

Figure 22. Changes in vegetation cover over time, Plot 3.

On this site, no browsing by mammals was ever observed. The plot therefore simply bore witness to the great meeting between land and sea, between Tane Maliuta and Tangaroa. Pingao, nga tukemata o Tane (the eyebrows of Tane, plucked out and offered to the sea god as a gesture of peace) was flung back on the shore as in the beginning of time (Herbert and Oliphant 1991). So too was spinifex, that stalwart and unsurpassed guardian and healer of this country's coastal sands. They were kept firmly in their place.

5. Conclusions and management recommendations

The sand dunes of Ocean Beach are full of drama. The whole system has regional and national significance, and is worthy of a high level of protection. This contradicts the ranking assigned by Partridge (1992) in a national dune and beach inventory. Partridge rated Ocean Beach as Priority 2-3, based on skeletal information. Using his criteria, I rate it Priority 1-2, in other words among the finest in the country. Without protection, the remaining natural and cultural features of Ocean Beach will pass rapidly into oblivion. The following is a breakdown of my findings and their implications.

1. This research has shown a trend in all sites examined of increasing vegetation cover on the Ocean Beach dunes. Most of this was accounted for by a bulking up and spread of marram grass. It can be partly attrib-

uted to a lessening of browse impact from domestic stock and feral goats, somewhat offset by an increase in rabbit browse. It is unlikely to be the result of climatic change because the more settled conditions required haven't actually occurred. Mostly it is consistent with basic patterns of weed invasion.

2. The increase in weediness observed in the study sites is happening throughout the dune system. It is at the expense of native sand plants, particularly pingao and spinifex. Marram grass is the most serious weed of the dunes and must be controlled if the native sand plants are to persist. Its rate of spread is such that the situation is now urgent. Pampas grass and self-sown pines are also spreading fast and should be checked before their control is a massive task. Willows and blackberry constitute lesser problems. Boxthorn (*Lycium ferocissimum*) may become a future problem unless checked.
3. *Coprosma acerosa* was the only native plant to increase at the same time and place as marram. Its relative health, despite severe rabbit browsing, is because it is able to take advantage of the increased sand stability created by the marram. In the long term, it too is likely to be swamped by introduced vegetation. *Carex pumila* is a "bit player" in the dune drama, an opportunist without malice.
4. Cattle are particularly damaging to pingao, through browsing, ripping up of runners and trampling. They and sheep browse and graze most of the other dune plants. Their impact and dung contribute substantially to the replacement of the native vegetation by introduced species. The Ocean Beach dune system needs a stock-proof rear fence to protect it. This need is also urgent.
5. Rabbits are the single greatest animal threat to the native dune vegetation, mainly through browsing seedlings and adolescent plants. Their control is essential for the health of the sandbinders in particular.
6. Possums and hares, though resident at Ocean Beach, make only minor impacts on the vegetation. Feral goats used to be quite damaging until they were eliminated: should they make a comeback they will need to be controlled again.
7. Offroad vehicles, mostly quads and trail bikes, are highly destructive to native sandbinders on dune faces. Their use at Ocean Beach has increased over the years until they are becoming a major conservation problem there. The dune system is too valuable and fragile to be used as a playground for these machines. Education and vigilance will be required to diminish their use sufficiently.
8. Pingao, Tane Mahuta's eyebrows and treasured gold of the traditional artisans, is indeed on the decline at Ocean Beach, as feared. The study showed an initial slight increase in adult Pingao cover as the result of lessened browse pressure, but that was quickly overtaken by a steady decline due to weed competition. Marram grass was the most serious competitor on mobile dunes. Invading pasture grasses and herbs, and

possibly their accompanying pathogens, killed off the pingao on a stable dune flat. Adult pingao loses vigour and dies naturally once it gathers enough stable sand around itself. Left to its own devices it will grow out into new sand, but the availability of such opportunities is being curtailed by weeds, browsing and vehicle damage. Finally, browsing by rabbits of pingao seedlings - ephemeral at the best of times - almost totally prevents the recruitment of new pingao genetic combinations into the dune population.

9. Spinifex is the unsung hero of the dune system, as surely as marram is the villain. It quietly goes about its business of binding the sand, but not fettering it, from the sea-plucked foredunes to the more stable rear dunes. It is beautifully adapted to life on the dunes, casting its seed to be tumbled in the wind looking for new sites and sending its runners out into new sand at remarkable speed. Spinifex and pingao readily coexist. Marram and browsing animals are threats to spinifex at Ocean Beach. Lucy Moore wrote of marram as "probably the most important sand plant of all" (Moore & Adams 1963), extolling its virtues as a sand stabiliser. I think the most important sand plant is spinifex, and if we treasure the wild nature of dunes the marram has to go. I am sure that Lucy would agree, were she alive today and able to look at the scene 35 years on.
10. Nothing illustrates the dynamic spirit of the dune system as well as the sand itself. This research has shown that there are substantial sand movements in the Ocean Beach system, driven by the energy of the wind. Sand ebbs and flows with prevailing winds and storms. Change can be gradual or abrupt, unidirectional or contrary. The shapes of the dunes depend on the obstacles to sand flow and their history. This is all natural and the native sand binders are adapted to it. Dunes are inherently dynamic (Cowie 1963, Ogle 1997). Stopping the flow of sand with solid barriers or plants like marram grass is inconsistent with conservation.
11. My whimsical study of a situation where pingao and spinifex grew down to the sea confirmed that these plants are firmly terrestrial, rejected by the marine environment. Nevertheless these children of Tane Mahuta will continue to court Tangaroa endlessly, dependent on the continued supply of fresh sand, salt and plankton.
12. The native fauna of the Ocean Beach dunes is already hugely diminished by the changes wrought by human settlement. Even before Europeans arrived, the big birds, seals and most reptiles had gone. Their traces, including those of moa, kakapo, petrels and tuatara, have been found in the middens. Many more delicate creatures will have disappeared without trace. A few birds, skinks and invertebrates are all that remain. They will only survive with help. What is needed is making sure the wild dune habitat remains, and competitor and predator control to make the habitat safer. The first thing to start with is a detailed survey of the invertebrates and their likely threats.
13. Ocean Beach has a long human history. Much evidence of that has seeped into the sand and remains there. Only if the dunes are cher-

ished will that evidence be protected. Cattle, self-sown pines, off-road vehicles and human fossicking are the greatest threats to the archaeological integrity of the dunes at present.

14. Partnership is the key to successful conservation management of the Ocean Beach dunes. The most obvious partnership is that between the two land custodians, Haupouri Station Trust and the Department of Conservation. The other main participants are the tangata whenua, Otarara Roopu Raranga, the Hastings District Council and the Hawkes Bay Regional Council. At Rangaiika on Summerlee Station, immediately to the north, many of the dune issues are identical to those at Ocean Beach. I suggest that the two land custodians of the Ocean Beach dunes get their heads together soon and work out a conservation strategy. They then consult the other participants, and if necessary set up a steering or advisory group to guide and oversee management. Otherwise, the situation will drift and the deterioration of the dunes will continue instead of being reversed.
15. The tasks essential for conservation management to be a success at Ocean Beach are:
 - legal protection of the dunes;
 - fencing to exclude domestic stock;
 - weed control (marram grass, pines, pampas grass);
 - rabbit control;
 - predator control (rodents, mustelids, cats, hedgehogs);
 - ecological monitoring and survey (vegetation plots, photopoints, invertebrate and lizard assessment);
 - public education (dune ecology, fragility, threats, vehicle impact).
16. Simply sand? No way!

6. References

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To all, my sincere thanks.

8. Photographic appendix: (Figures 23-38)



Figure 23 Three elevated views of the Ocean Beach dune system, showing its billowing dunes, ephemeral wetlands in hollows and vegetation mosaic. Plot 1 is sited near the centre of each dune view.

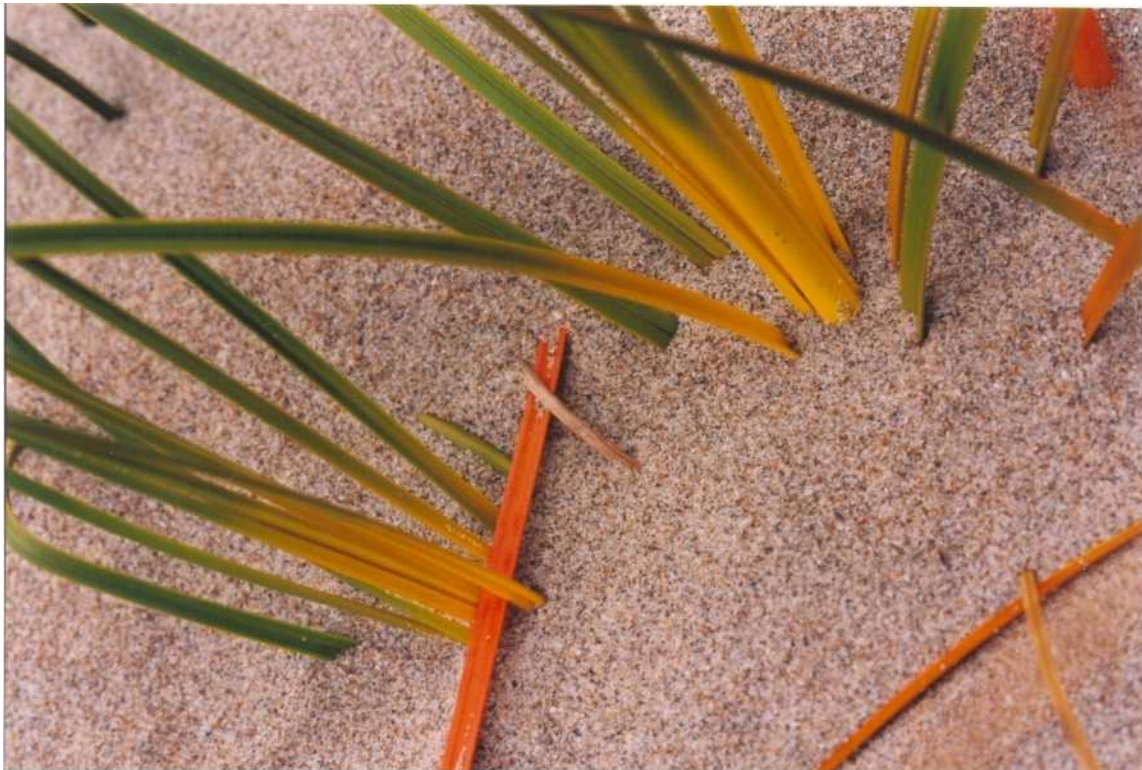


Figure 24 Top: pingao, nga tukemata o Tane, in seed on the Ocean Beach dunes. Bottom: winter colours of pingao.