



Backdunes

- an introduction

INTRODUCTION

The dunes located immediately landward of foredunes are often termed backdunes with increasing distance from the sea they are often characterised by increasing complexity of land forms and vegetation cover. As with foredunes, most backdunes are very heavily modified from human-induced disturbance. This has resulted in substantial loss of indigenous biodiversity for backdunes in virtually every region of New Zealand.

Backdunes vary from a narrow dune with a limited number of plant species to an expansive duneland complex several

kilometres wide. Backdunes can include dune crests, swales, dune wetlands and lakes, deflation zones, blowouts and sand plains with a diverse range of habitats supporting a vast range of plant and animal species.

Backdunes range from low dunes a metre or so in height on some coasts in areas of limited sediment supply, to over 30 m in height in some instances. On most sites, backdunes are relatively stable and are likely to have a cover of vegetation but in some circumstances they can be highly unstable and poorly vegetated.



Development of backdunes

Backdunes develop from foredunes (Hesp 2000). As a foredune builds up, the landward (or lee) slope becomes more stable, nutrient levels increase, and sand inundation and salt spray levels decrease. The lee slope is gradually colonised by a range of plant species that tolerate somewhat more stable conditions. Sand is gradually deposited on the seaward slope and sometimes the crest of the dune and it slowly becomes larger forming an established foredune.

With increasing shelter and types of habitat, there is an increase in the complexity of vegetation communities on sandunes landward (Figure 1). Backdunes can have associated wetlands, dune lakes, rivers and streams, flood plains, dunes of all sizes with lee and windward slopes and deflation zones all of which add to the complexity of plant communities that inhabit them.

Dune zonation

Before human arrival, many of the sand dunes throughout New Zealand would have supported substantial tracts of native vegetation occurring as a distinctive pattern of zones running parallel to shoreline. These zones would have comprised various plant communities that changed from frontal dunes to landward dunes.

Figure 1: A cross-section of coastal dune showing the foredune dominated by sand binding grasses and the backdune comprising increasing complexity landward of dune sites and habitats from ground cover to shrubs and coastal forest.



There are various environmental factors that contribute to a changing environment from high water mark landward critical in determining the composition and structure of vegetation in each zone along the coast. Plant successional trends and species richness on foredune varies as a function of the seasonal or annual volume of sand deposition, the amount of salt spray, and other factors such as nutrient availability, soil development, moisture availability, and age of the dunes.

Pioneer species occupy the seaward slopes. Further back from the sea, the environmental condition on established foredunes become less harsh and over time some organic development or soil is established. Shrubs and trees will start to appear, the species present determined by regional climate, local soil and moisture factors, and dune stability. Further inland on landward, lee slopes, again depending on the regional location, coastal and other forest ecosystems existed, but are now rare. (For more information on zonation in this Handbook, refer Technical Article 2.4 - *Zonation and succession on coastal sand dunes*).



Landward of the foredune zone, native backdune species such as the low growing wivi and pohuehue, the shrubs mingimingi and taupata and the trees houpara and pohutukawa occupy successive zones at increasing distance from the sea.





Modification of backdunes

Coastal dunelands are probably the most modified and degraded of all the major ecosystems in New Zealand. It is assessed that only 21,300 hectares of dunelands are left in New Zealand, about 11.6% of their original extent. Consequently dunes are prioritised as a national priority for protection (Ministry for the Environment, 2007).

The modification of dune vegetation has included almost total removal of original dune forests, extensive disruption and loss of other native dune vegetation, and the introduction of a wide range of competing exotic plant species and grazing. Human-induced disruption of stabilising dune vegetation (e.g. by fire, stock grazing, vegetation clearance) also resulted in significant modification of duneland ecosystems by wind erosion – a widespread and serious issue from the 1800's to the mid 1900's (Cockayne, 1915; Dahm et al., 2005). Stabilisation of these migrating sands (e.g. Gadgil 2005), almost exclusively used exotic species, many of which (e.g. marram grass, coastal wattle) are now widespread in remaining natural dunelands ecosystems.

A wide range of grazing animals, both stock and introduced pests, have also significantly impacted dune ecosystems, particularly more palatable species that evolved without grazing pressure. In some areas, widespread subdivision and development over the last 30-50 years has also severely impacted remaining dunelands – including levelling of both backdunes and frontal dunes and replacement of native vegetation with exotics (Environment Waikato, 1999; Dahm et al., 2005). (for more information in this Handbook refer to technical articles in Section 10 - *Human impacts on dunes*).

Garden escapes are invading many backdunes throughout the country.



Exotic species such as this Sydney golden wattle have been extensively planted on our dunes and have become a serious weed threatening or native backdune vegetation.



Roads and carparks are often located on top of backdune areas with loss of indigenous biodiversity.

These remaining duneland ecosystems are also typically subject to significant modification and coastal squeeze from adjacent productive land use and settlements – including land use encroachment, invasion of plant and animal pests (and sometimes stock) and pedestrian and off-road vehicle pressures.

Focus of restoration

The focus of dune restoration over the last two decades has been on the most dynamic zone, the foredunes (e.g. Bergin and Kimberley, 1999; Dahm et al., 2005). Successful community-based dune restoration programmes are underway in many regions of New Zealand. The characteristics of specialised plant communities that occur on foredunes and guidelines for restoration are provided in articles within Section 7 of this Handbook - *Native vegetation of foredunes*.



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There is now increasing interest in restoration of backdune areas especially as communities become aware of the degraded nature of these areas. However, in tackling restoration of backdunes, Coast Care groups and coastal managing agencies are being hampered by lack of information and have encountered a number of significant and difficult issues. These areas are considerably

more complex. They have a greater suite of species and community diversity, a range of sub-environments and exposure, often serious problems with invasive exotic vegetation and grazing animal pests. Development along the coastline has seen not only substantial modification of backdunes but also their complete loss in many high-use areas.

KEY BACKDUNE SPECIES

The following articles in this Section 8 - *Native vegetation on backdunes* - will describe the key species used in restoration from the ground cover zone to the shrub and forest zones (Articles 8.2 and 8.3).

Further articles will focus on providing greater details on individual backdune species in no particular order. Some are key species to use in restoration while others have become rare on dunes and sometimes difficult to establish requiring special attention as part of dune restoration programmes and in some cases further research.

REFERENCES

Bergin, D. O.; Kimberley, M. O. 1999: Rehabilitation of coastal foredunes in New Zealand using indigenous sand binding species. *Science for Conservation Series No 122*. Department of Conservation. 55p.

Dahm, J.; Jenks, G.; Bergin, D. 2005: *Community-based dune management for the mitigation of coastal hazards and Climate Change effects. A guide for local authorities*. Prepared for the Climate Change Office, Wellington. 36p.

Environment Waikato 2001: *Fragile – a guide to Waikato dunes*. Environment Waikato. 33p.

Hesp, P.A. 2000: Coastal sand dunes, form and function. *Coastal Dune Vegetation Network Bulletin No. 4*. Forest Research, Rotorua. 28p.

Ministry for the Environment, 2007: *Protecting our Places – Introducing the national priorities for protecting rare and threatened native biodiversity on private land*. Ministry for the Environment, Wellington. 8p.

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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.