18 Sand dune management and restoration

Environmental impact	3/3
Risk protection	2/3
Durability	3/3
Affordability	2/3

Intro

Dunes are natural flood barriers that protect the inland from the brunt of coastal floods and storm surges. The sandy ridges develop in parallel to the shoreline. Dunes change their size and shape due to tides, winds, storms, or heavy sea. In case of flooding, the health of the vegetation can decide upon the effectiveness of the dune's mitigation capacity.

The restoration of dunes includes the recovery of eroded areas and dune stabilization based on vegetation and fences. In general, the interventions that join the restorations of dunes should not disrupt the natural forming processes and the dune ecosystems. A careful assessment of the site before the implementation of measures is highly recommended.

Benefits and Risk

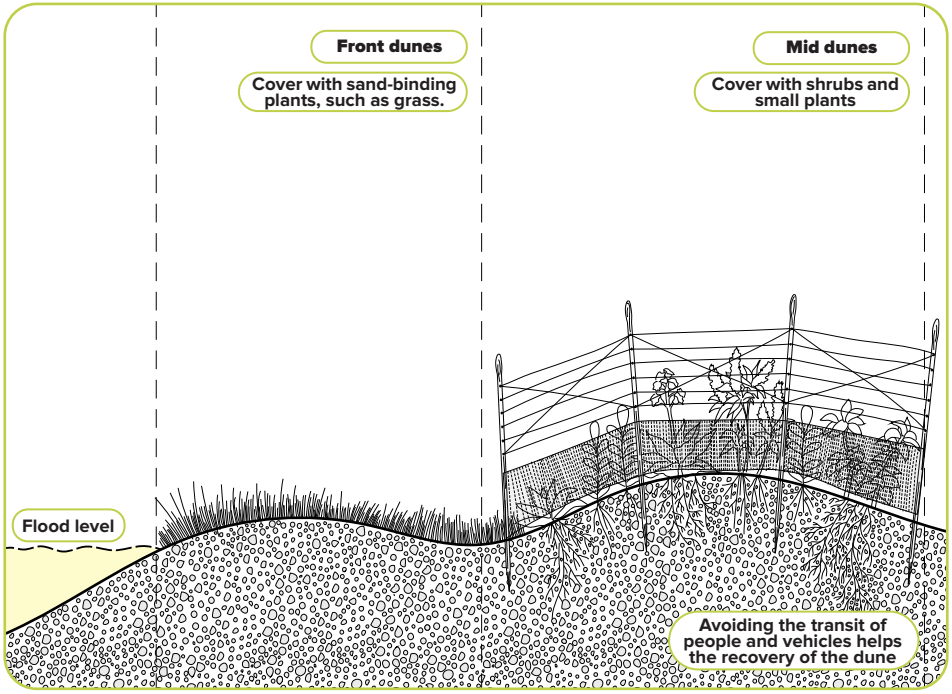
Compared to engineered dams, dune systems depend on more space between the shore and the developed inland to reach the highest efficiency. A sand dune with a narrow beach close to a developed area has a smaller flood mitigation impact than one with a wide and large beach. Overall, coastal development and increasing urbanization describe a severe threat for the health and effectiveness of dune systems.

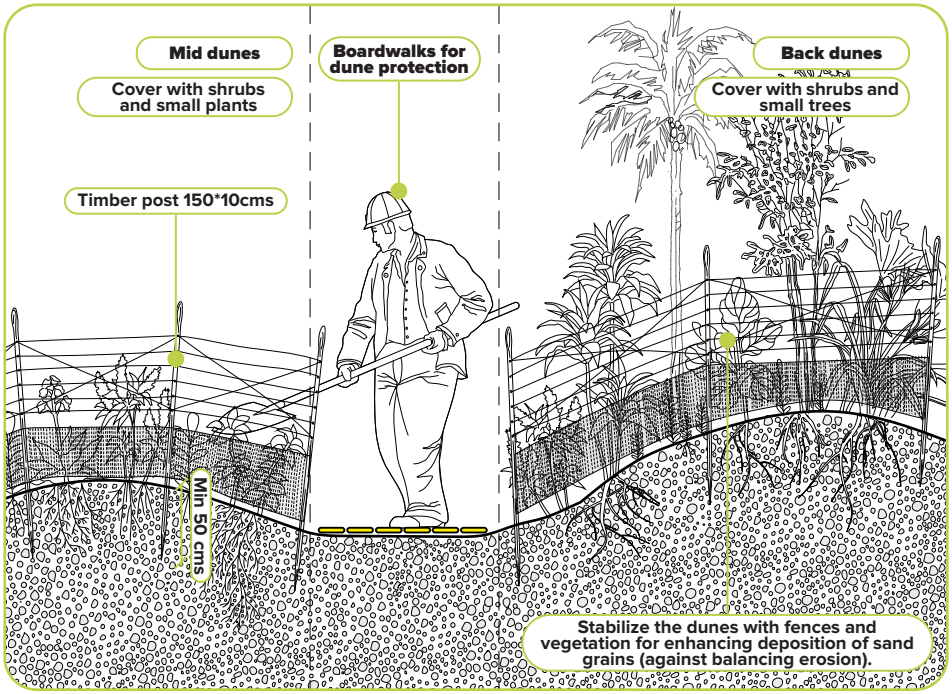
Good practice

Sand dune restoration in S. João Da Caparica, Portugal.
The Portuguese city of Almada lies at Atlantic coast. It faces sea-level rise, increasing erosion, the threat of storm surges, and extreme flooding. As a result, the project ReDuna was initiated in 2014 to prioritize dune restoration, coastal protection, biodiversity targets, and community awareness in the urban area of Almada.

After the destruction of the dune ecosystem due to winter storms, the project began with the dune restoration by installing willow, fences, pathways, and around 100'000 native plants along 1 km of the shore. After installing these measures within 6 months, a monitoring system continuously assessed the sand dune ecosystem. The Faculty of Science of Lisbon University, Center of Ecology led the monitoring which included, among other analyses, the site's geomorphological changes via GPS. After four years of monitoring, the results showed increased biodiversity, more stability in sediment transfer, and that the planted vegetation had formed a dense and effective root system (as deep as four meters) for dune stabilization. The Storm Emma in 2018 proved the regained efficiency of the sand dunes.

In addition, the local community was involved in the design process and maintenance campaigns. The actions for maintenance *(including the removal of alien species)* take place after each summer and storm season. The EU Structural and Cohesion Fund financed the structural interventions at the beginning of the project. The municipality then paid for the monitoring and human resources *(Connecting Nature 2020)*.





Overview of Criteria

Type of Intervention:
Nature-based.

Scale of Intervention:
Supra-settlement.

Materials:
Native Vegetation (For example, dune-forming perennial grasses such as sand couch, sea Lyme or marram grass), fences, (wooden) posts, wood for boardwalks.

Environmental Impact:
Sand dune restoration supports the protection of ecosystems and biodiversity. In addition, healthy sand dunes help mitigate coastal erosion and storm surges.

Targeted Natural Hazard:
Coastal/Riverine Flood.

Targeted Vulnerable Assets:
Buildings, Transport, Land Cover.

Strategy Type:
Reduce Hazard Magnitude.

Implementation Time:
Medium (1 month - 1 year), Long (<1 year).

Effect Duration:
Medium - term (1 year to 10 years).

Investment Costs:
Low, Medium.

Maintenance Costs (yearly):
Low (<10% investment costs), Medium (10-50%).

Climate ADAPT (2023)
Dune construction and strengthening.
Available online at
https://climate-adapt.eea.europa.eu/en/metadata/adaptation-options/dune-construction-and-strengthening/#implementation.

Connecting Nature (2020)
ReDuna - Restoration of S. João da Caparica Sand Dunes.
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UKCEH; UK Sand Dune and Shingle Network and Dynamic

Dunescapes partners (2021)
The Sand Dune Managers Handbook. 1st ed.: Produced for the Dynamic Dunescapes (DuneLIFE) project: LIFE17 NAT/UK/000570; HG-16-08643.
Available online at
https://dynamicdunescapes.co.uk/wp-content/uploads/2021/07/Dynamic-Dunescapes-Sand-Dune-Managers-Handbook-June-2021.pdf.

Flood Risk in Humanitarian Settlements: Compendium of Mitigation Measures

Spatial Development and Urban Policy, SPUR
ETH Zurich - Institute for Spatial and Landscape Development
Bruna Rohling, David Kostenwein, Mona Gairing, David Kaufmann

Geneva Technical Hub, co-convened by UNHCR and SDC
Ammar Al-Mahdawi, Emilie Schmid, Eric Bardou

External Experts
Mrudhula Koshy, Diego Bermúdez, Jonathan Parkinson

Layout and Drawings
Santiago Beaumé, Paola Pabón

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GENEVA TECHNICAL HUB

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