

FRAGILE

A GUIDE TO WAIKATO DUNES

Waikato



REGIONAL COUNCIL

Te Kaunihera ā Rohe o Waikato



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1 Our fragile dunes



Natural dune – Whiritoa.

Coastal dunes of the Waikato and New Zealand are under pressure from a wide variety of human activities. Over 70 per cent of all dunelands in the Waikato region have already been significantly modified.

This is a serious issue, as coastal dunes play a critical role in the protection of beaches and coastal values. However, the function and importance of these natural systems is poorly understood.

Successful protection and restoration of remaining natural dune systems depends on significant changes in human attitudes and behaviour.

This publication aims to raise awareness of the importance of coastal dunes, their natural function and values, and the human pressures on these natural systems.

Common dune management problems are illustrated, together with a brief outline of the key elements of dune management and restoration.



Dune damage and modification – Buffalo Beach south.

Over 70 per cent of all dunelands in the Waikato region have already been significantly modified.

2 Coastal dunelands of the Waikato

Coastal dunes are deposits of wind blown sand. They primarily occur along the ocean coasts of the Waikato region, both the west coast and the eastern Coromandel Peninsula. More rarely, dunes occur in more sheltered beach systems, such as Otautu Bay on the western coast of the Coromandel Peninsula.

There are also other dune-like coastal landforms, such as the extensive areas of beach ridges along the western margin of the Firth of Thames. However, these are wave built features rather than wind deposits. Although rare in New Zealand and an important element of the region's natural heritage, they are not included in this publication.

Coastal dunes of the eastern Coromandel

The eastern Coromandel is a rocky coast indented by numerous bays containing sandy beaches, which can be broadly divided into two types.

- Fine to medium sand beaches backed by wide coastal dune systems such as Whangamata, Pauanui, Cooks Beach, Whitianga and Matarangi.
- Isolated pocket beaches composed of medium-coarse grained sands. These beaches are much steeper than the fine-medium sand beaches. They also have very limited dune sand reserves, typically just a single dune. However, the dunes can be very high and wide – such as at Tairua, Hotwater and Otama beaches.



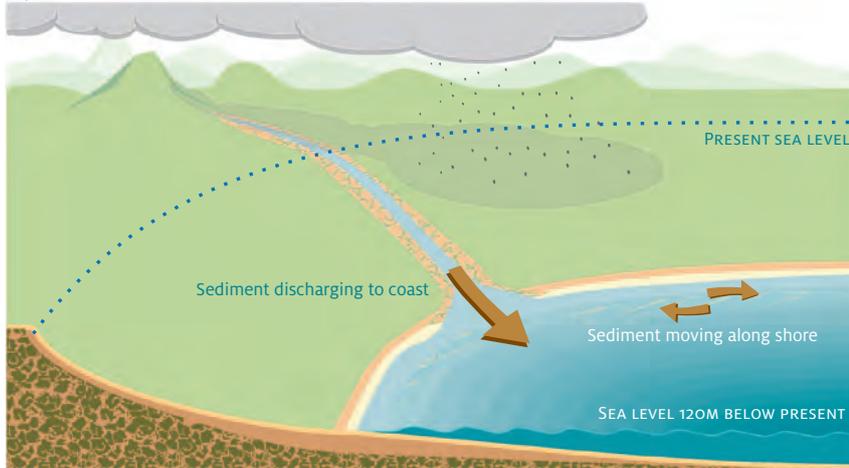
Whiritoa Beach, an isolated pocket beach with limited sand reserves.



Whitianga showing wide, multiple dune system behind the beach.

Coastal dunes are deposits of wind blown sand.

18,000 YEARS AGO



7,000 YEARS AGO



PRESENT DAY



Formation of Coromandel beaches

Most of the sand reserves of Coromandel beaches are stored in dunes behind the beach. These sand reserves can be regarded as savings for the future of the beaches.

← **18,000 years ago, the world was in an ice age.** The sea level was about 120 metres lower than at present. Sediments from rivers, volcanic eruptions and other sources accumulated on what is now the continental shelf. As the world warmed, ice melted and the sea level rose, submerging these sediments.

← Present sea level was reached about 7000 years ago. **The sediments buried by the rising sea level were then rapidly moved onshore by waves and currents to form beaches.** Some sediments also came from the remains of beaches that had formed the last time the sea level was at about the present elevation (about 120,000 years ago). Rivers, cliff erosion and shells from marine organisms also provided some beach sands.

At first, the rate of onshore movement was very high, and beaches built forward rapidly. However, the rate of beach building slowed over time as the sediment supply decreased and the offshore region came into equilibrium with waves and currents.

← **Over the last few centuries, forward building of the beaches has virtually stopped.** In other words, most Coromandel beaches now have all the sand they are going to get.

The beaches and dunes of the Coromandel now have all the sand they are likely to get.

West coast dunes

In simple terms, the beaches of the west coast can be regarded as an interconnected 'conveyor belt', moving sand from Taranaki and other sources northwards along the coast over time. In many places, this 'conveyor belt' is just a narrow beach along the face of coastal cliffs and bluffs, with little or no dune deposits.

However, some of the beaches along the coast are backed by coastal dunes, such as Kiritehere Beach to the south of Marokopa.

The west coast is exposed to strong westerly winds, so severe dune erosion and migrating sands can occur when stabilising vegetation is disrupted.

Over centuries, this process has resulted in mobile sand migrating inland from the coast to form large dunelands. Notable examples include the scientific reserve on the northern side of Aotea Harbour, the area between Kawhia and Aotea Harbour and the northern side of Whaingaroa (Raglan) Harbour.



Aotea dunefield.

... severe dune erosion and migrating sands can occur when stabilising vegetation is disrupted.

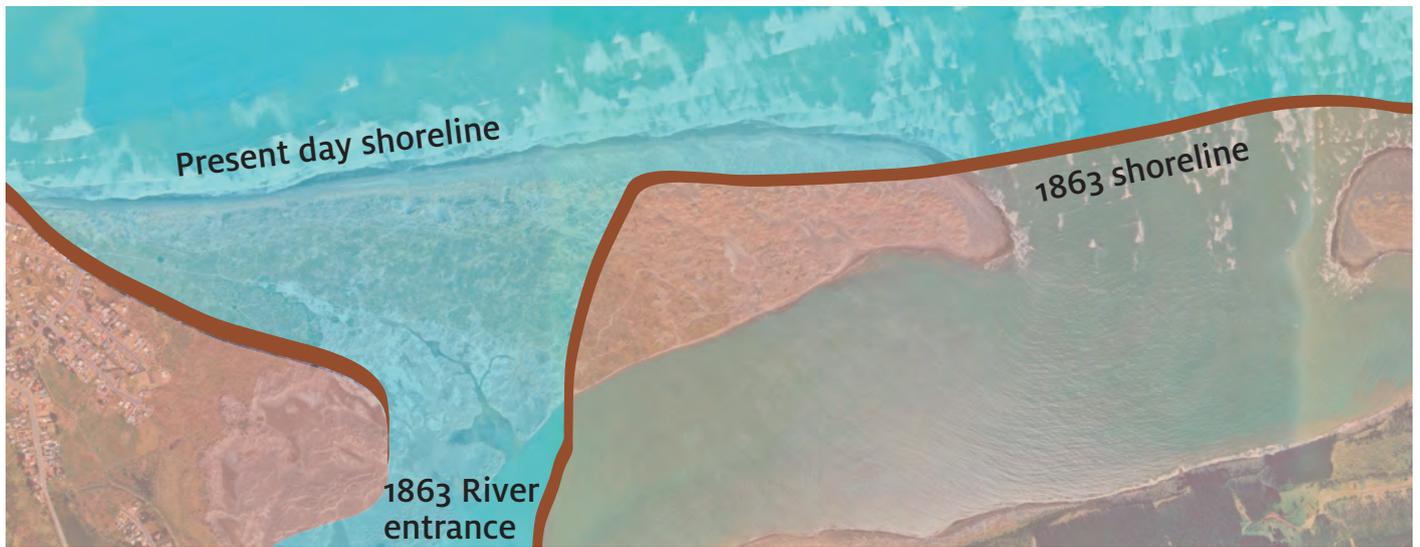


Kiritehere beach has coastal dunes.



Many west coast beaches have little or no coastal dunes.

... the beaches of the west coast can be regarded as a 'conveyer belt'.

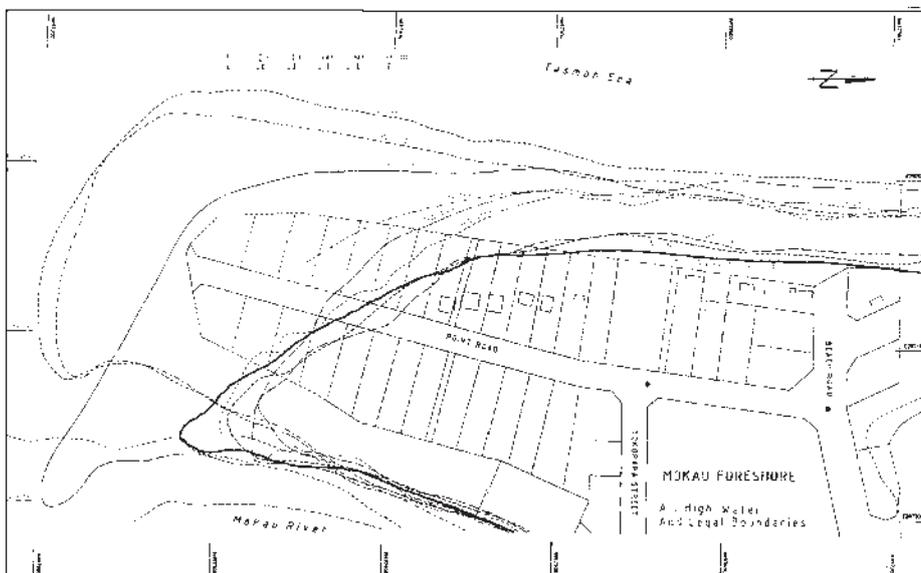


Changes at Waikato River entrance.

Sand spits can be very dynamic, experiencing major shoreline changes over decades . . .



Dune lake at Taharoa.



Considerable areas of coastal development have been lost or are now threatened by changes in the spit at Mokau.

In many places along the coast, the inland migrating dunes have blocked watercourses and given rise to dune lakes, particularly around Taharoa and the Awhitu Peninsula.

Sand spits built across river entrances also contain large areas of dunes, particularly the southern side of the Waikato River entrance at Port Waikato. These sand spits can be very dynamic, experiencing major shoreline changes over decades and centuries. The Port Waikato spit has grown northwards over the last 150 years, eroding large volumes of dunes from the north side of the river. These changes cause major problems where they threaten coastal development.

Strong winds on the west coast can result in severe wind erosion and dune damage . . .

3 Dynamics of natural beach and dune systems

Storm erosion and recovery

Dunes are an integral part of the total beach system, which includes areas extending several hundred metres offshore to water depths of several metres. Over time, individual sand grains can spend time in all parts of this system.

Frontal dunes are formed when dry sand that is blown landward from the beach is trapped by vegetation. The dune forms a reservoir of sand, which the beach can then draw on. In this way, dunes are like a savings account for the beach. During storms, sand is moved offshore, and forms a bar, which helps to dissipate the increased wave energy.

Over periods of decades, the seaward face of the dune can fluctuate by 15-30 metres associated with storm erosion and recovery. Larger changes can occur near estuary and river entrances. It follows that a good dune width should be maintained to accommodate these natural changes.

At some pocket beaches, such as Hahei, the beach and dune sands are just a veneer over older surfaces and can be almost completely stripped during severe storms.



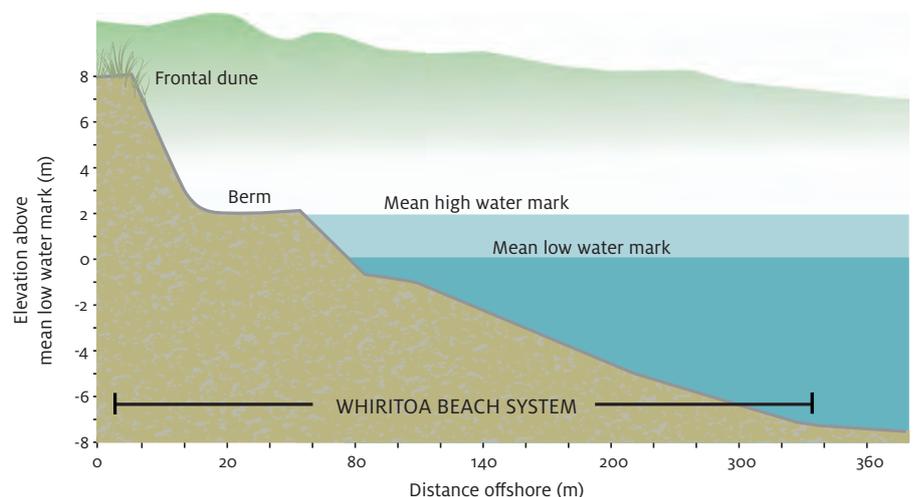
Photo: Harley Spence

Port Waikato 2007, before the severe erosion.



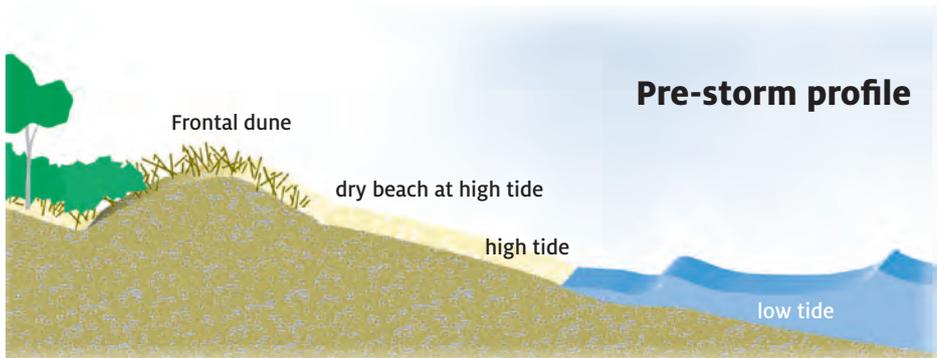
Photo: Harley Spence

Port Waikato after a series of storms hit the coast in the winter of 2008.

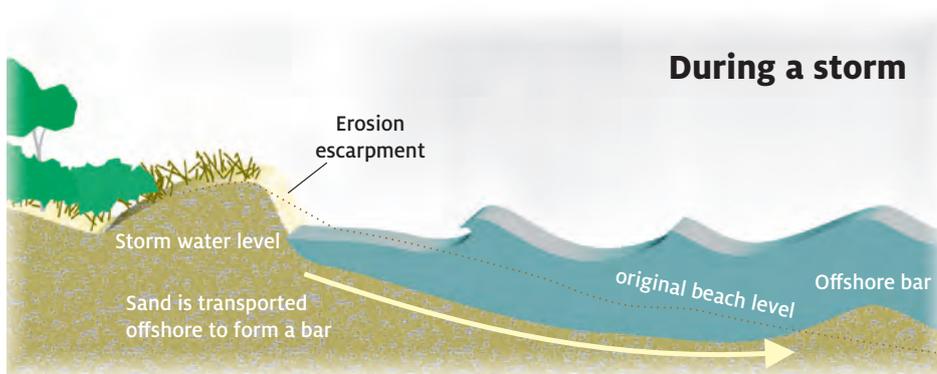


Dunes are an integral part of the active beach system..

Storm erosion and recovery

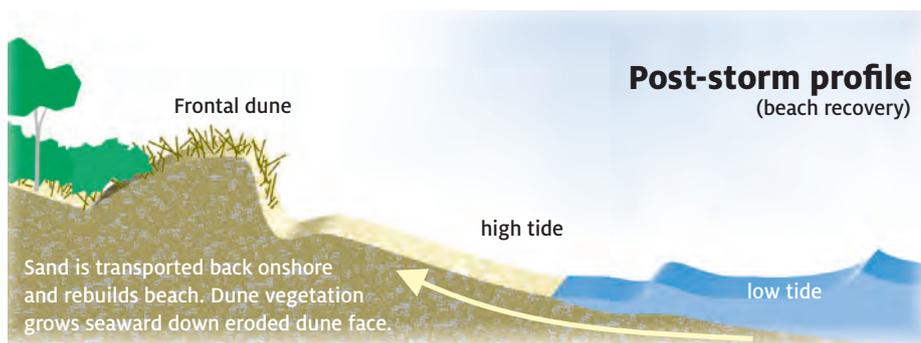


← **During periods of prolonged settled weather, sand builds up** on the visible part of the beach, including the dune.

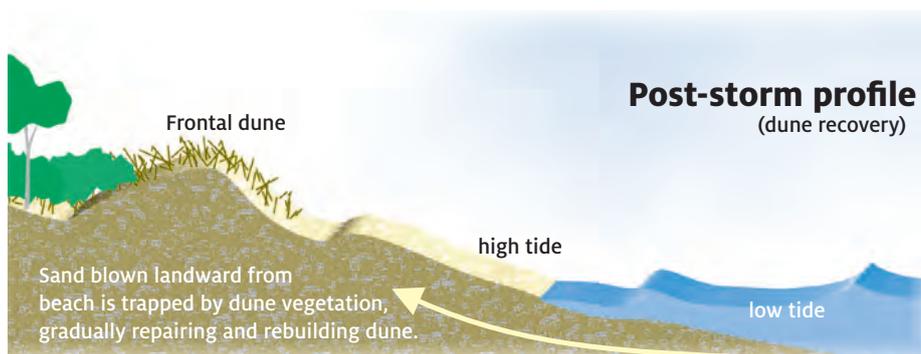


← **During major storms, waves erode the beach** and the most seaward dune, often leaving a near vertical erosion scarp cut in the face of the dune. **The eroded sand is deposited offshore** in the surf zone, where it forms shallow bars that help dissipate the high storm wave energy.

Significant dune erosion can occur in a few hours, but it can take years for the dune to fully recover.

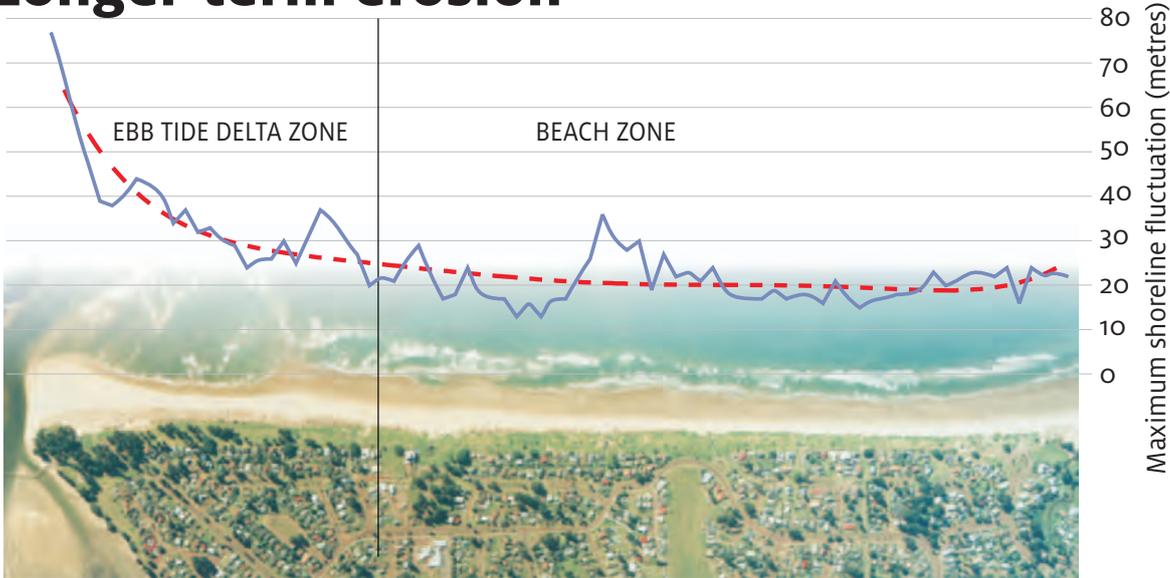


← After the storm, gentler wave action moves sand back to the shore, slowly rebuilding the beach.



← **As the beach recovers, dry sand is blown landward** and trapped by sand binding vegetation to repair the eroded dune. Natural dune repair depends on a good cover of native sand binding grasses, such as spinifex and pingao. If there are no suitable sand binding grasses on the seaward face of the dune, sand will not be trapped and little natural dune repair will occur.

Longer term erosion



As well as storm erosion and recovery, beaches can also experience longer term and larger scale erosion. Maintaining adequate dune reserves to cope with such erosion is critically important.

Waikato beaches typically undergo major shoreline movements over periods of decades, with the largest changes usually seen near estuary and river entrances. Though periods of erosion can continue for years, in most cases it is not permanent. When viewed over a long period of time, the shoreline is simply fluctuating backwards and forwards.

Very large shoreline fluctuations (often in excess of 100 metres) are experienced near some river and estuary entrances. Some west coast spits are probably completely reworked by erosion over periods of centuries (see page 5).

In the future, sea level rise and other changes likely to accompany predicted global warming could alter the dynamic stability of many beach and dune systems and lead to widespread permanent dune erosion.

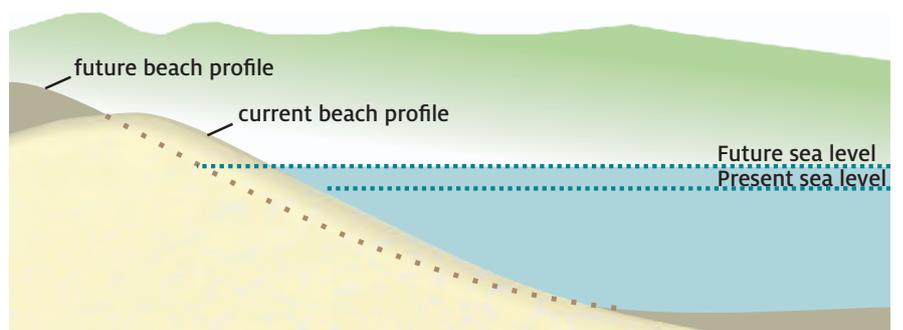
This is particularly likely along the eastern Coromandel, where beaches appear to be relatively isolated systems. Permanent erosion at beaches along this coast could exceed 15-20 metres over the next century, given present best estimates of sea level rise.

Given the potential for long term erosion, it is important wherever practical to maintain a wide area of natural dunes behind sandy beaches and to carefully manage all existing dune buffer zones.

Maximum shoreline changes recorded along Pauanui Ocean Beach over the last century. Shoreline changes are much larger near the tip of the spit.

Over decades, large shoreline fluctuations can occur.

Dunes provide a reservoir of sand.



The effect of long term sea level rise.

4 Nature and importance of dune vegetation



Wetland environment behind natural dunes at Otama.

Waikato dunes were originally heavily vegetated.

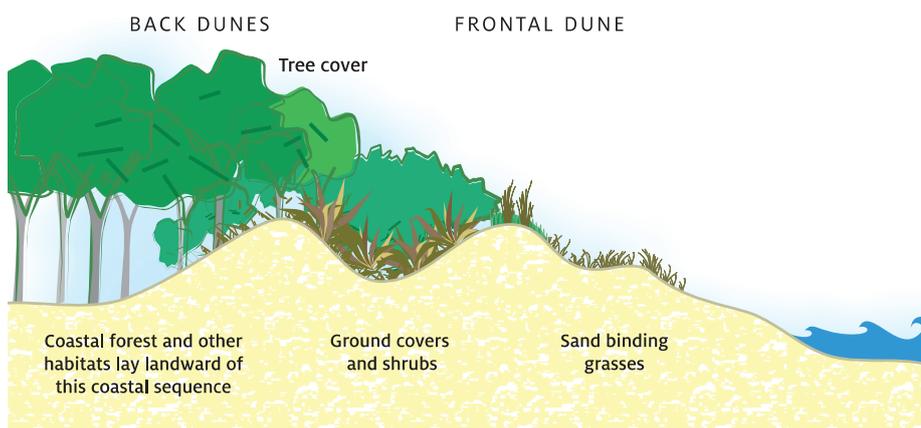
Waikato dunes were originally heavily vegetated. The most seaward dunes would have been characterised by a plant sequence ranging from sand grasses through to forest.

Full sequences of dune vegetation, ranging from sand grasses inland to forest can still be observed on some parts of the New Zealand coast, such as the west coast of the South Island.

However, in the Waikato region, the original vegetation cover has been disrupted by a wide variety of human activities and there are no remaining examples of the full original plant sequence. However, some remnants are left, particularly sand grasses. Early regeneration of the full vegetation sequence can also be seen in rare areas.

In some places, where dunes were relatively narrow, the vegetation sequence would have given way to other ecosystems, including estuarine and wetland environments.

Although, it is probable that most dune environments were heavily vegetated prior to human arrival, there is evidence that natural processes along the west coast of the region periodically disturbed such vegetation.



Natural sequence of Waikato dune vegetation.

In the Waikato region, . . . there are no remaining examples of the full original plant sequence.

Pioneer sand binders

Pioneer sand binders grow on the seaward face of the frontal dune. They generally extend inland to about the dune crest, though they can also occur much further inland on loose sand.

These are specialised plants that have adapted to grow in this harsh environment where they have to withstand loose mobile sand, periodic burial, salt spray, low levels of moisture and nutrients and temperature extremes.

Sand binding vegetation plays a critical role in natural dune building and repair. The plants slow wind speed near the ground, causing sand to be deposited, thereby building up the dune. Deposited sand is bound by extensive horizontal and vertical rhizome systems. A cover of sand binding vegetation therefore protects dunes against wind erosion.

The pioneer sand binders are generally perennial grasses, with spinifex (*Spinifex sericeus*) the major dune building species on the Waikato coast.

Pingao (*Desmoschoenus spiralis*) is also an effective sand trapping species and is found only in New Zealand.

Another common native species found on the seaward face of the frontal dune is sand convolvulus (*Calystegia soldanella*). More rarely, sand tussock (*Poa billardierei*) and sand carex (*Carex pumila*) is found.



Sand binding plants spinifex and pingao on the frontal dune.

Loss or disruption of this vegetation cover leads to serious dune management problems.



Distinctive seedheads of spinifex, a major native sand binding species in the Waikato region.



Sand tussock (*Poa billardierei*) previously known as *Austrofestuca littoralis*.

The plants slow wind speed near the ground, causing sand to be deposited, building up the dune.

Spinifex and pingao are the main native sand binding grasses on Waikato dunes.



Pingao (*Desmoschoenus spiralis*).

Sand binding vegetation plays a critical role in natural dune building and repair. Loss or disruption of this vegetation cover leads to serious dune management problems.



Nihinihi, sand convulvulus (*Calystegia soldanella*).

Native shrubs and trees on dunes

Native ground covers and low vegetation are typically found immediately landward of the sand grass zone.

Sand coprosma (*Coprosma acerosa*) also commonly occurs. Other ground covers like sand daphne (*Pimelia arenaria*) are less common.

The native dune rush Knobby clubrush (*Ficinia nodosa*) is common on dunes, with flax (*Phormium tenax*) and toe toe (*Cortaderia toe toe*) also occurring in places.

A wide variety of native shrubs and trees are found in rear dune areas and were probably in the original dune vegetation sequence.

These include taupata (*Coprosma repens*), coastal five-finger (*Pseudopanax lessonii*), karo (*Pittosporum crassifolium*), kawakawa (*Macropiper excelsum*), ngaio (*Myoporum laetum*), ake ake (*Dodonea viscosa*) and pohutukawa (*Metrosideras excelsus*).



Knobby club-rush growing alongside flax in the back dune area at Ruapuke beach on the west coast.



Pohuehue creates a dense mat of vegetation.

... a wide variety of native shrubs and trees are found in rear dune areas.



Secondary vegetation at Whiritoa with Pohutukawa and Houpara trees amongst a ground cover of Pohuehue and knobby club-rush.

Further inland, it is probable that numerous native tree and shrub species occurred within dune and coastal forests. These species would have included puriri (*Vitex lucens*), karaka (*Corynocarpus laevigatus*), titoki (*Alectron excelsus*), broadleaf (*Griselinia littoralis*), kohekohe (*Dysoxylum spectabile*), kanuka (*Kunzea ericoides*), manuka (*Leptospermum scoparium*), mahoe (*Melicytus ramiflorus*), kohuhu (*Pittosporum tenuifolium*) and kowhai (*Sophora microphylla*). Some of these species may have occurred further seaward.



Tauhinu, cottonwood (*Ozothamnus leptophyllus*).



Pohutukawa on the Coromandel peninsula.

. . . numerous native tree and shrub species occurred within dune and coastal forests.

5 Importance of coastal dunes

Hazard protection

Natural dunes play a vital role in protecting property from coastal hazards.

Maintaining an adequate width of well vegetated dunes provides a natural buffer that absorbs the impact of coastal erosion during storms and can repair itself naturally.

The wider the band of dunes fronting coastal development, the larger the reservoir of sand available to maintain the beach and protect properties in the event of serious long term erosion.

Serious erosion problems arise when coastal subdivision does not allow an adequate width of dune protection to cope with natural shoreline movements.

The height of natural dunes also provides protection from coastal flooding due to storm surge and wave action. If the natural protection provided by dunes is lost or destroyed, then serious coastal flooding problems can arise.

Protecting and enhancing remaining dunes is therefore critical to the future of beaches and existing beachfront properties. In particular, maximising the width of dunes and ensuring appropriate native vegetation cover is essential to maintain natural dune building and repair processes.



Property at Whangamata that is well protected by a natural well vegetated dune.



Timaru properties threatened by coastal flooding in July 2003
(Photo: Timaru Herald).

Natural dunes play a vital role in protecting people from coastal erosion and flooding.

Cultural heritage

As Maori settlement was frequently in coastal areas, dunes contain many important archaeological and cultural sites.

In Coromandel and west coast dunes, these include extensive midden (essentially domestic rubbish dumps) deposits and artifact manufacturing areas with flakes of stone, worked shell and other debris.

Many Coromandel dunes contain sites from the earliest periods of Maori settlement, with objects similar to those from east Polynesian sites of the same period. For example, a pearl shell fishing lure brought to New Zealand was found in a dune site at Tairua Ocean Beach.

Urupa (Maori burial grounds) and other waahi tapu (sacred) sites are found in the dunes of the Waikato coast. These sites are of significant spiritual value to local Maori.

Some dunes also contain debris from early European settlement. Dunes are also of enormous scientific value in terms of the information they contain about early human settlement, marine resources and environmental change.

Many archaeological sites in dunes along the eastern Coromandel and west coast have been destroyed by natural erosion. Considerable damage has also occurred as a consequence of human activities, including coastal development and serious wind erosion caused by disruption of dune vegetation. Fossickers have also removed many objects from dune sites.

An inspection of 90 known archaeological sites in coastal dunes along the eastern Coromandel in 1982 indicated that over 20 per cent appeared to have been destroyed and a further 50 per cent were being damaged by wind or wave erosion.



Maori carving amongst the dunes at Whaingaroa (Raglan).

Many Coromandel dunes contain sites from the earliest periods of Maori and European settlement . . .

Many archaeological sites in dunes along the eastern Coromandel and west coast have been destroyed.

Natural character, amenity and beach safety

The preservation of the natural character of the coastline is a matter of national importance in New Zealand's resource management legislation. This issue is particularly important on coastal dunes and sandy beaches of the eastern Coromandel, which are under enormous pressure from development.

Coastal dunes play a central role in the natural character of sandy beaches. If the frontal dune is modified or developed, the natural character of the beach can be significantly degraded.

However, natural dunes covered with native dune plants offer a pleasing natural backdrop and enhance aesthetic and amenity values at sandy beaches.

Dunes and dune vegetation can also help screen coastal development, important in preserving natural character on developed coastlines.

Dune vegetation is also important in providing shade for beach users. Research findings indicate that shade provides the most effective sun protection for beach users. In the future, it is probable that planting of appropriate trees and shrubs will be emphasised on Waikato beaches for human health and safety reasons as well as aesthetics and amenity.



Attractive natural dune at Whiritoa.



Well-screened development at Whangamata.



Modified dunes and coastal development at Pauanui Beach.

Coastal dunes play a central role in the natural character of sandy beaches.

Common dune management issues



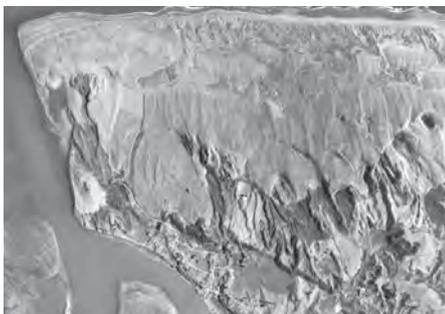
Barren modified dunes at Whitianga.

Barren dunes – loss of native trees and shrubs

The earliest human effect was probably the clearance of original dune forests by fire during Maori settlement. Most original dune forests were probably gone before Europeans arrived, though there is evidence of scrubland on some coastal dunes in many early maps and reports. Europeans cleared most remaining trees and shrubs for firewood, farmland and fencing materials.

No intact examples now remain of the original plant sequences that once characterised the most seaward dunes, nor are there any significant areas of coastal dune forest anywhere on the Waikato coastline. Most coastal dunes in the Waikato are now relatively barren and degraded environments compared to their original state, though regenerating secondary and tertiary vegetation is evident at some rare sites.

In particular, most coastal dunes lack native trees and shrubs. Apart from occasional Pohutukawa, the few trees occurring on Waikato beaches tend to be introduced species such as coastal banksia, Norfolk pine and Phoenix palm.



Barren dunes at Kawhia, 1974.



Norfolk pine at Whitianga.

Coastal dunes are now relatively barren environments compared to their natural state . . .

The barren nature of Waikato beaches is often accentuated along developed coastlines as property owners frequently damage or destroy regenerating shrubs and trees to protect sea views.

Opposition from property owners is the most important factor preventing the re-establishment of trees and shrubs on many Coromandel dunes and beachfront reserves.

Loss of native vegetation has also occurred where natural dune fields have been stabilised for pasture and forestry, such as the former duneland area between Kawhia and Aotea.



Trees damaged to protect views.



Forestry at Kawhia, 2000.

Dune vegetation has been extensively modified by a wide range of human activities.



Marakopa dune damage arising from human use and stock tramping.

Stock access and wind erosion

Early European settlement saw the introduction of stock to coastal dune systems. This resulted in disruption of sand binding grasses from trampling and grazing. This damage was also aggravated by fires. This led to widespread and serious wind erosion in the late 1800's and early 1900's, generating large inland migrating dunes and sand sheets. This wind erosion significantly disrupted many dunes along both the east and west coasts of the region, particularly those nearest the sea.

Stock access and consequent wind erosion problems are still common in many places along the west coast and at one or two beaches on the eastern Coromandel.

In addition to stock, rabbits and hares also damage dune vegetation at some sites. These pests can particularly impact on coastal restoration, especially more palatable species such as pingao and coastal five finger.

Sand mining

Some beach and dune systems in the Waikato region have also been extensively modified by sand mining.

For example, the west coast beach and dune sands contain high concentrations of iron sands. These are extensively mined in places, such as Taharoa to the south of Kawhia Harbour.

Sand extraction has also occurred at various eastern Coromandel beaches, removing large volumes of the finite and non-renewable beach sand reserves. Scientific investigations indicate that dune erosion has been aggravated by sand extraction at some of these sites, particularly Whiritoa and Kuaotunu west beaches.



Serious wind erosion at Whiritoa Beach, 1911.



Taharoa mining area.

Coastal subdivision

Coastal development has had a significant effect on coastal dune systems since the 1950's, particularly along the eastern Coromandel. Many large dune systems have now been almost completely covered with housing. Prominent examples include Whangamata, Pauanui, Cooks Beach and Matarangi.

Coastal development has tended to target beach and dune areas along the east coast, leaving very few undeveloped beaches. Over 75 per cent of all eastern Coromandel beaches are developed or partially developed. This issue is particularly significant at those sites with road access. Over 95 per cent of such sites are now developed to some extent.

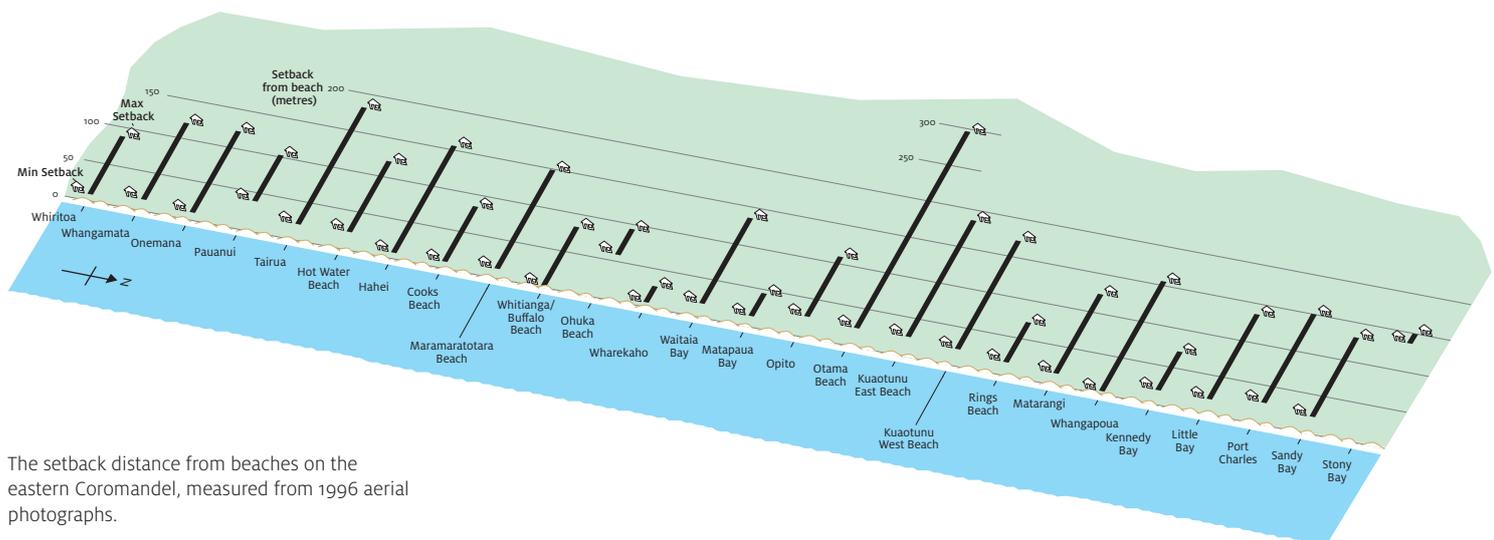
Coastal development is generally located very close to the shoreline, with only a very narrow strip of dunes retained between properties and the sea. The width of dunes fronting this development is often inadequate, or only barely adequate to protect from serious coastal erosion and flooding. At many beaches, most of the dune sand reserves important to the future of the beach now lie buried under houses and properties.



Pauanui before development, 1944.



Pauanui after development, 1995.



The setback distance from beaches on the eastern Coromandel, measured from 1996 aerial photographs.

The minimum setback is the distance from the toe of the frontal dune to the closest house on the beach. Where the open space was greatest between the beach and the first house, then was also measured to give maximum setback. If an average was taken of all setbacks at a beach, the value would generally be much closer to that of the minimum than the maximum.

Coastal development is generally located very close to the shoreline.

... frontal coastal dunes have been bulldozed to improve sea views.



Lawned dune at Whangamata.

At some sites, frontal coastal dunes have been bulldozed to provide improved sea views, and have been capped with fill to enable lawns to be developed. At many sites, sand-binding grasses have been displaced by lawns or exotic vegetation. These practices have significantly altered the natural character of coastal dunes and affected natural dune building and repair.

The placement of development too close to the sea and the damage of natural protective frontal dunes has already resulted in serious erosion damage to properties at some sites, including Cooks and Buffalo beaches, and to a lesser extent at Hahei and Whangapoua. There is also potential for similar problems at other sites.

These problems are likely to be considerably aggravated by sea level rise and other changes likely to accompany predicted global warming. These changes are also likely to result in more widespread coastal hazard problems, possibly affecting most developed eastern Coromandel beaches.



Pauanui showing bulldozed dunes and clay cap.



Pauanui after dune restoration.

Human activities have greatly modified natural dunes.

Existing erosion problems have often led to the placement of property protection works such as seawalls. These structures typically degrade the natural and recreational values of beaches and also affect public access along the beach at high tide.

Continuing intensification of coastal development on nearshore dune areas could worsen existing hazard problems.

Stormwater from coastal subdivisions has commonly been discharged from outlets onto beaches, worsening beach and dune erosion in these areas and degrading amenity and natural character.



Stormwater outlet.



Buffalo Beach 1950: the dune has already been modified by the road.



Buffalo Beach 1995: major structures are now necessary to protect the road.

Coastal structures have often been placed along the seaward margins of dunes, degrading beach values.



Exotic garden plants encroaching on the native dune plants on the east coast.



Marram dominated dune.

Introduction of exotic vegetation

Many exotic species have been introduced to the coastal dunes of the Waikato. These species have often resulted in weed pest problems and loss of natural character, and adversely affected natural dune building and repair.

For instance, the introduced marram grass (*Ammophila arenaria*) has been widely used to stabilise migrating sands. This species has now become established on many frontal dunes along the west coast of the region, competing with the native sand binders spinifex and pingao. Marram tends to build steeper and more hummocky frontal dunes than the native sand binders and these dunes are frequently more vulnerable to instability.

A variety of exotic species have also been introduced in back-dune areas, frequently displacing native species. Some introduced species are also potentially serious weeds in dune environments – including coastal wattle (*Acacia sophorae* var. *longifolia*) and pampas grass (*Cortaderia selloina* and *Cortaderia jubata*).

In many areas where houses have been placed close to the sea, native dunes have also been ‘gardened’, introducing a range of exotic weeds and vegetation and displacing native dune species.

A wide range of exotic weeds and vegetation have been introduced to Waikato dunes.

Vehicle and pedestrian effects

In many areas, the sand binding grasses on coastal dunes have been damaged or destroyed by off-road vehicles and pedestrian trampling. This disrupts natural dune building and can also lead to serious wind erosion. Off-road vehicles have seriously impacted on coastal dunes of the west coast.

In some high use areas along the Coromandel east coast, human trampling and subsequent wind erosion has almost completely eliminated the frontal dune. The esplanade area at Whangamata was a notable example, though the local community have since begun restoration activities.

... off-road vehicles have seriously affected coastal dunes of the west coast.



Whangamata Esplanade after restoration.



Dunes damaged at Karioitahi by motorbikes and 4WD vehicles.



Whangamata Esplanade area, showing the difference between modified and restored dunes.

Note: The natural dune in the background is less eroded than the modified dune in the foreground.

In many areas, the sand binding grasses on coastal dunes have been damaged or destroyed.

7

Guidelines for dune management



Dune accessway protecting vegetation.

The unique values of our sandy beaches have been extensively damaged and are increasingly threatened by a wide range of human activities. Protection and restoration of coastal dunes is critical if we are to preserve the natural character and amenity values of sandy beaches and avoid serious coastal hazard problems.

Improved dune management is now vital to the protection of sandy beaches for present and future generations. Protection of these values is critical to human use and enjoyment of our coast, and to the ongoing development of the tourist industry.



Accessway at Tairua protecting beachcare work.

General considerations

The primary aim of dune management is conservation, preservation and/or restoration of coastal frontal dunes. As such, the first emphasis is always to avoid the development and modification of natural dune areas.

If there is not enough dune space for these activities, it needs to be created (such as through building or development setbacks, landward relocation of existing development, land purchase).

In those areas where the frontal dune has already been significantly modified or degraded, dune restoration usually requires retoring and protecting:

- appropriate native sand binding species on the seaward dune face
- appropriate native vegetation on back dune areas.

These activities are important in restoring natural dune building and repair processes, and protecting and enhancing natural character and amenity values.



Accessway at Whiritoa.

Restoration of pioneer sand grasses on seaward dune face

The primary objective of this work is to restore an adequate cover of spinifex and pingao, to ensure natural dune building and repair and prevent wind erosion. These sand grasses will not prevent wave erosion and are not intended for this purpose. However, they are critical if dunes are to naturally repair after such erosion.

Restoration is needed where the native sand grass cover has been damaged or destroyed by human activities, or displaced by inappropriate exotic species. Restoration of sand grasses is particularly important at developed beaches along the eastern Coromandel, where remaining undeveloped dunes are often limited, and essential to the future of the beach and the protection of houses and properties close to the sea.



A good cover of native sand binding grasses growing on dunes at Whiritoa.



Sand binding grasses planted on the dune at Tairua.



Beachcare sign at Onemana.



Dune restoration at Whaingaroa.

The restoration of sand grass zones usually involves some or all of the following

- Identify any human activities causing vegetation disruption.
- Appropriately manage these activities to prevent further damage.
- Where required, remove any clay fill and repair dune damage.
- Re-establish a good cover of spinifex and pingao by plantings and/or fertilisation of existing stands.
- Where required, ensure the sand grasses are protected from human disturbance by the use of dune accessways and signage.



After shot of dunes at Whaingaroa.

Restoration of back dune areas

Once the sand binding grasses have been restored and are adequately protected from human activities, focus can then turn to back dune areas.

In this area, initial focus should be given to stabilising any loose, migrating sands using appropriate pioneer sand binders. Other appropriate species can be established once the sand is stabilised.

It is very important in restoring native ground covers, shrubs and trees to place this vegetation in appropriate areas. In general terms, ground covers usually lie immediately inland from the sand grass zone, with shrubs and trees placed further landward (usually landward of the crest of the frontal dune, except on very high and wide dunes). The width of each zone will vary considerably from site to site depending on overall width of the dune system, degree of exposure, local wind and wave climate and other factors.

It is not appropriate, for instance, to plant trees or shrubs in sand grass areas seaward of the dune crest. These species will be subject to salt burn or undermining by erosion in such areas.

Appropriate species of native ground covers, shrubs and trees for back-dune plantings are listed in section four of this guide (see page 10). Useful guidance on the most appropriate species can also be obtained by observing any native ground covers, shrubs and trees that naturally occur in the area. Early botanical reports can also provide useful guidance.



Trees on the frontal dune damaged by erosion at Whitianga.



Well restored back dune area at Kuaotunu.



Students helping with a back dune planting trial at Whaingaroa.

In initial stages of restoration, when there is not much shelter, it is important to use hardy species, such as karo, cottonwood, taupata and coastal five finger (though the latter species is very susceptible to rabbit browsing). Flax and cabbage tree can also often be established in earlier stages.

Vegetation trials have shown that most shrubs and trees will grow more quickly and with more vigour if a slow release fertiliser is applied at the time of planting. Shelter also assists growth rates and vigour with most species, though it is not essential for the more hardy species. Experienced practitioners also recommend using water retention crystals (such as crystal rain) and weed releasing (such as spraying or hand weeding to protect vegetation from being smothered) in early stages of planting, where practical.

A major obstacle to the planting of trees and shrubs on coastal dunes is opposition from adjacent land owners who often wish to maintain expansive sea views. However, it is possible to have quite extensive plantings of trees and shrubs while also maintaining some sea views. Moreover, it is important that the management of coastal reserves and other public lands addresses the needs of the entire community and is not dictated by any single interest.



Well established Houpara (coastal five-finger) shrubs from an earlier trial in the back dune area at Whaingaroa.

Making a start

Almost all beaches in the Waikato region are highly modified. However, there are practical ways in which you can improve their ability to trap sand, reduce wind erosion, protect property and enhance natural character.

First of all, identify interested parties such as land owners, relevant management agencies (such as your local council) and iwi, as the problems will usually affect others besides yourself.

If you have a local Beachcare group, this is the ideal place to start. If not, you could consider approaching your local council about getting a group established at your beach.

Secondly, it is very important to develop a plan for dune management, rather than simply launching into a range of activities. While planning without action is meaningless, action without planning is often a recipe for disaster.

A typical dune management plan will generally identify:

- the particular management issue(s) of concern and underlying cause(s)
- other management issues that are relevant at the site
- natural and human use values relevant at the site
- natural coastal processes and environmental context
- management objectives (what you hope to achieve)
- other stakeholders who have an interest in the site (who should be consulted)
- a relevant action plan (including timing)
- any potential adverse effects of the proposed action
- resource consent requirements
- funding requirements.



Community dune planting day at Kiritehere on the west coast.



Onemana.



Marokopa.

... you can improve their ability to trap sand, reduce wind erosion, protect property and enhance natural character.



Fertilising Onemana.

If the actions required are relatively simple, then the planning can often be fairly straight-forward. However, at a public beach there will generally be a large number of interested parties and planning requirements may be significant and require extensive consultation. A Beachcare group, in which all interested parties work together to develop and implement an action plan, is usually the most simple and effective approach to managing dunes in such areas.

Plans are worth the investment of time and energy. The single, most common problem with dune management action is inadequate planning resulting from a desire to 'get on with it' without proper consideration of the issues and management action.

Plans also help consultation processes and are also usually required if you wish to obtain funding or other support from management agencies.

A good plan can guide effective management action for years, though it should always be kept up to date.

If you need help to get started call the Waikato Regional Council's freephone 0800 800 401. We can advise you about the relevant contacts and information.



Planting by Onemana Beachcare Group.

A good plan can guide effective management action for years, though it should always be kept up to date.

8 Further information

Technical advice and support

Waikato Regional Council operate a Beachcare programme, which aims to encourage appropriate dune restoration activities within the Waikato region. Phone the Waikato Regional Council's freephone 0800 800 401.

Restoration of sand grass areas

Bergin, D.O. and Herbert, J.W. (1998): *Pingao on Coastal Sand Dunes*. CDVN Bulletin 1.

Bergin, D.O. (1999): *Spinifex on Coastal Sand Dunes*. CDVN Bulletin 2.

Bergin, D.O. (2000): *Sand Tussock on Coastal Sand Dunes*. CDVN Bulletin 3.

For more information on the above publications, please visit the Dunes Restoration Trust of New Zealand website: www.dunestrust.co.nz

Coastal vegetation

Crowe, A (1995): *Which Coastal Plant*. Viking. ISBN 0 670 86136 7. An informative and simple to use guide to the identification of New Zealand's most common coastal plants.

Moore, L.B. and Adam, N. 1963: *Plants of the NZ Coast*. Pauls Book Arcade.

Salmon, J.T. (1986). *The Trees of New Zealand*. Reed Methuen.

Partridge, T.R. (1992): *The Sand Dune and Beach Vegetation Inventory of New Zealand, I. North Island*. DSIR Land Resources Scientific Report Number 15. A useful survey of dune vegetation conducted on North Island beaches between 1984 and 1988. Lists major plant species and communities.



Dune morphology

Hesp, P.A. (2000): *Coastal Sand Dunes: Form and Function*. CDVN Bulletin No. 4.

The best work available for the layman on the morphology of coastal dunes in New Zealand. Covers the origin of sand, how beaches work, sand dune formation, sand dune morphology and dynamics, different dune types and the importance of coastal dunes. Written by one of the world's leading authorities on coastal dunes and is illustrated with magnificent New Zealand photos.

For more information on the above publications, please visit the Dunes Restoration Trust of New Zealand website: www.dunestrust.co.nz

General publications on dune management

Community-based Dune Management for the Mitigation of Coastal Hazards and Climate Change Effects: A Guide for Local Authorities

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