

The formation and function of coastal dunes

2

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Formation and function of foredunes and parallel dunes

Formation

Foredunes are built up at the back of beaches on the crests of berms and beach ridges where vegetation or other obstructions trap windblown sand. They become higher and wider as sand accretion continues.

Onshore winds of sufficient velocity to move sand particles erode sand from the dry parts of the beach and transport it landward. Saltation is the main method by which sand is moved from beaches by wind. It is a process whereby individual sand grains are carried by the wind close to the surface in a series of short hops. Nearly all windblown sand is moved by saltation.

Wind action effectively sorts the original beach material. The small particles may be completely removed from the beach/dune area while the largest particles remain. Sand grains removed from the beach

by wind and deposited in dunes are of essentially one size (diameter ranges from 0.15mm to 0.30mm).

Vegetation plays a dominant role in determining the size, shape and stability of foredunes. The aerial parts of vegetation obstruct the wind and absorb wind energy. Wind velocity near vegetation is thus reduced below the velocity needed for sand transport, and the sand is deposited around the vegetation. A characteristic of dune vegetation, particularly the grasses, growing under these conditions is its ability to produce upright stems and new roots in response to sand covering. Unless the plant continues to grow more rapidly than the rate of deposition, the arresting action of the plant ceases. Successive stages of plant growth and sand deposition result in increased width and height of the dune.



Sand spinifex grass colonising the first and second berm seaward of horsetail she-oak trees growing on the foredune on Bribie Island.

During periods of shoreline advance, successive foredunes may develop, forming a series of dunes parallel to the shore. The seaward margin of a foredune is trimmed back by storm waves. During calm weather, waves build up a new beach ridge in front of and parallel to the original foredune, or to the trimmed margin of the foredune. As the new beach ridge develops, a low-lying swale is formed between the developing ridge and the original foredune. Dune grasses colonise the new beach ridge and accumulate windblown sand, and a new foredune is built up. Figure 1 shows stages in the successive formation of parallel dunes.

Function

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 (see Figure 2). If they are damaged by storm

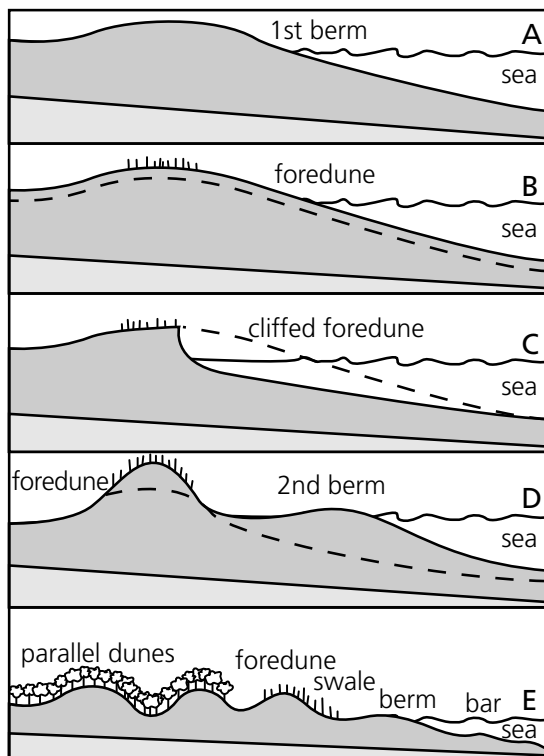


Figure 1. Stages in the successive formation of parallel dunes (adapted from Bird, 1972).

waves, the remaining vegetation traps sand blown from the beach and the dune is reformed, thus providing protection against future wave attack. Vegetated foredunes restrict wind, sand and salt spray intrusion into hind dune areas. The protective action of the foredune allows the development of a more complex plant community on the hind dunes. Parallel dunes landward of the foredune are protective to a lesser degree. If they are well stabilised, they serve as a second line of defence against water and wind erosion, should the foredune be destroyed by the action of storm waves.

Acknowledgments:

Bird, E.C.F. (1972) Coasts: An introduction to systematic geomorphology, vol. 4, p.132. Australian National University Press, Canberra.

Gale, R.W. and Barr, D.A. (1977) Vegetation and coastal sand dunes, Beach Conservation, issue no.28, Beach Protection Authority, Queensland.

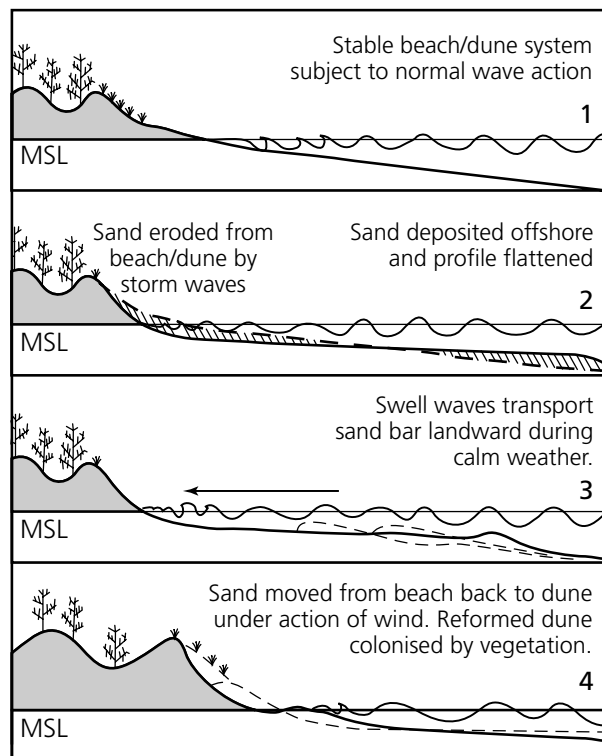


Figure 2. Flexible behaviour of vegetated foredune and ocean beach subject to wave action (adapted from Gale and Barr, 1977).