Changes over 50 Years in a Native Forest Quadrat in Otari Reserve, Wellington

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Summary

Where tongues of forest persist in valley heads towards the high western boundary of Otari Reserve, Wellington, Quadrat 12, one of several first described in my 1932-34 study, has been re-examined recently. Over 50 years, changes in vegetation have been substantial close to and beyond the bush edge, but superficially slight inside the forest. The grassed spur-top with windshorn humps of lianes, shrubs and ferns giving mutual protection became clad with gorse, which, in maturing, has been a nursery for a new generation of native shrubs and ferns. Barberry has become a recent aggressive invader. Morphological adaptations of some native woody plants to wind-exposed conditions are noted.

Introduction

Botanical studies which I undertook at Otari, Wellington, in the period 1932-34 reflect an association with Dr Leonard Cockayne during the last years of his life. He suggested that, for an honours thesis, I should determine why rangiora was such an important component of forested areas near Wellington. In retrospect, I have little doubt that Cockayne foresaw that the study would inevitably extend to rangiora's associates, but not necessarily to encompass the survey described as "A Preliminary Study of the Vegetation of Otari Plant Museum". Economic conditions, and some technical problems with data presentation in 1934, caused indefinite postponement of publication. In the absence of a published paper describing the design and performance of the field studies, it should be explained that methods of study of vegetation were at an early stage of development five decades ago. Belt transects were used to sample Otari areas, but quadrats covering forest associations and seral succession were eventually preferred for native vegetation. Quadrat size was varied with the vegetation complexity and is over-large according to present day ideas.

On a ground plan, the positions of all woody plants 3' (1m) or more tall were plotted, and approximate groundline diameters drawn in, according to a scale 1" (2.5 cm) = 10' (3 m). Beside each entry the species symbol and height in feet were entered. Where ferns produced a well-developed cover, as in Quadrat 12, another ground plan was usually drawn to show them. For consistency, the plant names used in the text are those on which the species symbols, used on the quadrat drawings, are based, and include both common and formal names. Changes in botanical nomenclature since 1932 tend to make a nonsense of some species symbols chosen at that time, e.g. N = *Pseudopanax (Nothopanax) arboreus*. Table 1 lists all the species and their symbols.

Some changes in procedure have been made for the benefit of future observers reviewing the quadrats. These are listed later in this article.

The situation in 1932-4

In my thesis, reference was made to clearing of forested hill slopes by European settlers, probably by fire last century. Clearing was incomplete in the major part of Otari lying west of Kaiwharawhara Stream;

Table 1: **Tally by Height Classes in Quadrat 12 in 1932-34 and 1982-83**

Names and Symbols used in text and figures		Height Class 1: 25' (7.6 m & Up)		Height Class 2: 12-25' (3.7-7.6 m)		Height Class 3: 3-12' (1-3.7 m)		Floor	
		1932-4	1982-3	1932-4	1982-3	1932-4	1982-3	1932-4	1982-3
kohekohe	K	10	17	39	27	18	23	8	6
Macropipier	m			4	5	13	40	56	15
rangiora	r			6	3	1	7		1
mahoe	M	1	1	2	3	1	5	7	5
Geniostoma	G				4	4	5	4	
Pennantia (corymbosa)	Pc			3	2	1		1	
tawa	T			1	2	2			
pigeonwood	P	1	1	1	4				1
pate	p			1	(1)	1		1	
mapau	S			1	(1)	3		3	1
rewarewa	RR				2		4	4	3
Olearia (rani)	O	1		2		2		2	
Fuchsia (excorticata)	F	1		2					
hinau	H					2		2	
Aristotelia (serrata)	A							1	
ramarama	rr					10		11	
five finger	N			3					1
karaka	Ka					2	1	4	4
kahikatea (white pine)	Wp							2	
Coprosma lucida	Cop.luc.			1	1	2	1		
C. areolata	Cop.are								
	Ca			1			2		
C. grandifolia	Cop.gr.								
(australis)	Cop.aus.			1	1		2	1	
Paratrophis									
(microphylla)	Pm					1	1		
titoki	Ti								1
Cyathea medullaris	Cm (cm)	1					1		
C. dealbata	Cd (cd)			2			3		
barberry									
(B. darwinii)	Barb						2		
gorse	Go						2		
Cassinia									
(leptophylla)	Cs (cass)					2			
supplejack	Sj	few	many						
TOTALS		15	19	70	56	65	99	107	38

Ground Ferns	**Symbol**	**Notes**	**1932-34**	**1982-83**
Asplenium bulbiferum	Ab	Principal clump fern	31	57
A. oblongifolium	Al	Sporadic in good light	14	5
A. polyodon	(Aa) Ap	Mainly on humps above floor	6	3
Blechnum filiforme	Bf	Principal creeping fern	(22)	(19)
B. chambersii	B ch	In heavy shade		4
Lastreopsis glabella	(Dg) Lg	Small clumps, very common	6	10
L. hispida	(Ph) Lh	Sporadic	14	5
L. velutina	Lv	Large clumps		3
Phymatosorus diversifolius	Pd	Mainly on humps, good light	(6)	
P. scandens	Ps	On dead tree ferns		(4)
Polystichum richardii	Pr	In good light	7	5
Pteris macilenta (auct. NZ)	Pm	Sporadic	1	3

tongues of bush persisted in valleys between the open spurs near the north-west boundary fence, with mahoe *(Melicytus ramiflorus)* and *Fuchsia excorticata* as common small trees. With exclusion of stock by good fence maintenance, encroachment on grassed slopes by native forest species was occurring in 1932-34 when Quadrats 9, 10, and 12 were plotted in that general area. Notes made at that time about Quadrat 12 state: "A quadrat extending from the bush edge down to the bottom of the shallow valley was charted. The slope towards the west is very gradual. The effect of the severe winds is well-marked — the height of the bush lessening up the slope until at the bush edge it is very stunted and of special character. Thus the bush is never higher than the level of the spur over which the north-west wind sweeps, with the exception of isolated trees such as the slender Kahikatea *(Dacrycarpus dacrydioides)* which appear above the general level along the bush margin."

Other wind-resistant and light-demanding species mentioned then as being common at the bush edge were:

1. Emergent trees: karaka *(Corynocarpus laevigatus),* titoki *(Alectryon excelsus),* toro *(Myrsine salicina)* and terrestrial *Griselinia lucida,* with *Muehlenbeckia australis* the main liane.
2. Smaller plants: *Cassinia leptophylla* (tauhinu) clumps, *Pennantia corymbosa* (kaikomako) as a tightly divaricating, wind-shaped shrub, *Myrsine australis* (mapau), *Elaeocarpus dentatus* (hinau), *Coprosma lucida, C. areolata* and *Polystichum richardii. Parsonsia heterophylla, Metrosideros* spp. and *Rubus cissoides* (lawyer) associated with *Lophomyrtus bullata* (ramarama), *Brachyglottis repanda* (rangiora) and *Aristotelia racemosa* (makomako) formed wind-shaped "humps" along with smaller "lumps" of vegetation built around dead tree fern bases beyond the bush edge.

Quadrat 12 encompassed a rectangle 100' (30 m) long by 20' (6 m) wide for most of its length, but broadened to 30' (9m) in the vicinity of the bush edge. As shown in the quadrat drawings (Figs 1 and 2) and in a profile sketch (Fig. 3), the kohekohe forest was extending up the quadrat towards the bush edge. Table 1 shows three height classes for woody plants and tree ferns over 3' (1 m) in height for the two surveys (Fig. 1); it also records the approximate number of clump ferns (and an assessment of creeping and climbing species) plotted in the quadrat drawings (Fig. 2).

Another note made in 1932-34 which is relevant to the 1982 re-assessment reads, with minor editorial changes:

> "A large rotting log has a number of plants peculiar to itself. No doubt the vegetation around the log is mostly of recent origin as the log would offer a convenient alighting spot for birds; seeds would have been deposited in droppings to produce the plants of *Coprosma lucida, Pseudopanax arboreus, Elaeocarpus dentatus* and *Astelia solandri* plants found there as epiphytes. Windborne *Brachyglottis* seeds and *Asplenium* spores have ensured their presence also on the log. A small nikau *(Rhopalostylis sapida)* nearby appears to have arrived by natural means. Two small kahikateas represent the podocarp element."

Unfortunately, many data, including diameter measurements for trees, were lost in a fire soon after completion of the original field work.

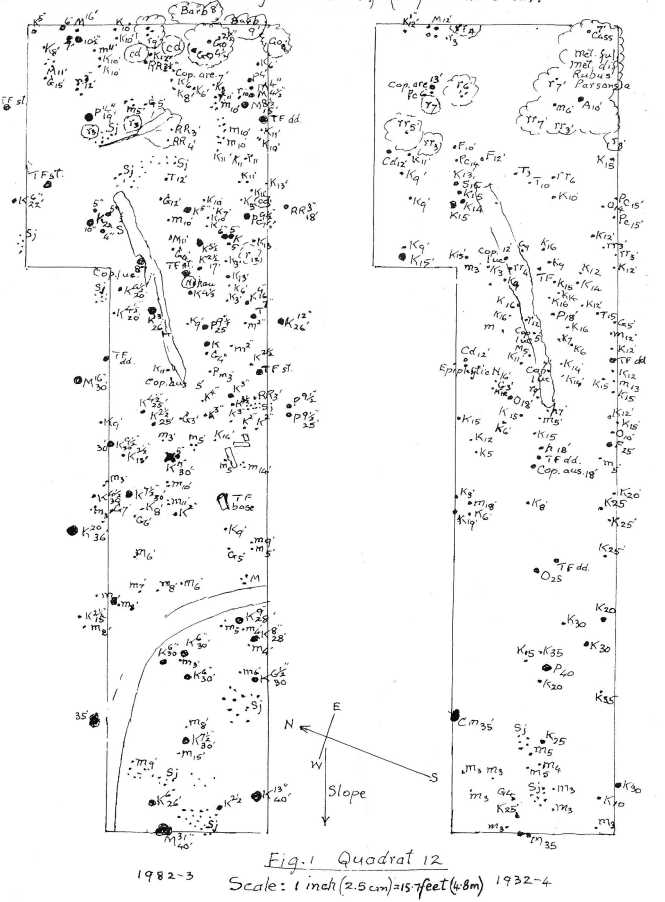


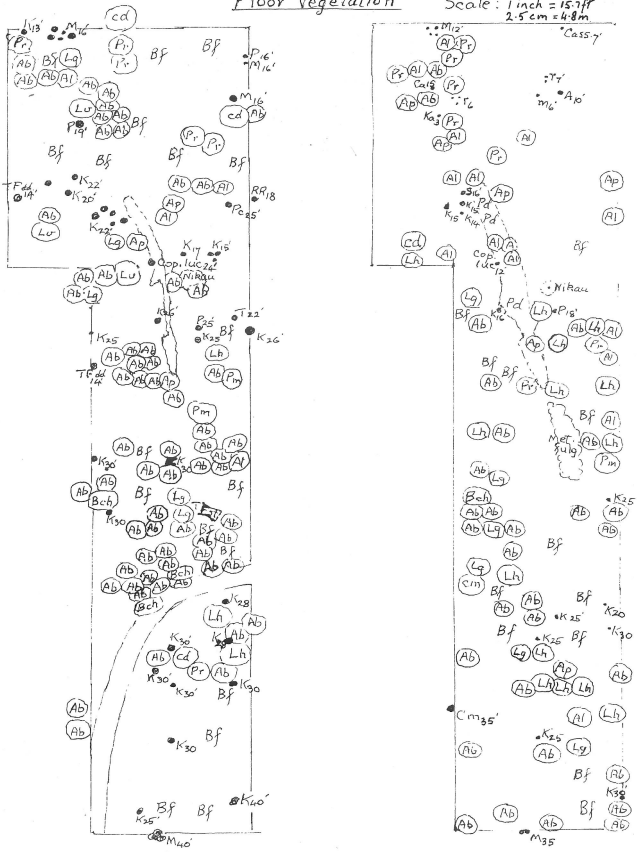
Fig. 1 Quadrat 12

Fig. 2

1982-3 Quadrat 12 1932-4

Floor Vegetation

Scale: 1 inch = 15.7ft
2.5 cm = 4.8m



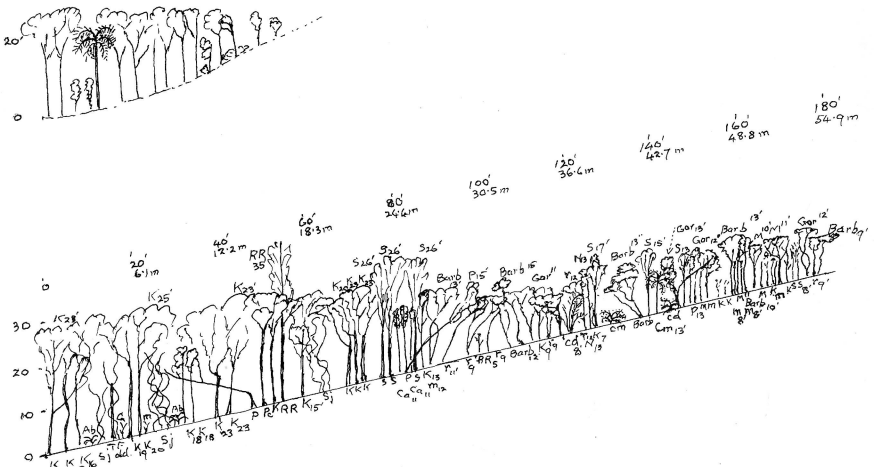


Fig. 3 Profiles 1932-4 above, 1982-3 below, extending from kohekohe forest beyond bushedge and into scrub belt respectively

Although the quadrat drawings were intended to give an accurate scaled representation, the scale (1" = 10') was scarcely suitable for showing small diameter stems in their true sizes. (N.B. In printing, the scale of these was reduced to 1" = 15.7'; Figs. 1, 2.)

Enduring features assisting quadrat recognition in 1982

When plotted initially, Quadrat 12 was approached from a track crossing the open grassed spur close to the bush edge and identified readily by vegetational features that have since been submerged as scrub growth replaced the grass. In public domains corner pegs cannot be relied upon. Recognition therefore depended on features shown on the ground plan such as:

(a) The *long log* mentioned as host to a number of plants has remained recognisable and certain plants have persisted, notably a *Coprosma lucida* grown into a canopy tree which, together with a persisting kohekohe, developed roots running horizontally within the rotting log.

(b) *Multi-stemmed trees.* Several mahoes with this feature, and closely-grouped kohekohes in which root-grafting had developed to some extent during the intervening years, were in corresponding positions in the two plottings. Other tree groups in distinctive geometrical patterns confirmed the plot location.

(c) *Tree ferns.* Swollen trunk bases of long-dead ferns persist for many decades; together with standing-dead trunks of other ferns which have succumbed through over-topping by other canopy species, they assist in completion of the geometrical pattern. From the trunkless stage when tree ferns are notably possessive of ground space to the exclusion of competing vegetation, the species common in Otari need to be plotted as significant components in the several seres — their virtues of durability and ready recognition in quadrat work are useful extras.

(d) *Fallen or standing-dead small trees.* One such fallen tree had recognisable wood structure which confirmed it as a rangiora, 14 cm in diameter, in a location corresponding to that occupied by a small plant in 1932-34.

Changes in plotting procedure 1982

(i) *Dimensions.* Because representation of tree diameters on quadrats drawn to the scale of 1" (2.5 cm) = 10' (3 m) could not be done accurately enough, a diameter measurement, (in inches to preserve continuity) was entered alongside the species symbol *upper right,* for woody plants down to 2" (5 cm) diameter. For all height classes, a figure (in feet) was desirable for comparison with earlier plotted data, but the tight canopy in Quadrat 12 with intermeshed crowns and generous reinforcement with supplejack, virtually precludes distinction of individuals. For canopy components heights in feet were estimated (or occasionally measured by climbing) and entered for trees dispersed through the quadrat; entries were made alongside the species symbol *lower right* in Fig. 1 for all items less than canopy height but more than 3' (1 m). In Fig. 2, whose primary purpose is to show the ground cover ferns, the position and height of

occasional canopy trees were entered because the nature of the canopy is reflected in the identity and vigour of the ferns.

(ii) *Tree ferns.* Trunkless tree ferns, already referred to as an aggressive element in seral succession, were recorded with the species symbol encircled and the initial letter in lower case rather than upper case. For tree ferns of more mature or dead status ("dd"), the initial capital letter in the species symbol is distinctive. Where species identity in dead individuals was in doubt the designation is "TF".

(iii) *Swollen and flanged butts.* For on-going observations a change in procedure provides for individual stems in multi-stemmed trees to have diameters measured at their bases, for diameters of flanged trees just above the flanges, and for tree fern trunks above the enormously-swollen bases. These diameters were recorded alongside the plotted stems with the expanded base as a "halo".

(iv) *Fallen and standing dead logs.* Along with tree fern trunks (erect or prostrate) and stumps, the logs are shown on the main quadrat drawing as location indicators and special plant sites; hinau logs are very durable.

(v) *Lianes.* Supplejack, an important component of the canopy although individual vines are small at ground level, is mostly shown on the drawing dealing with tall plants. However, ground-hugging entanglements 1 m or less in height, along with similar entanglements of *Metrosideros* species, are shown on drawings of floor vegetation.

Changes between the Two Surveys

The trend noted in 1932-34 for kohekohe to increase its dominance has continued. Table 1 shows that, in the top height class, 17 of the 19 trees (10 out of 15 in 1932-34) are kohekohe; for the second storey, the corresponding figures for kohekohe are 27 out of 55 in 1982-83 and 39 out of 72 in 1932-34, reflecting normal mortality in this intermediate class. Quadrat plans, and especially the extended profile sketch, show the substantial advance of kohekohe at the upper end into the scrub that has replaced grass during the last five decades. Interplay among the tree species in the critical bush edge zone is inadequately shown in the narrow quadrat, and a broadened quadrat is presented as Fig. 4; it retains the upper part of the old plot with extensions on three sides, especially southwards, to take in vegetation more characteristic of spur-tops. Main conclusions from 1982-83 observations are:

1. *Early sere small trees in the bush edge zone that tend to persist when kohekohe dominance is established* are mahoe and pigeonwood, both being represented in the quadrat canopy with adequate follow-up in understoreys and seedlings. Mapau and *Pennantia* persist for over fifty years where they originated just outside the old bush edge; their persistence and that of the emergent rewarewas and kahikateas is well-illustrated in Figs 3 and 4. Mapau, too, is emergent. The mapau seedlings fade out under a kohekohe canopy, but along with pigeonwood and mahoe they are the principal small trees under the gorse canopy, except where *Berberis darwinii* has established beyond the old bush edge. Among the smaller persistent species (see Table 1) are *Macropiper,* rangiora and *Geniostoma,* all of which, with their

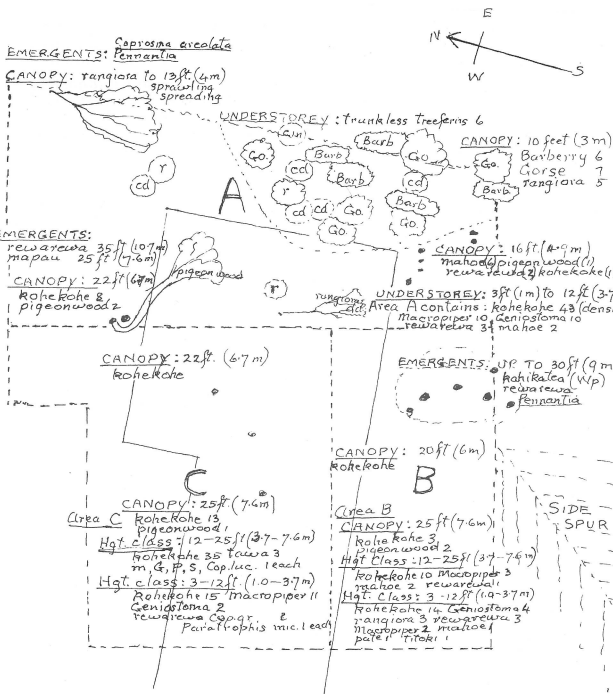


FIG. 4 Periphery to Upper Part Quadrat 12

note: Quad 12 solid line, diagonal orientation
A = "frontier" area – dotted line boundary
B = light-demanding spp (spur) and kohekohe
C = kohekohe forest

multi-stemmed habit, are more important species in the forest association than the recorded numbers in the understoreys suggest; in contrast with the earlier tally, multi-stemmed plants were recorded in 1982-83 as "singles".

2. *Early sere small trees and tall shrubs that have tended to be eliminated in the kohekohe-dominated association* include *Fuchsia, Olearia rani* and five-finger which are now absent from Quadrat 12, except for one five-finger seedling. A high possum density indicated by well-worn "highways" may account for the loss of two of these species and one or more of the smaller species, i.e. *Aristotelia serrata,* ramarama, pate, *Cassinia leoptophylla,* gorse and the two tree ferns formerly recorded within the quadrat. *Olearia rani* remains as a fairly common canopy tree in the adjacent forest.
3. *Species entering the kohekohe-dominated forest or extending their significance with increased shade* include *Macropiper* and *Asplenium bulbiferum* in the latter category; the new entry plants are *Blechnum chambersii, Lastreopsis velutina, Phymatosorus scandens* and *Paratrophis microphylla.*
4. *Light-demanding dominant tree and shrub species* along the advancing bush edge and on tops of spurs within the bush edge are mentioned in 1 above. Their dominance in such locations applies in the immediate vicinity of Quadrat 12, but is under threat from *Berberis darwinii.* Of the three *Coprosma* species recorded in Table 1, only *C. areolata* seems likely to persist, as it is a bush edge canopy component.
5. *Other trees, smaller plants and ferns* not encompassed by the foregoing categories. Failure of tawa and hinau to compete with kohekohe in the developing forest association is not explicable; of the representatives recorded in 1932-34, one tawa grown from 15' (4.6 m) to 22' (6.7 m), and another shrub-sized plant that has not grown significantly, remain, while the hinau seedlings have disappeared. Karaka occurs as single trees with large rounded crowns breaking through the kohekohe canopy adjacent to Quadrat 12; one sapling and several seedlings have persisted on the quadrat during the review period and it is anticipated that the species will continue to do so.

Table 1 and Fig. 2 indicate changes in the fern population associated with extension of the forest canopy and increased shade. As noted above, four species have been favoured. Clump ferns pose no problems in plotting procedure but creeping types cannot readily be enumerated. Bracketed numbers in Table 1 indicate areas of forest floor with substantial occupation by the creeping species. Observations suggest that *Blechnum filiforme* is the commonest fern. Certain ferns, and other plants, have been adversely affected by increasing shade, notably *Polystichum richardii, Asplenium oblongifolium, Phymatosorus diversifolius, Metrosideros* entanglements and *Astelia solandri.* Longevity in ferns is difficult to document in the wild; locations in the two time-separated plottings of *Polystichum richardii, Lastreopsis hispida, Asplenium bulbiferum* and *Blechnum filiforme* suggest their persistence for over fifty years.

Entries in quadrat drawings have to be restricted to retain clarity, and seedlings are enumerated (Table 1) rather than shown along with the ferns.

Within Quadrat 12, the failure of forest plants to occupy an area which in 1932-34 was grass and a wind-shorn "hump" of entangled *Metrosideros* and associated lianes and shrubs, is inexplicable. Airspace is now occupied, in part, by pigeonwood on the northward side and is being invaded by gorse and barberry from the east. Where *Pennantia, Fuchsia, Coprosma areolata,* tawa and kohekohe ranging from 10' (3 m) to 13' (4 m) in height grew in 1932-34 with ramarama thickets and small rangioras, only the last mentioned showed moderate growth, e.g. a recently-dead shrub whose wood was identified by lens as rangiora had a base diameter of 5½" (14 cm).

Adaptation by Woody Native Plants

Observations made within and immediately adjacent to Quadrat 12 have revealed some features that may contribute to the important roles played by two species, kohekohe and rangiora. Adaptation by *Griselinia lucida* in the struggle for survival in the same forest area takes a unique form: recorded as a terrestrial in the well-lit bush edge zone in 1932-34, it appears to have succumbed along with others termed, at the time, "wind-resisting, light-demanding, emergent trees". Notes made on the three species in 1982-83 are:

1. Kohekohe
   (a) *Root grafting* is familiar in the introduced conifer, Douglas fir, but unfamiliar in native species. Washing down of surface soil, seen as deposits at the lower end of the quadrat, probably occurred during a severe rain storm in 1976, and it is the movement of soil from among a closely-aggregated quartet of kohekohes (plus one mapau) that revealed the grafted roots sketched in Fig. 5. In the 1932-34 plot, all members of the group were present, ranging in height from 12' to 15'; they are now canopy trees 22' (6.7 m) tall with diameters from 4" (10 cm) to 10" (25.4 cm), but the mapau of similar size is decrepit.
   (b) *Branch grafting* is not easily detected in the interlaced crowns but the interlacing can lead to grafting if differential crown movement is prevented. In the lower branches, 8' (2.4 m) from the ground of two trees 10" (25.4 cm) and 3½" (8.9 cm) in diameter forming part of the canopy at 23' (7 m) height, grafting was observed in branches crossing at about 90°. Beyond the graft, involving branches 3" (7.6 cm) in diameter, it is impossible to determine, except as indicated by direction, which tree produced them (Fig. 6).
   (c) *Adventitious Roots.* In 1932-34, a prostrate log of substantial girth and length was plotted as the "home" of various tree seedlings, ferns and *Astelia solandri.* Close to it grew several trees, of which one kohekohe, then 16' (5 m) high, and a *Copromsa lucida* which has grown from 12' (3.7 m), share the canopy at about 25' (7.6 m). Both trees also shared the decaying log through which their roots had run for 10' (3 m) or more before "diving" into the ground. The large bundle of even-sized

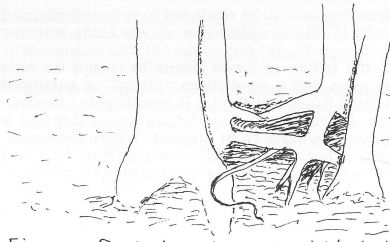


Fig. 5 Root Grafting in Kohekohe Quadrat 12

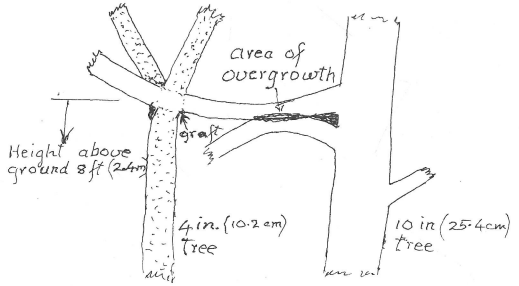


Fig. 6 Branch Grafting in Two Adjacent Kohekohe Trees.

roots averaging about 1¼" (3 cm) diameter and not readily identifiable, is revealed by reduction of the log so that the roots are now suspended above ground. The feature of particular interest is that the kohekohe roots originated adventitiously from a swelling on the trunk (Fig. 7). It is a matter for speculation whether proximity of the log, possibly causing dampness in that basal part of the trunk when the log was still of substantial girth, induced the root formation.

2. Rangiora had earlier been observed in Otari to be an efficient producer and distributor of fertile seed; it also has the habit of natural layering whereby its lateral spread is promoted. Epiphytic

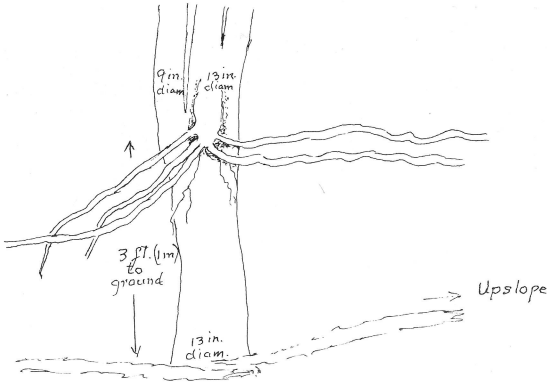


Fig. 7: Adventitious Roots from Kohekohe Tree

seedlings are seen occasionally on tree fern trunks, but the occurrence in Quadrat 12 of a well-grown epiphytic rangiora was sufficient reason to record it in a sketch that shows markedly tapering roots reaching down the mahoe trunk to the ground (Fig. 8). The short, thick trunk 10" (25.4 cm) in diameter is the principal one in this multi-stemmed mahoe, now 16' (4.9 m) tall, having grown from 12' (3.7 m) in 1932-34 when it was on the exposed bush edge.

3. Broadleaf *(Griselinia lucida)*. In the absence of conditions favouring terrestrial growth, and of traditional hosts such as old podocarps, hinau or rata on which the species may be epiphytic, broadleaf is uncommon in Quadrat 12. However, one broadleaf approaching small tree size is growing close to the Quadrat as an epiphyte whose host has disappeared. The sketch in Fig. 9 shows the "tripod" support on which it depends, but how it came about is obscure. About 10' (3 m) above ground the broadleaf *rests* on a branch of a kohekohe tree, the point of contact being close to the place of lodgement on its original host which adhering material indicates to have been a tree fern. The other tripod legs are part of the broadleaf itself, and are substantial trunks extending diagonally outwards and downwards to the ground at points about 10' (3 m) and 15' (4.6 m) distant. The shorter of the two legs gives off roots which grasp another kohekohe so that it appears to be a sophisticated tension and compression member. Certainly the load taken by the vertical leg (kohekohe) appears to be light.

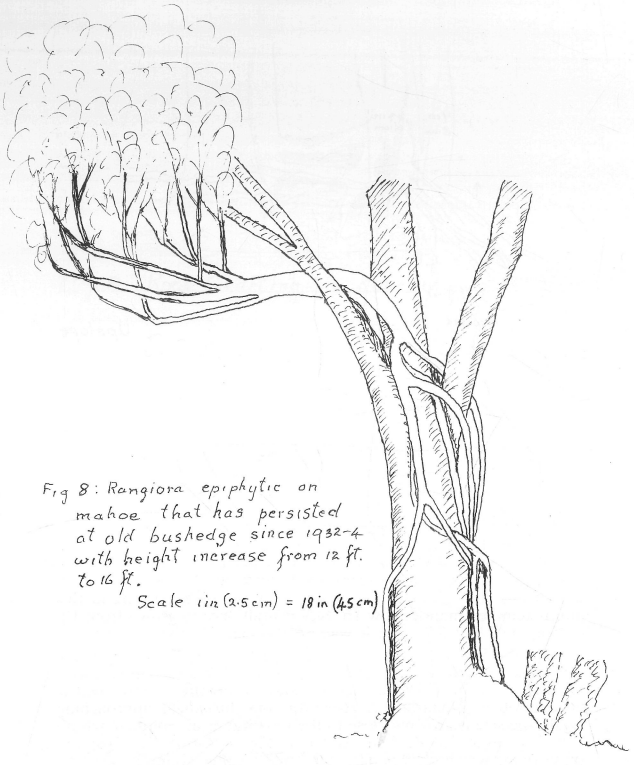


Fig 8: Rangiora epiphytic on mahoe that has persisted at old bushedge since 1932-4 with height increase from 12 ft. to 16 ft.
Scale 1 in (2.5 cm) = 18 in (45 cm)

Extended study of succession along old bush edge and in scrub-belt beyond : 1982-83 observations

Figure 4 shows the old bush edge zone more adequately than the presentation in the 1982-83 Quadrat 12 in which the critical upper part is 30' (9 m) wide. Doubling the width and extending the length by about 15' (4.6 m) brings about a marked reduction in the dominance of kohekohe and accentuates the part played by other species (Tables 1 and 2).

In 1982-83, in the height class 25' (7.6 m) and up, kohekohe comprises nearly 90% in Quadrat 12 and 73% in the new plot. In the

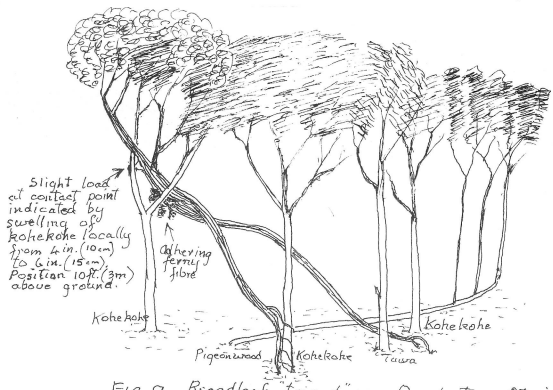


Fig. 9 Broadleaf "tripod" near Quadrat 12, Otari

Table 2: **Extended Upper Part of Quadrat 12 Tally of Species in Three Height Classes in Zones A, B and C, 1982-83**

Names and symbols used in text and figures		Height Class 1: 25' (7.6 m & Up)				Height Class 2: 12-25' (3.7-7.6m)				Height Class 3: 3-12' (1-3.7 m)			
		A	B	C	Total	A	B	C	Total	A	B	C	Total
kohekohe	K		3	13	16	9	10	35	54	43	14	15	72
Macropiper	m					1	3	1	5	10	2	11	23
rangiora	r					3			3	5	3		8
mahoe	M					7	2		9	2	1		3
Geniostoma	G					2		1	3	10	4	2	16
barberry	Barb									6			6
gorse	Go									7			7
Pennantia	Pc					2			2				
tawa	T							3	3				
pigeonwood	P		2	1	3	3		1	4				
pate	p									1		1	
mapau	S					2		1	3				
rewarewa	RR	1			1	1	1		2	3	3	1	7
Coprosma lucida	Cl												
	Cop.luc.							1	1				
C. areolata													
	Cop.are.									1			1
C. grandifolia	Cg									1		1	2
Cyathea medullaris	Cm									1			1
C. dealbata	Cd									5			5
white pine	Wp		2		2								
Paratrophis microphylla	Pm											1	1
titoki	Ti										1		1
TOTALS		1	7	14	22	30	17	43	90	94	28	31	153

second height class, corresponding figures are 50% and 54%, whilst in the third class, the numbers are only 23% and 47% respectively. These figures may be interpreted as reflecting virtual kohekohe dominance in Quadrat 12, compared with approaching dominance in the bush edge zone. The latter situation is likely to be slow in the well-lit parts carrying light-demanding natives that are still far from mature. Gorse and tree ferns may be bracketed with the last mentioned but barberry is the new and dangerous impediment to normal cycles.

Certain features emphasised in Fig. 4 are:

(a) the present dispersal of barberry close to the kohekohe forest with gorse and rangiora bushes of mature dimensions; their replacements may not be natives;
(b) a new generation of tree ferns at the trunkless stage;
(c) the decreasing general canopy height up-slope;
(d) emergent tree species on either flank of Quadrat 12's eastern end, those to the south being associated with a side spur; *Pennantia* and *Coprosma areolata* are bush edge species having the characteristics of emergents in some circumstances.

Species present in three height classes are shown, separately in Areas A, B and C (Fig. 4), and in the supporting Table 2.

Profiles in Fig. 3 along line transects close to Quadrat 12 depict changes which have taken place during the past five decades, especially in the scrub belt on the formerly grassed spur-top. It should be remarked that the "line transect" is probably about 1' (0.3 m) wide, but no account can be taken of plants outside that "line" at the ground surface which intrude into the airspace represented. No renumeration of the plants along the line has been presented to amplify the profile but it may be remarked:

(a) For the first 80' (24.4 m) kohekohe has undisputed dominance over the pigeonwood, rewarewa, mapau and *Pennantia* associates, but supplejack is a major canopy component.
(b) Beyond 80' is an old bush edge zone in which all the above-mentioned species plus *Coprosma areolata* are present, but a new low canopy identifies the vegetation beyond as the gorse invasion area. For most of the 100' (30 m) distance, mapau emergents are prominent, breaking through an incomplete canopy in which barberry, gorse, rangiora and mahoe (approximately in that order) dominate. Many other species are present among which the ephemeral phase ones include the two tree ferns noted in the old quadrat, and fivefinger. The more permanent elements are kohekohe, pigeonwood, *Macropiper, Geniostoma* and rewarewa, along with mapau and mahoe.
(c) A mahoe at 173' (53 m) provides a photo-point from which the liane element in the canopy was sampled *(Clematis paniculata* and *Parsonsia heterophylla)* and photos were taken of the canopy roof in which flowering barberry, gorse and rangiora were prominent.
(d) On the floor, the main ferns are *Asplenium bulbiferum, A. polyodon, Polystichum richardii* and *Blechnum filiforme;* seedlings of woody plants are mainly mapau, pigeonwood, mahoe, *Geniostoma* and *Macropiper.*
(e) Of the vegetation recorded beyond the bush edge in 1932-34 only tall *Cassinia leptophylla* appears to have persisted.

Final Note

In the Quadrat 12 area, the gorse phase had been following a predictable course towards a forest association in about 50 years until the intrusion of *Berberis darwinii.* With its abundant fruits attractive to birds, its shade tolerance, and suckering habit, this barberry is a serious menace to Otari reserve and to gardens in nearby suburbs; it should be cut out before the next fruiting.

Mouse-tail (*Myosurus novae-zelandiae*), a declining species?

Colin C. Ogle, Pukerua Bay

Myosurus novae-zelandiae, the native mouse-tail, is a species which has apparently become extinct in the Wellington region. Although the species was probably always rare in the North Island, in the remote chance that this inconspicuous plant is surviving in previously known or hitherto unrecorded sites, photographs of plants from the South Island are printed here to assist recognition of the species.

Mouse-tail is a tiny, herbaceous member of the buttercup family (Ranunculaceae). It is reported to be an annual (Allan 1961) or "is probably an annual or short-lived plant" (Given 1981). I have cultivated this species since 1981, and it has behaved exclusively as an annual, germinating in winter, flowering October-November, and becoming shrivelled by January. The photographed plants were grown in 1981 from seed taken from specimens collected near Patearoa, upper Taieri River, Otago, on 26 October 1979. All plants seen there were in fruit, and the species was collected without my suspecting its identity, or even that it was a native, because of the weedy nature of its habitat. It was in very closely grazed, impoverished pasture which comprised scattered native and exotic grasses and dicotyledonous herbs. Brown-top, *Poa maniototo, P. lindsayi, Raoulia* and *Acaena* spp., *Myosotis discolor,* shepherd's purse, *Veronica verna, Erophila verna* and *Stellaria gracilenta* were some associated species, but there were many bare areas of schistose gravelly soil. The terrain was gently rolling with scattered schist outcrops. Mouse-tail plants were locally quite common, but required a hands-and-knees search to spot them. It should be noted that the habitat was not the salt pan type described by Dr David Given (p. 97, 1981) for specimens from the Maniototo Plains.

My original specimens were identified by Tony Druce, and I subsequently divided them into three lots, for the herbaria of Botany Division, Christchurch (CHR 362463), Victoria University of Wel-