
What is Sand?

Level

2-3

Key question

What are the differences between sand particles collected up a beach?

Key outcome

Describe the features of sand found at different places.

Adapted from Moroney et al,
Coastal Activities for Primary Students.

What you need

Paper to work on
Glue or clear contact
Magnifying glasses
Sieves of different size, or
Home made sieves of stocking, gauze, or window netting
Field sheet

What you do

You can work in pairs or small groups. Collect the appropriate equipment. Each group goes to a different site up a beach, some close to the water, others at the top. Each group does the same field work.

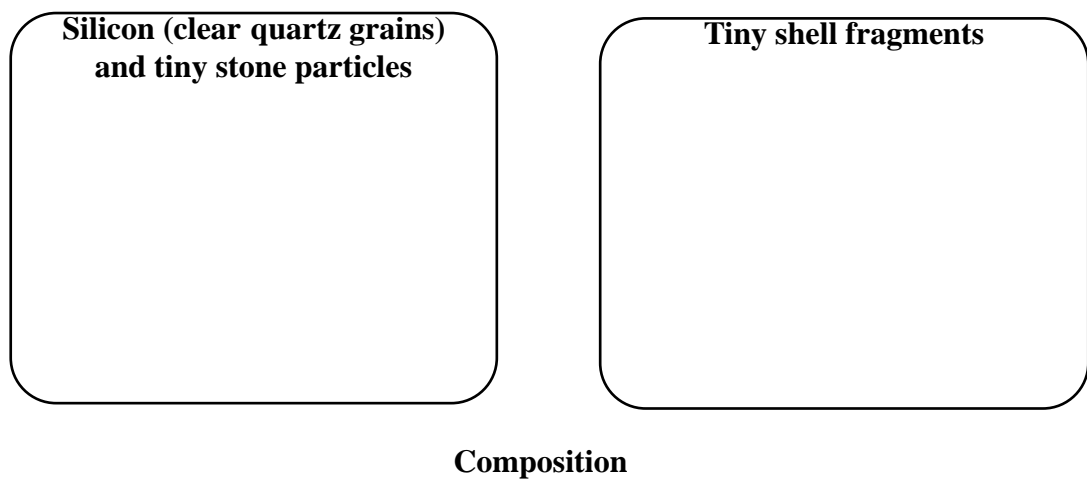
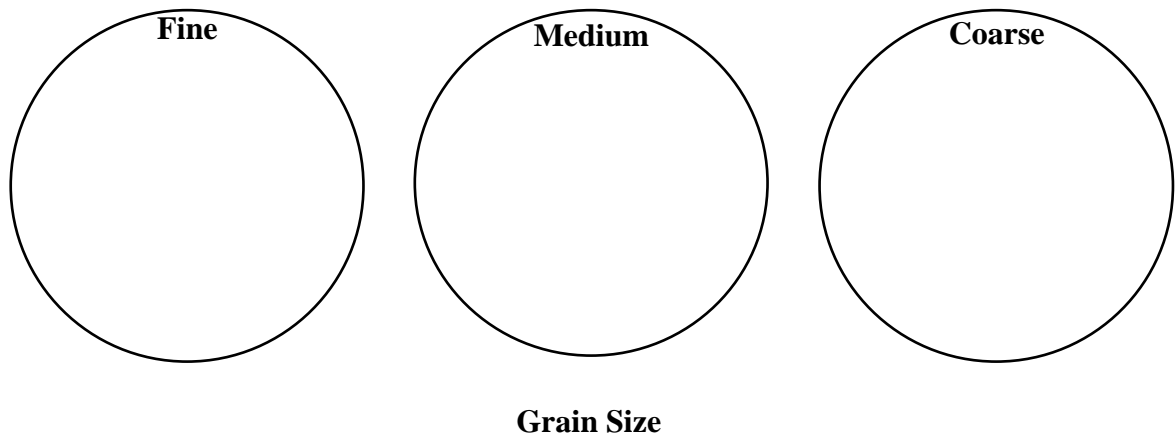
1. Collect a small amount of sand.
2. On a sheet of paper carefully separate some particles or use a sieve to separate the particles and sort them into the categories below. You need patience!
3. Use a magnifying glass to examine the samples. What do you observe? What else did you find in your samples of sand? Can you identify these? Are they all natural items or are they from human activities? Where do the stone particles come from? Are they rough feeling or smooth? How do they become smooth?
4. Lightly smear some glue onto the field sheet and sprinkle on the sample, one box at a time. Or you can use clear contact and sprinkle the particles onto the paper first then cover with a square of contact to hold them in place (see accompanying field sheet).

Discussion

Compare samples between groups from various places up the beach. Are there differences in the grain size and composition of the sand?

You may also be able to compare a small collection of sand from different beaches.

What is Sand?



The Sand Dune Ecosystem

Level

8

Key question

How do you measure the morphology of a sand dune ecosystem.

Key outcome

Appreciate the balances which exist within the sand dune ecosystem and human influence on these balances.

Adapted from field sheets of St Aidan's School, Corinda, Brisbane, Australian Littoral Society's *Moreton Bay Kit*, and Yallingup Coastal Geomorphology and Ecology Fieldwork, Geographical Association of WA.

What you need for each group

Clipboard, paper, pencil
Tape measure, ruler
Soil thermometer
Air thermometer
Hygrometer or other instrument for measuring humidity
Field guide to plants within sand dunes
Salinity probe or kit (may be shared across groups)

What you do in small groups

Draw the shape of the dunes looking from the beach.

- Are there any blowouts (hollows) or gullies?
- Estimate their heights from base to top.

The following information should be collected by each group so that it is available later for each individual to construct a detailed transect. Use the data sheet to record your findings.

Divide the coastal dune into these main areas: beach; foredune seaward side; foredune top; foredune landward side; hollow behind sand dune; and make observations about each of these areas on the data sheet.

Soil characteristics

At five locations, record the following information about the soil:

- depth of dry sand
- temperature at a depth of 10 cm
- amount of organic material (mainly plant roots) at a depth of 10-15 cm
- salt content – collect a test-tube sample from a depth of 5 cm so that it may be tested later.

Micro-climates

At the same five locations, record the following climatic information:

- air temperature
- relative humidity
- aspect and exposure to sun and wind (is the aspect sunny or shady in the morning/afternoon)
- Is the location exposed to or sheltered from westerlies?

The Sand Dune Ecosystem

Fauna

You probably won't see much fauna, but record the position of any that you see. Don't forget insects.

It is quite likely that there will be plenty of animal tracks. Record their position on the cross-section and try to identify them.

Flora

Wherever your cross-section intercepts any plants:

- Record where the ground is covered with plants.
- Identify the species.
- Discuss any adaptations they seem to have in order to cope with the conditions.
- Note whether the plants appear healthy or under stress. If stressed, why?

List observations of the human influence on these dunes.

Summarise changes in the physical factors, type of vegetation, and animals present as you walk inland from the beach.

Extension

Using the information collected by the whole group (see next page), prepare a detailed transect of the dune system. This should be done on large sheets of graph paper.

The Sand Dune Ecosystem

Data sheet for Dune Study

Observe	beach	foredune seaward side	foredune top	foredune landward side	hollow behind dune
topography					
wind direction					
slope					
temperature					
light intensity					
composition of sand					
• humus					
• carbon					
• rutile					
• quartz					
• other					
grain size					
amount of moisture					
vegetation					
use lists to identify prominent plants in each part					

Sand Sculpturing

Level

1-8

Key question

What does my creation mean?

Key outcome

Express your ideas by creating a sand sculpture on the beach.

Adapted from Moroney et al, *Coastal Activities for Primary Schools*, and the beach competition at Manly, Sydney, for Seaweed 1993.

What you need

Sandy beach

Buckets, spades, scrapers, brushes, moulds

Stencils, sticks, cups, sieves

Flotsam and jetsam from the beach

What you do

Select an area of beach which will not be inundated for an hour or so.

Sand sculpturing allows you to create and express your feelings about the beach. It can be done by individuals or small groups.

Decide what you are going to sculpture: familiar, original, bizarre, fantastic, humorous, beautiful, geometrical, mysterious, silly, puzzling?

- Create it with equipment and/or your hands.
- You can try dribbling wet sand on what you have made.
- You can decorate your creation with shells, pebbles, sea plant material, cuttle fish bones, feathers or whatever is available along the beach.
- You might decide to avoid the use of anything not natural.

Once all groups are finished, do a tour of the sculptures. Creators can explain their creation to the rest of the group. Watch what happens when the tide comes in!

Extension

Do 'What is Sand?' activity unit.

Do Sand Dunes Really Form a Barrier?

Level

8+

Key questions

What is the formation of dunes here? What primary colonisers grow on them? What happens to dunes if the vegetation goes? Can statements about the role of vegetated dunes be tested for their truth?

Key outcome

Using a questioning technique, develop understanding of the key role of vegetated sand dunes as a barrier along the coast against the action of waves and tides.

Adapted from field sheets of Beerwah Field Study Centre.

What each group needs

Diagrams as shown in Figure 1 with questions

Guide to grasses and beach plants

Long (30 m) tape measure and short (e.g. sewing measure of 1 m) tape or metre, thermometer, and pH kit per group

What each group does

Select an appropriate field site with vegetated foredunes, and parallel dunes behind a swale. Collect your equipment.

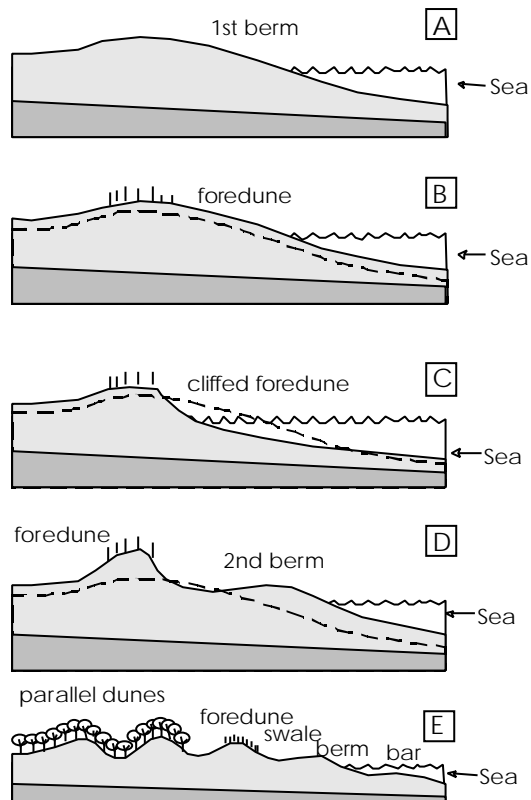
Field sheets

Figure 1 (A-E) shows the development of a succession of sand dunes along a beach. Figure 2 (A-D) shows the development of vegetation colonising those dunes.

1. Decide as a group which section of Figure 1 best shows your section of dunes.

You may decide that the dunes are at some inbetween stage. If so, sketch the formation. Outline the methods you used to reach your decision.

Figure 1. Stages in the formation of sand dunes



Do Sand Dunes Really Form a Barrier?

2. Carry out a field survey of the vegetation on the dunes, moving from the beach to the main dunes (see accompanying data sheet).

Measure out a transect line using the tape measure of approximately 150 m. Every 30 m OR at the change of vegetation type carry out a quadrat study over one square metre. The one square metre is called a station. Examine the species in your quadrat. At each station, either count numbers or estimate the percentage cover of the quadrat, and record the information on a data sheet like the sample one at the end of this activity.

3. Discuss your results.

- What is the most common vegetation type?
- Where does this occur most frequently?
- Does the amount of bare sand vary as you move away from the beach?
- What effect does the wind appear to be having on the vegetation? Is there any sign of wind sheering (the vegetation grows at a slope – the trees bend over)?
- Is there sign of fresh water?
- Is the area used frequently by people or grazing animals? How do you know?
- Has there been any attempt to revegetate the dunes you are working on?

4. Now use a questioning technique. The following statements are quoted directly from a leaflet on sand dunes in a series entitled *Coastal Sand Dunes*, ‘The Formation and Function of Coastal Dunes’, published by the Beach Protection Authority of Queensland. Add a question mark after each statement. Now, consider your field results, the questions, and Figure 2 (see next page).

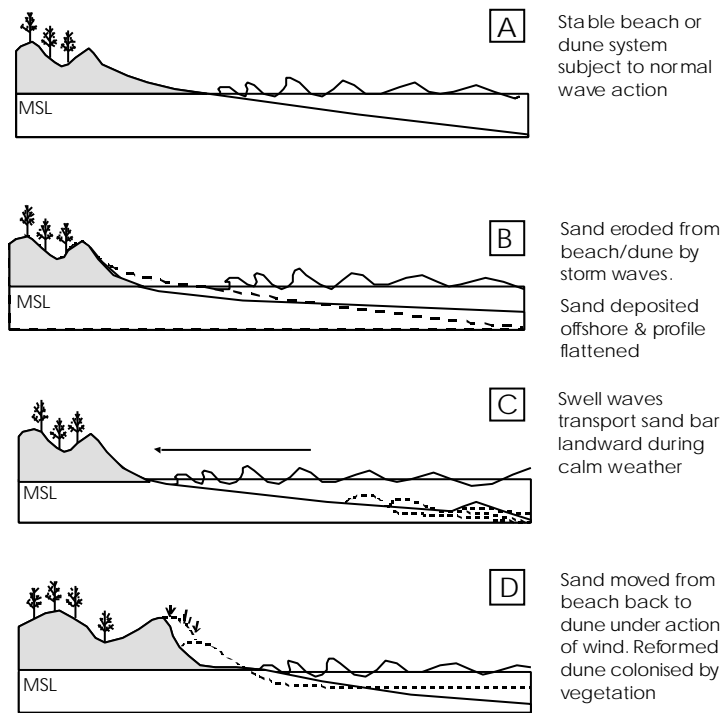
Can you prove that each statement is true? Which statements cannot be proven correct? Why? Do you need further information? Where would you get this information?

Statements to test:

- ‘Foredunes act as barriers against the action of waves and tides, and are a source of sand for the beach during periods of erosion’.
- ‘They protect areas behind them from wave damage and salt water intrusion during storms’.
- ‘Vegetated foredunes are inherently flexible (Figure 2, A-D)’.
- ‘If they are damaged by storm waves the remaining vegetation traps sand blown from the beach and the dune is reformed’.
- ‘Vegetated foredunes restrict wind, sand and salt spray intrusion into the hind dune areas’.
- ‘If landward parallel dunes are well stabilised, they serve as a second line of defence against erosion, should the foredune be destroyed by the action of storm waves’.

Do Sand Dunes Really Form A Barrier?

Figure 2. Flexible behaviour of vegetated foredune and ocean beach subject to wave action (adapted from Wave & Barr, 1977)



Conclusion

As a group, reach a consensus decision. Which of the methods you used today to study the dunes gave you the most information? Which was the most interesting to do?

References

Leaflets on *Coastal Sand Dunes*, published by the Beach Protection Authority, Queensland Department of Environment, PO Box 155, Brisbane Albert Street, 4002.

Bird, E.C.F. (1972), *Coasts. An Introduction to Systematic Geomorphology*, Vol 4., ANU Press, Canberra.

Do Sand Dunes Really Form A Barrier?

Sample data sheet for dune barrier study

TRANSECT STUDY: DUNES ATBeach

DATE:Group:.....

Metres	0	30	60	90	120	150
Weather						
Ground temperature						
Shade or sun?						
Wind strength (Estimate strong, moderate, low, nil)						
Wind direction (from _ to _)						
pH of top sand layer						
Bare sand %						
Ground cover % (grass/creepers)						
Bushes %						
Trees %						
Major species of vegetation						
Minor vegetation						