

Flora of the Waimamaku catchment, western Northland

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Introduction

Waimamaku is located in Western Northland south of the Hokianga Harbour (Figs. 1, 2). The Waimamaku River runs through the area out to the Tasman Sea on the West Coast. The Waimā Forest lies along the northern boundary and Waipoua Forest along the south, and together with these surrounding areas it forms part of the Tutamoe Ecological District (Miller & Holland 2008). The Waimamaku catchment is a relatively undeveloped and unsurveyed area and is therefore likely to hold a wide range of unrecorded biodiversity.

Geology

The soil, derived from andesitic basalt of the Waipoua Volcano and Tangihua basalts of the Waimā Range, consists of northern brown granular clays and loams, known to be extensive on hilly land and upland plateaus. Most of the catchment is strongly leached Waitakere clay indicative of land subjected to aeons

of weathering under a wet climate and previously covered in mixed podocarp-kauri (*Agathis australis*) forest. Within the Waimamaku valley and on the extensive floodplain near the coast there are thick fertile alluvial soils that would once have supported broadleaf forests but are now extensively farmed (Fieldes, 1968). The Waimamaku River is one of three main catchments that drains the Waipoua plateau. Where it drains out to the West coast, large dune complexes are present (Miller & Holland, 2008).

An anticline (an up-folding of rock strata into an arch-like shape) has formed a structural trap running through the Waimamaku Valley along where the river flows (Hayward, 2017). Where some layers are impermeable, such a formation can trap water or other fluids under the surface. Formed at depths, hydrocarbons (gas or liquid) tend to rise to the surface. Because of this, Waimamaku was explored for hydrocarbons by the drilling of wells (Bruce Haywood pers. comm.).

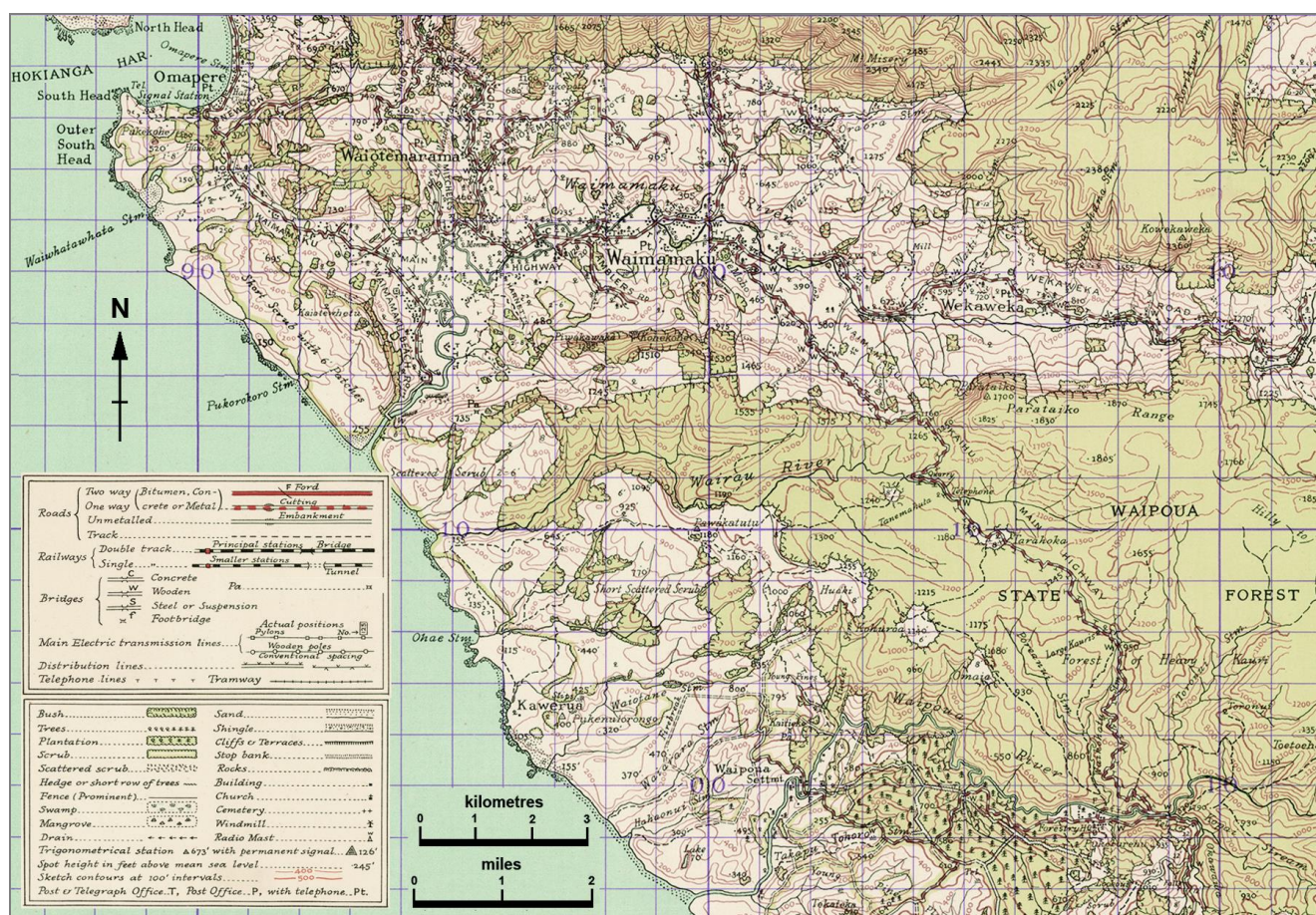


Fig. 1. Historical Map of Waimamaku. Waipoua, NZMS1 N18 1:63360 [1st ed] 1944. Modified by Joshua Salter.
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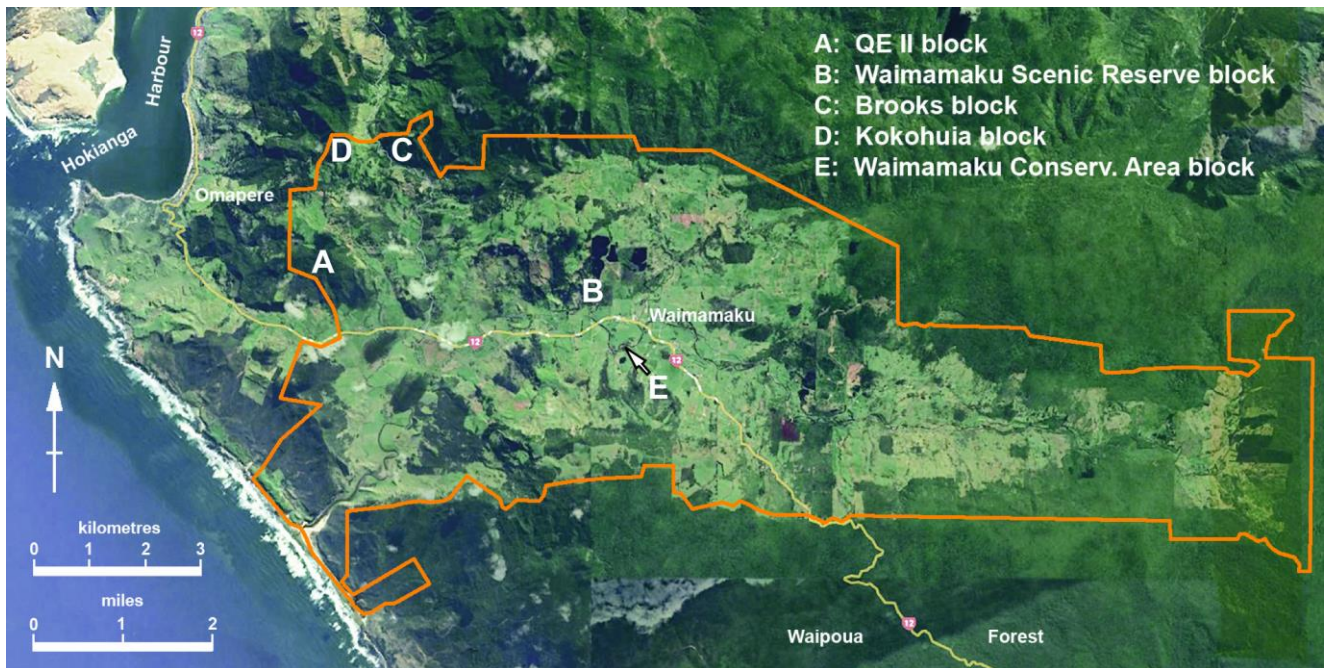


Fig. 2. Locations of the surveyed blocks in the Waimamaku catchment (within orange outline): QEII (A), Scenic Reserve (B), Brooks (C), Kokohuia (D) and the Waimamaku Conservation area (E). Google Earth map modified by Joshua Salter.

Methods

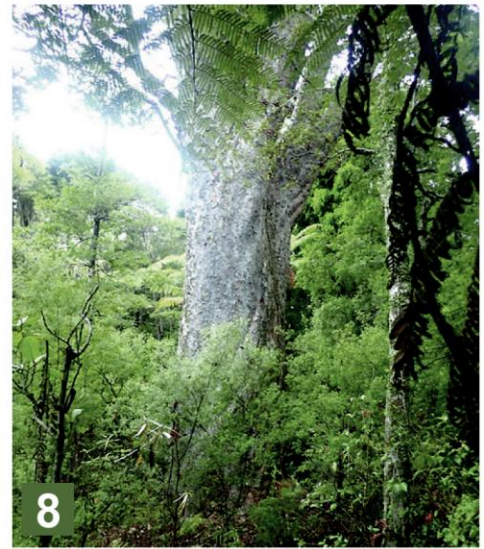
A survey of the flora was carried out in the Waimamaku catchment over the period 16th December 2020–26th March 2021. The site was traversed on foot, and all plants and fungi were recorded (see Appendix 1 A, B). In addition, vegetation associations were mapped, and species and areas suitable for revegetation were identified. For surveying purposes, the vegetation was separated into five Blocks shown in Fig. 2: QEII (A), Waimamaku Scenic Reserve (B), Brooks (C), Kokohuia (D) and the Waimamaku Conservation area (E). The original purpose of this survey was to provide advice to Landcare groups and the Department of Conservation on management requirements for endangered and locally significant

plant species within the Waimamaku catchment, including a range of forest associations.

Plant threat statuses in this report are from the Conservation Status assessment (de Lange et al. 2018a). The threat status categorises plants as, for instance, 'Threatened-Nationally Endangered', or 'at Risk-Declining', or 'Data Deficient'. 'Data Deficient' means a species may be 'Threatened' or 'At Risk' but there is a lack of current information about its distribution and abundance (de Lange et al. 2018a). Information on 'Regionally at-risk' sparse and 'Regionally Significant' species is from the *Natural areas of Tutamoe Ecological District* report (Miller & Holland 2008). A list of nationally- and regionally-threatened plants known to be in the Waimamaku



Figs. 3–4: **3.** Forest margin of the QEII block, the shrubby margins dominated by kikuyu and regenerating natives, 26 Mar 2021. All photos by the author. **4.** Taraire-dominated broadleaf forest with nikau understorey on the steep slopes of the QEII Block, 26 March 2021.



Figs. 5–10: **5.** Filmy fern (*Hymenophyllum demissum*) carpet on the shaded taraire forest floor, QEII Block, 26 March 2021. **6.** Patch of *Dicksonia lanata* subsp. *hispida* in the understorey, QEII Block, 26 March 2021. **7.** Tangle fern and kiokio under mānuka and towai at the QEII Block, 26 March 2021. **8.** Large emergent kauri with a trunk 2.7 m diam., QEII Block, 26 March 2021. **9.** Weedy infestation of pampas and ginger on recent slips, QEII Block, 26 March 2021. **10.** Velvet fern on the ground in the broadleaf-dominated slope forest, QEII Block, 26 March 2021.

catchment was compiled using the Australasian Virtual Herbarium (AVH) and the Department of Conservation's Bioweb Threatened Plants Database (see Appendix 2). Additional records, based on herbarium specimens of plants not recorded in these surveys, are compiled in Appendix 3.

Vegetation

Prior to European settlement most of the Waimamaku catchment would have been covered in

a dense forest of podocarps and broadleaves. Most of the Waimamaku area was initially cleared for sheep farming; today mostly dairy and beef farms are present. The lowlands of this ecological district have been highly modified but the surrounding Waima, Waipoua and Mataraua Forests make up some of the largest contiguous tract of indigenous forest in Northland (Miller & Holland 2008). Outside of these large forested areas there are significant natural features of national importance, located

towards the mouth of the Waimamaku River (Miller & Holland 2008). These are coastal and dune remnants, containing several threatened species. There are also some old growth forest remnants on an alluvial base.

In total, 363 vascular plant species were found during the survey across all sites. Of these, 238 were native and 125 exotics. The mistletoe *Peraxilla tetrapetala* (At-Risk – Declining nationally and Chronically Threatened regionally) was known from one record on an isolated tōwai tree (*Pterophylla sylvicola*) in farmland between Waimā and Waipoua, within the Waimamaku catchment (Forester & Townsend 2004). The plant has since died at this location and is now possibly extinct in Northland because of pressure from the introduced predators the brushtail possum (*Trichosurus vulpecula*), as it has not been recorded recently (Forester & Townsend 2004).

Survey findings for Forest Blocks A to E:

A: QEII Block

The QEII covenant is a 97 ha, privately owned, forest remnant (Fig. 2). This forest forms part of the SNA (Significant Natural Area) Waiwhatawhata Bush (FN636). This remnant has been milled historically but still has some large trees present. Most likely it was dominated by kauri on the ridges, indicated by the remnant large trees and ricker stands that remain. Now the forest is a mix of broadleaf and podocarps, the shrubby margins dominated by kikuyu (*Cenchrus clandestinus*) (Fig. 3). The steep forests are dominated by broadleaf forest with a coastal influence (Fig. 4). On the slopes taraire (*Beilschmiedia tarairi*) forest dominates the canopy with a few large emergent kahikatea (*Dacrycarpus dacrydioides*) and nikau (*Rhopalostylis sapida*) and shrubs including hangehange (*Geniostoma ligustrifolium*) underneath.

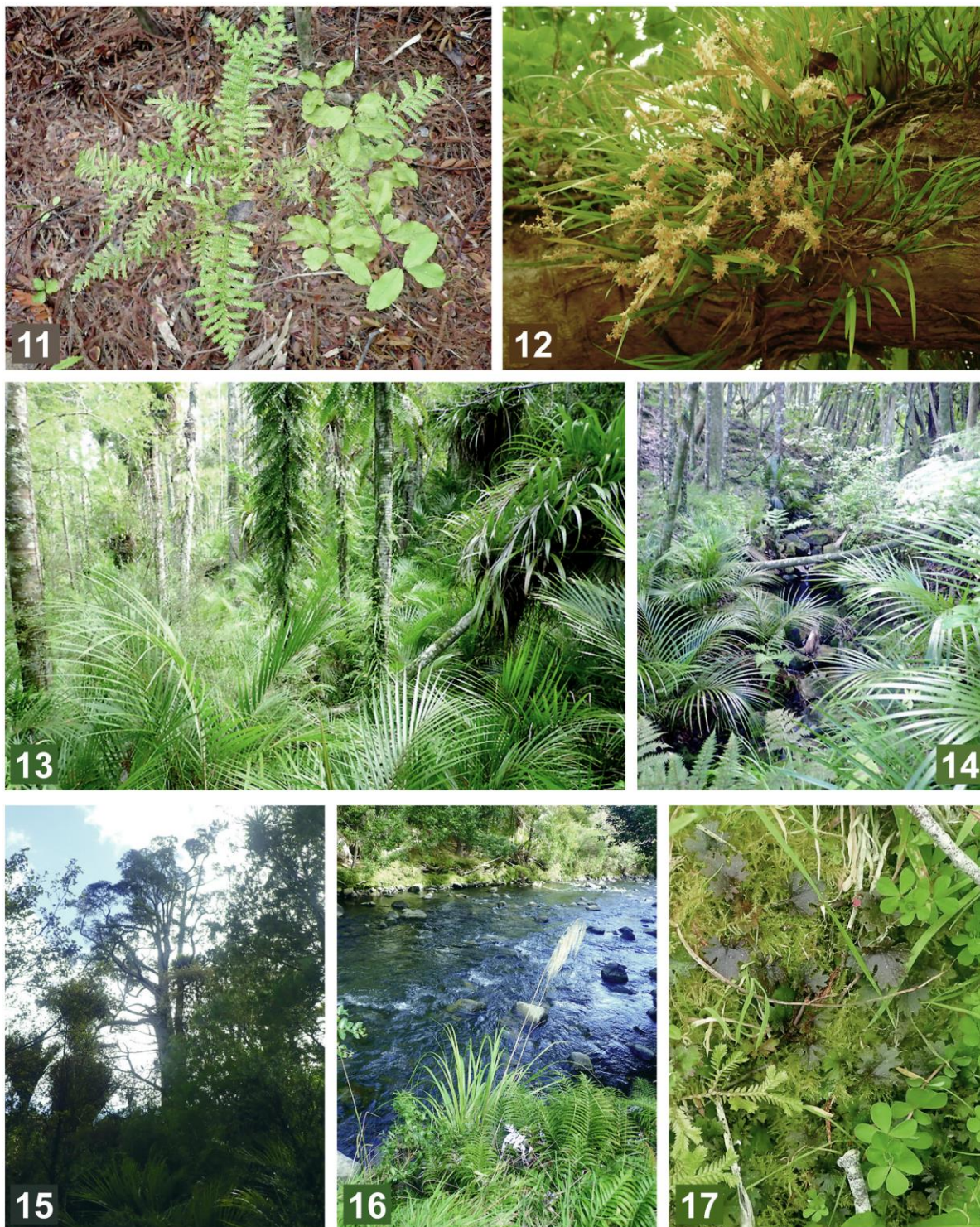
Broadleaf forest also dominates on the ridge top, the plateau being covered with patches of taraire and pūriri (*Vitex lucens*) forest with nikau and silverfern (*Alsophila tricolor*) in the subcanopy, the shining coprosma (*Coprosma lucida*) and māhoe (*Melicactus ramiflorus*) in the understorey with supplejack (*Ripogonum scandens*) growing throughout, the occasional kiekie (*Freyinetia banksii*) and climbing ferns such as mokimoki (*Dendroconche scandens*) and thread fern (*Icarus filiformis*). The filmy fern *Hymenophyllum demissum* carpets the shaded broadleaf forest floor (Fig. 5). On the earlier successional dry ridges is kānuka (*Kunzea robusta*) forest with occasional silverferns and miro (*Pectinopitys ferruginea*) and an understorey of mingimingi (*Leucopogon fasciculatus*) and *Gahnia pauciflora*. Patches of regenerating kauri forest occur on the plateau with occasional rimu, kahikatea and maire taiki (*Mida salicifolia*) scattered throughout the

understorey, and thick patches of *Gahnia xanthocarpa* and occasional groves of the short-trunked tree fern *Dicksonia lanata* subsp. *hispida* (Fig. 6). Patches of tangle fern (*Gleichenia microphylla*) and kiokio (*Parablechnum novae-zelandiae*) are seen in the lightwells (Fig. 7).

The forest remnant hosts a number of large kauri trees scattered throughout, the largest being 2.7 m in diameter (Fig. 8), most likely left behind when the forest was milled because of its imperfections. Kauri seedlings are local under the broadleaf forest and indicate the future succession of the forest if unhindered by kauri dieback (*Phytophthora agathidicida*). Under one large kauri tree an unusual sight is a large glade of terrestrially growing fork fern (*Tmesipteris tannensis*). Other large notable trees present are very large specimens of mānuka (*Leptospermum hoipolloi*) and kānuka, most likely the earliest trees to regenerate after the milling of the larger canopy trees. There are also a few large kahikatea trees present at the southern end of the forest. Large infestations of pampas (*Cortaderia selloana*) and wild ginger (*Hedychium gardnerianum*) dominate recent slips on steep slopes; these require control because they jeopardise the future succession of the sloped forest (Fig. 9).

Threatened plants of QEII Block

Many plants found in the QEII block are generally rare in the Tutamoe Ecological District. The 'Regionally Significant' tree daisy kohurangi (*Brachyglottis kirkii* var. *angustior*) was a local understorey shrub. The 'At Risk – Naturally Uncommon' short-trunked tree fern *Dicksonia lanata* subsp. *hispida* was present in the ridge top forest (Fig. 6). Maire taiki (*Mida salicifolia*) was a common tree in the understorey of the ridge forests with variable leaf forms ('At Risk – Declining nationally'; 'Gradual Decline Regionally'). The fan fern *Schizaea dichotoma* was local under kauri forest ('At Risk – Naturally Uncommon nationally'; 'Sparse Regionally'). Poroporo (*Solanum aviculare* var. *aviculare*) has been seen in the forest ('Threatened – Nationally Vulnerable'). The 'Regionally Significant' small tree *Coprosma parviflora* was scattered on the shrubby margins of the remnant. The 'Regionally Significant' ferns velvet fern (*Lastreopsis velutina*) (Fig. 10) and hen & chicken fern (*Asplenium gracillimum*) were both rare on the rocky southern face of the remnant. A few plants of the 'Regionally Significant' gumland tree *Dracophyllum lessonianum* were in the scrubby forest regeneration. The northland endemic 'Regionally Significant' shrub *Hebe flavida* and the shrub mairehau (*Leonema nudum*) were on the steep slopes. A few mature trees and seedlings of 'Regionally Significant' kawaka (*Libocedrus plumosa*) are scattered in the remnant (Fig. 11). The 'Regionally Significant' pōhutukawa hybrid *Metrosideros excelsa* × *M. robusta* was occasional on



Figs. 11–17. **11.** Kawaka seedling, QEII Block, 26 March 2021. **12.** The summer-flowering orchid *Earina aestivalis* on a pūriri, QEII Block, 4 January 2020. **13.** Nīkau seedlings dominate the understorey of the Waimamaku Scenic Reserve, 2 May 2021. **14.** Streams dissect the Waimamaku Scenic Reserve Forest, 2 May 2021. **15.** Large emergent kahikatea in Waimamaku Scenic Reserve Forest, 2 May 2021. **16.** Northern race of toetoe on the Waimamaku riverbank, 2 May 2021. **17.** Dark purplish foliage of *Gunnera monoica* on bank in pasture, 11 October 2022.

the ridges, some more closely resembling pōhutukawa (*M. excelsa*) and others northern rata (*M. robusta*). An orchid that resembles the species *Earina aestivalis* (Fig. 12) was seen as an epiphyte on a pūriri branch with kahakaha (*Astelia hastata*).

B: Waimamaku Scenic Reserve Block

The Waimamaku Scenic Reserve Block is a 5.7 ha publicly owned forest remnant (Fig. 2). This forest forms part of the SNA Waimamaku Scenic Reserve (FN612). It is south-facing forest with the



Figs. 18–24. **18.** Tree fern subcanopy under broadleaf on the ridges of the Brooks Block, 5 April 2021. **19.** Large kohekohe specimen in gully forest, Brooks Block, 5 April 2021. **20.** Gully forest with small stream running through, Brooks Block, 5 April 2021. **21.** Silhouette of ramarama in the canopy, Brooks Block, 5 April 2021. **22.** Ramarama leaf infected with the orange pustules of myrtle rust, Brooks Block, 5 April 2021. **23.** Small *Coprosma parviflora* shrub on the forest margin, Brooks Block, 5 April 2021. **24.** Broadleaf forest on the western slopes of Kokohuia Block, 4 May 2021.

Waimamaku River running along its southern boundary. This forest is mostly dominated by broadleaved species. The lower area has a canopy of taraire and pūriri with a nīkau and kohekohe (*Didymocheton spectabilis*) subcanopy, the

understory is lacking, and the ground is covered in native *Carex* species, African club moss (*Selaginella kraussiana*) and small nīkau seedlings (Fig. 13). Supplejack, thread fern and mokimoki are seen throughout with the epiphyte kahakaha. As the

forest grades up the slope it becomes more of a broadleaf kahikatea mix; taraire forest is seen in the gullies and other broadleaf species such as tawa (*Beilschmiedia tawa*) on steeper ridges. Streams dissect the sloping forest (Fig. 14). A large emergent kahikatea stands in the centre of the sloping remnant with a thick understorey of nikau and other natives (Fig. 15). On the open wet seeps rautahi (*Carex lesssoniana*) and the native herb *Euchiton japonicus* are seen.

Threatened plants of Waimamaku Scenic Reserve

A few threatened plants were noted at the Waimamaku Scenic Reserve, mainly along the Waimamaku River edge. One plant of the 'At Risk – Naturally Uncommon' toetoe *Austroderia* aff. *fulvida* (a) (CHR 477325; Puketi) was seen on the stream banks of the Waimamaku River (Fig. 16). The unnamed 'Data Deficient' species *Hebe* aff. *stricta* "tetraploid green" was seen on the riverbank. The 'Regionally Significant' daisy *Anaphalioides trinervis* was rare on the riverbanks. The 'Regionally Significant' shrub *Coprosma parviflora* was scattered throughout the Remnant. In the nearby farmland the 'Regionally Significant' herb *Gunnera monoica* was seen on a clay bank (Fig. 17).

C: Brooks Block

The Brooks Block is a 7.7 ha privately owned forest remnant (Fig. 2). This forest forms part of the SNA Northern Mataraua Forest (FNK001). The Block is a southwest-facing steep slope with a ridge running through the centre and sloping gullies either side. On the ridges tōwai (*Pterophylla sylvicola*) dominates the canopy with frequent rewarewa (*Knightia excelsa*) and occasional lancewood (*Pseudopanax crassifolius*), and in the understorey silverfern, mamaku (*Sphaeropteris medullaris*) and māhoe are present (Fig. 18). The gully canopy is dominated by taraire forest with a subcanopy of kohekohe, some specimens very large, and an understorey of kanono (*Coprosma autumnalis*) and a thick ground cover of parataniwha (*Elatostema rugosum*) (Fig. 19). A stream runs through the gully, and further down, the forest grades into an open understorey taraire forest with a nikau subcanopy and sparse understorey (Fig. 20).

Threatened plants of Brooks Block

A few threatened plants were noted at Brooks forest remnant. Ramarama (*Lophomyrtus bullata*) a 'Nationally Critical' plant was scattered throughout the forest (Fig. 21). Because of the fungal disease, myrtle rust, this species is at risk. Myrtle rust was present at the Brooks bush block on ramarama (Fig. 23). The 'Regionally Significant' small tree *Coprosma parviflora* was rare on the shrubby margins of the forest (Fig. 23). The 'Regionally Rare' kawaka (*Libocedrus plumosa*) was scattered under broadleaves on the main ridge.

D: Kokohuia B6 Block

Kokohuia forest is a large tract of forest that covers multiple land titles: DOC manages the 11.59 ha Kokohuia B6 Block surveyed here (located at D on Fig. 2). This forest forms part of the SNA Waiotemarama Gorge Forest (FN622). Most of the reserve is dominated by mixed broadleaf forest with podocarps and other conifers on the dryer ridges. The southern edge of the forest consists of rough, scrubby pasture, with the species māhoe and hinau (*Elaeocarpus dentatus*) scattered in pasture, and dense thickets of taurepo (*Rhabdodhamnus solandri*) on the steeper slopes (Fig. 24). In the wetter gullies, māhoe and patē (*Schefflera digitata*) are present with piupiu or gully fern (*Pakau pennigera*) and grazed patches of parataniwha. The forest on the southern side has a taraire canopy with the occasional miro or tawa on ridges, a subcanopy of nikau, an understorey of silverfern and the ground covered with thread fern, *Metrosideros perforata*, the mat-forming filmy fern (*Hymenophyllum demissum*) and thick leaf litter. Supplejack is seen throughout. On the ridges are stands of young kauri forest with a few larger trees, and with fields of kiekie and kauri grass (*Astelia trinervia*) underneath (Fig. 25), and mairehau and *Metrosideros albiflora* on the open margins. The forest on the northern side has a taraire canopy with an understorey of kanono. There is a large slip on this side with regenerating forest of mānuka and tree ferns (Cyatheaceae spp.). From this side the Hokianga Harbour and its giant sand dunes can be seen (Fig. 26).

Threatened plants of Kokohuia Block

Many threatened plants were seen in the Kokohuia forest. Ramarama plants ('Nationally Critical') were scattered in the forest with evidence of myrtle rust present. The tree maire taiki was occasionally seen in the understorey ('At Risk – Declining nationally'; 'Gradual Decline regionally'). A few plants of 'Regionally Significant' *Astelia* aff. *nervosa* (c) (AK 230033; "broad bronze") was seen amongst kauri grass and kiekie (Fig. 27). A few plants of 'Regionally Significant' *Hebe flavida* were noted on the north-facing ridges (Fig. 28). The 'Regionally Significant' tree daisy kohurangi (*Brachyglottis kirkii* var. *angustior*) was a local understorey shrub in kauri forest. The 'Regionally Significant' shrub mairehau was local on the steep slopes of the kauri forest margins (Fig. 29).

E: Waimamaku Conservation Area Block

The Waimamaku Conservation Area Block (5.7 ha) is an old riparian forest dominated by broadleaves and surrounded by ex-pasture, with currently managed farms around that. This reserve is significant as it is one of the few alluvial broadleaf forests remaining within the catchment. Two streams dissect the reserve, feeding into the Waimamaku River north of the forest (Fig. 2). The canopy is at least 25m tall

dominated by taraire and pūriri with the occasional kahikatea (Fig. 30), and epiphytes kahakaha (*Astelia hastata*) and kaiwharawhara (*A. solandri*). The subcanopy consists of nikau and kohekohe. The understorey is sparse from past grazing of cattle (Fig. 31). Now, with their exclusion, many native seedlings are regenerating. The ground, being an old stream bed, is rocky and is covered with patches of *Carex* sp. amongst the thick taraire leaf litter and basket grass (*Oplismenus hirtellus*). The forest hosts some healthy kohekohe specimens.

Liverworts and mosses

In total 11 liverworts and 29 mosses were recorded during surveys within the Waimamaku catchment. Only the more conspicuous bryophytes were noted; more study is definitely needed of the non-vascular species within the catchment. An interesting record was the 'Threatened – Nationally Critical' liverwort *Dumortiera hirsuta*. This thalloid liverwort was locally common along the stream banks of the Waimamaku River bordering the Scenic Reserve (Fig. 32). All plants seen were female, with young female sporangiophores (Fig. 33). The species is previously unrecorded from this site, making this the fifth mainland location for this species in New Zealand, the others being Te Pahi, Herekino, Little Barrier (Te Hauturu-o-Toi) and the Awhitu Peninsula (de Lange et al. 2020). The large liverwort *Plagiochila gigantea* was locally abundant in the steep pastured banks of the Kokohuia Block competing against exotic herbs and grasses (Fig. 34). The 'At Risk-Declining' liverwort wairuakoha (*Radula marginata*) was locally common on exposed tree roots at both the Waimamaku Scenic Reserve and the Kokohuia Block (Fig. 35) (de Lange et al. 2020).

Of the moss species recorded in the Waimamaku Catchment some specimens are illustrated here: The world's largest terrestrial moss species *Dawsonia superba* was seen on the roadside leading to the Brooks Block (Fig. 36). The epiphytic moss *Hypnum chrysogaster* was growing on a low root branch in the Kokohuia Block (Fig. 37). The moss *Sphagnum falcatulum* was local in small dips in the ground in the gumland scrub of the QEII Block (Fig. 38). The elegant moss *Orthorrhynchium elegans* was rare on the trunks of podocarps on the dry ridges of the Kokohuia Block (Fig. 39).

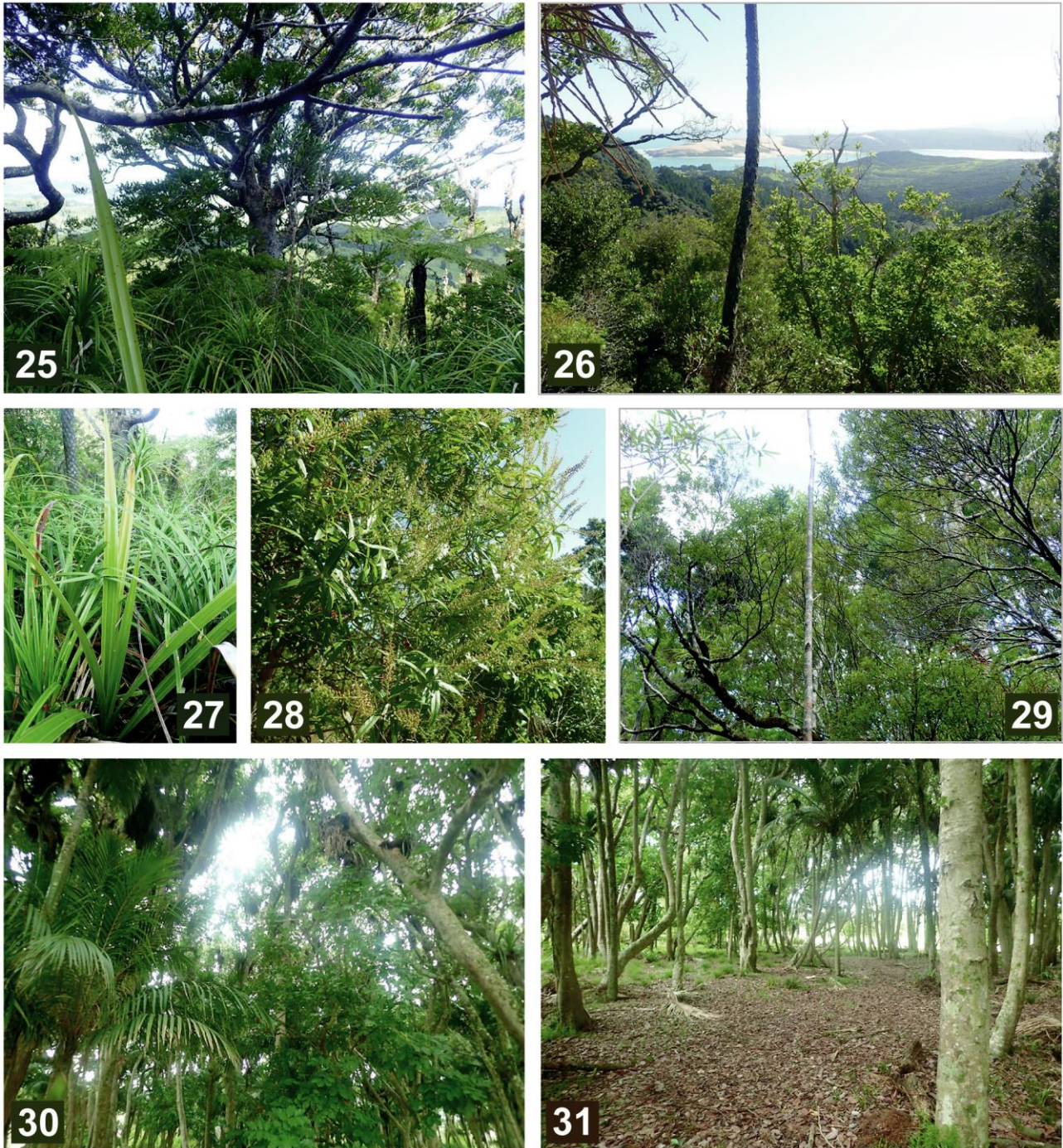
Lichens

The Waimamaku catchment hosts a wealth of lichen diversity. An attempt was made to classify the more conspicuous species, while smaller crustose species require further study. In total, 98 species were recorded in the catchment. The lichens were mainly corticolous, the typical habitat including tree branches and trunks. Many species are tolerant of

shade in the darker forest while others prefer the higher light on the forest edge or in the higher branches of the canopy. Kauri hosts a large diversity of lichens including *Anzia entingiana* (Fig. 40), *Coccotrema cucurbitula*, *Collema laeve*, *Dictyonema sericeum*, *Megalania* sp., *Menegazzia neozelandica*, *Miltidea ceroplasta*, *Notoparmelia testacea*, *Pannaria aotearoana* (Fig. 41), *Parmeliella nigrocincta*, *Parmotrema mellissii* (Fig. 42), *Sticta babingtonii* and *Usnea baileyi* (Fig. 43).

Some lichen species of interest include: *Anzia entingiana* (Fig. 40) that was local on the ridge top kauri of the Kokohuia Block. This genus has been found in 35–40-million-year-old Baltic amber, showing that the main distinguishing characteristics of the thallus morphology in section *Anzia* have been retained for tens of millions of years (Rikkinen & Poinar 2002). The crustose lichen *Bacidia laurocerasi* was a conspicuous lichen on a branch at head height in the Waimamaku Scenic Reserve block (Fig. 44). The cyanobacterial *Coccocarpia pellita* was corticolous in the Waimamaku Scenic Reserve (Fig. 45). The flattened phylidia distinguish it from the similar *C. palmicola* which was also present in the catchment. The jelly lichen *Gabura fascicularis* var. *fascicularis* (Fig. 46) was local in the forest of the Waimamaku Scenic Reserve. On the forest margin of the Waimamaku Conservation area, *Hypotrachyna osseoalba* (Fig. 47) grows on the trunks of nikau with *Parmotrema reticulatum* and *Usnea* sp. This *Hypotrachyna* is distinguished from other species by the golden reaction to ultraviolet light. The newly described species *Pannaria aotearoana* (Fig. 41) was common on the ridge forest of both the QEII covenant and Kokohuia Block. This tripartite species hosts both algae and cyanobacterial relationships. *Lobaria asperula* (Fig. 48) was common on the ridge forest of the QEII covenant. This species is separated from the similar members of subfamily Lobarioideae, *Pseudocyphellaria* and *Sticta*, by its lack of pseudocyphellae or cyphellae on the thallus underside, and from the more closely related *L. adscripta*, *L. asperula* is separated by its copiously phyllidiate lobes. (The Lobarioideae, formerly a family, is now placed within the family Peltigeraceae (Lumbsch & Leavitt, 2019)). A conspicuous forest lichen of Waimamaku's forests is *Pseudocyphellaria carpoloma* (Fig. 49), which is separated from other similar large foliose species in the North by the foveolate lobes and the yellow pseudocyphellae on the underside. The beard lichen *Usnea nidifica* was local on dead twigs of the scrubby Kokohuia forest margins (Fig. 50).

There were three 'Data Deficient' species: *Gabura fascicularis* var. *fascicularis*, *Psoromaria versicolor* and *Usnea baileyi*, and seventeen 'Naturally Uncommon' species: *Anzia entingiana*, *Coccocarpia*

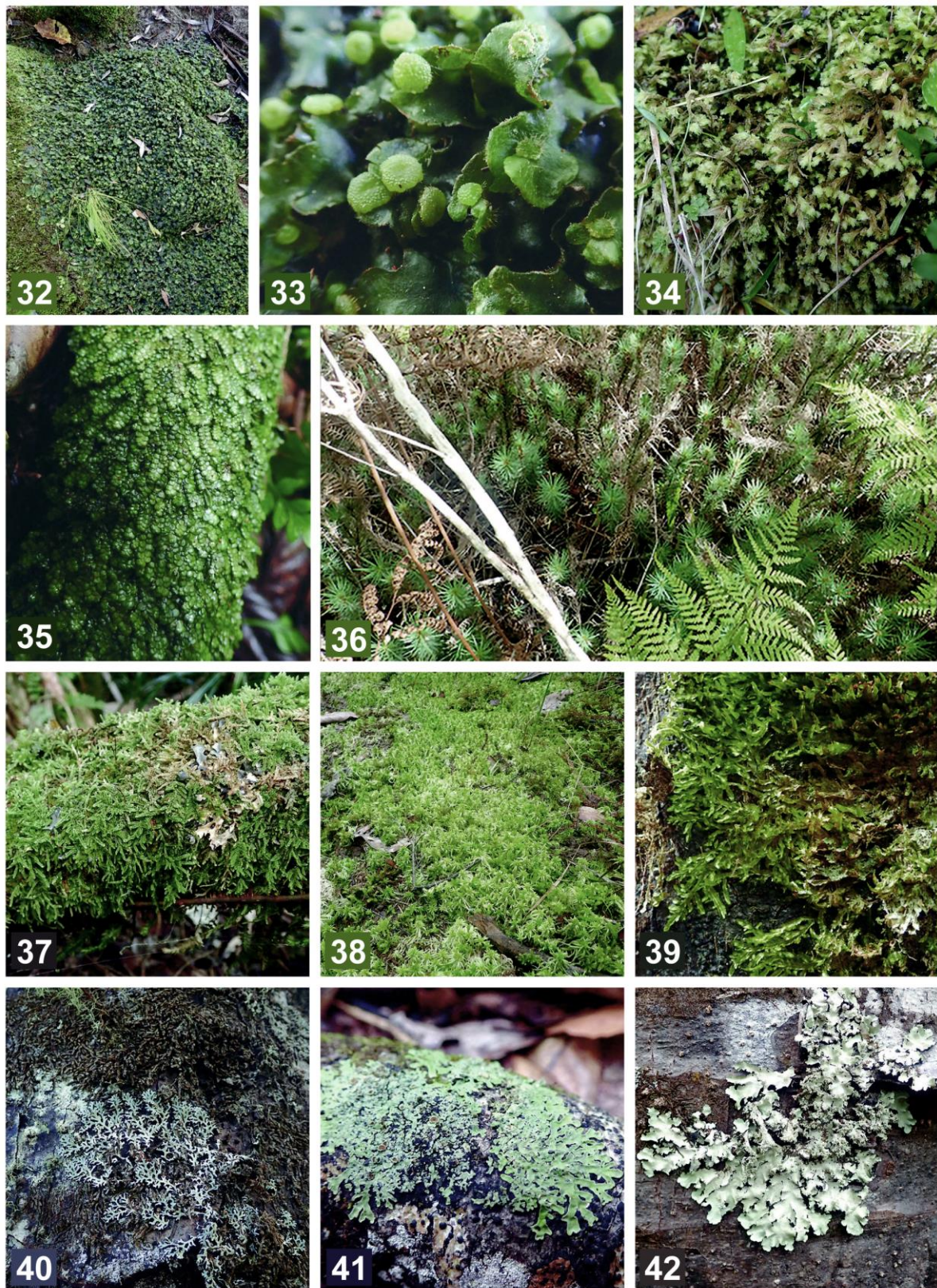


Figs. 25–31. **25.** Large kauri tree on the Kokohuia ridge with kiekie and kauri grass underneath, 4 May 2021. **26.** View north-west over the broadleaf forest of Kokohuia to the Hokianga Harbour and the dunes at the harbour mouth, 4 May 2021. **27.** *Astelia* aff. *nervosa* amongst kiekie, Kokohuia Block, 4 May 2021. **28.** Developing capsules of the northern *Hebe flavida*, Kokohuia Block, 4 May 2021. **29.** Shrubs of mairehau on kauri forest edge, Kokohuia Block, 4 May 2021. **30.** Broadleaf canopy of the Waimamaku Conservation Area with a subcanopy of kohekohe and nikau, 24 February 2022. **31.** Sparse understorey of the Waimamaku Conservation Area with thick layer of tarairae leaves on forest floor, 24 February 2022.

pellita, *Collema subflaccidum*, *Crocodia poculifera*, *Dictyonema sericeum*, *Dirinaria picta*, *Heterodermia casarettiana*, *Hypotrachyna osseoalba*, *Parmotrema mellissii*, *Parmotrema robustum*, *Pertusaria puffina*, *Pseudocyphellaria intricata*, *Pseudocyphellaria lividofusca*, *Sticta babingtonii*, *Strigula delicata*, *Strigula novae-zelandiae* and *Usnea nidifica*.

Fungi

Some conspicuous fungi were noted during the surveys. A native species of *Agaricus* was seen on the ground in the broadleaf-podocarp forest of the QEII Block. Myrtle rust was present on all of the ramarama species surveyed in the Kokohuia and Brooks Forest Blocks. These incursions are some of



Figs. 32–42. **32.** The liverwort *Dumortiera hirsuta* was locally common along the stream banks of the Waimamaku River, Waimamaku Scenic Reserve, 2 May 2021. **33.** Female sporangiophores of the liverwort *Dumortiera hirsuta*, Waimamaku Scenic Reserve, 2 May 2021. **34.** The liverwort *Plagiochila gigantea* on sloping ground, Kokohuia Block, 4 May 2021. **35.** The liverwort wairuakoha (*Radula marginata*) on exposed tree roots, Kokohuia Block, 4 May 2021. **36.** The large moss *Dawsonia superba* on roadside, Brooks Block, 5 April 2021. **37.** The epiphytic moss *Hypnum chrysogaster* on a low root branch, Kokohuia Block, 4 May 2021. **38.** Patch of the moss *Sphagnum falciculatum* at the QEII Block, 26 March 2021. **39.** The elegant moss *Orthorrhynchium elegans* on podocarp trunk, Kokohuia Block, 4 May 2021. **40.** *Anzia entingiana* amongst bryophytes on kauri trunk, Kokohuia Block, 4 May 2021. **41.** *Pannaria aotearoana* on windfall branch with *Pyrenula* sp. QEII, 26 March 2021. **42.** The grey-white foliose lichen *Parmotrema mellissii* on kauri trunk, QEII, 26 March 2021.



Figs. 43–50. **43.** The fruticose lichen *Usnea baileyi*, Waimamaku Scenic Reserve, 2 May 2021. **44.** The green crustose lichen *Bacidia laurocerasi*, Waimamaku Scenic Reserve, 2 May 2021. **45.** *Coccocarpia pellita*, Waimamaku Scenic Reserve, 2 May 2021. **46.** The jelly lichen *Gabura fascicularis* var. *fascicularis*, Waimamaku Scenic Reserve, 2 May 2021. **47.** *Hypotrachyna osseoalba* (centre) with *Parmotrema reticulatum* and *Usnea* sp. on nikau trunk, Waimamaku Conservation area, 24 February 2022. **48.** The green foliose lichen *Lobaria asperula*, QEII Block, 26 March 2021. **49.** The large foliose lichen *Pseudocyphellaria carpoloma*, Waimamaku Scenic Reserve, 2 May 2021. **50.** The beard lichen *Usnea nidifica* on a dead shrub, Kokohuia Block, 4 May 2021.

the first observed in natural vegetation of Western Northland. Further monitoring should be undertaken to assess the severity of the infection and if there is an increased mortality rate amongst the local ramarama population. The native smut fungus *Bauerago gardneri* was noted on the fruiting spikelets of the native sedge *Cyperus ustulatus*. The large fungus tawaka (*Cydlocybe parasitica*) was seen parasitising some trees in the mature

forests of Waimamaku. The blue mushroom werewere-kokako (*Entoloma hochstetteri*) were seen with empty shells of kauri snails or pūpū-rangi (*Paryphanta busbyi*) at the QEII site (Fig. 51). A similar but gray mushroom, *Entoloma latericolor*, was seen growing with *E. hochstetteri* at Kokohuia. A native rust *Uredo puawhananga*, was noted on the young leaves of the native vine *Clematis paniculata*.



Figs. 51–52: 51. Large empty kauri snail shell seen with the mushroom werewere-kokako, QEII Block, 26 March 2021. 52. Large Auckland cave weta, QEII Block, 26 March 2021.

Fauna

A rich variety of fauna is known from the Waimamaku catchment. The 'At Risk-Declining' North Island brown kiwi (*Apteryx mantelli*) is well known in the forest and scrub remnants (Miller & Holland 2008). During the fieldwork a range of native bird species were seen, including the following endemic species:

- Tūi or kōkō (*Prothemadera novaeseelandiae*).
- Kūkupa or New Zealand pigeon (*Hemiphaga novaeseelandiae*).
- Tirairaka or North Island fantail (*Rhipidura fuliginosa* subsp. *placabilis*).
- Miromiro or tomtit (*Petroica macrocephala* subsp. *toitoi*).
- Riroriro or grey warbler (*Geryone igata*).
- Pūkeko (*Porphyrio porphyrio* subsp. *melanotus*).

Other native fauna seen:

- The chorus cicada (*Amphipsalta zelandica*) was loudly calling throughout the forest.
- A few large specimens of the Auckland cave weta (*Pachyrhamma acanthocerum*) were seen in kānuka bark (Fig. 52).

- Empty kauri snail/Pūpū-rangi shells were seen with the mushroom werewere-kokako (*Entoloma hochstetteri*) at the QEII site (Fig. 51).
- Squeaking longhorn beetle (*Hexatricha pulverulenta*) was seen on the leaves of mapou (*Myrsine australis*) at the Brooks Block.
- Dead huhu beetles (*Prionoplus reticularis*) were seen at the QEII block.

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Appendix 1. Lists of plants and lichens recorded from this survey within the Waimamaku catchment, separated into the following categories: 1A: Native vascular plants; 1B: Exotic vascular plants; 1C: Non-vascular plants (Bryophytes); 1D: Lichens; 1E: Fungi.

Accession numbers are shown for specimens lodged in the Auckland Museum Herbarium (AK)
= taxa also recorded by the author in iNaturalist <https://inaturalist.nz/>

QEII = QEII Block

WSR = Waimamaku Scenic Reserve Block

Brooks = Brooks Block

Koko = Kokohuia Block

WCA = Waimamaku Conservation Area Block

Appendix 1A: Native vascular plants.

Scientific name	Common Name	QEII	WSR	Brooks	Koko	WCA
Ferns and Allies						
<i>Abrodictyum elongatum</i> (syn. <i>Trichomanes elongatum</i>)	bristle fern	x	x		x	
<i>Adiantum cunninghamii</i>	common maidenhair	x				
<i>Adiantum fulvum</i>	maidenhair	x	x	x	x	
<i>Adiantum hispidulum</i>	rosy maidenhair	x				x
<i>Alsophila tricolor</i> (syn. <i>Cyathea dealbata</i>)	ponga	x	x	x		x
<i>Asplenium bulbiferum</i>	pikopiko	x		x	x	
<i>Asplenium flaccidum</i>	hanging spleenwort	x	x	x	x	x
<i>Asplenium gracillimum</i>		x # AK383753				
<i>Asplenium lamprophyllum</i>		x			x	
<i>Asplenium oblongifolium</i>	huruhuruwhenua	x	x		x	
<i>Asplenium polyodon</i>	sickle spleenwort	x	x	x		x
<i>Austroblechnum lanceolatum</i>	rereti	x	x		x	
<i>Austroblechnum membranaceum</i>		x		x		
<i>Dendroconche scandens</i> (syn. <i>Microsorium scandens</i>)	mokimoki	x	x	x	x	
<i>Deparia petersenii</i> subsp. <i>congrua</i>		x	x			
<i>Dicksonia lanata</i> subsp. <i>hispida</i>	stump tree fern	x # AK383808				
<i>Dicksonia squarrosa</i>	whēki-ponga	x	x		x	
<i>Diplazium australe</i>		x				x
<i>Diploblechnum fraseri</i>	miniature tree fern	x			x	
<i>Doodia australis</i>	rasp fern	x	x	x		x
<i>Gleichenia microphylla</i>	tangle fern	x				
<i>Histiopteris incisa</i>	mātā	x	x			x
<i>Hiya distans</i>			x			
<i>Hymenophyllum demissum</i>	irirangi	x	x	x	x AK383836	
<i>Hymenophyllum dilatatum</i>	matua mauku	x		x	x	
<i>Hymenophyllum flabellatum</i>	filmy fern				x	
<i>Hymenophyllum flexuosum</i>		x #			x # AK383837	
<i>Hymenophyllum nephrophyllum</i>	kidney fern	x		x	x	
<i>Hymenophyllum sanguinolentum</i>	filmy fern	x		x	x	
<i>Hymenophyllum revolutum</i>	filmy fern	x	x		x	

Scientific name	Common Name	QEII	WSR	Brooks	Koko	WCA
<i>Icarus filiformis</i> (syn. <i>Blechnum filiforme</i>)	thread fern	x	x	x	x	x
<i>Lastreopsis hispida</i>	hairy fern	x	x		x	
<i>Lastreopsis velutina</i>	velvet fern	x # AK383853				
<i>Lateristachys lateralis</i> (syn. <i>Lycopodium laterale</i>)		x # AK383861				
<i>Leptopteris hymenophylloides</i>	heruheru	x	x		x	
<i>Lindsaea trichomanoides</i>		x			x	
<i>Lomaria discolor</i> (syn. <i>Blechnum discolor</i>)	petipeti			x	x	
<i>Loxogramme dictyopteris</i>		x		x	x	
<i>Lygodium articulatum</i>	mangemange	x			x	
<i>Paesia scaberula</i>	ringfern	x	x	x	x	
<i>Pakau pennigera</i> (syn. <i>Pneumatopteris pennigera</i>)	piupiu, gully fern	x	x	x	x	x
<i>Palhinhaea cernua</i> (syn. <i>Lycopodiella cernua</i>)					x	
<i>Parablechnum minus</i>	kiokio		x			
<i>Parablechnum novae-zelandiae</i>	kiokio	x	x	x		x
<i>Parapolystichum glabellum</i>	smooth shield fern		x			
<i>Parapolystichum microsorum</i> subsp. <i>pentangulare</i>			x			
<i>Phlegmariurus billardierei</i>	hanging clubmoss	x	x			
<i>Polyphlebium endlicherianum</i> (syn. <i>Trichomanes</i>)			x			
<i>Polystichum wawranum</i>		x			x	
<i>Pseudodiphasium volubile</i> (syn. <i>Lycopodium volubile</i>)	waewaekoukou	x		x		
<i>Pseudolycopodium densum</i> (syn. <i>L. deuterodensum</i>)	clubmoss	x			x	
<i>Pteridium esculentum</i>	rarauhe	x	x		x	
<i>Pteris macilenta</i>	sweet fern	x	x	x	x	
<i>Pteris tremula</i>	shaking brake	x	x	x		x
<i>Pyrrosia elaeagnifolia</i>	leather-leaf fern		x	x	x	x
<i>Schizaea dichotoma</i>	fan fern	x #				
<i>Sphaeropteris medullaris</i> (syn. <i>Cyathea medullaris</i>)	mamaku	x	x	x	x	x
<i>Tmesipteris elongata</i>	fork fern	x		x	x	
<i>Tmesipteris lanceolata</i>	fork fern			x		
<i>Tmesipteris sigmatifolia</i>	fork fern				x	
<i>Tmesipteris tannensis</i>	fork fern	x # AK383957			x	
<i>Zealandia pustulata</i> (syn. <i>Microsorium pustulatum</i>)	kowaowao	x	x	x	x	x
Gymnosperms						
<i>Agathis australis</i>	kauri	x #		x	x	
<i>Dacrycarpus dacrydioides</i>	kahikatea	x				
<i>Dacrydium cupressinum</i>	rimu	x #				
<i>Libocedrus plumosa</i>	kawaka	x AK383859		x		
<i>Pectinopitys ferruginea</i> (syn. <i>Prumnopitys ferruginea</i>)	miro	x #	x		x	
<i>Prumnopitys taxifolia</i>	matai	x		x		

Scientific name	Common Name	QEII	WSR	Brooks	Koko	WCA
<i>Phyllocladus trichomanoides</i>	tānekaha	x		x	x	
<i>Podocarpus laetus</i>	Hall's totara				x	
<i>Podocarpus totara</i> var. <i>totara</i>	tōtara	x	x	x		x
Dicots						
<i>Acaena novae-zelandiae</i>	piripiri			x	x #	
<i>Alectryon excelsus</i> subsp. <i>excelsus</i>	tītoki		x		x	x
<i>Alseuosmia quercifolia</i>	toropapa	x #			x	
<i>Anaphalioides trinervis</i>			x #			
<i>Aristotelia serrata</i>	makomako, wineberry			x		
<i>Beilschmiedia tarairi</i>	taraire	x #	x	x		
<i>Beilschmiedia tawa</i>	tawa	x	x	x	x	
<i>Brachyglottis kirkii</i> var. <i>angustior</i>	kohurangi	x		x	x	
<i>Brachyglottis repanda</i>	rangiora				x	
<i>Callitriche muelleri</i>	mueller's starwort	x				
<i>Carmichaelia australis</i>	native broom			x		
<i>Carpodetus serratus</i>	putaputawētā	x				
<i>Centella uniflora</i>	centella			x		
<i>Clematis cunninghamii</i>			x		x	
<i>Clematis paniculata</i>	puawhananga	x				
<i>Coprosma areolata</i>	thin-leaved coprosma				x	
<i>Coprosma arborea</i>	māmāngi	x	x	x		x
<i>Coprosma autumnalis</i>	kanono	x		x	x #	
<i>Coprosma lucida</i>	shining karamu	x #		x	x	
<i>Coprosma macrocarpa</i> subsp. <i>minor</i>	karamu	x		x		x
<i>Coprosma parviflora</i>	leafy coprosma		x		x	
<i>Coprosma rhamnoides</i>	twiggy coprosma	x	x	x	x	x
<i>Coprosma robusta</i>	karamu	x				x
<i>Coprosma spathulata</i> subsp. <i>spathulata</i>		x	x			
<i>Coriaria arborea</i> var. <i>arborea</i>	tutu		x		x	x
<i>Corynocarpus laevigatus</i>	karaka	x	x	x	x	x
<i>Didymocheton spectabilis</i> (<i>Dysoxylum spectabile</i>)	kohekohe	x #	x	x	x	
<i>Dracophyllum latifolium</i>	neinei	x		x	x	
<i>Dracophyllum lessonianum</i>		x #				
<i>Dracophyllum sinclairii</i>		x #				
<i>Elatostema rugosum</i>	parataniwha	x	x	x	x	
<i>Elaeocarpus dentatus</i> var. <i>dentatus</i>	hinau			x	x	
<i>Epilobium nerteroides</i>	willow herb		x			
<i>Epilobium rotundifolium</i>	round-leaved willowherb				x	
<i>Euchiton japonicus</i>		x			x	
<i>Fuchsia excorticata</i>	kotukutuku			x		
<i>Gaultheria antipoda</i>		x #				

Scientific name	Common Name	QEII	WSR	Brooks	Koko	WCA
<i>Geniostoma ligustrifolium</i> var. <i>ligustrifolium</i>	hangehange	x	x	x	x	
<i>Geranium homeanum</i>			x			
<i>Gonocarpus incanus</i>		x				
<i>Griselinia lucida</i>	puka	x	x	x	x	x
<i>Gunnera monoica</i>			x			
<i>Haloragis erecta</i> subsp. <i>erecta</i>	toatoa	x		x	x	x
<i>Hebe flavida</i> (syn. <i>Veronica flavida</i>)		x #			x	
<i>Hebe</i> aff. <i>stricta</i> (syn. <i>Veronica stricta</i>)			x #			
<i>Hypericum pusillum</i>	swamp hypericum	x	x		x	
<i>Hedycarya arborea</i>	porokaiwhiri	x	x	x	x	
<i>Hoheria populnea</i>	houhere	x	x	x	x	
<i>Knightia excelsa</i>	rewarewa	x	x	x		
<i>Kunzea robusta</i>	kānuka	x	x		x	x
<i>Laurelia novae-zelandiae</i>	pukatea	x	x	x		
<i>Leionema nudum</i>	mairehau	x # AK381541		x	x	
<i>Leptospermum hoipolloi</i> (syn. <i>L. scoparium</i> agg.)	mānuka	x	x	x	x	
<i>Leptostigma setulosum</i> (<i>Nertera setulosa</i>)			x	x	x	
<i>Leucopogon fasciculatus</i>	mingimingi	x	x		x	
<i>Litsea calicaris</i>	mangeao			x	x	
<i>Lobelia anceps</i>	punakuru			x	x	
<i>Lophomyrtus bullata</i>	ramarama			x	x #	
<i>Melicope ternata</i>	whārangi	x				
<i>Melicytus macrophyllus</i>		x			x	
<i>Melicytus ramiflorus</i>	māhoe	x #	x	x	x	
<i>Metrosideros albiflora</i>	akatea				x	
<i>Metrosideros carminea</i>	carmine rātā		x			
<i>Metrosideros diffusa</i>	white rātā	x	x		x	
<i>Metrosideros fulgens</i>	climbing rātā	x	x	x		
<i>Metrosideros perforata</i>	akatea	x	x	x	x	x
<i>Metrosideros robusta</i>	northern rātā	x		x		
<i>Metrosideros excelsa</i> x <i>M. robusta</i>	hybrid pōhutukawa	x #				
<i>Mida salicifolia</i>	maire taiki	x			x	
<i>Muehlenbeckia australis</i>	pohuehue			x # AK383867	x	
<i>Myrsine australis</i>	māpou	x	x	x	x	x
<i>Nestegis lanceolata</i>	white maire	x	x	x	x	
<i>Nertera depressa</i>	nertera				x	
<i>Nertera dichondrifolia</i>	nertera	x			x	
<i>Olearia furfuracea</i>	akepiro	x #		x		
<i>Olearia rani</i> var. <i>rani</i>	heketara	x		x	x	
<i>Oxalis exilis</i>	creeping oxalis		x			
<i>Passiflora tetrandra</i>	kohia		x			

Scientific name	Common Name	QEII	WSR	Brooks	Koko	WCA
<i>Parsonsia</i> sp.	kaihua	x	x	x		
<i>Persicaria decipiens</i>	tutunawai					x
<i>Piper excelsum</i> subsp. <i>excelsum</i>	kawakawa	x	x	x	x	x
<i>Pittosporum tenuifolium</i>	kohuhu	x				
<i>Pseudopanax arboreus</i>	whauwhaupaku	x			x	
<i>Pseudopanax crassifolius</i>	horoeka		x	x	x	
<i>Pterophylla sylvicola</i> (syn. <i>Weinmannia sylvicola</i>)	tōwai	x	x	x	x	
<i>Quintinia serrata</i>	tawheowheo	x			x	
<i>Ranunculus reflexus</i>	mārūrū	x			x	
<i>Rhabdothamnus solandri</i>	taurepo	x	x	x		
<i>Rubus australis</i>	tātarāmoa	x				
<i>Rubus cissoides</i>	tātarāmoa	x			x	
<i>Schefflera digitata</i>	patē	x	x	x		
<i>Senecio bipinnatisectus</i>	Australian fireweed	x	x		x	
<i>Senecio elseri</i>	fireweed					x
<i>Solanum americanum</i>	small-flowered nightshade	x	x	x	x	x
<i>Solanum aviculare</i> var. <i>aviculare</i>	poroporo	x		x		
<i>Sophora chathamica</i>	kōwhai	x	x			x
<i>Streblus heterophyllus</i>	tūrepo	x	x			
<i>Veronica plebeia</i>			x			
<i>Vitex lucens</i>	pūriri	x	x	x		
<i>Wahlenbergia violacea</i>	violet harebell		x			
Monocots						
<i>Acianthus sinclairii</i>	pixie orchid		x	x	x	
<i>Astelia hastata</i>	kahakaha	x	x			x
<i>Astelia</i> aff. <i>nervosa</i> (c) (AK 230033; "broad bronze")					x	
<i>Astelia solandri</i>	kaiwharawhara	x			x	x
<i>Astelia trinervia</i>	kauri grass	x			x	
<i>Austroderia</i> aff. <i>fulvida</i> (a) (CHR 477325; Puketi)	kakaho		x # AK383500			
<i>Bolboschoenus fluviatilis</i>		x # AK383756				
<i>Bulbophyllum pygmaeum</i>	pygmy tree orchid	x			x	
<i>Carex banksii</i>		x		x	x	
<i>Carex dissita</i>	forest sedge		x			
<i>Carex flagellifera</i>	trip me up		x			
<i>Carex inversa</i>			x			
<i>Carex lambertiana</i>		x				x
<i>Carex lessoniana</i>	rautahi	x #	x	x		
<i>Carex solandri</i>		x	x			x
<i>Carex ochrosaccus</i>			x			
<i>Carex uncinata</i>	kamu	x	x			
<i>Carex virgata</i>	pūkio		x			

Scientific name	Common Name	QEII	WSR	Brooks	Koko	WCA
<i>Carex zotovii</i>		x			x	
<i>Cordyline australis</i>	cabbage tree, ti kouka	x	x	x	x	
<i>Cordyline banksii</i>	tī ngāhere				x	
<i>Cordyline pumilo</i>		x				
<i>Cyperus ustulatus</i>	toetoe upoko-tangata	x #	x			
<i>Dendrobium cunninghamii</i>	winikā	x	x	x	x	
<i>Dianella nigra</i> agg.	tūrutu	x			x	
<i>Drymoanthus adversus</i>		x	x		x	x
<i>Earina autumnalis</i>	raupeka	x				
<i>Earina mucronata</i>	peka-a-waka	x	x	x		
<i>Eleocharis acuta</i>		x #				
<i>Freycinetia banksii</i>	kiekie	x	x	x	x	
<i>Gahnia lacera</i>		x	x	x	x	
<i>Gahnia pauciflora</i>		x				
<i>Gahnia setifolia</i>	māpere		x	x	x	
<i>Gahnia xanthocarpa</i>		x		x	x	
<i>Isolepis inundata</i>			x #			
<i>Isolepis reticularis</i>		x				
<i>Juncus australis</i>	wīwī					x
<i>Juncus edgariae</i>	wīwī		x			
<i>Juncus planifolius</i>	grass-leaved rush				x	
<i>Libertia grandiflora</i>	mikoikoi	x				
<i>Libertia ixioides</i>	mikoikoi				x	
<i>Machaerina tenax</i>		x				
<i>Microlaena avenacea</i>		x		x	x	
<i>Microlaena stipoides</i>	pātiti			x	x	x
<i>Microtis unifolia</i>	onion-leaved orchid			x		
<i>Oplismenus hirtellus</i> subsp. <i>imbecillis</i>	basket grass	x	x	x		x
<i>Phormium tenax</i>	flax, harakeke	x	x	x	x	x
<i>Poa anceps</i>		x				
<i>Pterostylis banksii</i>	tutukiwi	x		x		
<i>Rhopalostylis sapida</i>	nīkau	x	x	x	x	x
<i>Ripogonum scandens</i>	kareao, supplejack	x	x	x	x	
<i>Rytidosperma gracile</i>	dainty bristle grass	x	x		x	
<i>Schoenus maschalinus</i>	dwarf bog rush			x	x	
<i>Schoenus tendo</i>	kauri grass	x				
<i>Thelymitra</i> sp.	sun orchid			x		
<i>Typha orientalis</i>	raupō			x		

Appendix 1B. Exotic vascular plants.

Scientific name	Common Name	QEII	WSR	Brooks	Koko	WCA
Ferns and allies						
<i>Selaginella kraussiana</i>	African club moss	x	x	x	x	
Gymnosperms						
<i>Pinus pinaster</i>	maritime pine			x		
<i>Pinus radiata</i>	pine			x	x	
Dicots						
<i>Ageratina riparia</i>	mist flower	x	x	x		x
<i>Bellardia viscosa</i>	tar weed	x #				
<i>Cardamine</i> sp.	bittercress		x			
<i>Cirsium vulgare</i>	Scotch thistle	x	x		x	x
<i>Cotoneaster glaucophyllus</i>	cotoneaster		x	x		x
<i>Crepis capillaris</i>	smooth hawksbeak				x	
<i>Daucus carota</i>	wild carrot			x	x	
<i>Digitalis purpurea</i>	foxglove		x	x	x	
<i>Erechtites valerianifolia</i>	brazilian fireweed		x			
<i>Erigeron karvinskianus</i>	Mexican daisy				x	
<i>Erigeron sumatrensis</i>	broad-leaved flea-bane	x	x	x	x	x
<i>Erythrina xyskiesii</i>	flame tree					x
<i>Galium aparine</i>	cleavers					x
<i>Gamochaeta simplicicaulis</i>	simple-stem cudweed	x	x	x	x	
<i>Helminthotheca echinoides</i>	oxtongue					x
<i>Hydrangea macrophylla</i>	hydrangea					x
<i>Hypochaeris radicata</i>	catsear			x		
<i>Jacobaea vulgaris</i>	ragwort	x	x		x	x
<i>Juglans nigra</i>	black walnut					x
<i>Impatiens sodenii</i>	shrub balsam					x
<i>Lapsana communis</i>	nipplewort		x			
<i>Leucanthemum vulgare</i>	oxeye daisy			x	x	
<i>Lotus pedunculatus</i>	lotus	x	x	x	x	x
<i>Lysimachia arvensis</i> subsp. <i>arvensis</i> var. <i>arvensis</i>	pimpernel					x
<i>Lythrum hyssopifolia</i>	hyssop loosestrife					x
<i>Oxalis incarnata</i>	lilac oxalis					x
<i>Paraserianthes lophantha</i>	brush wattle					x
<i>Persicaria hydropiper</i>	water pepper		x			
<i>Physalis peruviana</i>	cape gooseberry	x				
<i>Plantago lanceolata</i>	narrow-leaved plantain				x	x
<i>Plectranthus ciliatus</i>	plectranthus		x			
<i>Potentilla indica</i>	Indian strawberry			x	x	
<i>Prunella vulgaris</i>	selfheal		x		x	x
<i>Ranunculus repens</i>	creeping buttercup	x	x	x		x

Scientific name	Common Name	QEII	WSR	Brooks	Koko	WCA
<i>Rubus armeniacus</i>	blackberry	x #		x		x
<i>Rumex acetosella</i>	sheep's sorrel				x #	
<i>Salix xfragilis</i>	crack willow					x
<i>Scrophularia auriculata</i>	water figwort		x			x
<i>Sison amomum</i>	stone parsley	x		x		x
<i>Solanum mauritianum</i>	tobacco weed					x
<i>Sonchus asper</i>	prickly sow thistle	x				
<i>Sonchus oleraceus</i>	sow thistle	x				x
<i>Torilis arvensis</i>	hedge-parsley					x
<i>Tropaeolum majus</i>	nasturtium					x
<i>Trifolium repens</i>	white clover					x
<i>Ulex europaeus</i>	gorse	x			x	
<i>Verbena incompta</i>	purple top			x		x
<i>Verbena litoralis</i>		x				
<i>Veronica serpyllifolia</i>	thyme-leaved speedwell	x				
<i>Vinca major</i>	periwinkle					x
Monocots						
<i>Agrostis capillaris</i>	brown top	x		x	x	
<i>Allium triquetrum</i>	onion weed					x
<i>Asparagus scandens</i>	climbing asparagus		x			
<i>Carex divulsa</i>	grey sedge					x
<i>Carex flacca</i>	blue sedge			x		
<i>Carex longibrachiata</i>	Australian sedge	x	x			
<i>Carex punctata</i>	dotted sedge	x #				
<i>Carex vulpinoidea</i>	fox sedge	x #				
<i>Cenchrus clandestinus</i>	Kikuyu grass	x		x		x
<i>Cortaderia selloana</i>	pampas				x	x
<i>Crocasmia xcrocosmiiflora</i>	montbretia					x
<i>Cynosurus cristatus</i>	crested dogstail				x	
<i>Cyperus eragrostis</i>	umbrella sedge	x	x			x
<i>Dactylis glomerata</i>	cocksfoot	x	x		x	
<i>Ehrharta erecta</i>	veldt grass					x
<i>Festuca rubra</i> subsp. <i>rubra</i>	red fescue		x			
<i>Hedychium gardnerianum</i>	wild ginger	x	x	x		x
<i>Isolepis sepulcralis</i>		x				
<i>Juncus articulatus</i>	jointed rush				x	
<i>Juncus effusus</i> var. <i>effusus</i>	soft rush	x		x	x	
<i>Juncus tenuis</i>	track rush		x	x		
<i>Lolium arundinaceum</i>	tall fescue	x		x	x	x
<i>Paspalum dilatatum</i>	paspalum	x	x			x
<i>Phalaris canariensis</i>	Canary grass	x				
<i>Tradescantia fluminensis</i>	tradescantia		x			x
<i>Zantedeschia aethiopica</i>	arum lily					x

Appendix 1C: Non-vascular plants (Bryophytes).

Scientific name	QEII	WSR	Brooks	Koko	WCA
Liverworts					
<i>Dumortiera hirsuta</i>		x #			
<i>Leiomitra lanata</i>			x		
<i>Lepidozia spinosissima</i>			x	x #	
<i>Monoclea forsteri</i>	x				
<i>Plagiochila gigantea</i>				x #	
<i>Porella</i> sp.	x	x		x	
<i>Radula marginata</i>		x		x	
<i>Schistochila appendiculata</i>				x	
<i>Schistochila</i> sp.				x	
<i>Symphogyna hymenophyllum</i>	x			x	x
<i>Trichocolea mollissima</i>	x	x	x	x	
Mosses					
<i>Achrophyllum quadrifarium</i>	x		x	x	
<i>Campylopus clavatus</i>			x	x	
<i>Cladomnion ericoides</i>			x	x	
<i>Cyathophorum bulbosum</i>	x	x		x	
<i>Cyrtopus setosus</i>			x	x	
<i>Dawsonia superba</i>			x #		
<i>Dicranoloma billarderei</i>	x				
<i>Dicranoloma menziesii</i>	x	x	x	x	
<i>Dicranoloma fasciatum</i>	x #	x			
<i>Echinodiopsis hispidum</i>	x	x		x	
<i>Eurhynchium speciosum</i>					x
<i>Fissidens</i> sp.					x
<i>Hypnodendron arcuatum</i>			x		
<i>Hypnum chrysogaster</i>				x #	
<i>Hypnum cupressiforme</i>	x		x		
<i>Leptostomum macrocarpum</i>	x	x	x	x	x
<i>Leucobryum javense</i>	x	x	x		
<i>Macromitrium gracile</i>	x #		x	x	
<i>Mniodendron colensoi</i>	x	x	x	x	
<i>Orthorrhynchium elegans</i>	x			x #	
<i>Papillaria crocea</i>		x			
<i>Ptychomnion aciculare</i>	x	x	x		x
<i>Rhaphidorrhynchium amoenum</i>					x
<i>Rosulabryum subtomentosum</i>		x #			
<i>Sphagnum falciculatum</i>	x #				
<i>Thuidiopsis furfurosa</i>	x		x		x
<i>Trachyloma</i> sp.	x		x	x	
<i>Weymouthia cochlearifolia</i>	x				x
<i>Weymouthia mollis</i>		x	x	x	

Appendix 1D: Lichens.

Scientific name	QEII	WSR	Brooks	Koko	WCA
<i>Anzia entingiana</i>				x # AK383752	
<i>Austroparmelina conlabrosa</i>	x # AK384426	x # AK383642			
<i>Bacidia laurocerasi</i>		x #		x	
<i>Bacidia</i> sp.	x				
<i>Badimiella pteridophila</i>				x #	
<i>Biatoropsis usnearum</i>	x				
<i>Brigantiaea chrysosticta</i>	x		x		
<i>Cladia</i> aff. <i>inflata</i>	x			x # AK383767	
<i>Cladonia confusa</i>	x				x
<i>Cladonia darwinii</i>	x	x	x	x	
<i>Coccocarpia pellita</i>		x #			x
<i>Coccocarpia palmicola</i>	x			x	
<i>Coccotrema cucurbitula</i>				x # AK383794	
<i>Coenogonium implexum</i>		x			x
<i>Coenogonium lutescens</i>		x		x	
<i>Collema laeve</i>	x # AK384430				
<i>Collema subflaccidum</i>		x		x	x
<i>Collema subconveniens</i>		x		x	
<i>Crocodia poculifera</i>		x #			
<i>Dictyonema sericeum</i>		x		x #	
<i>Dirinaria picta</i>	x # AK383814				x
<i>Flavoparmelia haywardiana</i>					x
<i>Gabura fascicularis</i> var. <i>fascicularis</i>	x #	x #			
<i>Heterodermia casarettiana</i>	x	x		x	
<i>Heterodermia japonica</i>	x	x			x
<i>Hypotrachyna osseoalba</i>					x #
<i>Lecanactis subfarinosa</i>					x
<i>Leioderma solediatum</i>		x #			
<i>Leioderma erythrocarpum</i>		x #			
<i>Lepra truncata</i>		x #			
<i>Lepraria ulrikii</i>		x		x	x
<i>Leptogidium contortum</i>		x			
<i>Leptogium cyanescens</i>	x	x			
<i>Leptogium oceanianum</i>	x	x		x	x
<i>Lobaria asperula</i>	x # AK384428				
<i>Megalospora gompholoma</i>	x	x		x	x
<i>Menegazzia eperforata</i>				x	
<i>Menegazzia neozelandica</i>	x # AK384429	x		x	
<i>Menegazzia nothofagi</i>				x	
<i>Metus conglomeratus</i>				x # AK383864	

Scientific name	QEII	WSR	Brooks	Koko	WCA
<i>Miltidea ceroplasta</i>				x # AK383866	
<i>Notoparmelia erumpens</i>		x			x
<i>Notoparmelia testacea</i>	x # AK384033				
<i>Normandina pulchella</i>				x	
<i>Pannaria allorhiza</i>	x #	x			
<i>Pannaria aotearoana</i>	x #			x #	
<i>Pannaria araneosa</i>		x			
<i>Pannaria delicata</i>	x		x	x	
<i>Pannaria elixii</i>	x	x		x	
<i>Pannaria fulvescens</i>	x			x	
<i>Pannaria implexa</i>	x		x	x	
<i>Pannaria minutiphylla</i>				x	
<i>Pannaria</i> aff. <i>minutiphylla</i>	x # AK384014	x	x	x	x
<i>Parmeliella nigrocincta</i>	x # AK384427	x		x	x
<i>Parmotrema austrocetratum</i>	x	x			
<i>Parmotrema mellissii</i>	x # AK383882			x	
<i>Parmotrema reticulatum</i>	x	x	x	x	x #
<i>Parmotrema robustum</i>		x			
<i>Peltigera nana</i>	x	x	x	x	
<i>Pertusaria puffina</i>		x #			
<i>Pertusaria</i> sp.					x #
<i>Phlyctis</i> sp.		x	x		x
<i>Physcia poncinsii</i>	x				x
<i>Pseudocyphellaria carpoloma</i>	x	x		x	
<i>Pseudocyphellaria chloroleuca</i>	x #	x	x		
<i>Pseudocyphellaria crocata</i> agg.	x	x			
<i>Pseudocyphellaria dissimilis</i>	x #	x	x	x	
<i>Pseudocyphellaria glabra</i>	x #		x	x	
<i>Pseudocyphellaria intricata</i>		x			
<i>Pseudocyphellaria lividofusca</i>		x	x		
<i>Pseudocyphellaria montagnei</i>	x	x	x	x	x
<i>Pseudocyphellaria multifida</i>	x	x			
<i>Pseudocyphellaria wilkinsii</i>		x		x	
<i>Psoromaria versicolor</i> (syn. <i>Degeliella versicolor</i>)	x #				
<i>Podostictina pickeringii</i>	x # AK383912	x	x	x	x
<i>Porina exocha</i>	x	x	x	x	x
<i>Punctelia borreri</i>		x			
<i>Pyrenula</i> sp.	x	x		x	
<i>Pyxine subcinerea</i>		x #			
<i>Ramalina celastri</i>	x				x

Scientific name	QEII	WSR	Brooks	Koko	WCA
<i>Ramalina peruviana</i>					x
<i>Scytinium kauaiense</i>					x
<i>Stereocaulon ramulosum</i>			x		
<i>Sticta babingtonii</i>	x # AK383943			x	
<i>Sticta fuliginosa</i>		x			x
<i>Sticta lacera</i>				x # AK383946	
<i>Sticta latifrons</i>				x #	
<i>Strigula delicata</i>	x				
<i>Strigula novae-zelandiae</i>					x
<i>Thelotrema</i> sp.					x
<i>Usnea angulata</i>		x			
<i>Usnea baileyi</i>	x	x		x	
<i>Usnea cornuta</i>					x
<i>Usnea dasaea</i>					x
<i>Usnea nidifica</i>	x			x # AK383962	
<i>Usnea rubicunda</i>	x	x			

Appendix 1E: Fungi recorded across the Waimamaku catchment.

Scientific name	Common name	Scientific name	Common name
<i>Agaricus</i> sp.	native agaricus	<i>Hygrocybe</i> sp.	
<i>Austropuccinia psidii</i>	myrtle rust	<i>Pleurotus</i> sp.	
<i>Bauerago gardneri</i>	smut fungus on <i>Cyperus ustulatus</i>	Porothleaceae	
<i>Cyclocybe parasitica</i>	tawaka	<i>Stereum</i> sp.	
<i>Entoloma hochstetteri</i>	werewere-kokako, blue entoloma	<i>Uredo puawhananga</i>	rust on <i>Clematis paniculata</i>
<i>Entoloma latericolor</i>	grey entoloma		

Appendix 2. Threatened plant species in the Waimamaku area.

Several threatened plants known to be present in the Waimamaku area were not seen in the surveyed blocks; information on these taxa was collected from multiple datasets, including the Australasian Virtual Herbarium (AVH) and the Department of Conservation's Bioweb Threatened Plants Database. Some of these species' occurrences could be inaccurate due to error in recorded plant location. The Conservation Status for each taxon is from de Lange et al. (2018a), and data of regionally 'At-risk Sparse' species is from Miller & Holland (2008).

Scientific name	Common name	National Status [de Lange et al 2018a]	Regional Status [Miller & Holland 2008]	Record source
<i>Ascarina lucida</i>	hutu		Regionally Significant	AK164800
<i>Cranfillia nigra</i> (syn. <i>Blechnum nigrum</i>)			Regionally Significant	AK374998
<i>Doodia mollis</i>	rasp fern, mokimoki	At-Risk – Naturally Uncommon	Sparse	AK189745
<i>Drosera binata</i>	sundew		Regionally Significant	AK162513 AK203706
<i>Epilobium pallidiflorum</i>	swamp willowherb		Regionally Significant	AK143674
<i>Hebe acutifolia</i> (syn. <i>Veronica rivalis</i>)		At-Risk – Naturally Uncommon		AK217302
<i>Hebe diosmifolia</i> (syn. <i>Veronica diosmifolia</i>)			Regionally Significant	AK107625
<i>Hebe flavida</i> (syn. <i>Veronica flavida</i>)			Regionally Significant	AK165795
<i>Hymenophyllum australe</i> (syn. <i>Hymenophyllum atrovirens</i>)		At-Risk – Naturally Uncommon	Sparse	AK185532 AK223659
<i>Hymenophyllum lyallii</i>	filmy fern		Regionally Significant	AK128147
<i>Ixerba brexioides</i>	tawari		Regionally Significant	AK179228
<i>Lobelia physaloides</i> (syn. <i>Colensoa physaloides</i>)	koru	Threatened – Nationally Endangered, Vulnerable	Gradual Decline	
<i>Loxsoma cunninghamii</i>			Regionally Significant	AK223347
<i>Metrosideros carminea</i>	scarlet rata		Regionally Significant	
<i>Microlaena carsei</i>		Threatened – Nationally Endangered	Sparse	AK150988
<i>Nestegis cunninghamii</i>	black maire		Regionally Significant	AK296799
<i>Olearia albida</i>	tanguru, tree daisy		Regionally Significant	AK179233 AK276732
<i>Olearia angulata</i>	tanguru, tree daisy	At-Risk – Naturally Uncommon	Regionally Significant	AK209122 AK307594 AK380380
<i>Pittosporum ellipticum</i>		At-Risk – Naturally Uncommon	Sparse	AK176692 AK176693
<i>Pomaderris edgerleyi</i> (syn. <i>P. prunifolia</i> var. <i>edgerleyi</i>)	kūmerahou	At-Risk – Declining		AK66721
<i>Pseudowintera axillaris</i>	lowland horopito		Regionally Significant Sparse	AK172972
<i>Raukawa edgerleyi</i>	raukawa		Gradual Decline	CHR 477091
<i>Rubus squarrosus</i>	leafless bushlawyer		Regionally Significant	AK189740 AK192720 AK296788

Members of the Myrtaceae have had a recent elevation in threat status. This is because members of this family are expected to be affected by myrtle rust over the coming years (de Lange et al. 2018a). Members of now-threatened Myrtaceae within the Waimamaku area include:

- Ramarama (*Lophomyrtus bullata*) 'Threatened–Nationally Critical'.
- Rata vine *Metrosideros carminea* 'Threatened–Nationally Vulnerable'.
- Maire tawake or swamp maire (*Syzygium maire*) 'Threatened–Nationally Critical'.

A similar situation affects kauri (*Agathis australis*) which has now been classified as 'Threatened-Nationally Vulnerable' because of kauri dieback disease (*Phytophthora agathidicida*) (de Lange et al. 2018a). Scattered remnants of kauri forest can be found throughout the Waimamaku area.

Appendix 3. List of additional species, not observed during this survey of the Waimamaku catchment, based on online herbarium records accessed from the Australian Virtual Herbarium. * = exotic

Ferns and Allies		Monocots	
<i>Gleichenia dicarpa</i>	AK 223055	<i>Arthropodium cirratum</i>	AK 316310
<i>Lindsaea linearis</i>	AK 223687	<i>Caladenia minor</i>	AK 245870
<i>Notogrammitis pseudociliata</i>	AK 171324	<i>Carex leporina</i> *	AK 210001
<i>Rumohra adiantiformis</i>	AK 220325	<i>Corybas oblongus</i>	AK 208641
<i>Sticherus flabellatus</i>	AK 220416	<i>Danthonia decumbens</i> *	AK 278519
Dicots		<i>Genoplesium pumilum</i>	AK 144036
<i>Abelia</i> × <i>grandiflora</i> *	CHR 508322	<i>Machaerina teretifolia</i>	AK 155564
<i>Acaena anserinifolia</i>	AK 213070	<i>Melinis repens</i> *	CHR 20568
<i>Ackama rosifolia</i>	AK 213053	<i>Microtis parviflora</i>	AK 296810
<i>Alseuosmia macrophylla</i>	AK 279406	<i>Moraea flaccida</i> *	AK 375933
<i>Amaranthus powellii</i> *	AK 166396	<i>Scirpus georgianus</i> *	AK 210000
<i>Calystegia tuguriorum</i>	AK 213167	<i>Schoenus apogon</i>	AK 276076
<i>Cassytha pubescens</i>	AK 273199	Liverworts	
<i>Coprosma tenuicaulis</i>	AK 168548	<i>Heteroscyphus triacanthus</i> var. <i>magnistipulatus</i>	AK 258881
<i>Dodonaea viscosa</i>	AK 213030	<i>Lepidolaena clavigera</i>	AK 309821
<i>Entelea arborescens</i>	AK 316309	<i>Metzgeria consanguinea</i>	AK 317237
<i>Fuscospora truncata</i>	AK 328845	<i>Temnoma pulchellum</i>	AK 258882
<i>Helenium puberulum</i> *	CHR 5692	<i>Pallavicinia xiphoides</i>	AK 320790
<i>Helichrysum lanceolatum</i>	AK 276079	Mosses	
<i>Illecebrum verticillatum</i> *	WELT SP070202	<i>Cryptopodium bartramioides</i>	AK 168791
<i>Melicytus micranthus</i>	AK 273873	<i>Breutelia pendula</i>	AK 163716
<i>Nestegis montana</i>	AK 209119	<i>Bryum laevigatum</i>	WELT M030141
<i>Parsonsia heterophylla</i>	AK 209118	<i>Dendrohypopterygium filiculiforme</i>	CHR 516022
<i>Prunus persica</i> *	CHR 415409	<i>Hypopterygium didictyon</i>	CHR 516067
<i>Salix cinerea</i> *	AK 376004	<i>Lopidium concinnum</i>	CHR 516960
<i>Syzygium maire</i>	AK 182854	<i>Pendulothecium punctatum</i>	WELT M030143
<i>Torilis japonica</i> *	AK 192719		
<i>Verbena brasiliensis</i> *	CHR 450075		