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VEGETATION AND FLORA OF FANAL ISLAND, MOKOHINAU GROUP

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SUMMARY

Vegetation descriptions of the major plant communities and an annotated species list of the vascular flora of Fanal Island are presented. Including a small number of previous records, a total flora of 153 taxa is recorded. The island provides a relatively safe refuge for a number of rare or unusual species, most notably Cook's scurvy grass (*Lepidium oleraceum*).

The variety of stages of development of the vegetation indicate a history of modification, most commonly by burning. While some areas may have been burnt as recently as a few decades ago, several areas of mature coastal forest contain trees well over one hundred years old.

INTRODUCTION

Fanal Island (Motukino) is the largest of the Mokohinau Islands (latitude 35° 50' S, longitude 175° 10' E), the most isolated of the Hauraki Gulf island groups (Fig. 1). It comprises 73 hectares of Flora and Fauna Reserve under the control of the Hauraki Gulf Maritime Park Board.

The island is surrounded by steep cliffs, surmounted by a gently sloping summit plateau. Seasonal streams are found in the three valleys draining the western bulk of the island, and in a shallow valley draining the eastern peninsula. The valleys all fall west- and southwards from the higher northern clifftops which culminate in David's Lookout, the highest point, at 134 m.

Kiore (*Rattus exulans*) is the only known mammal on the island.

Studies on the vegetation and flora of Fanal Island were carried out during the Auckland University Field Club scientific trip to the Mokohinau Islands from 19 - 26 May, 1979.

PREVIOUS WORK

The first known botanical visitor to the island was Miss Frances Shakespear who made collections of plants whilst accompanying her father, the caretaker of Little Barrier Island, on visits to many offshore islands in the early years of the twentieth century. A set of ten specimens from Fanal Island collected by Miss Shakespear on 23

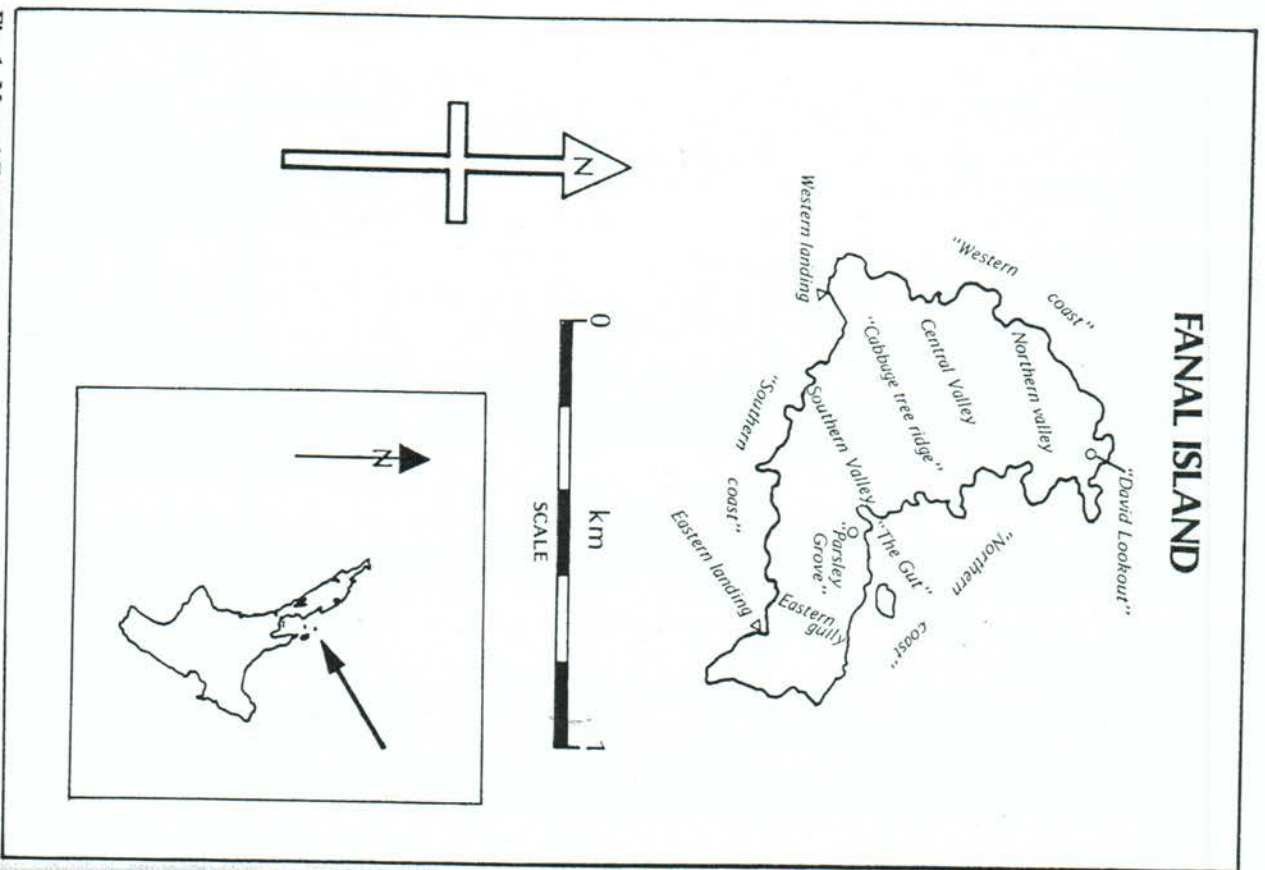


Fig. 1. Map of Fanal Island showing place names and localities mentioned in the text. Inset shows location off the North Island of New Zealand.

FANAL ISLAND

November, 1902 was presented to the Auckland Institute and Museum in 1970 and these specimens are now lodged in the Herbarium (AK). They include the introduced cabbage tree *ti pore* (*Cordyline terminalis*), Cook's scurry grass (*Lepidium oleraceum*) and *nestegis* (*Nestegis apetalae*).

Apart from passing references to the vegetation in unpublished reports by Officers of the Wildlife Service, Department of Internal Affairs, (Adams 1969, Bell 1964, Newcombe 1952) the only known account of the vegetation is that prepared by Esler (1978) following about three hours on Fanal Island, during which time 80 species were listed and brief ecological notes made. Thus this paper is the first detailed description of the island's vegetation and flora.

PLANT COMMUNITIES

The vegetation of Fanal Island can be conveniently divided into twelve communities for the purposes of description. It must be realised that the divisions are somewhat arbitrary as in most cases there is poor definition of boundaries between communities. The communities are primarily based on species associations, although the habitat and/or physical characteristics of a particular site may influence the species which grow there. Most of the communities are induced by fire or other human agency.

Coastal crevices

Crevice plants were extensively represented around the rocky, cliffed coastline of Fanal Island. The most prominent were the grasses coastal toetoe (*Cortaderia splendens*) and *Chionochoa bromioides*. Nearer highwater level, the ubiquitous salt-tolerant plants of the northern New Zealand rocky coast—*N.Z. iceplant* (*Disphyma australe*), Mercury Bay weed (*Dichondra repens*), glasswort (*Salicornia australis*), *Samolus repens* and *Scirpus cernuus* were abundant.

Coastal cliffs

On less steep coastal cliffs, particularly near the tops, a pohutukawa (*Metrosideros excelsa*) dominant low forest was found. *N.Z. flax* (*Phormium tenax*) was the major subcanopy plant and through this (e.g. at the eastern landing) scrambled quantities of mawhai (*Sicyos angulata*, *N.Z. spinach* (*Tetragonia trigyna*) and *N.Z. jasmine* (*Parsonsia heterophylla*). The ferns *Phymatodes diversifolium* and *Pyrrosia serpens* were common on rock faces, with large clumps of *Asplenium flaccidum* subsp. *haurakiense* growing in the rich humic soils.

Coastal meadow

An extensive area of low herbaceous plants was found on the

north-facing steep slopes between the top of the seacliffs and the summit plateau at the extreme northern end of the island. Right at the top of the cliffs was a dense mat of glasswort and N.Z. iceplant with occasional patches of N.Z. spinach growing amongst it. (A single klore (*Rattus exulans*) was observed for some time feeding on the leaves of the N.Z. spinach.) This association continued up the slope for 10 to 15 metres when large clumps of *Scirpus nodosus* and scattered *Samolus triandra* which continued under the petrel scrub community abutting the coastal meadow.

Within an area 10 x 8 m on the margins of the petrel scrub some twenty mature plants of Cook's scurvy grass (the common name is somewhat misleading since the plant is in fact a Crucifer, not a grass) were found. The whole area was densely burrowed by petrels, with considerable evidence of bird damage to the plants, especially where plants were situated right at the entrance to burrows. Despite numerous broken branchlets and disattached leaves, sprigs and inflorescences, all the plants were flowering profusely and growing strongly, apparently little worse for wear.

Petrel scrub

This is a low coastal shrub community usually characterised by *Hymenanthera novae-zelandiae* and taupata (*Coprosma repens*) which occurs in areas densely burrowed by petrels (Wright 1977). On Fanal Island, however, taupata was generally a minor constituent (or not present at all). *Hymenanthera* was the dominant species, with the local addition of ngatio (*Myoporum laetum*). *Rhagodia* formed a more-or-less continuous mat under the margins of the scrub. Two good examples of this community were noted - atop the northern-most cliffs described above under the heading 'coastal meadow', and on the south-western promontory of the island. In the former locality robust rosettes of N.Z. celery (*Apium australe*) were common amongst the other plants, while straggling specimens of *Rorippa stylosa* were common beneath the scrub at the latter locality.

N.Z. flax groves

Substantial areas of the western flanks of Central Valley (apparently the most recently burnt off area) were clothed with what appeared at first sight to be pure stands of N.Z. flax. Close searching revealed a few ferns and herbs, such as the maidenhair (*Adiantum cunninghamii*) and N.Z. pellitory (*Parietaria debilis*). Smaller areas of this community were found in coastal regions throughout the central and northern parts of the island. It was obviously a nurse crop leading to the formation of the following community.

N.Z. flax-dominant scrub

The following description was made at Parsley Grove (Fig. 1) and is typical of coastal areas and ridges throughout the central and northern parts of Fanal Island. A low (0.5 to 1 m high) community dominated by N.Z. flax with the addition of coastal toetoe, low wind-swept mingimingi (*Cyathodes fasciculata*), dune taubinu (*Cassinia retorta*), *Scirpus nodosus*, bracken (*Pteridium aquilinum* var. *esculentum*), *Hebe bolsonii* and occasional dwarfed, spreading pohutukawa and houpara (*Pseudopanax lessonii*) which were gradually overtopping the flax. Where space was available beneath and through these shrubs, tall clumps of rosy maidenhair (*Adiantum hispidulum*) grew, together with sparse plants of the true maidenhair (*Adiantum aethiopicum*). Three plants of the parsley fern (*Botrychium australe*) were found on our track through this grove.

Houpara 'islands' and immature forest

The growth of individual houpara bushes into larger units which eventually coalesce provided the major successional pathway from flax scrub to more mature forest communities. The houpara forms 'islands' which overtop and suppress the surrounding N.Z. flax. Mapou (*Myrsine australis*) appears around the houpara, and as the islands coalesce a mixed, immature, low forest dominated by houpara, with lesser amounts of mapou and mahoe (*Melicytus ramiflorus*) and occasional akepiro (*Olearia furfuracea*) in dry situations is formed.

Houpara forest

Considerable areas of almost pure houpara forest were found. In many instances, canopy closure was so high that groundcover was eliminated.

In the eastern gully, the houpara canopy was occasionally broken by large trees of karo (*Pittosporum crassifolium*), mapou, karaka (*Corynocarpus laevigatus*) and mahoe. In the bottoms of damp valleys, the ferns turawera (*Pteris tremula*) and wheki (*Dicksonia squarrosa*) were abundant, and seedlings of kawakawa (*Macropiper excelsum*) were locally numerous. *Asplenium lucidum*, *Carex spinirostris* and mats of Mercury Bay weed were found beneath breaks in the canopy in drier situations.

A number of microhabitats supporting a very different flora were found throughout the houpara forest and the mixed immature forest described above. Windthrown trees were relatively common and the resultant locally increased light intensities led to invasion by mainly annual weeds and dense turfs of the native grass *Opilsenus*. Prominent amongst the annuals were the native oxtongue (*Picris heiraoides*), broad-leaved fleabane (*Erigeron floribundus*), Scotch thistle (*Cirsium vulgare*) and inkweed (*Phytolacca octandra*).

On damper sites where canopy gaps were caused by windthrown trees (particularly in the eastern gully) speedy regeneration was being provided by whau (*Entelea arborescens*). Vigorously growing seedlings and saplings usually surrounded an older mature tree.

Mature forest

Esler (1978) recorded one patch of older forest in the mid-reaches of Central Valley. With more time for exploration during the present survey, several areas of forest considerably older and more mature were located. Two of the best examples were found at the eastern end of the island. Our campsite was located within one area (Fig. 1) and the other more extensive area was situated mainly along the southern side of the flattened ridge trending south-west/north-east between Eastern Gully and Southern Valley.

The canopy was generally provided by large trees of tawapou (*Planchonella novo-zelandica*), nestegis, milktree (*Paratrophis banksii*, *puriri* (*Vitex lucens*) and senescent houpara. Kohokohe (*Dysoxylum spectabile*) was frequently approaching canopy status, but appeared to fall more often within the subcanopy class together with parapara (*Heimerliodendron brunonianum*), nikanu (*Rhopalostylis sapida*), mahoe, kawakawa, karaka and coastal karamu (*Coprosma macrocarpa*). Apart from the widespread forest groundcover species *Asplenium lucidum* and *Phymatodes diversifolium*, dense patches of *Asplenium lamprophyllum* and karaka seedlings occurred beneath the mature forest.

In order to more clearly demonstrate the composition of the mature forest, a 10 m by 10 m quadrat in a representative area was studied and the results are presented in Table 1.

A number of other noteworthy plants were seen on the ridge in the vicinity of the quadrat described in Table 1. Just outside the quadrat were young shrubs of parapara 3cm in diameter at breast height and several large nestegis and tawapou 40 to 60 cm d.b.h. Nikanu became common on flatter ground just up the ridge. Adult large-leaved tawa (*Beilschmiedia tawa*) up to 20 cm d.b.h. were found further again up the ridge with several seedlings beneath and scattered throughout the surrounding forest. A small number of seedlings of taraira (*Beilschmiedia tarairi*) were also seen in this area, but no adult trees of this species were located. Presumably both these species were relatively recent (probably re-) introductions brought from Hen Islands by birds. Large puriri trees which would provide roosting and food for birds were common on the ridge in the vicinity of the tawa and taraira seedlings. As well as the two common ferns recorded in the quadrat, *Opismenus* formed dense swards below openings in the canopy.

Table 1. 10 m by 10 m quadrat in mature nestegis-tawapou-houpara-milktree forest, situated off the southern extremity of the ridge between Eastern Gully and Southern Valley. Aspect south-south-west. Slope 6° on ridge to 17°. Average canopy height 6m. Canopy closure approx. 80%. All plants observed in the quadrat are listed. Where possible, individuals are listed according to their diameter at breast height (d.b.h.) in cm. s = seedling.

Major class	Species	Occurrence
Canopy	<i>Nestegis apetala</i>	42
	<i>Paratrophis banksii</i>	12.5
Subcanopy	<i>Planchonella novo-zelandica</i>	60, 20, s
	<i>Pseudopanax lessoni</i>	24, 19, 18, 18, 12, 10, 8, 3, 3, 2
	<i>Coprosma macrocarpa</i>	2, 2, 1, 1, 1, s
	<i>Corynocarpus laevigatus</i>	3, 1, 0.5, 0.5, 0.5, 0.5, 0.5, 0.5, s, s, s
	<i>Dysoxylum spectabile</i>	10, 10, 6, 4, 4, 3, 1.5, 1, 1, 0.5
	<i>Geniostoma ligustrifolium</i>	4, 2
	<i>Hedycarya arborea</i>	3, 1.5, 0.5, 0.5
	<i>Macropiper excelsum</i>	2, 2, 1.5, 0.5
	<i>Melicytus ramiflorus</i>	6, 6, 5, 5, 4, 4, 4, 4, 3, 3, 2, 2, 1.5, 1.5, 1.5
	<i>Myrsine australis</i>	4, 2.5, 2, 2, 2, 2, 2, 2, 2, 1.5, 1.5, 1, 1, 1, 0.5, 0.5, 0.5, 0.5, 0.5, 0.5
Liane	<i>Pitiosporum crassifolium</i>	4
	<i>Rhopalostylis sapida</i>	s (1 m tall)
	<i>Parsonsia heterophylla</i>	climbing in kohokohe
	<i>Asplenium lucidum</i>	Dense on ridge, less down slope
	<i>Beilschmiedia tawa</i>	8
Groundcover	<i>Phymatodes diversifolium</i>	Scattered around rocks along bottom edge of quadrat

Mingimingi heath

Limited areas of a low heath community dominated by mingimingi were found scattered along the northern cliffs between houpara and pohutukawa bushes to 3 m high. Sparse bracken and occasional *Hebe boltonii* were found associated with the mingimingi. Groundcover was provided by the ferns *Asplenium lucidum*, *Doodia media* and the true maidenhair, and numerous small orchids (*Acianthus fornicatus* var. *sinclairii*) just coming into flower.

Kanuka forest remnants

Kanuka (*Leptospermum ericoides*) and manuka (*L. scoparium*) were scattered along the eastern ridge of the Central Valley. Just off the ridge into Central Valley was an area of more mature kanuka forest with a very dense canopy which precluded any groundcover. Surrounding this 'core' was more open kanuka/manuka scrub with straggling plants of tauhinu (*Pomaderris phyllifolia* var. *ericifolia*), turtu or blueberry (*Dianella nigra*) and dense colonies of two orchids: *Acianthus fornicatus* var. *sinclairii* and a small greenhood orchid

Perostylis alobula, once again just beginning flowering. Locally high light intensities at ground-level in this open scrub were demonstrated by the large showing of annual and perennial weeds and grasses, e.g. silvery hair grass (*Aira carophyllae*), *Bromus mollis*, long-hair plume grass (*Dichelachne crinita*), danthonia (*Rytidosperma racemosum*), native oxtongue and *Senecio hispidulus*.

Mapou seemed to be actively establishing within the kanuka/manuka scrub, although no other forest trees were present as seedlings.

No sign was seen of the kanuka recorded by Esler (1978) on the western side of Central Valley.

Herbfield

A minor community but nevertheless very striking in the small area in which it occurred. A number of species were confined to the herbfield on a very steep, damp slope facing south-east between the summit plateau of the island and a set of inland cliffs just below. Small numbers of rauhuia (*Linum monogynum*), *Lagenophora pumila* and *Sceleranthus biflorus* were found, together with numerous *Acianthus*, sun orchids (*Thelymitra longifolia*) and the decaying remains of annual weeds amidst a carpet of lichens (Wright *et al.* 1980). Sparse N.Z. flax tufts and stunted pohutukawas were scattered throughout the whole community.

VASCULAR PLANT SPECIES LIST

153 taxa of native and adventive vascular plants are listed for Fanal Island, together with common names and comments on distribution, abundance and other points of interest. One species recorded by Miss Shakespear in 1902 and six species listed by Esler (1978) were not found during the present survey but have been included in this listing.

Nomenclature of indigenous plants follows Allan (1961), Moore and Edgar (1970) and Cheeseman (1925) except where otherwise referenced. Adventive plants and common names follow the New Zealand Weed and Pest Control Society (1969) and Healy and Edgar (1980)

Families are listed according to volumes 1 and 2 of the Flora of New Zealand. Genera are listed alphabetically within the families, as are species within genera. * denotes adventive plants.

FILICOPSIDA

Ophioglossaceae	<i>Botrychium australe</i>	Parsley fern. Three plants (non-fertile) were found on the path through low N.Z. flax scrub in Parsley Grove, east of The Gut.
Dicksoniaceae	<i>Dicksonia squarrosa</i>	Wheki. Young sporelings common on banks of watercourse in head of Eastern Gully. No adults located.
Cyatheaceae	<i>Cyathea dealbata</i>	Ponga. Young plants and seedlings common in damp valleys.
Polypodiaceae	<i>Phymatodes diversifolium</i>	Hound's tongue. Abundant on forest and scrub floor throughout, occasionally ascending trees. Common on exposed rock at clifftops.
	<i>Pyrrosia serpens</i>	Scattered rupestral colonies. Common in larger trees in older areas of forest.
Dennstaedtiaceae	<i>Hypolepis tenuifolia</i>	Rare colonies beneath houpara scrub in deep leaf litter.
Davalliaceae	<i>Arthropteris tenella</i>	Occasional in older forest remnants, usually covering all rocks and trunks for an area of several metres square.
Pteridaceae	<i>Histiopteris incisa</i>	Water fern. Rare seedlings found around the roots of wind-thrown houpara trees. Adult plants quite possibly exist in flax groves elsewhere on the island.
	<i>Pteridium aquilinum</i> var. <i>esculentum</i>	Bracken. Common amongst mixed N.Z. flax scrub and as remnants amongst kanuka scrub. Nowhere is it extensive as a colony in its own right.
	<i>Pteris macilentia</i>	Rare in dry coastal forest. Two plants found amongst turawera in head of Eastern Gully.
	<i>P. tremula</i>	Turawera. Abundant in small clearings where trees have fallen throughout.
Aspleniaceae	<i>Asplenium flaccidum</i> subsp. <i>aurakiense</i>	Abundant on coastal rocks; occasionally terrestrial in coastal forest.
	<i>A. lamprophyllum</i>	
	<i>A. lucidum</i>	Occasional large colonies in older parts of forest.
Blechnaceae	<i>Blechnum norfolkianum</i>	Huruhuruwhenua. The major component of groundcover in forest throughout.
	<i>Doodia media</i>	Large plants common around rocks and in valleys in steeper areas of mature forest.
Dryopteridaceae	<i>Ctenitis velutina</i>	Abundant in flax scrub and kanuka scrub.
	<i>Polystichum richardii</i>	Velvet fern. Occasional plants on dry banks in main forested valleys.
Adiantaceae	<i>Adiantum aethiopicum</i>	Large plants growing in dry open forest.
	<i>A. cunninghamii</i>	Makaka. Abundant in low flax scrub and kanuka scrub.
		Maidenhair. Growing in coastal flax groves. One colony seen below forest on side of steep valley.

	<i>A. hispidulum</i> <i>Pellaea rotundifolia</i>	Rosy maidenhair. Abundant in open scrubby places throughout. Tarawera. Occasional colonies in openings in scrub on ridges on either side of Central Valley.
SPERMATOPSIDA ANGIOSPERMAE	<i>DICOTYLEDONES</i>	
<i>Lauraceae</i>	<i>Beilschmiedia tarairi</i> <i>B. tawa</i>	Taraira. Five seedlings seen in mature forest near the following. Tawaroa (large-leaved tawa). Two adult trees and several seedlings seen in mature forest near the southern coastline between Central and Southern Valleys.
Monimiaceae Ranunculaceae Piperaceae	<i>Hedycarya arborea</i> <i>Clematis paniculata</i> <i>Macropiper excelsum</i>	Pigeonwood. Occasional small trees or saplings in forest. Clematis. Abundant in forest and scrub throughout. Kawakawa. Common shrub species in forest. Occasional battered shrubs in exposed flax scrub. In general, leaf size insufficient to class plants as var. <i>majus</i> .
Cruciferae	<i>Peperomia urvilleana</i> <i>Brassica oleracea*</i>	Occasional around rocks in steep coastal forest. Wild cabbage. Several plants growing amongst petrel scrub on northern cliffs.
34	<i>Cardamine debilis</i> <i>Lepidium oleraceum</i>	N.Z. bitter cress. Occasional plants in openings in coastal scrub and crevices amongst rocks at clifftops. Cook's scurvy grass. A population of twenty plants was found scattered around the entrances to petrel burrows on the northern cliffs below David's Lookout. The plants were spread over an area of 15 x 10 metres. Although all plants were flowering and fruiting prolifically, the incidence of avian damage to the plants was high.
Violaceae	<i>Rorippa stylosa</i> <i>Hymenanchera novae-zelandiae</i>	A few large spreading plants were found around petrel burrows on end of headland above Western Landing. Locally abundant on clifftops, particularly in areas burrowed by petrels and where streams meet clifftops.
Crassulaceae	<i>Melicytus ramiflorus</i> <i>Crassula decumbens*</i>	Mahoe. Present as shrubs or small trees in most forest and scrub communities. Common, although easily overlooked, herb in small crevices on exposed rocks along clifftops.
Aizoaceae	<i>Disphyma australe</i> <i>Tetragonia trigyna</i>	N.Z. iceplant. Common on rocks in upper maritime zone; extensive mats at summit of cliffs above The Gut and around clifftops below David's Lookout. N.Z. spinach. Occasional plants scrambling amongst rocks and scrub on coastal cliffs.
Caryophyllaceae	<i>Cerastium glomeratum*</i> <i>Polycarpon tetraphyllum*</i> <i>Scleranthus biflorus</i> <i>Stellaria parviflora</i>	Annual mouse-ear chickweed. Occasional weed in small openings or on disturbed ground. Allseed. Common on dry rocks around clifftops. A very small number of plants amongst moss and lichen on steep herbfield south-east of David's Lookout. One small sterile plant with dark green, succulent leaves was found in a rock crevice where the Southern Valley stream meets the clifftops. Cuttings grown on in Auckland have flowered and appear to correspond with this species.
Portulacaceae Polygonaceae	<i>Portulaca oleracea*</i> <i>Muehlenbeckia complexa</i>	Wild portulaca. Recorded by Esler (1978) Wire vine. Common tangles in coastal scrub with persistent lianes climbing amongst trees in younger forest communities. Occasional mats, mainly around petrel burrows along clifftops.
Chenopodiaceae	<i>Rhagodia triandra</i> <i>Salicornia australis</i>	Glasswort. Common amongst upper maritime zone rocks and on steep, petrel-burrowed slopes to the north of David's Lookout.
Geraniaceae	<i>Geranium</i> sp. (un-named)	This species which occurs on many islands off the Northland coast was occasionally found in open coastal areas.
35 Oxalidaceae Linaceae	<i>Pelargonium inodorum</i> <i>Oxalis corniculata</i> <i>Linum monogynum</i>	Kopata. Common in dry, open areas along clifftops. Abundant scrambling herb in well-lit areas throughout.
Haloragaceae	<i>Haloragis erecta</i> <i>H. incana</i>	Ruahua. Small number of plants found in steep, damp herbfield off south-east side of David's Lookout. Shrubby haloragis. Abundant herb to small shrub in low coastal scrub. Common but insignificant mat plant beneath dry, open scrub on ridges, particularly beneath tea-tree communities.
Nyctaginaceae	<i>Heimerliodendron brunonianum</i>	Parapara. Occasional in remnants of mature coastal forest. Many-branched, bushy trees are a feature of the forest at the eastern extremity of the island.
Thymelaeaceae	<i>Pimelea prostrata</i>	Strathmore weed. Occasional low mat-forming plants along exposed clifftops.
Pittosporaceae	<i>Pittosporum crassifolium</i>	Karo. Scattered small trees around clifftops with occasional very large trees amongst houpara forest in shallow Eastern Gully.
Cucurbitaceae	<i>Sicyos angulata</i>	Mawhai. Occasionally found scrambling through rocks and low pohutukawa trees on steep coastal banks. Plants flowering and with immature fruit.
Myrtaceae	<i>Leptospermum ericoides</i>	Kanuka. A sizeable stand of mature trees was found on the eastern side of the Central Valley. Esler (1978) noted a patch of kanuka on the western side of the same valley.

	<i>L. scoparium</i> <i>Metrosideros excelsa</i>	Manuka. Scattered along eastern ridge of central valley. Pohutukawa. Abundant shrub and small tree on exposed coastal cliffs. Common large tree in sheltered situations; most notably forming a pure stand above The Gut in the head of the Central Valley.
Tiliaceae	<i>Entelea arborescens</i>	Whau. Older trees surrounded by several very vigorous seedlings and young saplings common in breaks in the houpara canopy in Eastern Gully. Occasional trees in forest elsewhere.
Euphorbiaceae	<i>Euphorbia peplus*</i>	Milkweed. Occasional plants in disturbed soil on track up cliff from western landing.
Papilionaceae	<i>Carmichaelia aligera</i>	N.Z. broom. Occasional small trees in scrub and forest.
Moraceae	<i>Paratrophis banksii</i>	Large-leaved milk tree. Rare, very old trees in coastal forest remnants; some regeneration in developing coastal forest.
Urticaceae	<i>Parietaria debilis</i>	N.Z. pellitory. Abundant weed around N.Z. flax bushes along clifftops.
Corynocarpaceae	<i>Corynocarpus laevigatus</i>	Karaka. Occasional constituent of more mature stands of coastal forest.
Rhamnaceae	<i>Pomaderris phylliciflora</i> var. <i>ericifolia</i>	Tauhinu. Associated with manuka and kanuka. Low bushes scattered through kanuka forest. Straggling remnants being shaded out by dense manuka and mapou stands.
36 Rutaceae	<i>Melicope ternata</i>	Wharangi. Occasional constituent of more mature areas of forest.
Meliaceae	<i>Dysoxylum spectabile</i>	Kohekohe. Major constituent of canopy in older areas of forest, best seen at the eastern end of the island. Seedlings and saplings were numerous in developing forest. Dispersal may be aided by the attraction of kakas (<i>Nestor meridionalis</i>) to kohekohe fruit.
Araliaceae	<i>Pseudopanax lessonii</i>	Houpara. Abundant throughout, both as extensive almost pure stands in more sheltered areas or as scattered individuals amongst other communities.
Umbelliferae	<i>Apium australe</i>	N.Z. celery. Uncommon. The largest population seen was scattered amongst petrel scrub on the steep slopes below, and to the north of, David's Lookout.
Epacridaceae	<i>Cyathodes fasciculata</i>	Mingimingi. Common shrub, particularly along the exposed northern clifftops.
Sapotaceae	<i>Planchonella novo-zelandica</i>	Tawapou. Common tree up to 60 cm or more D.B.H. in older areas of forest. Some individuals, of a much larger size class than the other forest trees surrounding them, may have survived burnoffs.
Myrsinaceae	<i>Myrsine australis</i>	Mapou. Early coloniser of N.Z. flax groves. Also appeared to be taking over manuka scrub along Cabbage Tree Ridge. Prominent sub-canopy constituent of mature coastal forest.
Oleaceae	<i>Nestegis apetala</i>	Occasional trees up to 50 cm D.B.H. in older forest areas.
Loganiaceae	<i>Geniostoma ligustrifolium</i>	Hangehange. Common in scrub or as a sub-canopy constituent of forest.
Apocynaceae	<i>Parsonsia heterophylla</i>	Kaiwhiria. Locally plentiful climbing among pohutukawa trees on coastal slopes or in older forest areas.
Rubiaceae	<i>Coprosma lucida</i> <i>C. macrocarpa</i>	Karamu. Recorded by Esler (1978)
	<i>C. repens</i>	Coastal karamu. Apart from taupata, all large-leaved <i>Coprosma</i> plants seemed to fall within this taxon. Plentiful throughout.
Compositae	<i>C. rhamnoides</i> <i>Brachyglottis repanda</i> <i>Cassinia retorta</i>	Taupata. Common around coastline and along damper coastal clifftops.
	<i>Cirsium vulgare*</i>	Occasional in dry coastal forest, particularly in Central Valley.
	<i>Erigeron floribundus*</i>	Rangiora. Uncommon shrub in older forest areas.
	<i>Gnaphalium audax</i> <i>G. gymnocephalum</i>	Dune tauhinu. Common constituent of low N.Z. flax scrub, e.g. at Parsley Grove.
	<i>G. involucreatum</i>	Scotch thistle. Occasional weed on coastal cliffs or on disturbed soil around wind-thrown trees.
	<i>G. luteo-album</i> <i>G. spicatum*</i> <i>G. ustulatum*</i>	Broad-leaved fleabane. Occasional weed in open areas along clifftops or around wind-thrown trees.
	<i>Hypochoeris radicata*</i> <i>Lagenophora pumila</i>	Uncommon in rock crevices around clifftops.
	<i>Olearia furfuracea</i> <i>Picris heiraoides</i>	Creeping cudweed. Common weed amongst coastal scrub or in forest openings.
	<i>Senecio bipinnatisectus*</i> <i>S. glomeratus</i> <i>S. hispidulus</i> <i>S. lautus</i>	Creeping cudweed. Rare, found only once growing around the base of a wind-thrown houpara tree.
		Jersey cudweed. Common in coastal rock crevices.
		Purple cudweed. Plentiful in open or disturbed areas throughout.
		Rare on disturbed soil around wind-thrown trees in forest.
		Catsear. Abundant weed in all open situations.
		A small number of plants were found on steep, south-east facing slopes between the summit plateau (David's Lookout) and the inland clifftops.
		Akepiro. Occasional small trees in dry forest.
		Native oxtongue. Tall flowering plants common on disturbed soil around wind-thrown trees in forest.
		Australian fireweed. Common in disturbed soil and amongst low scrub.
		Occasional plants amongst coastal scrub.
		Occasional plants amongst coastal scrub.
		Shore groundsel. Uncommon in rock crevices at the two landing points.

	<i>S. vulgaris</i> *	Groundsel. One plant only which appears to correspond with this species was found in disturbed soil at the base of a wind-thrown tree.
Gentianaceae	<i>Sonchus oleraceus</i> *	Sowthistle. Abundant weed in open situations throughout.
Primulaceae	<i>Centaurium erythraea</i> *	Centaury. Occasional weed in exposed clifftop situations.
	<i>Anagallis arvensis</i> *	Scarlet pimpernel. Common weed in dry, open clifftop situations.
	<i>Samolus repens</i>	Abundant in rock crevices above high tide zone at the two landing points.
Campanulaceae	<i>Wahlenbergia gracilis</i>	N.Z. harebell. Common herb in low scrub around clifftops. Occasional in manuka and kanuka forest.
Lobeliaceae	<i>Lobelia anceps</i>	Shore lobelia. Occasional plants in sheltered crevices around coastline.
Solanaceae	<i>Solanum aviculare</i>	Poroporo. Rare seedlings around wind-thrown trees in forest. No adults seen.
	<i>S. nodiflorum</i>	Small-flowered nightshade. Abundant weed in disturbed soil beneath petrel scrub.
Convolvulaceae	<i>Calystegia tugoriorum</i>	Occasional tangles in low scrub along coastal clifftops.
Scrophulariaceae	<i>Dichondra repens</i>	Mercury Bay weed. Occasional large colonies beneath houpara forest.
	<i>Hebe bollonsii</i>	Abundant shrub in younger scrub communities on ridges and along clifftops.
38 Myoporaceae	<i>Myoporum laetum</i>	Ngaio. Occasional on coastal cliffs. The largest numbers seen were associated with petrel scrub on steep slopes below and to the north of David's Lookout.
Verbenaceae	<i>Vitex lucens</i>	Puriri. Occasional very large, old trees in older forest areas.
Labiatae	<i>Prunella vulgaris</i> *	Selfheal. Occasional weed on open ground along clifftops and beneath open kanuka forest.
Orobanchaceae**	<i>Orobanche minor</i> *	Broomrape. Recorded by Esler (1978).
Phytolaccaceae**	<i>Phytolacca octandra</i> *	Inkweed. Common in disturbed soil, particularly around wind-thrown trees.
	MONOCOTYLEDONES	
Liliaceae	<i>Arthropodium cirratum</i>	Renga lily. Locally common on coastal cliffs and beneath forest along clifftops.
	<i>Astelia banksii</i>	Wharawhara. Recorded by Esler (1978).
Agavaceae	<i>Dianella nigra</i>	Turutu; blueberry. Common ground plant in dry forest and scrub.
	<i>Cordyline australis</i>	Cabbage tree. Occasional individuals scattered through scrub.
	<i>C. terminalis</i> *	This species, considered by Moore (Moore and Edgar 1970) to be adventive in New Zealand, was collected by Miss Shakespear in 1902 (specimen in AK). Despite searching around the campsite in the Central Valley, the species was not found during the present survey.
	<i>Phormium tenax</i>	N.Z. flax. Dominant plant over large areas of the island. Also present as remnants beneath some younger forest areas.
Palmae	<i>Rhopalostylis sapida</i>	Nikau. Young palms common in forested valleys throughout. Larger plants emerging through the canopy in Central Valley.
Orchidaceae	<i>Acianthus fornicatus</i> var.	Locally abundant beneath kanuka and manuka forest, low clifftop scrub and amongst the steep herffield community south-east of David's Lookout.
	<i>sinclairii</i>	Occasional dried remains found in open areas along clifftops.
	<i>Microtis unifolia</i>	Plentiful within the kanuka forest on the eastern side of Central Valley.
	<i>Pterostylis alobula</i>	Sun orchid. Abundant dried remains in openings in low scrub throughout.
	<i>Thelymitra longifolia</i>	Occasional in low scrub, generally near clifftops.
39 Cyperaceae	<i>Carex breviculmis</i>	Common in dry forest.
	<i>C. spirostris</i>	Occasional clumps in scrub.
	<i>C. testacea</i>	Locally abundant about mouths of watercourses.
	<i>Cyperus ustulatus</i>	Generally confined to damper areas.
	<i>Gahnia lacera</i>	Common in dry scrub. Locally abundant beneath forest.
	<i>Lepidosperma australe</i>	Square-stemmed sedge. Very plentiful over a small area east of Parsley Grove.
	<i>Scirpus cernuus</i>	Abundant in damp coastal rock crevices both at the landing points and where streams meet the clifftops.
	<i>S. nodosus</i>	Abundant on coastal cliffs and in dry open areas along clifftops. Also present in low scrub such as at Parsley Grove.
Gramineae	<i>Agropyron kirkii</i>	Occasional in open areas along clifftops.
	<i>Aira caryophyllea</i> *	Silvery hair grass. Scattered in open areas throughout though more common along clifftops.
	<i>Avena barbata</i> *	Wild oat. Recorded by Esler (1978).
	<i>Bromus diandrus</i> *	Ripgut brome. Dried remains were found in the kanuka forest.
	<i>B. mollis</i> *	Dried remains common in open areas along clifftops and in low scrub.
	<i>B. unioides</i> *	Prairie grass. Rare dried remains in kanuka forest.
	<i>Chionochloa bromoides</i>	Scattered over coastal cliffs.
	<i>Cortaderia seloana</i> *	Pampas grass. One large clump was found in the head of Southern Valley.

<i>C. splendens</i>	Coastal toetoe. Abundant amongst N.Z. flax and low scrub, particularly along clifftops.
<i>Dactylis glomerata*</i>	Cocksfoot. Occasional in open areas around clifftops.
<i>Deyeuxia billardieri</i>	Sand wind grass. Common in sheltered rock crevices along coastline.
<i>Dichelachne crinita</i>	Long-hair plume grass. Occasional in kanuka forest and open scrub.
<i>Lachnagrostis filiformis</i>	N.Z. wind grass. Abundant in exposed rock crevices along coastal cliffs.
<i>Microlaena polynoda</i>	Recorded by Esler (1978)
<i>Rytidosperma biannulare</i>	(Connor and Edgar 1979). <i>Danthonia</i> . Common in rock crevices on cliffs.
<i>R. racemosum*</i>	<i>Danthonia</i> . Locally plentiful amongst low scrub around David's Lookout.
<i>R. unarede</i>	<i>Danthonia</i> . Rare plants scattered through houpara forest in east of island.
<i>Oplismenus imbecillis</i>	Locally plentiful, forming dense swards beneath open forest and around wind-thrown trees.
<i>Poa anceps</i>	Occasional along coastal clifftops and amongst coastal rocks.
<i>Sporobolus africanus*</i>	Ratstail. Common in exposed, open sites throughout.
<i>Vulpia bromoides*</i>	<i>Vulpia</i> hair grass. Abundant weed of dry, well-lit places and rock crevices.

DISCUSSION

Although the greater part of Fanal Island is clothed in immature regenerating communities, it is fortunate that some relict areas of older and more mature vegetation still exist. These areas, described under the 'Mature Forest' heading in the section of Plant Communities, are probably indicative in a general way of the original forest cover of the island, with a canopy dominated by tawapou, *nestegis* and large-leaved milk tree, with the local addition of *kohekohe*, *tawa*, *karaka*, *puriri* and *nikau* palms. We are fortunate that these areas remain, because they provide an abundant seed-source for the gradual re-establishment of forest over the whole of the island.

Composition of the flora

For an island the size of Fanal with a lack of permanent water and little variety of habitat the flora (153) species is relatively large and varied. It is pleasing to note the small adventive element in the flora (less than 20% - Table 2). This number will probably drop with the further development of forest in presently open or disturbed areas, until only the more-or-less standard group of ubiquitous coastal weeds remain. Only one of the adventive species recorded poses a threat to the native communities. This is the pampas grass (*Cortaderia sellonana*) of which one flowering clump some 0.8 m across at the base was found growing in an open area in ngaiouhoupara-pohutukawa scrub in the head of a small side gully leading off from the upper reaches of Southern Valley. Every effort should be made to remove this pest which possessed several dozen spent culms to 4 m tall.

While the adventive element of the flora may be marginally reduced in number of species in the future, occasional further additions to the native flora are likely to occur. The taraire seedlings found are an example of a recent introduction, probably by visiting birds from Hen Island or northern Great Barrier Island. The large-leaved *tawa* trees found, although a little older, are also fairly obviously relatively recent introductions. As stated earlier, both these species are probably reintroductions as it is highly likely that they were present on the island before prehistoric man's modification of the vegetation.

Successional pathways

Following through the Plant Community descriptions above the reader should have noted a number of seral stages present in the vegetation of Fanal Island. A fairly clear generalised successional pathway for most of the island has emerged from the attempt to characterise the various communities.

After burning or clearing, an almost pure cover of N.Z. flax is established, with the gradual addition of ferns such as maidenheads and herbs such as N.Z. pellitory. As the N.Z. flax increases in height

(and thus provides better shelter) mingimingi, dune tauhinu, bracken, *Scirpus nodosus*, *Hebe boltonii*, pohutukawa and houpara appear scattered amongst it. The latter two species are the most important as they can best withstand exposure to salt-laden winds and gradually overtop the N.Z. flax. Houpara was the more common with a full range of sizes present throughout the island. The larger individuals eventually coalesce and suppress the N.Z. flax. Mapou appears around the houpara and gradually a mixed community (still dominated by houpara) is formed with the addition of mahoe and akepiro. This young forest then provides the cover for the development of more mature coastal forest dominated by tawapou, nestegis, large-leaved milk tree and kokekoke, and a denser ground-cover of ferns. Fig. 2 illustrates part of this sequence from south to north on one side of Southern Valley.

Fig. 2 also illustrates the zonation of communities locally observed around the coastline of Fanal Island. It is based on the ability to tolerate salt, with the most salt-tolerant plants nearest the cliff-tops and successively less tolerant species/communities ranked back from the cliff-tops. It is seen to the right of Fig. 2 at the top of the northern cliffs with a mat of N.Z. iceplant right at the cliff-top, backed by low, wind-shorn petrel scrub, backed by a belt of ngaio and finally pohutukawa forest.

The vegetation of Fanal Island is undergoing dynamic regeneration. Abundant seed sources are available in relict forest areas to aid in this regeneration. The mature forest tree species, together with the rare Cook's scurvy grass and uncommon rauhuia, mawhai, and parsley fern combine with isolation to render Fanal Island a very valuable flora reserve.

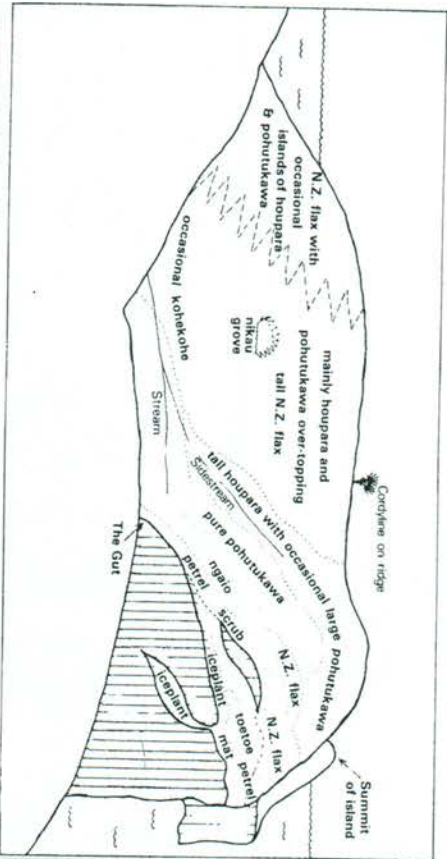


Fig. 2. Sketch plan of vegetation on western side of Southern Valley. Looking west from Parsley Grove.

Table 2. Distribution of the vascular flora of Fanal Island according to plant groups and native or adventive status.

Group	Native	Adventive	TOTALS
Ferns	22		22
Dicot trees, shrubs and lianes	39	1	40
Dicot herbs	32	19	51
Monocot trees and shrubs	3	1	4
Monocot herbs and grasses	26	10	36
TOTALS	122	31	153

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