Simply sand?
Ocean Beach dunes, Hawkes Bay

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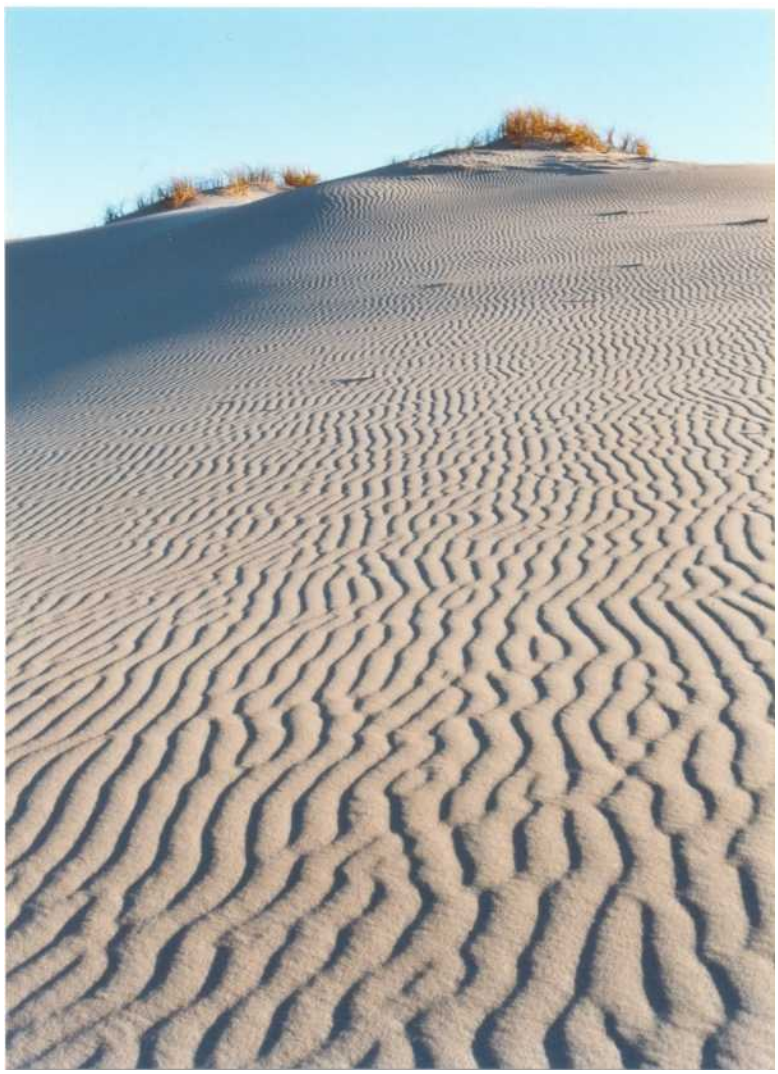

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Summary

Ocean Beach is a large important Hawkes Bay sand dune system, lived on by people for centuries and traditional home of native sandbinding vegetation and the small animals it shelters. Of note are pingao (*Desmoschoenus spiralis*), prized for its golden leaves and symbolic of the tension between land and sea, of Tane Mahuta and Tangaroa, and its companion the silvery spinifex (*Spinifex sericeus*). This research set out to discover how the dune vegetation was changing over time, what were the agents of change, what was the impact of browsing mammals and human recreationists, and what was causing the decline of pingao.

The results of eight years of study (1989-97), centred around exclosure plots, show that the vegetation cover increased overall, due to weed invasion and lessened browsing pressure. Marram grass *(Ammophila arenaria)* is a serious weed of the more mobile dunes, squeezing out native plants by competition and stabilising the sand so that it is unsuitable for pingao and spinifex. Self-sown pines and pampas grass *(Cortaderia selloana)* are major threats to the more stable rear dunes and dune hollows. Pasture grasses and herbs are colonising relatively stable sites, to the detriment of pingao. Adult pingao naturally dies back once it stabilises a site, but sends new growth out into fresh sand. Pingao seedlings need moist open hollows to establish, and are vulnerable to being buried or undermined by shifting sand. Their greatest threat though, comes from rabbits, which eat them avidly, thereby preventing genetic evolution in the system. Spinifex is highly adapted to life in dynamic sand, and is capable of elongating more than five metres in a single year. Pingao and spinifex can readily coexist, but both get flung back when they grow down too close to the sea. Cattle are highly damaging to dune vegetation, especially pingao. Sheep, horses and feral goats have lesser though still significant impacts. Possums and hares, though present, have little impact on the dune vegetation. Off-road vehicles, especially quads and trail bikes, are particularly damaging to dune faces.

It is recommended that conservation management begin as soon as possible at Ocean Beach, to halt the decline of the natural and cultural features of the dunes. A healthy partnership between the land custodians - Haupouri Station Trust and the Department of Conservation - is necessary. So is consultation with the other key people and organisations involved. Essential for successful conservation are legal protection of the dunes, fencing, pest control, ecological monitoring and public education. It is suggested that a steering group be set up to guide these tasks.

1. Introduction

Ocean Beach is a great wild sweep of sand just south of Cape Kidnappers (Figure 1). In conservation terms - size, diversity and naturalness - it is the best remaining dune system on the eastern North Island between East Cape

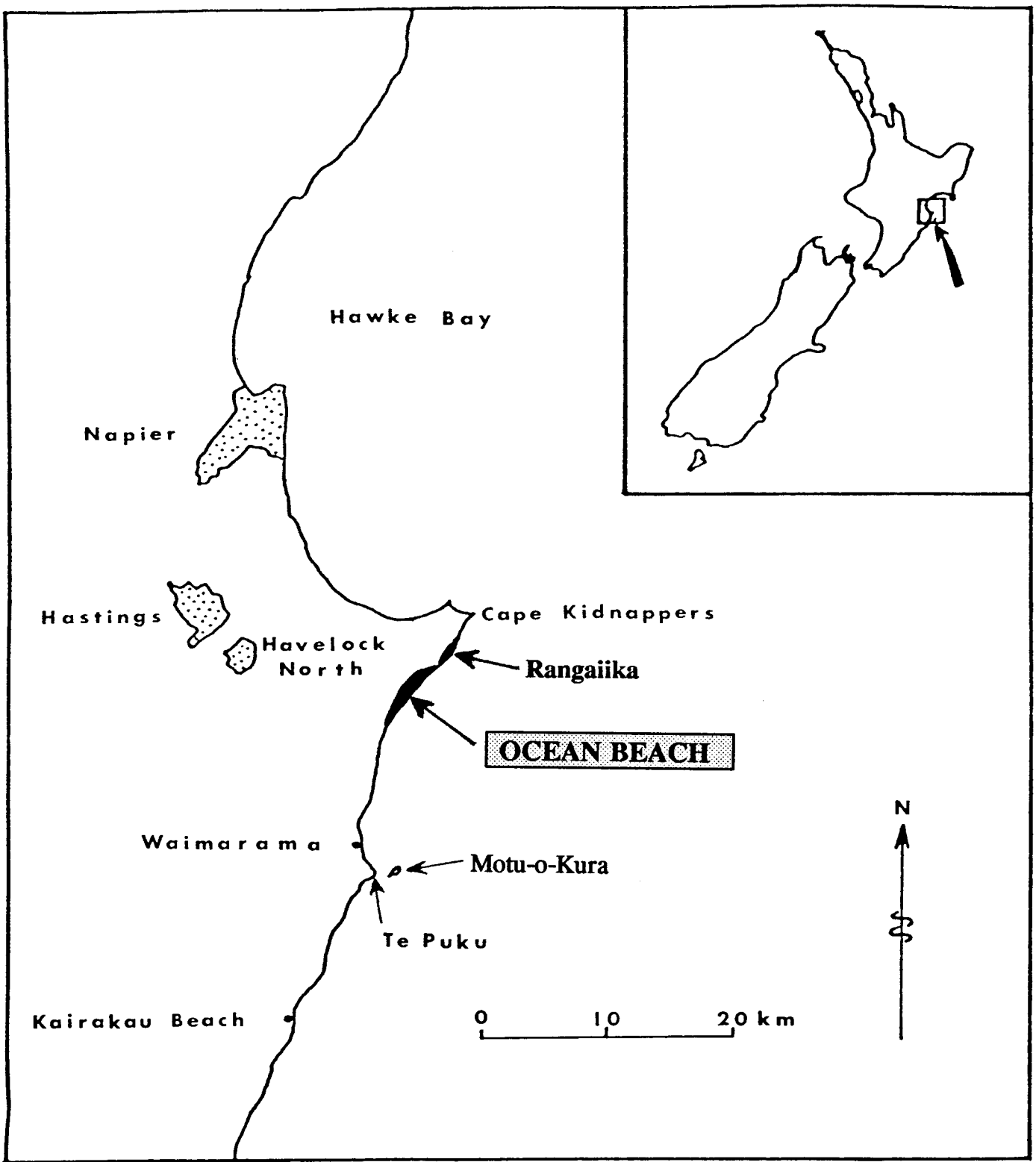


Figure 1. Location map, Ocean Beach, Hawkes Bay.

and Wellington. Nevertheless, it has been severely degraded by farming practices, introduced animals, weeds and off-road vehicles. The degrading influences are mostly still there, despite one of the custodians being the Department of Conservation (the other is Haupouri Station Trust, a traditional Hawkes Bay commercial farming venture).

For me, Ocean Beach is a place of inspiration, insight, peace and delight, but also of great despair. I came to Hawkes Bay in the hope of being able to help protect the natural and cultural features it possessed in abundance. Thirteen years on, despite much survey, research, reporting and negotiation with the landowners, tragically little conservation progress has been made. This report is an account of my connection with Ocean Beach as an ecologist. It tells much of the details of my research there. It tells little of my exploration of its contours and seasons over the years, or of the depth of my feelings for its spirit: that requires a more artistic forum than this.

Ocean Beach takes the form of a long gentle curve, pregnant with billowing dunes (Figures 2 & 23). The dunes are backed by a coastal flat behind which is a spine of steep hills containing a scattering of trees of titoki *(Alectryon excelsus)*, karaka *(Corynocarpus laevigatus)*, ngaio *(Myoporum laetum)* and ti kouka (cabbage tree, *Cordyline australis*), echoes of the former lush coastal forests. The dunes are the natural home of our two native sandbinding plants, the silvery spinifex *(Spinifex sericeus)* and the golden pingao (nga tukemata o Tane, *Desmoschoenus spiralis*). Both grow on the most mobile seaward clunes, but are under threat from competition with the introduced marram grass *(Ammophila arenaria)* and from browsing and vehicle damage.

The rear dunes are quite stable and are vegetated in a low cover made up of varying proportions of spinifex, *Coprosma acerosa*, hare's tail *(Lagurus ovatus)*, knobby clubrush *(Isolepis nodosa)*, tauhinu *(Cassinia leptophylla)*, bracken *(Pteridium esculentuin)* and exotic pasture grasses and herbs. There are clumps of blackberry (*Rubus fruticosus* agg.) and scatterings of self-sown pines in places (Figure 38). In the mid section of the dune system the dune hollows are quite damp, even in high summer, and there are small wetlands of jointed rush *(Leptocarpus similis)* and ever-increasing expanses of pampas grass *(Cortaderia selloana)*. In the past, the rear dunes were probably clothed in low windswept forests made up of totara *(Podocarpus totara)*, ngaio, ti kouka, kanuka *(Kunzea ericoides)*, manuka *(Leptospermum scoparium)* and various tree and shrub daisies. Karaka would have arrived with the first settlers.

The Ocean Beach dunes are home to many animals. Most go unseen because they are small or come out at night. Most conspicuous are the farm animals - cattle, sheep, horses and dogs - that are there from time to time. Less so are rabbits, hares, possums, hedgehogs, rats, mice, stoats, ferrets, weasels and feral cats. All these smaller introduced pests hide in the vegetation cover at the rear of the dunes and operate on the wider dune area when humans are not in evidence. They are responsible for preventing blue penguins from using the dunes. So are dogs: I have found penguins killed in the dunes by dogs. Without these predators, penguins would be plentiful and would breed there. So too would small petrels such as diving petrels and storm petrels. The only evidence I ever found of them was a single burrow in the northern dunes that

could have been made by a diving petrel. I once found a crash-landed giant petrel in a dune hollow, and a gannet and a fairy prion on other occasions.

Other birds I have recorded in the dunes include southern skua, black-backed gull, red-billed gull, white-fronted tern, white-faced heron, pied stilt, spur-winged plover, paradise shelduck, welcome swallow, pipit, banded dotterel, skylark (including one albino), yellowhammer, greenfinch, goldfinch, chaffinch, redpoll, starling, silvereye, magpie, blackbird, songthrush, dunnock, house sparrow, pheasant, California quail, pukeko, black shag, variable oystercatcher and kahu (Australasian harrier).

Lizards should be abundant in the dunes, but for the predators. I have seen only common skinks *(Leiolopisma nigriplantare polychroma)*, and no geckos. There is certainly enough invertebrate life to sustain lizards. It includes native sand specialists such as the big sand scarab, whose tracks can be seen meandering over the exposed sand on calm mornings, and whose great grubs fatten beneath driftwood logs. It also includes the endemic katipo spider, black earwig, darkling beetles, ground beetles and carabid beetles, and a wealth of native and introduced sandhoppers, woodlice, centipedes, millipedes, bugs, moths, small butterflies, spiders, mites and springtails. Most surprising perhaps is the abundance of garden snails, their shells much thicker than in the domestic situation, and many little snails.

This study focused on the vegetation and the sand, guided by the ecological presumption that, in general, what happened to them had direct implications for the animals, especially the specialist native fauna.

Ocean Beach is one of the highest ranking RAPs (Recommended Areas for Protection) in the wider Hawkes Bay region, and is enshrined as such in the Department of Conservation's PNAP (Protected Natural Areas Programme). The PNAP survey document highlighting Ocean Beach has been published (Maxwell et al. 1993). The beach system is also recognised for its natural and cultural attributes in the draft Hastings District Plan and in the draft Hawkes Bay Regional Coastal Plan.

People have lived on the Ocean Beach dune system and its hinterland for many centuries - it is one of the most important archaeological landscapes in New Zealand. I have taken several archaeologists there, and together we have traced many clues to the people who lived and died there in the past. People flock to the beach still, especially in summer. Their presence is both a blessing and a threat: on the one hand they value it as a wild coastal place, on the other they wish to ride their destructive off-road vehicles all over it, unaware of its fragility, and help create the push to exploit and "develop" the area.

In 1984, even before I had been appointed DSIR (Department of Scientific and Industrial Research) Regional Botanist to Hawkes Bay-East Coast, I was first made aware of the conservation values of the Ocean Beach dunes, and the threats to them. Jody Stent wrote to DSIR headquarters in Christchurch on behalf of Otatara Roopu Raranga, a group of Hawkes Bay artists and traditional Maori weavers. Her plea was for DSIR to investigate the plight of the pingao, so beloved of the weavers for its rich natural gold and its coastal symbolism, at Ocean Beach. This study is born out of that plea.

2. History of research and conservation

What follows next is a potted history of the study and the attempts at protection that I have undertaken over the years.

1985: As soon as I reached Hawkes Bay, as DSIR Regional Botanist, I went to see Jody and the other weavers, then headed out to Ocean Beach for a look. It was obvious to me as an ecologist that the pingao, although relatively common, was under threat. It was being eaten by cattle, goats, sheep, horses, rabbits, possums and hares. It was being invaded by marram grass.

I discussed the situation with other ecologists, DSIR managers and the weavers. We resolved that something needed to be done if the wild dunes and the pingao were to survive. I developed a working relationship with the Haupouri Station manager, who seemed interested and sympathetic. I began research on the issues surrounding the concept of protection.

1986-87: Working with Haupouri Station staff, I got them to reconsider their management practice of wintering cattle on the dunes. Sheep and horses were kept off the dunes more actively, too, and the numerous feral goats were cleaned out.

I visited the dunes regularly, in an effort to get to know them and their ecology better. I learned that wind and sea were shifting the sand constantly, often huge quantities in a short time, and that whilst spinifex and pingao could go with this flow, the marram grass acted to stifle it, with abrupt disruptive results.

I saw whole dunes blow away and others form. I saw hollows fill with water and become wetlands, only to dry again and disappear. I saw weeds on the move. I found evidence of predation on sea birds, and found others grounded by storms. I witnessed the mindless trashing of the dunes at the hands of off-road vehicle joyriders.

I learnt also the degree of archaeological richness of both the dunes and their hinterland. Even when I had the place to myself, I always felt the presence of those who had lived there, with the elements and the seasons, the fauna and flora, for so long.

Jody and I negotiated with the Haupouri Station manager for an area where we could fence off the dunes to protect the pingao from stock and vehicles. We began putting the case together to seek funding.

1988: I continued observing the dune system and the pingao. Nothing I saw made me feel easy about the long-term future of the dunes and the pingao. I began to suspect the lack of recruitment of pingao seedlings

was critical and that rabbits were the major culprit, and designed an exclosure study to test this.

Negotiations with Haupouri Station continued, and with their blessing Jody and I submitted an application to Lottery Grants Board for funding to fence off the northern section of the dunes (roughly 15% of their area).

1989: The Lottery Grants Board application was successful. However, Haupouri Station Trust members, with no warning, quashed the fencing initiative. The reasons for that decision still aren't totally clear, but relate to issues of access, control and partnership.

I was permitted to extend the study, though, and set up a series of exclosures, vegetation plots and photopoints to examine the impacts of different browsing animals, vehicles, weeds and sand flow on pingao, spinifex and other native dune plants. This study continued to October 1997, with regular inspections, exclosure maintenance and analysis of data, as an official Department of Conservation research project, funded by Science and Research Division and supported by the Conservancy. It is described in detail in the following sections of the report.

1990-96: With my transfer from the DSIR to the Department of Conservation in 1990, the prospects for protection of the Ocean Beach dunes looked brighter than before. This was because it brought the research into the agency that:

(a) had management responsibility for the Crown coastal strip of the dunes;

(b) had a public conservation advocacy role in the region, of which Ocean Beach is the prime dune and beach system;

(c) had a working relationship with the landowners of the area over a whole range of issues;

(d) had responsibility for the Protected Natural Areas Programme (PNAP) which sought to identify and help conserve the best remaining natural areas in the region;

(e) had responsibility for archaeological and historical resource protection issues;

(f) had practical knowledge and resources for fencing, revegetation, weed control and animal pest control;

(g) had a working partnership with local Maori over cultural materials, their use and conservation;

(h) had responsibility for protection of threatened flora and fauna;

(i) had working partnerships with the local authorities.

In 1992 the Department of Conservation carried out a PNAP survey of the Eastern Hawkes Bay Ecological Region, in which Ocean Beach lies. It identified the Ocean Beach dune system as of highest priority for protection, because of its wealth of natural and historic attributes. The report from this survey was published and distributed widely (Maxwell et al. 1993).

Several meetings were held during this time between key members of the Department of Conservation and Haupouri Station/Haupouri StationTrust. There was also an interchange of letters and phone consultations. All of these gave the appearance of progress towards a close partnership between the Department of Conservation and Haupouri Station Trust, in which virtually the whole dune system would be set aside for protection.

It seemed as though the interests and aims of the two parties came together neatly, and that what would serve the station best for farming would also serve conservation well.

What was verbally agreed included:

- The majority of the dune system would be protected, fenced on the inside to exclude domestic stock; this would be a joint Department of Conservation/Haupouri effort, as would fence maintenance.

- The Department of Conservation would contribute to planting of trees (native preferably, but possibly also exotics) at the rear of the dunes, to prevent sand encroachment on to the farmed flats.

- The Department of Conservation would ensure continuation of pingao on the dunes, by weeding, animal control and planting where necessary; it would have a monitoring system in place for indicating when such work was necessary.

- The Department of Conservation, in conjunction with Haupouri Station, Hawkes Bay Regional Council and Hastings District Council, would put a campaign of public education in place to heighten awareness of the value of the dunes and to gain support for their conservation and wise use.

To date - February 1998 - none of this has happened.

Meanwhile, the dune study progressed to the stage where the finger could be pointed at the chief threats to the duneland ecosystem and the pingao:

- weeds: marram grass and pampas grass (the worst); self-sown pines, self-sown willows and blackberry (lesser problems);

- rabbits (the worst browser), possums and hares (relatively minor impact);

- straying domestic stock, especially cattle;
- off-road vehicles (especially damaging to archaeological sites and dune faces).

All of these threats could be managed relatively easily.

1997: Restructuring of the Department of Conservation axed a number of positions based in Napier, including that of Advisory Scientist. As a result, I wound up the duneland study, the final field measurements being made in late July-early August. A visit was then made with Alan Lee of the Ahuriri Field Centre to ensure the exclosure site would continue to be used by the Department of Conservation for monitoring the condition and trend of the dune vegetation.

At the time of the field measurement, I had a long conversation with Warwick Hansen, Haupouri Station Manager. He expressed the opinion that he and the Trust wished to wait for the final Hastings District Plan and Hawkes Bay Regional Coastal Plan to appear before proceeding with any duneland protection. Encouragingly, by the time of the visit with Alan Lee, Warwick seemed open to continued dialogue with the Department of Conservation.

Otatara Roopu Raranga has remained in the background as an interested and supportive observer. It has kept its resources potentially available for protection of the dunes, but cannot be expected to do so forever.

3. Study design and methods

The study of the Ocean Beach dune dynamics was undertaken to address some basic questions:

1. How was the vegetation on the mobile dunes changing?
2. What were the agents of vegetation change?
3. What was the impact of browsing mammals and human recreationists?
4. Was the pingao dying, and if so, why?

The field work was founded on the hypothesis that most of the vegetation changes were not natural, but the result of impacts by browsing mammals, machines and weed competition. Accordingly, three fixed plots or quadrats were designed and established in winter 1989. One of these (Plot 1) was a paired exclosure set-up; the others (Plots 2 and 3) were simply defined by pegs in the ground. The plot locations are illustrated in Figure 2, design of Plot 1 in Figure 3, and typical monitoring sheet in Figure 4.

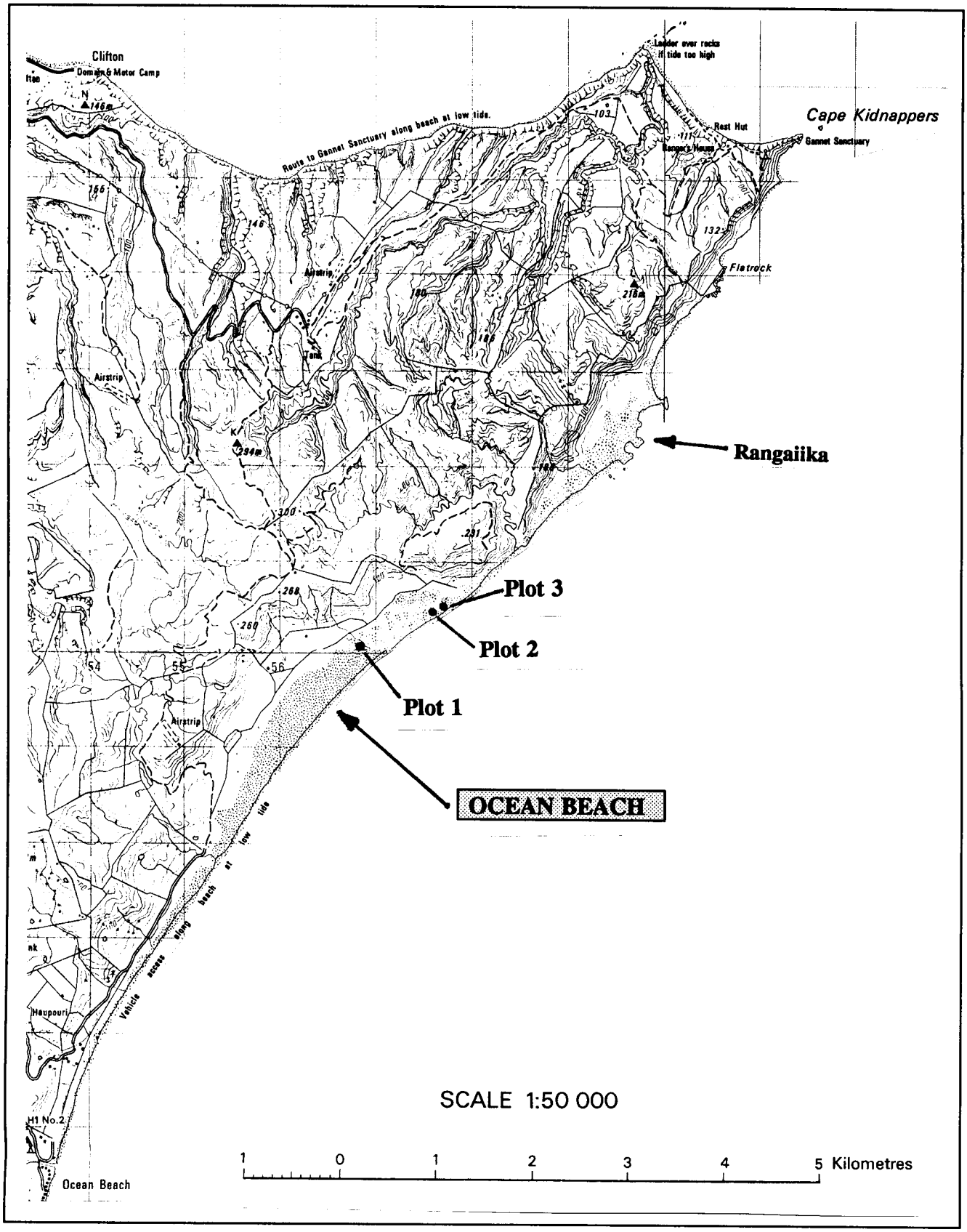


Figure 2. Location of study sites, Ocean Beach.

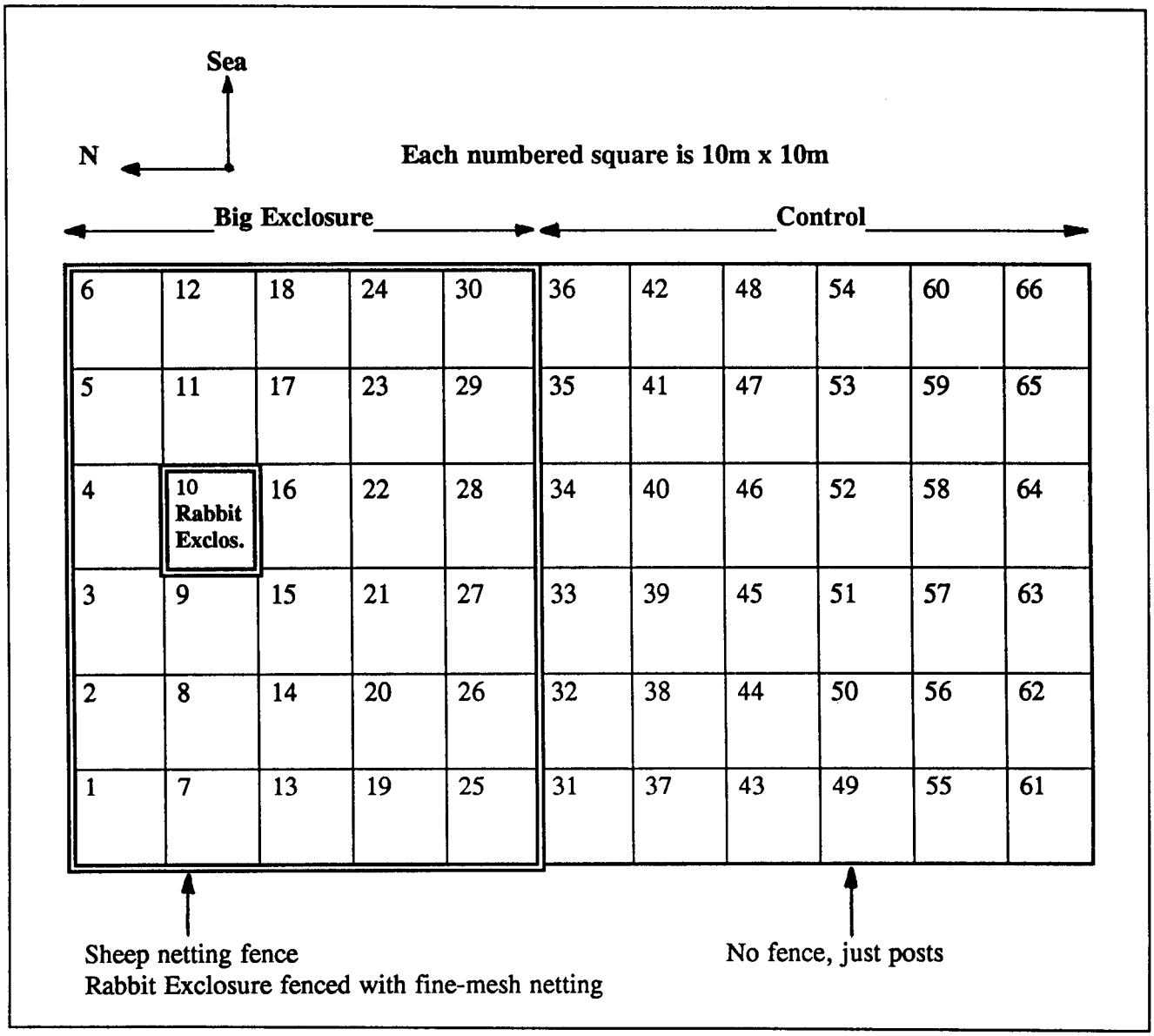
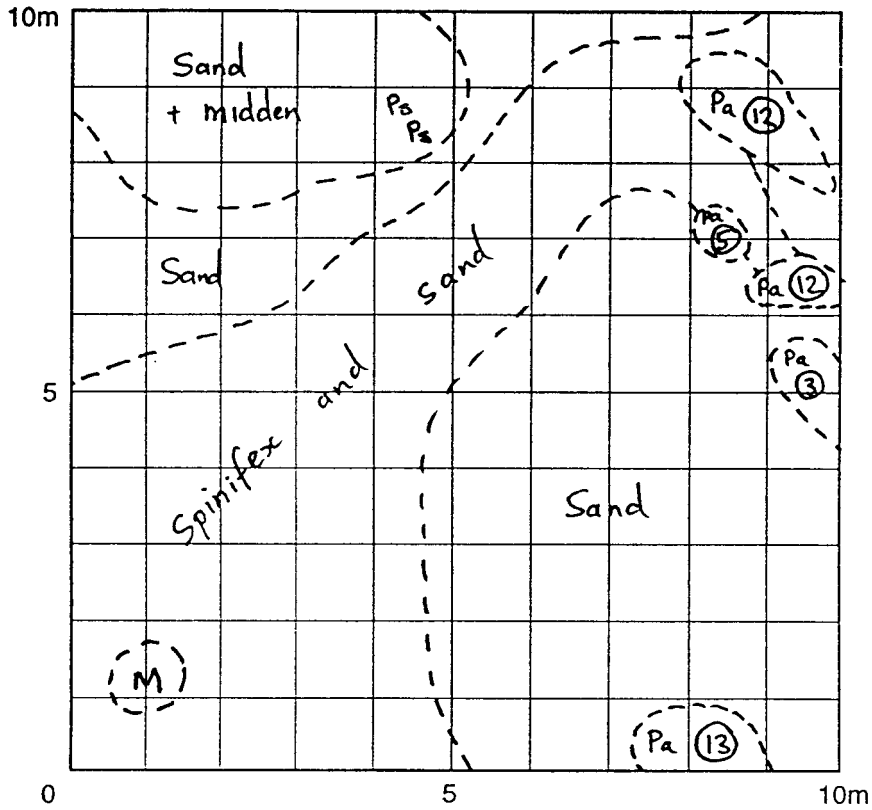


Figure 3. Design and layout of Plot 1, Ocean Beach.

Square No: (9) Date: 19/10/92



	% cover	No's	Height	Comments
Pingao - adult (Pa), healthy	3	45	25-50cm	Dying back in places, expanding in others
- adult (Pa), dying	<1	5		
- adult (Pa), dead	—	—		
- seedlings (Ps), established	—	—		
- seedlings (Ps), new	—	2	<5cm	Tiny seedlings
Spinifex (S)	c.15			
Marram (M)	1-2			Expanding via runners
Carex pumila (Cp)	—			
Coprosma acerosa (Ca)	✓			One seedling
Other vegetation	✓			A few small King Island melilots and 1 evening primrose
Substrate	Sand c.80 Midden 3-5			Some rabbit scratches in midden area

Figure 4. Example of field sheet used for plot monitoring.

PLOT 1

Plot 1 (Figures 3, 28, 30, 33 & 35) was by far the biggest and most complex of the plots, and as such constituted the heart of the study. Its location was chosen because of the relatively high number of pingao seedlings on that part of the dune system, the presence of adult pingao, spinifex and marram grass in reasonable quantities, and the combination of building and deflating dunes.

A large exclosure (60 m x 50 m in size) was built to keep out domestic cattle, sheep and horses, feral goats and off-road vehicles. It was constructed of tanalised pine posts and sheep netting, and with regular maintenance proved effective for the duration of the study. Because of my desire to study complexity, as well as the impossibility of finding a homogeneous site, the adjacent control (non-treatment) plot ended up at 60 m x 60 m in dimension. Within the big exclosure a smaller rabbit exclosure, 10 m x 10 m in size, was built using small-mesh galvanised netting dug at least 30 cm into the sand. It was necessary to renew the rabbit netting twice because of rust. A couple of cages, 2 m x 1 m in ground area and covered in the same small-mesh netting, were installed as well, to prevent possums getting to pingao seedlings. One stayed in place inside the rabbit exclosure, whilst the other was moved about from time to time to cover groups of tiny ephemeral seedlings.

PLOT 2

Plot 2 was 1 km to the north-east of Plot 1. Unlike Plot 1, which was representative of vast areas of the mobile dunes, it was chosen to follow a very unusual circumstance. At this site, a broad flat backed by large mobile dunes, adult pingao was growing where there was no sand movement and plenty of other vegetation: in fact the sand substrate was totally covered in vegetation (apart from pingao, mainly *Carex pumila*, knobby clubrush and pasture grasses and herbs).

The plot was simply a 10 m x 10 m square encompassing as much pingao as possible.

PLOT 3

The third plot was another representative one. Seventy metres to the north-east of Plot 2, it was right on the seaward face of a small foredune. There, a pingao plant cascaded down the sand among spinifex, occasionally reached by high seas. I put in the plot, a mere 5 m wide strip, out of curiosity, to watch the interplay of the sandbinders and the sea right where they met.

PHOTOPOINTS

A number of photopoints were set up. Most of these were centred on the plots, but a few were chosen elsewhere to illustrate other vegetation changes.

RECORDING METHODS

Detailed measurements of the plots and photopoints were done at the following times:

- late June-early July 1989
- mid June 1990
- late July-early August 1991
- mid October 1992
- mid-late December 1993
- late October 1995
- late July-early August 1997

On these occasions the plots were measured to a standard formula I devised. Plot 1 was gridded up into 10 m x 10 m squares, and each of the 66 squares was measured individually. Within each, the following were recorded:

adult pingao:	no. of live tufts; % cover
pingao seedlings:	no. alive; no. dead
spinifex:	% cover
marram grass:	% cover
Carex pumila:	% cover
Coprosma acerosa:	% cover
other vegetation:	% cover
substrate (sand, sediment, midden):	% cover of each.

Besides this, a sketch map of the vegetation of each square was made (Figure 4 is an example). Observations on ecological processes were noted.

For Plots 2 and 3, the same procedure was followed, with minor adaptations because of their different nature. The whole process of measuring the three plots took two long days each time.

Interested in the movement of sand, and aware that it drifted or deflated according to prevailing wind conditions, I marked posts in Plot 1 so that I could regularly record the sand levels on them. In the time period of the study (eight years) I measured the sand levels 23 times - almost every time I visited the plots to check the exclosures, do maintenance on them or measure them.

4. Results

4.1 PLOT 1

4.1.1 Vegetation cover

In both the big exclosure and the control, the overall vegetation cover steadily increased over time, by 83% and 68%, respectively (Figure 5). These trends are very similar, though the slightly greater proportional increase in the big exclosure may be due to the lack of browsing by big animals. By stark contrast, the vegetation cover in the rabbit exclosure skyrocketed, with a more than 20-fold increase. This superficially suggests that rabbits were responsible for a radical impact on the vegetation. I believe that is true, but that another influence was also responsible for the vegetation increase: that of sheltering provided by the close-mesh netting used to keep out the rabbits. I think that the mesh broke the wind just enough to make give extra stability within the exclosure, and this allowed the vegetation to grow more easily than outside. Without a replication to test the relative effects of these two influences, it is impossible to say which was the greater. With this exclosure evidence though, coupled with direct browsing observations, I am certain that rabbits are responsible for major impacts on the vegetation of the Ocean Beach dunes.

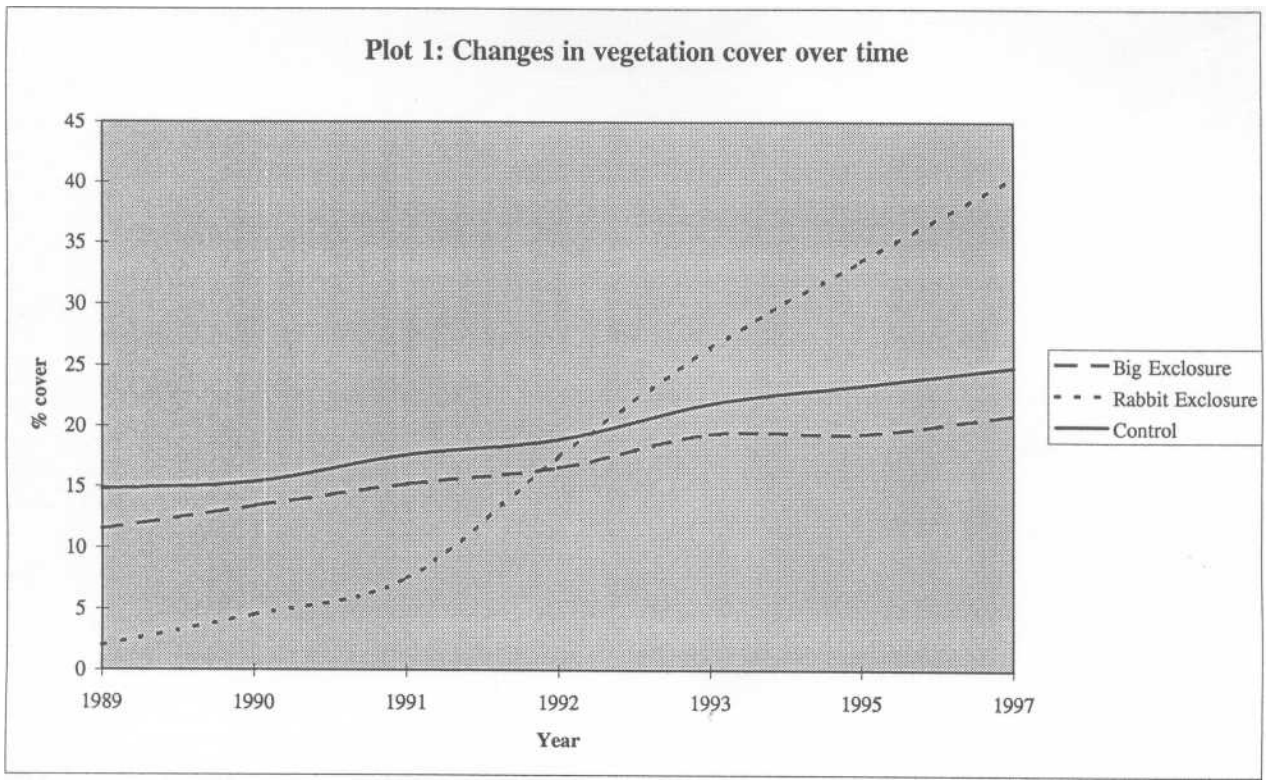


Figure 5. Overall changes in vegetation cover over time, Plot 1.

Figures 6-8 give a more detailed breakdown of the vegetation changes. They show that the changes within the big exclosure and the control (Figures 6 and 7) were very similar, and that most of the change was contributed by a large increase in marram grass (see Figure 33). The proportional increase was greater within the exclosure, suggesting that browsing by cattle and sheep

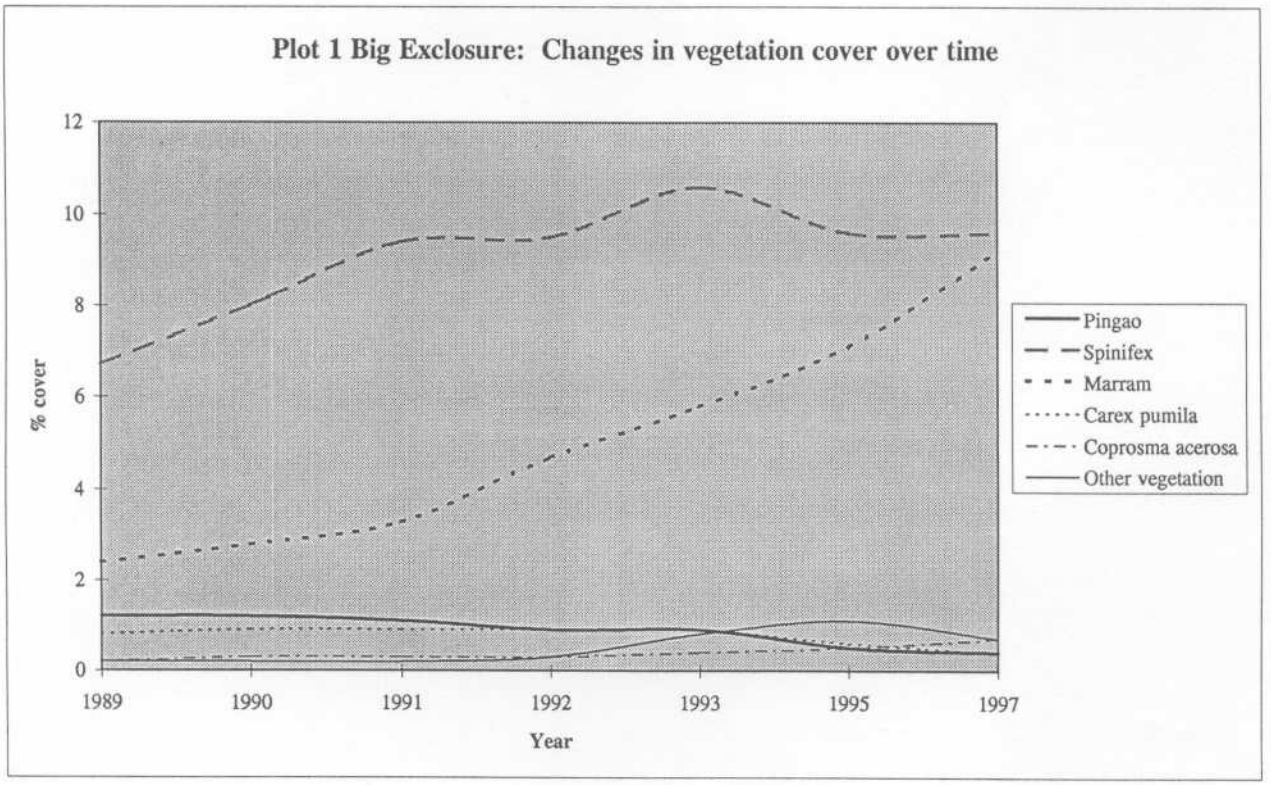


Figure 6. Changes in vegetation cover, big exclosure, Plot 1.

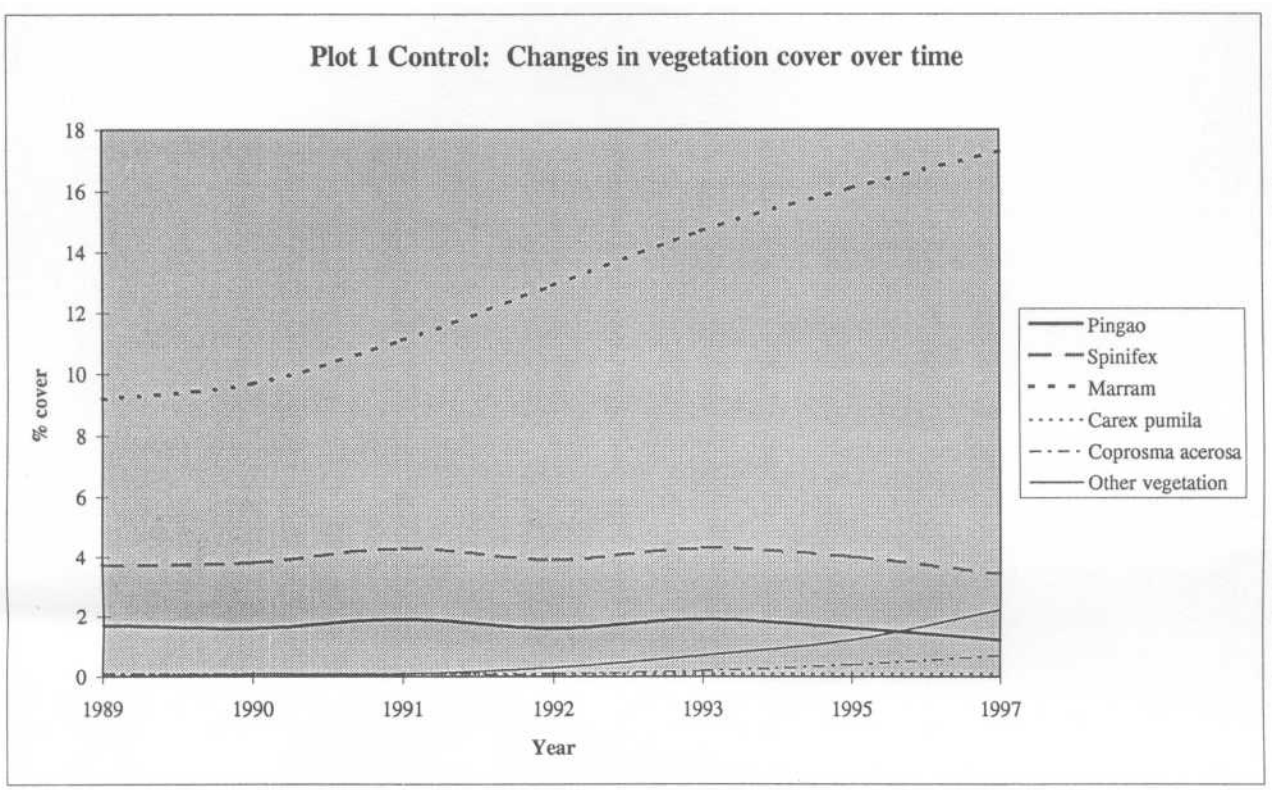


Figure 7. Changes in vegetation cover, control, Plot 1.

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