

4b Formation of dunes

Understanding the form and
function of sand dunes

Objectives for today

- Today we will look at the process by which dunes are formed.
 - How are sand dunes formed and eroded?
 - What the different stages in the formation and erosion process?

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What is sand and where does it come from?

- Sand is made from material that has been eroded by water, wind and waves.
- On the coast a lot of sand comes from the erosion of coastal rock, gravel, pebbles and shell.
- Sand also comes from eroded material that is washed down rivers.
- Sand is moved up and down the coast by currents and wind.



Ōhope

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Sand dune formation

- The formation of dunes is a **dynamic** (constantly changing) process.
- There are different stages in the process that forms dunes – a quiet stage, an erosion stage and an accretion stage.
- The process is sometimes called the **cut and fill cycle**.
- Each stage in this process is shown on the following slides.

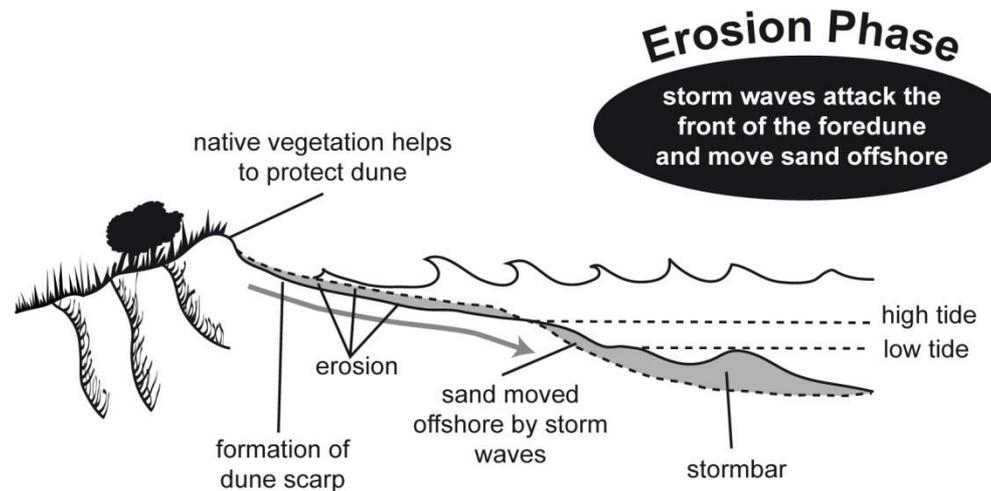


Image: Pāpāmoa Beach

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The erosion stage

- What type of weather occurs during this stage?
- Is the dune stable or changing in this stage?
- What happens to sand during this stage?
- What time of year do you think this stage most often occurs?

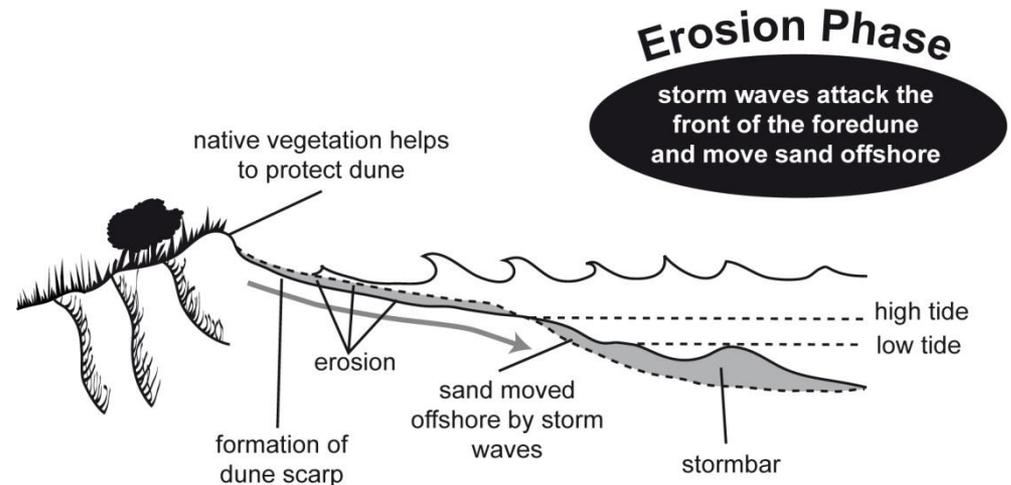


(see next slide for answers)

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The erosion stage

- What type of weather occurs during this stage? – **Stormy**
- Is the dune stable or changing in this stage? – **Changing**
- What happens to sand during this stage? – **Moved offshore**
- What time of year do you think this stage most often occurs? – **Winter**

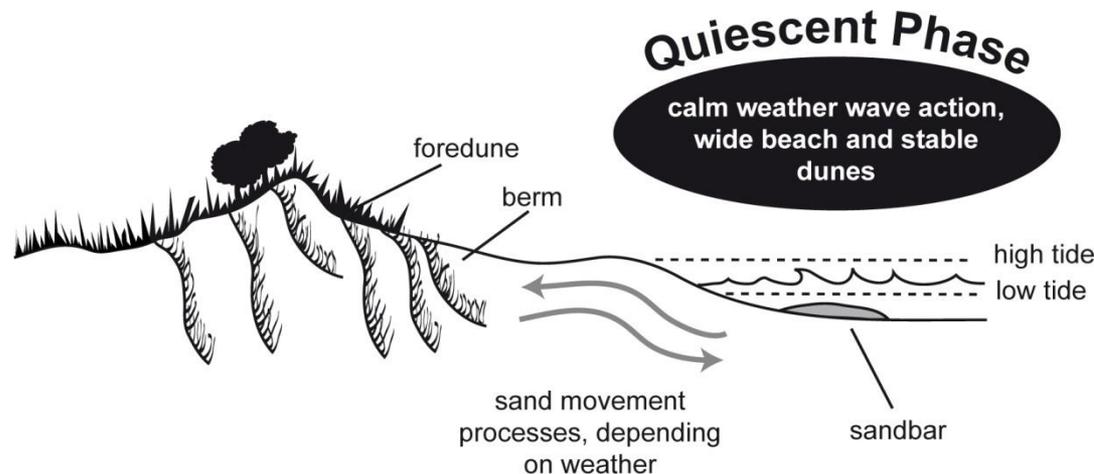


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The quiet stage

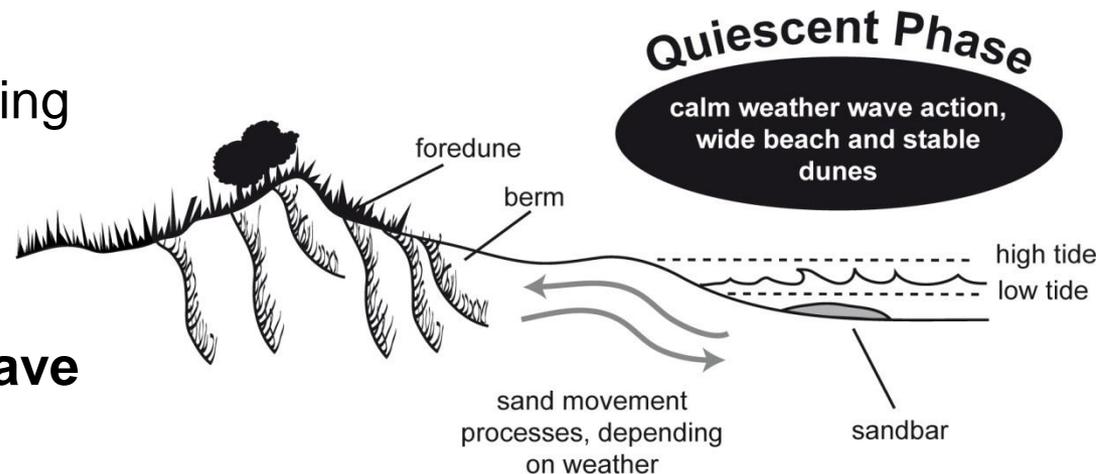
- What type of weather occurs during this stage?
- Is the dune stable or changing in this stage?
- Are the waves here as powerful as in the erosion stage?
- What time of year do you think this stage might occur?

(see next slide for answers)



The quiet stage

- What type of weather occurs during this stage?
– **Calm weather**
- Is the dune stable or changing in this stage? – **Stable**
- Are the waves here as powerful as in the erosion stage? – **Less powerful wave action**
- What time of year do you think this stage might occur? – **Spring and Autumn**

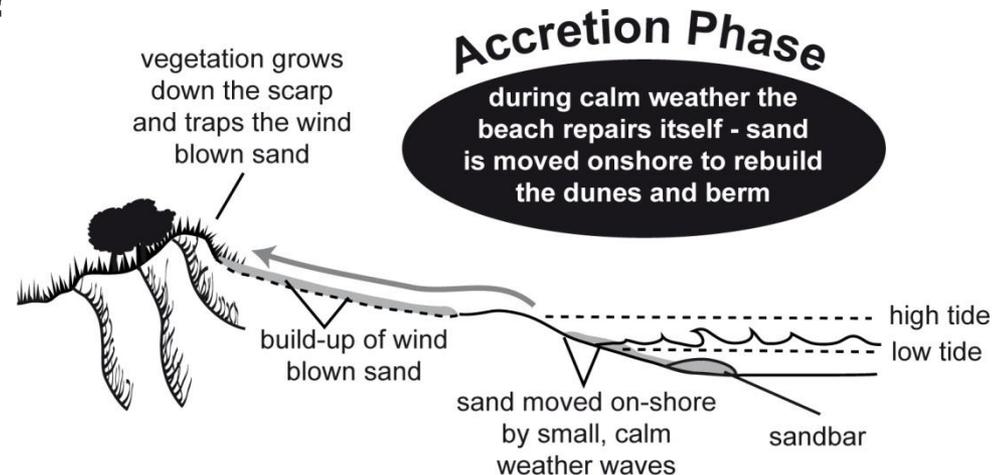


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The accretion stage

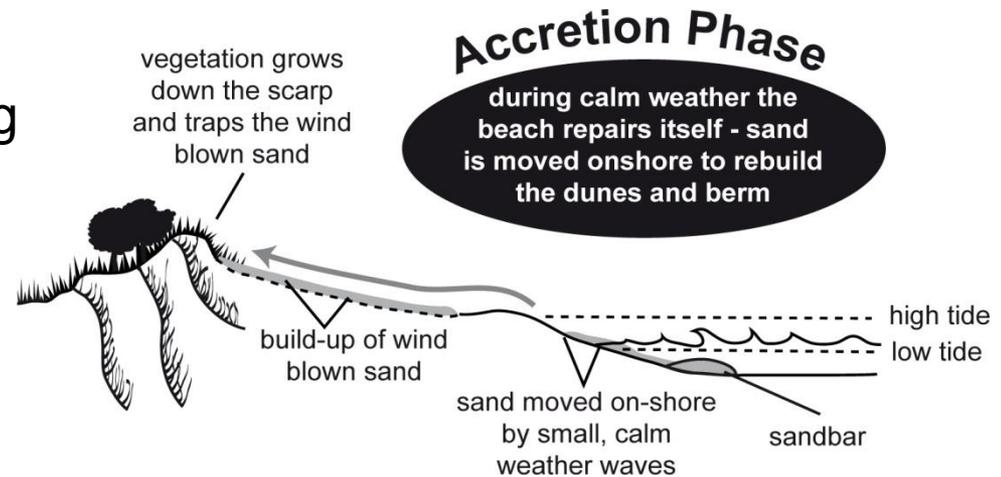
- What type of weather occurs during this stage?
- Is the dune stable or changing in this stage?
- What happens to sand during this stage?
- What time of year does this stage occur?

(see next slide for answers)



The accretion stage

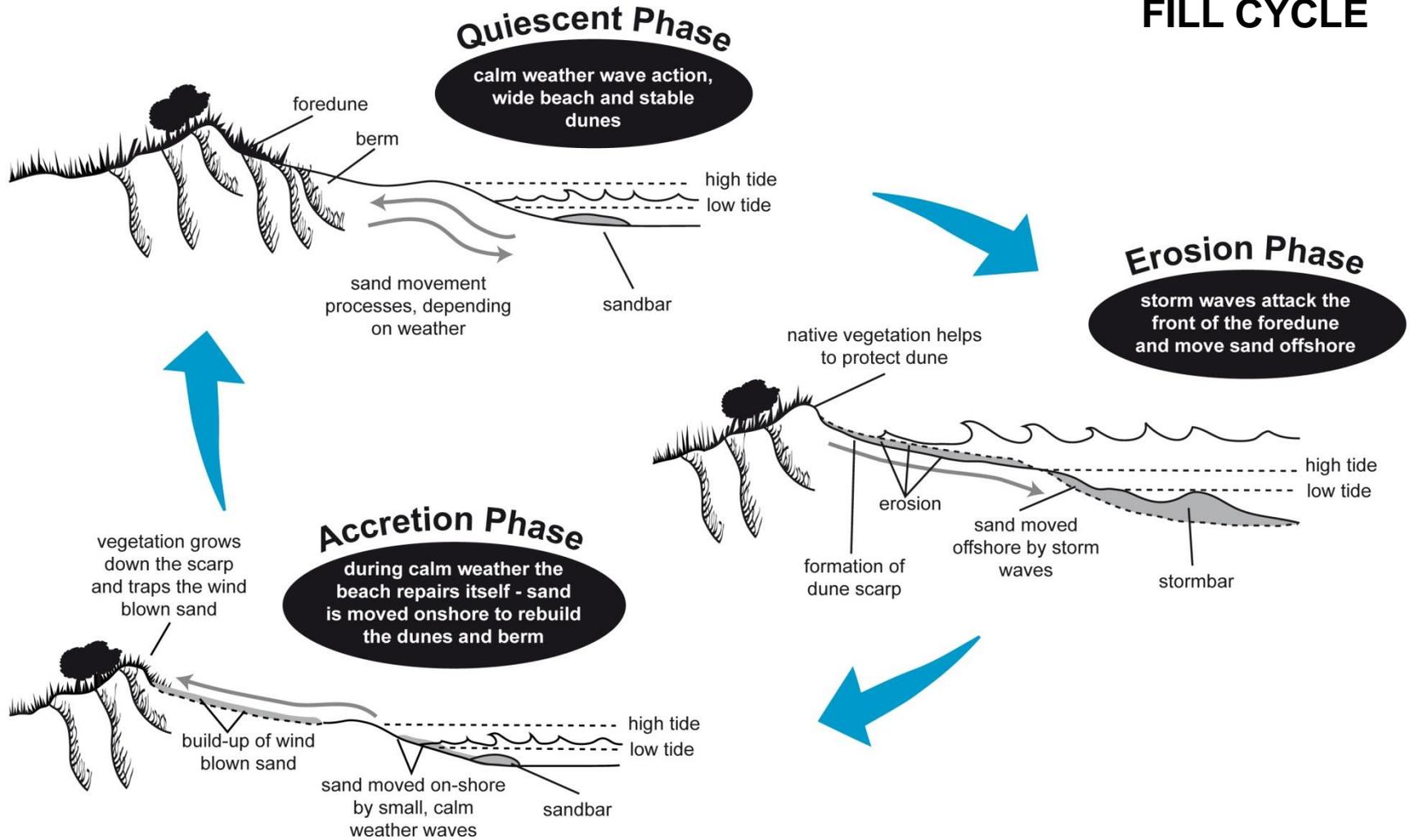
- What type of weather occurs during this stage?
– **Calm weather**
- Is the dune stable or changing in this stage?
– **Changing/rebuilding**
- What happens to sand during this stage? – **Sand is moved onshore to rebuild dunes**
- What time of year does this stage occur? – **Spring and Autumn**



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The whole process

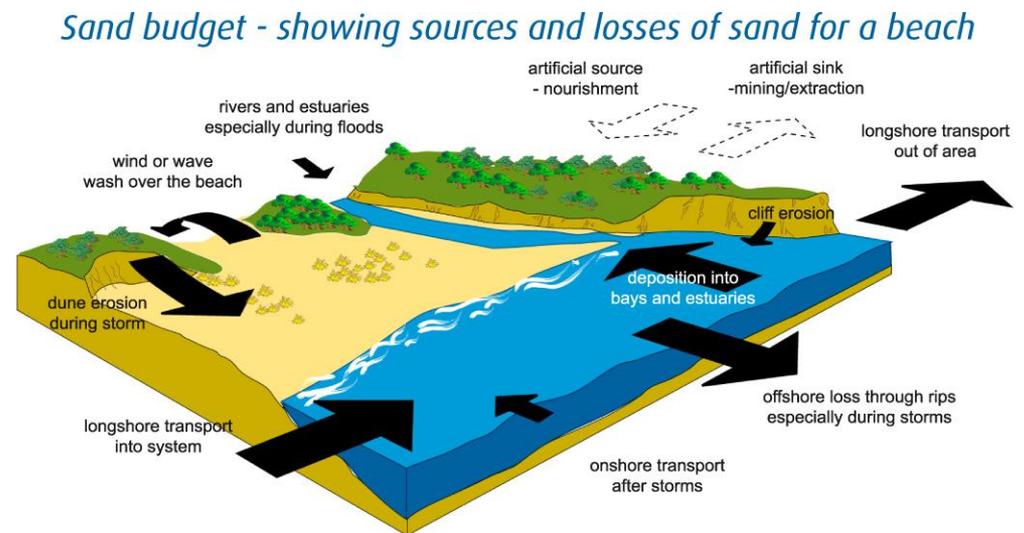
CUT AND FILL CYCLE



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Maintaining the balance

- Keeping sand dunes healthy means the sand budget needs to be maintained.
- If too much sand is lost and not enough accreted, the dune will decline.
- If more sand is accreted than lost, the dune will grow.



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Native dune plants are important in keeping the sand budget healthy



Picture: Pīngao – a native sand binding dune plant

- Coastal scientists now know that native front dune plants are important in keeping the sand budget healthy.
- Native plants are very good at trapping and building up or accreting sand.
- Native front dune plants are also important in the release of sand that occurs in the natural erosion part of the dune ‘cut and fill’ cycle.

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What happens when the sand budget is not maintained?

- Erosion is a natural coastal process that operates in cycles.
- Coastal erosion is only a problem when we build or develop too close to the coast.
- The following slides show some examples of what can happen when the sand budget is not maintained, but it is not necessarily unnatural.

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Pukehina

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Life's a Beach

Erosion photos





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Bay of Plenty Regional Council in partnership with Tauranga City Council; Whakatane, Western Bay of Plenty, and Opotiki District Councils; and the Department of Conservation.