

# The formation and function of coastal dunes

## Sources of sand, sand transport and deposition, and dune formation

### Introduction

This leaflet is a brief introduction to the general processes involved in the formation of coastal sand masses. Subsequent leaflets in this series will describe in more detail the processes involved in the formation of foredunes and parallel dunes, beach ridges and cheniers, blowouts, parabolic dunes and low dune mobile sandsheets. The function of coastal sand masses, particularly foredunes and beach ridges, in beach protection will also be described.

### Sources of sand

Principal sources of nearshore sediment for coastal areas are streams and rivers which transport sand directly to the ocean.

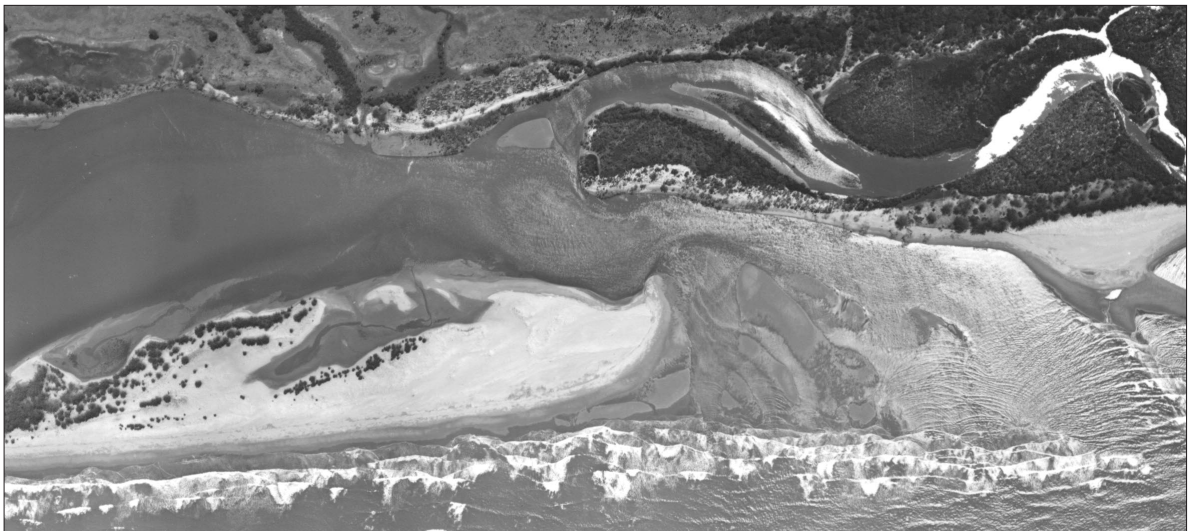
Sand is also derived from the gradual wearing away and weathering of rock formations and cliffs exposed

on the shore. Shell, coral and other skeletal fragments provide sediment to some beaches, especially those in the tropics.

### Sand transport and deposition

Sand is moved along the coast by wave action, wind and currents. The movement of sand up and down the coast is called longshore transport.

Coastal features, both natural and built, can indicate the presence and direction of longshore transport, as shown on the diagram. Obstacles in the path of longshore transport, such as headlands, groynes and breakwaters, cause accretion on the updrift side, resulting in build-up of sand on the beach. A similar amount of erosion occurs along the coast on the downdrift side.



Sand deposition and spit formation at the mouth of Littabella Creek, north of Bundaberg.



Beach sand is also moved onshore and offshore by the action of waves, tides and currents. High-energy storm waves erode sand from the beach. This sand is often deposited offshore as submerged sandbars. During periods of calm weather, low-energy waves move sand from offshore sources and deposit it back on the beach to form a berm parallel to the shoreline. The berm, or ridge of sand, is formed on the upper part of the beach outside the reach of normal high tides by the swash of incoming waves. Storm waves can also deposit sand as berms at the peak of wave run-up and outside the reach of normal waves and tides.

### Beach ridge formation

Beach ridges consist of sand deposited by wave action. They can form as successive beach berms deposited on a seaward-advancing shoreline. Grasses and other obstacles (e.g. debris) on the beach ridge trap sand blown up from the beach. The beach ridge is increased in width and height by accumulation of windblown sand.

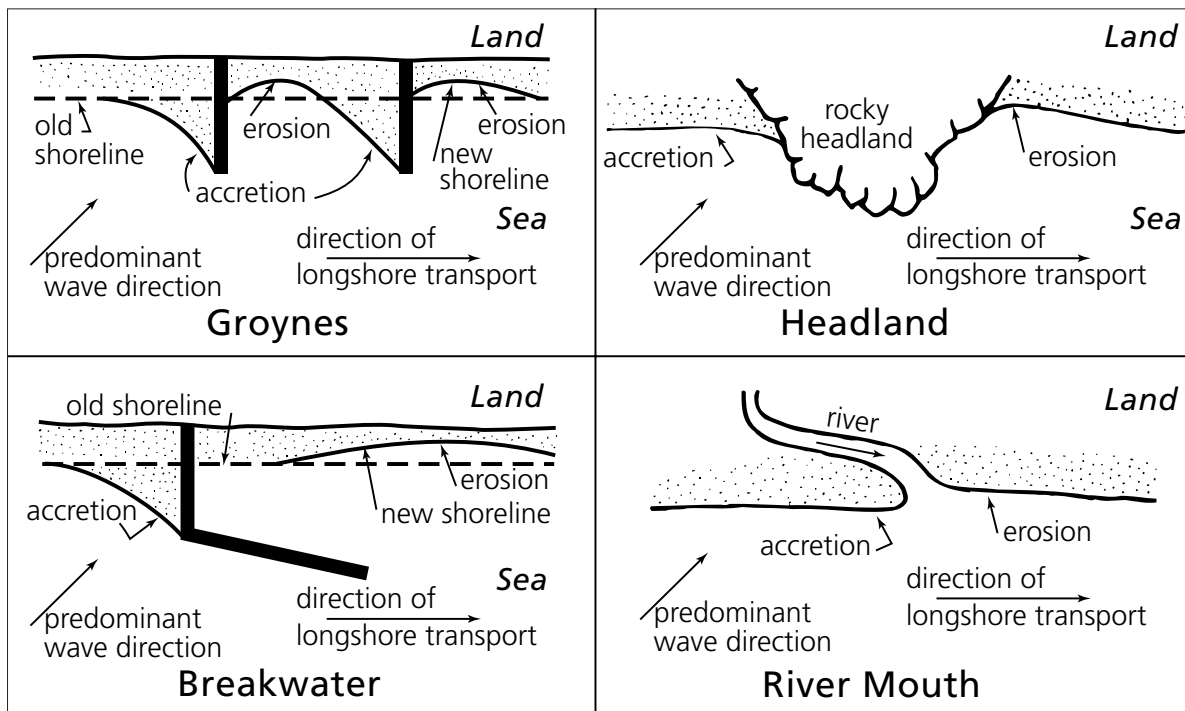
### Dune formation

Dunes are composed of windblown sand. Foredunes are deposited immediately behind sandy beaches. Strong onshore winds erode dry sand from the steepening face of the beach. This windblown sand is deposited towards the top of the beach and a foredune gradually forms.

Foredunes also form where vegetation and other obstacles on the upper part of the beach cause deposition of windblown sand. During periods of shoreline advance, successive foredunes may develop to form a series of parallel dunes. Blowouts, parabolic dunes and mobile sandsheet complexes are initiated in foredune, parallel dune or beach ridge systems, where strong onshore winds erode sand from unstable (unvegetated) areas.

Acknowledgment:

O’Keeffe, P.D. (1978) Sediment budgeting, Beach Conservation, issue no.30, Beach Protection Authority, Queensland.



Sand accretion/erosion caused by coastal features obstructing longshore transport (adapted from O’Keeffe, 1978).