DUNE RESTORATION TRUST OF NEW ZEALAND

Technical Article No. 1.1

Why do we need to restore our coastal dunes?

Sand dune ecosystems occupy about 1100 km of the New Zealand coastline. With 90% of New Zealanders living within 50 km of the coastline, beaches play an important role reflected in iconic summer holidays, a wide range of recreational and other activities, and extensive coastal subdivision and development. However, the way we have chosen to live, work and play on the coast has often bought us into conflict with natural coastal processes and has resulted in one of our most highly modified ecosystems (Dahm et al., 2005).

WHAT'S WRONG WITH OUR DUNES?

Human modification of coastal dunes is common worldwide (Nordstrom, 1994). In New Zealand such impacts have been much more widespread and significant than is commonly realised with major changes in dune morphology, vegetation cover and composition, and natural coastal processes (e.g. Cockayne, 1911; Esler, 1978; Environment Waikato, 2001; Hilton et al., 2000; Jenks and Brake, 2001; Dahm and Spence, 2002). In fact, coastal dunelands are probably among the most modified of all New Zealand ecosystems. There are few coastal dune systems in New Zealand that have not been significantly impacted by human activities.

Early modification

Much of the modification of our dunes accompanied Maori and early European settlement as a result of fire, forest clearance, and grazing by introduced mammals. By the early 1900s, disruption of native dune vegetation had given rise to huge areas of wind erosion and migrating dunes. This led to one of our foremost botanists Leonard Cockayne being commissioned to report

on the issues and how best to manage them. In his 1911 report he advocated among other measures large scale plantings of the exotic sand binding plant marram grass (*Ammophila arenaria*) to stabilise mobile dunes (Cockayne, 1911). This led to marram grass, yellow tree lupin (*Lupinus arboreus*) and pine (*Pinus* spp.) being widely used in subsequent dune stabilisation work by the New Zealand Forest Service.

Dunes were further extensively modified in the mid and late 1900s during the post World War II explosion of coastal development. Dunes were often bulldozed, extensive loss of remnant native vegetation, introduction of a wide range of exotic weeds and garden plants, and increased human pressure associated with both pedestrian and vehicle use.

Current status

Natural dune ecosystems have now been extensively degraded right around New Zealand with significant loss of native dune biodiversity. Coastal dunelands are probably the most modified and degraded of all the major ecosystems in New Zealand. Recent estimates suggest 21,300 hectares of sand dunes remain – just 11.6% of the original extent of sand dunes (MFE, 2007). Widespread disturbance of sand dunes to varying degrees by fire, grazing and the introduction of exotic species, particularly marram grass, has impacted on our sand dune systems (e.g. Hilton et al., 2000). Native successions from our native sand binders pingao (*Ficinia spiralis*) and spinifex (*Spinifex sericeus*) on foredunes through to duneland forests which dominated the natural coast are now extremely rare.

The historic wind erosion and the change in vegetation cover can also change the morphology of dunes significantly. Marram grass on highly dynamic sites in some regions has formed unnaturally tall foredunes with steep seaward faces that can become highly unstable with human pressure resulting in wind erosion (e.g. Esler, 1978).

Commonly, only narrow widths of native vegetation remain, often just a spinifex-vegetated frontal dune backed by narrow widths of scattered native ground cover and shrub species. In a nationwide survey of sand dunes, Partridge (1992) and Johnson (1992) found a variety of exotic species are now widely established on dune systems. In many places, the dunes are completely dominated by exotic species.

THE 'COASTAL ENGINEERING' PARADIGM

The encroachment of development close to the sea and the loss of natural dune protection and dune function have also seen the proliferation of engineering structures such as seawalls – these structures now often replacing the beach and dune as the shoreline at high tide. Historically, the management of coastal erosion has focussed on management of the natural coast rather than management of human use and activities, a 'coastal engineering' management paradigm, which has emphasized "holding the line" or "stopping" erosion (Dahm et al., 2005).

Engineering approaches often involve significant environmental damage and adverse impacts on human use values, and can reinforce inappropriate patterns of use and development. In addition, the engineering solutions are generally very expensive to implement and maintain. There are serious questions now being raised about the resilience and sustainability of this approach in the face of projected climate change.

CLIMATE CHANGE

Over the next few decades, climate change effects including sea level rise have the potential to considerably exacerbate hazard risk to coastal communities. Sea level has risen by 10-15 cm over the last century and projections are for this trend to continue and to accelerate for centuries. Predictions are for a potential relative sea level rise of 50-80 cm by 2100 (MFE, 2008). This rise in sea level will result in severe hazard problems for many coastal communities if mitigation or adaptive plans are not progressively implemented (MFE, 2001; 2008).

Sea level rise will increase extreme sea levels and markedly increase the probability of exceeding present flooding levels. There will be more frequent and more serious flooding of low-lying coastal margins by extreme tides, storm surge and wave effects.

There is potential in many coastal areas for erosion to be considerably aggravated. Sediment is "food" for beaches and long-term erosion arises when there is insufficient sediment supply to the nearshore system to keep pace with sediment transport out of the system by waves and currents. With rising sea level, open coasts that have been dynamically stable over time are likely to show a bias towards permanent shoreline erosion if sand supply and associated physical drivers do not keep pace (MFE, 2001).

In many regions throughout New Zealand, hazard vulnerability continues to rise due to ongoing intensification of development in nearshore areas vulnerable to coastal erosion and a rapid escalation in the value of high-risk nearshore properties.

A 'COLLISION COURSE'

In addition to the threat to development, many existing erosion problems around New Zealand have been managed with seawalls - commonly resulting in serious degradation of important beach values, including amenity values, natural character and public access along the coast (e.g. Gibb, 1996; Dahm and Spence, 2002). Aggravation of erosion by sea level rise will severely worsen such adverse effects and will also threaten the viability of many of these structures.

In short, coastal communities and climate change are on a collision course (MFE, 2001) – with an escalating risk profile and serious ongoing degradation of coastal values. Effective action to mitigate hazard vulnerability, including the impact of projected climate change, is a priority if existing trends are to be reversed.

The challenge for the future is to manage these issues in a more cost-effective and sustainable manner, while also maintaining and restoring the natural, amenity, cultural and recreational values that we as New Zealanders attach to the coastline. On sandy beaches, restoration of natural dunes and dune function is a critical element of this change (Dahm et al., 2005).

NEED FOR A NETWORK

Up to the early 1990s established practice for dune repair and management in New Zealand was based primarily on use of exotic plants. Large scale production of native plants for dune restoration purposes was seen as impractical and there had been little work on restoration of sand dunes using native species.

During the 1990s, community-based dune restoration programmes (often known as Beach Care or Coast Care) were introduced to New Zealand – starting in the eastern Coromandel in early 1993 and subsequently spreading around much of the New Zealand coast. These programmes emphasized the use of native species in dune restoration. However, there had been little research on techniques for re-establishing native species or for enhancing existing native vegetation. This issue was not directly addressed in existing research programmes and transfer of information from the science community to managers and landowners was often poor. The early research involved committed scientists conducting research trials in partnerships with the communities – the findings generally widely adopted in practice well before they appeared in the literature!

The need for a nation-wide body to promote restoration of natural dune form and function with an emphasis on using native plants became obvious and led to the formation of the Coastal Dune Vegetation Network (CDVN) in early 1997 under the umbrella of the Forest Research Institute. Early research and technology transfer focussed on the restoration of the foredunes using the native sand binding species. This has led to adoption of management practices throughout New Zealand that has seen Coast Care groups undertaking highly successful restoration and stabilisation of foredunes.

In recent years the focus is increasingly on restoration of semi-stable backdunes and the complex of coastal and estuarine habitats that these contain and the substantial human-induced degradation. The Network became an independent charitable trust known as the Dune Restoration Trust of New Zealand (Dunes Trust) in 2006 where the complexity of restoring and managing backdunes is increasingly becoming the focus of supporting research and technology transfer.

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Authors: Jim Dahm, Eco Nomos Ltd and David Bergin, Environmental Restoration Ltd

DUNE RESTORATION TRUST OF NEW ZEALAND

Ministry for the Environment
Manatū Mō Te Taiao
Sustainable Management Fund

Dune Restoration Trust of New Zealand
Email: info@dunestrust.org.nz
www.dunestrust.org.nz

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The mission of the Dunes Trust is:

"To see the majority of New Zealand dunes restored and sustainably managed using indigenous species by 2050".