STUDY OF DUNE PLANT COMMUNITIES AT THE MOUTH OF THE WAIPOUA RIVER

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SUMMARY

A study was carried out on dune plant communities adjacent to the mouth of the Waipoua River during May, 1986. Six community types were identified ranging from sparse spinifex (*Spinifex hirsutus*) dominated dune to well established vegetation e.g. *Muehlenbeckia complexa,* tauhinu (*Cassinia leptophylla*). A small area of pingao (*Desmoschoenus spiralis*) was found in an area of exposed sand, however this may be eventually taken over by lupin (*Lupinus arboreus*). A zonation pattern was observed, corresponding to distance from sea and successional stage.

INTRODUCTION

Auckland University Field Club has had a scientific station at Kawerua since 1966. Approximately 6km south of the Field Station is the mouth of the Waipoua River (see Fig.1), and the dunes adjacent to this have an interesting and varied set of plant associations.

Changes in these dune structures over the last 45 years have been documented by Hayward (1980) so present vegetation conditions can be related to their known history.

This paper aims to look at plants and plant communities of this area. Particular emphasis is given to probable successional changes, inferred from existing vegetation patterns.

METHODS

Two transects were laid across the dunes from the foot of the hills parallel to the coast, to the seaward edge of the dunes. The first transect was oriented on a north-south bearing, the second on 210 degrees south-west (see Fig. 2).

Pairs of 4m x 4m plots were laid adjacent to each other on either side of the transect. These were situated within obvious community types. Where these community types extended over a large length of transect, more than one set of plots were laid e.g. plots 29-34. Seven pairs of plots were laid on transect 1 and 10 on transect 2.

Within each plot vegetation was recorded using a percentage cover estimate for each species. These were then grouped into classes. Classes used were:

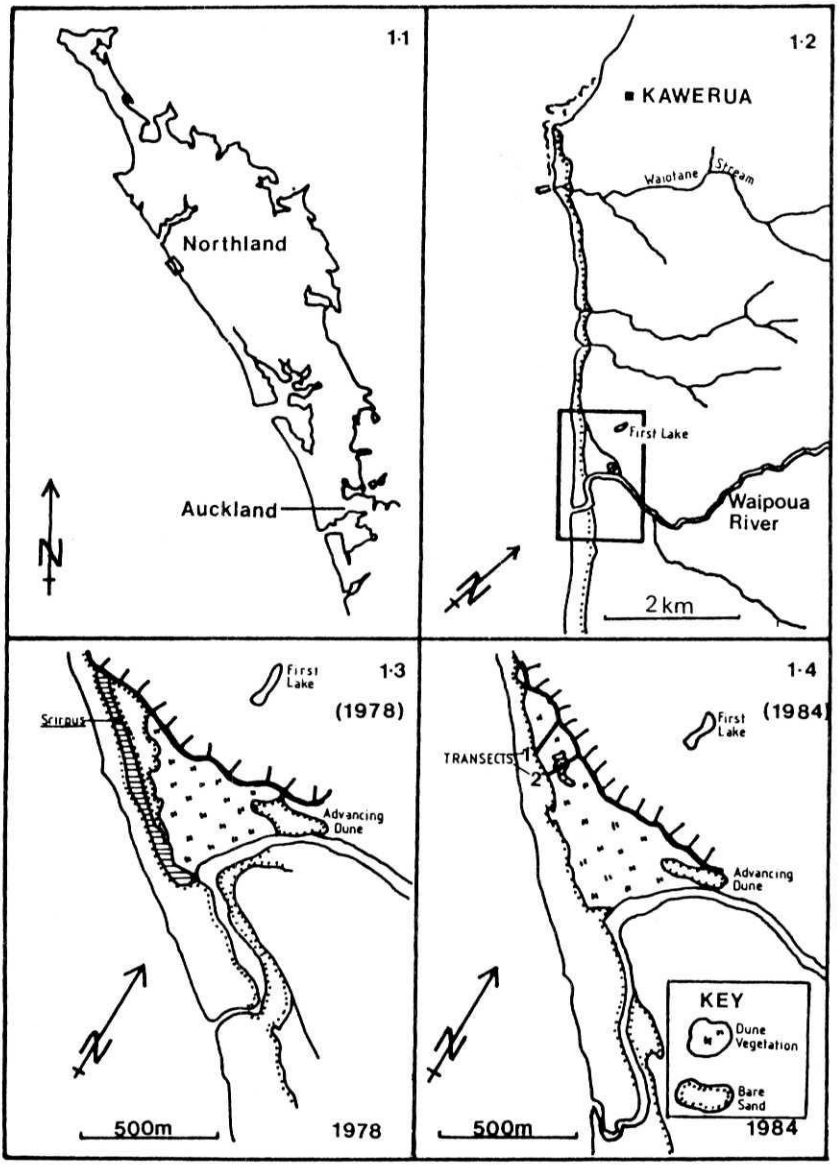

Fig. 1. 1.1 - Shows the location of the study area in Northland.
1.2 - Study area, near the mouth of the Waipoua River.
1.3 - Study area, 1978. Note the area of bare sand situated between the band of *Scirpus* to the seaward side and the area described by Hayward as dune vegetation (Hayward 1980).

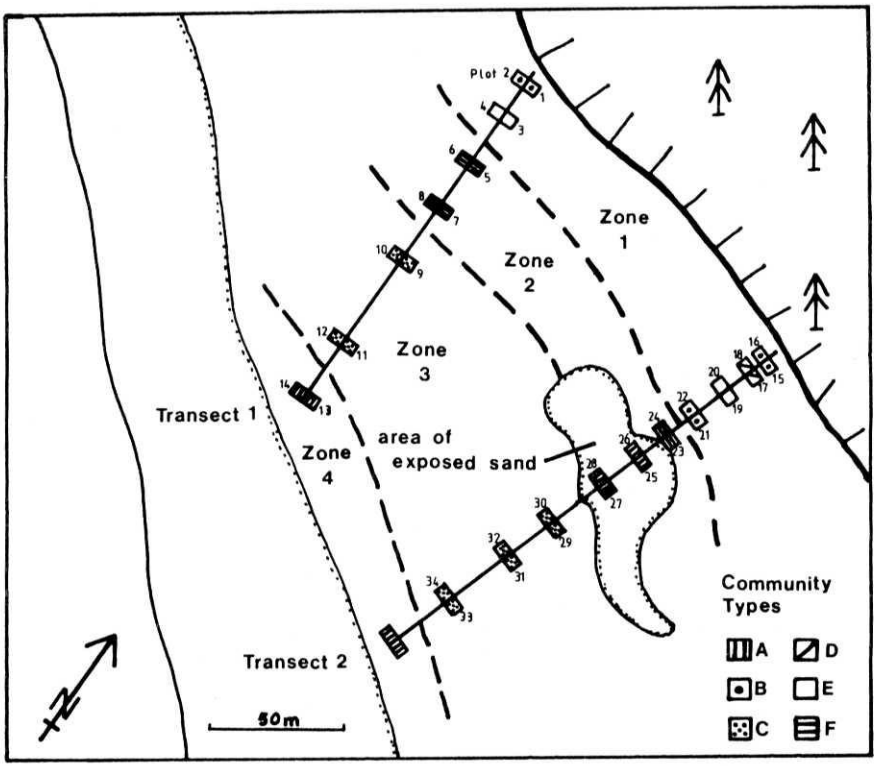

Fig. 2. The two transects, with the position of plots and community types given. Community A, large sandy areas; community, B, *Meuhlenbeckia / Scirpus;* community C, tauhinu scrubland; community D, *Cassytha* dominated; community E, *Muehlenbeckia* and community F, lupin dominated. The area of exposed sand on transect 2 is probably the remnants of a much larger strip (see fig. 1.3). Plots 27 and 28 contain pingao. Top left of the figure is pine covered hillside.

Class	% Cover
1	< 1
2	1 - 5
3	5 - 25
4	25 - 50
5	50 - 75
6	75 - 100

A cluster analysis using the SAS programme ordinated the plots into groupings based on similarities of plants present and their abundances (SAS Institute Inc. 1985).

The dune profiles were surveyed using a 'Shikosha' dumpy level and a 5m staff graduated in 1 cm intervals. A horizontal line of sight was set up from either end of each transect. These horizontal lines of sight (lines of collimation) followed the transects as closely as possible. The surveyor's dumpy level was used to read the point at which the lines of sight cut the graduated staff which was held vertically over points of interest (e.g. dips and rises in the dune, positions of plots).

These profiles show only the relative heights of the dunes along the two lines surveyed. The profiles were continued down to the swash zone of the sea to give an idea of its position, but heights above mean sea level are only an approximation.

RESULTS

Six clusters were identified, each equating to a community type (see Fig. 3).

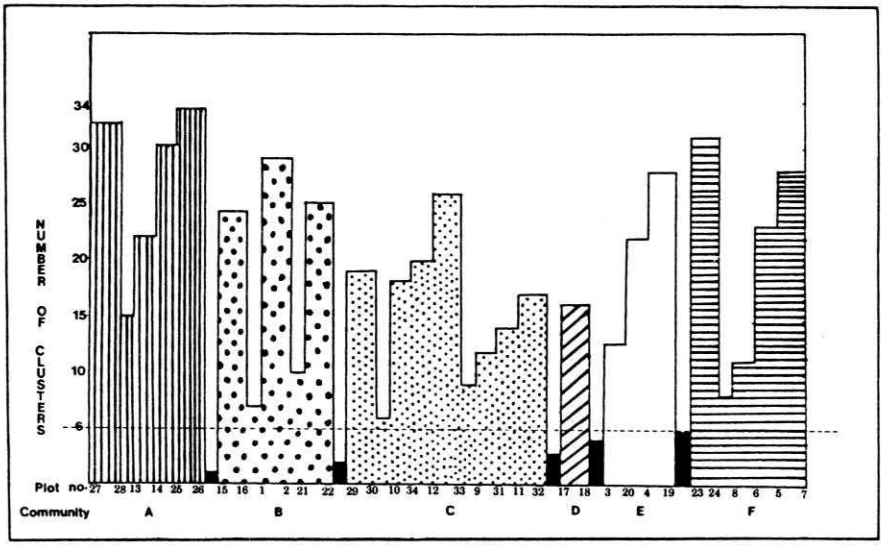

Fig. 3. From the cluster analysis. The data has been ordinated into groupings based on similarities. The dotted line represents the 'cut-off' point — i.e. the level of six clusters, giving six community types. This cut-off point was relatively arbitrary, with field observations being used to help decide its position.

Description of Community Types:

Community A — Large sandy areas.

Over half of the area of the plots was bare ground. Spinifex was the

most common species, with lupin (especially seedlings). The sand convolvulus (*Calystegia soldanella*) was present on the most seaward portion of the dunes. Pingao was found in an area of exposed sand in the middle of the second transect.

This community type was quite homogeneous and was characteristic of areas of unstabilised sand. It was found on dunes nearest to the beach and in the exposed area mentioned above.

Community B — *Muehlenbeckia /Scirpus nodosus*

This was a fairly heterogeneous community type (see Fig. 3). *Muehlenbeckia* and *Scirpus* were co-dominants, with the parasitic plant *Cassytha pubescens* prevalent in plots 15 and 16, and *Leptocarpus similis* in plot 22. Other plants (e.g. sand convolvulus, *Coprosma acerosa, Deyeuxia billardieri, Scirpus* and *Crepis* sp.) were present in smaller amounts.

This community type tended to be found in areas of dune that were well established, near the base of the hill.

Community C — Tauhinu Scrubland

Tauhinu, lupin, *Coprosma,* spinifex and *Scirpus* were the 5 major species, present in most plots in varying abundance.

This community type was the most common, and was typical of the large, relatively flat area immediately behind the foremost dunes.

Community D — *Cassytha* Dominated

Cassytha dominated, with high incidence of fathen (*Conyza albida*), lupin, sand convolvulus, and bracken (*Pteridium aquilinum* var *esculentum*), the latter being relatively clumped in distribution.,

This community was found in a small area on Transect 2, close to community B, in a well established dune area.

Community E — *Muehlenbeckia* Dominant

Mainly *Muehlenbeckia,* with native spinach (*Tetragonia trigyna*), lupin, fathen and sand convolvus notable in varying amounts.

This community was found on both transects, near the base of the hill, in stabilized areas.

Community F — Lupin Dominant

Lupin dominated although *Muehlenbeckia* was also very common, along with *Solanum americanum.* These plots had significant areas of bare ground. Fathen and spinifex were also quite common.

Present in relatively unstable areas, e.g. flanking the area of exposed sand in Transect 2, and near the base of the hill.

Zonation patterns

The community types tended to form 4 distinct zones, parallel to the coast. These zones were decided upon according to how well established the vegetation was, and on position between the hills and the seaward dunes (see Fig. 2).

Zone one

This zone occurred near the base of the hill and consisted of Communities B, D and E. *Muehlenbeckia* was common throughout the zone, on transect 2 being largely covered (and parasitised) by *Cassytha* along with other plants close to the hill.

Plots 3 and 4 on transect 1, and 19 and 20 on transect 2 (Community E) were in a dune slack. In this low lying area there was a patchy belt of *Leptocarpus* with some *Carex pumila.*

This appeared to be slightly wetter than adjacent areas, and would retain moisture during the hottest part of the year (Mitchell 1980), as well as probably flooding during periods of heavy rainfall.

Pine (*Pinus radiata*) trees were seen scattered in this zone, but these were quite large trees, and there was little evidence of recent pine invasion. Some flax plants (*Phormium tenax*) were seen at the base of the hill, and several large toetoe *(Cortaderia splendens)* were noted, mainly in zones 1 and 2.

Zone two

This consisted solely of community F (lupin dominated). Hayward described this zone in 1978 as being unvegetated dune (Hayward 1980), but by 1984, aerial photographs show it to be largely colonized.

Between zones two and three, on transect 2 there was an area of open sand, with patchy colonization by pingao and spinifex (Community A), the latter with a high incidence of lupin seedlings under it.

Zone three

This was the widest of the four zones (approximately 80m and 60m on transects 1 and 2, respectively) covering an elevated and relatively flat area immediately behind the foredunes (see Fig. 4). It consisted of Community C, which was characterised by well established tauhinu scrubland.

Zone four

This zone covered the foredunes. It was mainly uncompacted sand, with vegetation in low abundance but with spinifex being the most prevalent. This zone was comprised of Community A.

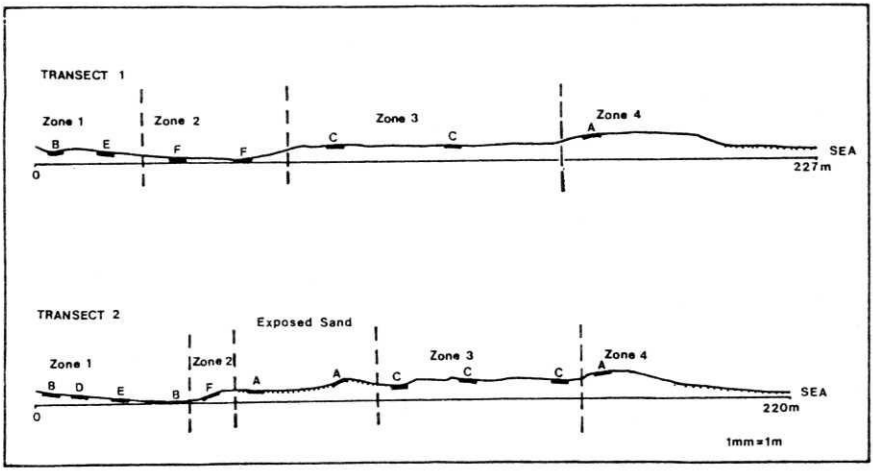

Fig. 4. Profiles along the 2 transects, using a 'Shikosa' dumpy level. Zone 1 appears to be of a generally seaward facing aspect, whereas zone 2 is generally landward facing. Zone 3 can be seen as wide, flat and elevated. Zone 4 occupies the raised, rounded area of the foredunes.

DISCUSSION

Of the four zones outlined above, Zones 1 and 3 would have been established the longest, colonization taking place probably around the 1950s. Aerial photographs taken about this time show a thin strip of uncolonized sand along the base of the hill, which is possibly a continuation of the advancing dune face mentioned by Hayward (1980).However, the vegetation observed was quite well established with the *Muehlenbeckia* of Community E known to be indicative of well established areas (Esler 1974). The vegetation appeared to be facilitating the build up of a thin but moist humus layer, which supported a dense bryophyte cover including *Ptychomnion sciculare* and *Thuidium furfurosum*.

Hayward (1980) states that ". . . a patch of vegetation began to establish itself across the middle and seaward side of the dune . . ." during the 1950s. This is interpreted as corresponding to Zone 3. This same area was shown to be *Scirpus* dominated in 1978 (Hayward 1980). In our study, a small amount of *Scirpus* was present in Zone 3, although the area was dominated by tauhinu.

The vegetation in Zone 2 has been established for a maximum of 6 years (Hayward 1980) — see Fig. 1.3. Lupin is the dominant species in this zone, and probably played a major role in early colonization of bare dune. The nitrogen fixing abilities of lupin facilitates soil formation along with its shrubby habit, i.e. large amounts of leaf litter and a dense

root system.

The area of exposed sand between Zones 2 and 3 on transect 2 seems be all that is left of the 1978 unvegetated area, now colonized b Community F, i.e. lupin dominated. Alternatively the area could hav been previously vegetated but suffered wind erosion to form an area o blowout.

The vegetation in Zone 4 represents the earliest stages of colonizatio — with species able to withstand harsh conditions, i.e. salt and win erosion. Spinifex plays a major role in stabilising the dunes, with it downward growing rhizomes accumulating sand at the base of the plan (Esler 1978).

Esler has described the stabilisation of hind dunes as being a moder feature, occurring since the arrival of adventive species e.g. marran grass (*Ammophila arenaria*) and lupin (Esler 1978).

CONCLUSIONS

The area studied shows a well established sequence, perhaps characterised by early colonization by pingao, spinifex and sand convolvulus with lupin coming in slightly later. As the sand became more stable, other plants (e.g. tauhinu, *Muehlenbeckia, Scirpus*) would start to become prevalent.

It is hard to say where this succession will eventually lead. Perhaps in a completely natural environment (i.e. with no adventive plants) the sequence would stay much longer in the pingao, spinifex stage — but the presence of lupin means that a good soil cover is built up more quickly.

The conclusions arrived at were drawn from limited data, and more studies could profitably be done in this area.

ACKNOWLEDGEMENTS

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APPENDIX. Raw data, showing species % cover class/plot

Species	Plot																															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
Aristea ecklonii				1																														
Calystegia soldanella	2	2	2	1	1	1			1		2	2	2	2	1	1	3	3	2	3	1	1	3	2										
Carex pumila																				2	3		1											
Cassinia leptophylla									4	3	5	3						2											2	2	4	5	3	
Cassytha pubescens															4	6	5	3																
Conyza albida			2	3	2	1	2		1	1	2	2					3	4	3	3	1		3	3				1	2	3	2	2	2	2
Coprosma acerosa	2	2							4	4	2	2			2														3	4	3	3		3
Cortaderia splendens								3											2											1	3			
Crepis sp	1	2	2	1	1	2	1	1	1	1	1	1				1	2	2	1	2	1	2	1						4			1	2	2
Cyathodes fasciculata																					1													
Desmoschoenus spiralis									4																		3	3						
Deyeuxia billardieri	1	1				1			2	2	1					1				2	1	1									2	2		
Geniostoma ligustrifolium																					1													
Lactuca virosa																1																		
Leptocarpus similis																					3	5												
Lupinus arboreus		1	2	3	6	5	3	3	3	3	3	3	3				2	3	3	3			5	6					5	4	2	1	3	3
Muehlenbeckia complexa	4	6	5	6	2	5	3	3	2	2	2	1			5	4		1	5	6	3	3	2	2							2	2	1	
Phormium tenax																1																		
Scirpus nodosus	5	4							2	2	4	3			4	4		1		1	5	3							2		3	3	3
Senecio hispidulus					1	1																							1					
Solanum americanum			2		4	3	4	3	2	2	2	2					1							1							2	2	2	2
Spinifex hirsutus				4				4		4	2	5	3	3									3	3	3	2	1	2			2	2	5	5
Tetragonia trigyna			3	2	2	1	2	2		2									3	3														
Trifolium dubium		1																																
Wahlenbergia marginata																	1	1																
Bare ground					3	3	3	3	2	1		1	5	6			2	2						1	6	6	6	5	4	3	2	4	2	2
Pteridium aquilinum var *esculentum*																2		4																
Bryophytes	3	2	2	1		1					1						1	2	1															

% cover classes: 1=<1%; 2=1-5%; 3=5-25%; 4=25-50%; 5=50-75%; 6=75-100%