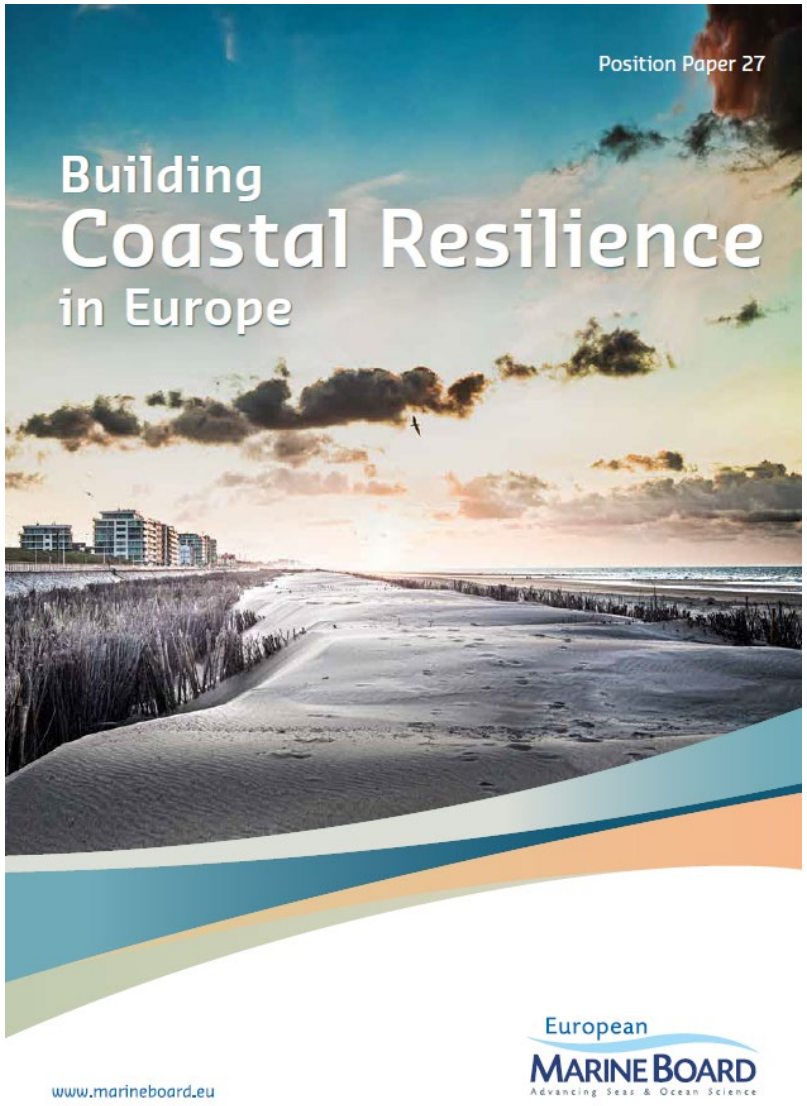

EMB Position Paper N°27: Building Coastal Resilience in Europe

Sebastian Villasante
Working Group Chair

Position Paper N°27: Building Coastal Resilience in Europe

European MARINE BOARD
Advancing Seas & Ocean Science

Working Group Chairs: Sebastian Villasante, Kristin Richter

Chapter Leads: Jennifer L. Bailey, Thorsten Blenckner, Eugene J. Farrell, Remi C. Mongruel, Karen Timmermann

Working Group Members: Sebastian Villasante, Kristin Richter, Jennifer L. Bailey, Thorsten Blenckner, Eugene J. Farrell, Remi C. Mongruel, Karen Timmermann, Tjeerd J. Bouma, Donata Melaku Canu, Margaret Chen, Liam Lachs, Andres Payo, Isabel Sousa Pinto

External Reviewers: David Lusseau, Tiffany Morrison, Daniela Schmidt, Rodolfo Silva

Series Editor: Sheila J. J. Heymans

Publication Editors: Britt Alexander, Paula Kellett, Ángel Muñiz Piniella, Ana Rodriguez-Perez, Jana Van Elslander, Fernanda Bayo Ruiz, Sheila J. J. Heymans

Chapters

1. Introduction
2. Concepts and frameworks to assess coastal resilience
3. Pressures and impacts on the coast
4. Tools, barriers and enablers to build coastal resilience
5. Case-studies
6. Future challenges and recomendations

The document is aimed at policy makers, research funders and scientists

→ Written to be understandable by a wide audience

What is Coastal Resilience?

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Coastal resilience is: *"The capacity of coastal natural and socio-economic systems to **persist, adapt or transform when faced with disturbances** induced by factors such as sea-level rise, extreme events and human impacts, whilst maintaining their essential functions"*

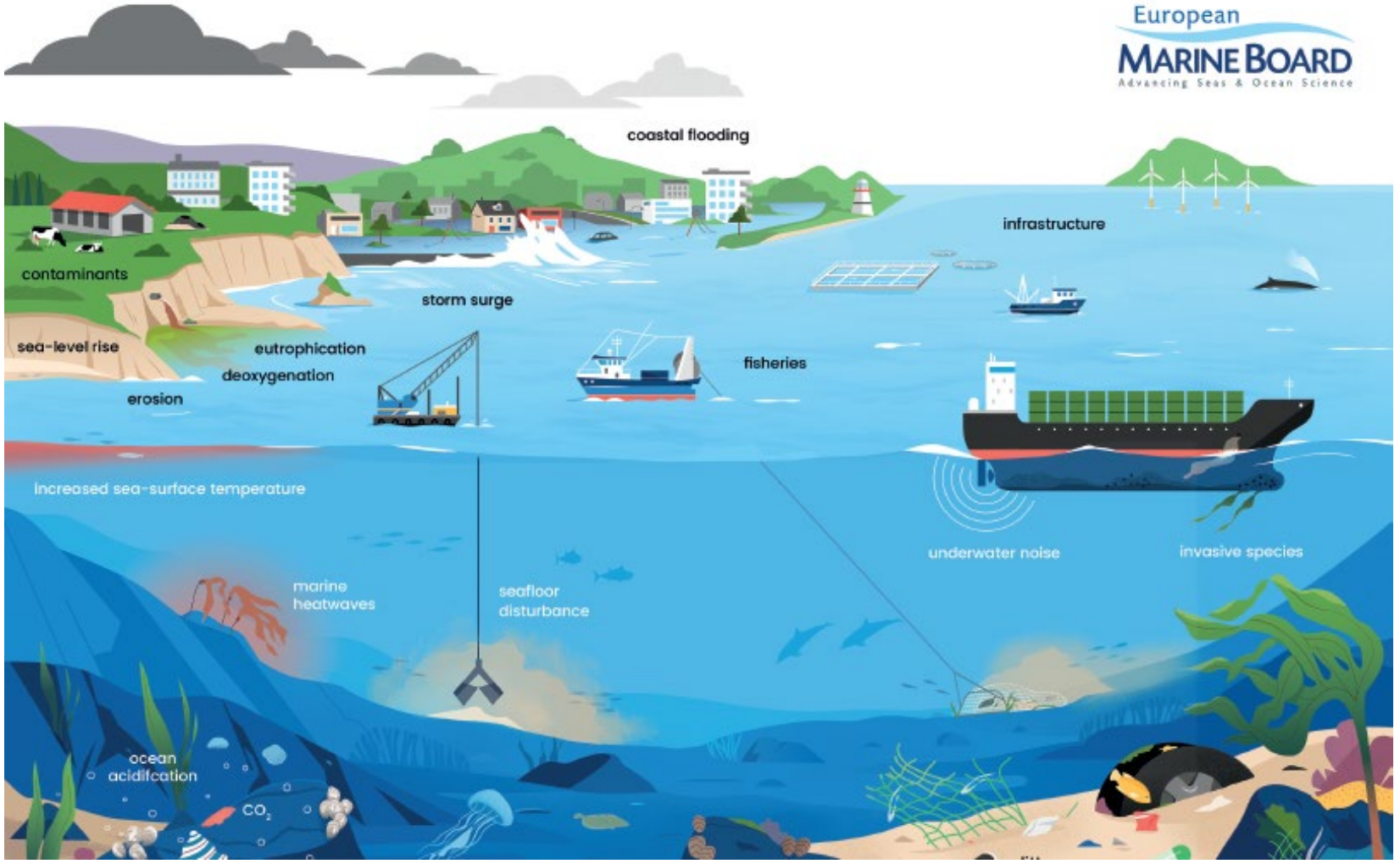
Resilience is not an outcome or destination but best perceived as a **relational journey** i.e. a non-linear, dynamic process.

Pressures and impacts on the coast

Key **pressures and impacts** that influence coastal resilience and key **knowledge gaps** to address to build and enhance resilient coasts.

- European coasts face multiple, interacting and **cumulative pressures** including those resulting from increasing **greenhouse gas emissions** (sea-level rise, Ocean warming, Ocean acidification, extreme events) and **localized activities** such as fishing, aquaculture, waste disposal and coastal urbanisation.

- These create a unique set of **context-specific issues** that need to be addressed **holistically**, considering the dyanmics between both coastal societies and ecosystems as part of interconnected **social-ecological systems**.



Pressures and impacts on the coast

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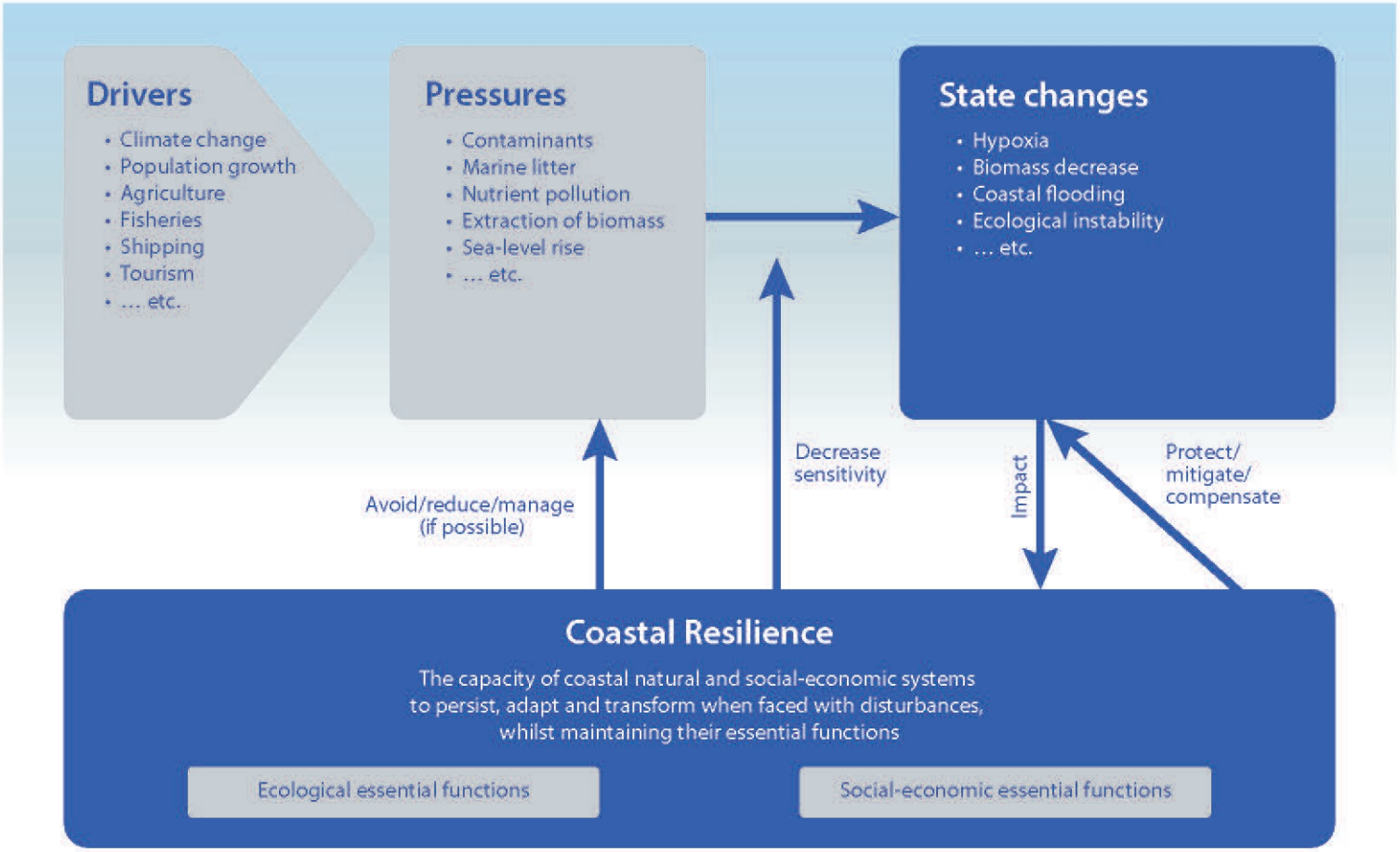
Describes key **pressures and impacts** that influence coastal resilience and key **knowledge gaps** to address to build and enhance resilient coasts.

Pressures are "*mechanisms of change of state on the natural system, and subsequently the social system*"

The document describes advances to build and enhance resilience to sustain **essential ecological** and **social-economic functions** provided by **coastal social-ecological systems**.



Pressures and impacts on the coast

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Key knowledge gaps:

- **Impacts of single pressures** on coastal social-ecological systems;
- Site-specific, multiple, **cumulative pressure-response relationships** in the coastal zone;
- Understanding **resilience properties**, including **integrated ecological and social tipping points**;
- Understanding consequences of **social tipping points** at local, national and European levels;
- Understanding the impacts of coastal pressures on **socioeconomics** and **human-Ocean interactions**;
- **Responses of coastal communities** to coastal pressures, including how best to assist human populations to migrate to areas away from the coast;
- **Model prediction capacities of cumulative pressures** into the future world (magnitude, timing, location) and their potential coastal impacts; and
- How to **scale-up sustainable practices to reduce coastal pressures**.

Concepts and frameworks to assess coastal resilience

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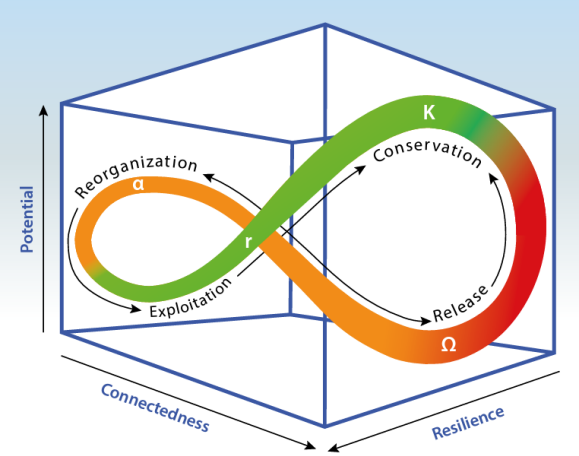
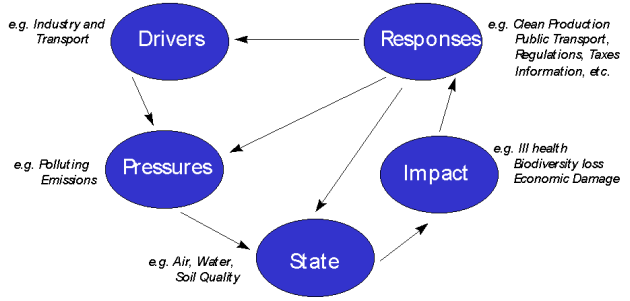
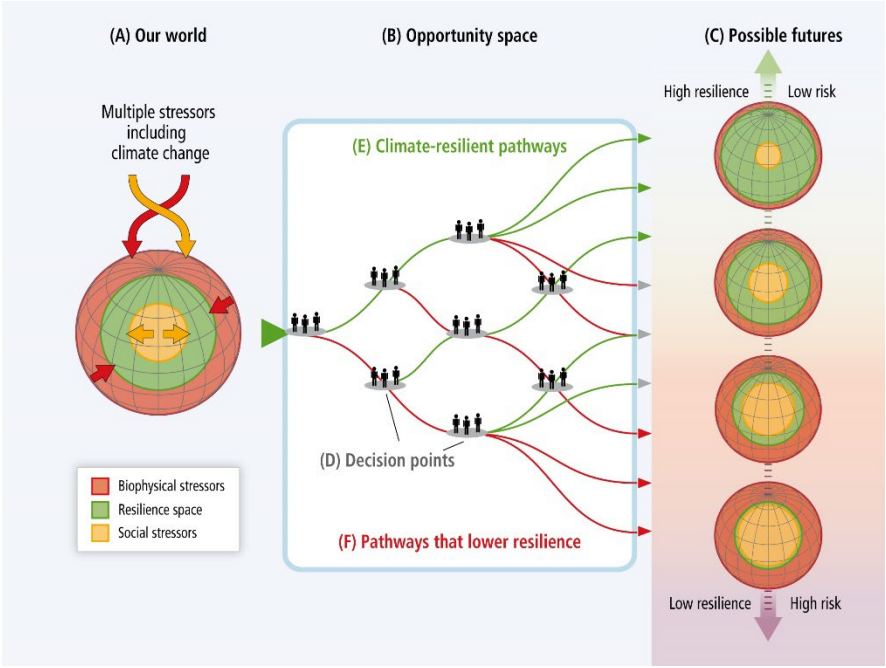
Highlights various **frameworks** to address coastal resilience issues and their **operationalisation:**

- The sustainable development concept
- Social-Ecological Systems (SES) frameworks
- The Driver-Pressure-State-Impact-Response (DPSIR) framework
- Integrated Coastal Zone Management (ICZM)
- Ecosystem Services Assessment (ESA) framework
- Risk, Vulnerability and Adaptive capacity (RVA)
- Climate resilient pathways framework
- Community resilience frameworks







Six-step approach to building coastal resilience

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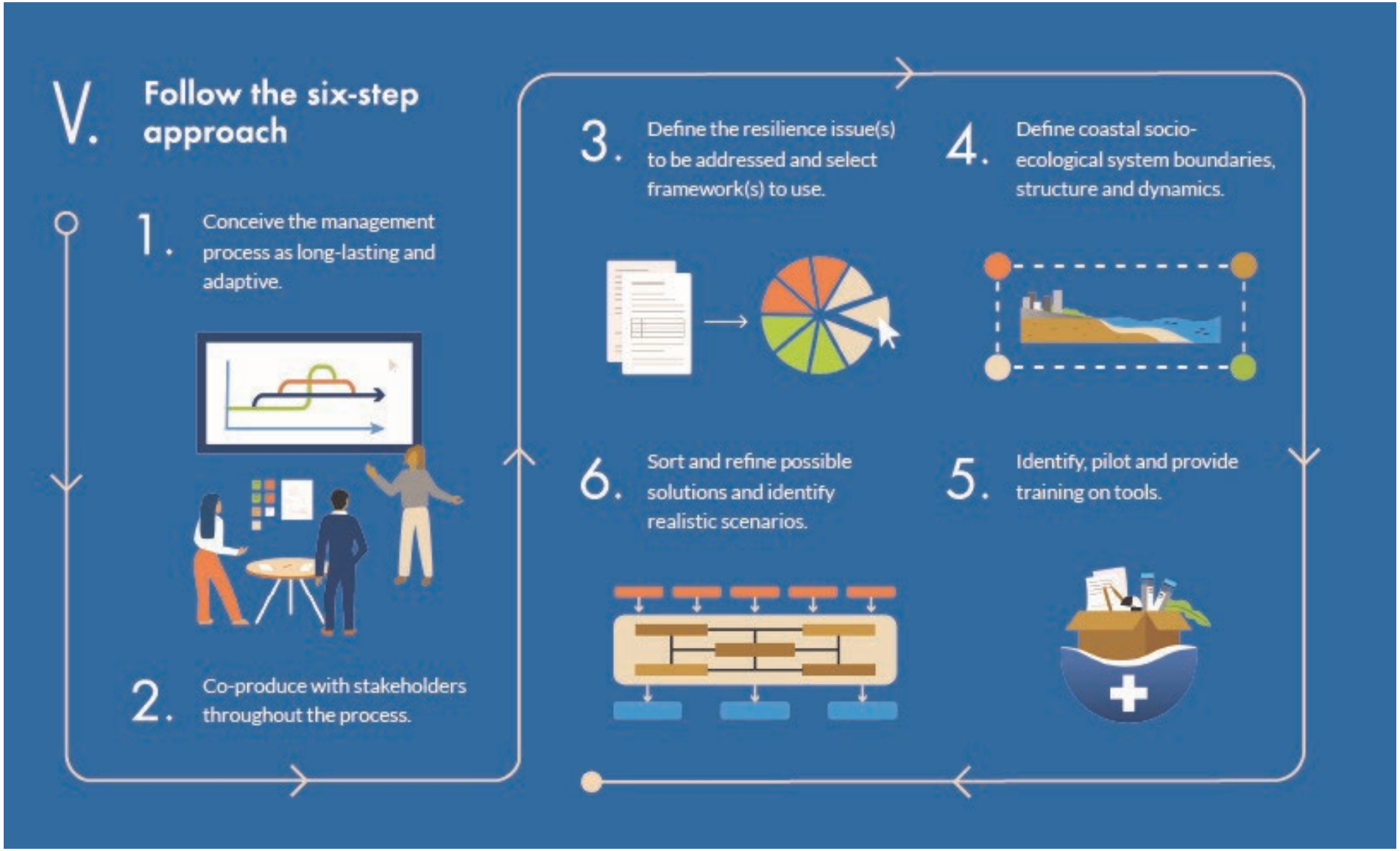

Tools, barriers and enablers to build coastal resilience

- **Governance pathways to build resilience**
- Resilient human communities
- Scale and level of action: (whole-of-government/whole-of-society approach)
- Policy coherence, integration and implementation
- Holistic financial mechanisms

- **Observations, monitoring, data and models**
- Coastal observations and monitoring services
- Holistic and integrated datasets (environmental & social data)
- Modelling, forecasting, scenario analysis and early warning systems
- Need for standardised resilience indicators

Policy recommendations

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POLICY RECOMMENDATIONS

I. Adopt a systems approach to coastal management

This should be based on adaptive, cross-sectoral and coherent policies. All aspects of the land-sea interface should be included in the Integrated Maritime Policy and links between marine- and land-based policies should be improved.

II. Include nature and people from the beginning of the design process

An ecosystem-based management approach should be adopted and an inventory developed of coastal management solutions and their impacts.

III. Build adaptive capacity at multiple scales

This should be across local communities, and national, regional and EU governance.

IV. Reflect the values of natural capital

The multiple social and economic values of natural capital should be reflected in our public policies and decision-making processes.

Scientific recommendations

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SCIENTIFIC RECOMMENDATIONS

I

Establish integrated transdisciplinary research on coastal social-ecological systems

This should address knowledge gaps for single pressure and site-specific multiple, cumulative pressure-response relationships, and tipping points.

II

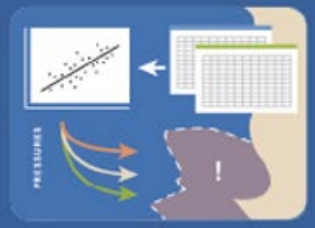
Develop sufficient observational, monitoring and data capacity

Increased investment in observations, monitoring, Big Data and artificial intelligence is needed. Data should be integrated into aninterdisciplinary platform with resilience indicators.

III

Develop and operationalise standardised coastal resilience indicators for Europe

A pan-European framework to develop clarity and standardisation in the definition and practice of coastal resilience is needed to operationalise indicators in practice.



IV

Improve model prediction capacity

This is needed to forecast and develop future scenarios on the magnitude, timing, location and impacts of multiple, cumulative pressures.

Tools, barriers and enablers to build coastal resilience

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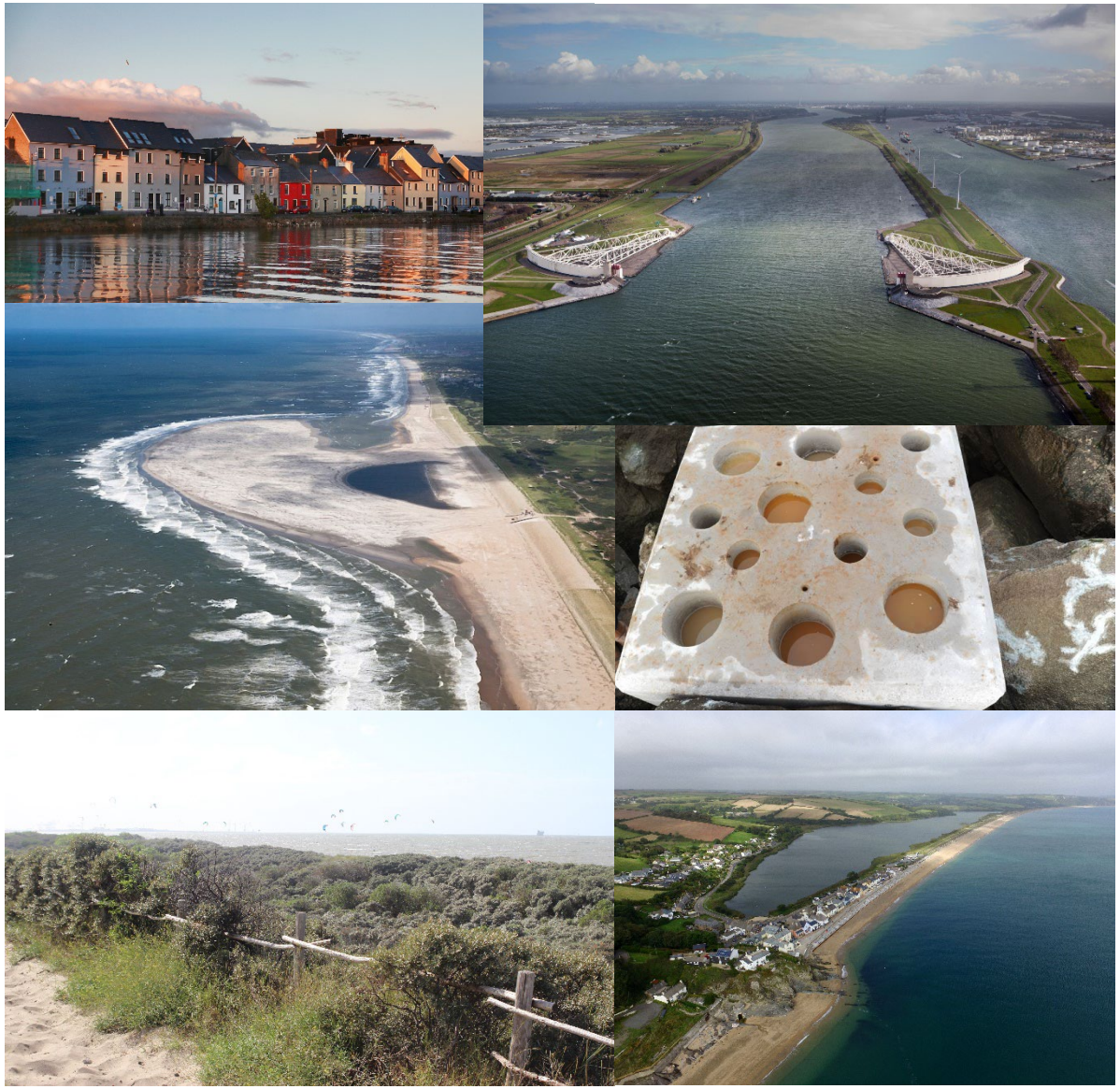
Coastal protection

- The choice of coastal protection strategy is **context- and place- specific** and resilient solutions are likely to be a **mix of grey blue-green and hybrid infrastructure**
- To make informed decisions, an inventory is needed that includes information on various strategies':

- Efficacy to build and enhance resilience
- Impacts on coastal ecosystems
- Socio-economic impacts
- Long-term value in preparing for sea-level rise, extreme events and changing socio-economic conditions.



Tools, barriers and enablers to build coastal resilience

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Nature-based Solutions (NbS)

"Actions to protect, conserve, restore, sustainably use and manage natural or modified terrestrial, freshwater, coastal and marine ecosystems which address social, economic and environmental challenges effectively and adaptively, while simultaneously providing human wellbeing, ecosystem services, resilience and biodiversity benefits (UNEA, 2022)"

Scientific recommendations

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V Invest in research on nature-based and hybrid solutions

The environmental and socio-economic co-benefits, site specific feasibility, and impacts of various combinations of seaward and landward Nature-based Solutions should be identified.

Examples of Nature-based Solutions

HYBRID Marsh-levee systems; artificial beaches in front of seawalls; dune-dyke systems.

SEAWARD Conservation and restoration of marine coastal habitats; vertical ocean farming; marine protected areas; low trophic aquaculture.

LANDWARD Conservation and restoration of landward coastal habitats; vegetated dunes and marshes; 'green' structural engineering.

Community recommendations

- Obtain **systematic natural and social scientific knowledge that is useful to individual communities** and share this among all interested parties with clear messages;
- Develop and adhere to **coherent national coastal plans** to coordinate community actions with the regional priorities of local authorities;
- **Co-design citizen science initiatives** that support communities to collect and understand coastal data and resilience issues; and
- **Enhance the adaptive capacity** of local communities.

Case-study: The Maharees Peninsula, Ireland

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Pressures & impacts

- Sea-level rise, heat waves, over-crowding from tourism, land-use management, flooding, chronic coastal erosion.

Concepts & frameworks to assess coastal resilience

- Climate resilient pathways framework, IPCC opportunity space – applied in the 'Building Coastal and Marine Resilience in Ireland' project to develop roadmap using community-driven perceptions of a resilient future.

Tools, barriers & enablers to build coastal resilience

- 'Maharees Conservation Association', a community volunteer group, work in collaboration with local and national government, public bodies, and research bodies.
- Institutional barriers (governance, legal responsibility, stakeholder forum, tourism)
- Technical barriers (climate adaptation, funding, environmental designations, varying terminology around climate resilience and sustainability)
- Enablers: coordination of actions and regional priorities of local authorities, empower and resource local authorities and communities, coherent national plans.

Case-study: The Venice Lagoon, Italy

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Pressures & impacts

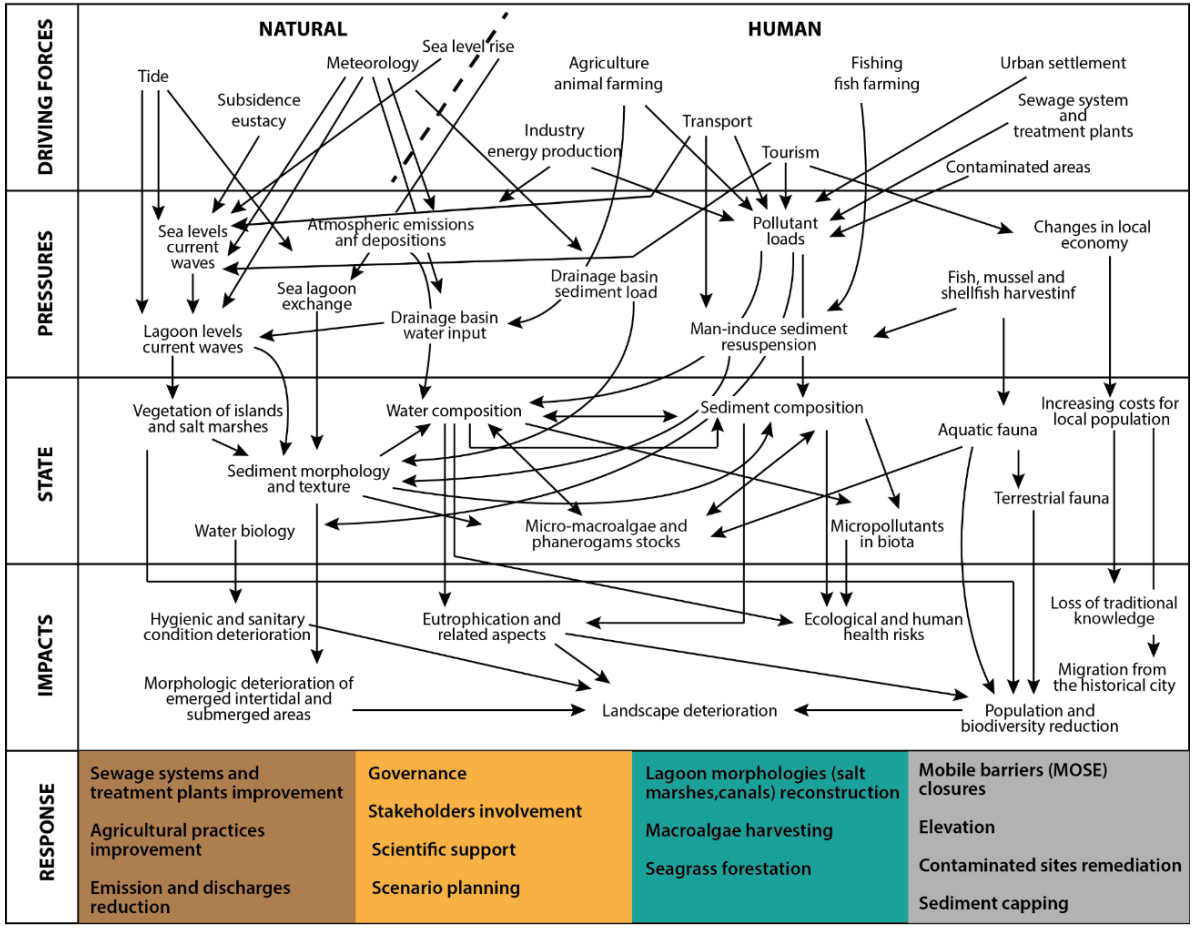
- Silting, erosion, eutrophication, dystrophy, contrasting economic interests (e.g. tourism vs conservation), mass tourism, high-waters, fisheries crisis, pollution, invasive species.

Concepts & frameworks to assess coastal resilience

- Driver-Pressure-State-Impact-Response (DPSIR) framework taking into account critical spatial and temporal scales.
- Integrated Coastal Zone Management (ICZM) approach for zoning and conflict resolution.

Tools, barriers & enablers to build coastal resilience

- Range of blue-green infrastructure e.g. morphological restoration on channels and salt marshes, seagrass transplantation.
- Grey infrastructure e.g. mobile barriers and elevation of lower parts of the city
- Special law No. 171 of 1973 which considered all componenets of the coastal social-ecological system.
- Barriers: difficulty to coordinate among stakeholders with contrasting interests.
- Enablers: improved monitoring and observations, addressing uncertainty, social participation and debates, use best available scientific knowledge, scenario planning, co-management approach.



Case-study: The Belgian coast

Pressures & impacts

- Long-term sea-level rise 2mm/year 1925 – 2019.
- Storm surges at least once per year causing beach erosion and flooding.
- Grey coastal protection.
- Densely populated.
- Intense use of coast by maritime transport, commercial harbours, ports, marinas, tourism and recreation.

Concepts & frameworks to assess coastal resilience

- Risk, Vulnerability and Adaptive Capacity (RVA) framework applied.
- 2011 Flemish Masterplan for Coastal Safety – measures to be taken by 2050 to protect the coast from storm surges and sea-level rise.
- Safety of coast re-assessed every six years to update flood maps and calculate residual risk after new measures are implemented.

Tools, barriers & enablers to build coastal resilience

- Groynes, dykes, piers, seawalls, jetties, breakwaters.
- Increasing trend to use Nature-based Solutions (e.g. beach and dune nourishment), complemented by engineering approaches.

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Download from the EMB website:

https://www.marineboard.eu/coastal-resilience