the distribution and ecology of these species.

- We need to improve our knowledge of individual sites, visiting forest fragments and coastal areas, publishing species lists and depositing voucher specimens in herbaria. Previously visited sites should be revisited to determine if any species are declining and old species lists should be revised and updated.

- If lichens have disappeared from any sites we need to investigate translocation methods. Some work on such methods has been done overseas (e.g. Scheidegger 1995).

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Our current level of knowledge is based on the hard work over many years by a number of lichenologists and those interested in lichens. The list is long but includes: David Galloway, Glenys Hayward, Bruce Hayward, Anthony Wright, Peter de Lange, Rick Kooperberg, Carol Elliott, Jennifer Bannister, Alison Knight, Enid Asquith, Indra Kularatne, Mike Wilcox, Doug Rogan and Ewen Cameron. I would also like to thank those who supplied photographs.

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Vascular flora (and some fauna) of islands/islets in the Hauraki Gulf

Ewen K. Cameron

This talk is partly based on a wider talk given to the Auckland Botanical Society (ABS) in 2006 on twelve small northern New Zealand islands (Cameron 2006). However, today's talk is confined to the Hauraki Gulf islands of which only three were included in the previous talk. Examples, mostly based on my personal experiences and ABS field trips, will be given of some special features, threats, progress, and I will finish with some conclusions (several examples and recent references have been added since the talk).

Based on the northern offshore island register (Taylor 1989), Lee (1999) recorded that there are 425 islets and islands in the Hauraki Gulf, ranging in size from 0.1 to 27,761 ha (Great Barrier Island), but most are < 1 ha. This is a remarkable biological resource at our doorstep, each with clearly defined boundaries making them ideal study areas. The biota

of some is well known, but many are still undocumented. ABS has greatly assisted in the botanical recording with 29 Society trips to Gulf islands (Fig. 1) and 73 *Journal* articles on Gulf islands over the last two decades (1993–2012).

When landing for the first time on an island with little previous published information, a quick search can be made for 'good signs' that indicate whether the vegetation is in a healthy condition and whether the island is mammalian-pest-free, e.g. presence of special northern 'island' plants (defined below), copious invertebrates (under rocks and wood), and good lizard and nesting seabird numbers. These all indicate a lack of major disturbance and mammalian predators, e.g., rats, stoats, possums or cats. 'Bad signs' would include: rat caches of gnawed seeds, mammalian faeces, and environmental weed species.