Moore and Wodzicki (1950) recorded 4 vascular plants, including a grass (and 10 algae) amongst gannet nest material on White Island, in the Bay of Plenty. The terrestial plants included the same 3 found growing on Oaia Island. Imagine the damage to Oaia's vegetation if most gannet nests annually have pieces of vascular plants added to them.

Cook's scurvy grass has drastically declined thoughout New Zealand; it was well known on Auckland's west coast in the 1930s and was recorded at Piha in 1948 (Esler 1975). The 1953 Oaia record of scurvy grass appears to be the last that close to Auckland. The increase of gannets may have caused the loss of scurvy grass on Oaia, but it is well suited to guano enriched islands (Ogle 1987).

We thank the Muriwai Surf Life Saving Club for transporting us to the island and F.I. Dromgoole for assisting identify the Prasiola.

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KOROMATUA BUSH, PIRONGIA HIGHWAY

P.J. de Lange

INTRODUCTION

The Koromatua Bush (NZMS S14 053710, altitude c.60 m) is situated on the Tuhikaramea Hills in the vicinity of the Mormon Temple settlement of Temple View. The land is currently leased for dairy farming. The forest was first examined by the author in early 1985 (de Lange, 1985a) because it contained large karaka trees (Corynocarpus laevigatus) mentioned by Gudex (1963). The dominance of karaka is probably due to

deliberate introductions by the Maori (Gudex, 1963). The forest is now largely tawa (Beilschmiedia tawa) but it may have once contained much rimu (Dacrydium cupressinum) since several quite large trees still exist in the main gully.

Forest of this type is virtually extinct in the Hamilton basin. In addition, within the remnant, a small swamp forest containing 37 maire tawake (Syzygium maire) trees was discovered. This species is now very local in the Waikato although in the past it was probably quite widespread.

Several species more typical of coastal sites or the surrounding ranges were located. As with the Orini forest (de Lange, 1987), this small remnant indicates that the past flora of the Hamilton basin probably contained a significant "northern range element" which is now confined to the surrounding ranges or coastal forest. This pattern was first noted by Gudex (1963) who listed some plant distributions for the greater Waikato. His work has provided the basis for further research into this matter, and it would appear the northern range floral component is much more widely distributed than previously believed.

This paper discusses the forest composition, the coastal and northern range element of the vegetation, and compares this forest's flora with other remnants surveyed. Tables of species considered to represent northern and southern elements of the basin's flora and a checklist of the Koromatua Bush is appended. Unless otherwise stated, all collections cited are those of the author.

THE FOREST

The forest is situated on the eastern side of a series of low rolling hills composed of mid Pleistocene deposits - the Puketoka and Karapiro Formations and mantled with volcanic ash (McCraw, 1967). These separate the Rukuhia Peat Swamp from the Waipa River Basin. The hills traverse the middle of the main Hamilton basin from Kihikihi to Ngaruawahia and thus provide a means for vegetation typical of the surrounding ranges to enter the Hamilton Basin. The survival of the forest on these hills has been poor, the Koromatua Bush being the only known example of tawa dominated forest left in the basin (personal observation).

The extent of the remnant is not large (c. 3 Ha) but most of the forest is well protected from the prevailing wind since the larger part is on the lee side of the hill. Two small gullies divide the hill and these contain a small swamp which has been preserved from drainage by the construction of oxidation ponds immediately outside the forest area.

The upper section of forest is severely wind damaged and is now dominated by titoki (Alectryon excelsus var. excelsus) and karaka, with an understorey of Solanum pseudo-capsicum and S. chenopodioides. The condition of this damaged forest would improve if stock were removed from the remnant and the edge planted in kanuka (Kunzea ericoides var. ericoides), thus allowing an understorey to establish. When the forest was first examined in 1985 stock were not present in the forest and the condition of this edge was much better.

Sections of the forest have been cleared in the past and have regenerated as kanuka forest. This forest has little understorey, but where this is present it is dominated by mahoe (Melicytus ramiflorus subsp. ramiflorus) and mapou (Myrsine australis). The ground cover is now largely pasture but in places Doodia media subsp. australis covers

the bare ground.

Both gullies contain a pukatea (Laurelia novae-zelandiae)/maire-tawake forest, which is in good condition in the larger gully. The canopy is dominated by tall pukatea and three emergent rimu and the understorey contains many maire-tawake forming a thick tier. Scattered kahikatea (Dacrycarpus dacrydioides) also occur in these gullies, but most are small pole-sized specimens not numerically important in the association. This type of swamp association is not protected in any of the Basin's reserves or Queen Elizabeth Trust Covenants and is of a type rapidly vanishing from the surrounding King Country areas (Clarkson, B.D. in: Wilde, K.A. 1982).

Beneath the interlacing tier of maire-tawake, a dense tangle of supplejack, kiekie (Freycinetia baueriana subsp. banksii), wheki (Dicksonia squarrosa), kanokano (Coprosma grandifolia) and mahoe is present. The ground cover is largely made up of Asplenium oblongifolium, A. bulbiferum s.s. and Blechnum filiforme, large pools completely devoid of vegetation are common.

Between the gullies and the main ridges a thick tawa forest is present. Whilst most of the tawa have leaf dimensions usual for that species, this grades from narrow elliptic-lanceolate leaves to broad elliptic-ovate (see WAIK 1521, 1522, (tawaroa like), 8119 (intermediate) to 8120 (normal tawa like)). Specimens from a single tree growing in an exposed site adjacent to a clearing have canopy leaves comparable to the dimensions described for Beilschmiedia tawaroa (Wright, 1984). Duplicates from this specimen were forwarded to AK where they were determined as B. tawa by Anthony Wright. Whilst these "tawaroa" like specimens are not comparable to specimens of this species from the Northland area, they fit closely material referred to as tawaroa from the East Cape area. It is the author's personal belief that B. tawaroa is not a good species south of a line between Auckland and Coromandel. In these more southerly areas the distinction between B. tawa and B. tawaroa both morphologically and ecologically becomes blurred.

THE NORTHERN RANGE AND COASTAL COMPONENT OF THE FOREST

As with the Orini Forest (de Lange, 1987b), Gordonton kahikatea forests (de Lange, 1985b) and Koromatua gully system (de Lange, 1986) the Koromatua Bush contains a number of species typically associated with coastal forest and/or the surrounding ranges of the basin. Unlike the latter examples (excluding Gordonton), Koromatua Bush is fairly isolated from the ranges, however as noted before the forest is situated on a series of low hills which traverse much of the basin, thereby allowing plants of the ranges to enter the basin without having to cross the previously peat bog and kahikatea dominated forest of the basin. It is probably for this reason that Koromatua Bush contains a number of these "northern range and coastal" species. Although the hills provide a plausible point of entry into the basin, it fails to account for the disjunct distribution of Lastreopsis velutina, Pteris macilenta, Blechnum sp. "Green Bay", and Blechnum fraseri in the greater Waikato.

The Lastreopsis was considered rare by Gudex (1963), in his list for the greater Waikato (listed as Ctenitis velutina). This is confirmed by the low number of collections in the University of Waikato Herbarium, which contains only two collections from the western Waikato (WAIK 1872 A, B Puti Pt. S.R. Kawhia, and WAIK 4873, 74 Gordonton Kahikatea

Forest). Aside from these collections the species has been observed by the author on the Karioi Coast, Raglan in the west and at the base of Mt Te Aroha in the east. It is nowhere common, known from single plants on old logs or rocks. In Koromatua Bush a single large specimen was found on a dry slope amongst Doodia media (WAIK 8176).

Neither the Pteris[1] nor the Blechnum species have been recorded from the basin before. The Pteris is probably quite common in the western Waikato, despite only one collection from the coast (WAIK 3421, Te Maika Peninsula, Kawhia, de Lange). I have found it to be locally abundant in the western King County on calcareous rocks (although here it merges with P. saxatilis and seen it in several coastal reserves around Kawhia. Still the isolated occurrence of a single specimen at Koromatua is peculiar when the species is not known from nearby Pirongia (Druce, 1978) or the Kapumahunga Ranges (personal observation).

Blechnum sp. "Green Bay" is common on coastal banks and cliffs, calcareous rocks and lowland coastal forest in the western Waikato (e.g. WAIK 6209, 7545, 7551), but as one heads east it is eventually replaced by Blechnum sp. "Black Spot" such that it is absent from the Pirongia massif (Druce, 1978) and surrounding ranges.

Blechnum fraseri is common north of the basin, where it is often a feature of the gullies of the Hakarimata and Hapukohe Ranges. South of Mt Pirongia it becomes increasingly rare, being noted at Te Kauri Scenic Reserve (de Lange, 1986), the Taharoa Ranges and right on the coast near Awakino. I have yet to observe it further inland. At Koromatua small specimens were discovered on steep banks above the main gully system, this is the first time this species has been noted from the basin.

Aside from the ferns the forest contains other elements of a more northerly influence. The distribution of mamangi (Coprosma arborea) was discussed in de Lange (1987b) as largely following the ranges on either side of the basin. Its presence at Koromatua Bush is not surprising as it can easily have entered the basin via the basin hills. What is intriguing is the absence of Coprosma spathulata from the few remnants containing C. arborea, since both species usually occur together in the ranges. C. spathulata is present in the Koromatua Gully 12 Km west of the bush (de Lange, 1986), possibly it has been selectively browsed from the site, since in all the Basin localities where it is known it is heavily browsed. The specimen of mamangi at Koromatua is a sizeable adult tree, and at Orini the forest has been fenced since the early 1900s (de Lange, 1987b); possibly C. arborea was more widespread in the past and has also succumbed to forest destruction and browsing pressure.

Kawakawa (Macropiper excelsum f. excelsum) is common in the ranges on either side of the basin. Kawakawa is locally common on the banks of the Waikato River so it is quite likely it was once common in forested areas of the basin.

Maire taiki (Mida salicifolia) is not so easily explained, this species is not common in the greater Waikato,[2] although this is now difficult to assess since it is heavily browsed by opossum (Trichosurus vulpecula). Despite this, Gudex (1963) considered it sufficiently uncommon to be noted in his list of plant distributions (opossum only became common in the Waikato in the early 1970s, personal observation), noting it as common only around Mt Karioi (see Gudex Herbarium in WAIK). It is also occasionally seen where ever large stands of tanekaha Phyllocladus trichomanoides) occur in the western Waikato, but in general it is confined to warm coastal forest or kauri forest and even

in these sites it is usually never abundant. A single specimen in the Koromatua Bush was discovered parasitising a rimu, in early 1985 (WAIK 1509), by 1987 this specimen had succumbed to stock damage. This species has previously been reported from Claudelands Bush by Gudex (1955)[3] where it has since become extinct (Boase, 1985). It is unlikely to have been a common component of the basin flora.

Arthropteris tenella, also found here, is uncommon in the Hamilton basin, being a species more normally associated with coastal forest. Gudex (1963) considered it not widely distributed, but commented that where present it is often quite common. In the Waikato lowlands I know of it from only four localities: Awaroa Wildlife Management Reserve, Whangape, WAIK 6222, Champion, P.D.; Claudelands Bush, Hamilton, WAIK 2985, Champion, P.D.; Mt Kakepuku Historic Scenic Reserve, AK 169857, Smith, Dodsworth, J. & de Lange, P.J. and Koromatua Bush WAIK 1515, 8152.[4] In these four sites it is extremely common, yet it is absent from many areas of seemingly suitable habitat in between. This pattern is not unique to Arthropteris but is typical of many species in the Waikato.

Aside from this northern and coastal component the bush contains a number of species not yet reported from other forested areas in the basin. Notably; kohurangi (Brachyglottis kirkii var. kirkii), tawhiri-karo (Pittosporum cornifolium) and maire tawake. Fine specimens of puka (Griselinia lucida) also occur on rimu and pukatea. A single specimen of Collospermum microspermum has also been found, this species is the only example of the "southern montane flora" noted in the remnant.

Table 1 lists those species either confined to Koromatua Bush (at present) or known from three or less localities in the basin.

From the surveys already prepared from the Hamilton basin a distinctive pattern of northern and southern components of the basin's

Table 1. Species confined to Koromatua Bush or with very restricted distributions in the Hamilton Basin

Species	University of Waikato Herbarium number
Tmesipteris lanceolata	
Arthopteris tenella	8152
Blechnum sp. "Green Bay"	8126
Lastreopsis velutina	
Pteris macilenta	8141
Brachyglottis kirkii var. kirkii	8174
Coprosma arborea	8121
Macropiper excelsum f. excelsum	8134
Metrosideros robusta	
Mida salicifolia	1509
Nestegis cunninghamii	7587
Olearia rani	8169
Pittosporum cornifolium	8117
Syzygium maire	8139
Earina autumnalis	
Collospermum microspermum	

flora is emerging. A number of species typical of either northern forests or southern montane forest have been discovered. These consist of the following groupings: A) northern species more often associated with kauri forest and/or coastal forests at this latitude, and B) species normally confined to land above 300 m in this area. Those of grouping B are often confined to the higher peaks and ranges (e.g. Pirongia) and table lands.

In sites where conditions are favourable, elements of types A and B will occur outside their usual range. This has been observed in lowland forest of the western Waikato where local topographic features have enabled both types of flora to survive e.g. Apple tree Rd, Tawarua Forest (Ogle and Druce, 1986), Te Kauri Scenic Reserve (de Lange, 1987a). The same appears to hold true for the Hamilton Basin.

Tables 2 and 3 list species found in the basin which are considered to represent floral assemblages of types A and B. The placing of these species is only tentative being based on a knowledge of the distribution patterns of these species in the greater Waikato area. The removal of some of those listed is expected. In all cases mentioned the species has been seen by the author or is represented by a cited herbarium specimen.

Table 2. Species found within the Hamilton Basin considered to be elements of northern or coastal affinities in the Waikato.

Agathis australis	Phyllocladus trichomanoides
Libocedrus plumosa	Adiantum aethiopicum
Adiantum hispidulum	Arthropteris tenella
Asplenium lamprophyllum	Blechnum fraseri
Blechnum sp. "Green Bay"	Doodia mollis
Doodia squarrosa	Doodia x digena
Hypolepis dicksonioides	Marattia salicina
Lastreopsis velutina	Bulbophyllum tuberculatum
Cordyline pumilo	Gahnia xanthocarpa
Trisetum sp. antarcticum agg.	Alseuosmia x quercifolia
Coprosma arborea	Coprosma spathulata
Mida salicifolia	Nertera dichondrifolia s.s.
Rorippa gigantea WELT 29944 Petrie	Pseudocyphellaria aurata

Table 3. Species found within the Hamilton Basin considered to be elements of southern or montane affinities in the Waikato.

Blechnum penna-marina	Dicksonia lanata
Hymenophyllum armstongii	Polystichum vestitum
Astelia fragrans	Carex forsterii
Collospermum microspermum	Cordyline indivisa
Uncinia distans	Melicytus lanceolatus
Neomyrtus pedunculatus	Pseudopanax anomalus
Pseudowintera axillaris	Pseudowintera colorata
Nephroma australe	

Those of Table 2 are usually found in lowland forest (e.g. Orini, Koromatua), the Waikato River Banks, Gully edges and under scrub. Whilst some may occur as single specimens most are found together in distinct associations, e.g. Orini, Koromatua Bush and Koromatua Gully. Those of Table 3 are typically associated with kahikatea remnants or deep, shaded gullies; areas subject to local ponding of cool air. They are less common than those of Table 2 and are probably very dependent on the habitat remaining undisturbed.

SUMMARY

The Koromatua Bush is a remnant of high botanical significance. The bush supports a vegetation type not represented within the present Hamilton Basin reserves network. This type is the pukatea/maire tawake swamp forest, an association rapidly vanishing from the surrounding ranges as more lowland sites are converted to pasture. In addition the bush is dominated by a tawa type forest not yet seen elsewhere in the basin.

Whilst the remnant holds no threatened plant species, this is not important. The remnant contains species which are locally uncommon and some which may no longer exist in other forested areas of the basin. The forest is currently under threat from stock browsing, which has already caused the extinctions of Mida salicifolia and Nestegis cunninghamii and caused much damage to the regenerating forest tiers.

Koromatua Bush holds some important clues to the past vegetation composition of the Hamilton Basin, a feature it shares with similar remnants examined by the author in the northern and western edges of the basin.

From the systematic survey of the Hamilton Basin remnants a distinctive pattern of the past vegetation is emerging. It is apparent that the past basin flora contained a significant northern component and a lesser southern element, as well as the more usual forest species. This pattern is still to be seen in the surrounding ranges of the basin.

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INDIGENOUS VASCULAR FLORA OF KOROMATUA BUSH

Based on two visits to the forest in February 1985 and October 1987. Vouchers of most records are lodged with the University of Waikato Herbarium (WAIK) with some duplicates in AK and WELT.

\+ = uncommon or local within confines of forest (usually 2 or less specimens observed)

	WAIK
Psilopods	
Tmesipteris elongata +	8145
T. lanceolata +	
Ferns	
Arthropteris tenella	1515, 8152
Asplenium bulbiferum s.s.	8133
A. flaccidum subsp. flaccidum	8175
A. oblongifolium	8172
A. polyodon	8124
Azolla filiculoides	8147
Blechnum chambersii	8144
B. filiforme	8125
B. fluviatile +	
B. fraseri +	8142
B. membranaceum	8157

B. minus	8150
B. sp. (common sp., "Black Spot" reduced lower pinnae)	
B. sp. "Green Bay" +	8126
Cyathea dealbata	8118
C. medullaris	
Deparia petersenii subsp. congrua	8136
Dicksonia squarrosa	
Diplazium australe	
Doodia media subsp. australis	8228
Lastreopsis glabella	8137
L. hispida	8128
L. microsoria subsp. pentangularis	8121
L. velutina +	8176
Paesia scaberula	
Pellaea rotundifolia	8164
Phymatosorus diversifolius	8170
P. scandens	
Pneumatopteris pennigera	8149
Polystichum richardii +	
Pteridium esculentum	
Pteris saxatilis +	8177
P. tremula +	
P. macilenta +	8141
Pyrrosia elaegnifolia	8143
Trichomanes venosum	8138

Gymnosperms

Dacrycarpus dacrydioides	
Dacrydium cupressinum +	
Prumnopitys taxifolia +	8129

Dicotyledons

Alectryon excelsus var. excelsus	8116
Aristotelia serrata	8154
Beilschmiedia tawa	1521, 1522+, 8119, 8120
Brachyglottis kirkii var. kirkii +	8174
Carpodetus serratus +	8135
Coprosma arborea +	8121
C. areolata +	
C. grandifolia	8130
C. lucida +	8114
C. rigida	
C. robusta	
C. rotundifolia	1544
C. rotundifolia x areolata +	8148
Corynocarpus laevigatus	8163
Fuchsia excorticata +	8151
Geniostoma rupestre var. ligustrifolium	8127
Griselinia lucida +	8162
Hedycarya arborea	8113
Knightia excelsa +	
Kunzea ericoides var. ericoides	8153
Laurelia novae-zelandiae	8155
Leptospermum scoparium +	

Leucopogon fasciculata	8156
Macropiper excelsum f. excelsum +	8134
Melicytus ramiflorus subsp. ramiflorus	8161
Metrosideros robusta +	
Mida salicifolia +	1509
Myrsine australis	
Nestegis cunninghamii +	7587
Olearia rani +	8169
Pittosporum cornifolium +	8117
P. eugenioides +	8165
Pseudopanax arboreus +	
Schefflera digitata	8123
Solanum aviculare +	8171
Syzygium maire	8139

Monocot lianes

Freycinetia baueriana subsp. banksii	
Ripogonum scandens	8167

Dicot lianes

Metrosideros diffusa	
M. fulgens	8115
M. perforata	8166
Muehlenbeckia australis	
Parsonsia heterophylla	
Passiflora tetrandra	

Grasses

Oplimenus hirtellus subsp. imbecillus	
Ehrharta diplax	
E. stipoides	

Orchids

Bulbophyllum pygmaeum	
Corybas trilobus +	
Drymoanthus adversus	
Earina autumnalis +	
E. mucronata	8159

Sedges

Carex inversa	
C. lambertiana	
C. lessoniana	
C. secta s.s.	
C. solandri	
C. virgata	
Isolepis reticularis	
Schoenus maschalinus	
Uncinia uncinata	

Rushes

Juncus australis +	
J. gregiflorus +	
J. planifolius +	

Other monocots	
Astelia solandri	8173
Collospermum hastatum	8112
C. microspermum +	
Lemna minor +	8131
Wolfia australiana	
Dicot herbs	
Cardamine debilis agg.	
Haloragis erecta subsp. erecta	
Rorippa palustris +	8168
Composite herbs	
Senecio minimus +	

Footnotes

1 Since this paper was submitted P. macilenta has been discovered in the Mangatea Kahikatea Forest, Tauhei (WELT), (de Lange, in prep.). Although the distinction between P. saxatilis and P. macilenta is blurred in Basin collections, suggesting hybrid origin (Brownsey pers. comm., pers. obs. 1988 - based on specimens in WELT from Koromatua). Lastreopsis velutina has also been discovered in this locality where it is rare.

2 Recently large specimens have been discovered on the Tauhei Range, some of these enter the basin proper at Mangatea (de Lange, in prep.).

3 This record is probably based on Nestegis lanceolata. There is no supporting specimen of Mida in the Gudex collection and the kahikatea forest of Claudelands seems an unlikely site for this species.

4 Recently discovered in the Mangatea Kahikatea Forest (de Lange, in prep.)

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RHEOPHYTES IN NEW ZEALAND*

R.O. Gardner

Plants especially adapted for life in or near swift river waters, a life often hazardous and brief, but a well-illuminated one, are called rheophytes. The term, which strictly applies only to perennials, covers plants in a variety of situations from mountain stream boulder deposits to rocky gorge walls and river flats.

Rheophytes tend to have lanceolate glabrous leaves, often arranged in

*In memory of John Bartlett