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The vascular flora of the DSIR study area lower Orongorongo Valley, Wellington, New Zealand

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Abstract All vascular plants recorded in the lower Orongorongo Valley DSIR study area (1100 ha) are listed with notes on their status and distribution. Of the 501 taxa, 355 are native, 128 are naturalised, and 18 have probably been deliberately introduced or cultivated. Of the native taxa, 35% are woody plants, but only 75 of these (or 60% of woody native taxa) are common and thus make up the bulk of the vegetation structure. By contrast, less than 9% of the naturalised species are woody plants, and all except two — gorse and buddleia — are either uncommon or rare. Annuals comprise 5.6% of all native dicotyledon herbs and 49% of the naturalised dicotyledon herbs. The history of the study area, public use, introduced animals, and tectonic events, particularly the earthquake-induced landslides of the mid-nineteenth century, are outlined and discussed in relation to the native and adventive flora. Exotic herbivores, especially possums (*Trichosurus vulpecula*), have greatly reduced the abundance of some plants which were common 30 years ago, including *Alectryon excelsus, Fuchsia excorticata, Coriaria arborea*, and *Pseudopanax arboreus*. Some other species, although probably never common, have been brought to the verge of extinction. Naturalised plants — especially daisies and grasses — have been able to colonise extensive open habitats created by earthquake slipping in 1855, and the reactivated terraces and river flood plain. If current selection pressures continue, it is predicted that other species such as *Metrosideros robusta, Weinmannia racemosa*, and *Sphaeropteris medullaris* will become rare, at least in lowland forest. Spread of *Pinus radiata* into mid-altitude communities will accelerate as exotic forests to windward mature.

Keywords vascular flora; introduced herbivores; earthquake-induced landslides; floristic composition; altitudinal distributions; naturalised plants; weeds; spread of weeds; Orongorongo Valley; New Zealand flora

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INTRODUCTION

The lower Orongorongo Valley (Fig. 1), which is part of Rimutaka State Forest Park, is divided into several trapping blocks where licence holders can trap or poison possums (*Trichosurus vulpecula*). Through the co-operation of New Zealand Forest Service one of these blocks has been set aside from trapping and is used as a research area by Ecology Division, DSIR, for ecological research, mainly on animal populations. As part of these ecological studies, information has been collected on the vegetation of the area, the flora, and some of the effects of exotic animals on the flora and vegetation. This work began in 1966 and an herbarium of the study area has been collected over the intervening years. Ecological research in the Orongorongo Valley began in 1945 when the late R. I. Kean and L. T. Pracy of the Department of Internal Affairs started possum research, and it was continued by the New Zealand Forest Service until 1960. During those early studies into possum biology, permanent plots were set up, and information was collected on the effects of possums on their food plants (Mason 1958).

The boundaries of the DSIR study area are largely artificial. It is bounded on the north by the south catchment of Browns Stream and to the south by southern Peak Stream, and extends from the crest of the main divide in the east to the top of Cattle Ridge in the west (Fig. 1). The flora within the study area cannot be considered in isolation from the rest of the Orongorongo Valley and the adjacent mountain ranges, because the geology and climate of the whole region have determined the available habitats.

Species lists are often published for islands but only infrequently for mainland areas where boundaries are arbitrarily defined, yet the processes of invasion and extinction proceed as relentlessly on the mainland as on smaller islands. Moreover, changes in the abundance of species often go unnoticed unless an area has a history of detailed investigation.

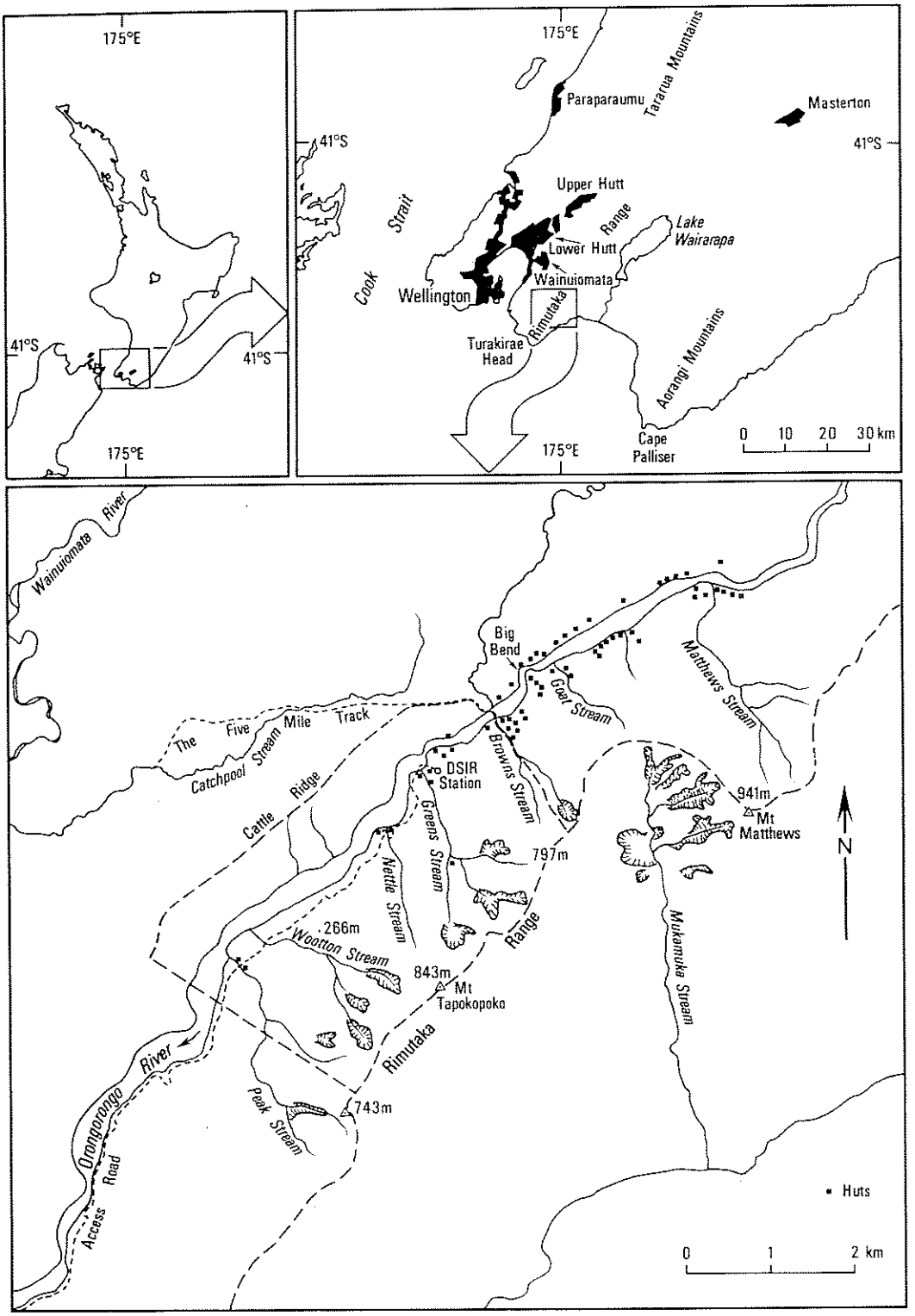

Fig. 1 Location map of study area and environs.

European contact, but after 1860 was displaced by the ship rat (*R. rattus*) (Atkinson 1973). Ship rats and mice (*Mus musculus*) are now widespread in the study area, but Norway rats are rare. Wild pigs (*Sus scrofa*), cats (*Felis catus*), and dogs (*Canis familiaris*) were all present in the Hutt Valley in 1839 (Dieffenbach 1843), and were probably present in the Rimutaka Range by about the same date.

Goats (*Capra hircus*) were reported in the Rimutaka Range shortly after the 1850s (Matthews in Monrad 1968), and were in sufficient numbers by the late 1880s to be described as 'abounding' in the area (Denton in Greig 1946). By the 1920s goats were so numerous that one man was employed on Riddifords Station to the south of the study area solely to kill them, and as many as 1500 were killed in one year (Donne 1924). In 1932 the Department of Internal Affairs started a programme to control goats.

Possums were liberated at several sites around the Rimutaka Range in 1893–94 (Pracy 1962), and gradually spread into the forested areas. From 1921 to 1929 possums were trapped by the New Zealand Forest Service after more than 30 years of protection. After 1927, trapping was continued by the Wellington City Corporation, and after 1947 all restrictions on killing possums ended (Wodzicki 1950). In 1951 a government bounty system was introduced nationally to increase possum control.

Red deer were liberated in 1911 near the source of the Wainuiomata River, and in 1913 at Orongorongo Station. They first appeared in the study area in 1932–33 (R. I. Kean, pers. comm.). Although three deer were released on the eastern side of the range in 1895 (Wodzicki 1950), these do not appear to have been the ancestors of the first deer to arrive in the Orongorongo study area.

Goats were shot out of the study area in 1976 after a period of over 10 years free from disturbance, and now goats, deer, and pigs are kept to low numbers by New Zealand Forest Service cullers. Possums are trapped each winter under a licence system, except in the study area.

Public use of area

The Orongorongo Valley is only 35 km from Wellington by road and the 'five mile' track (some 2 h total travelling time from the population centres of Wellington City and the Hutt Valley, which together house about 300 000 people). During 1971–72 some 23 600 man-days/year were spent in the area south of the water catchment area (Palmer 1976).

During the economic depression of the 1930s the Orongorongo Valley was a popular venue for the local tramping clubs, but later lost its popularity in preference to more distant areas when transport became easier in the 1940s (Greig 1946). Private huts, built on sites leased from the Wellington Regional Water Board (now included within the Wellington Regional Council), have been a feature of the Orongorongo Valley since 1929, and some 70 huts were in use in 1971–72 (Palmer 1976), mainly by families. There are 18 huts in the study area. Access to the Orongorongo Valley is either by tramping track (the 'five mile' track) or via the Orongorongo river bed. Initially the only vehicle access was up the wide shingle river bed, but in 1968 a road suitable for four-wheel-drive vehicles was constructed up the east side of the river to the research station by the DSIR. The increase in the use of vehicles and the greater frequency of visits by the public has resulted in some of the introductions of plants into the study area during the last two decades.

The study area is now part of the Rimutaka Forest Park, under the control of the New Zealand Forest Service.

Land use in the vicinity of the study area

To the north and east, native forest and scrub vegetation forms part of a continuous tract which links up with the Tararua forests. To the west of the study area the largely deforested valleys of some eastern tributaries of the Wainuiomata River contain a mixture of farmland, scrub, and forest remnants on the steeper hillsides. The land to the west of the study area is now being converted to exotic forest by the New Zealand Forest Service; some 200 ha have recently been planted in *Pinus radiata* (Wellington Regional Council 1982).

The farm at the south end of the Orongorongo Valley was first established in 1845, and extends to the southern edge of the forest of the study area. Over the years, burning to keep the land clear for pasture has resulted in parts of the southern lower flats of the study area having been burnt. Tauhinu and kanuka are common shrubs of the reverting pastures of the farmland, but gorse is gradually extending up the river and has established on suitable sites in the river bed and a few of the side streams. Gorse has also established along the access road to the research station; it is probably spread by farm animals that stray up the river, especially during dry summers.

PLANT LIST

The present list contains only those plants found within the study area outlined in Fig. 1. It does not include species found only in coastal frost-free sites to the south, or species found elsewhere in the Rimutaka Range at altitudes higher than those in the study area.

Nomenclature follows Cheeseman (1925), Allan (1961), Moore & Edgar (1970), Healy & Edgar (1980), and later taxonomic treatments where appropriate. Families are listed in the order of Hutchinson. Synonyms are cited for species that have undergone recent name changes.

Conventions used in this checklist are: * denotes naturalised, + cultivated; rare refers to fewer than 10 individuals, or restricted to fewer than 5 locations; and uncommon refers to fewer than 100 individuals or 10 locations. Numbers after each taxon refer to voucher specimens held at Ecology Division, Lower Hutt, except where prefix letters in front of the number refer to other herbaria listed in the Index Herbariorum.

Psilopsida

1 *Tmesipteris elongata* Dang.
Moderately common on trunks of tree ferns, especially below 500 m a.s.l. in lowland forest. 1651

2 *T. tannensis* (Spreng.) Bernh.
Occasional as an epiphyte, or on the ground, especially at higher altitudes. Usually on trees rather than on tree ferns. 3248

LYCOPSIDA

3 *Lycopodium fastigiatum* R. Br.
Uncommon. In induced open grassland at mid altitudes. 2379

4 *L. scariosum* Forst. f.
Uncommon. In open grassland, and in early successions on slips. 1598

5 *L. varium* R. Br.
Common. The upright form (*L. varium*, 2386) is occasional in grassland and on rock outcrops, especially at upper altitudes. The pendulous form (*L. billardieri*, 1143) occurs as an epiphyte.

6 *L. volubile* Forst. f. waewaekoukou
Uncommon to locally common. Mainly on clay banks and open areas up to about 450 m a.s.l. 155

FILICOPSIDA

Ophioglossaceae

7 *Ophioglossum coriaceum* A. Cunn.
adder's tongue fern
Uncommon. Present in grassland and on river terraces. Inconspicuous, and probably more common than records suggest. 2990

Osmundaceae

8 *Leptopteris hymenophylloides* (A. Rich.) Presl heruheru
(syn. *Todea hymenophylloides* A. Rich.)
Common in lowland forest, especially in damper sites. 51

9 *L. superba* (Col.) Presl
prince of Wales feather
(syn. *T. superba* Col.)
Rare below 450 m but common at higher altitudes. Most specimens are small, because of browsing by goats, or by deer. 2829

Gleicheniaceae

10 *Sticherus cunninghamii* (Hook.) Ching
umbrella fern
(syn. *Gleichenia cunninghamii* Hook)
Rare. This fern is known from only one locality in the research area, in black beech-podocarp/kamahi forest. This contrasts with the western headwaters of the Orongorongo Valley, where *S. cunninghamii* is widespread. 171

Hymenophyllaceae

11 *Cardiomanes reniforme* (Forst. f.) Presl
kidney fern
(syn. *Trichomanes reniforme* Forst. f.)
Common at all altitudes, especially in beech forest. Often forms extensive patches on the ground, extending up on to the bases of trees or rocks. 169

12 *Hymenophyllum bivalve* (Forst. f.) Swartz
Not common. Mainly grows on the ground or on tree bases in moss. All altitudes. 183

13 *H. demissum* (Forst. f.) Swartz
Common at all altitudes. Chiefly occurs on the ground or on fallen logs. Occasionally epiphytic. 61

14 *H. dilatatum* (Forst. f.) Swartz
Common, especially on logs in lowland forest. 2173

15 *H. flabellatum* Labill.
Mainly found as an epiphyte on trees or tree ferns, or growing on boulders in forest. 167

16 *H. flexuosum* A. Cunn.
Rare. Occurs with other more common species on boulders or stream banks, forest edge. 4226

17 *H. multifidum* (Forst. f.) Swartz
Widespread and abundant. Often forms dense mats on boulders or tree bases, especially at higher altitudes. Dehydrated ferns are very obvious on parched boulders during dry periods. 172

18 *H. peltatum* (Poir.) Desv.
Uncommon. Found in silver beech-kamahi forest as an epiphyte. 1629

19 *H. rarum* R. Br.
Common as an epiphyte or on rocks at higher altitudes. Is often very abundant on tree ferns or on silver beech trunks. 164

20 *H. revolutum* Col.
Common in forest at lower altitudes, especially as an epiphyte or on fallen logs. 62

21 *H. sanguinolentum* (Forst. f.) Swartz
Found in lowland forest as an epiphyte or on the ground. 4272

22 *H. scabrum* A. Rich.
Not common, but found on boulders or as an epiphyte. More common at higher altitudes. 4228

23 *Trichomanes venosum* R. Br.
Occurs as an epiphyte, especially on tree fern trunks, widespread and locally abundant. 1630

Dicksoniaceae

24 *Dicksonia squarrosa* (Forst. f.) Swartz
wheki
Common to locally abundant, extending up into silver beech forest. Is a frequent invader of light-gaps, especially at lower altitudes, or where the forest has collapsed after severe animal modification. Browsed by deer when it is young, but left when it is older as recorded on Secretary Island by Mark & Baylis (1982). A group of trees in a light-gap in lowland forest fared badly in the 1980–81 drought. 1131

Cyatheaceae

25 *Alsophila cunninghamii* (Hook. f.) Tryon
Cunningham's tree fern
(syn. *Cyathea cunninghamii* Hook. f. in Hook.)
Common to abundant in lowland forest, especially in damper areas. Easily confused with *A. smithii* if the fronds are retained on the trunk. Until recently (Brownsey 1979), the validity of *C. cunninghamii* as a distinct species was uncertain. In the Orongorongo Valley, *C. cunninghamii* is relatively common. In a 2.25 ha forest permanent quadrat near the research station, 802 tree ferns were labelled in 1978. Of these 101 were *A. cunninghamii*, 420 were *A. smithii*, 257 were *A. tricolor*, 24 were *Sphaeropteris medullaris*, and 192 were *Dicksonia squarrosa* (Campbell & Robinson 1981). 4010

26 *A. smithii* (Hook. f.) Tryon
Smith's tree fern
(syn. *C. smithii* Hook. f.)
Abundant at all altitudes, especially as part of successions occurring in light gaps or in slip areas where the regeneration has been influenced by browsing animals. In places *A. smithii* may occur in pure stands, because it is not browsed by deer or goats. Several *A. smithii* at lower altitudes were badly affected by the summer drought during 1980–81. 4006

27 *A. tricolor* (Col.) Tryon
silver tree fern, ponga
(syn. *C. dealbata* (Forst. f.) Swartz)
Abundant up to 400 m altitude especially in drier ridge sites, reaching an upper altitude at 520 m. Is becoming more abundant in lowland forest, especially in light gaps as a result of selective removal of competing species by introduced animals. 179

28 *Sphaeropteris medullaris* (Forst. f.) Bernh.
mamaku
(syn. *Cyathea medullaris* (Forst. f.) Swartz)
Common in lowland forest and especially abundant on damp, steep hillsides. Often badly defoliated by possums, especially when the young fronds are emerging between July and October. Is gradually being eliminated from lowland forest (Campbell & Robinson 1981). Occurs up to 560 m a.s.l. 4003

Polypodiaceae

29 *Anarthropteris lanceolata* (J. Smith) L. B. Moore
Common in lowland forest on trees or scrambling over stones. 50

30 *Phymatosorus diversifolius* (Willd.) Pic. Ser.
(syn. *Phymatodes diversifolium* (Willd.) Pic. Ser.)
Common at all altitudes, but its abundance is severely limited by browsing animals. Is often epiphytic or on boulders out of the reach of animals and in small exclosures near the research station, and forms a sensitive indicator of animal browsing (Rudge & Campbell 1977, Veblen & Stewart 1980). 2086

31 *P. scandens* (Forst. f.) Presl
Common at all altitudes, generally as an epiphyte. 44

32 *Pyrrosia serpens* (Forst. f.) Ching
Present in sunny sites as an epiphyte in the tops of trees or on rocks at all altitudes, but less common in silver beech forest. 24

Grammitidaceae

33 *Ctenopteris heterophylla* (Labill.) Tindale
(syn. *Grammitis heterophylla* Labill.)
Occasional in forest and on rocks at all altitudes. 47

34 *Grammitis billardieri* Willd.
Moderately common at all altitudes, on the ground, or epiphytic on trees or rocks. 49

35 *G. ciliata* Col.
Uncommon. Found on rocks in mid-altitude beech forest. 4185

Thelypteridaceae

36 *Pneumatopteris pennigera* (Forst. f.) Holttum
(syn. *Cyclosorus penniger* (Forst. f.) Cop.)
Uncommon. In lowland forest and scrub on wet stream sides. 4182

Dennstaedtiaceae

37 *Hypolepis millefolium* Hook.
Rare. Known only from one patch about 4 m across on the main divide above Wootton Stream. 2995

38 *H. rufobarbata* (Col.) N. A. Wakefield
Common at all altitudes under scrub and in open forest. Occasionally as an epiphyte on the bases of tree trunks. 4248

39 *H.* sp. (*H. tenuifolia* auct. N.Z. non *H. tenuifolia* s.s.)
Uncommon. Lowland scrub on river terraces. 904

40 *Leptolepia novae-zelandiae* (Col.) Kuhn
Common in lowland scrub, forest, and mid-slope forest 944

Lindsaeaceae

41 *Lindsaea trichomanoides* Dryand
Moderately common in dry beech forest at mid altitudes. 65

Davalliaceae

42 *Arthropteris tenella* (Forst. f.) Smith
Rare. Lowland forest, epiphytic or rupestral. 491

Pteridaceae

43 *Histiopteris incisa* (Thunb.) J. Smith
Present at all altitudes. Often dominates light-gaps in silver beech forest, because it is not browsed by deer or goats. 2585

44 *Paesia scaberula* (A. Rich.) Kuhn hardfern
Common to abundant in grassland and sunny dry places, often localised. 177

45 *Pteridium esculentum* (Forst. f.) Kuhn bracken
Uncommon. Found in open places and on terraces under light scrub, especially on mature soils. The rhizomes form part of the food of pigs in autumn (B. M. Fitzgerald, pers. comm.). 4262

46 *Pteris pendula* (Col.) Cheesem.
(syn. *P. macilenta* auctt. N.Z., non *P. macilenta* s.s.)
A common fern in lowland forest and under scrub. Extends up into mid-altitude forest. 4245

47 *P. tremula* R. Br.
Rare. Present on river terraces at the south of the study area. 945

Aspleniaceae

48 *Asplenium bulbiferum* Forst. f. s.s. hen and chicken fern
Widespread in lowland forest. Less common because of browsing by deer or goats; often seen in wet gullies where browsing animals are excluded. The late R. I. Kean (pers. comm.) said that a 'dense cover of ferns' was present in the lowland forest before deer occupied the area in 1932–33. It is probable that the fern cover consisted largely of *Asplenium bulbiferum*. Mark & Baylis (1975 & 1982) have given a graphic account of the rapid reduction of *Asplenium bulbiferum* after deer occupied Secretary Island, and Veblen & Stewart (1980) have documented similar changes on Stewart Island. 1098

49 *A. gracillimum* Col.
Uncommon. Lowland forest and scrub. 4241

50 *A. flabellifolium* Cav. necklace fern
Rare. Known from only one site at 120 m altitude, in low grass under tall kanuka scrub. 953

51 *A. flaccidum* Forst. f. ssp. *flaccidum* drooping spleenwort
Occurs at most altitudes both as an epiphyte, and terrestrially. Browsed by deer and goats, and sometimes by possums (Mason 1958) 26, 1100

52 *A. hookerianum* Col.
Widespread. Forms with narrow leaf segments (*A. colensoi*, 40) and broad leaf segments (*A. hookerianum*, 902) occur throughout but are less common at higher altitudes. Unbrowsed specimens are uncommon.

53 *A. oblongifolium* Col. shining spleenwort
(syn. *A. lucidum* Forst.)
Uncommon. Lowland forest; its abundance is reduced through browsing by deer and goats; few unbrowsed ferns are seen. Sometimes eaten by possums (Mason 1958). 17

54 *A. polyodon* Forst. f.
(syn. *A. falcatum* Lam.)
Lowland and upland forest, especially as an epiphyte, often occurring at the base of *Astelia solandri* epiphyte masses high up trees. 46

Blechnaceae

55 *B. chambersii* Tindale
(syn. *B. lanceolatum* (R. Br.) Sturm)
Common from low to mid altitudes. Severely browsed by deer and goats, but becoming more obvious following their reduction in numbers. Possums have also been observed eating *B. chambersii* (G. D. Ward, pers. comm.). 1101

56 *B. colensoi* (Hook. f.) Wakefield
(syn. *B. patersonii* (R. Br.) Mett.)
Uncommon and localised. Occurs in damp gullies at all altitudes. 1927

57 *B. discolor* (Forst. f.) Keys crown fern
Widespread and abundant, especially under hard beech forest; much in evidence in areas modified by selective browsing, where it forms dense stands. A prolonged drought during the summer of 1981–82 nearly killed *B. discolor* on a ridge site, and they were slow to recover. 178

58 *B. filiforme* (A. Cunn.) Ettingshausen
Common in lowland forest, may form extensive mats on the ground in open modified forest at mid altitudes. 268

59 *B. fluviatile* (R. Br.) Salom.
Common at upper altitudes, especially in the zone of silver beech forest. 221

60 *B. membranaceum* (Col.) Mett.
Occasional. Banks and stream sides, especially at lower altitudes. 3249

61 *B. minus* s.s.
Uncommon. This narrow-leaved bog species is present in some of the poorly drained terraces bordering the Orongorongo River. 4230

62 *B. nigrum* (Col.) Mett.
Uncommon. Silver beech forest. Locally common in very wet shady gully heads and on south-facing slopes; especially under closed forest. More frequently encountered on the SE side of the main divide. 4427

63 *B. penna-marina* (Poir.) Kuhn
Uncommon. Present in grassed slips at upper altitudes, rarely occurs under kanuka forest on stream terraces. 975

64 *B. vulcanicum* (Blume) Kuhn
Uncommon. Sunny banks at forest margins or in grassland, up to mid altitudes. 34

65 *B.* sp. (unnamed cf. *B. capense* (L.) Schlect.) kiokio
This lowland species with leaves up to, or greater than 1 m long, is uncommon, but usually found in wet sites or on shaded banks. 1028

66 *B.* sp. (*Lomaria latifolia* Col. non. *B. minus* Allan)
Common at upper altitudes, especially on podzolised soils in silver beech forest. 4159

Dryopteridaceae

67 *Polystichum richardii* (Hook.) J. Smith
Uncommon, lowland forest and scrub. 42

68 *P. sylvaticum* (Col.) Diels
Rare, lowland forest and scrub. 4169

69 *P. vestitum* (Forst. f.) Presl prickly shield fern
Present at all altitudes. Is often a very prominent fern in colder wetter areas, especially in silver beech forest, but usually reduced in size by animal browsing. 1102

70 *Rumohra adiantiformis* (Forst. f.) Ching
Common in lowland forest as epiphyte or on decaying stumps. Rare above 450 m a.s.l. 2190

Aspidiaceae

71 *Lastreopsis glabella* (A. Cunn.) Tindale
Common in forest and in scrub, especially in dry sites, low to mid altitudes, rare above 450 m a.s.l. 897

72 *L. hispida* (Swartz) Tindale
Common in lowland forest and scrub, usually on the forest floor, but also as an epiphyte on the base of trees. 860

73 *L. microsora* (Endl.) Tindale ssp. *pentangularis* Col.
Rare. Lowland forest and scrub. 1076

74 *L. velutina* (A. Rich.) Tindale
Occasional in scrub on river terraces and along lowland forest edge. 1016

Adiantaceae

75 *Adiantum cunninghamii* Hook. common maiden hair fern
Uncommon. Mainly under shady, overhung banks. 30

76 *Pellaea rotundifolia* (Forst. f.) Hook.
Common in dry sites in lowland forest and scrub. 160

Azollaceae

77 *Azolla rubra* R. Br. red azolla
(syn. *A. filiculoides* Lam. var. *rubra*)
Rare. Collected from only two sites; a seepage on the access track, where azolla later appears to have died out, and a backwater of the main river which later dried up. 1019

SPERMATOPSIDA

GYMNOSPERMAE

Pinaceae

78 * *Pinus radiata* D. Don radiata pine
Rare. Five juvenile pines, from windblown seed, have been found on the eastern side of the river. They are growing mainly in open sites at mid altitudes. The largest of these pines now has a girth of more than 50 cm dbh and is fertile, so as these trees mature, they will undoubtedly act as seed sources for further spread of pines. No pines were known from the area when the New Zealand Forest Service occupied the Valley in 1947–1950 (L. T. Pracy, pers. comm.). 999

Podocarpaceae

79 *Dacrycarpus dacrydioides* (A.Rich.) de Laubenfels kahikatea
(syn. *Podocarpus dacrydioides* A. Rich.)
Common on poorly drained fans and terraces at low altitudes, and occasional at higher altitudes, one tree growing at 450 m on a dry colluvial site. A few river flats have dense stands of pole kahikatea. 1009

80 *Dacrydium cupressinum* Lamb. rimu
A dominant emergent tree up to 540 m a.s.l. Few smaller diameter trees are found, mainly on steep slopes in conjunction with black beech. Juveniles appear to be very site-specific, and are often associated with slips, or establish on disturbed soil on the bases of overturned trees in light-gaps. Isolated rimu are very susceptible to 'salt burn' during storms with high wind and no rain, and this probably explains the dieback and crown asymmetry of isolated emergent trees. Rimu were killed in 1957 by a series of dry westerly storms. These storms also desiccated foliage of beech, manuka and kanuka (L. T. Pracy, pers.

268 *E. brunnescens* (Cockayne) Raven et Engelhorn ssp. *brunnescens*
Common on river gravels and moist or shady banks up to the silver beech zone. 984

269 *E. cinereum* A. Rich.
(syn. *E. billardierianum* Ser. ssp. *cinereum* (A. Rich.) Raven et Engelhorn)
Occasional on open river bed, river bank, and openings in lowland scrub. 4221

270 *E. glabellum* Forst. f.
Rare. Only one site known in an open area in grassland at 560 m. 4173

271 *E. melanocaulon* Hook.
Rare. Known from one collection on a shingle river flat, 20.4.1949. CHR 62301

272 *E. microphyllum* A. Rich.
Occasional on shingly river flats, and in fine material on stony screes up to mid altitudes. 4146

273 *E. nerteroides* A. Cunn. creeping willow herb
Common in shady sites along stream banks up to upper altitudes. 998

274 *E. nummulariifolium* R. Cunn. ex A. Cunn. creeping willow herb
Common, on slips or eroding stream banks. 4123

275 *E. pallidiflorum* Sol. ex A. Cunn.
Occasional in swampy backwaters of the main river. 1025

276 *E. pedunculare* A. Cunn. (syn. *E. linnaeoides* Hook. f.)
Occasional, stream bank in shade, stabilising slip face, edge of the river bed. 2807

277 *E. pubens* A. Rich.
Common at low to mid altitudes, on dry unstable sites beneath broadleaf scrub, and along stream margins. 1201

278 *E. rotundifolium* Forst. f.
Common. Stream banks, moist sites in open stream beds, and along openings in lowland scrub. 997

279 *Fuchsia excorticata* (J. R. et G. Forst.) Linn. f. tree fuchsia
Once common at all altitudes in regenerating forest, especially on slip faces. Fuchsia was dying in the study area from 1935 onwards (R. I. Kean, pers. comm.), and although fuchsia wood is very hard, and fairly durable, most of the evidence of past fuchsia distribution has now disappeared. For example, 246 fuchsia trees were recorded by L. T. Pracy in 1946–47 along the margin of a slip face from 350 m to 520 m a.s.l. In the first survey, 5 were unbrowsed, 182 were browsed, and 59 were dead. In 1970 all trees were dead, and now little evidence can be seen of any fuchsia having been in the area. Fuchsia was still an important possum food in 1946–47 (Mason 1958), but by 1966, it was entirely absent from the area where Mason's possums had been collected. Now chiefly confined to cool south-facing unstable sites at higher altitudes. Larger trees are present in old light-gaps in silver beech forest, but juveniles anywhere are rare, and often browsed. Fuchsia sometimes persists where it is protected by nettles from browsing animals. 2701

Callitrichaceae

280 *Callitriche petriei* Mason ssp. *petriei* starwort
Rare. Found at one site on damp ground in a clearing in lowland forest. 4311

281 * *C. stagnalis* Scop. starwort
Common. Occurs in stagnant or slowly running water in the open on the river bed and in moist hollows at higher altitudes. 534

Proteaceae

282 *Knightia excelsa* R. Br. rewarewa
Common in forest and scrub up to 650 m. Often remains as an emergent tree above scrub after the collapse of forest, and is abundant in regenerating lowland forest after fire. Flowers are eaten by possums (P. E. Cowan, pers. comm.) and rats (Campbell 1978). 400

Coriariaceae

283 *Coriaria arborea* Lindsay tree tutu
Rare. Tutu was common in stream beds, on stream banks, and on slip areas until the early 1960s, but has largely been eliminated, presumably by possums. Tutu was commonly browsed by possums in 1946–47 despite little evidence being found in stomachs (Mason 1958). Plants occasionally persist on banks or other sites inaccessible to possums, and in the centre of the river bed. 1156

284 *C.* sp. (unnamed)
Specimens of a small-leaved *Coriaria* have been found occasionally on shingle 'islands' in the main river bed. More recently, large patches of this *Coriaria* have been located in the induced grassland in the headwaters of some of the eastern side streams of the study area, especially in Wootton and Peak streams. This plant is most commonly found in open grassland of *Poa anceps* on fine gravelly soils at the apex of stabilised screes, but it also grows on a range of sites, such as on spray-washed rock walls alongside waterfalls. H. D. Wilson has found this taxon or a very similar *Coriaria* on western Stewart Island on open sandy and rocky ground near the sea (Wilson 1982). This taxon corresponds closely to a specimen illustrated in Oliver 1942 (pl. 12, fig. 2). He ascribed his specimen to a hybrid between *C. arborea* and *C. plumosa*, but noted that Zotov had not seen any hybrids between those two species in the Tararua Range. *C. plumosa* is not known from the Rimutaka

Range, and is unlikely to be a parent as *C. plumosa* has ten carpels, whereas the unnamed taxon has only five. 4072

Pittosporaceae

285 *Pittosporum cornifolium* A. Cunn.
Common in clumps of epiphytic *Astelia* in emergent trees in lowland forest. Less common in epiphytes within the forest canopy. 1466

286 *P. eugenioides* A. Cunn. tarata
Uncommon; lowland forest and scrub on richer soils up to 450 m. 8

287 *P. lineare* Laing et Gourlay
Uncommon. Lowland hard beech forest. 4057

288 *P. rigidum* Hook. f. var. *rigidum*
Rare. Occurs in silver beech forest and windthrow openings in silver beech forest. 4064

289 *P. tenuifolium* Gaertn. kohuhu
Rare. Occasional along forest edges or slips up to mid altitudes. 1860

Passifloraceae

290 *Passiflora tetrandra* DC.
native passion vine
Uncommon to locally common in lowland forest and scrub. Entire ripe fruits are rarely seen, because they are commonly eaten by rats (Campbell 1978), or by possums (Mason 1958). 891

Myrtaceae

291 *Leptospermum ericoides* A. Rich. var. *ericoides* kanuka
Locally abundant, and widespread up to 580 m. Colonises freshly washed alluvium, and open sites with fine talus debris. *L. ericoides* has increased in importance as a colonising species as a result of *Melicytus ramiflorus* and *Weinmannia racemosa* being suppressed by goats and deer. 2221

292 *L. scoparium* J. R. et G. Forst. var. *scoparium* manuka
Common to locally abundant on lowland riverbed sites, and areas cleared by fire. *L. scoparium* is a species which follows burning if the area is able to regenerate immediately but *L. ericoides* often takes over if the site is first colonised by grass. Manuka becomes dominant in marginal riverbed sites where the water table has risen as a result of aggradation of the main river channel. Most plants in the study area are infected by sooty mould. 2222

293 *Lophomyrtus bullata* (A. Cunn.) Burret
ramarama
Uncommon in lowland forest, may be locally common on open river flats. 1089

294 *L. obcordata* (Raoul) Burret
Locally abundant in Greens Stream, uncommon elsewhere; lowland forest and scrub, especially on seral sites. 1090

L. obcordata × *bullata*
Uncommon, but may be locally abundant where both parents meet. Hybrid swarms showing all the intergrades between the parents occur in Greens Stream where they have colonised recent alluvium on the stream bank. 222, 284, 918

295 *Metrosideros colensoi* Hook. f. (including var. *pendens* (Col.) Kirk
Locally abundant in lowland forest and scrub, especially evident on alluvial terraces and fans and forest edge sites. 1241

296 *M. diffusa* (Forst. f.) Smith
Widespread in lowland forest and scrub, locally common. Abundant in open grassland up to 660 m. 895

297 *M. fulgens* Gaertn.
Widespread but sparsely distributed in lowland forest and scrub, beech forest and open grass-scrubland up to 500 m. Mason (1958) noted that *M. fulgens* was sometimes severely damaged by possums, and Fitzgerald (1978) records *M. fulgens* as a seasonal food. 7

298 *M. perforata* (J. R. et G. Forst.) A. Rich.
Widespread but scattered in all forest and scrub up to mid altitudes. 1088

299 *M. robusta* A. Cunn. northern rata
Common in lowland forest as an epiphyte of tall trees; later becoming self supporting when the host tree dies and when the roots coalesce around the trunk. Common to locally abundant at higher altitudes up to 600 m, more commonly as terrestrial trees on steep exposed sites. Trees at all altitudes, of all size classes, and on all sites have been dying since the 1930s (R. I. Kean, pers. comm.) principally through browsing by possums. On several higher bluffs no living rata remain (Fig. 7). Mason (1958) found that northern rata was the second most frequently occurring item in possum diet in 1946–47, and the species is still subject to severe browsing pressure from possums (Meads 1976, Fitzgerald 1978). In the Aorangi Range, Wardle (1967) describes northern rata as 'nearly extinct' and Druce (1971) recorded it in his floristic list, but notes that he had not seen any. Although northern rata still contribute most basal area on the intensively studied permanent plot near the research station, it appears that rata will continue to decline in abundance in the Orongorongo Valley while the present severity of possum browsing continues. 1282

300 *Neomyrtus pedunculata* (Hook. f.) Allan
Local and scattered in lowland beech forest. 1120

301 *Syzygium maire* (A. Cunn.) Sykes et Garnock-Jones swamp maire
(syn. *Eugenia maire* A. Cunn.)
Rare. Only one plant known from lowland forest in a shaded gully. 464

Hypericaeae

302 * *Hypericum androsaemum* L. tutsan
Uncommon and localised. Scattered plants occur on open river flats and stream beds. Not seen above 240 m. 277

Elaeocarpaceae

303 *Aristotelia serrata* (J. R. et G. Forst.) W. R. B. Oliver wineberry
Wineberry is widespread at higher altitudes, and locally common, chiefly in moist slip sites or light gaps. Was more abundant in the past (R. I. Kean, pers. comm.). Uncommon at lower altitudes, except where the effects of browsing animals are reduced. Along the access road possums eat most flowers as little fruit sets (R. E. Brockie, pers. comm.). Is still sometimes an important colonist on disturbed soil. Has featured prominently in regeneration along parts of the access roadway, presumably being carried there from higher altitudes by birds. 1191

304 *Elaeocarpus dentatus* (J. R. et G. Forst.) Vahl hinau
Abundant and widespread in lowland forest up to 560 m a.s.l. Hinau is probably one of the most important trees of lowland forest. In a 2.25 ha lowland forest plot studied near the field station, hinau has shown only a slight change in numbers over 10 years at some 37/ha, but is now the second most important tree in terms of total basal area at 16 m^2/ha (Campbell & Robinson 1981). Although hinau is browsed by both possums and ungulates, numbers are not yet declining in this forest in contrast to some more vulnerable species. This may be because possums also spread the seed, as frequently only the flesh is removed from the fruit. Possums also eat fruit before it has ripened (A. D. Robinson, pers. comm.). 1823

305 *E. hookerianus* Raoul pokaka
Uncommon. Widespread but sparsely distributed in lowland beech forest. Although this species is capable of growing at much higher altitudes, it has not been located above 360 m in the study area. 1157

Escalloniaceae

306 *Carpodetus serratus* J. R. et G. Forst. putaputaweta
Occurs widely in lowland forest and scrub, reaching 760 m a.s.l. in light-gaps in silver beech forest and upland scrub. Is an important shrub in forest regeneration, but is commonly browsed by goats or deer, and sometimes stunted to a few centimetres tall. 28

Malvaceae

307 *Hoheria* sp. (unnamed) lacebark
Uncommon. This narrow-leaved species, similar to *H. sexstylosa*, has been found at upper altitudes on forest edges and in open country, chiefly in the zone of silver beech forest. Juvenile plants are quite commonly seen in some localities, but adults are rare. Most juveniles have been repeatedly browsed. 1094

308 *Plagianthus betulinus* A. Cunn. var. *betulinus* lowland ribbonwood
Rare. Still occasionally occurs on river flats or stream terraces at low altitudes, especially at the south end of the study area, but most individuals are browsed by possums as soon as the juvenile plant provides sufficient support for the possum. Described as 'locally common on river flats' in 1950s by the late R. I. Kean (pers. comm.). 870

Cunoniaceae

309 *Weinmannia racemosa* Linn. f. kamahi
Widespread, and present through almost the entire altitudinal range. Occurs as an undercanopy tree in silver beech, lowland beech or lowland broadleaf forest, and forms the canopy in lower stature forest at mid altitudes. Kamahi were dying in Greens Stream in the early 1950s (Robbins 1958), but he erroneously attributed the deaths to changes in drainage following the 1855 earthquake. From the 1960s onwards kamahi has been dying in lowland sites where it occurs as an understorey in beech forest, and on the margins of areas of beech. In lowland forest near the research station, possums are causing the death of many of the adult kamahi, which are not being replaced. At higher altitudes, where goats have been a major influence, seedlings have been suppressed, altering the direction of regeneration of the slip faces which resulted from the 1855 earthquake. Many of these slips are still in grassland. Many kamahi show evidence of having established on tree ferns, probably largely those on the ground have succumbed to browsing by hoofed animals. 1212

Hydrangeaceae

310 *+ *Hydrangea macrophylla* Ser. hydrangea
Uncommon. Scattered plants of hydrangea have established on the river bed, as escapes from plants introduced to private huts. Those plants near private huts persist untended, but odd plants which have established in unstable riverbed sites are often vulnerable to further disturbance by flooding. 1290

Grossulariaceae

311 *+ *Ribes uva-crispa* L. gooseberry
Rare. Known from one plant on a site on a river terrace where it was planted and has persisted for some 20 years, and one outside a private hut. 299

Rosaceae

312 *Acaena anserinifolia* (J. R. et G. Forst.) Druce piripiri
Common to locally abundant in open areas up to 760 m. 1188

313 * *A. novae-zelandiae* Kirk piripiri
Uncommon. Occasional to locally common, mixed with *A. anserinifolia*, at low altitudes. 4415

314 * *A. agnipila* Gandoger var. *aequispina* Orchard (syn. *A. ovina* A. Cunn.)
Rare. Occasionally single plants are encountered in the main river bed. 875

315 *+ *Malus domestica* Borkh. apple
Rare. Known from one tree planted outside a private hut. No evidence of any spread. 1216

316 *+ *Prunus cerasifera* Ehrh. cherry plum
Rare. Known from only one site, planted outside a private hut. 1292

317 *+ *P. persica* (L.) Batsch. peach
Rare. As with *P. cerasifera*, planted outside a private hut. Only one known individual. 1288

318 * *Rosa rubiginosa* L. sweet brier
Rare. Known from only one site in regenerating lowland scrub on a stream bank, at the south of the study area. *R. rubiginosa* is present in the Wainuiomata Valley, but does not appear to be spreading into the Orongorongo Valley, despite the fruit being carried by birds (Kirk 1879). 907

319 *Rubus australis* Forst. f.
Uncommon. Occasionally found in dry lowland beech forest. 154

320 *R. cissoides* A. Cunn. lawyer
Occasional in lowland forest, extending up to the top of the main range at 850 m. Most abundant in scrub or regenerating forest especially at higher altitudes. Larger vines in tall trees in lowland forest have been aged at over 60 years old. Possums eat new growth and flowers from lawyer vines, thus reducing the crop of fruit. 1168

321 * *R. fruticosus* agg. blackberry
Rare. One plant only has been found on a river terrace commonly used for camping by casual trampers. The vine is fruiting, but no further plants have yet been seen. 2328

322 *R. squarrosus* Fritsch
Rare. Known from two localities on river terraces at the south of the study area. 4194

Papilionaceae

323 *Carmichaelia arborea* var.
(syn. *C. flagelliformis* Hook. f. var. *corymbosa* (Col.) Kirk)
Rare. Known from only one site on steep sunny banks on the east side of the main Orongorongo river. Young plants are uncommon through browsing by ungulates. Noted by Zotov et al. (1938), as a species suppressed by goats, but in the study area, any plants within reach of cattle or sheep are also severely browsed. 973

324 + *Clianthus puniceus* (G. Don) Lindl. kaka beak
Rare. One was known from outside a private hut but the plant disappeared after the hut was demolished. One at another private hut flowers profusely, but periodically suffers severe setbacks from browsing by straying stock. 1189

325 * *Cytisus scoparius* (L.) Link broom
Rare. First noted at one site on the access road in 1970. Further plants have since been found in three other sites, over a distance of about 2 km. The plants of broom occasionally are heavily browsed, probably by cattle. Kirk (1879) recorded broom as "common about Wellington and other places" yet did not comment on the abundance of gorse, which is now far more important in the Wellington flora. 854

326 * *Lotus pedunculatus* Cav. lotus
Uncommon to locally abundant in open sites in the main river bed and shingly flats in the side streams. Extends on to soil slips on the margins of the river. Lotus is browsed by rabbits on the river bed (B. M. Fitzgerald, pers. comm.). 297

327 * *Lupinus arboreus* Sims tree lupin
Rare. One plant present on the main river bed, was brought into the area as seed by a vehicle about 1976. Plants from this introduction were removed and destroyed in 1978. Further plants which have appeared subsequently, seem to have established successfully and have potential for spread. Plants are also known from the main river at Goat Stream, north of the study area. 1680

328 * *Medicago arabica* (L.) Hudson spotted bur medick
Rare to locally common on the banks of Wootton Stream, and on the main river bed near the mouth of this stream. Extends into the grassland in the upper Wootton catchment. 1182

329 * *Trifolium arvense* L. haresfoot trefoil
Uncommon. Known from a few sites in open gravel on the river bed at the south of the study area. Locally abundant in places along the access road to the south. 989

330 * *T. dubium* Sibth. suckling clover
Widespread and locally common in open sites and grassland up to 540 m. 216

331 * *T. glomeratum* L. clustered clover
Rare. Known from a collection on an 'island' in the main river bed. 1965

332 * *T. ornithopodioides* L. trigonel
Uncommon. Occasionally found in open sites on the main riverbed 'islands' and grassland up to 600 m. 4108

333 * *T. repens* L. white clover
Widespread and locally common, in open sites and grassland up to 740 m. 276

334 * *T. striatum* L. striated clover
Widespread but infrequent. Occurs in open sites from the main river bed to open grassland at mid altitudes. 4110

335 * *Ulex europaeus* L. gorse
Locally common to abundant. Present in scattered localities on the river bed, and spreading strongly up the gravel stream beds at the south end of the study area. Has colonised several sites along the access road, and is gradually spreading from these. Unknown from the Valley in the 1950s (L. T. Pracy, pers. comm.) it now occurs upstream beyond Goat Stream about ⅓ of distance to Matthews Stream. In Peak Stream, one plant is known from a slip face at 500 m, and a group of three has been found in an open site at higher altitudes in Wootton Stream. In the river bed, most plants are hedged by rabbits or sheep until they grow out of reach. Deer and goats are known to browse young foliage of plants still within reach, but if adjacent plants coalesce those in the middle are protected, and able to grow strongly. 228

336 * *Vicia hirsuta* (L.) Gray hairy vetch
Common in open areas and on scrub edges, up to mid altitudes. 901

337 * *V. sativa* L. vetch
Common and widespread, often trailing over rank grass on river terraces and along forest edges. 1218

Salicaceae

338 *+ *Populus nigra* L. var. *italica* Du Roi Lombardy poplar
Rare. Known from only one collection from a cutting on the side of the main river. Not seen since it was first collected in 1972. 1299

339 *+ *Salix caprea* L. goat willow
Rare. Known from two sites on the main river bed. The first collection (in 1971) and the second are ten years apart, and do not appear to be related to spread from a single site. 4012

Fagaceae

340 *Nothofagus menziesii* (Hook. f.) Oerst silver beech
Abundant and widespread at upper altitudes, from 480 m to the altitudinal limit of more than 850 m. Forms forest on the axial range and major leading ridges down to the level of frequent orographic cloud. The lower edge of the silver beech forest has been opened in many places as a result of avalanche slipping during the earthquakes of last century, and this has exposed many parts to the high winds that blow across the range from the north and west (Fig. 4). In many places there is an abrupt edge between silver beech forest, and lower scrub or open habitat. Wind striae are prominent on the forest canopy in some areas where wind velocity is most pronounced. Zotov et al. (1938), gave a graphic description of the effects of wind on silver beech at higher altitudes. Both Zotov et al. (1938), and Wardle (1962) stated that silver beech in the Tararua Range showed little effective regeneration because of browsing by deer and regeneration is limited in the study area. One small seedling has been found in the study area in hard beech forest at 120 m altitude, some 1.5 km from the nearest trees, and not in a site where riparian spread would have assisted dispersal. 257

341 *N. solandri* (Hook. f.) Oerst. var. *solandri* black beech
Locally common to abundant up to 540 m. Occurs chiefly on the steeper slopes surrounding hard beech forest, or on basement rock on steep sites. During the prolonged summer drought in 1969–70 many *N. solandri* trees up to 250 mm dbh died, mostly in steep to very steep sites bordering hard beech. Trees in the Hutt Valley in similar sites also died during this drought, and many of the dead trees were still standing in 1983. Possums have been observed browsing black beech leaves (M. J. Daniel, pers. comm.). 246

342 *N. truncata* (Col.) Ckn. hard beech
Common to dominant on sites with gentle slopes and old soils (Fig. 6). On the east side of the river the species does not extend to altitudes higher than the upper limit of gravels laid down as fans during the Pleistocene, whereas to the west of the river it only occurs along part of the top surface of Cattle Ridge. In sites exposed to the north west, pole stands of hard beech, with some black beech, date back to the 1936 cyclonic storm. Possums eat hard beech flowers and leaves (M. J. Meads, pers. comm.) and newly emerged seedlings (M. J. Daniel, pers. comm.). 1493

N. truncata × *N. solandri* var. *solandri*
Rare. Occasional trees have been found with ovoid leaves up to 25 × 14 mm. These are considered to be hybrids between *N. truncata* and *N. solandri*. 686

Moraceae

343 *Paratrophis banksii* Cheesem. milk tree
Rare. Known only from two juveniles growing on river terraces towards the south of the study area. One of these was severely defoliated by possums in 1970, although hardly able to support their weight. Adults, although not located, must be in the vicinity but very rare.

Fig. 6 Open hard beech (*Nothofagus truncata*) forest, with sparse understorey composed mainly of crown fern (*Blechnum discolor*) and mingimingi (*Leucopogon fasciculata*). Silver tree fern (*Alsophila tricolor*) is in the background.

The late R. I. Kean remembered *P. banksii* from the vicinity of Wootton Stream in the 1950s. 863

344 *P. microphylla* (Raoul) Ckn. small-leaved milk tree
Uncommon. Juveniles are present occasionally in lowland forest and scrub up to 320 m. Browsed by possums. No adults seen. 666

Urticaceae

345 *Parietaria debilis* Forst. f. native pellitory
Uncommon. Locally abundant at one site in open lowland forest; rare elsewhere. 657

346 *Urtica ferox* Forst. f. tree nettle
Common to abundant, especially in open fertile sites, such as the base of talus slopes, up to 850 m a.s.l. Leaves are eaten by both goats and 'Admiral' butterfly larvae, and often nettles at higher altitudes are bare of leaves after winter frosts. The density of stinging hairs is variable, but many more are present than in some other populations such as Trio Islands (833) and Makara coast (1683) where pressure from browsing animals is either absent (833) or is not as great (1683). Possums at the Wootton study area eat great quantities of fruit and disperse the seed (P. E. Cowan, pers. comm.). 289

347 *U. incisa* Poir nettle
Common and widespread, especially in damp lowland forest and scrub. Present up to 750 m. Pigs root up the rhizomes of *Urtica incisa* in winter for food (B. M. Fitzgerald, pers. comm.). 905

Corynocarpaceae

348 *Corynocarpus laevigatus* J. R. et G. Forst. karaka

Widespread but generally uncommon in lowland forest up to 400 m. The fruit is carried widely by pigeons, and both fruit and leaves are eaten by possums, but both possums and rats (Campbell 1978) commonly discard the poisonous kernel. 2566

Icacinaceae

349 *Pennantia corymbosa* J. R. et G. Forst. kaikomako

Common to abundant in lowland scrub up to an altitude of about 600 m. Present in light-gaps in lowland forest, or as scattered small trees remaining after light-gaps have grown over. The species is a more common component of scrub regeneration on slips and terraces when other species are suppressed by browsing animals. 1820

Loranthaceae

350 *Peraxilla tetrapetala* Tiegh. mistletoe

Mistletoe has been collected from the Orongo rongo Valley in the past by T. Kirk (WELT 31375), but has not been located in the last 20 years. Present in silver beech forest but uncommon in the 1950s (L. T. Pracy, pers. comm.). Apparently exterminated from the area by possums. This species seems to be particularly vulnerable to attacks by possums. For example, a small, but healthy plant, epiphytic on a black beech tree at Silverstream, was severely defoliated during one visit by an possum in 1970, and died the following year.

Rutaceae

351 *Melicope simplex* A. Cunn.

Occasional in lowland scrub and open forest, extending up to the silver beech zone in forest, and up to 610 m a.s.l. in scrub. 1169

Sapindaceae

352 *Alectryon excelsus* Gaertn. var. *excelsus* titoki

Uncommon. Occurs in lowland forest up to 400 m a.s.l. Locally abundant on stream terraces and the base of hillsides amongst talus debris. Many trees have died because of heavy defoliation by possums. Titoki was a more common component of lowand forest and scrub up to the 1950s (Mason 1958). Juvenile plants are still common but pole size plants are rare, most being defoliated as small saplings by possums as soon as they will support an possum's weight. Flowers and fruit are rarely seen on surviving plants. 2563

353 *Dodonaea angustifolia* Linn. f. akeake
(syn. *D. viscosa* Jacquin)

Rare. Known from only two sites in *Leptospermum scrub* on river terraces. 1014

Araliaceae

354 *Pseudopanax anomalus* (Hook.) Philipson

Occasional to locally common in lowland beech forest, extending up to the altitudinal limit, where it is locally abundant in open scrub. Browsed by goats and deer, especially when young, and before the tight divaricating growth form has developed. 1018

355 *P. arboreus* (Murr.) Philipson var. *arboreus* fivefinger

Occasional in lowland forest and scrub, and in black beech-rimu forest bordering hard beech forest. Was more important in lowland forest successions but is now much reduced in numbers through browsing by goats, deer and possums. From 1946 onwards, fivefinger in the vicinity of the field station was severely defoliated by possums (R. I. Kean, pers. comm.). Possums (and also rats; Campbell 1978), eat the petioles of fivefinger leaves in preference to the lamina, and often the ground is littered with discarded leaves from which the lower petiole has been removed. Although some trees still remain, most are moribund through the effects of browsing. This species no longer features in light-gap or slip-face successions. 32

356 *P. crassifolius* (A. Cunn.) C. Koch lancewood

Widespread and locally common in lowland beech forest, *Leptospermum* scrub, and lowland scrub. Small seedlings often have prostrate, cryptically coloured leaves, which blend in with leaf litter. Seedlings are common at this stage, but repeated browsing by ungulates often severely stunts the growth of juvenile lancewood. The species occupies a wide range of sites, from swamp to dry ridges in hard beech forest. Spread widely by birds; small juveniles are common in all forest types up to about 600 m a.s.l. 4189

357 *P. edgerleyi* (Hook. f.) C. Koch raukawa

Uncommon. Lowland forest up to about 450 m a.s.l., chiefly epiphytic on the trunks of tree ferns. Much reduced in abundance by browsing animals. 1110

358 *P. simplex* (Forst. f.) Philipson (including var. *sinclairii* (Hook. f.) Edgar)

Common in silver beech forest, and scrub down to about 480 m a.s.l. Seedling establishment has been limited by goats to inaccessible sites on cliffs, or as epiphytes on tree ferns. Seedlings are often present as suppressed 'bonsai' shrubs in grassland. Probably much more common in the past. On Secretary Island, for example, deer have totally eliminated, mainly by ringbarking, a dense understorey of the related *P. colensoi*, and within a 12-year period much of the evidence of this species has been lost from the forest (Mark & Baylis 1982). Before the arrival of goats and deer *P. simplex* must have been an important understorey and seral species at higher altitudes in the Orongorongo Valley. 114

359 *Schefflera digitata* J. R. et G. Forst. pate
Common and widespread in moist lowland forest, extending to exposed sites up to 800 m a.s.l. An important species in early stages of forest succession, but establishment of juveniles is often curtailed by deer or goats. Numbers are increasing in an intensively studied area of lowland forest near the research station (Campbell & Robinson 1981). 14

Cornaceae

360 *Griselinia littoralis* Raoul broadleaf
Widespread up to 800 m a.s.l. Adult plants are scattered, locally common in forest and scrub at higher altitudes. Seed is widely dispersed by birds, and ephemeral seedlings are common in all vegetation types, at all altitudes. *G. littoralis* is one of the most sought-after plants by both goats and deer, and juvenile plants are very rare, and restricted to sites which are safe from browsing. At higher altitudes *G. littoralis* is occasionally affected by heavy snowfalls, and large branches often comprising much of the tree crown snap off. Broadleaf is now often restricted to epiphytic sites in larger silver beech trees, or becomes self-supporting after establishment on tree ferns. 3145

361 *G. lucida* Forst. f. broadleaf
Common as an epiphyte in lowland forest up to about 400 m. Less common as a terrestrial shrub, partly because of browsing. Fruit is widely distributed by birds. 853

Apiaceae (Umbelliferae)

362 *Aciphylla squarrosa* J. R. et G. Forst. var. *squarrosa* spaniard
Locally abundant in grassland between 450 and 600 m a.s.l. Scattered plants occur on slip areas in the lower part of the plants' altitudinal range, and although spaniard occurs at sea level on the coast, plants have not been seen in open areas at lower levels in the study area. The rootstock is eaten by both pigs and rats (Campbell 1978). 259

363 *Daucus glochidiatus* (Labill.) Fisch., Mey. et Lallemant
Locally common at three sites: open forest edge, stream terrace in lowland broadleaf scrub, and *Leptospermum* scrub. Although the glochidia on the seeds would make this species ideally suited to wide dispersal, most plants would be browsed by ungulates before reaching maturity. 1936

364 * *Foeniculum vulgare* Mill. fennel
Rare. Known from only one site in open grassland on the access roadway. Established from a single plant, and now consolidated by seeding. 4400

365 *Hydrocotyle americana* L. var. *americana*
Widespread but localised. Chiefly found in sopping wet gravel stream beds up to mid altitudes. 4174

366 *H. elongata* A. Cunn.
Locally common in grass beneath *Leptospermum* scrub on river terraces and open sites bordering streams. 4179

367 *H. moschata* Forst. f.
Widespread and present in most community types in open areas or light-gaps. Shows a large variation in leaf size depending on the site. Occurs at all altitudes. 4148

368 *H. novae-zelandiae* DC. agg.
(syn. *H. alsophila* Col.)
Uncommon to locally common, scrambling over low vegetation under *Leptospermum* scrub. 4139

369 *Oreomyrrhis colensoi* Hook. f. s.s.
Restricted to higher altitudes in grassed areas. Widespread in these sites, and locally common. 2412

370 *Schizeilema trifoliolatum* (Hook. f.) Domin
Rare and localised. Under overhanging shady banks on stream margins. 4059

Ericaceae

371 * *Erica lusitanica* Rud. Spanish heath
Uncommon to locally common on river flats of the main river. Only one plant known from a slip at 600 m. This plant does not seem to be spreading, perhaps because of goats. 1858

372 *Gaultheria antipoda* Forst. f. snowberry
Widespread, and locally abundant, in open areas up to 740 m. 861

373 *G. rupestris* (Linn.f.) D. Don
Rare and localised, on open slip areas and in regenerating scrub up to 580 m. 866

Epacridaceae

374 *Cyathodes juniperina* (J. R. et G. Forst.) Druce var. mingimingi
Locally common to abundant under hard beech forest on dry ridges up to 280 m. 2722

375 *Dracophyllum longifolium* (J. R. et G. Forst.) R. Br. var.
(syn. *D. filifolium* Hook. f.)
Uncommon. Known from a few sites in open grassland at mid altitudes and from one site under hard beech forest. Locally common, with potential for spread. 1192

376 *Leucopogon fasciculatus* A. Rich. mingimingi
(syn. *Cyathodes fasciculata* (Forst. f.) Allan)
Widespread and common under lowland beech forest, and in scrub, and as shrubs in grassland up to 740 m a.s.l. 184

Myrsinaceae

377 *Myrsine australis* (A. Rich.) Allan mapou
Common and widespread in lowland scrub and in forest light gaps up to 540 m a.s.l. 1199

378 *M. divaricata* A. Cunn.
Uncommon. Present at all altitudes in openings in beech forest and in open shrubland at higher altitudes. More common in the silver beech zone. 585

379 *M. salicina* Hook. f. toro
Occasional in lowland forest, but becoming scarce because of defoliation by possums. Common and widespread at the lower edge of silver beech forest at about 600 m, where many trees are defoliated by possums, and extending into the silver beech forest at higher altitudes. Scattered trees occur at mid altitudes in forest. Although small seedlings are scattered and widespread, at lower altitudes, larger plants are very rare through the effects of browsing animals. 486

Oleaceae

380 *Nestegis cunninghamii* (Hook. f.) L. Johnson black maire
Uncommon, in lowland forest up to 240 m a.s.l. 499

381 *N. lanceolata* (Hook. f.) L. Johnson white maire
Uncommon. Lowland broadleaf forest and beech forest up to 400 m a.s.l. Juveniles more commonly seen than adults. 337

382 *N. montana* (Hook. f.) L. Johnson
Rare. Known from only one tree in hard beech forest at 240 m. 498

Loganiaceae

383 *Geniostoma rupestre* J. R. et G. Forst. var. *crassum* (Cheesem.) Conn. hangehange
(syn. *G. ligustrifolium* A. Cunn.)
Widespread and abundant in moist lowland forest, especially in light-gaps and along forest margins, extending up to 400 m into mid-altitude scrub. Seedling establishment has been suppressed by goats or deer in many areas. Despite its abundance in the study area, it was not recorded by Druce (1971) for the Aorangi range, and noted as rare by Wardle (1967), through browsing by introduced animals. Often establishes as an epiphyte on tree fern trunks, probably in response to browsing by ungulates. Possums eat hangehange leaves, and severely defoliated plants are sometimes seen. 4374

Buddlejaceae

384 * *Buddleja davidii* Franch. buddleia
Widespread and common in some stream beds and parts of the main river bed. Buddleia was first introduced to the Orongorongo Valley after the 1950s and from a few sites has spread down stream. Most spread seems to have occurred from the establishment of a single plant in an open site at up to a kilometre from other plants, and then a rapid downstream spread from this plant. Buddleia has largely taken the place of *Coriaria arborea* in colonisation and succession on stream terraces, and is now becoming established in suitable sites on slip debris and open faces. 4176

Apocynaceae

385 *Parsonsia heterophylla* A. Cunn.
New Zealand jasmine
Widespread and abundant in forest and in scrub up to 600 m. Especially common in open scrub at lower altitudes. In the study area the flowers are often eaten by possums. 1024

Caprifoliaceae

386 *Alseuosmia pusilla* Col.
Rare in lowland forest at lower altitudes, but widespread and common in silver beech forest at higher altitudes. Very similar in superficial appearance to small *Pseudowintera colorata*, which is very common as a shrub species. *P. colorata* is avoided by goats, and was barely recorded in a large sample of goat rumens from the area, and it is likely that *Alseuosmia* has greatly benefitted from its resemblance to *P. colorata*. 1931

Rubiaceae

387 *Coprosma areolata* Cheesem.
Common and widespread in lowland forest and scrub up to 460 m. 252

388 *C. colensoi* Hook. f.
Both the round-leaved (*C. colensoi* form) (957) and the long-leaved (*C. banksii* form) (1865) are present, and intermediates between these are widespread and common in lowland beech forest and associated scrub.

389 *C. crassifolia* Col.
Rare. Known from two sites, both in lowland scrub on stream terraces. 4149

390 *C. foetidissima* J. R. et G. Forst. stinkwood
Present throughout, scattered in lowland forest, abundant in forest and scrub at higher altitudes. 186

391 *C. grandifolia* Hook. f. kanono
(syn. *C. australis* (A. Rich.) Robinson)
Present and widespread in lowland forest up to 660 m. Much reduced in numbers because of browsing by goats and deer, and now largely restricted to cliffs or as epiphytes on logs or large trees. Seedlings are still common throughout, but juveniles are uncommon to rare. 22

392 *C. lucida* J. R. et G. Forst.
Widespread but uncommon in all forest and scrub up to an altitude of 640 m. As with *C. grandifolia* the species is restricted by browsing to sites inaccessible to deer or goats. More common than *C. grandifolia* as an epiphyte,

probably because it is less affected by protracted droughts. Has reappeared in forest dominated by hinau when deer and goats are excluded. 1221

393 *C. microcarpa* Hook. f.
Rare. Occasional plants are found in silver beech or hard beech forest. 3135

394 *C.* sp. unnamed (aff. *C. parviflora*)
Common to abundant, forest edges and scrub at higher altitudes. 1150

395 *C. propinqua* A. Cunn. ssp. *propinqua*
Common to abundant, extending throughout the altitudinal range from the edge of the silver beech forest to the main river bed. Occurs in a wide range of sites from swampy river terraces to dry ridges. 3001

C. propinqua × *C. robusta*
Uncommon to locally common on river terraces where these two species meet. The entire range of variation occurs, but the F1 hybrid is the most commonly seen. 4205

396 *C. rhamnoides* A. Cunn.
Common and widespread. Found at all altitudes and in all vegetation types. Most common in open areas and scrub and along forest edges, but also occurs in forest interiors. 1600

397 *C. robusta* Raoul karamu
Common along forest edges, especially stream banks. Much reduced through browsing by herbivores, but reappears in exclosures. The stems are frequently used by cicadas (*Amphipsalta* spp.) for egg laying sites, and the stems thus weakened become subject to breakage by possums. 192

398 *C. rotundifolia* A. Cunn.
Locally common lower and mid-altitude sites. Common in open scrub at higher altitudes. 4192

399 *C. rugosa* Cheesem.
Common to abundant, grassland and scrub edge at higher altitudes, occasionally extending down stream beds in open sites. 4250

400 * *Galium aparine* L. cleavers
Rare. Known from only two sites near to well-frequented huts. Probably introduced on trampers socks. 1207

401 * *G. divaricata* Lam. slender bedstraw
Rare. Known from only one site in lowland beech forest. 2545

402 *G. propinquum* A. Cunn.
Common and widespread, especially in moist sites with partial shade; low to mid altitudes. 4197

403 *Nertera depressa* Banks et Sol. ex Gaertn.
Common to abundant, widespread in open areas at mid to upper altitudes. Often forms dense mats over boulders and on banks in open sites. 2571

404. *N.* sp. (unnamed) (*N. dichondraefolia* auctt. N.Z. non *N. dichondraefolia* Hook. f.)
Common and widespread in silver beech forest, especially on damp to very wet sites on the ground or mossy logs. 1925

405 * *Sheradia arvensis* L. field madder
Uncommon to locally common in stream beds at the southern end of the study area, extending up to mid altitudes. 1161

Compositae

406 * *Achillea millefolium* L. yarrow
Rare. Known from only one collection, forest edge on road side. 1499

407 *+ *Artemisia absinthium* L. wormwood
Rare. Present as a planted specimen outside an abandoned hut. Also established as a single plant on the river bed nearby. This latter plant may well have arisen from pieces broken off the original plant when erosion of the river bank occurred at the hut site. 1126

408 * *Bellis perennis* L. daisy
Rare. Present in a few places in open areas of grassland at lower altitudes. 1173

409 *Brachyglottis lagopus* (Raoul) Nordenstam (syn. *Senecio lagopus* Hook. f.)
Common and widespread, especially at higher altitudes. Present through beech forest and scrub up to 740 m. 374

410 *B. repanda* J. R. et G. Forst. var. *repanda* rangiora
Common to abundant in scrub, especially at mid altitudes; widespread. Occurs up to 720 m a.s.l., but more abundant below about 550 m. Occurs extensively at mid altitudes in scrub on steep slopes remaining after forest deterioration, and is widespread in areas used by goats despite being one of their important food species. Rangiora is one of the first species to show the effects of drought. The leaves are eaten by possums (G. D. Ward, pers. comm.). 1219

411 *B. rotundifolia* J. R. et G. Forst. var.
(syn. *Senecio eleagnifolius* Hook. f.)
Locally abundant in open sites between 480 and 800 m. Seedlings are widespread throughout this altitudinal zone, but adults are scattered and local. 911

412 *Brachyglottis* sp.
(syn. *Senecio kirkii* Hook. f. ex Kirk s.s.)
Rare. Known from only two collections, one at 120 m and the other at 560 m altitude. The plant at higher altitude was reduced to a few centimetres tall by repeated browsing. The other two plants were found in mid 1980, on

a vertical bank near 'Jacobs Ladder', the Orongorongo end of the 'five mile' walking track, and were not browsed. All these specimens lacked flowers. Specimens collected by Zotov, Beddie, and Elder (in CHR) in the 1930s from both the Rimutaka and Tararua ranges were flowering and demonstrate that this species was previously more plentiful and that its ability to flower has been severely affected by browsing animals. 1682

413 * *Carduus pycnocephalus* L.
slender winged thistle
Uncommon. Occasional in open sites at low altitudes, especially towards the south of the study area along the roadway. Common to abundant on farmland to the south. 2976

414 * *C. tenuiflorus* Curt. winged thistle
Widespread, but local. Occasionally common in open areas or in light-gaps up to mid altitudes, but more especially in open sites along the access road and river bed. 1266

415 *Cassinia leptophylla* (Forst. f.) R. Br. var. *leptophylla* tauhinu
Common to locally abundant in open areas, especially grassland and recent alluvial deposits and as a pioneer in sandy river bed. Common in grassland and on slip faces at mid altitudes up to 450 m. In reverting grassland to the south, forms with either white or yellow tomentum may be found growing near each other. Strongly invades reverting pasture in the Wellington area, especially when selectively avoided by sheep. Rabbits, however, will eat young foliage and stems. 855

416 * *Cirsium arvense* (L.) Scop.
Californian thistle
Uncommon to locally common, open areas along the access roadway, and some open clearings at lower altitudes. 1278

✓ 417 * *C. vulgare* (Savi) Ten. Scotch thistle
Widespread and locally abundant in open sites, including light-gaps, up to mid altitudes. Scotch thistle has been present in the local flora for more than 100 years. Ward (1929, p. 73) records one (perhaps the first) introduction of thistles to the Wellington area as follows: "The anniversary of St Andrew's Day was commemorated by a picnic held at Glenlyon, Mr William Lyon's farm, Pito-one, [Petone] on the 30th of November, 1840. During the day a Scotch thistle seed was sown on the property ..." Thistles have a remarkable capacity for dispersal. I have seen many hundreds of thistledown 500 km out to sea south-east of Cook Strait. These were being swept along above the sea by a NW frontal air flow that averaged 65 km/h. Although most of these pappi had lost their seed, an occasional one was seen with a seed still attached. 4201

* *C. vulgare* × *C. palustre* (L.) Scop.
Uncommon to locally common in open sites at lower altitudes, especially open stream beds and along the access roadway. Although *C. palustre* has not been collected in the Orongorongo Valley, pure *C. palustre* specimens (4393) have been found in the Wainuiomata water catchment area. The specimens of *C. vulgare* × *C. palustre* do not have surface spines on the leaves, have a strict, upright habit and winged stems as in *C. palustre*, and large flowers in groups of 2–4 as in *C. vulgare*, but flower size and number is variable. Juvenile plants are recognised by their lack of surface spines on the leaves, and broader less spear-like leaves. 1655, 2988

418 * *Conyza canadensis* (L.) Cronq.
Canadian fleabane
(syn. *Erigeron canadensis* L.)
Common to locally abundant in open areas at lower altitudes. 1443

419 *Cotula australis* (Sieb.) Hook. f.
Widespread and scattered in open dry sites up to mid altitudes. 214

420 *C. squalida* Hook. f. ssp. *squalida*
Uncommon to locally abundant under *Leptospermum*, on silty terraces bordering the main river. 1092

421 *Craspedia uniflora* Forst. f. var. *grandis* Allan
Common in open sites, especially damp earthy scree at mid to higher altitudes. 4171

422 *C. viscosa* Col.
Locally common in similar sites to *C. uniflora*, but distinguished from *C. uniflora* by autumn flowering and the abundance of viscid glands on the leaves. 4145

423 * *Crepis capillaris* (L.) Wallr. hawksbeard
Common in open areas, especially shingle river and stream beds and mid-altitude grassland up to 740 m. Has a wide variety of growth forms, depending on site. 4402

424 * *Erigeron karvinskianus* DC. mexican daisy
(syn. *Erigeron mucronatus* DC.)
Rare. Known from only two sites in scrub on stream terraces at low altitudes. 1236

425 *Gnaphalium audax* Drury ssp. *audax*
Uncommon. Occasional in open dry areas in grassland low to mid altitudes up to 620 m. 915

426 * *G. calviceps* Fern.
Common to locally abundant, open stream beds and disturbed sites. 349

427 *G. delicatum* Drury
Uncommon. Occasional in open areas and light-gaps in scrub, especially on bare soil o moist clay banks. 283

428 *G. gymnocephalum* DC.
Occasional to common in open sites an openings in forest and *Leptospermum* scrub Frequent on slips and stream sides, bu uncommon in shingle sites. 284

429 *G. limosum* Drury
Uncommon. Found in very wet sites up to 600 m a.s.l., often in minor watercourses. 4067

430 *G.* sp. (*G. luteo-album* L. agg)
Occasional in open areas up to 740 m a.s.l., especially in grassland and along stream sides. 618

431 *G. sphaericum* Willd.
Common on slips and open disturbed sites and in low to mid-altitude grassland. Very variable in habit. 203

432 * *G. spicatum* Lam.
Common in open sites, river bed, slips, open scrub, and grassland at low to mid altitudes. 305

433 *G. trinerve* Forst. f.
Common to abundant at mid altitudes, especially on steep wet cliffs or banks and near streams. 2815

434 *Helichrysum aggregatum* Yeo
(syn. *H. glomeratum* (Raoul) Benth. et Hook. f.)
Common to locally abundant in grassland and shrubland up to 620 m a.s.l., and extending occasionally into openings in forest; uncommon and localised at lower altitudes. 1226

435 *H. bellidioides* (Forst. f.) Willd.
Locally abundant in open stable sites at mid altitudes. 1240

H. bellidioides × *Gnaphalium trinerve*
Hybrid plants occur in small patches in open sites on fine talus on slip faces. Uncommon. 2420

436 *H. filicaule* Hook. f.
Locally abundant in moss under *Leptospermum* scrub and in short grassland and herbfield up to 740 m a.s.l. 250

437 * *Hypochoeris radicata* L. catsear
Widespread and common in open sites and grassland up to 740 m a.s.l., extending into openings in forest and scrub. 929

438 *Lagenifera pumila* (Forst. f.) Cheesem.
Occasional under light scrub at low to mid altitudes. 1254

439 *L. strangulata* Col.
Locally common at 750 m and higher altitudes, usually under silver beech forest. 2980

440 * *Leontodon taraxacoides* (Vill.) Merat. hawkbit
Common, especially on slips and fine screes in open areas at lower altitudes, extending into open grassland at mid altitudes. 4401

441 * *Matricaria matricarioides* (Less.) Port. rayless chamomile
Rare. Known only from one recent collection on the access roadway. 1663

442 * *Mycelis muralis* (L.) Rchb. wall lettuce
Widespread under open forest and scrub up to 740 m a.s.l. Occurs in light-gaps, along forest edges and similar open sites. 1138

443 *Olearia arborescens* (Forst. f.) Ckn. et Laing
Uncommon. Restricted to cliffs or other sites out of the reach of goats. Found mainly near the headwaters of the eastern streams, on cliffs, up to 700 m a.s.l. 2999

444 *O. paniculata* (J. R. et G. Forst.) Druce akiraho
Uncommon. Locally abundant in dry sites, especially on the the ends of dry ridges which abut onto the main river bed. Occurs up to 400 m a.s.l. 971

445 *O. rani* (A. Cunn.) Druce heketara
Widespread and common up to 660 m a.s.l., becoming abundant in low forest on steep valley sides above 400 m. Common as an understorey shrub in beech forest either with kamahi or on its own. In forest originally composed of kamahi, or rata and kamahi canopy with *O. rani* as understorey, *O. rani* now comprises the main canopy species, following the death of rata and kamahi (Fig. 7). Flowers irregularly; 1976 was an exceptionally prolific flowering. The leaves are occasionally eaten by possums, and periodically widespread defoliation occurs from attacks by caterpillars which eat the leaf lamina. 1202

446 *O. solandri* Hook. f.
Rare. Known from only two collections in *Leptospermum* scrub on river terraces at low altitudes. *O. solandri* is common on the beach ridges at Cape Turakirae (Bagnall 1975). 4181

447 *O. virgata* Hook. f. var. *virgata*
Rare. Known from one site on the edge of a river terrace. More common near the coast. 1012

448 * *Picris echioides* L. oxtongue
Rare. Known from only two recent collections, one near the mouth of Browns Stream and one on the access road. 1291

449 *Raoulia glabra* Hook. f. scabweed
Common to locally abundant in open sites on sand or silt in the river bed, extending up to mid altitudes in suitable sites on screes and fine debris on rock faces. 1289

450 *R. tenuicaulis* Hook. f. scabweed
Abundant and widespread as an early colonising species on sand and silt in the main river bed. More common than *R. glabra* both on the river bed and on screes up to 640 m a.s.l. In early stages of succession scabweed often

Fig. 7 Dead terrestrial rata (*Metrosideros robusta*), on a ridge at 400 m a.s.l. The main canopy of this low forest is now composed of hinau (*Elaeocarpus dentatus*) and heketara (*Olearia rani*).

forms large patches more than a metre across, which trap windblown soil or silt, and encourage other species to establish. Patches of scabweed are grazed by both possums and rabbits. 4202

451 * *Senecio bipinnatisectus* Belcher Australian fireweed
(syn. *Erichtites atkinsoniae* F. von Muell.)
Common to locally abundant at low altitudes, on sites where the ground has been totally cleared or soil has been disturbed. Occurred prominently on early successions along parts of the access road for a few years after its construction, and is occasional on slips and open stream beds. This species tends to appear sporadically in a site, and not be present each year. 2549

452 * *S. glastifolius* Linn. f. large senecio
Rare. Known from only one plant on the access road, at Nettle Stream. Appears not to have established permanently. 908

453 *S. hispidulus* A. Rich.
Uncommon. Occurs in open clearings in forest and scrub, along open forest edges and on slips. 1214

454 * *S. jacobaea* L. ragwort
Widespread. In open sites up to 740 m a.s.l. but especially common in the grassland at mid altitudes. Common in openings in forest and scrub and on open slips and shingle river bed. Flower heads are often eaten by ungulates, and the leaves of flowering plants are commonly stripped by caterpillars of magpie moth

Solanaceae

478 *Solanum aviculare* Forst. f. var. *aviculare* poroporo
Uncommon. Occurs up to 320 m a.s.l. Occasional in forest edge sites and in light gaps in forest. *S. laciniatum* has been searched for, but not found. 617

479 * *S. nigrum* L. black nightshade
Common and widespread at lower altitudes. Frequently occurs in light-gaps, in open forest, or on slips. 4186

480 *S. nodiflorum* Jacquin native nightshade
Uncommon to locally common, not as widespread as *S. nigrum*. The two species grow together on slips or other sites, completely intermixed. 4216

481 *+ *S. tuberosum* L. potato
Rare. Known only from two sites where they have been deliberately planted by hut-owners.

Convolvulaceae

482 *Calystegia tuguriorum* (Forst. f.) Hook. f.
Rare. Occurs to the south of the study area in farmland, scrambling over bushes, but in the study area known from only one site at low altitude near a public hut. 1281

Scrophulariaceae

483 * *Digitalis purpurea* L. foxglove
Common to locally abundant, and widespread. Occurs in open areas, chiefly slips, light-gaps in forest and scrub, and along forest margins. Extends into grassland up to 400 m a.s.l., but is not common in open shingle sites. Occurred abundantly along parts of the access roadway soon after its construction, but has since been displaced by woody species. The purple-flowered form outnumbers the white by approximately 1000:1 though white predominates in nearby Wainuiomata Valley (R. E. Brockie, pers. comm.). 614

484 *Euphrasia cuneata* Forst. f.
Widespread and common. Occurs in open sites up to 620 m a.s.l., mainly in stable sites in grassland and on stream terraces. 4106

485 *Hebe* sp. (*H. parviflora* (Vahl) Ckn. et Allan agg.
(syn. *H. parviflora* var. *arborea* (Buchan.) L. B. Moore)
Uncommon but widespread up to 700 m a.s.l. Much reduced in abundance through browsing by exotic animals. 1809

486 *H. stricta* (Benth.) L. B. Moore var. *atkinsonii* (Ckn.) L. B. Moore koromiko
Uncommon to locally common. Largely eliminated over much of the area by browsing animals, but making a partial comeback in the scree and grassland sites at mid altitudes following animal control. 4184

487 *Jovellana repens* (Hook. f.) Kranzl.
Locally common in suitable sites. Has been found in wet gully heads, both in forest and in grassland. Prefers sopping wet stream bed sites in shade, often near to, or in running water. 4261

488 * *Mimulus guttatus* DC. monkey musk
Uncommon. Chiefly restricted to sluggish running water in cut-off backwaters or side streams up to 420 m a.s.l. 4204

489 * *M. moschatus* Lindl. musk
Uncommon. Occasional in sluggish running water at edges of the main river bed. The plants of *M. moschatus* are scentless. 2842

490 *Ourisia macrophylla* Hook. var. *drucei* L. B. Moore
Locally abundant in open grassland, and occasional under silver beech or other forest from mid altitudes up to 740 m. 2842

491 *Parahebe catarractae* (Forst. f.) W. R. B. Oliver ssp. *diffusa* (Hook. f.) Garnock-Jones
Uncommon. Occasional in stream beds and open sites up to 740 m a.s.l. Frequently plants are browsed and the potential distribution is probably much reduced by introduced animals. 2818

492 * *Parentucellia viscosa* (L.) Car. tarweed
Common in open areas, especially in gravel river or streambed sites. Most *P. viscosa* plants are found smothered in trapped midges. 348

493 * *Verbascum thapsis* woolly mullein
Locally common in open sites at low altitudes, on the access road, river bed, and stream beds. 338

494 * *Veronica arvensis* L. field speedwell
Uncommon but widespread in open sites, especially at lower altitudes. 1209

Myoporaceae

495 *Myoporum laetum* Forst. f. var. *laetum* ngaio
Rare. Known from only one specimen which established on an area of lowland forest burnt in the early 1960s. Ngaio is locally common to the south, especially on screes near to the coast. On one occasion an possum in poor condition was observed browsing ngaio leaves during the day (J. A. Gibb, pers. comm.), but it is not known whether ngaio is a regular food of possums. Ngaio is eaten by goats on Arapawa Island (G. Asher, pers. comm.). 1249

Orobanchaceae

496 * *Orobanche minor* Sm. var. *minor* broomrape
Uncommon. Occasional in grassland where clover occurs, up to mid altitudes. 274

(*Nyctemera annulata*) or cinnabar moth (*Callimorpha jacobaeae*). Possums have occasionally been seen during the daytime, feeding on ragwort leaves (B. M. Fitzgerald, pers. comm.). 460

455 *S. lautus* Willd. ssp. *lautus* shore groundsel
Uncommon. Open sites on gravel stream bed or sandy screes up to mid altitudes. 4290

456 *S. minimus* Poir fireweed
Uncommon to locally common. Open areas, such as shingle river beds, openings in forest, slips and induced grassland up to 480 m a.s.l. 962

457 *S. quadridentatus* Labill.
Uncommon. Occurs in open sites, along the access roadway, in light-gaps, forest edges, and extends into grassland up to 740 m. 1222

458 *S. rufiglandulosus* Col.
Common throughout grassland and open areas at mid and upper altitudes to 740 m, widespread but uncommon in open areas at lower altitudes. 2989

459 * *S. sylvaticus* L. wood groundsel
Uncommon. Collected on only two occasions from near the same site. May have died out. 1263

460 * *S. vulgaris* L. groundsel
Rare. Known from only two open sites on the main river bed. 3290

461 * *Silybum marianum* (L.) Gaertn. variegated thistle
Rare. Despite its long history in the Wellington area (Kirk 1879) and relative abundance to both the west and south of the study area, variegated thistle has only recently appeared on the access road at the south of the study area. This species could spread and become more common. 1666

462 * *Sonchus asper* (L.) Hill prickly sow thistle
Common. Widespread in open sites at low to mid altitudes. 4318

463 * *S. oleraceus* L. sow thistle
Widespread but uncommon in open sites up to 560 m. Probably reduced in abundance because of browsing animals. 4287

464 * *Taraxacum officinale* Weber dandelion
Uncommon. Known from only a few widely scattered sites up to 480 m a.s.l. 1128

465 *Vittadinia australis* Hook. f. white fuzzweed
Rare. Occasional plants are encountered, especially in open rocky sites up to 440 m a.s.l. 2986

Gentianaceae

466 * *Centaurium erythraea* Raf. centaury
Locally common in open areas up to 500 m. 1599

Primulaceae

467 * *Anagallis arvensis* L. scarlet pimpernel
Widespread and common in open stream and riverbed sites. 687

Plantaginaceae

468 * *Plantago lanceolata* L. narrow-leaved plantain
Widespread, but not common, in open sites on the river bed and along the access road. Occasional in open grassland and on scrub edges. 219

469 * *P. major* L. broad-leaved plantain
Rare to locally common, mainly in open lowland sites. 4178

470 *P. raoulii* Decne
Locally common but patchy in distribution. Under light scrub or partially shaded moist sites in lowland scrub and on the river bed. 1252

Campanulaceae

471 *Wahlenbergia colensoi* N. E. Brown
Uncommon but widespread, especially in moist, partially shaded sites. 4063

472 *W. gracilis* (Forst. f.) Schrad. New Zealand harebell
Common and widespread, grassland and screes up to 750 m a.s.l. Common on forest margins and along open stream beds. 4062

473 * *W. marginata*
Uncommon to locally common along the access road and in a few open sites at low altitudes. More robust, and with a darker blue flower than *W. gracilis*. 4066

Lobeliaceae

474 *Pratia angulata* (Forst. f.) Hook. f. pratia
Common and widespread up to 750 m a.s.l., especially in moist or wet open areas. Often creeping through grass or moss. 227

Polemoniaceae

475 * *Navarettia squarrosa* (Esch.) Hook. et Arn. Californian stinkweed
Rare. Only recently colonised a few sites along the access road. Present in farmland to the south. 1662

Boraginaceae

476 * *Myosotis caespitosa* Schultz water forget-me-not
Locally common in sluggish water in backwaters of the main river and in the side streams up to 500 m a.s.l. 2957

477 *M. forsteri* Lehm.
Rare. Occasional in moist sites in mid-altitude open herbfield and grassland. 4170