

4d Role of plants in formation and function of dunes

Understanding the form and function of sand dunes

Objective for today

- Today we will look at the process by which dunes are formed.
 - What role do plants play in the formation and function of dunes?

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Sand dune formation

- The formation of dunes is a dynamic (constantly changing) process.
- Sand is eroded from dunes by storms, wind and waves.
- To maintain the sand budget, sand also accretes (collects) on dunes.
- Plants have an important role to play in this process.

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Dune vegetation is pretty amazing!

- What can dune vegetation do?
 - Reduce wind erosion by decreasing wind speed at ground level.
 - Build up sand dunes, reducing the amount of damage during a storm.
 - Reduce wave erosion.
 - Tolerate a hostile environment of high winds, salt spray, sand blast, covering by sand, sandy soil and little water.



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Dune vegetation is pretty amazing!

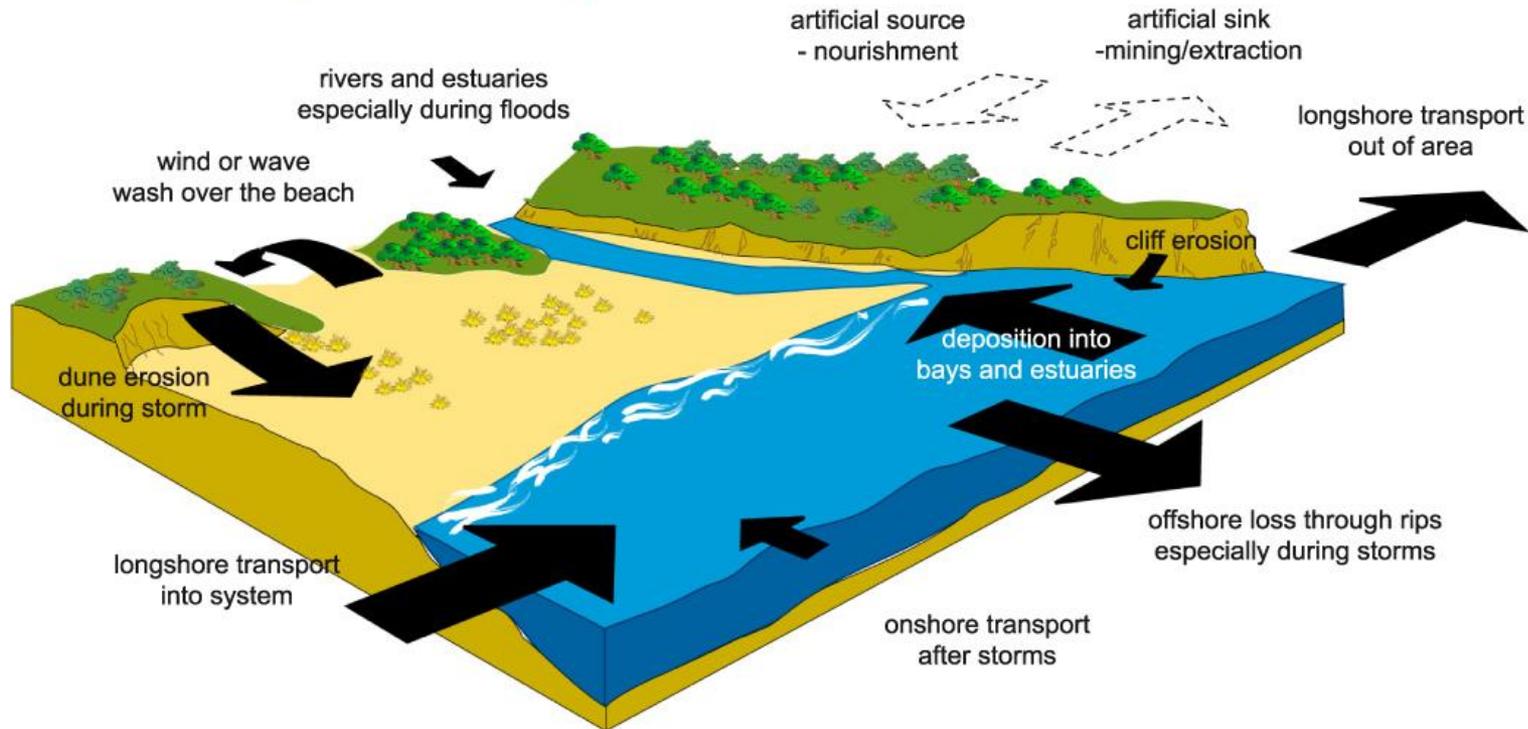
- Can you see the accretion happening during this storm?
- Where sand is blown into plants in places where people don't walk, the sand is well aerated and able to absorb waves.
- This results in less erosion when big storm waves hit these foredunes.
- Where sand is more compact it is less able to absorb waves.



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Maintaining the sand budget

Sand budget - showing sources and losses of sand for a beach



- Keeping sand dunes healthy means the sand budget needs to be maintained – plants are an important part of this process.

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Dunes look different with and without plants

Dune management in Ohope Maraetotara Reserve



Dune Front

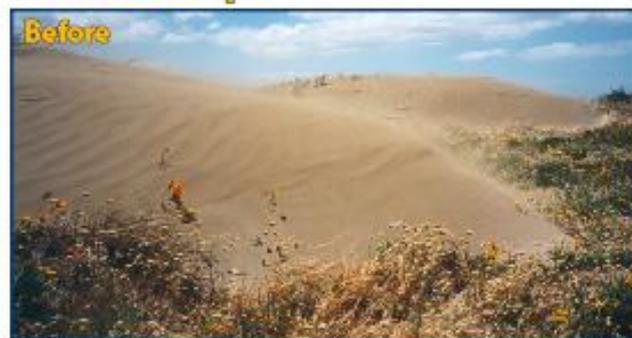


Before
A storm water drain (by peg in middle of photo) was lowering beach level, which promoted wave attack on the dune front slope.



After
Whakatane District Council removed the storm water drain and formed a drainage swale behind the dune. Excess sand from the swale was used to fill in the embayment. Ohope Coast Care members planted the sand with functional dune plants.

Dune Backslope



Before
The eroded front slope encouraged wind erosion of sand over the crest, to be deposited on the backslope. This untethered sand was smothering daisies and weeds, and blowing towards the road and houses.



After
The wind deposited sand was also planted with functional dune plants by Ohope Coast Care, to result in a functional and stable dune.

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A wide healthy foredune



- A restored dune system with beach access marker, east of Pāpāmoa Domain.

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Importance of foredune plants

- Foredune plants like kōwhangatara (*Spinifex sericeus*) and pīngao (*Ficinia spiralis*), trap wind-blown sand in the foredunes.
- This sand serves as a reservoir for the beach during periods of wave erosion.
- In the absence of sand trapping dune vegetation, wind-blown sand from the beach moves inland and is lost to the beach/dune system.
- Sand remains mobile and loose in the system, so can be moved along the beach in long shore drift currents.

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How do native foredune plants trap the sand?



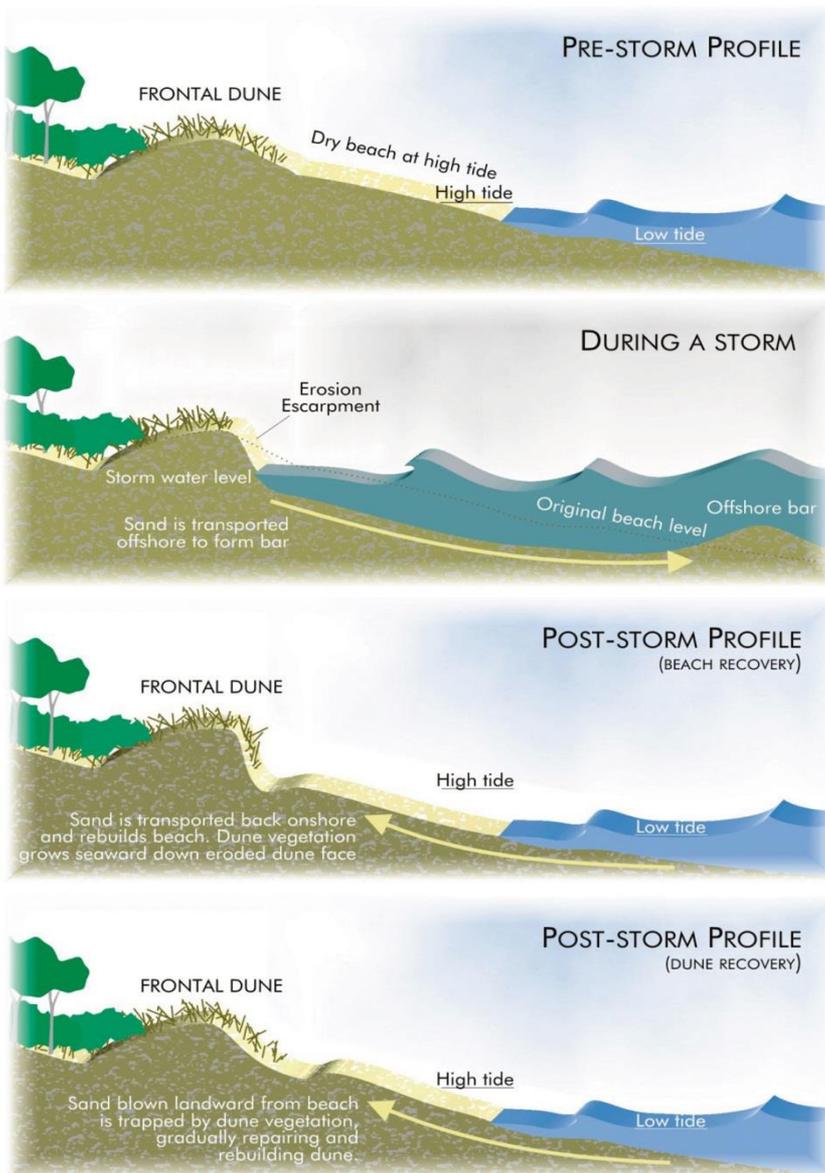
Picture shows sand being trapped by kōwhangatara or spinifex

- The higher the wind speed the more sand it carries. Plants slow the wind down.
- The reduction in wind movement results sand being deposited on and around these plants.
- Kōwhangatara (spinifex) and pīngao have the ability to grow through accumulations of wind-blown sand.

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The natural storm cut and beach recovery processes

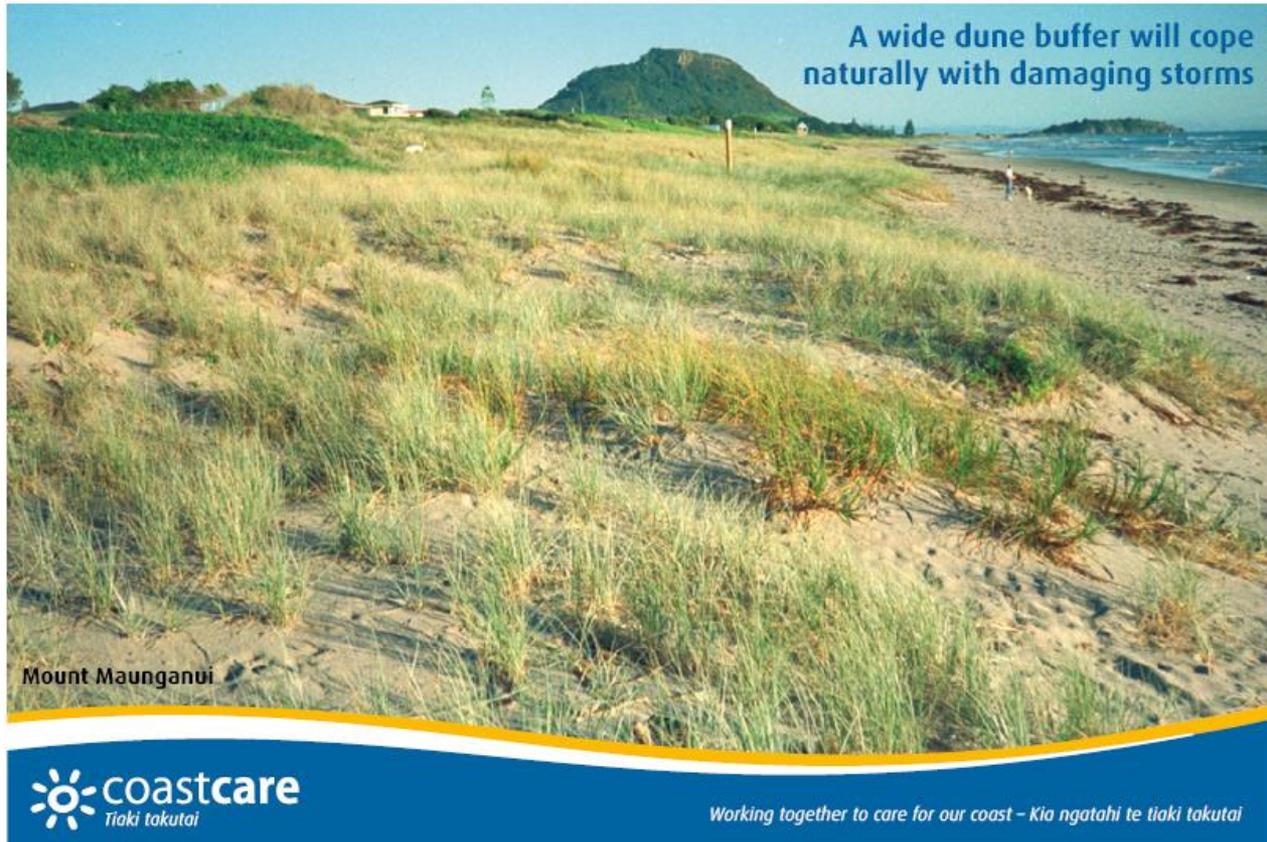
(Images from Environment Waikato 2001)



- Post storm recovery is aided by sand binding plants colonising the dune scarp, trapping wind-blown sand to repair the dune.

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Healthy dunes with good vegetation can buffer the effects of storms



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Plants can make a difference

Papamoa Domain

This popular area provides easy access to great coastal views and beach, and attracts many people year round.



June 1995
Lack of native front-dune plants meant sand was regularly blown onto the carpark, blocking access on occasion.



August 2000
Coast Care BOP members designed, installed and planted leaf shaped plots to create multiple access points, blocking access on occasion.



June 2002
The "weather bomb" struck and the spinifex and pingao trapped vast quantities of sand. The bollards and ropes had to be raised to renew effectiveness.



31 December 2002
Just six months later, the plants have emerged completely, ready to trap more sand in the next storm event.



9 January 2003
Nine days later it happened again.



6 May 2004

Plants behind the foredune

- The area behind the foredune is sometimes called the mid or back dune (shown as Zone B, C or D in the diagram).
- Plants here gradually replace the foredune plants as soil conditions improve and conditions become less harsh (e.g. decreased exposure to salt spray and sand blast).
- These plants play a lesser role in dune formation.

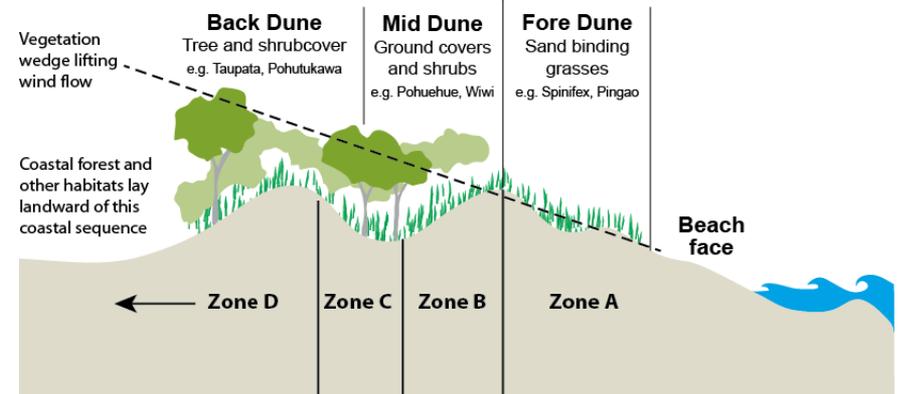


Diagram showing the vegetation sequence which probably characterised the most seaward coastal dunes of the Bay of Plenty region before human settlement.

Note: In some parts of the Bay of Plenty coast, houses now occupy zones B, C and D and development excludes native plants.

What happens in severe storms?

- In severe storms dune plants sometimes get washed away. It's a natural part of the dune formation process. Their remnants are left to re-grow.



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Dune vegetation cannot tolerate...

- residential development too close to the beach.
- recreational activities such as 4-wheel drives and sand boarding.
- farming – including grazing stock on the beach.
- beach mining.
- mowing – which destroys some species.
- topsoiling – which prevents free drainage and is unsuitable for growth of many natural dune species.
- introduction of unsuitable plant species – some displace natural vegetation, others such (like palm trees) accelerate wave erosion when they fall.



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