ACTIVITY

# 4g

Activity Title:

# Tsunami and the dunes!

## Focusing questions

How would a tsunami affect the dunes?

## Resources required

- Pen and paper
- Whiteboard
- Tsunami FAQ cards - page 181
- Beach model building equipment (either sand and pipe-cleaners / sponge or people!)

## Prior learning

- 1c – Beach diagram
- 1d – Formation and characteristics of different types of beaches
- 4a – The importance of sand dunes
- 4b – Dune formation

## Method

1. The objective of this activity is to explore a 'what if' scenario of a tsunami
2. Use the whiteboard to brainstorm key facts about tsunami until students have a good understanding of tsunami and their implications for the beach environs. Break into groups and give each small group a copy of the Tsunami FAQ cards. Allow between 10 and 20 minutes for matching of question and answer cards, then discuss all together.
3. Invent and demonstrate a model of a beach during a tsunami by either:

a. Build a model of a beach (with sand dunes) using sand – you could do this outside or in a glass tank. Use a bucket of water to simulate several different sized tsunami breaking over the beach and dunes. Your demonstration should illustrate a range of loss of sand and damage to dunes. Discuss what happens to the sand when the wave hits. Then repeat the exercise but this time with plants added (these can either be created using green pipe-cleaners or pieces of green sponge attached to buried pegs). The quality and quantity of 'plants' needs to prevent some sand from washing away under at least small tsunami wave conditions.

**Activity Title:**

Tsunami and the dunes!

**Environmental Education Aspect:**

About the environment

**Environmental Education Concept:**

- Interdependence

**Curriculum Links:**

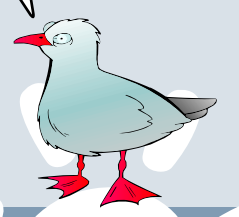
- Social Science
- Science

**Suggested Curriculum Level:**

Any secondary

**SUSTAINABILITY TIP!**

Re-use or recycle any materials used in the creation of the beach model.



OR:

b. Build a model of a beach using people. A line of people act as the sand dune and a line of people act as the wave. Start with a small wave that touches the dunes but doesn't take all the sand with it. Try different sized waves (the line of people slither, crawl on knees, crawl on all fours, walk and run). As the waves increase in size and intensity a greater amount of sand is taken back to the sea. Then add some people who are plants. Simulate how the plants prevent the wave from washing the entire dune away.

Then debrief, discuss and complete the following 'what if' brainstorm activity.

4. Conduct a 'What if' brainstorm activity. Use the following questions to guide this activity and record answers on a whiteboard.

   'What if' questions:

   - What if there was a tsunami on a beach where the dune plants and dunes had been removed?
   - What if there was a tsunami on a beach where the dunes and plants remained?
   - How can dunes help protect us from tsunami?

## Possible next steps

- Visit www.bopcivildefence.govt.nz to learn more about the warning signs of tsunami, local inundation maps, and how to prepare yourself for a civil defence emergency.
- Explore the history of tsunami in New Zealand on the Te Ara website. See the following article - Willem de Lange and Eileen McSaveney. 'Tsunamis - New Zealand's tsunami history', Te Ara - the Encyclopedia of New Zealand, updated 2-Mar-09 URL: http://www.TeAra.govt.nz/en/tsunamis/2
- 5g Beach erosion – a summary of impacts illustrating how erosion occurs. Some of which are also relevant for tsunami.
- 6m Developing a plan of action to protect the local beach – an activity that encourages action to take care of local beaches

# Tsunami FAQ cards

| Question cards | Answer cards |
|---|---|
| **Question:**<br>What is a tsunami? | **Answer:**<br>A series of surges of water of extremely long wavelength and period usually generated by an undersea disturbance (such as an earthquake) |
| **Question:**<br>What type of earthquakes are most likely to generate a tsunami? | **Answer:**<br>Large, shallow earthquakes with an epicenter or fault line near or on the ocean floor. Normally tectonic sub-duction along a plate boundary. |
| **Question:**<br>Aside from earthquakes, what else can generate a tsunami? | **Answer:**<br>Underwater volcanic eruptions, submarine landslides and rock falls can cause massive displacement of water. |
| **Question:**<br>Where do most tsunami occur? | **Answer:**<br>In the Pacific Ocean, because the Pacific covers more than one-third of the earth's surface and is surrounded by a series of mountain ranges called the 'ring of fire'. |
| **Question:**<br>How much of the vertical water column is involved in a tsunami surge? | **Answer:**<br>These surges involve movement of the entire water column from surface to sea floor. |

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| **Question:**<br>How much of the vertical water column is involved in a normal ocean wave? | **Answer:**<br>Normal waves involve movement of the upper most layer of the water. |
| **Question:**<br>How fast do tsunami surges travel? | **Answer:**<br>600 - 965 km per hour in the open ocean (about the speed of a passenger jet) |
| **Question:**<br>How fast do normal waves travel? | **Answer:**<br>8 - 100km per hour |
| **Question:**<br>How far apart are tsunami surge crests? | **Answer:**<br>10 - 500 km apart |
| **Question:**<br>How is a tsunami measured? | **Answer:**<br>By its maximum height above sea level |

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| **Question:**<br>How many tsunami greater than 10 metres have been recorded in New Zealand? | **Answer:**<br>Three tsunami greater than 10 metres since 1840 |
| **Question:**<br>How do we measure waves? | **Answer:**<br>By wave height and wavelength |
| **Question:**<br>What is wave height? | **Answer:**<br>The distance between the crest (wave top) and trough (wave bottom) |
| **Question:**<br>What is wavelength? | **Answer:**<br>The horizontal distance between two consecutive wave crests (wave tops) |
| **Question:**<br>How far apart are normal waves? | **Answer:**<br>5 to 20 seconds apart |

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| **Question:**<br>How far apart are tsunami surges? | **Answer:**<br>10 minutes to 2 hours apart |
| **Question:**<br>How fast did the Indonesian tsunami that occurred on Boxing Day 2004 travel? | **Answer:**<br>600km in 75 minutes<br>(that's 480km per hour) |
| **Question:**<br>Why does the water often recede immediately before the arrival of a tsunami? | **Answer:**<br>The water often recedes away from the shoreline immediately before a tsunami. This is the surge trough that arrives before the surge crest. |
| **Question:**<br>What happens when a normal wave reaches the shoreline? | **Answer:**<br>The wave breaks and then recedes in a few seconds |
| **Question:**<br>What happens when a tsunami surge reaches the shoreline? | **Answer:**<br>The surge may come ashore as steep breaking wall of water or fast rising water levels. Water can rush inland for many minutes often penetrating far inland and for many kilometres up rivers. |