

# Process-based approach needed to dune and beach management

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During the 1990s, several environmental and social changes including implementation of the Resource Management Act (RMA) resulted in a greater need to understand sand dune behaviour and the role of dunes within the coastal system.

Progress has been made, with local government rules minimising potential sand mobilization associated with development proposals, and guidelines designed to restore and protect foredune areas, often with community involvement. However, in some situations the level of understanding of dune

processes is inadequate to address management issues. This article briefly considers the nature of coastal dunes, the history of traditional dune management in New Zealand and the need for process-based management in the future.

Most coastal sand dunes are formed by wind-driven sand being deposited where an obstruction, usually vegetation, reduces wind speed. Sand dunes are referred to as 'soft landforms' as they are easily eroded and their morphology rapidly responds to environmental changes in climate, vegetation cover or sediment supply.

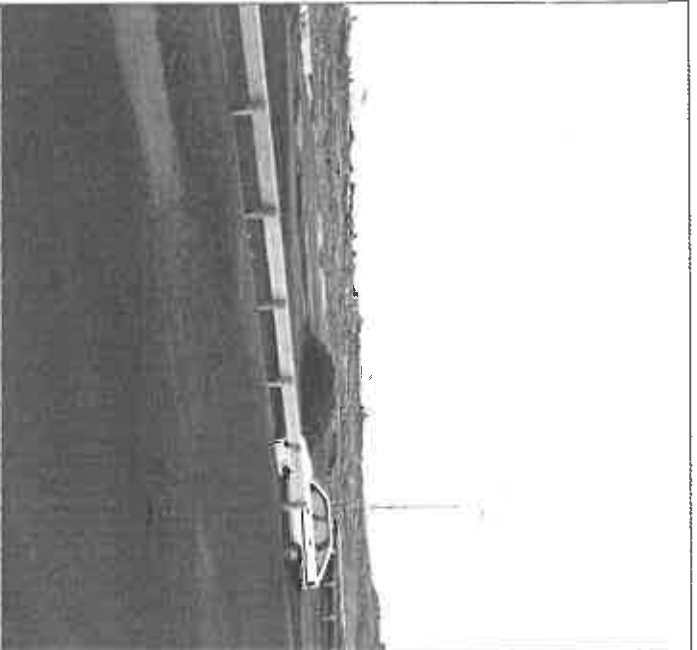
Coastal sand dunes usually consist of a foredune adjacent, and parallel, to the beach from which sediment is derived, and a backdune area which may consist of older (relict) foredunes and/or erosional dunes such as blowouts, parabolic dunes and larger transgressive features which can extend inland for several hundred metres.

Sand dunes occur along approximately 15% of the New Zealand coast, and are concentrated along the west coast of the North Island. Dunes that occur elsewhere are often in the vicinity of sand-bearing river mouths; areas which often happen to coincide with more populated locations.

The accessibility of coastal dune country led to early settlement by Europeans. Subsequent depletion of the vegetation cover by activities such as cutting, burning, grazing, as well as the introduction of pests (rabbits, hares) resulted in wind erosion, sand mobilization and encroachment of sand onto higher-valued land further inland. Interestingly, a phase of instability also accompanied early Maori settlement several hundred years earlier.

Government-financed research and reclamation projects during the 19th and 20th centuries led to a basic understanding of dune behaviour, together with the development of stabilization techniques. These techniques were used on approximately 50,000 ha of foredunes and also 250,000 ha of backdunes, 80% of which now support plantation or pasture. These 'traditional' management techniques consist of:

- establishing and protecting a stable foredune by the use of



Above and top right Sand drifts over beach car parks and amenities can be substantially reduced using process-based dune management practices.

## Sand dune management and development consultants

Leading academic and applied specialists in dune and beach dynamics



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contouring, windbreaks, fencing and a continuous cover using sand-binding vegetation

- stabilizing the backdune areas using similar methods, together with increasing the soil's organic and nitrogen contents;

- establishing a forested wind-protection belt was established on the backdunes a few hundred metres inland, and finally

- planting exotic production forestry and pasture on remaining dune areas further inland.

By the mid 1980s it appeared that the 'sand problem' had been solved. However, the following natural and social changes stimulated further research and changes in dune management:

- dune instability associated with increasing numbers of resorts and more recently residential subdivisions, together with the increase in recreational use of the coast;

- the onset of dune mobilization associated with natural environmental change - in particular very low frequency weather and oceanic-based cycles, and also systematic change associated with global warming;

- the RMA's requirement to protect and preserve the natural character of New Zealand's dunelands;

- the RMA's requirement for environmental effects of proposed developments to be identified and addressed prior to the issue of permits.

These factors have resulted in a need for all interested parties, from planners and managers to the community in

general, to increase their understanding of the role of dunes within the coastal system.

Localised success in foredune rehabilitation and protection has been achieved in some areas thanks to the collaborative approach developed between local government and communities, e.g. the Coast Care Programme. However, success has not been as great in more exposed environments where dune areas are typically more extensive, the population (and rating-base) tends to be lower and solutions more difficult to identify.

Scientific research is addressing some of the new generation of management issues such as hazard zoning associated with global warming. However, more general work into dune processes is



proceeding only slowly and at times the lack of knowledge compromises accurate assessment of development proposals. Such limited research reflects the general lack of training in dune systems within tertiary institutions, and many consultants are not well prepared to address dune-based environmental issues.

Coastal Systems NZ is an environmental consultancy established by academic and applied experts in dune processes both from within New Zealand and also from Australia and the USA. By identifying site-specific dune processes, the effects of development projects within dune areas are more accurately predicted. In addition, process-based innovative solutions are developed for problematic dune management areas. ■

## Cyanobacteria - monitoring management and mitigation

### Phytoplankton and biotoxin laboratories at Cawthron in Nelson are a 'one stop shop' for monitoring freshwater algae and their toxins

Cyanobacteria, or blue-green algae, are known for their tendency to form nuisance 'blooms' in standing waters such as lakes, reservoirs and deep, slow-flowing rivers.

This particularly occurs in nutrient-enriched waters during periods of warm, dry weather when bodies of water stratify.

Past experience has shown seasonality in the frequency and duration of bloom events in New Zealand, and with the approaching summer season Cawthron expects to see an increase in the number of bloom events nationwide.

New Zealand's fresh water quality is commonly

compromised by toxins (taste and odour compounds) produced by planktonic (suspended) and benthic (attached) freshwater microalgae.

The implications of freshwater algal blooms range from aesthetic impacts to the prohibition of lake or river activities, animal deaths and health warnings. Regular monitoring enables effective management of water bodies by providing information on the presence and composition of micro-algae and then associated toxins, enabling mitigating measures to be enacted through the course of the bloom.

### What are they?

Cyanobacteria are an ancient group of organisms with characteristics in common with both bacteria (prokaryotes) and algae (eukaryotes). Cyanobacteria are found all over

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