

Nature-Based Solutions for Ports

Image source: [GoComet](#)



GLOBAL PROGRAM ON
NATURE-BASED SOLUTIONS
FOR CLIMATE RESILIENCE



GFDRR
Global Facility for Disaster Reduction and Recovery



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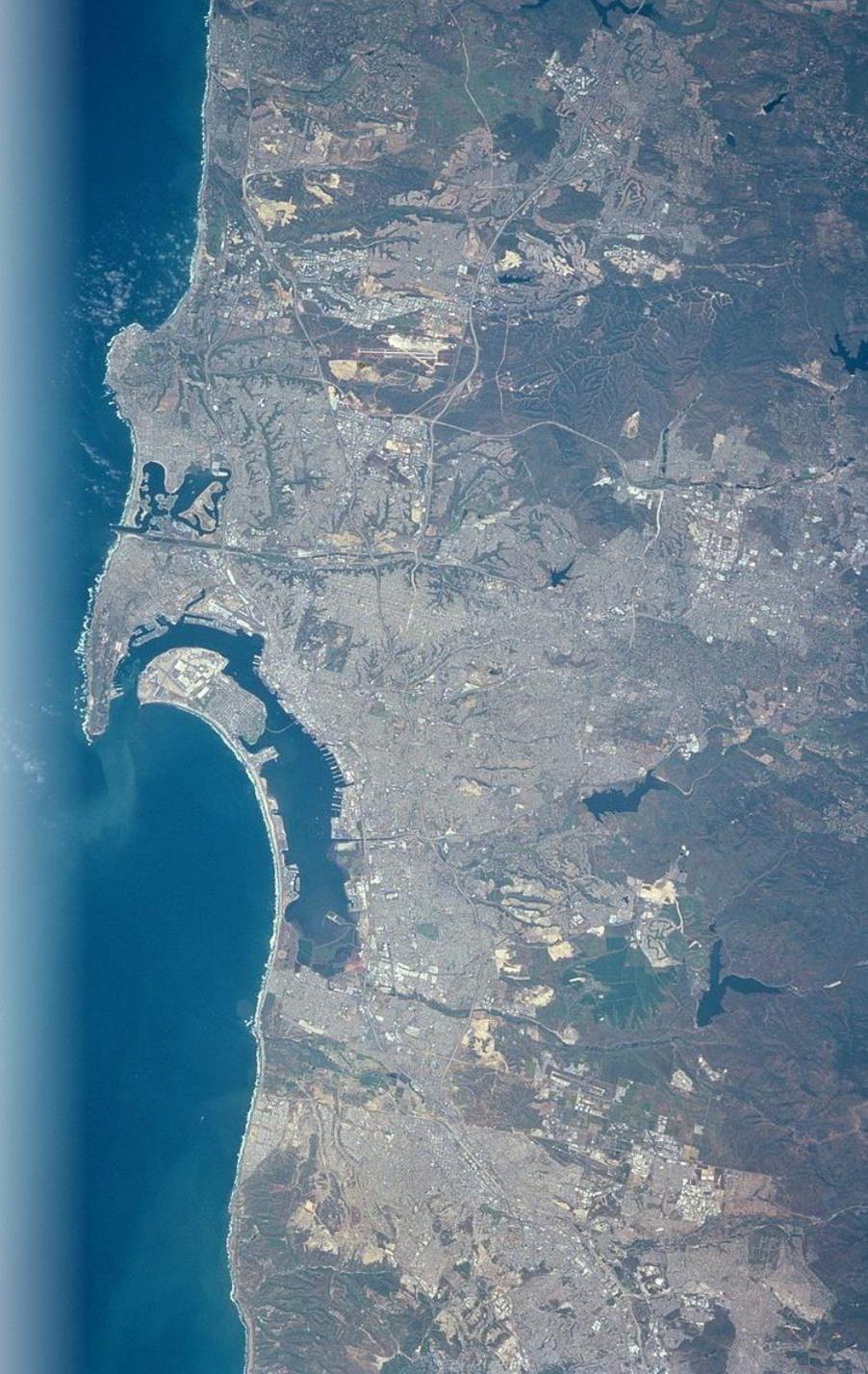
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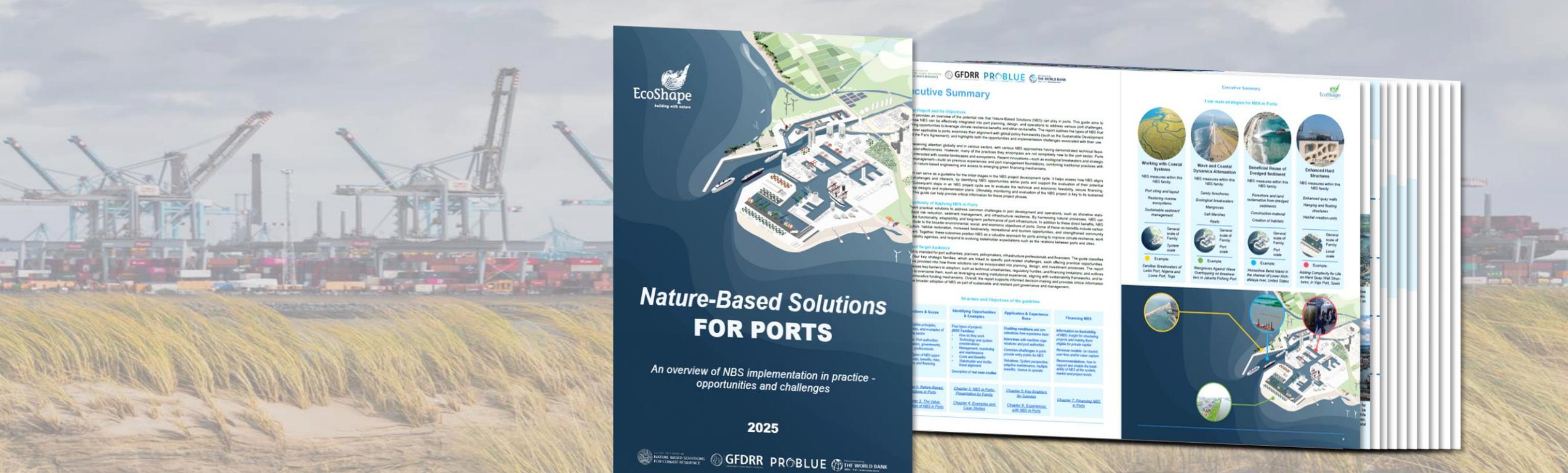


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Why port resilience matters

1. Ports handle **80% of global trade!** (by volume)
2. Ports and harbors also stand **at the forefront of climate resilience challenges** (from rising sea levels, intense rainfall, heatwaves and evolving regulatory demands) e.g. Izaguirre et al 2021; Verschuur et al 2023; Fernandez, Perez et al 2024
3. These forces are **reshaping how ports' infrastructure is designed, maintained and modernized** to ensure long-term functionality and sustainability.
4. Ports are also key **'coastal managers'** of land and water; and in **increasingly populated coastlines and with ever-growing economic activity** and critical infrastructure.
5. Port resilience keep connections with **climate mitigation and NetZero strategies**; Sustainable Development Goals (SDGs); and Environmental, Social, and Corporate Governance (**ESG**) principles.





NBS IN PORTS



Goal: Create a document which can be used to help ports make NBS and its opportunities more tangible and practical.

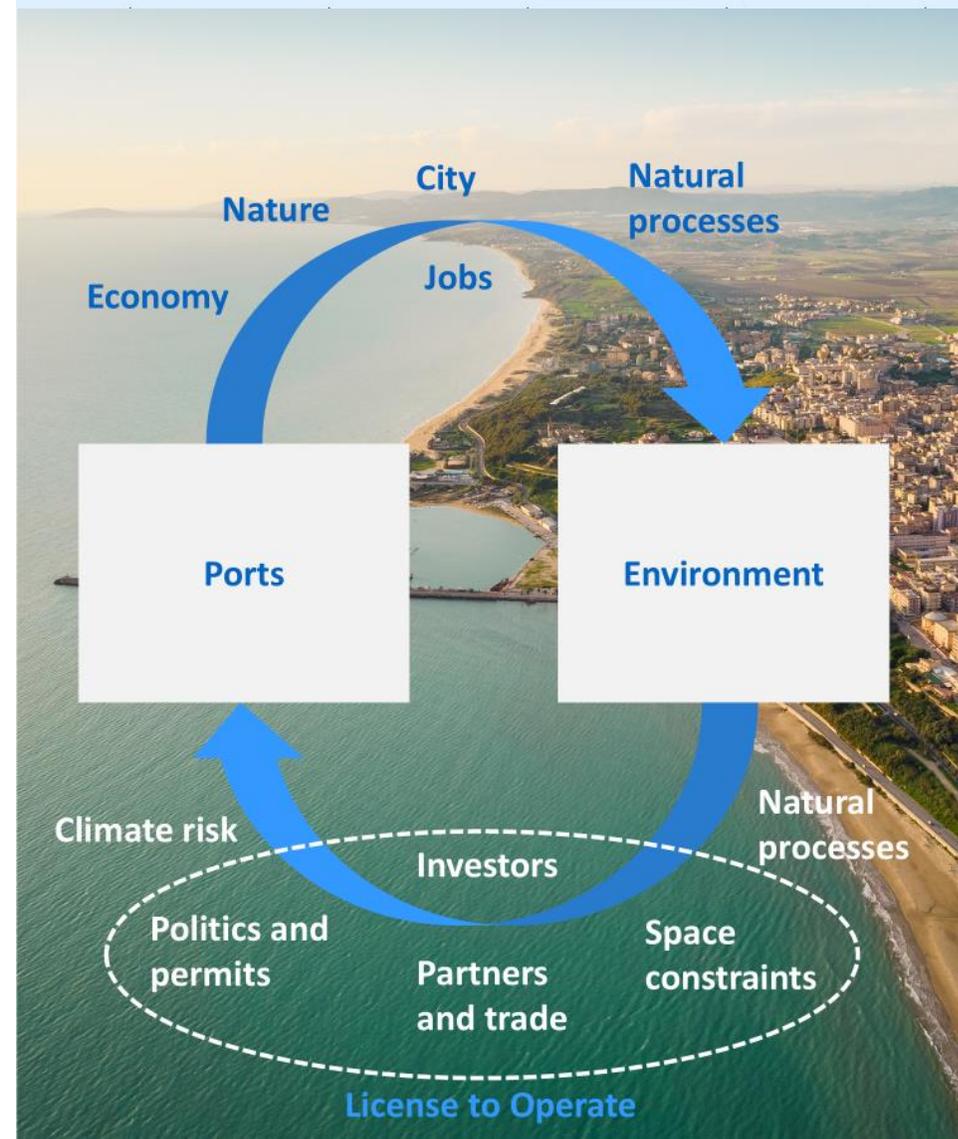


NBS in ports

NBS and green infrastructure are gaining interest in the sector for:

- Their effects on coastal processes
- Potential to offer co-benefits and multifaceted solutions
- Balancing environmental, social, and economic factors
- Opening up Public-Private Partnerships (PPPs) opportunities; can make permit processes easier; good will to neighbors and improved relationships with all
- Accessing to additional funding streams and leveraging

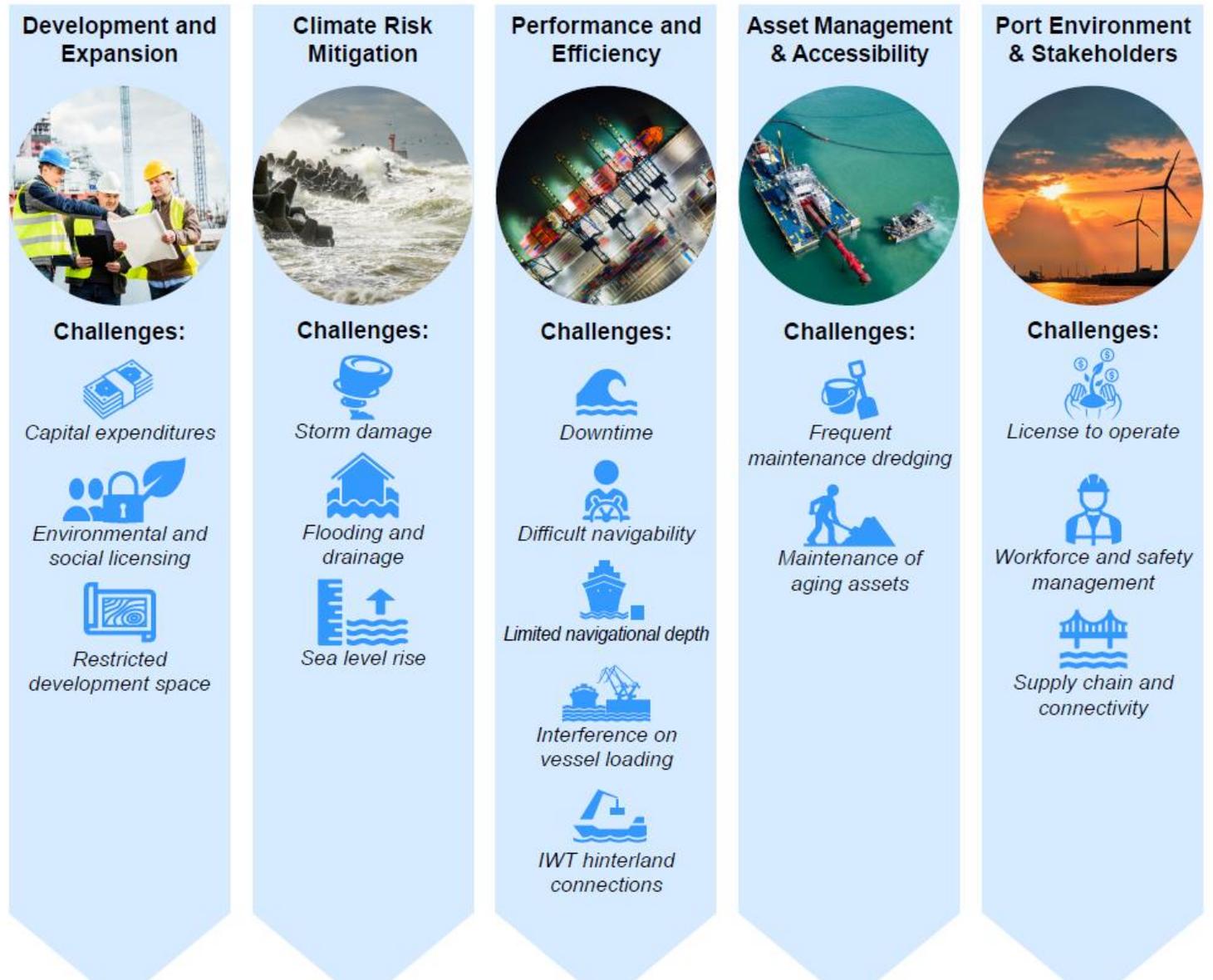
Ports are major influencers, players and stakeholders in the local, regional, national and international marine environment



Value proposition Port challenges

Similar to the climate related challenges faced by communities, ports also face their own obstacles.

Challenges in Port Governance and Development



Port challenges

Based on these challenges the guide identifies four NBS families that are relevant for ports.

Challenges in Port Governance and Development

Development and Expansion	Climate Risk Mitigation	Performance and Efficiency	Asset Management & Accessibility	Port Environment & Stakeholders
Challenges:	Challenges:	Challenges:	Challenges:	Challenges:
Capital expenditures	Storm damage	Downtime	Frequent maintenance dredging	License to operate
Environmental and social licensing	Flooding and drainage	Difficult navigability	Maintenance of aging assets	Workforce and safety management
Restricted development space	Sea level rise	Limited navigational depth	Interference on vessel loading	Supply chain and connectivity
		IWT hinterland connections		

NBS Families



Working with Coastal Systems



Wave and Coastal Dynamics Attenuation



Beneficial Reuse of Dredged Sediment



Enhanced Hard Structures

Identify NBS opportunities

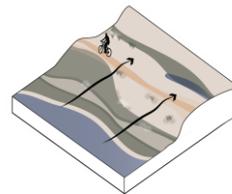


NBS Family: Wave and Coastal Dynamics Attenuation

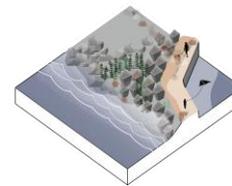
How can I minimize the impact of waves and currents on maritime activities?

- Leverages natural elements for wave attenuation
- Reduces wave energy
- Traps sediments and Minimises sedimentation in ports
- Reduces storm impact
- Promotes biodiversity and improves water quality

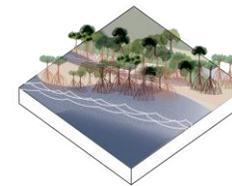
NBS:



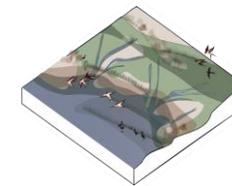
**Sandy
foreshores**



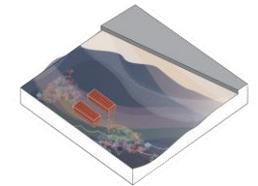
**Enhanced
breakwaters**



Mangroves



Salt marshes



Reefs

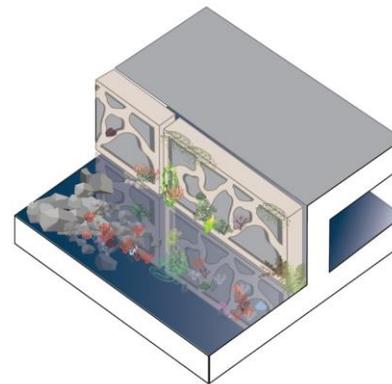
Identify NBS opportunities

NBS Family: Enhanced hard structures

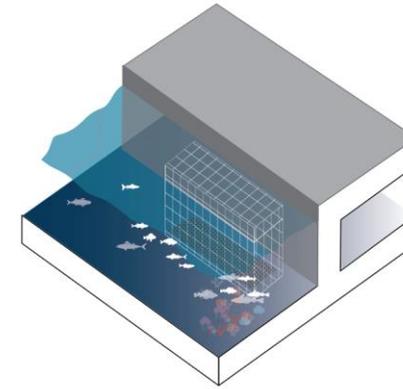
Hard infrastructure equipped with nature-based features can help create habitats while contributing to increased performance of certain infrastructure elements.

Ecologically enhanced design features are integrated into existing infrastructures, to mimic natural habitats of various scales.

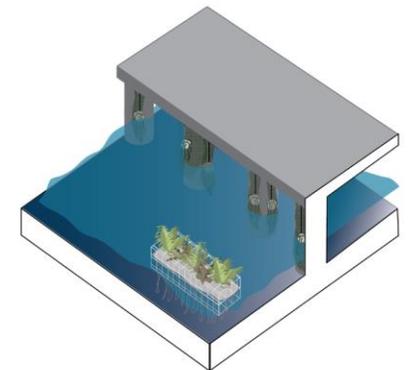
Some of these features may include varying textures, added complexity, and substrate types that attract and provide refuge for marine organisms



**Enhanced walls and
revetments**

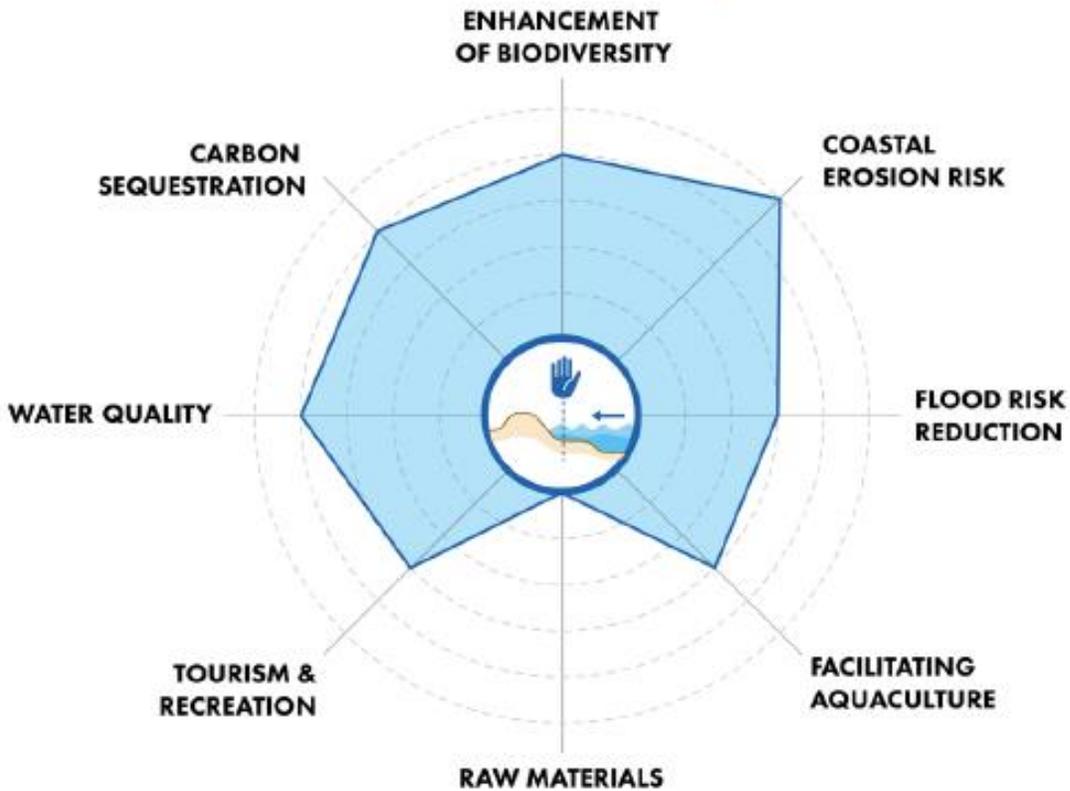


**Hanging and floating
structures**

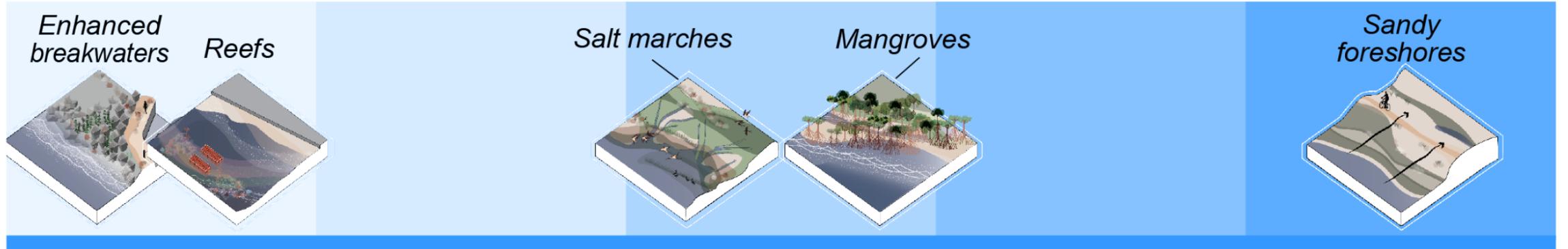


Habitat creation units

With information on settings, co-Benefits & examples...



And Cost and Benefits ...



Low CAPEX

High CAPEX



Less OPEX

Similar OPEX

Higher OPEX

Examples: Port of Rotterdam expansion



8-kilometer stretch of sand dunes as a soft breakwater

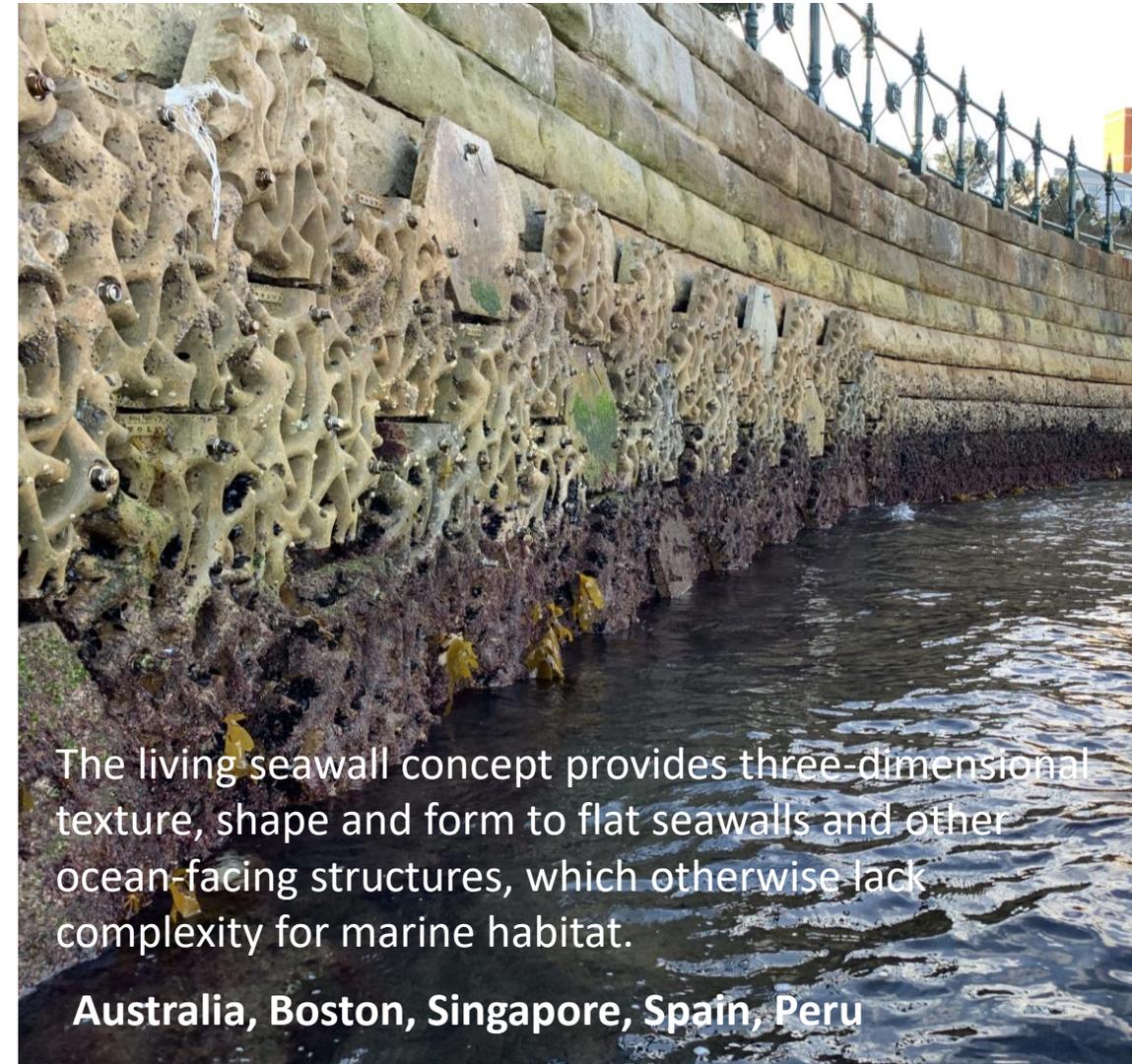
Source: Van Zetten et al (2022); Port of Rotterdam

Examples: Retrofitting & Microhabitat enhancement

<https://www.livingseawalls.com.au>

Harbor Island
Port of San Diego

ECONcrete worked with the Port to design a single layer armor unit that provides structural support and native habitat to rock riprap



The living seawall concept provides three-dimensional texture, shape and form to flat seawalls and other ocean-facing structures, which otherwise lack complexity for marine habitat.

Australia, Boston, Singapore, Spain, Peru

Source of images:

EcoConcrete & Inland and coastal Marina Systems

It also proposes alignment with six enablers of Building with Nature projects by EcoShape

Technology and system knowledge



Multi-stakeholder approach



Management, monitoring and maintenance



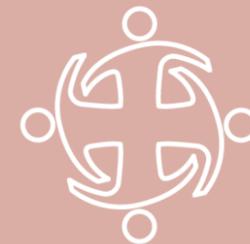
Institutional embedding



Business Case



Capacity building



Key take-aways



- **Guidance** built up from analysis of the challenges in the sector
- **Identified NBS strategies** with description of families, characteristics, costs, benefits, and examples.
- **Interviews and review** of ports' challenges and concerns with NBS, with identification of solutions and specific entry points.
- Although the implementation of **NBS would be depending on local circumstances**, the guide provides a first resource.
- **Ports are a key manager along coastlines**, and therefore an important part for building coastal climate resilience.
- **The time is right: Increasing number of pilot initiatives and momentum** in hybrid infrastructure and integration opportunities



Thank you



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