

Commissioned by



HIGH LEVEL PANEL for
**A SUSTAINABLE
OCEAN ECONOMY**

BLUE PAPER

Summary for Decision-Makers

Coastal Development: Resilience, Restoration and Infrastructure Requirements

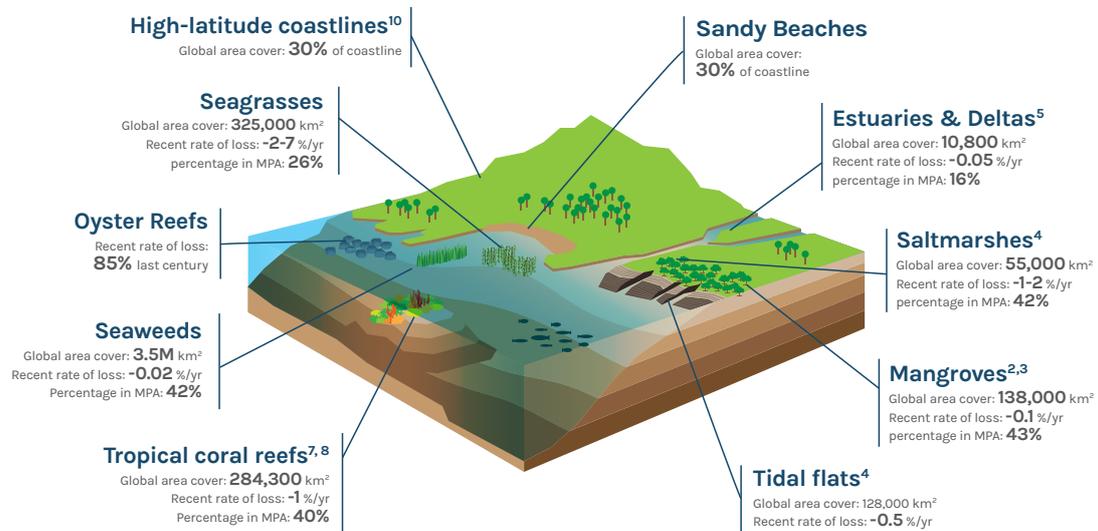
Over the past 30–50 years, there have been significant—and, in many cases, rapid, abrupt and irreversible—changes across the world’s coastal ecosystems (sand-dunes, saltmarshes, mangroves, seagrass, and coral and shellfish reefs). These have included erosion of coastlines, significant global loss of coastal ecosystems (50 percent of saltmarshes, 35 percent of mangroves, 30 percent of coral reefs and 85 percent of shellfish reefs over the last 30–50 years), and the significant reduction in coastal resilience (Figure 1).

If current trends continue, projections indicate widespread and potentially catastrophic risks to coastal ecosystems, human populations, built infrastructure and economies. The way in which coastal development around the world is managed over the next few decades will carry significant consequences for present and future generations.

Failure to properly manage our coastal assets will result in continued environmental damage, and inadequate natural infrastructure to meet the demands of changing demographics and climate change impacts. Without resilient coasts, the development and sustainability of established and emerging sectors of the ocean economy, as well as disadvantaged nations and peoples, will be compromised.

A new paper,¹ commissioned by the High Level Panel for a Sustainable Ocean Economy, focuses on how to enhance coastal ecosystem resilience and enable sustainable pathways for economic and infrastructure development, without compromising the integrity and benefits of coastal ecosystems, or disadvantaging the people that rely upon them. The paper reviews the major human activities that have increased pressure on, and reduced the resilience of, coastal ecosystems, and makes an economic and security case for the sustainable development of resilient coastlines.

Figure 1. Areal Extent and Historical and Projected Losses of Major Coastal Ecosystems



Source: CSIRO. 1 Beck et al. 2011; 2 Bunting et al. 2018; 3 Goldberg et al. 2020; 4 Mcowen et al. 2017; 5 Murray et al. 2018; 6 Nienhuis et al. 2020; 7 Rogers et al. 2020; 8 UNEP 2020; 9 Vousdoukas et al. 2020; 10 Wernberg et al. 2019.

The paper highlights a range of positive policy, planning and coastal infrastructure developments for the health and resilience of coastal ecosystems. These include designing coastal infrastructure to deliver positive economic, environmental, social and development impacts, and using natural infrastructure to deliver multiple objectives of ecosystem restoration, natural resource provisioning, preservation of aesthetic, cultural and spiritual values, and coastal stabilisation and protection.

The vast majority of resources for current and emerging sectors that comprise the ocean economy are concentrated along coastal areas and must operate within a complex, multiple-use context (Table 1). To ensure the environmental, economic and social sustainability of our space-constrained coastal systems, the over-arching challenge is to balance ongoing developments with multiple competing uses and balance the trade-offs between restoration and infrastructure development, recognising the many tangible and intangible benefits of healthy and resilient coastal ecosystems.

Table 1. Crowded Coasts: Global Growth of Major Coastal Infrastructure

| CATEGORY | TYPE | FOOTPRINT | CATEGORY | TYPE | FOOTPRINT |
|-----------------------|---|---|----------------------|--|--|
| Reclamation | Coastal reclaimed land ² | Area: 3,370 km ² | Water Infrastructure | Large dams ¹⁰ | Number: 58,000 |
| | Artificial islands ¹ | Number: 480 Area: 1,267 km ² | | Desalination plants | Number: 16,000 Growth rate: 10.5%/yr |
| | Artificial reefs | Area: 36,000 km ² | | Commercial harbours | Number: 4,700 Area: 4,500 km ² |
| Coastal Defence | Cemented shorelines | Length: >14,000 km | Ports and Shipping | Marinas | Number: 9,628 Area: 776 km ² |
| | Breakwaters ¹ | Number: 268 Area: 577 km ² | | Commercial vessels ⁹ | Number: 95,402 Growth rate: 2.6%/yr |
| | Coastal canals ⁶ | Area: 4,000km | | Cruise ships ⁷ | Number: 272 Growth rate: 6%/yr |
| Energy Infrastructure | Oil rigs | Number: 5,179 Area: 89,964 km ² Growth rate: 1.2%/yr | Miscellaneous | Fishing vessels ⁸ | Number: 4,600,000 |
| | Oil pipelines ¹ | Length: 136,000 km Growth rate: 1.2%/yr | | Motor vessels ⁸ | Number: 67,800 |
| | Offshore wind energy ¹ | Number: 6,000 Area: 30%/yr | | Coastal aquaculture and mariculture ¹ | Number: 78,240 Area: 22,927 km ² Growth rate: 3%/yr |
| | Offshore wave and tidal energy ¹ | Growth rate: 208%/yr | | Telecom cables ¹ | Number: 428 Length: 39,304 km Growth rate: 8.2%/yr |

Source: CSIRO. 1 Bugnot et al. 2020; 2 Donchyts et al. 2016; 3 Jones et al. 2019; 4 Jouffray et al. 2020; 5 Liu et al. 2020; 6 Waltham and Conolly 2011; 7 CLIA 2019; 8 FAO 2020a; 9 UNCTAD 2020b; 10 Mulligan et al. 2020.

The paper finds that there are four main management strategies that can be used to secure the integrity and resilience of coastal ecosystems and their contributions to people:

- 1. Protection strategies** use regulations and area-based management to designate where and how much of specified activities can and cannot occur in coastal environments and in the adjacent catchment, and legislate areas for conservation such as marine protected areas (MPAs) or implement area, habitat and species-specific conservation plans, including inclusive approaches that recognise indigenous and traditional rights.
- 2. Mitigation strategies** aim to reduce local stressors caused by human action using technology, regulation and the promotion of stewardship to minimise the introduction of pollutants, the overexploitation of resources or activities that will otherwise harm coastal environments.
- 3. Adaptation strategies** use principles of ecosystem-based adaptation and eco-engineering to incorporate natural infrastructure into existing grey infrastructure, relocate at-risk activities and populations away from the coast, and also use incentives to change behaviours and practices.
- 4. Repair strategies** seek to restore damaged ecosystems by restoring the composition and/or function of lost or fragmented habitats, or by restoring the natural hydrology, sediment and nutrient balance entering and cycling through coastal ecosystems.

Opportunities for Action

- 1. Build ecosystem resilience:** Coastal ecosystems must be better protected by strengthening regulations and increasing area-based conservation to halt the net loss, increase the extent and improve the condition of critical coastal habitats, such as sand-dunes, saltmarshes, mangroves, seagrass, and coral and shellfish reefs. At-scale habitat restoration, and re-establishing natural coastal and hydrological processes, are required in order to repair many damaged coastal ecosystems and restore functional resilience.
- 2. Enhance community resilience, equity and access:** Building the socioeconomic resilience of those who are most vulnerable, and empowering and engaging natural resource users and coastal communities, especially those who directly rely on coastal resources for food security, nutrition and livelihoods, are critical aspects of ensuring healthy coastal ecosystems and realising a sustainable ocean economy. Inclusive governance, incorporating indigenous and local knowledge in planning and decision-making processes, and inclusive business processes are required, alongside incentives to protect and restore coastal ecosystems and to enhance local livelihood opportunities.
- 3. Mitigate impacts of terrestrial and extractive activities on coastal ecosystems:** A growing global population requires food, water, energy and housing, all of which create pressures and impacts on coastal ecosystems. There is a need to ensure better management of upstream catchment agricultural, extractive and urban activities, which compromise the quantity and quality of surface and groundwater, altering the natural supply of sediment to the coast.
- 4. Advance sustainable, future-proofed blue infrastructure:** Nature-based and hybrid approaches are increasingly being used to adapt existing—and design new—coastal infrastructure to increase resilience to changing climate conditions, support sustainable development of local communities and minimise the loss of ecosystem services. Financial mechanisms and funds, which remunerate the protection and enhancement of ecosystem services, are available to implement natural and hybrid approaches, for the next generation of climate-resilient infrastructure, and to empower nations and communities to protect coastal ecosystems.

COVID-19 is having serious and significant impacts on the national trajectories of economic growth, including for coastal economies. The hardening of borders, the ceasing of movement of people and shrinking income opportunities, the disruption of globalised supply chains and the rise of restrictive trade policies are emerging as early consequences of the global pandemic that are relevant for coastal economic sectors.

A unique window of opportunity exists to engage and influence policy and investment decisions and ensure stimulus funds foster sustainable ocean economic pathways and support the recovery and development of impacted communities. Coastal restoration can be used to help economic recovery from the COVID-19 pandemic while providing co-benefits of ecosystem services, community cohesion and climate adaptation.



The High Level Panel for a Sustainable Ocean Economy

The High Level Panel for a Sustainable Ocean Economy (Ocean Panel) is a unique initiative by 14 world leaders who are building momentum for a sustainable ocean economy in which effective protection, sustainable production and equitable prosperity go hand in hand.

Co-chaired by Norway and Palau, the Ocean Panel comprises members from Australia, Canada, Chile, Fiji, Ghana, Indonesia, Jamaica, Japan, Kenya, Mexico, Namibia, Norway, Palau and Portugal and is supported by the UN Secretary-General's Special Envoy for the Ocean.

The Ocean Panel gathers input from a wide array of stakeholders, including an Expert Group and an Advisory Network. The Secretariat, based at World Resources Institute, assists with analytical work, communications and stakeholder engagement.

The Blue Paper that this brief summarises is an independent input to the Ocean Panel process and does not necessarily represent the thinking of the Ocean Panel, Sherpas or Secretariat.

For more information, including the full report, visit www.oceanpanel.org

Endnote

- 1 Steven, A.D.L., Appeaning Addo, K., Llewellyn, G., Vu, T.C. et al. 2020. *Coastal Development: Resilience, Restoration and Infrastructure Requirements*. Washington, DC: World Resources Institute. www.oceanpanel.org/blue-papers/coastal-development-resilience-restoration-and-infrastructure-requirements