

The Flora of the Aorangi Range, Southern Wairarapa

With Notes on the Vegetation

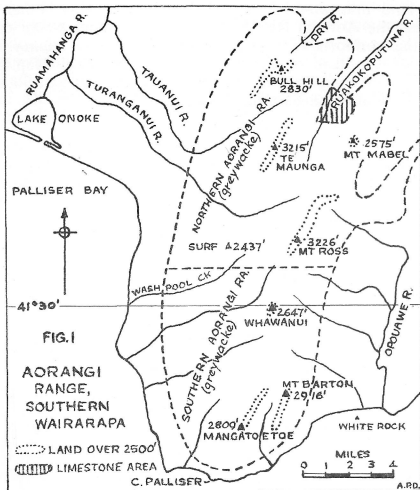
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My first introduction to the Aorangi Ra., the southernmost range of mountains in the North Island, was with V. D. Zotov in 1947. Since then I have visited these mountains many times, and in the company of many different people. The Wellington Botanical Society has run at least six trips there, the first in 1954, the most recent in 1969. Altogether I have spent 27 days in the area and during this time all the higher parts of the Range have been visited. I thank all those numerous people who have helped in the field either directly or indirectly. In particular I thank Dr Ian Atkinson for a critical reading of the manuscript.

I am not aware that any profound changes have taken place in the Aorangi Ra. over the period from 1947 to 1970. The boundaries between cleared land and native forest were stabilised in most places long before 1947. Logging of rimu and miro has continued, locally, to the present day, but I was told while on a recent visit to the Ruakokoputuna V. that on that very day (7 September 1970) the logging trucks were to make their last haul out from the Turanganui V., over the saddle, and down the Ruakokoputuna. The Wairarapa Catchment Board has done some planting of exotic trees on slips, e.g. at the head of Dry R. below Bull Hill, and the N.Z. Forest Service has erected a hut or two for use in its animal control work. But the forest shows little change: the palatable understorey plants are still largely absent, having long ago been replaced by unpalatable species, mostly of low stature. (In present day popular jargon, mountain horopito is *in*, mountain fivefinger is *out*). In many places there is moving rock debris beneath the surviving canopy trees. At times many of the surrounding farmlands have gone back to scrub, and then, as in the upper Ruakokoputuna V., been cleared again.

What does the future hold? Continued degradation of the remaining forests with eventual loss, through windfall and old age, of the present canopy? Or a reversal of the trend, with gaps in the canopy being filled once again? It all depends on whether methods can be developed for controlling browsing animals, especially deer and goats.

From the scenic point of view the northern part of the Range is not particularly attractive, excepting the Ruakokoputuna V., with its limestone cliffs, rocks and gorges and the impressive fault scarp of Te Maunga. The southern part, near Cape Palliser, is altogether



different. The mountains here rise steeply from a narrow coastal strip to open tops at nearly 3000 ft. This is the part I like most. Much of the original forest has been burnt (possibly in pre-European times) but there is great diversity in the secondary vegetation; and it is here that the greatest range of plant species is found. There has been erosion of course — some of it spectacular — but in this area it is hard to draw a line between natural, geological erosion and that induced by man, fire, and introduced animals. The gullies and spurs are precipitous, particularly on the seaward side of the ridge running SSW from Mt Barton; and there are cliffs, screes, and fans (the largest, topped with wind-blown sand, pushing out into the sea) to add to the fascination of the landscape. The largest stream, the Waitutuma, emerges from the cliffs through an impressive gorge before rushing across a boulder-strewn, rocky bench raised from the sea. On the high, open tops the soil has been removed in many places by wind and rain, leaving the underlying rock exposed like the backbone of a gigantic animal (Fig. 2). If any area on the southern North Island coastline should be declared a National Coastline Park this is it! The amount of

grazing land that would be lost is negligible. One other point: Don't visit the Aorangi Ra. if you have been spoilt by an easy life amidst the comfortable vegetation of Wellington's nearer ranges, for, as you can read on the back of the Geological Map of N.Z. (Sheet 12 — Wellington), the "vegetation is far less luxurious [sic!] than in the Rimutaka-Tararua ranges".

PHYSIOGRAPHY

The Range, consisting of Mesozoic sedimentary strata (greywacke) and a small area of Pliocene limestone directly overlying the greywacke (Geol. Map of N.Z.), runs for some 20 miles from near Martinborough southwards to Cape Palliser. Although the highest peak, Mt Ross, is only 3226 ft and the area above 2500 ft is small (Fig. 1), most of the land is steep — in fact just as steep as in the higher greywacke ranges of the North Island. The Range is cut across by faults running at an angle to the main axis. In the northern part where these run north-east the tilted blocks of Bull



Photo: G. C. Kelly, Sept. 1968

Fig. 2 — Southern Aorangi Ra. from the air, looking NE, with Mt. Barton (2916ft) at left and White Rock in bay at extreme right. The vegetation in this part of the Range is mostly secondary and consists of the following main types: manuka scrub, manuka-kanuka scrub and silver beech forest, above 1800-2000ft; and kanuka scrub and mahoe-rewarewa forest below that altitude. Along the top of the main ridge, which runs NNE-SSW, the vegetation is diverse, consisting of an array of shrub communities, small areas of grassland and herbfield, and various open communities of cliffs, screes, rocky ground, and eroding soil.

Hill and Te Maunga are the dominant features. The steep, south-east-facing scarp of the latter is clearly seen when one goes up the Ruakokoputuna V.; the north-west slopes by contrast are relatively gentle, especially near the crest of the ridge. In the southern part of the Range, where the faults run NNE as well as NE, the high blocks of Mt Ross, Mangatoetoe and Mt Barton dominate. The Mt Barton block can be seen in Fig. 2.

THE FLORA

The indigenous flora of the Aorangi Ra. is similar to that of the Rimutaka Ra., 10 miles to the north-west, the main distinction lying in the number of mountain plants present. (Mountain plants: plants found only or mainly above 1500 ft, i.e. in the montane zone in this area.) One hundred and eleven are present in the Rimutaka Ra., compared with 68 in the Aorangi Ra. Sixty-one of these are common to the two ranges. The 50 found in the Rimutaka Ra. but not in the Aorangi Ra., and the seven found in the Aorangi Ra. but not in the Rimutaka Ra., are listed below. Neither range has any endemic plants. The two ranges cover about the same area (c.130 sq. miles) and reach about the same height (Aorangi Ra., 3226 ft; Rimutaka Ra., 3086ft). The Aorangi Ra. includes a small area of limestone (Fig. 1), to which a few species are confined; otherwise the rock in both areas is greywacke. The significant difference is in climate. In the Aorangi Ra. rainfall is less (45 - 100 in. compared with 50 - 150 in.), and the raindays are fewer (125 - 175 compared with 150 - 200). The tops are less often in cloud and the dry periods are longer.

Mountain plants found in the Rimutaka Ra. but not in the Aorangi Ra.

TREES AND SHRUBS

Hoheria sp. (unnamed)
Melicytus lanceolatus
Coprosma pumila
C. rugosa
Cyathodes empetrifolia
Gaultheria sp. (*G. depressa* var. *novae-zelandiae*)
Neomyrtus pedunculata
Olearia colensoi var. *colensoi*
O. lacunosa var. (*O. alpina*)
O. virgata var. *virgata*
Pentachondra pumila
Pittosporum rigidum

LYCOPODS AND FERNS

Lycopodium australianum
Dicksonia lanata
Gleichenia cunninghamii
G. dicarpa
Hymenophyllum armstrongii
H. atrovirens

H. pulcherrimum
Schizaea australis

ORCHIDS

Aporostylis bifolia
Pterostylis venosa
Thelymitra venosa

GRASSES AND SEDGES

Chionochloa flavescens s.s.
Deyeuxia aucklandica
Notodanthonia nigricans
Carex sp. (sect. *Acutae*)
Carpa alpina
Oreobolus pectinatus
O. strictus
Uncinia astonii
U. caespitosa
U. distans
Uncinia rupestris
U. sp. (aff. *U. nervosa*)

HERBS (OTHER THAN ORCHIDS,
GRASSES, SEDGES)

Astelia linearis var. *novae-zelandiae*
Libertia pulchella
Abrotanella caespitosa
Celmisia sp. (aff. *C. gracilentata*)
Drosera stenopetala
Epilobium pernitens

Galium perpusillum s.s.
Gentiana matthewsii
Jovellana repens
Ourisia colensoi
O. macrophylla var. *drucei*
Nertera ciliata
Ranunculus verticillatus
R. sp. (*R. hirtus* var. *stoloniferus*)
Schizeilema nitens

Mountain plants found in the Aorangi Ra. but not in the Rimutaka Ra.

FERNS

Grammitis armstrongii
Hymenophyllum minimum

HERBS

Celmisia spectabilis var.
Colobanthus strictus
Ranunculus muricatus

GRASSES AND RUSHES

Poa colensoi
Luzula migrata

Nearly all the mountain plants found in the Rimutaka Ra. but not in the Aorangi Ra., are characteristic of either wet forests or poorly drained tussock and shrub-tussock lands in high-rainfall areas. In contrast all seven found in the Aorangi Ra. but not in the Rimutaka Ra. are characteristic of open, well drained areas — on cliffs or in tussock land. To me this suggests that the floras differ essentially not because of chance factors of dispersal but because of real environmental differences in the two areas.

A similar sort of floristic separation exists within the Aorangi Ra. itself. Whereas the Rimutaka Ra. runs NE-SW, i.e. at right angles to the markedly predominant north-west winds, the Aorangi Ra. runs N-S. On many occasions I have noticed that the cloud cover on the tops of the Aorangi Ra. decreases from north to south. Rainfall possibly decreases likewise. And I have already alluded to the fact that there are many more cliffs and unstable areas in the south than in the north. To these factors, I think, can be attributed a marked difference in the floras of the northern and southern parts of the Range. Thirteen species are confined to the northern part and 46 to the southern. Another 13 are almost confined to the southern, occurring only locally in the north. Six of the 13 northern species, *Uncinia filiformis*, *U. gracilentata*, *Luzula subclavata*, *Luzuriaga parviflora*, *Scirpus habrus*, and *Myrsine divaricata*, are found only in silver beech or red beech-silver beech forests on the highest and wettest tops. Hard beech is the only species of importance among the remaining seven; the rest are low-land plants that barely enter the area. When we consider the 59 species confined, or almost confined, to the south — and all seven mountain plants not found in the Rimutaka Ra. occur here — we find that all but five, i.e. 54, are non-forest plants of well drained sites, particularly cliffs, screes, and rocky ground.

These 54 species fall into two groups: a group of 23 mountain plants which, though a few descend almost to sea-level, are most abundant above 1500 ft; and a group of 31 lowland plants which are most abundant below 1500 ft, though about half of them ascend to beyond 2000 ft, some reaching the tops (2800–2900 ft) in small numbers. Included in the mountain group, in addition to the seven listed above (*Grammitis armstrongii* etc.) are *Dracophyllum filifolium*, *Hebe venustula*, *Gaultheria rupestris*, *Pimelea gnidia*, *P. longifolia*, *Senecio elaeagnifolius*, *Brachycome radicata*, and *Epilobium glabellum*. The lowland plants include *Senecio greyi*, *Hymenantha crassifolia*, *Chionochloa beddiei*, *Festuca multinodis*, *Lachnagrostis richardii*, *Aciphylla squarrosa* var. *squarrosa*, *Craspedia uniflora* var. *grandis*, *Linum monogynum*, *Microseris* sp., *Plantago spathulata*, *Scandia geniculata*, and *Wahlenbergia gracilis*.

Considering next the 68 species in the Aorangi Ra. as a whole that I have classed as mountain plants: 39 are typical of montane beech forest and 29 are non-forest plants. As mentioned above, 23 of the latter are essentially plants of well drained, open sites in the south. (The remaining six are typically found in wet sites — watercourses mainly.) These 23 species, I conclude, have been able to survive in what is now climatically a montane forest area solely because of the continued presence of cliffs, screes or other open areas throughout the post-glacial period (the last 10,000 years or so). The relatively dry climate has probably been an additional factor tending to prevent the development of forest on steep slopes.

The situation in the Rimutaka Ra. is somewhat different. Of the 111 mountain plants, 54 are typical of montane beech forest (all 39 Aorangi Ra. forest plants are among these) and 57 are non-forest plants. In this case the non-forest plants have been able to survive not so much because of the persistence of well drained open sites (Mt Matthews vicinity and elsewhere), but chiefly because of the persistence of tussock vegetation in an area of very poorly drained soils (Pukuratahi catchment). About 30 of the mountain plants are found mainly in this area, 20 mainly in the well drained sites (cliffs, screes, open rock ground), and six in watercourses.

The distribution of some of the plants in the Aorangi Ra. calls for comment. Considering first the three that are endemic to the south-eastern part of the North Island, *Senecio greyi*, *Chionochloa beddiei*, and *Celmisia spectabilis* var. (a large plant, with long narrow leaves, and almost white tomentum), we find that all are cliff plants, though after fire the *celmisia* has spread on to sites formerly in forest (e.g. Fig. 3). Allan in *The Flora of N.Z.* gives the distribution of *Senecio greyi* as “coastal rocks and adjacent ravines from Pahaoa River to C. Turakirae”. This is misleading as the shrub is essentially an inland plant. It ranges from the S. Rimutaka Ra.

60 miles north-eastwards to a point inland from Castle Point, and from sea level to 2800 ft. It grows abundantly in many places on greywacke cliffs and is in no danger of extinction.

Chionochloa beddiei is said to occur "on coastal bluffs of Paliser Bay" (V. D. Zotov, *N.Z. Jl. Bot. 1*). This tussock also grows inland, 25 miles to the north-east, in the Pahaoa Gorge and on the nearby hill Teneriffe. It can be a major component of cliff vegetation up to 2000 ft, and scattered plants can be found as high as 2800 ft.

The variety of *Celmisia spectabilis* is a characteristic plant of the eastern Wairarapa hill country, from the S. Aorangi Ra. to a point inland from Akitio. It has been reported to occur even further north, on the Whangai Ra. Its overall distribution is not very different from that of *Senecio greyi* but the two species don't often grow together. The *celmisia* occurs mainly on shady faces and former forest sites above 1500 ft, the *senecio* mainly on sunny faces below 1500 ft. The lowest altitude at which I have seen the *celmisia* is 250 ft.

The presence of the small filmy fern *Hymenophyllum minimum* in the Aorangi Ra. is noteworthy. According to Allan it only occurs in the South Island and in Stewart Island, but in fact it was collected in the North Island (near Atiamuri) about 1930. In recent years it has been found not only in the S. Aorangi Ra. but also on the coast south of Wellington city (by R. Chinnock) and near Heights, a taipo (jagged peak) 20 miles north-east of the Aorangi Ra. It ranges from near sea level to 2800 ft and forms mats, up to several feet across, on cliffs, open rock ground, and clay banks in manuka scrub.

Hebe venustula is of very local occurrence in the southern part of the North Island. Besides the S. Aorangi Ra., where it is abundant, it is present near Heights (mentioned above) and in a few places on the north-east side of the Pahaoa Gorge. It has also been recorded by V. D. Zotov (*Trans. R. Soc. N.Z. 68*) from Mt Matthews in the Rimutaka Ra., and from Mt Dennan in the Tararua Ra., but I have not seen it in either of these localities myself. It rarely occurs below 2000 ft.

Colobanthus strictus likewise is of local occurrence in the southern part of the North Island. Outside the S. Aorangi Ra. I have seen it only on cliffs on Mts Mitre and Holdsworth in the Tararua Ra. In the Aorangi Ra. it ranges from near sea-level to 2800 ft.

Pimelea longifolia is abundant in the Tararua Ra. and occurs locally near Mt Matthews in the Rimutaka Ra. In the Wairarapa district it is found only in the southern part of the Aorangi Ra. The species is not encountered again in the North Island till the northern part of the Ruahine Ra. is reached. *P. gnidia* is said by Allan to occur from lat. 30°30' (the latitude of Te Aroha) southwards, but the only record I know of north of lat. 41° is "Hihi,

Kauaeranga River, Thames" (Cheeseman in the "Manual"). And south of lat. 41° in the North Island it is very local: I have seen it only in rocky places south of the road summit in the Rimutaka Ra., in the southern Aorangi Ra., and on the north-east side of the Pahaoa Gorge. In the Aorangi Ra. *P. gnidia* and *P. longifolia* often grow side by side and can appear very similar. A good distinguishing character is the presence of conspicuous veins on the back of the leaves of *P. longifolia*. I have failed to find any evidence that the two species hybridise.

Poa colensoi, an abundant mountain grass in the main axial ranges (except the Rimutaka Ra.), is known in the lower, eastern ranges only from the S. Aorangi Ra. and from Taipo Minor 35 miles to the north-east. In these two places it is a local plant of cliffs and rocky ground above 1200 ft.

The occurrence of *Ranunculus muricatus*, a species described from "high, dry, open plains, Tahoraiti, south of Dannevirke" (the Oringi Clearing) by Colenso in 1891, is puzzling. This buttercup is common in the southern part of the volcanic plateau, and I have seen plants from the Wither Hills, Marlborough, but I did not expect to find it in the Aorangi Ra. Perhaps it was more widely spread in the Wairarapa in pre-European times.

Six plants of the Aorangi Ra. that I have found only on limestone in the Ruakokoputuna V. are *Asplenium anomodum*, *Gnaphalium subrigidum*, *Craspedia viscosa*, *Lobelia anceps*, *Blechnum* sp. (cliff sp. of *B. capense* agg.), and *Corybas orbiculatus*. In the Rimutaka Ra. and elsewhere, however, the last four of these can occur on non-calcareous rocks. Three plants that might be expected to occur on limestone in the Aorangi Ra., but which have not so far been found there, are *Parahebe lyallii*, *Notodanthonia buchananii*, and *Fuchsia perscandens**. These occur on cliffs in the Maungaraki Ra., an extension of the Ruakokoputuna limestone 20–25 miles to the north-east. The grass *Simplicia laxa*, discovered in the Dry R. valley by T. Kirk in 1880 but not seen since, should be looked for on limestone in that valley and in the Ruakokoputuna, for a closely related species in the South Island has been found on such rock.

No previous flora of the Aorangi Ra. has been published. In compiling the list that follows I have included only those species that occur above 1000 ft. Most of the purely coastal species are thus excluded. Several species appear to have been nearly exterminated by browsing animals. They are: *Pseudopanax colensoi*, *P. eagerleyi*, *Metrosideros robusta*, *Chionochloa conspicua* var. *cunninghamii*, and *Astelia nervosa*. I have not seen any of the larger mistletoes — they may well have been eliminated by opossums some time ago.

*Since writing this I have found *F. perscandens* X *F. excorticata* in the Ruakokoputuna V.

FLORA OF AORANGI RANGE
(1000-3200 ft)

Maximum altitudes are given for some species.

Brackets round a plant name indicate that the species is not found much above 1000ft in this area

Species not marked "uncommon" are regarded as common in at least parts of the area (above 1000ft).

Five and six-figure numbers refer to specimens in Botany Division Herbarium, Lincoln.

N — found only in northern part of Range (see Fig. 1).

S — found only in southern part of Range.

L — found only in limestone area, Ruakokoputuna V., between 1000 and 2000ft.

No. of indigenous species: 375.

No. of hybrid groups: 27.

No. of adventive species: 81.

INDIGENOUS PLANTS

GYMNOSPERMS

- Dacrydium cupressinum* (2500ft max.)
Podocarpus dacrydioides (uncommon)
P. ferrugineus
P. hallii (197475)
P. spicatus (1500ft max. for adult, 2500ft for juvenile, uncommon)
P. totara (uncommon) (209838)

MONOCOT TREES AND SHRUBS

- Cordyline australis* (2100ft max.)
C. banksii
C. indivisa (uncommon)
C. australis X *C. banksii* (uncommon) (*Rhopalostylis sapida*)

DICOT TREES

- (*Alectryon excelsus* var. *excelsus*) (209351)
Aristolelia serrata
Carpodetus serratus (2400ft max.)
Elaeocarpus dentatus (1800ft max.)
E. hookerianus (uncommon) (209330, 209397)
Fuchsia excorticata
Griselinia littoralis
Hedycarya arborea (1800ft max.)
Hoheria populnea var. (*H. sexstylosa*) (2400ft max.) (192150-1, 209338, 209420-2)
Knightia excelsa (2400ft max.) (*Lophomyrtus obcordata*) (209328)
Macropiper excelsum var. *excelsum* (1400ft max.) (209359)
Melicytus ramiflorus var. *ramiflorus* (2400ft max.)
Metrosideros robusta (nearly extinct according to Wardle; not seen by A.P.D.)
Myoporum laetum var. *laetum* (1400 ft max.) (209369)

Myrsine australis

- M. salicina*
Nestegis cunninghamii (2400ft max.) (209301-2)
N. lanceolata (1400ft max., uncommon) (209419)
(*N. montana*) (209303)
Nothofagus fusca (not present south of Mt. Barton) (197491, 209348, 209367)
N. menziesii (197490, 209366)
N. solandri var. *solandri* (2600ft max.) (197492-3)
N. truncata (N — from Tauanui and Dry river valleys north-westwards)
N. fusca X *N. solandri* var. *solandri* (197497)
Olearia paniculata (2000ft max.)
O. rani (2400ft max.) (209353) (*Paratrophis microphylla*) (209356)
Pennantia corymbosa (2400ft max.)
Pittosporum eugenioides (2000ft max.)
P. tenuifolium var. *tenuifolium* (2400 ft max., uncommon) (197482) (*Plagianthus betulinus*)
Pseudopanax arboreum
P. colensoi s.s. (found only on cliffs or as an epiphyte) (197347)
P. crassifolium (2400ft max.)
P. edgerleyi (uncommon, no juvenile plants seen) (209371)
P. simplex var. (*Panax sinclairii*) (209322-3)
Schefflera digitata (197375)
Sophora microphylla (2400ft max.) (197369, 209358)
Weinmannia racemosa var. *racemosa* (192147)

DICOT SHRUBS

- Alseuosmia pusilla* (uncommon)
Brachyglottis repanda var. *repanda*
Carmichaelia arborea var. (*C. flagelliformis*) (197484)
Cassinia leptophylla
Coprosma areolata (1500ft max.) (209357)
C. australis
C. colensoi (incl. *C. banksii*) (197478, 209395-6)
C. crassifolia (2000ft max.) (209344)
C. foetidissima (uncommon) (197367)
C. linariifolia (Oliver 1935; not seen by A.P.D.; plants so identified by Wardle are almost certainly *C. microcarpa*)
C. lucida s.s. (197346)
C. microcarpa (197500)
(*C. propinqua*) (197399)
C. rhamnoides (197479)
C. rigida (1500ft max.) (209329)
C. robusta
C. rotundifolia (2400ft max.) (209335)
C. rubra (2400ft max.) (209342-3)
C. sp. (unnamed, included in *C. parviflora* by Oliver and others) (192155, 197477, 209327)
C. propinqua X *C. robusta* (uncommon) (209398)
Coriaria arborea var. *arborea*
C. sarmentosa (2200ft max., uncommon, S — south of Mt. Barton) (190905)
C. arborea var. *arborea* X *C. sarmentosa* (2200ft max., uncommon)
Cyathodes fasciculata var. (197499)
C. fraseri (mainly south of Mt. Barton)
C. juniperina var. (197498)
Dracophyllum filifolium var. (mainly south of Mt. Barton) (165298, 192156, 192489, 197480)
(*Fuchsia perscandens* X *F. excorticata*) (N — Ruakokoputuna V.) (209858)
Gaultheria antipoda
G. rupestris (incl. *G. subcorymbosa*) (mainly south of Whawanui) (165300, 197481)
G. antipoda X *G. rupestris* (197398)
Griselinia lucida (1500ft max.)
Geniostoma ligustrifolium (rare according to Wardle; not seen by A.P.D.)

- Hebe stricta* var. *atkinsonii* (209373)
H. venustula (S) (86362-4, 165299, 192157, 197345)
H. sp. (*Veronica arborea*) (sometimes reaches tree size, d.b.h. up to 12in.) (192153, 209337, 209400)
H. stricta var. *atkinsonii* X *H. venustula* (uncommon)
Helichrysum aggregatum (197489)
H. hybrids — see under Dicot Herbs (*Hymenanthera crassifolia*) (S — south of Mt. Barton)
(*Korthalsella salicornioides*)
Leptospermum ericoides (commonly reaches tree size) (197495)
L. scoparium (197494)
Melicope simplex (1400ft max.) (209360)
Myrsine divaricata (N — Te Maunga ridge) (209399)
Olearia arborescens (197496)
(*O. solandri*) (S — south of Mt. Barton)
Pimelea gnidia (S — south of Mt. Barton) (112784, 192486, 197385)
P. longifolia (S — south of Mt. Barton) (165297, 192487-8)
(*Pomaderris ericifolia*) (N)
Pseudopanax anomalum (uncommon) (209331)
Pseudowintera colorata (197395)
Senecio elaeagnifolius var. (mainly south of Mt. Barton) (165321-2, 192154, 209305-6)
S. greyi var. *greyi* (2800ft max., S — south of Mt. Barton) (190891, 197397)
Solanum aviculare (1400ft max.) (209352)
(*S. laciniatum*) (N)
Urtica ferox

MONOCOT LIANES

- (*Freycinetia banksii*)
Ripogonum scandens (1400ft max.)

DICOT LIANES

- Calystegia tuguriorum* (1500ft max.) (209839)
Clematis foetida (2000ft max.) (209339)
C. forsteri (incl. *C. hookeriana*) (190878, 209310)
C. paniculata
Metrosideros colensoi (incl. *M.c.* var. *pendens*) (1800ft max.) (192152, 209405)

- M. diffusa* (2400ft max.)
M. perforata (1400ft max.)
Muehlenbeckia australis
M. complexa
M. australis X *M. complexa* (uncommon)
Parsonia capsularis var. *ochracea* (209346)
P. heterophylla (209418)
Rubus cissoides var. *cissoides* (197396, 209321)
R. schmidelioides var. *schmidelioides* (1800ft max.) (209368)
R. squarrosus (1500ft max., uncommon)
(*Scandia geniculata*) (S — south of Mt. Barton) (190879)
(*Tetrapathaea tetrandra*)
PSILOPSIDS AND LYCOPODS
Tmesipteris sp. (*T. tannensis* agg.) (uncommon) (209392)
Lycopodium fastigiatum (S — south of Mt. Barton) (190877)
L. scariosum
L. varium (incl. *L. billardieri* and *L. novae-zelandicum*) (197351, 209336)
L. volubile
FERNS
Adiantum cunninghamii
(*Anarthropteris lanceolata*) (209402)
Asplenium anomodum (L) (209410-1)
A. bulbiferum
A. colensoi (uncommon)
A. falcatum
A. flabellifolium
A. hookerianum s.s. (209404, 209413)
A. lucidum (209412)
A. sp. (*A. flaccidum* agg.) (common forest sp., usually an epiphyte) (197487)
(*A. sp.*) (*A. flaccidum* agg.) (usually on rocks) (S — south of Mt. Barton) (190886, 197408)
A. anomodum X *A. hookerianum* s.s. (uncommon, L) (209414)
A. a. X *A. lucidum* (uncommon, L) (209415)
A. bulbiferum X *A. hookerianum* s.s. (209403)
A. b. X *A. colensoi* (uncommon) (209840)
(*Azolla rubra*)
Blechnum aggregatum (209423)
B. colensoi (uncommon)
B. filiforme
B. fluviatile
(*B. membranaceum*)
B. penna-marina (190902)
B. procerum (*B. minor* auct.) (209307)
B. vulcanicum (uncommon)
B. sp. (*B. capense* agg.) (common sp., lower pinnae reduced in length) (209377)
B. sp. (*B. capense* agg.) (cliff sp., lower pinnae not reduced) (L) (209378)
(*B. sp.*) (*B. capense* agg.) (bog sp., lower pinnae reduced, fronds narrower than in common sp.) (209334)
(*B. aggregatum* X *B. membranaceum*) (209424-5)
B. procerum X *B. sp.* (*B. capense* agg.) (common sp.) (209315)
Cardiomanes reniforme
Cyathea colensoi (uncommon) (209380-1)
C. dealbata
C. medullaris
C. smithii (209389)
(*Dicksonia fibrosa*) (N — Ruakoputuna V.) (209374)
D. squarrosa
Grammitis armstrongii (uncommon, S — south of Mt. Barton) (129600, 190885, 197394)
G. billardieri (209390)
G. heterophylla (209364)
Histiopteris incisa
Hymenophyllum bivalve
H. demissum
H. dilatatum (uncommon)
H. flabellatum
H. minimum (2800ft max., uncommon, S — south of Mt. Barton) (190888-90, 192483, 197349-50)
H. multifidum (197400)
H. peltatum (uncommon) (197348, 209394)
H. rarum
H. revolutum (uncommon)
H. sanguinolentum (incl. *H. villosum*) (190881, 197401)
(*H. scabrum*)
Hypolepis millefolium (uncommon, S — south of Mt. Barton, near tarn)
H. rufobarbata (209333, 209382)
H. rugosula (197485, 209324)
H. tenuifolia (209320)
(*Lastreopsis glabella*)
(*L. hispida*)
(*L. velutina*) (209354)

Leptolepia novae-zelandiae (uncommon)
Ophioglossum sp. (uncommon, S — south of Mt. Barton)
Paesia scaberula
Pellaea rotundifolia
Phymatodes diversifolium
Polystichum richardii (209842)
P. silvaticum (209316, 209318)
P. vestitum (209317, 209843)
P. richardii X *P. vestitum* (uncommon) (209841)
P. silvaticum X *P. vestitum* (uncommon) (209319)
Pteridium aquilinum var. *esculentum* (*Pteris macilenta*) (209355)
(*P. tremula*)
Pyrrosia serpens
Rumohra adiantiformis (*Thelypteris penniger*)
Todea hymenophylloides (209383)
T. superba (209384)
T. hymenophylloides X *T. superba* (209385)
Trichomanes venosum (uncommon)

ORCHIDS

Caladenia carnea (uncommon)
Chiloglottis cornuta
Corybas macranthus (209854)
C. trilobus
(*C. orbiculatus*) (uncommon, L) (209379)
Dendrobium cunninghamii
Earina autumnalis
E. mucronata
Microtis unifolia
Prasophyllum colensoi (uncommon, S)
P. banksii
(*P. montana*) (uncommon, N)
Thelymitra hatchii (uncommon)
T. longifolia
T. pauciflora (uncommon)

GRASSES

Agropyron sp. (*A. scabrum* agg.) (sp. of rocky sites, lvs glabrous) (mainly south of Mt. Barton) (197413)
A. sp. (*A. scabrum* agg.) (sp. of grassland, lvs hairy) (197412)
Chionochloa beddiei (2800ft max., S — south of Mt. Barton) (190887, 197388)
C. cheesemanii (182183, 190882)
C. conspicua var. *cunninghamii* (uncommon, Surf and Mt. Barton)
C. beddiei X *C. cheesemanii* (uncommon) (165318)

Cortaderia fulvida
Deyeuxia avenoides (incl. *D. a.* var. *brachyantha*) (186174, 197389)
(*D. conspicua*) (N) (209884)
D. crinita (209845)
Echinopogon ovatus (2600ft max., uncommon)
Festuca multinodis (2800ft max., S)
Hierochloa sp. (unnamed, aff. *H. redolens*) (S — south of Mt. Barton) (197190-1, 197362)
Lachnagrostis richardii (2800ft max., S) (192148, 197390)
Lachnagrostis richardii (2800ft max., S) (192148, 198390)
Microlaena avenacea
M. stipoides
Notodanthonia clavata (197403, 197405)
N. gracilis (197404, 197407)
N. penicillata (197406)
N. racemosa (186175)
N. unarede (2000ft max., S — south of Mt. Barton)
Oryzopsis rigida (uncommon)
Poa anceps var. *anceps* (190908, 197409-10)
P. breviglumis s.s. (197379)
P. colensoi (uncommon, S — south of Mt. Barton) (84875, 129612, 197391-2)
P. laevis var. (2800ft max., S — south of Mt. Barton) (190909-10)
P. sp. (unnamed, aff. *P. imbecilla*) (165312, 192149, 197363, 197380)
P. anceps var. *anceps* X *P. laevis* var. (190911-3)
Trisetum sp. (unnamed, aff. *T. antarcticum*) (mainly south of Mt. Barton) (184877-8, 190904)
(*T.* sp.) (unnamed) (197361)

SEDGES

Carex breviculmis (S — south of Mt. Barton) (197354, 197357)
C. dissita
C. flagellifera s.s. (209416)
C. forsteri
C. geminata (uncommon)
C. lessoniana (uncommon)
(*C. secta*)
C. solandri (209417)
Eleocharis acuta (uncommon)
E. gracilis (uncommon)
Gahnia pauciflora (uncommon) (209313)
(*Scirpus chlorostachyus*) (209846)

Scirpus habrus (uncommon, N — Te Maunga ridge)
S. pottsii (190893, 197393)
S. reticularis (uncommon) (*Schoenus maschalinus*)
Uncinia augustifolia (192161, 209-308)
 (*U. banksii*) (197474)
U. clavata (197360)
U. ferruginea (209849)
U. filiformis (N) (197483)
U. gracilentia (uncommon, N) (209-340, 209386)
U. leptostachya (192162-3)
U. scabra (209309)
U. silvestris (209387-8)
U. uncinata (209848)
U. zotovii (197476)

RUSHES

Juncus australis (209850)
J. gregiflorus (209851)
J. novae-zelandiae (uncommon) (197386)
J. pallidus
J. planifolius
J. sarophorus (209852)
Luzula migrata (S — south of Mt. Barton) (112731, 131696, 165-317, 190935)
L. picta s.s. (197356)
L. subclavata (uncommon, N) (209-332)
 (*L. banksiana* s.s. X *L. picta* s.s.) (S — south of Mt. Barton) (190936, 197414)
L. migrata X *L. picta* ss. (uncommon) (190937-8)

MONOCOT HERBS (OTHER THAN ORCHIDS, GRASSES, SEDGES, RUSHES)

Arthropodium candidum (2500ft max.)
Astelia fragrans (uncommon)
A. nervosa var. (uncommon) (190-898)
A. solandri (209312)
Collospermum microspermum (209-311)
Dianella nigra (uncommon)
Libertia grandiflora
L. ixioides (uncommon) (209853)
Luzuriaga parviflora (uncommon, N — Te Maunga and Mt Ross ridges)
Phormium cookianum

DICOT HERBS

Acaena anserinifolia (190883) (*A. novae-zelandiae*)

(*A. sp.*) (*A. pusilla*?) (S — south of Mt. Barton)
Aciphylla squarrosa var. *squarrosa* (2800ft max., mainly south of Mt. Barton)
 (*Australina pusilla*) (209401) (N — Ruakokoputuna V.)
Brachycome radicata var. *radicata* (S) (129614, 159978, 165344, 192484)
Cardamine sp. (*C. debilis* agg.) ("Narrow Petal" of Pritchard, 1957) (209325)
C. sp. (*C. debilis* agg.) ("Long Style" of Pritchard) (190899, 209326)
 (*C.* sp.) (unnamed, aff. *C. corymbosa*) (Mainland Coastal Race of Pritchard) (N — Ruakokoputuna V.) (209363)
 (*Centella uniflora*)
Celmisia spectabilis var. (S) (165323-4, 192160, 190896-7)
Colobanthus strictus (2800ft max., S — Mangatoetoe) (129615, 165305)
 (*Cotula perpusilla*) (S — south of Mt. Barton) (197370)
Craspedia minor ss. (116505, 197-374)
C. uniflora var. *grandis* (mainly south of Mt. Barton) (190907)
C. viscosa (uncommon, L) (82322)
Dichondra brevifolia (uncommon) (197488)
D. repens (S — south of Mt. Barton)
Drosera auriculata (uncommon, N)
Epilobium alsinoides s.s. (uncommon)
E. atriplicifolium (incl. *E. novae-zelandiae*) (mainly south of Mt. Barton) (116846, 190875)
E. cockaynianum (uncommon, S — Mangatoetoe) (129616, 197234)
E. glabellum s.s. (incl. *E. erubescens*) (uncommon, S — south of Mt. Barton) (165302, 192485)
E. komarovianum (incl. *E. k.* var. *inoratum*) (uncommon) 190-874)
E. microphyllum (incl. *E. m.* var. *prostratum*) (S)
E. nerteroides (incl. *E. pedunculare* var. *viride*) (209409)
E. nummularifolium
E. pedunculare (two forms present: one with smaller lvs — *E. pedunculare* s.s.; the other with

- larger lvs — *E. linnaeoides*) (former — 199382; later — 197-256-7, 199385)
- E. pubens* s.s. (incl. *E. p.* var. *strictum*) (197235)
- E. rotundifolium* (197238)
- E. sp.* (unnamed, at present placed as var. *brunnescens* of *E. pedunculare*) (190876, 197231-3)
- E. nerteroides* X *E. nummularifolium* (uncommon) (197228-30, 197-315)
- Euphrasia cuneata* (Ruakcokoputuna V. limestone, and south of Whawanui) (197382, 209376)
- Galium propinquum* (197358, 197-373)
- Geranium microphyllum* var. (197-355)
- G. sessiliflorum* var. *novae-zelandiae* (mainly south of Mt. Barton) (209314)
- Gnaphalium collinum* s.s. (197353)
- G. involucreatum* s.s. (uncommon) (190901)
- G. sp.* aff. *G. luteo-album* (190884)
- G. subrigidum* (L.) (82229, 209345)
- G. trinerve* (uncommon)
- G. sp.* (unnamed, aff. *G. involucreatum*) (uncommon, bogs and seepages)
- G. sp.* (unnamed, aff. *G. collinum*) (lvs white or greenish white) (190892, 192158, 197377)
- G. sp.* (annual) (uncommon)
- G. hybrids* — see under *Helichrysum*
- Gunnera monoica* (incl. *G. albocarpa* and *G. strigosa*) (209372)
- Haloragis depressa* (uncommon, S — south of Mt. Barton) (197-366)
- H. erecta*
- H. micrantha* (uncommon)
- Helichrysum bellidioides* s.s. (165301, 165303, 179443)
- H. filicaule*
- Helichrysum-Gnaphalium-Raoulia* hybrids (E — between early flowering spp.; A — between late-flowering spp.)
- H. bellidioides* s.s. X *Gnaphalium trinerve* (uncommon) (197376) (E)
- H. b.* s.s. X *H. aggregatum* (uncommon, S — south of Mt. Barton) (165316, 179436) (E)
- H. filicaule* X *Raoulia glabra* (uncommon, S — Whawanui) (192159) (A)
- Gnaphalium subrigidum* X *G. trinerve* (uncommon, L) (209347, 209408) (E)
- G. s.* X *Raoulia tenuicaulis* (uncommon, L) (209406) (E)
- Hydrocotyle americana*
- H. elongata* (197411, 209365)
- H. microcarpa* (uncommon)
- H. moschata*
- (*H. novae-zelandiae*) (209855)
- Lagenophora petiolata* (209391)
- L. pumila* (209856)
- Limosella lineata* (uncommon, S — south of Mt. Barton, tarn)
- Linum monogynum* (2800ft max., uncommon, S — south of Mt. Barton) (197381)
- Lobelia anceps* (L.) (209350)
- (*Microseris sp.*) (*M. scapigera?*) (S — south of Mt. Barton)
- Myosotis forsteri* (uncommon)
- Nertera cunninghamii* (209857)
- N. sp.* (unnamed, included in *N. dichondraefolia* by Allan and others) (uncommon) (209393)
- Oreomyrrhis ramosa* (incl. *O. colensoi* var. *delicatula*) (uncommon, S — near Mt. Barton) (192492)
- Oxalis lactea*
- O. sp.* (small, prostrate, fls. yellow) (197371)
- Parahebe cataractae* var. (uncommon, S — south of Mt. Barton) (192490-1)
- (*Parietaria debilis*) (197365)
- Plantago raoulii* var. (197372)
- (*P. spatulata*) (S — south of Mt. Barton)
- Pratia angulata* (190880)
- Ranunculus hirtus* s.s. (197486)
- R. muricatus* (uncommon, S — south of Mt. Barton) (165295)
- Raoulia australis* (2000ft max., S) (197402)
- R. glabra* (190903)
- R. tenuicaulis* (incl. *R. t.* var. *pusilla* and *R. t.* var. *dimorpha*) (197-387, 209370, 209407)
- R. hybrids* — see under *Helichrysum*
- Schizeilema trifoliolatum* (197368)
- Scleranthus biflorus* (2800ft max., mainly south of Mt. Barton) (190900)
- (*Senecio glomeratus*)
- (*S. hispidulus* s.s.)
- S. lagopus* (S) (165304, 190894-5)
- S. lautus* var. *lautus* (Ruakcokoputuna V. limestone, and south of Mt. Barton) (209349)

- S. minimus* (incl. *S. heterophyllus*)
S. quadridentatus (209361-2)
S. rufigliandulosus var. (S — Mt. Barton)
Stellaria parviflora (incl. *S. minuta*) (129710, 131689, 197352, 197352, 197359)
Tillaea sieberiana (190906, (209375)
Urtica incisa
- Viola filicaulis* (197378)
(Vittadinia australis) (S — south of Mt. Barton)
Wahlenbergia colensoi (2800ft max.) (197383)
W. gracilis s.s. (2800ft max., S — south of Mt. Barton) (197384)
(W. sp.) (fls blue, *W. marginata*?)

ADVENTIVE PLANTS

SHRUBS

- Erica lusitanica* (N — north-western fringe of Range)
Rosa rubiginosa (uncommon, N)
Sarothamnus scoparius (N — north-western fringe of Range)
Ulex europaeus (N — north-western fringe of Range)

GRASSES

- Agrostis tenuis*
Aira caryophyllea
A. praecox
Anthoxanthum odoratum
Cynosurus cristatus
Dactylis glomerata
Festuca arundinacea (uncommon)
F. ovina (uncommon, S — south of Mt. Barton) (84874)
F. rubra
Glyceria fluitans
Holcus lanatus
Lolium perenne
Poa annua
P. pratensis (uncommon)
Vulpia bromoides (84873)

RUSHES AND SEDGES

- Juncus articulatus*
J. bufonius
J. effusus
Luzula congesta (uncommon)
Scirpus setaceus (uncommon) (209-847)

DICOT HERBS

- Acaena ovina* (uncommon)
Achillea millefolium
Aphanes arvensis
Arenaria serpyllifolia (L)
Bellis perennis
Callitriche stagnalis
Cardamine hirsuta
Carduus tenuiflorus
Centaureum erythraea
Cerastium holosteoides
Chrysanthemum leucanthemum
Cirsium vulgare

- Conium maculatum* (uncommon)
Conyza canadensis
Crepis capillaris
Digitalis purpurea
Epilobium adenocaulon (uncommon)
Erodium cicutarium (uncommon)
E. moschatum (uncommon)
Galium aparine
Geranium dissectum (uncommon)
G. molle
Gnaphalium spicatum
Hypochoeris radicata
Leontodon taraxacoides
Lepidium ruderalis (uncommon)
Linum catharticum
Lythrum hyssopifolia (uncommon)
Marrubium vulgare (uncommon)
Mycelis muralis
Plantago lanceolata
Prunella vulgaris
Ranunculus parviflorus
R. repens (uncommon)
Rorippa microphylla
Rumex acetosella
R. brownii (uncommon, S — south of Mt. Barton) (197415)
Sagina procumbens
Senecio jacobaea
S. silvaticus (uncommon)
Sherardia arvensis
Silene gallica
Silybum marianum
Sisymbrium officinale (uncommon)
Sonchus asper
S. oleraceus (uncommon)
Stellaria media
Taraxacum officinale
Torilis nodosa
Trifolium dubium
T. repens
T. subterraneum
Urtica urens (uncommon)
Veronica arvensis
Vicia hirsuta
V. sativa

In addition the following species commonly regarded as indigenous (and listed as such above) are almost certain adventive:

Acaena novae-zelandiae

Agropyron sp. (*A. scabrum* agg.) (sp. of grassland, lvs, hairy)

Gnaphalium sp. (annual)

Notodanthonia clavata

N. penicillata

N. racemosa

Wahlenbergia sp. (fls blue, *W. marginata*?)

The following four species are mentioned by J. Wardle in the course of his description of the vegetation of the Range (*N.Z. J Bot. 5*). The plants in question (with the possible exception of the fourth) appear to have been misidentified.

Blechnum minus = *B. procerum* (*B. minor* auct.)

Coprosma parviflora = *C.* sp. (unnamed)

Poa imbecilla = *P.* sp. (unnamed) and/or *P. breviglumis* s.s.

Pterostylis venosa = ?

In Bulletin 27 I wrongly recorded the following two species from the Aorangi Range:

Chionochloa bromoides (as *Danthonia bromoides*) = *C. beddiei*

Uncinia strictissima = *U. leptostachya*

NOTES ON THE VEGETATION OF THE AORANGI RANGE

J. Wardle in his recent paper on the Aorangi Range (*N.Z. J Bot. 5*) divides the vegetation into four main types of forest, and a number of seral (mostly non-forest) types resulting from erosion and fire. I summarise his classification below:

Forest

- W1: mahoe-hinau-rewarewa forest (up to 1700-1900ft)
 - W1a: mahoe forest (younger soils)
 - W1b: mahoe-hinau-rewarewa forest with podocarps
- W2: black beech forest (up to 1600-1800ft)
 - W2a: black beech-hard beech forest
- W3: red beech forest (above 1400-1900ft)
 - W3a: red beech forest with podocarps (below 2200ft)
 - W3b: red beech forest with silver beech and kamahi
- W4: silver beech forest (2000-3200ft)
 - W4a: silver beech forest with red beech

Seral communities on slips, in gully heads and on river terraces

(Various herb, fern and shrub communities; and various forests dominated by mahoe, fuchsia, wineberry, broadleaf, lacebark, and titoki.)

Seral communities following fire

- W5: tall kanuka scrub (up to 1500-200ft)
- W6: subalpine scrub
- W7: subalpine tussock grassland

D. A. Franklin in his report on the forests south of the Manawatu Gorge (*N.Z. Forest Service Technical Paper 53*) places the forests of the Aorangi Range in sixteen types of a general North Island classification, as follows:

Beech forests

- F1: silver beech forest
- F2: red beech-silver beech forest (widespread type in northern part of Range)
- F3: red beech forest (small areas)
- F4: red beech-silver beech-hard beech and/or black beech forest
- F5: black beech forest (widespread on western side of Range)
- F6: hard beech-black beech forest

Rimu-beech forests

- F7: rimu-miro-red beech-silver beech forest (widespread)
- F8: rimu-miro-red beech forest
- F9: rimu-miro-rata-red beech (Turanganui R. catchment)
On p. 20 of his report Franklin says of this forest type: ". . . in the Aorangi Mountains matai is also present, but *rata* and *kamahi* are *absent*" (my italics).
- F10: rimu-miro-red beech-black beech forest (headwaters of Turanganui R.)
- F11: rimu-miro-black beech forest (at low altitudes in northern part of Range)

Logged rimu-beech forests

- F12: black beech-tawa (local in northern part of Range)

Rimu-matai-hardwood forests

- F13: matai-rimu-hinau forest

Miscellaneous hardwood forests

- F14: hinau-rewarewa-shrub hardwoods forest (widespread)
- F15: kanuka forest (widespread in southern part of Range)
- F16: shrub hardwoods forest

I found it took quite a bit of juggling to reconcile these two classifications: I have indicated below how they might be correlated. Dividing vegetation (or soil—the other half of the ecosystem) up into types, or classes of any kind, has always been, and I think always will be, an essentially arbitrary procedure, not only because we have to place boundaries in something that varies more or less continuously over the surface of the earth, but also because of the virtually infinite choice we can make in the combination of criteria to use as a basis for classification. No one classification is right, or the best, though one may be better than another for a particular purpose. And one can get oneself into a comic situation when placing the vegetation of a *particular* locality in a *general* classification, exemplified here by Franklin's placing of a forest without rata into rimu-miro-rata-red beech forest (F9).

Correlation of Wardle and Franklin's forest types

Forests with beech

- F1 = W4
- F2 = W3b and W4b
- F3 = W3
- F4 = W2-W3 and W3-W4
("transition zones")
- F5 = W2
- F6 = W2a
- F7 = W3a-W3-b (transition)

- F8 and F9 = W3a
- F10 = W2-W3a (transition)
- F11 = W1b-W2 (transition)
- F12 = W1-W2 ("transition zone")

Forests without beech

- F13 = W1b
- F14 = W1
- F15 = W5
- F16 = W1a and seral forests

I am not going to provide a third classification, but I do want to make a few comments. Firstly, I would certainly follow Franklin in considering red beech-silver beech forest (F2) to be a major type, widespread in the northern part of the range and more important than either red beech forest or silver beech forest, with which it is placed by Wardle. Also I would agree with Franklin in recognising miro-rimu-red beech-silver beech forest as a type in the Aorangi Ra. The largest remaining unlogged area appears to be in the Tauanui R. catchment.

Secondly, no one person or team can cover all of an area the size of the Aorangi Ra. (c.130 sq. miles) and some kinds of forest are likely to be missed. There are four of Franklin's types, all locally distributed, that I haven't encountered (F9, F10, F11, F12). I doubt, however, whether two of these, rimu-miro-rata-red beech forest (F9) and black beech-tawa forest (F12) have a meaningful existence in the Aorangi Ra. One important type seems to have been missed by both Wardle and Franklin. In the vicinity of Surf (2437 ft) and some of the headwaters of Washpool Ck., where only a few, isolated stands of beech occur, there is a sizeable area of podocarp-dicotylous forest that clearly warrants distinction from Franklin's matai-rimu-hinau forest (F13), which anyway, as Franklin says, is found "on lower valley sides and on slopes of southerly aspect at altitudes less than 1,000 ft". On Franklin's map the forest in this area is wrongly classed as "rimu-beeches".

The important podocarps in the forest are rimu, miro and Hall's totara. These, together with black maire, emerge above a lower canopy layer of small trees, the more important of which are lacebark (*Hoheria populnea* var.), broadleaf, toro, kaikomako, putaputaweta, and mahoe. Lancewood and rewarewa are also present. The main understorey plant is horopito (*Pseudowintera colorata*); others important are *Cyathea smithii*, *Coprosma rotundifolia*, and *C. rhamnoides*. I think this forest can be regarded as a montane equivalent of Wardle's mahoe-hinau-rewarewa forest with podocarps (W1b). The change is gradual and I would place the boundary around 1700 ft.

Of the land over 1000 ft in the Aorangi Ra. that I am describing in this article — roughly the area enclosed by the dashed line in Fig. 1 — only a little over half, or 70 sq. miles, is at present in forest. Most of the rest, about 60 sq. miles, is in scrub, fernland, or pasture. Tussock land, herbfield and open communities add up to perhaps no more than 2 sq. miles. Originally the range was almost all in forest. (That there was some vegetation other than forest in the south, small in extent but of special significance, may be deduced from the composition of the present flora. I have discussed this in the previous section.) The forest present today is in two blocks: one north of the Turanganui R. (some 25 sq.

miles), the other south of Surf and Mt Ross (some 45 sq. miles). Very nearly all of this forest has been severely modified by introduced mammals (deer, goats, opossum, pigs, and, locally, cattle). Some of the forest in the north and a significant part of the forest in the south is secondary; podocarps are generally absent from these areas. In the north there are logged forest also. The history and present state of the Aorangi Ra. forests are discussed in detail by Wardle in his paper.

None of the original podocarp-dicotylous forest on limestone, between 1000 and 2000 ft in the Ruakokoputuna V., is left. To judge from patches of second growth, the composition of the original forest was probably different from that of any forest on greywacke in the Aorangi Ra. Matai, rimu, totara, kahikatea and miro were probably all present, together with many different kinds of medium-sized and small trees in the lower canopy layers. Possibly white and black maire were the most important of these.

If we look at the Aorangi Ra. as a whole and compare its vegetation with that of the Rimutaka Ra., we find some striking similarities and some striking differences. In both ranges silver beech is almost universally present at higher altitudes, and in both ranges red beech is absent from the south and west (absent from roughly the south-western two-thirds of the Rimutaka Ra., and from Mt Surf and the southern third of the Aorangi Ra.). But kamahi, which is a major component of most forests in the Rimutaka Ra. has a very patchy distribution in the Aorangi Ra. Surprisingly it is absent from much of the beech forest there, especially in the south. If it does become important, locally, it is usually on a south- or east-facing slope or on a high ridge. It is rarely a major component of manuka scrub even at high altitudes. Other forest species which are common in the Rimutaka Ra. and in the hill country to the west, but are missing from much or all of the Aorangi Ra., include northern rata, tawa, hangehange and *Pseudowintera axillaris*. A number of trees, regularly associated with soils of moderately high fertility, ascend to considerably higher altitudes in the Aorangi Ra. than they do in the Rimutaka Ra. Lacebark (*Hoheria populnea* var.), kaikomako, black maire and kowhai (*Sophora microphylla*) all reach 2400 ft in parts of the Aorangi Ra. As I have already mentioned in the first half of this article, the climate of the Aorangi Ra. is significantly drier than that of the Rimutaka Ra. As a result it is likely that the soils are less leached. At high altitudes they are noticeably better drained, poorly drained soils being practically confined to the tops of the Te Maunga and Mt Ross ridges. Geological factors, especially the texture of the mantle of rock debris that forms the soil parent material, are certainly of major importance in these ranges but they affect local patterns rather than regional differences in vegetation.

But while climatic factors may account for these regional differences in vegetation, I don't think they explain the distribution patterns displayed by red beech. I can only think that these reflect the restricted dispersal of the species in the post-glacial period, from some area or areas to the north, probably in the Tararua Ra. foothills. In contrast, silver beech was probably widespread in the southern part of the North Island during the glacial period, and subsequent dispersal may have been over relatively short distances, mainly upslope.

Considering, next, the 60 sq. miles of the Aorangi Ra. in scrub, fernland and pasture, my impression is that more than half is in pasture. But with the pasture continually being invaded by scrub species my estimate could be well out. Most of the pasture is unimproved, and dominated by browntop or danthonia. Of three danthonias present, *Notodanthonia racemosa* is the commonest, especially on the coastal hills. *Agropyron* sp. (leaves hairy) is abundant in most places, and one or more of the following grasses may be present: sweet vernal, Yorkshire fog, crested dogstail, cocksfoot. Clovers other than suckling clover are generally absent, though subterranean clover is important in some pastures. On the limestone country in the Ruakokoputuna V., between 1000 and 2000 ft, the pastures are better and, in marked contrast to those on greywacke, show no sign of changing to scrub. The main areas of pasture in the Aorangi Ra. are in the Dry R., Ruakokoputuna and Turanganui catchments, and along the coastal hills from Wash-pool Ck. to C. Palliser. Most are below 1500 ft, but those in the Ruakokoputuna V., on both limestone and greywacke, reach 2000 ft or even higher (2500 ft in Mt Mabel).

Tauhinu (*Cassinia leptophylla*) is by far the commonest shrub invading pasture, and there are large areas of land in various stages of transition to scrub dominated by this plant. Gorse and broom are restricted to the north-western fringe of the Range and the lower part of the Turanganui catchment. Bracken is important locally in the north, where there are scattered areas of bracken fernland, tauhinu-bracken shrub-fern land and manuka-mingimingi (*Cyathodes* spp.)-bracken shrub-fern land.

In contrast to tauhinu, which comes in most strongly on the relatively more fertile land that once carried podocarp-dicotylous forest, manuka comes in mainly on the less fertile land that once carried beech forest. In the north manuka is important along the north-west fringe and in the higher parts of the Ruakokoputuna catchment. In the south it is a dominant plant above 1800 - 2000 ft from Mt Barton southwards (Figs 2 - 7). Mingimingi (*Cyathodes fasciculata*) is the commonest shrub associated with manuka, and it may dominate locally. Above about 2500 ft, on Whawanui, on the ridge tops south of Mt Barton, and very locally in the northern



Photo: A. P. Druce, Nov. 1955.

Fig. 5 — Manuka-coprosma-*Celmisia spectabilis* shrub-herb field at about 2700ft, 1½ miles SSW of Mt. Barton. The site was formerly occupied by beech forest.

part of the Range, several mountain shrubs become important members of manuka scrub, especially *Dracophyllum filifolium*, *Hebe venustula*, *Senecio elaeagnifolius* and *Coprosma* sp. Locally, one or other of these may dominate. These communities are described by Wardle under the heading "subalpine scrub"; however, the Aorangi Ra. is not high enough to have a true subalpine zone — only a montane zone. *Inter alia*, he says that fire was "responsible for the development of the subalpine scrub" (my italics). But if the "subalpine" species had not been available, i.e. growing in nearby, non-forest communities, no amount of burning of forest could have been "responsible" for the development of this type of scrub.

Like tauhinu, kanuka dominates in areas that carried podocarp-dicotylous forest rather than beech forest. Much of the kanuka scrub has probably developed from tauhinu scrub, or tauhinu-kanuka scrub. Nevertheless kanuka often occurs mixed with manuka on land formerly in beech (Fig. 5). The largest areas of kanuka scrub are in the southern part of the range.

There are various other kinds of scrub but they don't cover a great area. Two are rather distinctive. On the summit of Mt Mabel and elsewhere above 2000 ft there are patches of horopito

(*Pseudowintera colorata*) scrub; and in the Ruakokoputuna V. where red beech-silver beech forest has been burnt but the land not cleared, there is a very mixed scrub in which the principal species are tree ferns (*Cyathea smithii*), putaputaweta, mingimingi (*Cyathodes fasciculata*), horopito, and bracken.

Tussock land, dominated by the narrow-leaved bush tussock *Chionochloa cheesemanii*, occurs mainly on the peak north-west of Mt Barton (Fig. 6) and in places on the ridge running south-west from there to Mangatoetoe (Fig. 7). There are only very small areas elsewhere. In one direction it grades into shrub-tussock land, with *Coprosma* sp., *Dracophyllum filifolium*, manuka and flax (*Phormium cookianum*), in the other into tussock-herb field with *Celmisia spectabilis* important. Under the heading of "subalpine tussock grassland" Wardle says: "This community, like subalpine scrub, appears to have been induced by fire." But, as with "subalpine scrub", burning of forest could not have induced tussock vegetation if the tussock species had not already been present in the area, either as a forest understorey plant or as a member of non-forest vegetation. Although this tussock is rarely found in



Photo: A. P. Druce, Nov. 1955.

Fig. 4 — *Chionochloa cheesemanii*, manuka, coprosma, and *Celmisia spectabilis* on soil remnant at about 2600ft, just below crest of ridge $1\frac{1}{2}$ miles SSW of Mt. Barton. The soil is formed with wind-blown material overlying an older, podzolised soil (with well developed ash-grey horizon) formed under a (? pre-European) cover of silver beech.

forest in the Aorangi Ra. today there is plenty of evidence from elsewhere that forest is its normal habitat. I postulate, therefore, that tussock plants present in the original forest survived burning and then increased to form a major part of the succeeding vegetation. Browsing animals later eliminated the tussock from inside the forest but not from outside, where plants other than tussock were the main plants affected. The broad-leaved bush tussock, *C. conspicua* var. *cunninghamii*, has come to dominate burnt areas in the Tararua and Rimutaka ranges in a precisely similar way, I think. The problem is to account for the difference in palatability of the tussocks in the two habitats, inside and outside forest. An additional factor favouring tussock growth in the Aorangi Ra. has been the addition of wind-blown sand from nearby eroding areas (Figs. 4 and 6).

The only areas of herbfield in the Aorangi Ra. occur on ridge tops in the south, where *Celmisia spectabilis* has come to dominate on soils that once carried silver beech. The herbfield grades into tussock-herb field, shrub-herb field (Fig. 3), and various open communities of cliffs and rocky ridge tops.



Photo: A. P. Druce, Nov. 1955.

Fig. 5 — View NW from a point on the ridge $\frac{3}{4}$ mile SSW of Mt. Barton, showing manuka-kanuka scrub surrounding a tarn (2400ft), and silver beech forest behind (2300-2700ft). Scattered small trees of silver beech, broadleaf, and kowhai are present in the scrub. Note the wind-shorn canopy of the forest on the left-hand (SW-facing) sides of the spurs.



Photo: A. P. Druce, Nov. 1955.

Fig. 6 — Unnamed peak (c. 2900ft) NW of Mt. Barton, showing erosion at head of gully. *Chionochloa cheesemanii* tussock land and shrub-tussock land to right of eroding area. Manuka scrub on slopes of Mt. Barton (lower right of photo). The tussocks reach their maximum development (4-5 ft high, 4-5(-7) ft diam.) near the edge of the eroding area and stand on pedestals of wind-blown sand up to 18in. tall. The addition of this material seems to have been an important factor favouring tussock dominance.

The open communities of cliffs, screes, rocky ridge tops, slip faces, and stream banks are very diverse. Apart from one from a ridge top, all the examples below are from cliffs. These communities are of special significance, for from them come many of the species that have since become important in secondary vegetation. The first four examples of cliff vegetation — all from greywacke in the vicinity of Mangatoetoe — form an altitudinal sequence in which temperature and soil moisture are probably the controlling factors.

1. *Shrub-tussock cliff vegetation*, at 1200 ft, facing S; height 0 - 40 in.; cover 30%. Main spp.: *Senecio greyi*, *Chionochloa beddiei*, flax (*Phormium cookianum*). The 41 other spp. present comprise seven shrubs (incl. *Carmichaelia arborea* var., *Coprosma crassifolia*, *Helichrysum aggregatum*, *Hymenanthera crassifolia*), six ferns (incl. *Asplenium flabellifolium*, *Polystichum richardii*, *Pyrrosia serpens*), 27 herbs (incl. *Aciphylla squarrosa*, *Brachycome radicata*,



Photo: A. P. Druce, Nov. 1955.

Fig. 7 — Vegetation pattern at 2700ft on ridge $\frac{3}{4}$ mile NNE of Mangatoetoe: *Chionochloa cheesemanii* tussock land, silver beech forest, manuka scrub (foreground), and open communities of cliffs and rocky ground.

Colobanthus strictus, *Craspedia uniflora* var. *grandis*, *Libertia grandiflora*, *Linum monogynum*, *Plantago spathulata*, *Senecio lagopus*, *S. lautus*, *Wahlenbergia colensoi*), and one liane (*Clematis forsteri*).

2. *Tussock-herb cliff vegetation*, at 2000 ft, facing SW; height 0–20 in.; cover 20%. Main spp.: *Chionochloa beddiei*, *Celmisia spectabilis*. The 28 other spp. present comprise nine shrubs (incl. *Cyathodes juniperina*, *Hebe venustula*, *Helichrysum aggregatum*, *Gaultheria rupestris*, *Senecio greyi*), one fern, and 18 herbs (incl. *Aciphylla squarrosa*, *Brachycome radicata*, *Colobanthus strictus*, *Epilobium atriplicifolium*, *Senecio lagopus*, flax).

3. *Shrub-herb cliff vegetation*, at 2500 ft, facing E, S, and W; height 0–30 in.; cover 25%. Main spp.: *Hebe venustula*, *Celmisia spectabilis*, *Poa colensoi*. The 18 other spp. present comprise eight shrubs (*Coprosma* sp., *Cyathodes fasciculata*, *Gaultheria rupestris*, *Senecio elaeagnifolius*, *S. greyi*, mountain fivefinger, broadleaf, manuka), three ferns (*Grammitis armstrongii*, *G. heterophylla*, *Hymenophyllum multifidum*), and seven herbs (*Aciphylla squarrosa*,

Brachycome radicata, *Chionochloa beddiei*, *Euphrasia cuneata*, *Luzula picta*, *Senecio lagopus*, flax).

4. *Shrub-fern-herb cliff vegetation*, at 2700 ft, facing S, on side of gully; height 0–60 in.; cover of shrubs 50%; total cover nearby 100%. Main spp.: *Coprosma* sp., *Hebe venustula*, *Senecio elaeagnifolius*, *Blechnum procerum*, *Celmisia spectabilis*. The 15 other spp. present comprise seven shrubs (incl. *Dracophyllum filifolium*, *Gaultheria rupestris*, *Olearia arborescens*, manuka), three lycopods, and five herbs (incl. *Euphrasia cuneata*, *Poa colensoi*, *Viola filicaulis*).

5. *Shrub-herb-rock field*, at 2800 ft, on ridgetop; height 0–20 in.; cover 25%. Main spp.: *Hebe venustula*, *Celmisia spectabilis*, *Cyathodes fraseri*, *Raoulia glabra*, catsear. The 20 other spp. present comprise three shrubs (*Pimelea gnidia*, *P. longifolia*, *Senecio greyi*), one fern, and 16 herbs.

6. *Shrub-tussock cliff vegetation*, 1200 ft, facing N, on limestone; height 1–5 (–10) ft; total cover between 75 and 100%. Main spp.: *Coprosma robusta*, manuka, flax, *Gahnia pauciflora*, tall fescue, *Chewing's fescue*, *Blechnum* sp. (cliff sp. of *B. capense* agg.). There are a few small kowhai (*Sophora microphylla*) and cabbage trees. The 42 other species present comprise three shrubs, five lianes (incl. *Clematis forsteri*, *Metrosideros colensoi*), nine ferns (incl. *Adiantum cunninghamii*, *Asplenium anomodum*, *A. hookerianum*, *A. lucidum*), and 25 herbs (incl. *Corybas macranthus*, *Craspedia viscosa*, *Gnaphalium subrigidum*, *Euphrasia cuneata*, *Lobelia anceps*, *Senecio lautus*).

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