

# Cornwall Beach & Dune Management Plans

## An Overview of Coastal Sand Dunes (August 2015)

### Introduction

This briefing note is intended to provide a broad-overview of coastal sand dunes. Specifically it:

1. Identifies the key features of coastal sand dune systems, including physical features and vegetation/habitat types;
2. Highlights the types of coastal sand dunes to be found around the coast of Cornwall; and
3. Summarises the main physical processes that drive coastal sand dune evolution and how future climate change may impact upon these.

### 1. Key features of coastal sand dune systems

Sand dunes have a number of distinct zones across a typical cross-section, as illustrated in **Figure 1**, with low embryonic/fore dunes towards the sea, increasing in size, age and vegetation cover progressing landwards for up to several hundred metres or more.

Fore Dunes are unstable low ridges of sand on the foreshore where there is a characterising community of open, often sparse vegetation. Sand Couch and Lyme Grass is often dominant.

Yellow Dunes are more landwards than fore dunes with, with more vegetation cover and a greater range of species on ridges of sand. Marram Grass is often dominant

Grey Dunes are the most landward dunes. The sand ridges are almost completely vegetated and Marram Grass is present. The shape of the land (topography) is uneven and the sand ridges are still evident as hilly or undulating ground and the sand is not fully consolidated.

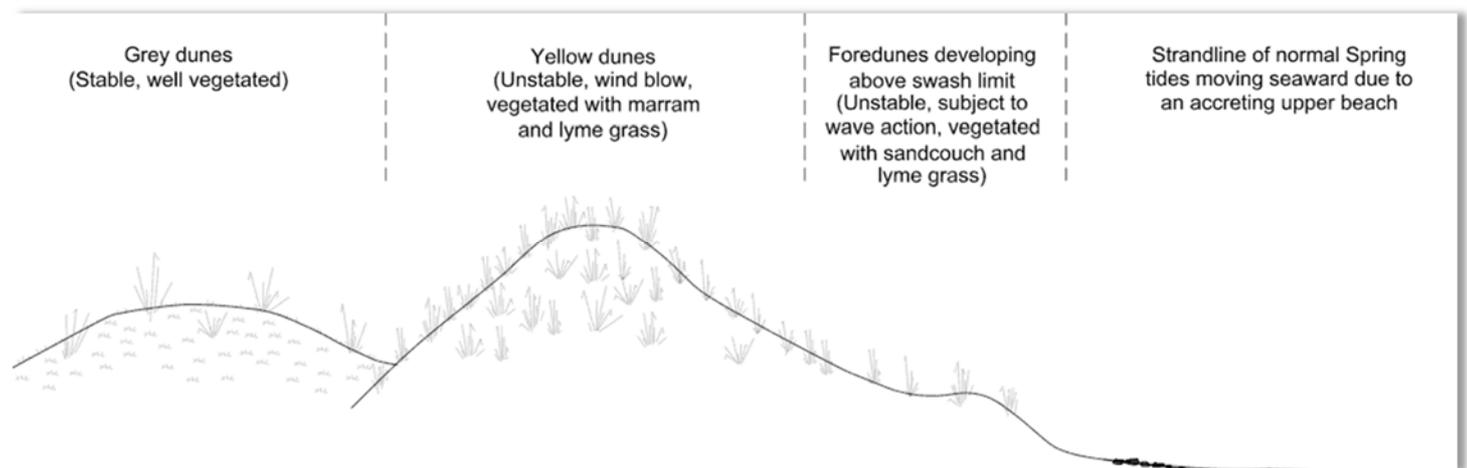


Figure 1 – Schematic cross-section of typical coastal sand dune system (Scottish Natural Heritage, 2000; <http://www.snh.org.uk/publications/on-line/heritagemanagement/erosion/2.2.shtml>).

Within the dunes system a number of features then typically develop at different times and at different scales. These include:

- **Blow Outs** – a wind shaped hollow or basin formed within the dune system, with sand driven landward to form a horseshoe shaped ridge. They generally form where dunes are unstable, which may be due to a lack of vegetation cover. They form in two main ways:
  - (1) where natural gaps or storm damaged cliffs in the fore dune ridge are exploited by the wind;
  - (2) by erosion processes such as the deflation of a poorly vegetated terrain, which may be a result of human trampling.

The movement of a blow out is dependent on the direction, frequency and strength of onshore winds.

- **Slacks** – When multiple dune ridges are present, linear depressions known as troughs or slacks exist between the ridges. If the water table is high or the base of the depression has been wind scoured these slacks can become water logged.
- **Breaches** – A low lying area in the seaward face of the dune barrier caused by wave action.
- **Cliffing of the Dune Face** – The formation of a vertical dune face as a result of wave erosion. This may be a seasonal feature and can be a feature of storm response.

## 2. Coastal sand dunes around the coast of Cornwall

The coast of Cornwall has around 25 locations coastal sand dunes are present (see **Figure 2**).



Figure 2 – Location of coastal sand dunes around the coast of Cornwall (Cornwall Sand Dune and Beach Management Strategy (Halcrow, 2009)).

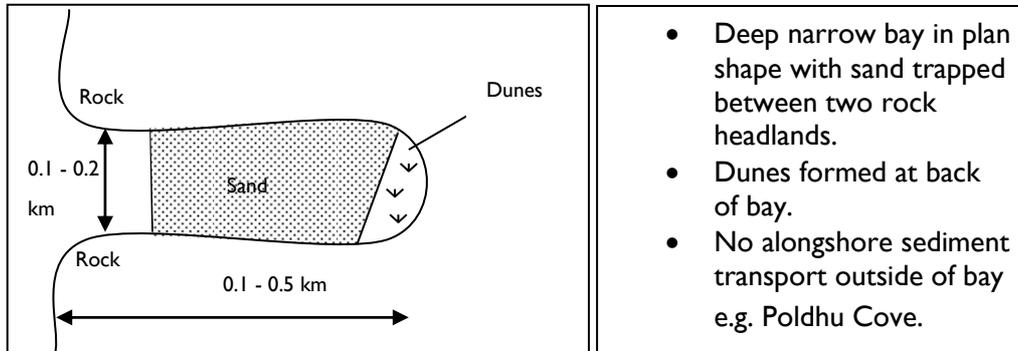
The main types of sand dune present in Cornwall are:

- **Embryo Dunes** – these represent the first stage in the development of dune ridges (the pre-cursor to fore dunes) and are formed by the deposition of sand along the high tide mark. They are low lying mounds of sand, often vegetated by salt tolerant species, and provide an indication that the dune system is accreting.
- **Linear Dunes** – these are relatively low ridges of sand, they tend to align with the dominant wind direction or the resultant vector of multiple wind directions. Most often occur as parallel ridges separated by a wide sandy area which is often vegetated.
- **Hummocky Dunes** – the term hummock describes an irregularly shaped mound of sand whose surface is wholly or partly vegetated. In coastal dune fields the dunes may sometimes form a series of discontinuous chains parallel to the shoreline, but commonly they display a haphazard distribution.
- **Climbing Dunes** – on cliffed coasts sand dunes which migrate towards the cliff can accumulate at the base and eventually migrate up and over the cliff face. Where they become separated from a source of sand they become relict cliff-top dunes.

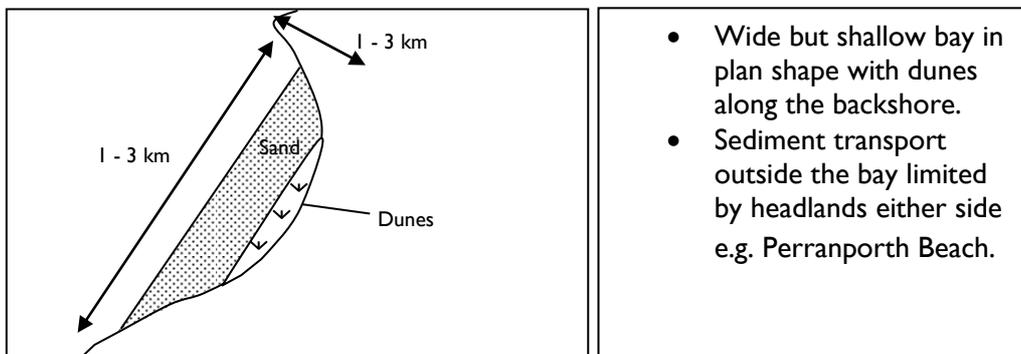
- **Relict Dunes** – these are dunes which have spilled inland and become separated from any source of sand, or dunes in areas which have no present day source of sand.
- **Fixed/Well Vegetated Dunes** – a these are older dunes with a thick vegetation cover (i.e. grey dunes). These dunes are stable and immobile with the vegetation protecting the sand from wind action and erosion.

These dune types are typically found in one of three settings around the coast of Cornwall as illustrated in **Figure 3**.

#### Long deep bays



#### Wide shallow bays



#### Bays forming part of a larger composite bay system

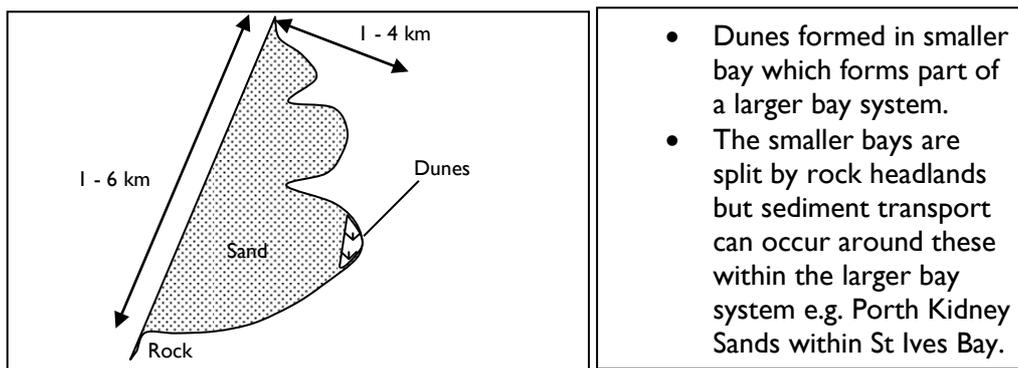


Figure 3 – Schematic diagrams of the main settings in which coastal sand dunes are found around the coast of Cornwall (Cornwall Sand Dune and Beach Management Strategy (Halcrow, 2009)).

### 3. Physical processes driving coastal sand dune evolution and the impact of climate change

Sand dunes play an important role in providing protection against the risk of coastal flooding due to the dynamic nature of beach-dune interactions and their sheer size preventing the sea from impacting upon the hinterland behind the dune systems. That dynamic beach-dune interaction often involves sand being eroded from the front of dunes and drawn down the beach to be stored offshore during storm events, with sand typically returning to the beach and dunes in quieter periods between storms.

The principle issues for beach and dune management are frequently related directly to the sediment budget, such as the loss of material due to wave erosion or the build-up of aeolian (wind-blown) sand

on roads which requires removal. An understanding of the sources and sinks and the sediment transport pathways that drive sand dune evolution, is therefore integral to the development of effective beach and dune management strategies. A clear understanding of how, when and where sediment is moving both to and from, enables the problems at a site to be understood. Consideration of future climate change impacts on the sediment budget then enables management approaches to be developed which will be successful in the longer term.

**Figure 4** shows a simple schematic sediment budget for a beach-dune system. It shows that exchange between the dune system and the beach system must also be considered as well as the overall inputs and outputs to the system as a whole. **Figure 5** then shows how future climate change may impact upon this beach-dune system.

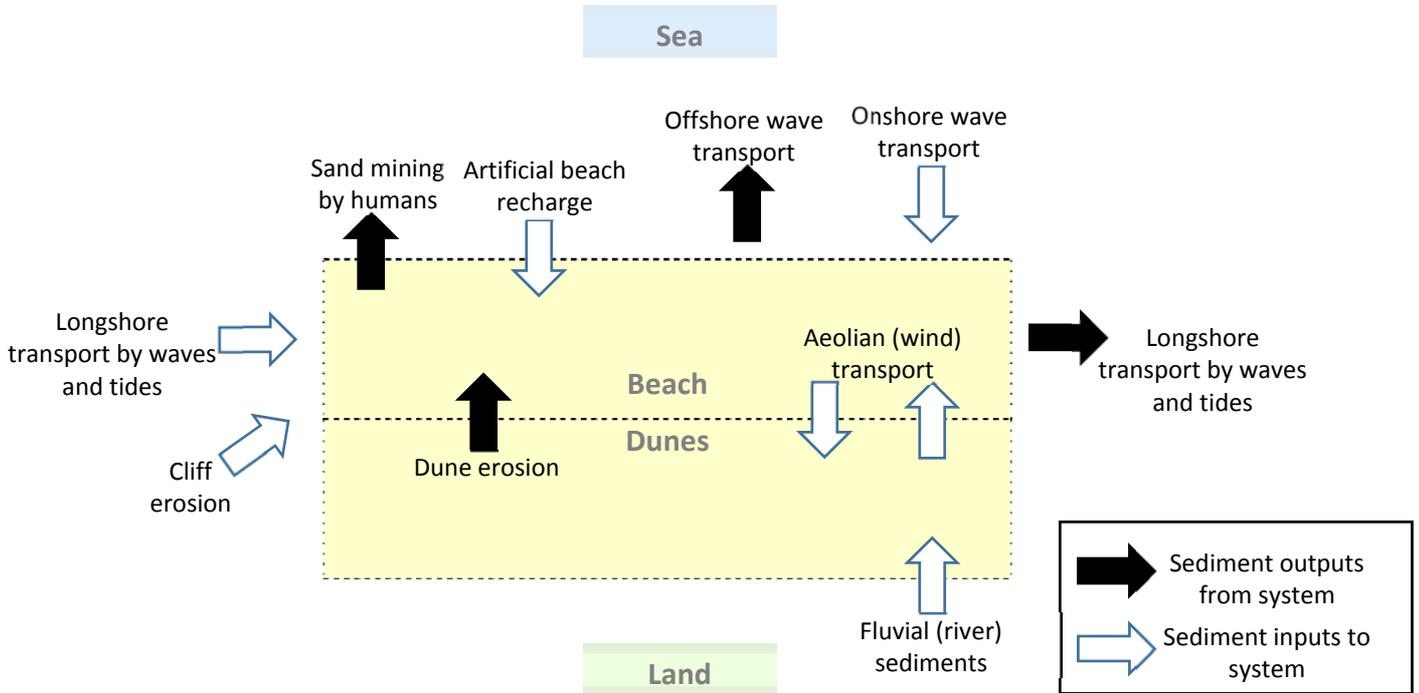


Figure 4 – Schematic sediment budget for a beach-dune system showing key processes for coastal sand dune evolution.

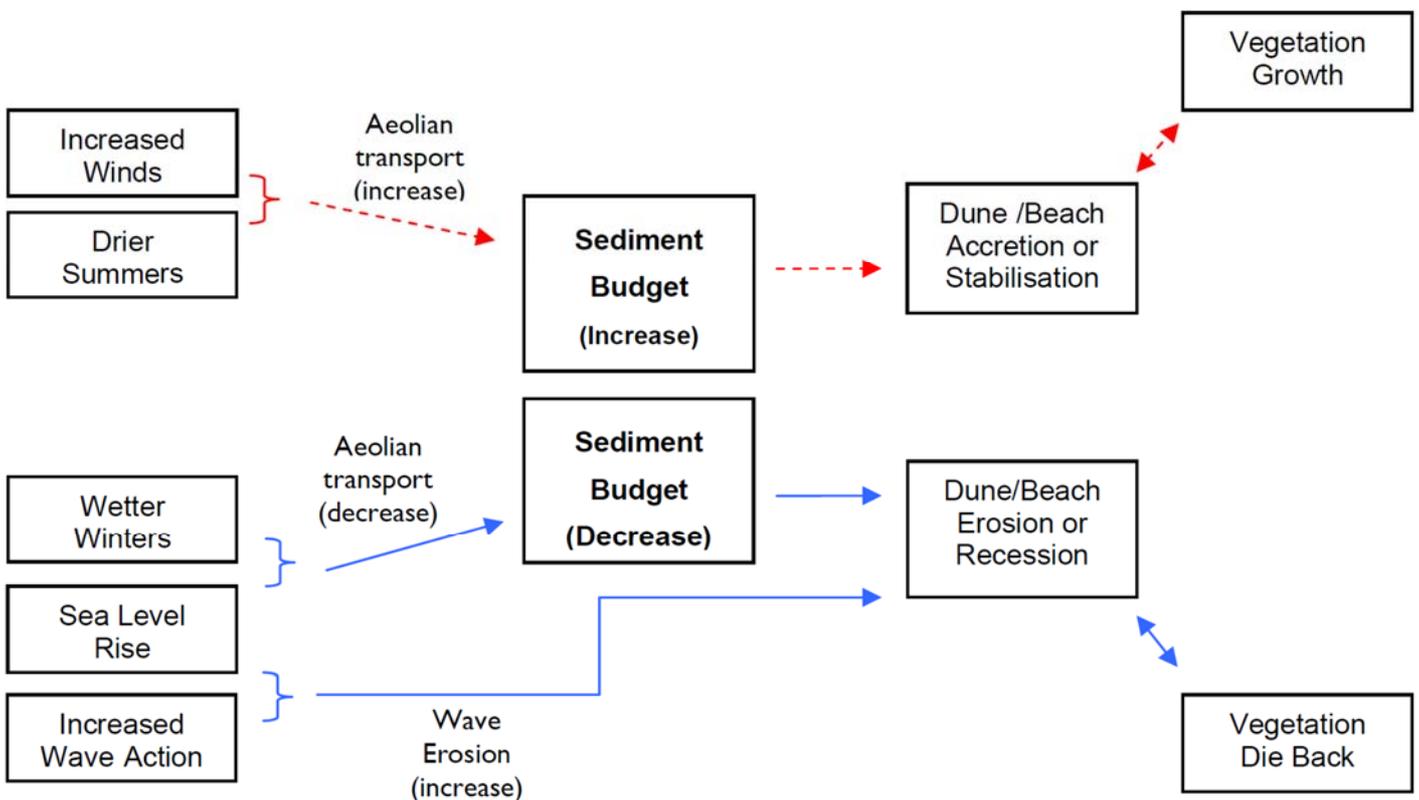


Figure 5 – Conceptual diagram indicating possible impacts of climate change on sand dunes (Cornwall Sand Dune and Beach Management Strategy (Halcrow, 2009)).