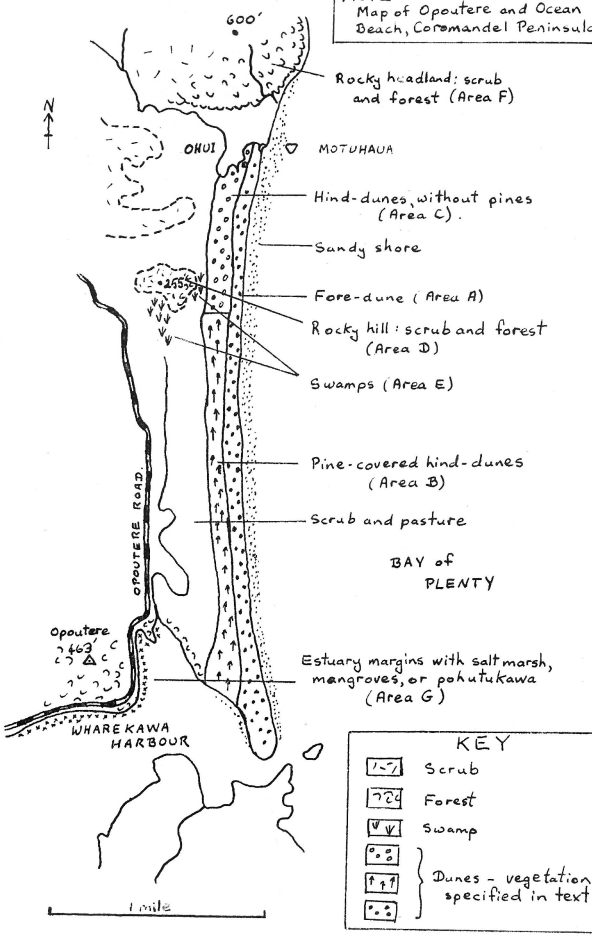


FIG. I
Map of Opoutere and Ocean Beach, Coromandel Peninsula
600'
Rocky headland; scrub and forest (Area F)
N
OHUI
MOTUHAUA
Hind-dunes without pines (Area C).
Sandy shore
265'
Fore-dune (Area A)
Rocky hill: scrub and forest (Area D)
Swamps (Area E)
Pine-covered hind-dunes (Area B)
OPOUTERE ROAD
Scrub and pasture
BAY of PLENTY
Opoutere
463'
Estuary margins with salt marsh, mangroves, or pohutukawa (Area G)
WHAREKAWA HARBOUR
KEY
Scrub
Forest
Swamp
Dunes - vegetation specified in text.
1 mile

The Effect of Pines on the Diversity of Indigenous Species

Observations on Sand Dunes at Opoutere, Coromandel Peninsula

C. Ogle, Pukerua Bay

In the present controversies about exotic pines versus indigenous forest, little publicity seems to have been given to species diversity of understorey plants in pine forests as compared with previous vegetation or adjacent unplanted areas. Opoutere Beach on the east coast of Coromandel Peninsula is a sandy shore about 6km long, limited by a steep rhyolite hill (Opoutere Point, 300m a.s.l.) to the north, by the Wharekawa inlet and estuary to the south, and backed by four roughly parallel dunes, each 10m to 15m high (Fig. 1).

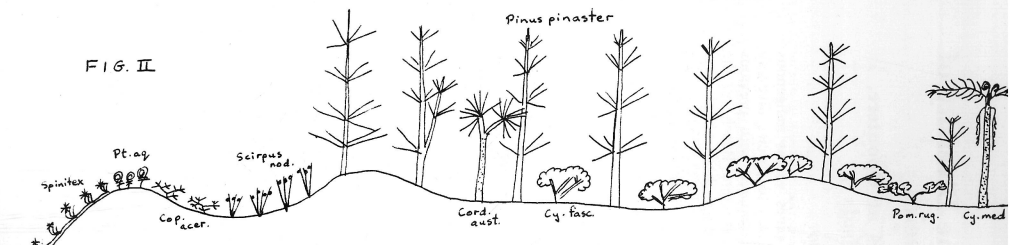
Throughout its length the fore-dune is typically fronted by *Spinifex* with some pingao and isolated marram clumps, becoming a closed community of *Scirpus nodosus*—bracken—*Coprosma acerosa*—*Muehlenbeckia complexa* between the crests of the fore-dune and second dune.

The southern half of the second and third dunes has been planted in *Pinus pinaster* up to 7/100m^2, while the fourth dune has more sparse (*P. pinaster* and some *P. radiata*) at densities occasionally down to 1/100m^2. These variable densities of pines create a greater variety of "micro-habitats" than is usual in managed pine forests. Behind these pine-covered dunes is a low, broad, swampy hollow draining southwards to the estuary from a *Baumea rubiginosa* swamp. Much of this flat area is in poor-quality grazed pasture with manuka and *Juncus* species.

The northern half of the three hind-dunes is largely covered by manuka and bracken forming a dense wind-shorn canopy between 1.5m and 2.5m tall. The profile diagram (Fig. III) shows one of several isolated pines in the area. The effect of pines in breaking the manuka canopy can be seen here, where a circle of dead manuka occurs under the branch spread of each pine. No manuka occurs in dense pine forest further south on the dunes, though some are found in open sites on the fourth dune where pines are more sparse. The two profile diagrams illustrate these differences.

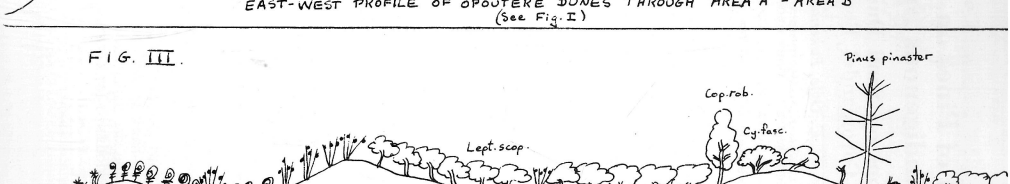
The species list below shows there are only 13 indigenous species in the closed manuka-bracken community on the northern hind-dunes (area C), but where pines have been planted (area B) a total of 67 indigenous species occurs. There is no doubt that pines have created micro-habitats not available in low manuka scrub. Obvious ones include site opportunities for epiphytic ferns (5 spp.), and symbiotic relationships for *Gastrodia*. Extra leaf litter and, as

FIG. II



EAST-WEST PROFILE OF OPOUTERE DUNES THROUGH AREA A - AREA B
(See Fig. I)

FIG. III.



EAST-WEST PROFILE OF OPOUTERE DUNES THROUGH AREA A - AREA C
(See Fig I)

Abbreviations:

Cop. acer.	: *Coprosma acerosa*	Lept. scop.	: *Leptospermum scoparium*
Cop. rob.	: *C. robusta*	Pom. rug.	: *Pomaderris rugosa*
Cy. fasc.	: *Cyathodes fasciculata*	Pt. aq.	: *Pteridium aquilinum var. esculentum*
Cy. med.	: *Cyathea medullaris*	Scirpus nod.	: *Scirpus nodosus*
Cord. aust.	: *Cordyline australis*	Spinifex	: *Spinifex hirsutus*

previously stated, variable light intensities, create conditions suitable for shade-requiring or shade-tolerant plants (mamaku, rangiora, five-finger, kawakawa, etc.) yet sheltered well-lit clearings give opportunities for grasses, sedges, *Gnaphalium* spp. etc. Rather surprising were solitary plants of terrestrial *Astelia banskii* and *Collospermum hastatum,* and in a shaded dune hollow *Coprosma tenuicaulis.* The proximity of a rocky hill to the hind-dunes at the northern limit of the pines is obviously important as a seed source, as the variety of indigenous species decreases markedly in a southerly direction through the pines.

Since the first plantings of *Pinus pinaster* occurred in 1930, many of the indigenous species among them would represent first-generation plants, forming populations which could lead to their future spread southwards along the dune pine forest. The swamp areas are also probably the source of some plants for the hind-dunes (e.g. *Coprosma tenuicaulis*).

Opoutere Point consists of steep rocky cliffs planted in pines on top, descending through scrub to a coastal fringe of pohutukawa forest and a shingle beach with sand pockets and rock outcrops. A plant of special interest here is tawapou (*Planchonella);* more than 20 individuals occur over 400m of coastline, and numerous seedlings are also present.

The northern fringes of the Wharekawa estuary contain a complex pattern of communities including tidal *Zostera* and mangroves, sedgelands (*Baumea* and *Carex*), rushlands (*Juncus maritimus*) and pohutukawa with assocated forest species overhanging salt marsh (*Selliera-Samolus*). For convenience, the list is confined to plants between the road and estuary, though continuous pohutukawa forest rises above the road, on a hill not examined in this survey.

For simplicity, the species are listed from seven broad geographical areas only. Within each area are distinct communities as follows:

Area A; Fore-dune:

(a) *Spinifex/Calystegia soldanella,* on seaward slope
(b) *Scirpus nodosus*—bracken, on landward slope
(c) *Coprosma acerosa—Spinifex,* in dune hollow

Area B; Hind-dunes:

(a) *Pinus pinaster/Cyathodes fasciculata/Lepidosperma laterale,* on second and third dunes
(b) *Pinus pinaster* (scattered) — *Cyathodes fasiculata* — manuka — *Pomaderris kumeraho/P. ericifolia—Lepidosperma laterale,* on fourth dune
(c) *Lepidosperma laterale—Pomaderris rugosa—P. kumeraho/Cyathodes fraseri,* in dry sand "blowouts" on fourth dune
(d) *Pinus pinaster — P. radiata* (both scattered)/mamaku/*Coprosma* spp. (seedlings only), in dune hollow between third and fourth dunes

Area C; Hind-dunes:

(a) Manuka—bracken, on dune slopes and hollows
(b) Manuka—*Scirpus nodosus,* on dune crests

Area D; Rocky hill:

(a) Manuka (up to 3m tall)/*Geniostoma ligustrifolium—Olearia townsonii—Astelia banksii/Schoenus brevifolius,* with a few emergent pohutukawa, rewarewa and *Pinus ponderosa,* on south and west slopes
(b) Manuka (up to 2m tall)—*Olearia townsonii—Cyathodes fasciculata—Lycopodium deuterodensum—Schoenus brevifolius,* on summit
(c) *Olearia townsonii*/manuka (up to 1m tall near summit, and 5m tall near base of hill) on steep east-facing slopes
(d) Pohutukawa/*Astelia banksii—Rhabdothamnus solandri/Doodia media,* on rocky cliffs at base of hill on east side (the old pre-dune coastline?)

Area E; Swamps:

(a) A zonation of *Eleocharis sphacelata* to *Baumea articulata,* to *Typha orientalis,* to *Baumea juncea,* from open water to progressively drier ground against rocky cliffs at eastern base of hill (Area D)
(b) A zonation of *Baumea rubiginosa — Gleichenia* sp. — manuka (up to 5m tall)/*Baumea tenax* and *B. juncea*—manuka/mamaku and ponga, from wet hollows (no open water) to progressively drier ground, at southern base of hill (Area D)

Area F; Opoutere Point: Described above.

Area G; Wharekawa Estuary: Described above.

ACKNOWLEDGEMENTS

My special thanks to Mr A. P. Druce for his assistance with identification of specimens and advice concerning this article, and to the Forest Service for information regarding the identification and date of pine plantings.

KEY TO SPECIES LIST

Area A — fore-dune throughout
Area B — under pines on dunes (southern half of beach)
Area C — on dunes of northern half of beach — isolated pines only
Area D — rocky hill behind dunes near junction of areas B and C
Area E — swampy areas at foot of hill D, and stream draining swamp
Area F — rocky headland (Opoutere Point) at north end of beach
Area G — estuary and margins at south end of beach

DICOTYLEDONS	A	B	C	D	E	F	G
Acaena novae-zelandiae		x				x	
Apium australe						x	
Atriplex sp. (indigenous?)						x	
Avicennia resinifera							x
Beilschmiedia tawa							x
Brachyglottis repanda		x		x		x	
Calystegia sepium agg. (pink fls)					x	x	x
C. soldanella	x					x	x
Cassinia leptophylla	x			x			
Centella uniflora				x	x		
Clematis paniculata		x		x			
Coprosma acerosa	x						
C. areolata		x(1)					
C. lucida			x	x		x	
C. propinqua		x(1)				x	
C. repens						x	
C. rhamnoides		x(1)		x			
C. robusta		x	x	x	x	x	x
C. tenuicaulis		x(1)			x		
C. propinqua x C. robusta		x(1)					
Coriaria arborea							x
Corynocarpus laevigatus				x(2)		x	x
Cyathodes fasciculata		x	x	x	x	x	x
C. fraseri		x		x		x	
C. juniperina		x		x		x	
Dichondra repens				x	x	x	
Disphyma australe							x
Drosera auriculata		x		x			
Dysoxylum spectabile						x	x
Entelea arborescens						x	
Gaultheria antipoda				x			
Geniostoma ligustrifolium		x		x	x	x	x
Geranium sp. (G. homeanum?)							x
Gnaphalium gymnocephalum		x		x			
G. luteo-album agg.				x			
G. sphaericum		x		x			
Haloragis erecta				x		x	x
H. micrantha		x					
H. procumbens		x		x	x		
Hebe stricta var. stricta				x			x
H. pubescens						x	
Hedycarya arborea						x	
Helichrysum lanceolatum				x		x	
Knightia excelsa		x		x			
Lagenifera pumila				x			
Leptospermum ericoides					x		
L. scoparium		x	x	x	x	x	x
Lobelia anceps				x		x	
Macropiper excelsum		x				x	x
Melicope ternata				x		x	
Melicytus ramiflorus				x		x	x
Metrosideros excelsa		x(1)	x(1)	x		x	x
M. perforata				x			
Muehlenbeckia complexa	x	x	x			x	
Myoporum laetum				x		x	
Myrsine australis		x		x			
Nertera depressa				x			
Olearia townsonii			x	x		x	
Oxalis sp. (yellow fls)		x					

	A	B	C	D	E	F	G
Peperomia urvilleana				x		x	
Pimelea arenaria	x						
P. tomentosa				x			
Pittosporum crassifolium				x		x	
P. ellipticum						x	
Plagianthus divaricatus							x
Planchonella nova-zelandica						x	
Pomaderris kumeraho		x		x			
P. ericifolia		x	x	x			
P. rugosa		x	x	x		x	
Pseudopanax arboreus		x		x		x	x
P. lessonii		x		x		x	x
Ranunculus hirtus				x			
Rhabdothamnus solandri				x		x	
Salicornia australis						x	
Samolus repens							x
Selliera radicans							x
Tetragonia trigyna	x	x				x	
Vitex lucens						x	x
Wahlenbergia marginata				x		x	
Weinmannia sylvicola				x			
MONOCOTYLEDONS							
Arthropodium cirrhatum						x	
Astelia banksii		x(1)		x		x	x
Baumea articulata					x		x
B. juncea					x		x
B. rubiginosa					x		
B. tenax		x		x	x		
Bulbophyllum pygmaeum							x
Caladenia carnea				x			
Carex breviculmis				x		x	
C. dissita				x		x	
C. flagellifera					x	x	x
C. inversa				x		x	
C. pumila						x	
C. spinirostris				x		x	
C. testacea	x	x					
C. virgata					x		x
Collospermum hastatum		x(1)		x		x	x
Cordyline australis		x	x	x	x	x	x
C. pumilio		x		x			
Cortaderia toetoe		x					x
Cyperus ustulatus					x	x	x
Dendrobium cunninghamii							x
Desmoschoenus spiralis	x						
Deyeuxia billardieri	x					x	
Dianella nigra		x		x		x	
Dichelachne crinita	x	x		x		x	
Drymoanthus adversus							x
Earina mucronata							x
Echinopogon ovatus						x	
Eleocharis acuta				x	x		
E. sphacelata					x		
Gahnia lacera				x		x	
Gastrodia sesamoides		x					
Juncus australis		x			x		
J. gregiflorus					x		
J. maritimus var. australiensis							x
J. prismatocarpus (?)					x		

	A	B	C	D	E	F	G
Lepidosperma australe				x			
L. laterale		x	x	x		x	
Leptocarpus similis							x
Microlaena stipoides		x		x			
Microtis unifolia		x					
Morelotia affinis		x		x		x	
Notodanthonia clavata		x		x			
N. penicillata		x		x			
N. unarede		x		x		x	
Oplismenus imbecillus		x		x	x	x	x
Phormium tenax		x		x		x	x
Poa anceps		x		x		x	
Potamogeton cheesemanii					x		
Schoenus brevifolius				x			
S. maschalinus					x		
Scirpus cernuus							x
S. lacustris							x
S. nodosus	x	x	x	x		x	x
S. reticularis					x		
S. sulcatus var. distigmatosus					x		
Spinifex hirsutus	x					x	
Thelymitra longifolia				x		x	x
Triglochin striatum							x
Typha orientalis					x		
Uncinia uncinata				x		x	
Zostera muelleri							x
Zoysia pauciflora		x					
FERNS							
Adiantum aethiopicum				x			
A. cunninghamii				x		x	x
A. hispidulum				x			
Asplenium falcatum		x				x	
A. flaccidum agg. (common forest sp.)		x		x			x
A. lucidum		x		x		x	x
Blechnum capense agg. (common lowland sp.)		x		x	x		x
B. chambersii				x		x	
B. filiforme				x		x	
Cyathea dealbata				x		x	
C. medullaris		x		x		x	x
Dicksonia squarrosa				x			x
Doodia media subsp. australis		x		x		x	
Gleichenia sp.					x		
Hymenophyllum sanguinolentum				x			
Lindsaea linearis		x					
Lygodium articulatum				x			
Paesia scaberula		x			x		
Pellaea rotundifolia				x		x	
Phymatodes diversifolium		x		x		x	x
Polystichum richardii		x		x		x	x
Pteridium aquilinum var. esculentum	x	x	x	x	x	x	x
Pteris tremula				x		x	
Pyrrosia serpens		x		x		x	x
Thelypteris penniger						x	
FERN ALLIES							
Lycopodium billardieri				x			x
L. deuterodensum				x			