Dune construction and rehabilitation

Challenge: Sea level rise **Adaptation response:** Green infrastructure for shoreline protection

Description

Naturally occurring sand dunes are wind-formed sand deposits representing a store of sediment in the zone just landward of normal high tides (French 2001). Artificial dunes are engineered structures created to mimic the functioning of natural dunes. Dune rehabilitation refers to restoring degraded natural or artificial dunes to optimize coastal protection benefits.

Artificial dune construction and dune rehabilitation are technologies aimed at reducing both coastal erosion and flooding in adjacent coastal lowlands. Dunes naturally occur along most undeveloped, sandy coastlines. Their coastal defence role is two-fold:

1) They provide a barrier between sea and land in a similar way to a sea wall.
2) They provide 'dynamic' protection: the dune/beach system is dynamic and constantly undergoing small adjustments in response to changes in the wind and wave climate and sea level. As such, dunes are able to supply sediment to the beach when it is needed in times of erosion, or store it when it is not (French, 2001).

Implementation

At its simplest, artificial dune construction involves the placement of sediment from dredged sources on the beach. This is followed by reshaping of these deposits into dunes using bulldozers or other means. As a result, dune construction is most frequently carried out at the same time as beach nourishment.

There are a number of methods for dune rehabilitation. One method is to build fences made from tree branches on the seaward side of an existing dune to trap sand and help stabilise any bare sand surfaces (USACE, 2003). This method can also be used to promote growth after a dune has been created using bulldozers (Nordstrom & Arens 1998). Alternatively, vegetation planting can also help stabilise natural or artificial dunes.

Artificial dune creation and dune restoration can be carried out on existing beaches, beaches built through nourishment, existing dunes, undeveloped land, undeveloped portions of developed areas, and in fully developed areas that have been purchased for restoration.

Environmental Benefits

- Limits negative effects on landscapes (even artificial dunes) as dunes are naturally occurring features.
- Restores a degree of natural character to places that had naturally occurring dune complexes before development.
- Provides valuable coastal habitats for many highly specialised plants and animals.

Socioeconomic Benefits

- Offers a high degree of protection against coastal flooding and erosion (if managed properly).
- Meets multiple management objectives, such as habitat protection, public access to environmental and recreational resources and hazard mitigation.

Opportunities and Barriers

Opportunities:

- Dune construction is generally less expensive and more aesthetically pleasing than engineering solutions
- Planting of dune vegetation can be undertaken at the community level using widely available tools
- Restoration programmes can be linked to environmental education initiatives on naturally functioning coastal landscapes and their advantages for hazard management

Barriers:

- Most dunes occur on wide sandy beaches, which are highly appealing for development. They compete for valuable coastal land
- Despite being a natural feature of many sandy coastlines, dunes also represent a barrier to beach access
- Many communities are only familiar with static defences and may therefore hesitate to accept dynamic defences such as sand dunes

Implementation considerations*

Technological maturity:	4-5
Initial investment:	2-4
Operational costs:	2-4
Implementation timeframe:	2-4

* This adaptation technology brief includes a general assessment of four dimensions relating to implementation of the technology. It represents an indicative assessment scale of 1-5 as follows:
Technological maturity: 1 - in early stages of research and development, to 5 – fully mature and widely used
Initial investment: 1 – very low cost, to 5 – very high cost investment needed to implement technology
Operational costs: 1 – very low/no cost, to 5 – very high costs of operation and maintenance
Implementation timeframe: 1 – very quick to implement and reach desired capacity, to 5 – significant time investments needed to establish and/or reach full capacity
This assessment is to be used as an indication only and is to be seen as relative to the other technologies included in this guide. More specific costs and timelines are to be identified as relevant for the specific technology and geography.

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