

<i>Phlegmariurus billardierei</i>	1 October 2017, one on bush margin high on northern cliffs above Pascoe's Quarry. 22 October 2019 same plant relocated, along with one other. Both sterile. 28 September 2022, original plant relocated, now fertile.
<i>Calystegia tuguriorum</i>	Winter 2018, rare. Two plants seen, one on forest floor, the other climbing into canopy [in light-well]. 3 July 2020, locally common in disturbed area [light-well].
<i>Dichondra repens</i>	13 December 2020, large patch growing in mown lawn between Withiel Drive and rock forest remnant. AK382580, Goodwin 2020
<i>Wahlenbergia vernicosa</i>	1 October 2017, occasional, sunny spots, along bush margin high on northern cliffs above Pascoe's Quarry. March 2021, unable to relocate any plants.
<i>Microlaena stipoides</i>	Winter 2018, few in open spots along northern bush margin.
<i>Melicope ternata</i>	Winter 2018, rare. One tree on margin [of Withiel Drive], probably cultivated. 25 April 2023, small clump of seedlings on southern margin.
<i>Solanum laciniatum</i>	September 2018, one big shrub on road margin, flowering. 22 October 2019, large shrub on road margin. AK380920, Goodwin 2019. NB: these plants almost certainly naturalised here from cultivated plants nearby (e.g., on the Maungawhau cone). This species seems to have replaced <i>Solanum aviculare</i> , which was previously present (1990s).
<i>Streblus banksii</i>	25 April 2023. One small wild plant, presumably naturalised from garden plants nearby.

A secondary kauri bush block at Laingholm, west Auckland

Mike Wilcox, Geoff Davidson, Ben Goodwin

Introduction

We held a field trip on 17 June 2023 to the bush-clad 4 ha property of Tony van Raat and Penny Sender at 129 Laingholm Drive, Laingholm (Figs. 1, 2, 3). The sixteen people attending were *Jenny Andrew*, *Amanda Charlton*, *Geoff Davidson* (co-leader), *Frances Duff*, *Alex Fox*, *Beth Gibbs*, *Ben Goodwin* (principal plant recorder), *Leslie Haines*, *Saryu Mae*, *Peter Moosberger*, *Sharon Osman*, *Suman Pancha*, *Helen Preston Jones*, *Juliet Richmond*, *Joshua Salter*, *Mike Wilcox* (co-leader). A list was compiled of the plants and fungi present (see Appendix). Photos by Mike Wilcox (MW), Amanda Charlton (AC), Beth Gibbs (BG), Geoff Davidson (GD) and Joshua Salter (JS).

Geography

The property is at an elevation of 20 to 70 m, gently sloping to the east towards the shore of Little Muddy Creek, Manukau Harbour. The underlying geology is Tertiary complex marine breccias and conglomerates (Parnell Grit) overlying Tertiary Waitemata Sandstones and Mudstone (Hayward 1976, 2017; Allen 2004), though there are no rock outcrops or exposures here. The land was farmed up to 1920 (Laing 1985). The soil type is Parau Clay Loam (Martindale et al. 2008), a comparatively deep and well-drained fertile soil over most of the property, but shallower and less fertile on the ridges.

Forest types and history

The forest cover is complete, comprising second-growth kauri (*Agathis australis*) ricker forest (Figs. 4, 5) (Forest Ecosystem Type 10.2, Regenerating kauri 'ricker' stands, of Singers et al. 2017), with plentiful tānekaha (*Phyllocladus trichomanoides*) and kānuka (*Kunzea robusta*), and with a sprinkling of rimu (*Dacrydium cupressinum*), Hall's tōtara (*Podocarpus laetus*), and rewarewa (*Knightia excelsa*), and part of a larger expanse of this type of forest in Laingholm (Fig. 2). It is mapped as Forest Class *Kauri-Softwoods-Hardwoods* (Clarkson & Clarkson 1993) and has developed following kauri logging in the 1850-1920 period (Harvey 2006), clearing and burning of the logged kauri forests and scrubland for farm development by early settlers, and reversion to mānuka (*Leptospermum scoparium*) scrub and then kānuka – this latter still plentiful here (Fig. 3) – following abandonment of farming, and subsequent subdivision and sale as bush blocks for private houses in the 1960s and 70s. A 1940 aerial photo shows just low scrub with very few tall trees on the site, other than in a stream gully on the southern boundary. Laingholm Drive shows up in a 1959 photo, but with no house or driveway into the property. The kauri trees are in the range of 30-55 cm DBH (diameter at breast height), with a probable age range of 100-120 years (based on a mean diameter of 45 cm and mean annual diameter



Figs. 1–3: **1.** Location of 129 Laingholm Drive. Brown rectangle shows area included in Fig. 2. From NZTopo50 Map Laingholm BB31, adapted by Joshua Salter. Scale: 1 km square grid. **2.** 129 Laingholm Drive is mostly regenerating forest. White dashed line indicates boundary. Auckland Council GeoMap, modified by Joshua Salter. Scale bar = 100 m. **3.** Canopy of kānuka with emergent kauri, 2008 (Auckland Council GeoMap, modified by Joshua Salter. Scale bar = 10 m.



Fig. 4. Kauri rickers. Photo: MW, 17 June 2023.



Fig. 5. Bot Soc group. Photo: MW, 17 June 2023.



Fig. 6. The biggest kauri, at 100 cm diameter. Photo: MW, 6 July 2023.



Fig. 7. *Astelia trinervia*. Photo: MW, 17 June 2023.

increment of 0.4 cm/year). On a steep slope above a creek are a few large kauri (100 cm DBH) with spreading crowns, likely to be 250 years old or so, and pre-dating the forest destruction during European settlement (Fig. 6).

Hatch (1994) has given a brief account of the vegetation of Laingholm, together with a list of plants. Other relevant references to the flora and vegetation of this area are Beever (2006), Braggins (2006), Esler (2006), Harvey (2006), and Hatch (2006). Cameron & Morton (1993) provide a great account of Auckland's native forests, of which this Laingholm property is a fine example of regenerating forest. More generally, Mirams (1957), Ecroyd (1982) Burns & Smale (1990), Ogden & Stewart (1995), and Beveridge, Stewart & Bergin (2009) provide informative insight on how secondary kauri forests such as this have developed.

Kauri and its associates

It is well documented (Bieleski 1975a, b; Wyse, Burns & Wright 2014) that kauri forest typically has a suite of associated or companion species adapted to thrive in the understorey, with the soil over time becoming highly acidic, infertile, and tending to podsolization. At this site in Laingholm we observed the following kauri associates:

<i>Alseuosmia macrophylla</i>	toropapa
<i>Astelia trinervia</i>	kauri grass
<i>Brachyglottis kirkii</i> var. <i>angustior</i>	kohurangi, Kirk's tree daisy
<i>Coprosma lucida</i>	shining karamū
<i>Coprosma spathulata</i>	
<i>Gahnia pauciflora</i>	
<i>Leionema nudum</i>	mairehau
<i>Leucopogon fasciculatus</i>	mingimingi
<i>Olearia furfuracea</i>	akepiro
<i>Phyllocladus trichomanoides</i>	tānekaha
<i>Pterostylis brumalis</i>	kauri greenhood orchid
<i>Toronia toru</i>	toru



Figs. 8–12: **8.** *Leucobryum javense*. Photo: MW, 6 July 2023. **9.** *Olearia furfuracea*, with strongly serrated leaves, Photo: JS, 17 June 2023. **10.** *Mniodendron colensoi*. on tree fern stump. Photo: AC, 17 June 2023. **11.** *Mniodendron colensoi*. on forest floor. Photo: MW, 17 June 2023. **12 a, b.** Two *Corybas cheesmanii* plants. Photos: Ben Goodwin (12a); Amanda Charlton (12b); 17 June 2023.

The most prominent of these in the understorey were the highly shade-tolerant *Alseuosmia macrophylla* and *Brachyglottis kirkii*, *Coprosma lucida*, *C. spathulata*, *Leucopogon fasciculatus*, and more locally, *Astelia trinervia* (Fig. 7). Kauri and tānekaha seedlings were common.

Other observations

Other plants seen here that are not exclusive to kauri forest, were māmāngi (*Coprosma arborea*), *Coprosma rhamnoides*, silver tree fern (*Cyathea dealbata*), rimu, *Gahnia xanthocarpa*, *G. setifolia*, hangehange (*Geniostoma ligustrifolium*), pigeonwood (*Hedycarya arborea*), māpou (*Myrsine australis*), five-finger (*Pseudopanax arboreus*), *Pterostylis trullifolia*, rewarewa, kānuka, Hall's tōtara and miro (*Pectinopitys ferruginea*).

A few dead kauri rickers were seen – likely victims of kauri dieback disease *Phytophthora agathidicida* – but otherwise this looks to be a healthy forest. Several old kānuka trees have fallen, creating canopy gaps in the forest (some colonised by nikau, *Rhopalostylis sapida*), but the property did not suffer any windblow or soil erosion during the 2023 January and February storms.

Native conifers (especially kauri and tānekaha) and kānuka are the dominant woody trees in the bush here, with just a few other scattered broadleaved trees. As well as the wind-dispersed rewarewa we observed a sizeable kohekohe (*Didymocheton spectabile*) and a white maire (*Notelaea lanceolata*), both animal-dispersed. Kānuka has been very prominent as the major nurse for the developing forest. At present these trees are around 18m tall, with DBH c. 30 cm. The Auckland Council GeoMap aerial photo (Figs. 2, 3) shows dense canopies of kānuka, which are now breaking up, with trees collapsing as the dominant kauri emerge above it. Although Ecosystem Type 10.2 Regenerating kauri 'ricke' stands (but here including residual kānuka) applies to much of the area, Type WF11 Kauri, podocarp, broadleaves, is trending towards becoming a better fit on the more fertile slopes, and both have been through an earlier phase of VS2 Kānuka scrub/forest (following Singers et al. 2017 classification).

Broadleaved tree species seen here only as rare seedlings were pūriri (*Vitex lucens*), karaka (*Corynocarpus laevigatus*), tawa (*Beilschmiedia tawa*) and toru (*Toronia toru*).

An open mānuka association persists in a few places, with plants such as the sedges *Lepidosperma laterale*, *Morelotia affinis*, *Schoenus tendo*, the club-moss *Lycopodium volubile*, milk moss (*Leucobryum javense*) which forms hummocks on the ground (Fig. 8) and on exposed tree roots, and

with the shrubs prickly mingimingi (*Leptecophylla juniperina*), akepiro (*Olearia furfuracea*) – several with unusually deeply serrate leaves (Fig. 9), *Gonocarpus incanus*, and *Veronica plebeia*. Tangle fern (*Gleichenia microphylla*) was locally common in one area, with a dense colony spreading across several square meters.

Smaller plants to attract our attention were the umbrella moss *Mniodendron colensoi* (Fig. 10) on a tree fern trunk and forming carpets on the ground on the forest margins (Fig. 11); the ground orchids *Corybas cheesemanii* (Fig. 12), *Pterostylis brumalis* (Fig. 13) and *P. trullifolia*; and the native herbs *Centella uniflora* and *Nertera dichondrifolia* – the most abundant native herb on the forest floor. The *Nertera* and the umbrella moss seem particularly shade tolerant. Common maidenhair (*Adiantum cunninghamii*) was frequently seen in the kauri forest.

A damper site near the entrance to the property has a grove of kahikatea (*Dacrycarpus dacrydioides*), with saplings of putaputawētā (*Carpodetus serrata*), kawakawa (*Piper excelsum*), pigeonwood (*Hedycarya arborea*), māhoe (*Melicytus ramiflorus*), kiekie (*Freycinetia banksii*), mamaku tree fern (*Cyathea medullaris*) and kiokio (*Blechnum novae-zelandiae*). A small creek flows down through the property and under Laingholm Drive by Janet Place to Little Muddy Creek on the Manukau Harbour.

Epiphytes and lianes are noticeably sparse. The abundant tree fern *Cyathea dealbata* supports low epiphytes on its trunks, notably *Tmesipteris lanceolata* (Fig. 14) and *Asplenium flaccidum*, and we saw the rātā vines *Metrosideros fulgens* and *M. perforata*. Mangemange (*Lygodium articulatum*) and *Lecanopteris scandens* are present. We saw no perching epiphytes on the tallest trees. Kiekie (*Freycinetia banksii*) and supplejack (*Ripogonum scandens*) are sparse. The foliose lichen *Parmotrema reticulatum* was common on kauri trunks on the edge of the driveway.

Silver tree fern is plentiful in this bush. In some places it is the main cover, without canopy trees. Such sites may have been burned, or harvested for tea tree firewood, with the tree fern surviving by resprouting. Brock et al. (2016) indicated that silver tree fern favours fertile well-drained sites in early successional forest, and can inhibit, through shading and the hindrance of fallen dead fronds, the regeneration of tree species such as rewarewa and kohekohe, and can live for up to 250 years. Furthermore, Brock et al. (2020) indicated that the persistence of conifers (e.g., rimu and kauri) is promoted at the expense of broadleaved canopy trees when a tree fern sub-canopy is present.



Figs. 13–19: **13.** *Pterostylis brumalis*. Photo: GD, 17 June 2023. **14.** *Tmesipteris lanceolata* on trunk of *Cyathea dealbata*. Photo: AC, 17 June 2023. **15.** *Breutelia pendula*. Photo: MW, 6 July 2023. **16.** *Calliergonella cuspidata*. Photo: MW, 6 July 2023. **17.** Hakeke (*Auricularia cornea*), on dead wood. Photo: BG, 17 June 2023. **18.** *Gymnopilus crociphyllus*, on dead kanuka. Photo: BG, 9 July 2023. **19.** Pekepeke-kioire (*Hericium novae-zealandiae*) on a dead kauri. Photo: BG, 17 June 2023.

Modified open sites (very damp this year) near the house, including the grassy road verges, support a mixed turf of the mosses *Breutelia pendula* (Fig. 15)

and the introduced *Calliergonella cuspidata* (Fig. 16), with the native herb *Centella uniflora*, and in places, *Euchiton japonicus*. Beth Gibbs found the pink dot

lichen, *Dibaeis absoluta*, on a soil bank beside the driveway, and also recorded several fungi (Figs. 17, 18, 19) (see Appendix).

The main exotic plants observed were lilly pilli (*Syzygium smithii*) saplings in damper forest at the entrance, occasional seedlings of loquat (*Eriobotrya japonica*) and Queensland poplar (*Homalanthus populifolius*), Kahili ginger (*Hedychium gardnerianum*), phoenix palm (*Phoenix canariensis*), climbing asparagus (*Asparagus scandens*), and patches of blue-eyed iris (*Aristea ecklonii*, African clubmoss (*Selaginella kraussiana*), and in scrub near the house, gorse (*Ulex europaeus*), *Hakea salicifolia* and *H. sericea*.

Conclusion and thanks

This forest is dynamic and thriving. It is protecting the land, providing habitat for native plants and

invertebrates, and is contributing to carbon sequestration. Kauri, tātēkaha and the declining kānuka are the main trees here, with kauri the present and long-term dominant. The favourable soil suggests that further recruitment of broadleaved trees and nikau may be expected, but this will require nearby seed trees, birds (especially NZ pigeon) to disperse the seed into the site, and freedom from possums and rats.

Our sincere thanks to Tony van Raat and Penny Sender for inviting us to explore their native bush, and for their kind hospitality. Amanda Charlton, Geoff Davidson, Beth Gibbs, and Joshua Salter provided photos, and Jessica Beever confirmed the identity of the umbrella moss. Kirsty Myron helped with the editing of the manuscript.

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Appendix. Species list for plants, fungi and lichens at 129 Laingholm Drive, Auckland.

*= exotic; pl.= planted

Liverworts

Lunularia cruciata *

Mosses

Breutelia pendula (Fig. 15)

Calliergonella cuspidata * (Fig. 16)

Leucobryum javense (Fig. 8)

Mniodendron colensoi (Figs. 10, 11)

Thuidiopsis furfurosa

Lycopods

Lycopodium deuterodensum

Lycopodium volubile

Selaginella kraussiana *

Ferns [Names follow Schönberger et al. 2022]

Adiantum cunninghamii

Adiantum hispidulum (pl.)

Asplenium flaccidum

Asplenium oblongifolium

Asplenium polyodon

Blechnum novae-zelandiae

Blechnum filiforme

Blechnum fraseri

Blechnum parriseae

Cyathea dealbata

Cyathea medullaris

Deparia petersenii

Gleichenia microphylla

Hymenophyllum nephrophyllum

Lastreopsis hispida

Lecanopteris pustulatum (*Microsorium pustulatum*)

Lecanopteris scandens (*Microsorium scandens*)

Lindsaea trichomanoides

Lygodium articulatum

Nephrolepis cordifolia * (encroaching on northern boundary from neighbours on Laingholm Drive)

Paesia scaberula

Pakau pennigera (*Pneumatopteris pennigera*)

Psilotum nudum

Pteridium esculentum

Pteris macilenta

Pteris tremula

Tmesipteris elongata

Tmesipteris lanceolata (Fig. 14)

Conifers

Agathis australis (Fig. 6)

Dacrycarpus dacrydioides

Dacrydium cupressinum

Pectinopitys ferruginea (*Prumnopitys ferruginea*)

Phyllocladus trichomanoides

Pinus pinea * (pl., house area)

Podocarpus laetus

Dicot trees, shrubs, and climbers

Alseuosmia macrophylla

Aristotelia serrata

Beilschmiedia tawa (seedling only)

Brachyglottis kirkii var. *angustior*

Brachyglottis repanda

Carpodetus serratus

Coprosma arborea

Coprosma lucida

Coprosma macrocarpa subsp. *minor*

Coprosma rhamnoides

Coprosma robusta

Coprosma spathulata

Corynocarpus laevigatus (seedlings, saplings only)

Didymocheton spectabile (*Dysoxylum spectabile*)

Dodonaea viscosa (pl., house area)

Eriobotrya japonica *

Geniostoma ligustrifolium

Hakea salicifolia *

Hakea sericea *

Hedycarya arborea

Homalanthus populifolius *

Knightia excelsa

Kunzea robusta

Leionema nudum

Leptecophylla juniperina

Leptospermum scoparium

Leucopogon fasciculatus

Metrosideros excelsa (pl.)

Metrosideros fulgens

Metrosideros perforata

Muehlenbeckia complexa (pl., house area)

Myrsine australis

Myrsine salicina

Notelaea lanceolata (*Nestegis lanceolata*)
Olearia furfuracea (Fig. 9)
Olearia rani
Piper excelsum
Pittosporum eugenioides
Pseudopanax arboreum
Pseudopanax crassifolius
Pseudopanax crassifolius × *P. lessonii*
Rubus australis × *R. cissoides*
Sophora microphylla (pl.)
Syzygium smithii *
Toronia toru
Vitex lucens (seedlings only)

Dicot herbs

Centella uniflora
Daucus carota subsp. *carota* *
Elatostema rugosum (pl.)
Euchiton japonicus
Geranium homeanum
Gonocarpus incanus
Hydrocotyle moschata
Hydrocotyle tripartita *
Lobelia anceps
Lobelia angulata *
Nertera dichondrifolia
Prunella vulgaris *
Ranunculus repens *
Stellaria media *
Trifolium repens *
Tropaeolum majus * (house area)
Veronica plebeia

Monocots

Acianthus sinclairii
Agapanthus praecox *
Archontophoenix cunninghamiana * (seedling)
Aristea ecklonii *

Arthropodium cirratum (pl.)
Asparagus scandens *
Astelia trinervia (Fig. 7)
Canna indica *
Carex banksiana (*Uncinia banksii*)
Carex dissita
Carex lessoniana
Carex uncinata (*Uncinia uncinata*)
Cordyline australis
Cordyline banksii
Corybas cheesemanii (Fig. 12)
Cyperus congestus *
Cyrtostylis oblonga
Dianella nigra
Freycinetia banksii
Gahnia lacera
Gahnia pauciflora
Gahnia setifolia
Gahnia xanthocarpa
Hedychium gardnerianum *
Ichthyostomum pygmaeum
 (*Bulbophyllum pygmaeum*)
Lepidosperma laterale
Microtis unifolia
Miscanthus nepalensis *
Monstera deliciosa * (pl.)
Morelotia affinis
Oplismenus hirtellus
Phoenix canariensis *
Pterostylis brumalis (Fig. 13)
Pterostylis trullifolia
Rhopalostylis sapida
Ripogonum scandens
Schoenus tendo
Thelymitra longifolia
Tradescantia fluminensis *

Fungi (by Beth Gibbs)

<i>Auricularia cornea</i>	on dead wood	iNaturalistNZ 168217615, 17 June 2023	(Fig. 17)
<i>Beauveria</i> sp.	on dead shield bug	iNaturalistNZ 168401781, 17 June 2023	
<i>Collybiopsis villosipes</i>	on dead punga	iNaturalistNZ 168750694, 17 June 2023	
<i>Cortinarius</i> sp. A	driveway, soil/leaves	iNaturalistNZ 171877020, 6 July 2023	
<i>Cortinarius</i> sp. B	on tree fern trunk	iNaturalistNZ 171871328, 6 July 2023	
<i>Gymnopilus crociphyllus</i>	on dead kanuka	iNaturalistNZ 171663936, 6 July 2023	(Fig. 18)
<i>Hericium novae-zelandiae</i>	on dead kauri	iNaturalistNZ 168579282, 17 June 2023	(Fig. 19)

<i>Laccaria</i> sp.	driveway, soil/moss	iNaturalistNZ 171665149, 6 July 2023
<i>Nidula</i> sp.	on fallen kauri twig	iNaturalistNZ 171868691, 6 July 2023
<i>Protheleum albodecendens</i>	on fallen twig	iNaturalistNZ 168751859, 17 June 2023
<i>Roridomyces</i> sp.	on dead wood	iNaturalistNZ 168579941, 17 June 2023

Lichens

<i>Dibaeis absoluta</i>	driveway, soil bank	iNaturalistNZ 17243215, 6 July 2023
<i>Parmotrema reticulatum</i>	on kauri tree trunks at edge of driveway	

ABS field trip, 15 July 2023 to Sylvan Park and Kitchener Park, Milford, Auckland City

Rhys Gardner

A hundred and fifty years ago the volcanic crater of Lake Pupuke was ringed by native forest (its extent clearly shown in two Auckland Libraries maps, from 1863 and 1886, referenced below). Sylvan Park and Kitchener Park, on the northern side of the lake, contain almost all of what remains of it. Like the better-known Smith's Bush a short way to the south, these two contiguous reserves represent an old-growth community of great rarity in the Auckland City region.

Large karaka (*Corynocarpus laevigatus*) (Fig. 1), kohekohe (*Didymocheton spectabilis*) and taraire (*Beilschmiedia tarairi*), and a lesser number of puriri (*Vitex lucens*), make up most of the forest canopy. Big old kowhai (*Sophora chathamica*) were much more conspicuous forty years ago (Gardner 1986) than they are now, many having died or declined to a stump and a few branches (but as we saw, the latter are still producing copious amounts of seed) (Fig. 2).



Fig. 1. Old karaka tree still managing to produce a canopy. Photo: EK Cameron, 15 Jul 2023.



Fig. 2. ABS group inspecting the two old kowhai by the carpark. Photo: EK Cameron, 15 Jul 2023.