

Restoration Guidelines for the Ahipara Recreation Reserve, Mapere Block



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Finalised September 2010

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Summary

The coastal environment represents one of the most dynamic and vulnerable eco-systems in New Zealand. The Ahipara Recreation Reserve is a highly sensitive environment both culturally and ecologically and contains estuarine, riparian and coastal dune habitats. It is situated in Ahipara in the Far North where there are increasing threats to healthy, fully functioning dunes systems. In the reserve vehicle and animal damage has caused dune blowouts and erosion has exposed Koiwi and shell middens.

Restoration of the site using appropriate native plant species and protecting against vehicle and stock damage will allow the dune system to function fully, providing a natural defence against coastal erosion. This will result in greater security for the cultural Taonga, as well as acting as a highly visible example of appropriate management of the coastline.

Planting of the foredunes is fundamental as it will stabilise the dune, mitigate against future erosion and trap wind blown sand. Pingao (*Ficinia spiralis*), and kowhangatara (*Spinifex sericeus*), are key species in this zone. The current decimated populations should be protected and supplemented with plantings of nursery grown, eco-sourced seedlings. Recommendations are also given for suitable plants for the various zones of the back dune and estuarine area.

It is intended that this report is used as a basis for consultation with all stakeholders and that a detailed management plan is prepared and agreed with DOC before physical work commences.

KEY WORDS: Ahipara, dune system, foredunes, erosion, natural defence, taonga, pingao, kowhangatara, eco-sourced.

1. Introduction

Ecologically the coastal environment represents one of the most fluid and easily damaged ecosystems in New Zealand. The coastal zone is heavily impacted on by inappropriate recreational use, in particular, vehicles impacting on the sand dunes, and urban development. Natural hazards that are increasingly important in terms of risk to current lifestyles are increased as frequency and intensity of storms and sea level rise.

The Mapere block is a highly sensitive environment both culturally and ecologically. The 20.4084ha reserve straddles the Wairoa stream at the coastal outlet and includes estuarine, riparian and coastal dune habitats. Due to erosion Koiwi and shell middens have been unearthed.

It is situated in Ahipara where there is increasing inappropriate development of the dune systems. The most typical being kikuyu lawns down to what should be an active fore dune zone. Ahipara is a popular holiday destination and the coastal environment is coming under increasing pressure from recreational use. In particular, the inappropriate use of quad bikes, dirt bikes, and four wheel drive vehicles is a major threat to healthy, fully functioning dune systems in the area.

By restoration of the site using appropriate native plant species and providing protection against vehicle and stock damage this erosion will be mitigated. This is a naturally very dynamic system which can not be completely stabilised. However, by restoring native bio-diversity, and protecting the site from vehicles and animals the dune system will be enabled to function fully, providing a natural defence against coastal erosion. This will ultimately result in greater security for the cultural Taonga, as well as acting as a highly visible example of appropriate management of the coastline.



Figure 1: Vehicle tracks over foredunes and exposed middens

2. Background and scope of this report

The Department of Conservation (DOC) was approached by representatives of Te Rununga O Te Rarawa who expressed interest in Iwi led restoration of the Ahipara Recreation Reserve known also as the Mapere Block. From this DOC approached Northland Regional Council (NRC) to help with preparing a document to guide restoration planning.

On the 25th March 2009 Laura Shaft from NRC and Janeen Collings from DOC met with Runanga representatives and members of Korou Kore Marae. It was agreed at the meeting that Laura and Janeen would put together a document that would provide guidelines for holistic restoration of the Mapere Block including the fore dunes, rear dunes and the stream environment.

This report has been prepared following site visits and discussions with members of Korou Kore Marae. The recommendations contained within are based on experience of similar projects, taking into account the particular nature of this site (physically and socially). It is intended that this report is used as a basis for consultation with all stakeholders. A detailed plan of action should then be prepared.

3. Site description

General overview

The foredune area of the site is extremely dynamic, particularly at the eastern end where the Wairoa stream passes out to sea. See appendix for historic aerial photographs showing the extent to which the stream has meandered over time. Within the last 9 years there has been significant erosion of the fore dunes resulting in further exposure of middens and loss of sand from the system.

East of the access path at the seaward face of the foredune is steep erosion scarps with no native sand binding plants present at the crests. Near the stream end of the western side this erosion has progressed further so there is less of a steep scarp but significant blowouts into the reserve. These can be seen in the aerial photograph of the site (figure 4).

Non native species represent the dominant vegetation on the reserve. Some are serious environmental weeds like Boneseed, and Boxthorn.



Figure 2: view of the site from seaward



Figure 3: Aerial Photograph of the Ahipara Recreation Reserve with key features marked

Detailed description of the site in sections – notes from site visit

Front of foredune, from the access path, moving northeast to stream mouth

At the mouth of the access is a dune blow out caused by foot and vehicle traffic (see figures 6 and 7). Approximately the first 20m is steep bank with *muehlenbeckia* growing down it, with some pingao in front. The next 40m approximately is also very steep and sheer with non native species including South African ice plant and boxthorn growing. There is also some spinifex growing here.



Figure 4: First section of the frontal dune (August 2009)



Figures 5 and 6: Dune blow out caused by erosion from foot and vehicle traffic

The next section is comprised of steep bank with unvegetated patches, and sections vegetated by non-natives including iceplant and boxthorn, and also some patches of *muehlenbeckia*. There are a number of areas where the bank has collapsed.



Figure 7: Second section of the foredune area (August 2009)



Boxthorn – *Lyceum ferocissimum*



Flame tree/coral tree – *Erythrina x sykesii*



South African Iceplant - *Carpobrotus edulis*



Agapanthus – *Agapanthus praecox*



Non Native Succulent

Figure 8: Non native plant species growing on the dunes in Ahipara Recreation Reserve



Figure 9: Overview of third section of foredune (August 2009)

Backdune Area

Form

Dunes with shallow swales and ridges oriented parallel to the coastline. These are stabilised to a degree but there are areas of active sand where blowouts have occurred due to damage of vegetation cover. The blowouts are occasional and do not represent a significant area. A steep escarpment at the narrowest part of the reserve adjacent to the Wairoa river is a feature which can be seen in the historic aerial photographs dated from 1950 onwards.

Vegetation

The dominant vegetation consists of introduced weedy species interspersed with native species. A mix of closely integrated pohuehue and kikuyu is the dominant vegetation through out with habitat changing weeds such as ice plant, thorn apple, box thorn, boneseed and pampas. Other native plants present are native convolvulus, flax, knobby clubrush, sand coprosma, kowhangatara, beach spinach and coastal fivefinger.

Stream area

The stream flat is the area which is like a peninsula surrounded by the stream as it meanders back onto itself at the oxbow. The flat itself is stable due to close vegetative cover. Native vegetation is represented by Wiwi, Raupo, and other sedges. Weed species of importance include kikuyu grass and pampas.

The river margins in the main consist of a dominant cover of kikuyu grass with grazing animals having access to the waters edge in parts. The margins adjacent to the steep escarpment include other weeds such as boneseed, and lupin. It is widely recognised that riparian plantings can assist with soil conservation, improve water quality and habitat for aquatic life. It is definitely worth restoring this zone within the reserve as it links with the stream side restoration the Ahipara Primary school is doing.

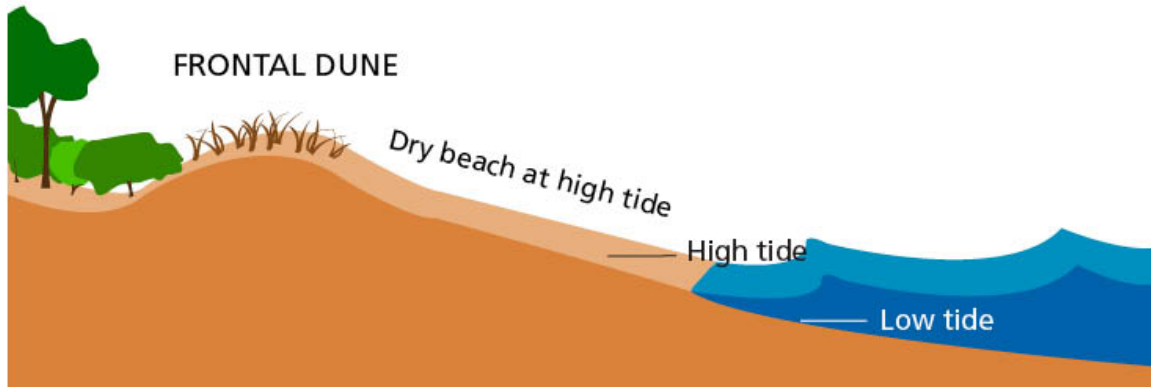
4. Natural dune form and function

Function of sand dunes

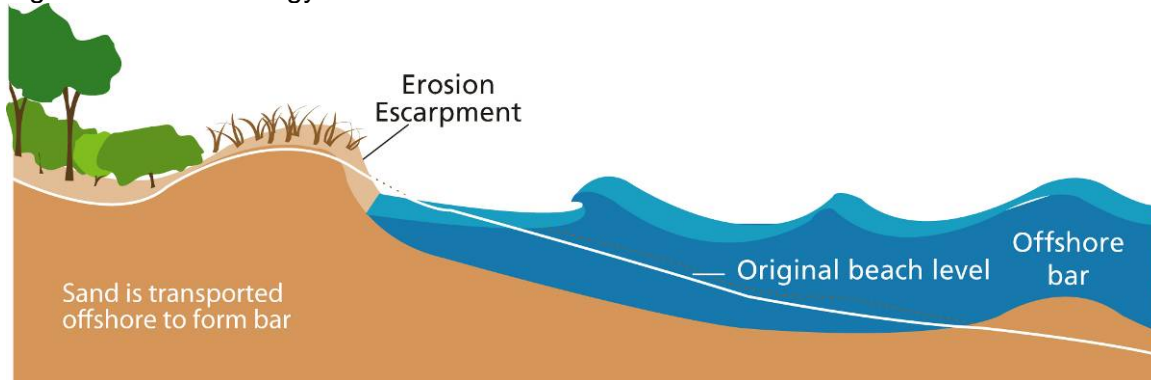
Sand dunes are the crucially important buffer between the sea and whatever is landward. A properly functioning dune system helps protect the land and property inland of it. Figure 14 demonstrates how dunes adapt to changing conditions.

Sand dune dynamics

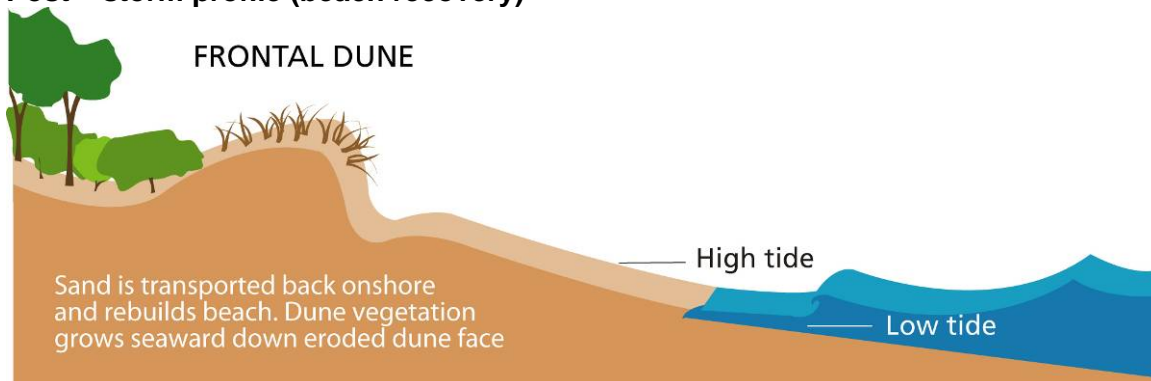
Pre-storm Profile – During periods of settled weather, sand builds up on the beach and dunes.



During a Storm – During major storms, waves erode the beach and dune, often leaving a near vertical dune face. Eroded sand is deposited offshore in the surf zone, where it helps dissipate the high storm wave energy.



Post – storm profile (beach recovery)



Post-storm profile (dune recovery)

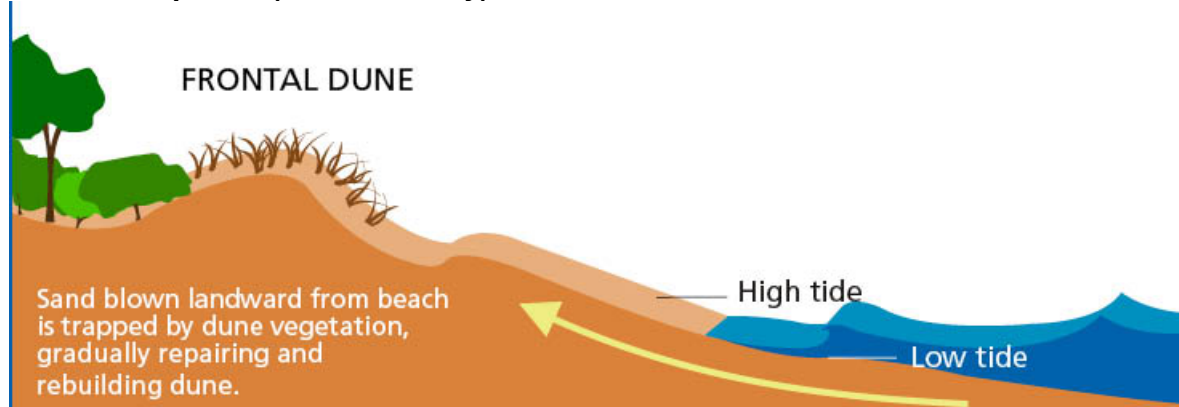


Figure 10: Diagrams demonstrating dune formation and recovery after storm events (adapted from Dahm, Jenks and Bergin, 2005)

Role of native sand-binding vegetation in dune function

Native sand binding plants such as kowhangatara and pingao can survive severe storms, salt spray and being buried by sand. Kowhangatara and pingao are very effective in trapping sand as their root systems help to bind the sand together and they grow long runners and tall leaves to trap wind blown sand. Restoring sand binding vegetation to the fore dunes has the potential to not only moderate the erosion but to increase the build up of land.

Impact of dominance of non native species

In comparison, exotic species such as daisies, ice plant and kikuyu cannot tolerate direct contact with salt water and do not accumulate sand as efficiently. Once the exotic plants come into contact with salt water the plant experiences die back and releases the sand that it is trapping. Once this sand is re-released into the system it is potentially lost through longshore currents or wind erosion.

Large trees such as macrocarpa's and pohutukawa hold the bank together for a time, but as wave action undermines the bank beneath the tree, it eventually topples over taking a large portion of the bank with it. This exposes a greater inland portion of the bank to erosion.

Loss of native sand dune binding plants through stock trampling, vehicle damage and browsing by rabbits and stock can produce a system where sand is lost during storm events and is not returned during calmer conditions.

The fact that sections of the seaward face of the dune lack any native sand binding vegetation, such as kowhangatara or pingao, means that any positive sand flux onto the shore is not able to be retained at the base of the bank by dune building processes. The existing exotic vegetation does little, other than to provide some limited stabilisation to the existing bank. This factor may account for the assumed accelerated erosion of the bank, as no dune building phases are present to compensate for the erosion phases.

Restoration of natural features for erosion mitigation

The use of natural features in the coastal environment to protect land use from coastal hazards is a preferred management option where practicable due to cost benefit and minimal associated adverse environmental effects. The restoration of natural features for mitigation of natural coastal hazards is well documented and readers are referred to *Community Based Dune Management for the Mitigation of Coastal Hazards and Climate Change Effects: A Guide for Local Authorities*, for more details. This report is available on line (see references for details).

5. Restoration Recommendations

Preparing a detailed Restoration Plan

Due to the size of the area under consideration, it is recommended that the project be undertaken in stages. The key area to focus on to start with would be restoration of native sand binding plants to highly eroding sections of the fore dunes. This will then provide some protection to the areas behind.

A restoration plan should allow for ongoing maintenance including pest animal and plant control, and maintenance of any infrastructure such as fences and signage. Rabbits are the key animal pest to be considered and thought will need to be given on how to protect plantings from rabbit browse. Weed control will need to be undertaken at the site and this must not increase the risk of erosion. In order to prevent further erosion when weeds are removed the space needs to be filled quickly with native vegetation. See appendix 4 for more information on pest animal and plant control.

Consideration needs to be given to staging of the plantings with respect to natural processes. For example parts of the back dunes will be suitable for establishing coastal forest and although most are hardy species there are some that will do better with the shelter of earlier plantings. Figure 15 demonstrates basic natural plant succession in a dune area. The planting recommendations below give a lot more detail on suitable plants for the different zones of the site.

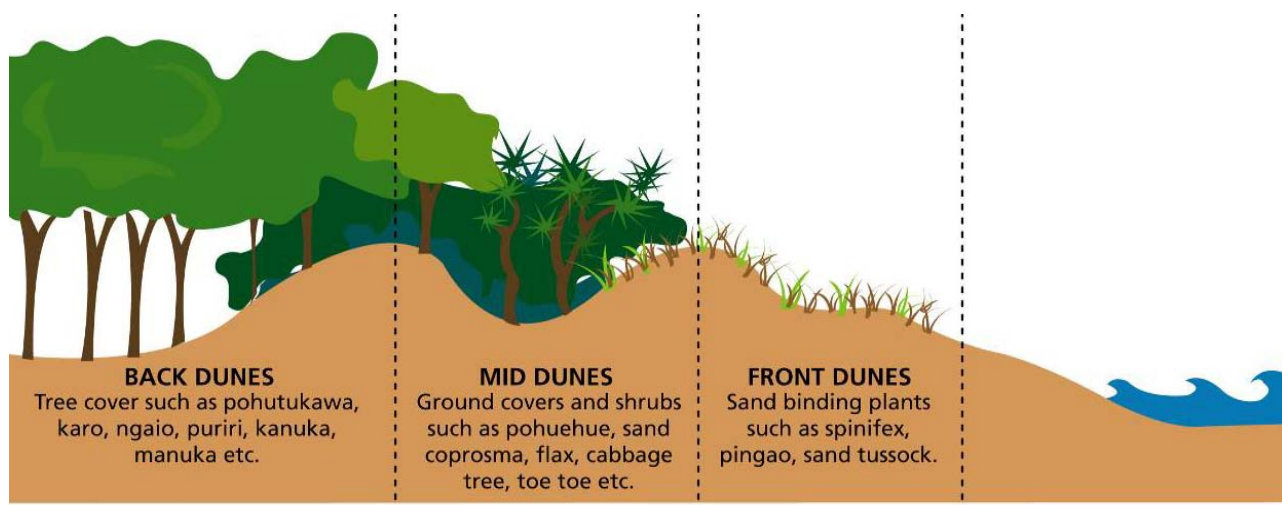


Figure 11: Dune Plant Succession – Where plants naturally grow within the dune system

Frontal dune restoration

The restoration methodology typically involves reforming dunes to a smooth contour to limit the amount of variability in the dune profile as to prevent wind channelling causing erosion of the dune, or landward sand drift causing a loss of sand from the system, and to enable revegetation with sand binding vegetation. This may range in scale from the recontouring of small dune blowouts to the remobilisation and reshaping of large areas of dune.

This methodology would typically involve:

- Reshaping of the existing dune profile to a natural profile and may include the filling of blow outs, remobilisation to remove scarp faces and removal of foreign materials such as clay and soil and non native sand binding vegetation.
- Establishment of native sand binding vegetation and shrubs/trees to trap sand on the dune complex.

- Provision of public accessways, fences and signage at restored areas to prevent damage occurring to restored areas from foot and vehicular traffic.
- Maintenance and monitoring of restored areas.

As part of the detailed restoration plan it needs to be decided whether such measures are appropriate for this site. It is recommended that the steep sections of the frontal dune which are not vegetated by native plants be re-shaped prior to planting with appropriate sand binding plants as this will give the best chance of success. It may however be possible to reshape some sections manually.

Planting Guidelines

Eco-sourcing and Restoration Success

The Mapere Block Reserve sits near the border of the Ahipara and Aupouri ecological districts. An ecological district is a part of New Zealand where geological, topographical, climatic and biological features and processes interrelate to produce a characteristic landscape and range of biological communities.

It is important to source all plants for restoration from within the ecological district. There are two main reasons for doing this; (i) local plants are adapted to local conditions and because of this the success rate of plants establishing and thriving will be higher, (ii) it ensures that the local plants remain protected from genetic pollution and potential pest and diseases that may originate in another area.

All the plants listed here are available from within the Ahipara and Aupouri ecological districts. One species that is notably absent as occurring naturally in the dune systems of both ecological districts is Pohutukawa. It is likely that Pohutukawa in sand dunes near settlements have been planted. There is, however a small remnant of Pohutukawa forest near Hukatere.

Identifying Zones

Different parts of the reserve present different challenges for plant life. For example the active seaward face of a fore dune is a very different environment than a swale (low lying area) in the back dune. For this reason the plants recommended are arranged within the zones where they will have the best impact for restoration. Some of the plants are specific to a zone and others can be used throughout. There are notes for each that show where they can be planted.

Zone: Seaward Side of Fore Dunes



There are two key dune building species that should be the immediate focus of restoration of the highly mobile fore dunes. They are pingao (*Ficinia spiralis*, or Golden Sand Sedge) and kowhangatara (*Spinifex sericeus*, or spinifex)

Revegetation trials undertaken by the Coastal Dune Vegetation Trust (The Dune Restoration Trust of NZ) have demonstrated that pingao and kowhangatara are best planted in the winter months between May and August. Planting in autumn makes the plants vulnerable to sand accretion and scouring during winter storms and spring plantings will succumb to drought if the plant root systems have not developed and extended into the lower sand levels before early summer (Bergin 1999, Bergin 1998).

Pingao should be planted in groups of 10-20 pingao seedlings, with approximately 50 cm spacing between plants, on the lower fore dune. The close spacings will provide mutual shelter at exposed sites and planting of small groups resemble those of natural communities. Pingao should also be planted on a diagonal rather than in straight lines to minimise the formation of wind channels. Pingao will grow on the lower dune as it is a primary dune builder and thrives on wind accumulated sand. Plants should also be planted deep to avoid the exposure of roots (half again between the top of the root ball and the top of the plant). Application of a slow release NPK fertiliser (e.g., Magamp, 30 g per plant) incorporated into the planting hole will boost early growth and health and is recommended for planting both pingao and kowhangatara (Bergin 1999, Bergin 1998).



Kowhangatara



Pingao

Kowhangatara should be planted from the crest of the dune down to the toe of the dune between the pockets of Pingao at a diagonal spacing of 50 cm spacings. Like pingao, kowhangatara should be planted deep, with only the top half of the plant showing above the sand.

Trials have shown that both kowhangatara and pingao respond well to a broadcast application of a high-nitrogen fertiliser (e.g. urea, diammonium phosphate and Nitram all produced similar responses in plant growth and vigour). Fertiliser should be applied in early spring at an equivalent of 400kg/ha weight (Bergin 1999, Bergin 1998).

There are some other suitable plant species which can be inter-planted with the kowhangatara and pingao at a later date. These include:

Hinarepe

Austrofestuca littoralis

Sand tussock



A light straw coloured tussock which grows in upright clumps. Different to the introduced marram grass in that the flower stalks are always shorter than the leaves. An endangered plant that is very sensitive to habitat disturbance.

Where to plant

- Seward side of fore dune
- Leese side of fore dune
- Back dune
- Estuarine flats

Nihinihi

Calystegia soldanella

Shore bindweed



This is a common low-growing plant with bright green shiny leaves and showy striped lilac and white flowers. Nihinihi is in the centre of this photo surrounded by the endangered sand daphne, *Pimelia arenaria*.

Where to plant

- Seaward side of fore dunes
- Crest of fore dune.
- Leese side of foredunes
- Back dunes

Waiu-o-kahukura

Euphorbia glauca

Shore spurge



A very elegant blue-green leaved sand trapping plant that provides contrasting colour against the yellow and orange hues of kowhangatara, pingao and sand tussock. It is an endangered plant and very palatable to grazing animals.

Where to plant

- Seaward side of fore dune
- Crest of fore dune.
- Leese side of fore dune
- Back dunes

Zone: Crest of foredunes

Continue to plant kowhangatara and pingao. These are important at the crest of dunes to provide for sand recapture after significant erosion events. Also continue planting Waiu-o-kahukura and Nihinihi.

Key plants for crest of foredunes:

Pohuehue

Muehlenbeckia complexa

Wire Vine



A wiry creeper that can climb other shrubs but can also stay close to the ground where it forms dense low mounds. Provides good cover for other plants that need shelter to become established.

Where to plant

- Crest of fore dune.
- Leese side of foredunes
- Back dunes
- Riparian zone

Tarakupenga

Coprosma acerosa

Sand coprosma



This creeper has small green leaves, orange brown stems and translucent blue/silver berries in autumn. The berries and flowers provide food for native skinks.

Where to plant

- Crest of fore dune.
- Leese of foredunes
- Back dunes

Zone: Leese of fore dune

Continue to plant

Kowhangatara

Pingao

Hinarepe

Nihinihi

Tarakupenga

Pohuehue

Waiu-o-kahukura

Key plants for leese of foredune:

Harakeke

Phormium tenax

Flax



The common NZ flax has stiff upright leaves and red flowers on stalks that attract nectar feeding creatures like birds, lizards and bees. It will do better in the damper areas of shallow depressions.

Where to plant

- Leese of fore dune
- Back dunes
- Riparian zone

Toetoe

Cortaderia splendens

Coastal Toetoe



Native Toetoe is similar in appearance to the invasive weed pampas. Make sure you identify correctly before collecting seed to grow.

Where to plant

- Leese of fore dune
- Back dunes

Powhiwhi

Ipomoea cairica

Coastal Morning Glory



Creeping through other vegetation it has large mauve flowers and palmate leaves. It is easy to grow and is an excellent sand binder. A close cousin to kumara.

Where to plant

- Leaside of fore dune
- Back dunes

Tauhinu

Ozothamnus leptophylla

Cottonwood



Golden shrub with very tiny leaves, this one is shown covered in clusters of creamy flowers. Does well in the driest areas.

Where to plant

- Leaside of fore dune
- Back dunes

Wiwi

Ficinia nodosa

Knobby Clubrush



Forms dense patches spreading by underground stems. The leaves are light green and stiff with flowers as small brownish clusters near the tips.

Where to plant

- Leaside of fore dunes
- Back dunes
- Sandy stream flats
- Estuarine

Wiwi

Apodasmia similis



Jointed Wire Rush

Large clumps with fibrous roots. Leaves are varied in colour from light green to quite orange-brown. They have the characteristic dark patches along the stems giving the jointed look.

Where to plant

- Leaside of fore dunes
- Back dunes
- Sandy stream flats
- Estuarine

Zone: Back Dunes

Continue planting:

Hinarepe

Nihinihi

Tarakupenga

Waiu-o-kahukura

Pohuehue

Tauhinu

Powhiwhi

Harakeke

Toetoe

Wiwi (both)

Key plants for back dunes:

Kowharawhara

Astelia banksii



Coastal Astelia

Silvery flax like clumps that can form a thick cover. The leaves funnel water down toward the base which is stored in a reservoir created by the curled leaf bases. Ripe fruit was eaten by Maori.

Where to plant.

- Back dunes

Ngaio

Myoporum laetum



Ngaio

Low growing spreading shrub, or small tree. Leaves fleshy and spotted with prominent glands. Ngaio could be confused with Tasmanian Ngaio (Boobialla) so be very sure you have sourced the native Ngaio before planting.

Where to plant

- Back dunes
- Riparian zone

Taupata

Coprosma repens

Coastal Coprosma



Widely spreading shrub in exposed places becoming tree like in more sheltered sites. It can form extensive ground cover as an understory plant in coastal forests. It has very glossy leaves and is sometimes called mirror plant.

Where to plant

- Rocky areas
- Back dune

Kohiki

Tetragonia implexicoma

Beach Spinach



Fleshy leaved creeping, sprawling plant with bright red berries. Edible leaves have a sharp tangy flavour.

Where to plant

- Back dunes
- Rocky places

Ti Kouka

Cordyline australis

Cabbage Tree



Iconic native species. Forked branches with clusters of strap like leaves. Flowers have a pleasant smell.

Where to plant

- Back dunes
- Riparian zone

Wharangi

Melicope ternata



Wharangi

Bright green leaves that have a citrus smell when crushed. The resin was used to perfume hair oil. Small tree that needs some shelter from strong winds.

Where to plant

- Back dunes
- Riparian zone

Whau

Entelea arborescens



Corkwood

Lush tropical looking leaves. Very fast growing shrub to tree size. The tree is short lived, about 10 years but produces vast quantities of seed. Quick turnover, a good restoration species.

Where to plant

- Back dunes
- Riparian zone

Houpara

Pseudopanax lessonii



Coastal Five Finger

Good colonising plant it provides shelter for other coastal forest species. Semi woody shrub with glossy leathery leaves.

Where to plant

- Back dunes
- Riparian zone

Kahikatoa/Manuka *Leptospermum scoparium var. incanum* Ti Tree



Be careful to source from the ecological district as manuka from further south is quite different. Shrubby in the dune environment and this northland type has beautiful pink flowers.

- Where to plant
- Back dunes
 - Riparian zone

Zone: Estuarine salty stream flats

Horokaka *Disphyma australe*



New Zealand Iceplant



The leaves of the NZ ice plant are smaller than the exotic species it flowers right through summer with cream or pink flowers up to 70mm across. Better suited to rocky coastlines.

- Where to plant
- Salty stream flats
 - Coastal cliffs and rocky areas

Hibiscus diversifolius



Native Prickly Hibiscus

Semi woody sprawling shrub with large cream/yellow flowers. Likes wet feet and coastal sites. Is an endangered plant and highly favoured by cattle and horses.

- Where to plant
- Brackish stream flats

Toetoe Upoko-Tangata



Cyperus insularis

Giant Umbrella Sedge

Large clumps of wide light green/grey leaves with contrasting dark seed heads held up on triangular stems. Was used for kite making and thatching.

Where to plant

- Coastal river margins
- Coastal lagoons
- Dune swales

Carex pumila



Sand Sedge

Deep blue-green, tufted sedge; tufts are coarse, arising from a long, creeping underground stem. An excellent sand binder.

Where to plant

- Coastal river margins
- Coastal lagoons
- Dune swales

Makaka

Plagianthus divaricatus

Saltmarsh Ribbonwood



A tangly branched shrub forming a distinct zone at the edges of salt marshes. The makaka is the shrub in the centre of the photo.

Where to plant

- Where water is brackish
- Edges of estuaries

6. Rules and regulations

Requirements for consents, licenses or concessions

The dune plantings and fencing will not require consents from either the Northland Regional Council or the Far North District Council.

Normally DOC would require a permit for collecting plant materials from public conservation land. DOC will not require the restoration group to obtain a permit for the purposes of collecting seeds and vegetative propagating material from areas that it administers under the following conditions:

1. That all plants raised from such collections are used solely for the purpose of restoration of the Mapere Block.
2. That no commercial gain is realised through the sale of plants.
3. The guidelines for collecting seed and taking cuttings are followed. (Appendix 3).
4. Biosecurity risks including weed and animal pests are managed. This means no new animal or plant pests are introduced to the site as a result of any activity associated with restoration. (Appendix 4).

There is an archaeological site on the western side of the reserve where Koiwi was exposed by erosion and subsequently removed for burial. There are exposed shell middens in the eroded part of the fore dunes. The Department of Conservation will apply to the Historic Places Trust for a licence to allow the restoration work to go ahead.

If mechanical reshaping is required (and deemed appropriate) in order to restore a more natural dune shape prior to planting it would be classed as earthworks within a Riparian Management Zone (RMZ) which is a permitted activity (not requiring a Resource Consent, provided that;

- (a) Environmental Standards in section 32 are complied with;
- (b) The earthworks are the minimum necessary;
 - i. To give effect to the permitted activity rules in this plan
 - ii. The area of exposed soil is less than 200m² and the volume of earth disturbed is less than 50m³; or
 - iii. For track or road maintenance
- (c) Following the completion of any earthworks those parts of the Riparian Management Zone that are not required for the permitted activity are reinstated to a stable contour and revegetated as soon as practicable;
- (d) As a result of the earthworks in the Riparian Management Zone there are no adverse flooding or drainage effect on any property owned or occupied by another person

Responsibilities

The Ahipara Recreation Reserve is currently administered by DOC and all district and regional plan compliance requirements are ultimately DOC's responsibility.

In order for DOC to be able to support restoration initiatives there will need to be an agreed project plan between DOC and the restoration group. Specific guidelines for planting and maintenance will be laid out in a project plan.

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De Lange, W. & Jenks, G. K., 2007. *Effectiveness of dune restoration for the management of coastal hazards and biodiversity*, NZ Coastal Society Conference, Tauranga.

Useful Websites

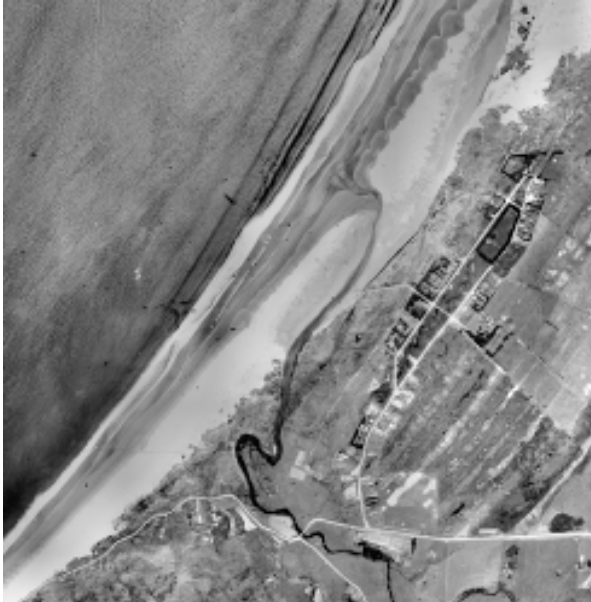
The New Zealand Plant Conservation Network website: www.nzpcn.org.nz
Contains fact sheets for plants including propagation advice.

NRC CoastCare website: www.nrc.govt.nz/coastcare
General information on CoastCare including projects around the region and downloadable factsheets on dune form and function and dune restoration.

DOC website: www.doc.govt.nz/getting-involved/volunteer-join-or-start-a-project/
Practical information on setting up community restoration projects.

Appendices

Appendix 1 – Historic Photographs of the Study Site



1950 (NRC)



1960 (NRC)



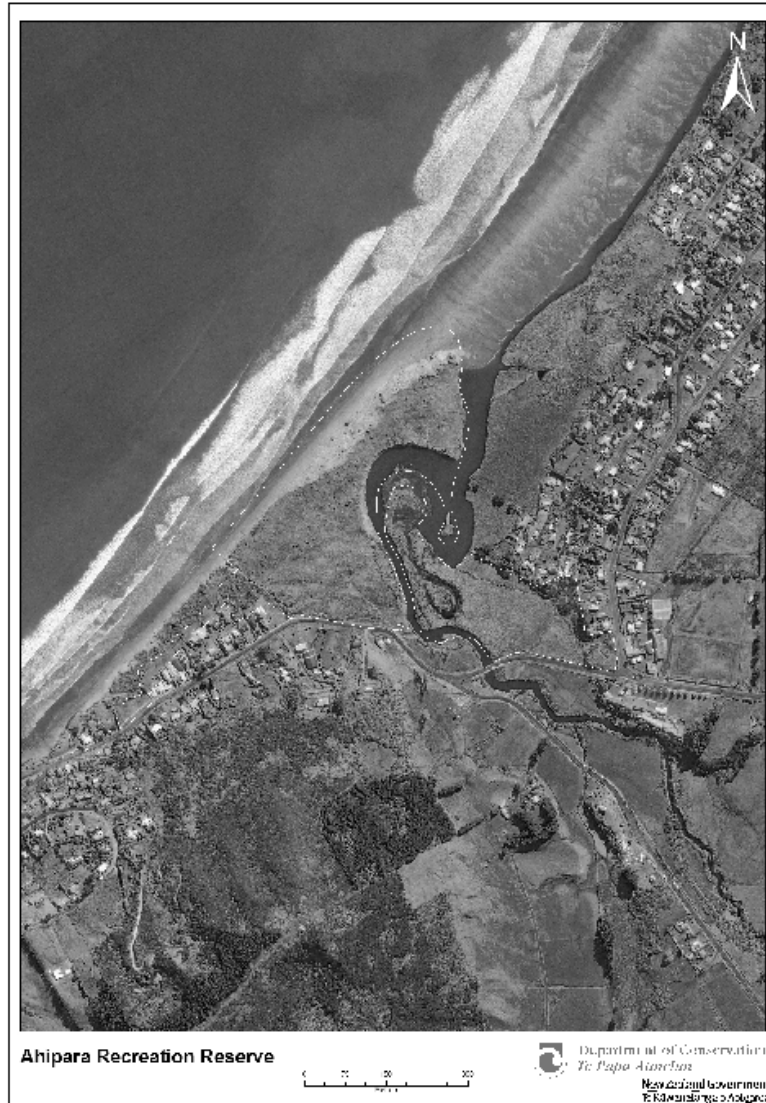
1977 (NRC)



1981 (NRC)



2000 (NRC)



2009 (DOC)



June 1996 (NRC)

Appendix 2. Guidelines for collecting seed and taking cuttings.

- Use a sampling strategy that will allow every plant to naturally disperse most of its seeds into the wild.
- In general collect less than 20% of the seeds from any plant. For populations of 10 or less individuals collect less than 5% of the seeds from any plant.
- Collect mature seeds and keep them cool and dry.
- Collect seeds into paper bags or envelopes (not plastic).
- If seed is slightly immature, and you will not be able to return to the site at a better time, it is sometimes possible to obtain good seed by removing a whole or part of an inflorescence with the stalk attached and allowing it to dry slowly in a paper bag. This does not mean remove the whole plant, only a flowering stem or branch.
- Collect from as many individuals as possible trying to sample from at least 40-50 plants, spread evenly across the population. This is to maintain genetic diversity at the restoration site.
- Collect a specimen of the plant - this is important to ensure that the species has been accurately identified. If there is too little material available to collect a specimen take a photo instead. Keep the specimen cool in a zip lock plastic bag and press between layers of newspaper so all the features are preserved.
- Document information about the site where seed is collected and approximately how many plants were collected from. Hand drawn dots on maps is OK, records of locations using GPS is better.
- To avoid wastage of plant material, follow horticultural practices when taking cuttings e.g. keep cuttings moist, cool and process quickly.
- Collect cuttings from as many individuals as possible trying to sample at least 40-50, spread evenly across the population. This is to maintain genetic diversity at the restoration site.

Appendix 3: Managing Biosecurity Risk

Argentine Ants

The key tasks to managing the risk of argentine ants getting to the Mapere Block are as follows:

- Monitor the Tuia nursery regularly. (DOC)
- Ensure potting mix suppliers are Argentine Ant free. (Tuia Nursery)
- DOC staff to inspect any contractor's machinery prior to working on site.

Argentine ants *Linepithema humile* (Mayr) are one of the world's most invasive and problematic ant species. They are very aggressive, and although they are not poisonous, they do bite people. Unlike other ant species, Argentine ant colonies cooperate with each other, and can combine over winter into super-colonies. They reach enormous numbers, which means they have a huge appetite. It also makes them more aggressive towards other insect populations through their sheer number.



Argentine ant

Argentine ants can have a massive impact on the natural environment. While they are one of the major household and garden pests, they pose a serious threat to the conservation values of our reserves and natural areas. These threats include:

- eliminating other species of ants
- competing with kiwi for food such as insects and worms
- competing with other native birds and lizards for nectar
- displacing and killing native invertebrates

Argentine ants are now known for many parts of Auckland and Northland, as well as Bay of Plenty, Hawke's Bay, Wellington, Nelson and Christchurch.

You can help to control the spread of argentine ants, in particular by:

- monitoring sites and controlling them if they are detected
- checking potted plants for ants before moving
- checking garden soil and bark, and building materials before moving
- checking camping gear, especially when you are moving in and around reserves
- asking your retailer prior to purchasing goods whether they have Argentine ants and if they do, what treatment regime do they have in place to prevent them from spreading?

For more information

Check out the following websites:

Department of Conservation www.doc.govt.nz

Northland Regional Council www.nrc.govt.nz

Manaaki Whenua (Landcare Research) www.landcareresearch.co.nz

Rainbow Skinks

The key tasks to managing the risk of rainbow skinks getting to the Mapere Block are as follows:

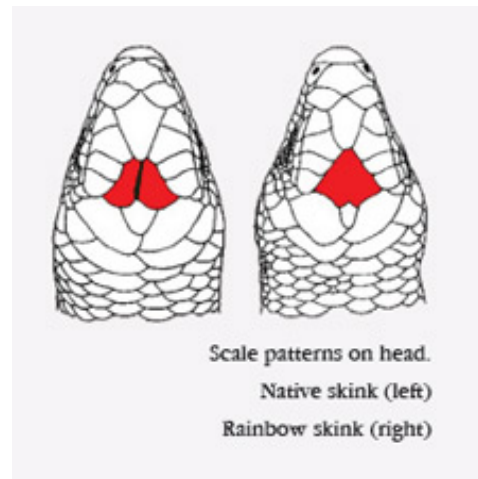
- Find out more about the pest <http://www.doc.govt.nz>
- Monitor Tuia nursery for rainbow skinks and eggs
- Ensure potting mix suppliers are Rainbow skink free

Potting mix in potted plants is a favoured breeding habitat. Please check these for any of the small white eggs, especially if plants are to be used in restoration projects e.g. on off-shore islands or adjoining key mainland ecosystems. Discuss their presence and threats with a neighbour and friends.

Australian rainbow skinks (*Lampropholis delicata*) are small, brown or grey-brown with an iridescent rainbow or metallic sheen when seen in bright light. They are about 3-4 cm long from nose to hind legs, i.e. excluding the long thin tail, and have a dark brown stripe on each side.



Head of rainbow skink, showing scale patterns



Rainbow skink scale patterns

Although the adults are smaller than native skinks, they look very similar but can be easily distinguished. Rainbow skinks have one large scale on the top of their head, where native skinks have two smaller scales.

Rainbow skinks prefer moist areas and are commonly found under vegetation, litter, rocks and logs but also frequently enter freight and shipping containers. They thrive in urban areas, gardens, commercial areas, industrial sites, garden centres, and waste ground.

The best time to look for them is during the day when temperatures are above 10 degrees. Look under vegetation, rocks and stacked wood, in gardens, on pathways and in the sun on the edge of bush and on the coast.

Lizards, although very active, can be hard to spot unless you keep still for several minutes at a time and move very slowly. It may help to use binoculars. You may find communal nests of 20-100 small white eggs, 8-10mm long, oval in shape, with a tough leathery shell.

Pest Plants

Reducing Risk of Introducing New Weeds to the Mapere Block

- Management at the nursery to ensure plants delivered to site are weed free.
- Monitor the Mapere site and remove any garden waste.

Most New Zealanders know that animal pests like possums are pest enemies to New Zealand's natural environment. The threat from weeds is not as well known but is just as serious. Weeds like old man's beard, wild ginger, pampas and contorta pine are a major threat to New Zealand's special native species, ecosystems and conservation lands.

In New Zealand weeds are almost always plant species that humans have introduced to the country. Sometimes, however, even a native species can be considered to be a weed in a particular site if it affects an important natural value on that site.

The Department of Conservation manages eight million hectares of native forests, tussock lands, alpine areas, wetlands, dunelands, estuaries, lakes and many islands. This is about 30% of New Zealand's land area. DOC is responsible for preserving and protecting these areas, including managing threats to them from invasive weeds.

This is, however, one issue where all New Zealanders can make a real difference. It is no accident that the weediest places are often those closest to towns. Over 70% of invasive weeds were originally garden plants. People continue to spread invasive weeds by growing them in their gardens, dumping rubbish from gardens or fish tanks, or accidentally spreading seeds and fragments.

Weeds are a problem both on land, and in freshwater environments. For help on how to control weeds, the [Weedbusters website](http://www.weedbusters.org.nz) has a lot of information, including photos to identify weeds, and how to control them.



www.weedbusters.org.nz

The Department of Conservation has been proud to have a lead role in the Weedbusters initiative. Controlling weeds is an important part of conservation work, and unless everyone plays their part in stopping the spread of weeds we will be fighting a losing battle.