Activity Title:

Climate change: Changing Beach and Coastline Profiles

Learning objective

Investigate how sea level rise predictions are expected to affect sand dunes at a local / regional coastal site

Focusing question

How is sea level rise expected to affect sand dunes locally / regionally?

Resources required (resources marked * can be found on the following pages)

- Prior Knowledge Chart*
- News article 'Bay Beaches, storms and climate change'*
- Questions and fill the gaps activity for news article 'Bay Beaches, storms and climate change'*
- Sketch pad, camera, pens and paper
- PMI Chart and/or Mind Map template*
- Access to internet
- Devices, screen or projector for viewing film clips / websites
- Additional resources for the beach profiling activity – *see the list on the following page*
- Summary quiz questions* / Kahoot quiz

ACTIVITY

5h(ii)

Activity Title:

Climate Change: Changing Beach and Coastline Profiles

Education for Sustainability Aspect:

- Environmental Aspect
- Socio-cultural political Aspect

Key Competencies:

- Thinking
- Sustainability
- Personal and social responsibility for action
- Participating and contributing

Curriculum Links:

- Science
- Social science

See green panel below for detail

Curriculum Links continued:

SCIENCE Level 1 & 2:

The Nature of Science: Participating and contributing. Explore and act on issues and questions that link their science learning to their daily living.

Living World: Ecology. Recognise that living things are suited to their particular habitat.

Planet Earth and beyond: Interacting systems. Describe how natural features are changed and resources affected by natural events and human actions.

SCIENCE Level 3 & 4:

The Nature of Science: Participating and contributing. Use their growing science knowledge when considering issues of concern to them. Explore various aspects of an issue and make decisions about possible actions.

Living World: Ecology. Explain how living things are suited to their particular habitat and how they respond to environmental changes, both natural and human-induced.

SCIENCE Level 5 and 6:

Living World: Ecology. Investigate the interdependence of living things (including humans) in an ecosystem. Investigate the impact of natural events and human actions on a New Zealand ecosystem.

SOCIAL SCIENCE:

Conceptual Strand: Place and Environment

Level 2: Understand how places influence people and people influence places.

Level 3: Understand how people make decisions about access to and use of resources.

Level 4:

- Understand how exploration and innovation create opportunities and challenges for people, places, and environments.
- Understand that events have causes and effects.

Level 5:

- Understand how people's management of resources impacts on environmental and social sustainability.
- Understand how the ideas and actions of people in the past have had a significant impact on people's lives.

Level 6 (Geography): Understand how people interact with natural and cultural environments and that this interaction has consequences.

Resources required for the Beach Profiling Activity

(resources marked * can be found on the following pages)

- Two 1.5m lengths of 50 x 25mm timber, marked and numbered at 1cm intervals from 0cm at the top to 150cm at the bottom
- One measuring tape at least 3m long
- Field activity instruction sheet – Beach profile and plant survey*
- Field activity worksheet – Beach profile and plant survey*
- Pens
- Copies of the **Coast Care Booklet No. 9: Backyard Buffers**

Prior learning

5h(i) Climate change in the Bay

Method

PRIOR KNOWLEDGE: CLIMATE CHANGE AND BEACHES

1. Review key learning from 5h(i) (Climate Change in the Bay).
2. Inquiry:
   - Why is climate change a big issue in relation to the sea?
   - What will climate change mean for our beaches and the communities of animals and plants that live there?
   - How will it affect coastal properties in the Bay of Plenty?
   - Have you noticed any possible climate change related changes on your beach?
   - Is there anything we can do to adapt or prevent the impacts of climate change on our coastline?
3. Discuss: What we already know about the possible effect of climate change on our coastline.
4. Use the Prior Learning Chart to record prior learning.

IMPACT OF STORMS AND CLIMATE CHANGE ON BAY BEACHES

1. Read the news article 'Bay beaches, storms and climate change'.
2. Answer the 'How well did you read: Bay beaches, storms and climate change?' questions and / or complete the 'fill in the gaps' activity. ***(Teacher answers: 1B, 2C, 3A, 4D, 5C, 6D, 7B, 8A, 9B)***
3. Inquiry (younger learners)
   - How does the sand come and go from our beach?
   - How do plants help sand to stay in the dunes?
   - Why do you think more sand might be lost from our beaches due to climate change?
   - What can we do to help?
   - How can we adapt to our changing climate?
4. Inquiry (older learners)
   - What is erosion?

- What is accretion?
- How do these two processes work together?
- What role do plants play on sand dunes? And which plants are particularly good at this job?
- How do sand dunes perform the role of a natural buffer? Between what and what?
- Why do you think more sand might be lost from our beaches due to climate change?
- What can we do to help?
- How can we adapt to our changing climate?

HOW DUNES WORK AND FUNCTION TO PROTECT THE COAST

1. Organise a walk / hikoi to your local beach.
2. Sketch or take photos of different dunes (including a healthy planted dune and an eroded unplanted dune).
3. Inquiry:
   - What do you notice about the shape of planted dunes v unplanted dunes?
   - What would the beach be like if there were no sand dunes?
   - How do sand dunes change their shape and form over time?
   - What role do plants play and how in making and keeping sand dunes?
   - What roles do sand dunes perform for (i) people (ii) plants and (iii) animals.
4. For younger students: Use a PMI (Plus, Minus, Interesting) chart to organise thinking about sand dunes. What is great about sand dunes? What is not great about sand dunes. What do I wonder or find interesting about sand dunes?
5. For older students: explain the idea of a 'mind map'. Break into small groups to create a mind map of the different roles played by sand dunes. Consider: climate change, storms, king tides, human activities, animals and plants, buildings... (For example: sand dunes protect houses behind the dunes, act as a habitat for animals, plants and insects, and as a buffer protecting from storms and sea level rise arising from climate change).
6. Watch **Our sand dunes clip 2 – How dunes work** to reinforce and add learning about how the dunes work.
7. Revisit the mind map / PMI chart and add new knowledge.
8. Using knowledge from the film clip and sketches / photos from the beach hikoi draw a diagram of an eroded sand dune that lacks planting and then sketch a healthy planted sand dune.
9. Inquiry:
   - How might the shape of a healthy dune be different to an eroded dune?
   - How might the amount and type of vegetation differ in healthy and unhealthy dunes?
   - How might a healthy dune and an eroded dune function differently during climate change induced conditions including: (i) storms of increased intensity, (ii) sea level rise and (iii) king tide events.
10. Share mind maps and pictures with the rest of the class OR brainstorm on a large piece of paper or the board record all the functions and roles of sand dunes that have been thought of collectively.
11. Complete the Summary quiz questions ***(Teacher answers: 1D, 2A, 3C, 4B, 5C, 6B, 7D, 8A)*** or do the Kahoot quiz **Our Changing BOP Climate: Beaches and Coastlines.**

BEACH PROFILES AND CLIMATE CHANGE

1. The objective of this exercise is to explore how the form and profile of eroded and accreting dunes differ and to investigate the likely impact of climate change on dune profiles and vegetation. In achieving these objectives, students gain practical experience in the conduct of beach profiles and plant surveys.
2. Identify two locations for conducting the beach profile exercise. One should be a dune that is eroded (a heavy use area) and the other where dunes are building up (a low use area). Your local Coast Care coordinator will be able to help you to identify good sites for this exercise.
3. In the classroom hand out a field activity instruction sheet and worksheet to each student. Give each group two pieces of timber required for the profiling activity. Get students to do a pretend practice in the playground or field of how they will conduct the activity once at the beach.
4. In the field: in small groups, create a beach profile and plant survey at the first of the two sites. Instructions on how to do this are described on the field activity instruction sheet. NOTE: Each small group will require two pieces of timber to complete this activity. Repeat the activity at the second of the two sites.
5. Inquiry:
    - What happened to the profile of the beach at the two sites? How are the two profiles different and why? Is this what you expected?
    - At each site – what happened to plant height along the beach profile? Why do you think this was the case? How did plant height compare at the two sites?
    - How did plant density differ along the profile? Was there a difference in plant density between the two sites?
    - What species were found common close to the sea? What species of plant were common further from the sea? Were the same plant species present at each site?
    - Consider the expected sea level rise in the chart below. Having examined the profile of these two dunes what are some of the likely effects of the predicted sea level rise, king tides and increasing storm intensity on:
        a. Sand (erosion and accretion)
        b. Dune shape and form
        c. Plants
        d. Dune community
        e. Properties situated on or behind the dune
    - What are some things we can do to adapt as sea levels rise and the frequency and severity of storms increases?
6. Extension learning:
    - Once back at school use the data collected to computer generate graphs and profiles.
    - Conduct a percentage cover exercise in the field. Use a square or circular quadrat and estimate the percentage cover of plants in that area for different plant species. Discuss how native foredune species like spinifex and pīngao only need 40-50% groundcover to be fully effective where marram is denser (NOTE: On some beaches it may be worthwhile retaining marram as it is the most common dune plant (sometimes only!!) in many South Island areas. And its excessive density is part of its poor function problem—a density of about 100 percent meaning sand blows right over the top of it, to accumulate only at the crest of the dunes. This creates all sorts of problems, as occurred on the Brighton dunes!)

Possible next steps

- 5h (iii) Impact of Climate Change on Coastal Animals and Plants.
- Create a visual diary recording storm events and dune changes for a beach near you. Record ngā tohu o te taiao – things you notice about the dunes, animals, plants and weather conditions at your local beach.
- Join a local Coast Care group and help re-plant local dunes.

Additional resources

- **Coastal Restoration Trust. How dunes work.**
- **Te Ara Encyclopedia of New Zealand. Sand Dunes.**
- **NIWA. Beach Profile Monitoring.**
- **Ministry for the Environment. Our Marine Environment 2019.**

Mahi / activity

Prior knowledge chart

How will climate change our coast and beaches?		
What we know	**What we would like to know**	**What we have learned**

News article - kōrero pukapuka / read

Bay beaches, storms and climate change

Adapted from Bay of Plenty Regional Council Media Release, October 2021

Read this article and answer the questions provided.

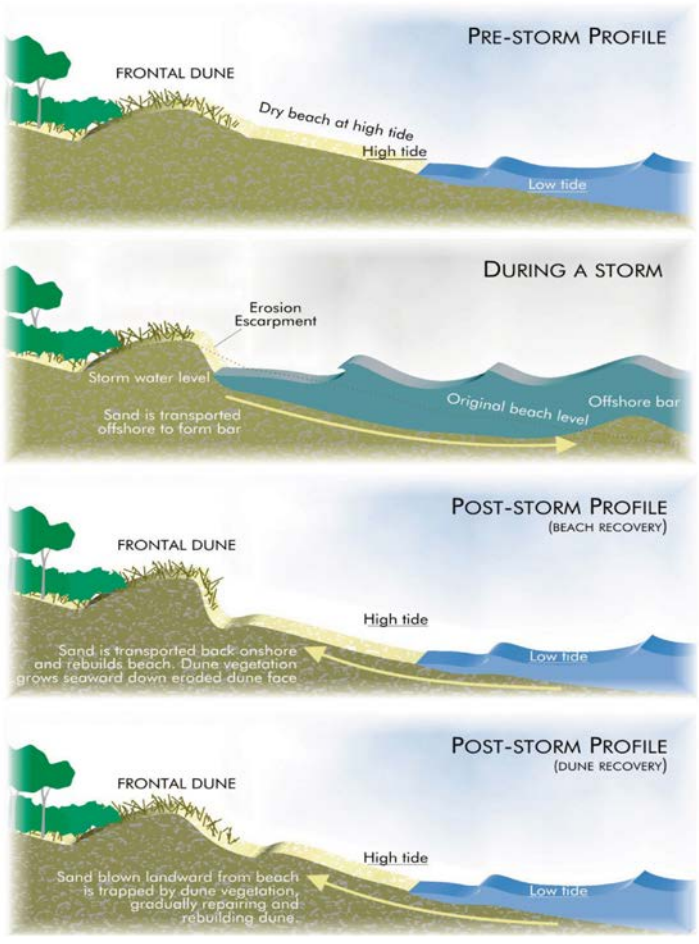
The Bay of Plenty's beaches have taken a battering this winter between wild storms, tides and the effects of climate change. Erosion can currently be seen along the coastline, from as far west as Waihi Beach right through to the East Cape. Coast Care Bay of Plenty would like to remind beach lovers that erosion is a natural process and the dunes do regenerate themselves.

Bay of Plenty Regional Council's Coast Care coordinator Rusty Knutson said sand dunes are a natural **buffer** between the land and the sea and a healthy dune system was our first line of defence against coastal flooding. But sand dunes were a dynamic system and we have to expect them to **change** over time, he said.

Mr Knutson said wild storms and king tides were events that were predicted to become more common due to both rising sea levels and increasing storm intensity as a result of climate change.

"After a big storm lots of sand can be lost from our dunes in a process called erosion. But when the weather settles down and weather patterns change, sand usually builds back up by a process called **accretion**.

"This is when smaller waves push sand back onto the beach and gentle winds then push sand into the dune system where it gets **trapped** by our native sand dune plants which rebuilds the sand dune system," he said.



Mr Knutson said a healthy frontal dune, those planted with native grasses (Spinifex / Kōwhangatara) and sedges (Pīngao), also absorbed energy from **storm** events and reduced damage to both dunes and the infrastructure sitting behind.

They are also able to regrow as they have long, deep **root** systems when conditions become more favourable, he said. "So, though it may look like some of our dunes are in danger at the moment we need to remember this is a natural process and they do regenerate themselves over time."

Mr Knutson said if you were concerned about our dunes, the best thing you can do for them is not walk over and trample the fragile native plants. Pīngao and spinifex can grow in sand and survive summer droughts and big waves but trampling over them will kill them, he said.

Mahi / activity – News article quiz:

How well did you read: Bay beaches, storms and climate change?

1. Erosion is a _____ process.

a. Unnatural
b. Natural
c. Human created
d. Unknown

2. After an erosion event, dunes will _____ over time.

a. Never repair themselves
b. Malfunction
c. Regenerate
d. Cease to exist

3. True or False? Sand dunes are a natural buffer between the land and the sea.

a. True
b. False

4. What does the article say is our first line of defence against coastal flooding?

a. An eroded dune system
b. An unstable dune system
c. Houses along the dunes
d. A healthy dune system

5. What is meant when it says that sand dunes are a "dynamic" system

a. Sand dunes will always remain the same
b. Sand dunes are static and never change
c. Sand dunes will change over time
d. Sand dunes are unnatural and should be removed

6. Why are wild storms and king tide events predicted to become more common?

a. Due to falling sea levels and reduced storm intensity.
b. Due to winter and seasonal weather changes
c. Due to eroding sand dunes
d. Due to rising sea levels and increasing storm intensity as a result of climate change

7. After a big storm lots of sand can be lost from the dunes in a process called erosion. But once the weather settles down and weather patterns change, sand usually builds back up. What is this process called?

a. Erosional sand
b. Accretion
c. Buffer up
d. Acclimatisation

8. How do native sand plants help build dunes back up after a storm event?

a. By trapping sand
b. By releasing sand
c. By looking pretty
d. By catching waves

9. True or False? Pīngao and spinifex cannot grow in sand or survive summer droughts and big waves

a. True
b. False

Mahi / activity – Fill the gaps

Bay beaches, storms and climate change

Adapted from Bay of Plenty Regional Council Media Release, October 2021

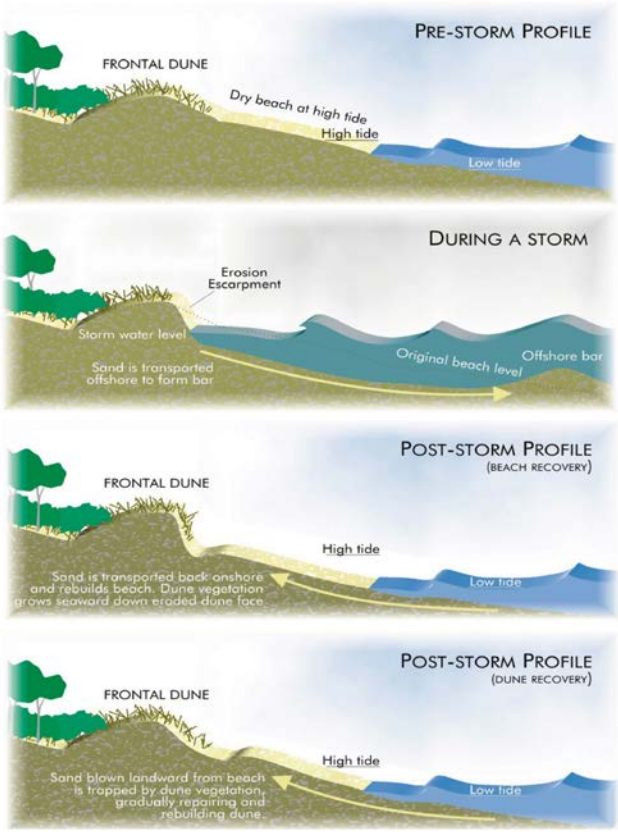
Use the kupu (words) in this box to fill the gaps in the following news article			
CHANGE	**ACCRETION**	**FRAGILE**	**TRAPPED**
REGENERATE	**EROSION**	**ROOT**	**RISING**
PROCESS	**STORM**	**BUFFER**	**CLIMATE**

The Bay of Plenty's beaches have taken a battering this winter between wild storms, tides and the effects of _____ change. _____ can currently be seen along the coastline, from as far west as Waihi Beach right through to the East Cape. Coast Care Bay of Plenty would like to remind beach lovers that erosion is a natural process and the dunes do _____ themselves.

Bay of Plenty Regional Council's Coast Care coordinator Rusty Knutson said sand dunes are a natural _____ between the land and the sea and a healthy dune system was our first line of defence against coastal flooding. But sand dunes were a dynamic system and we have to expect them to _____ over time, he said.

Mr Knutson said wild storms and king tides were events that were predicted to become more common due to both _____ sea levels and increasing storm intensity as a result of climate change.

"After a big storm lots of sand can be lost from our dunes in a process called erosion. But when the weather settles down and weather patterns change, sand usually builds back up by a process called _____.



"This is when smaller waves push sand back onto the beach and gentle winds then push sand into the dune system where it gets _____ by our native sand dune plants which rebuilds the sand dune system," he said.

Mr Knutson said a healthy frontal dune, those planted with native grasses (Spinifex / Kōwhangatara) and sedges (Pīngao), also absorbed energy from _____ events and reduced damage to both dunes and the infrastructure sitting behind.

They are also able to regrow as they have long, deep _____ systems when conditions become more favourable, he said. "So, though it may look like some of our dunes are in danger at the moment we need to remember this is a natural _____ and they do regenerate themselves over time."

Mr Knutson said if you were concerned about our dunes, the best thing you can do for them is not walk over and trample the _____ native plants.

Teacher answers for the news article fill the gaps

Bay beaches, storms and climate change

Adapted from Bay of Plenty Regional Council Media Release, October 2021

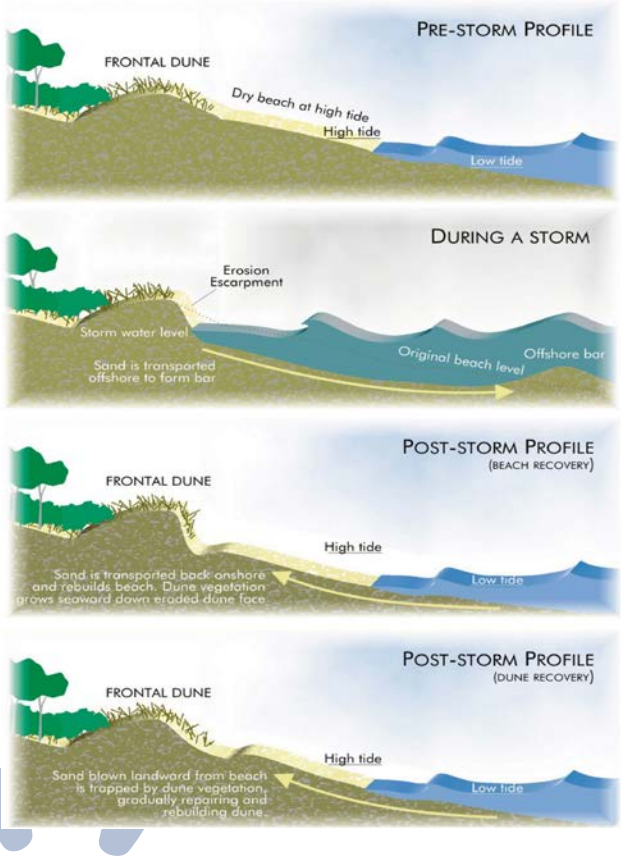
Use the kupu (words) in this box to fill the gaps in the following news article			
CHANGE	**ACCRETION**	**FRAGILE**	**TRAPPED**
REGENERATE	**EROSION**	**ROOT**	**RISING**
PROCESS	**STORM**	**BUFFER**	**CLIMATE**

The Bay of Plenty's beaches have taken a battering this winter between wild storms, tides and the effects of **CLIMATE** change. **EROSION** can currently be seen along the coastline, from as far west as Waihi Beach right through to the East Cape. Coast Care Bay of Plenty would like to remind beach lovers that erosion is a natural process and the dunes do **REGENERATE** themselves.

Bay of Plenty Regional Council's Coast Care coordinator Rusty Knutson said sand dunes are a natural **BUFFER** between the land and the sea and a healthy dune system was our first line of defence against coastal flooding. But sand dunes were a dynamic system and we have to expect them to **CHANGE** over time, he said.

Mr Knutson said wild storms and king tides were events that were predicted to become more common due to both **RISING** sea levels and increasing storm intensity as a result of climate change.

"After a big storm lots of sand can be lost from our dunes in a process called erosion. But when the weather settles down and weather patterns change, sand usually builds back up by a process called **ACCRETION**.



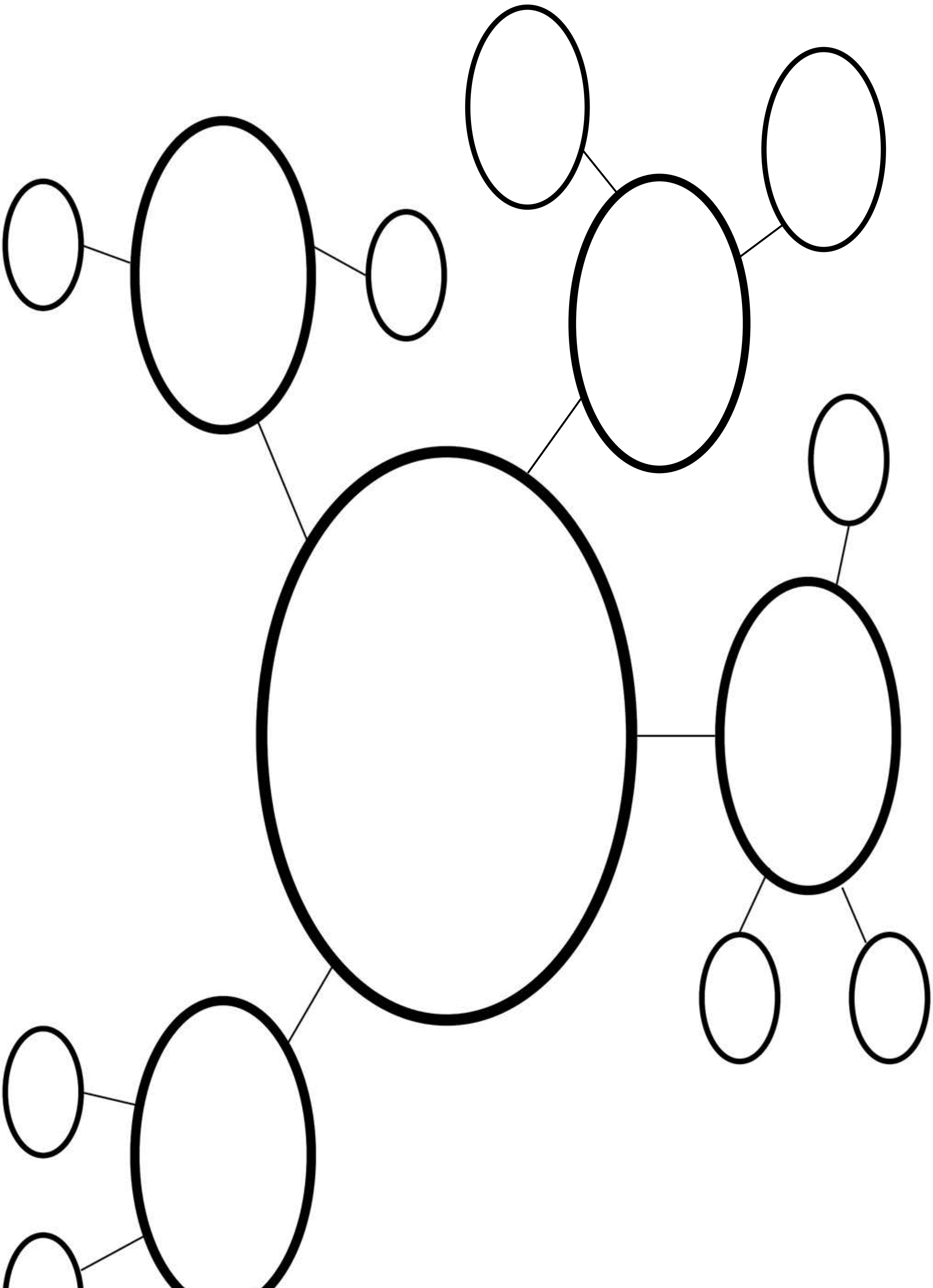
"This is when smaller waves push sand back onto the beach and gentle winds then push sand into the dune system where it gets **TRAPPED** by our native sand dune plants which rebuilds the sand dune system," he said.

Mr Knutson said a healthy frontal dune, those planted with native grasses (Spinifex / Kōwhangatara) and sedges (Pīngao), also absorbed energy from **STORM** events and reduced damage to both dunes and the infrastructure sitting behind.

They are also able to regrow as they have long, deep **ROOT** systems when conditions become more favourable, he said. "So, though it may look like some of our dunes are in danger at the moment we need to remember this is a natural **PROCESS** and they do regenerate themselves over time."

Mr Knutson said if you were concerned about our dunes, the best thing you can do for them is not walk over and trample the **FRAGILE** native plants.

Mind map



Mahi / activity

PMI (Plus Minus Interesting) Chart

Plus *What is great about this is…*	**Minus** *What is NOT great about this is…*	**Interesting** *What is interesting… / I wonder…*

Field activity instruction sheet

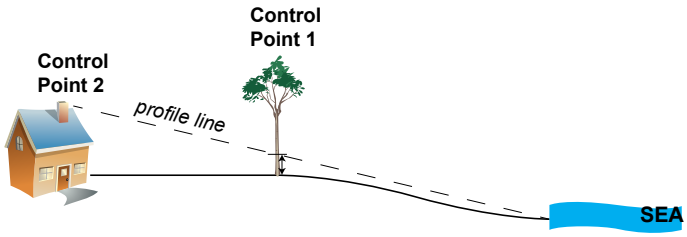
Beach profile and plant survey

Draw two beach profiles – one in an area where the dunes are being eroded (heavy use area) and one in an area where the dunes are building up (low use area). It is best to do this at low or up to half tide.

How to draw a beach profile and do a plant survey

Equipment needed

- Two 1.5m rods of bamboo or timber, marked and numbered at 1cm intervals from 0cm at the top to 150cm at the bottom (Rod 1 and Rod 2)
- One measuring tape at least 3m long



Method

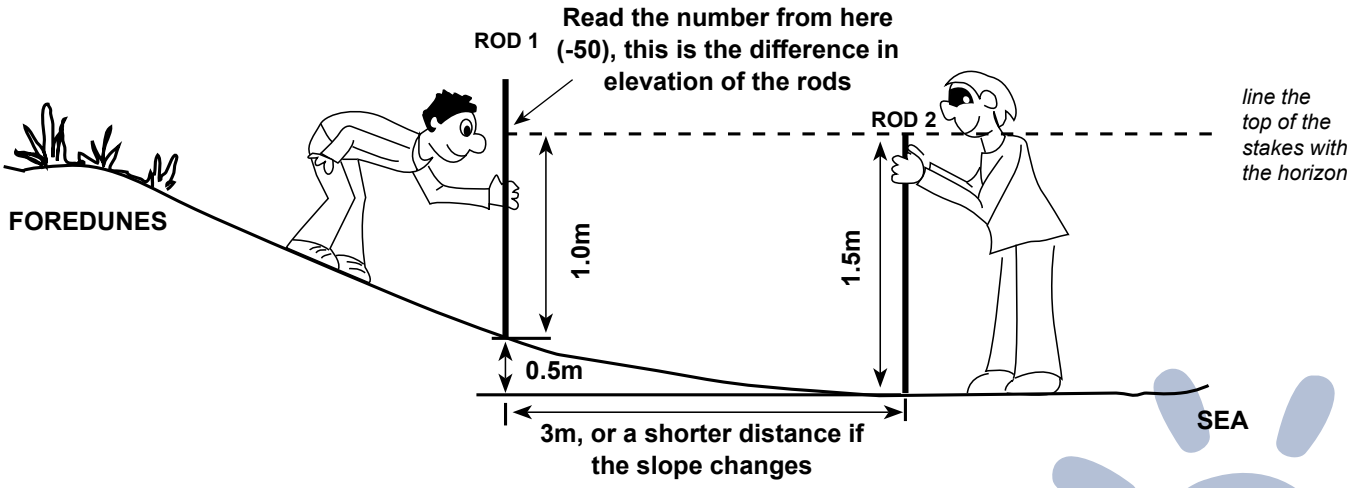
Part one – beach profile

Before you start:

1. Find a fence post or tree on the landward side of the dune that you will be able to find again. This is the control point for the beach profile line. Mark the fencepost or tree at a given height that won't change. The same control point will be reused for all future profiling and is the starting point of all measurements.
2. Imagine a straight line from the water that passes through your control point. Find a second control point (such as a power pole, tree, chimney, etc.) that the line also passes through to define a line to follow to measure a beach profile. At the control points, it often helps to place a temporary marker that rises up from the dune or above a seawall to maintain a line-of-sight down on the beach, or note down the point, for example 'top of the chimney'.
3. Measure the height of the mark you made on the fencepost or tree in relation to the ground. For example if the marker is 65cm above the level of the sand, record -65cm and note 'marker height above ground'.

Start:

1. Fill in the top part of the log sheet. Include names of people in the team profiling, class, date, time, the high tide time and the beach location.
2. Assign one person to look after Rod 1, and a second person to look after Rod 2. Rod 1 will always be the landward rod, and Rod 2 will be the seaward rod.

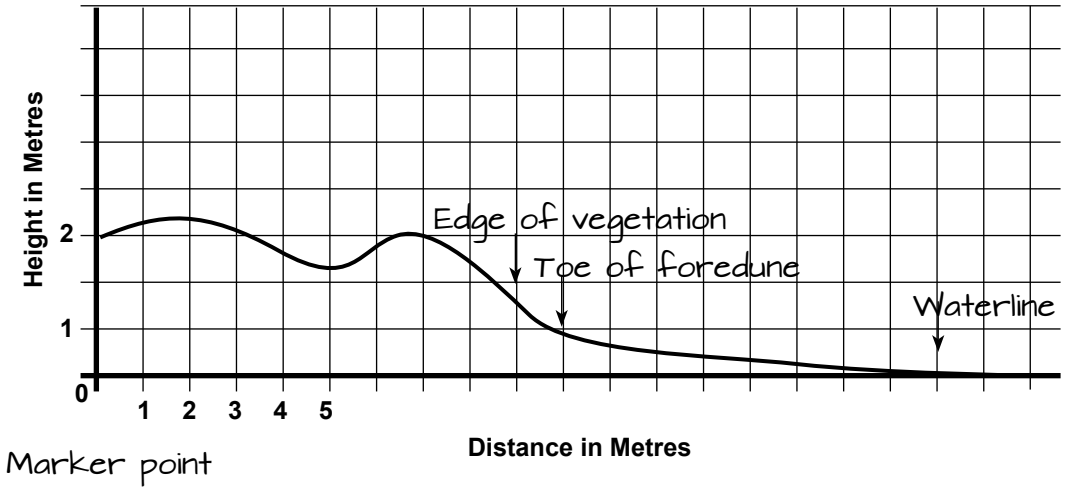


3. The first person stands the end of rod 1 on the ground next to control point one.
4. The second person uses the control points as a guide to measure three metres (or less if the slope changes) in a straight line towards the ocean. The second person places Rod 2 at this point.
5. From the landward rod (Rod 1), the first person sights the horizon and the top of the lower of the two rods, in this case Rod 2. This line-of-sight will intersect part way up the other rod. The second person will read the elevation number marked on rod 1 that is in line with the top of rod 2 and the horizon. Keep both poles vertical when reading!

   All measurements are read by the first person (the most landward one), either off Rod 1 in the event of a downward slope or Rod 2 if a rising slope. When there is a downward slope the measurement will be negative. When there is an upward slope the measurement will be positive. It takes careful attention to get this right on each measurement. A single error will make the rest of the data plot incorrectly on a graph. Record the elevation change and horizontal distance between poles on the log sheet.
6. Note any features at Rod 2, (such as edge of vegetation, toe of dune, water line, etc.) in the Notes column on the log sheet. Once the notes are taken, move Rod 1 to where Rod 2 is. Then move Rod 2 to a point 3m seaward of Rod 1 and repeat the measuring process, use a shorter distance if there is a change in slope before 3m is reached. The job of the second person is to be sure each forward move stays in line with the two control points.
7. Repeat steps 5 and 6. Measure, Record, and Move Ahead. Continue to move ahead, repeating these steps all the way to the water. As you go, everyone on the team should look ahead for features to stop on and measure. If some feature, perhaps the edge of the dune, does not occur at a horizontal interval of 3 metres, then make the horizontal distance smaller. For example, if the dune edge is only 0.6m from the last measurement, move the forward pole ahead only that far.
8. Stop at the water.

Adapted from www.seagrant.umaine.edu/files/pdf-global/.../emerymethod.doc
http://www.whoi.edu/page/live.do?pid=52235&tid=282&cid=88638
The original reference on Emery beach profiling is: Emery, K.O., 1961, A simple method of measuring beach profiles: Limnology and Oceanography, v. 6, p. 90-93.

Source: Maine Geological Survey, Department of Conservation, 22 State House Station, Augusta, ME 04333-0022



Field activity worksheet

Beach profile and plant survey

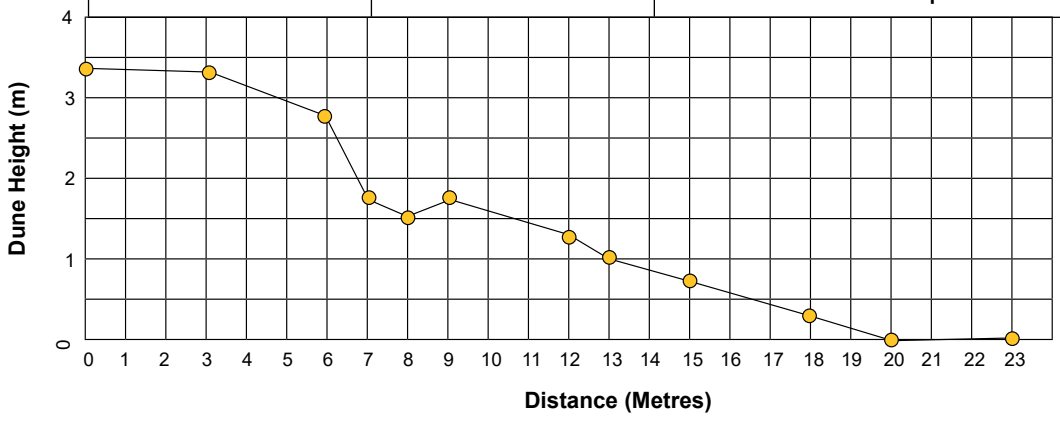
Beach profile

Name: _____ Class: _____

Beach: _____ Date: _____

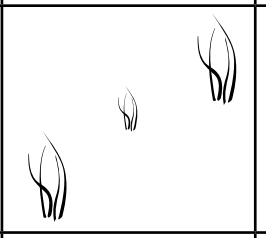
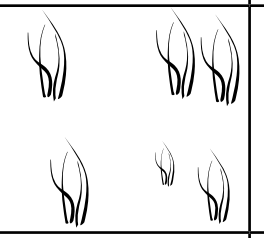
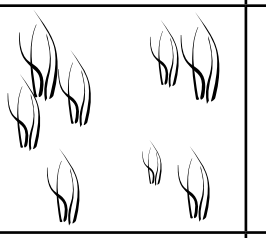
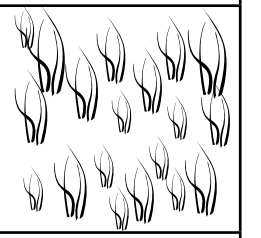
Time: _____ High Tide Time: _____

Distance travelled (m)	Height change (cm)	NOTES:
0		
		Sample Data and Chart



Distance travelled (m)	Height change (cm)
0	
3	-50
6	-100
7	-25
8	+25
9	-50
12	-25
13	-25
15	-50
18	-25
20	0
23	0

Plant density

0% Cover	25% Cover	50% Cover	75% Cover	100% Cover
				
0	1	2	3	4

Plant Species

Spinifex = Sp – Native

Leaves are grey/green and hairy. Seed heads look like tumble weeds.

Pīngao = Pg – Native

Leaves are green/bronze and shiny. Black seeds are attached to vertical 30-40 cm stalks.

Sea rocket = Sr – Introduced

Sprawling plant, light green irregular shaped leaves. Lilac flowers.

Shore spurge = Ss – Native

Grey/green leaves, brittle stems, white sap. Very rare.

Pōhuehue = Ph – Native

A scrambling vine with almost round mid green leaves about 5-10 mm across. The hairy stems are dark brown/black. Mid and back dune plant, leaves burnt off by salt spray.

Sand tussock = St – Native

Grows in tussocks (no runners) on front mild dune zone. The bright green to light brown thin leaves are 40-60 cm tall and end with a characteristically sharp point. The light brown seedheed is small, upright and like ryegrass.

Kikuyu grass = Ki – Introduced

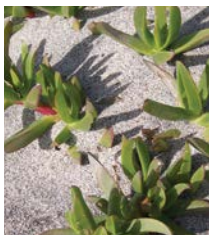
Grassy, green with thick runners capable of climbing over fences and other plants.

Wīwī = Ww – Native

Upright bushy plant. Dark brown seeds clumped tightly 50-80 cm from sharp tip.

Lupin = Lu – Introduced

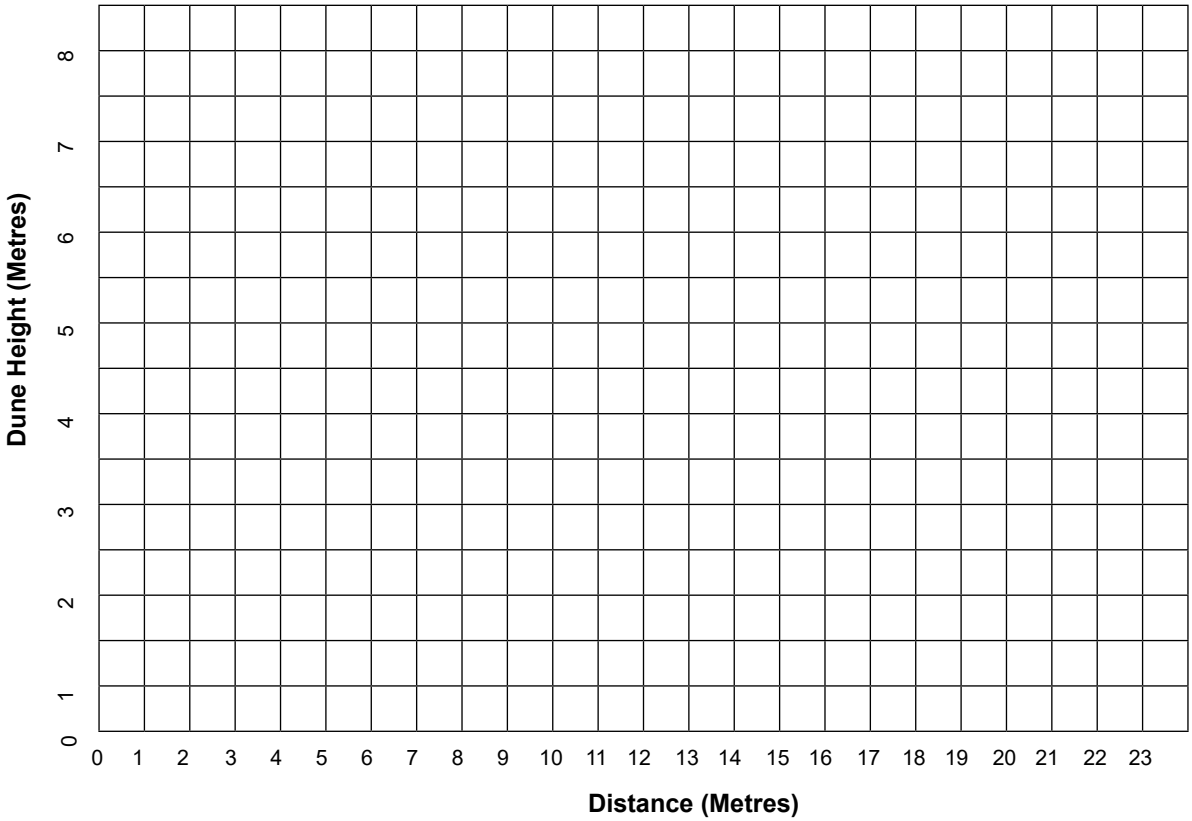
Bright green leaves on bushy wood stems. Yellow sweet scented flowers.



Iceplant = Ic – Introduced

Large succulent green leaves with pale yellow/orange flowers.

Record your beach profile here:



Part two – plant survey

Record the plants you find each time you gain 0.5 metres in height. Record the density using the scale on the back of the field sheet. Record the species using diagrams on the back of the field sheet and the Backyard Buffers booklet.

Distance travelled (m)	Height (m)	Plant Density Scale 0-4	Plant Species
	4.0		
	3.5		
	3.0		
	2.5		
	2.0		
	1.5		
	1.0		
	0.5		
	0		

See reverse for sample results

You should end up with a table of results something like this:

Distance travelled (m)	Height (m)	Plant Density Scale 0-4	Plant Species
20	4.0	4	Sp, Pg, Lu, Ph
16	3.5	3	Sp, Pg, Lu
14	3.0	2	Sp, Pg
13	2.5	1	Sp, Pg
12	2.0	1	Sp, Pg
10	1.5	0	-
8	1.0	0	-
5	0.5	0	-
Water Edge	0	0	-

Summary quiz questions

Climate Change: Changing beach and Coastline profiles

1. Which of the following is NOT likely to impact our coastline due to climate change?

a. Sea level rise
b. King (big high) tide events
c. Storms of increased intensity
d. Cooler temperatures

2. True or false? Sand dunes create a natural buffer between land and the sea.

a. True
b. False

3. Which of the following happens to sand on the beach during a storm event?

a. Sand is added to the beach, repairing sand dunes
b. Sand does not shift from the beach during a storm
c. Sand is taken out to sea

4. The process where sand is lost from dunes during a storm event is called

a. Buffering
b. Erosion
c. Accretion
d. Trapping

5. The process where sand is added and rebuilds dunes after a storm event is called

a. Buffering
b. Erosion
c. Accretion
d. Trapping

6. How do native dune plants help conserve and rebuild sand dunes?

a. By making the dunes look nice
b. By eroding the dunes
c. By trapping sand with their roots
d. By encouraging loss of sand during storms

7. Which of the following is NOT a way to help protect sand dunes?

a. By helping replant less healthy eroded dunes
b. By not trampling on fragile dune plants
c. By keeping to paths and staying off the dunes
d. By walking on the dunes

8. True or false. Climate change makes the role of sand dunes and dune plants less important.

a. True
b. False

Or you could take the Kahoot quiz:

Our Changing BOP Climate: Beaches and Coastlines