



BOOK OF ABSTRACTS

Session 13: Nature- based Solutions for coastal resilience

symposium

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This Book of Abstracts provides a comprehensive overview of the session content and is structured into two main sections:

I. Session Description: an introduction to the session

II. List of Abstracts – Orals & Posters: a complete compilation of all selected contributions showcasing relevant and impactful research related to the session theme

I. SESSION DESCRIPTION

Hosts:

	Name	Organization
Host	Christophe Proisy	Institut de Recherche pour le Développement (IRD)
Co-hosts	Mouncef Sedrati	Université du Littoral Côte d'Opale
	Aude Zingraff-Hamed	University of Dortmund

Description:

Date of session: Thursday, 5 November 2026

Time of session: 10:00 AM – 12:00 AM

The effectiveness and long-term performance of NbS on the coasts are highly contextdependent. In particular, key uncertainties persist regarding how NbS respond to evolving morphosedimentary conditions induced by both natural and anthropogenic pressures, coastal wetland dynamics, and governance constraints. Stronger scientific evidence and operational feedbacks based on a careful consideration of the diversity of ecosystems, societal challenges and stakeholder dynamics.

This session aims to:

1. Assess the processes and conditions controlling the implementation and performance of NbS in different coastal contexts, including consideration of specific coastal wetlands of any kind (mangroves, saltmarshes, seagrass meadows and other intertidal environments),
2. Examine how ecological dynamics, morphosedimentary change and socio-economics as well as governance transformations can support socio-ecological coastal resilience through time,
3. Explore how NbS can support a renewed paradigm for sustainable coastal management and socio-ecological adaptation.

Contributions based on monitoring, modelling, experiments, field observations and comparative case studies are welcome.



II. LIST OF ABSTRACTS – ORALS

The first author is the presenting author unless indicated otherwise.

01. A trans-Atlantic Network of Coastal Resilience Beacon Sites

First author: Martin Zimmer

Other authors: Jan-Stefan Fritz, Jonathan Heimer, Véronique Helfer and Alexandra-Sophie Roy

Affiliation: Leibniz Centre for Tropical Marine Research (ZMT) – Germany

Marine and coastal spaces are highly complex socio-ecological systems shaped by interacting physical, biological, chemical and human processes that sustain biodiversity, regulate climate and support global economies, while hosting competing uses such as fisheries, energy, shipping, conservation and urban and industrial development. Numerous climate change effects are posing increasing pressure on societies at local, regional and global scales, the coasts being at the forefront of those threats (e.g., SLR, extreme events). As a result, climate change-mitigation efforts will have to be amended by strengthened and accelerated climate change-adaptation measures. Besides climate change, pollution, resource pressures and geopolitics intensify the vulnerability of coastal communities.

Concurrently, and perhaps consequently, expectations of marine sciences have expanded dramatically from exploration and observation to policy-support, societal impact, implementation of adaptation measures, economic contribution and responsibility for mitigating human impacts, placing growing pressure on scientific capacities and institutions. This developing context calls for new formats that combine scientific excellence with societal relevance and impact. Nowhere is this felt more acutely than in coastal spaces, where a substantial proportion of the human population lives and enhanced resilience to climate change effects is particularly needed. In response, an All-Atlantic Network of Coastal Resilience Beacon Sites was established in 2025, bringing together locally managed sites committed to community co-design, knowledge (scientific and local)-based innovation and pan-Atlantic cooperation.

The network enables focused exchange of knowledge, lessons learnt and good practices between researchers, practitioners and local communities, supports co-designed adaptation strategies tailored to local challenges, promotes integration of local and traditional knowledge in scientific research, strengthens cross-border collaboration among coastal sites, and enhances the global visibility and scaling of effective coastal resilience actions.

Such an initiative brings its own challenges, but also opportunities to further connect scientific and local knowledge and fostering ocean science diplomacy.

Keywords: [Climate Change](#) [Adaptation](#) [Coastal Resilience](#) [Community-led action](#)
[Exchange & Communication](#) [ITLK](#) [Knowledge-sharing](#)
[Nature-based Solutions](#)

02. Beyond mangrove planting: socio-ecological and morphosedimentary conditions for effective coastal NbS in the Philippines

First author: Lisa Macera^{1,2}

Other authors: Julien Andrieu¹, Oliver-James Crook, Pauline Del Ben and Gowrappan Muthusankar

Affiliations: ¹Université Côte d'Azur – École universitaire de recherche Odysée – Sciences de la société et de l'environnement – France

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Coastal Nature-based Solutions (NbS) are increasingly promoted for disaster risk reduction and climate adaptation, but their effectiveness remains strongly context-dependent and difficult to assess across ecological, morphosedimentary and social dimensions. This contribution evaluates a hybrid coastal adaptation project implemented in Concepción, Iloilo, Philippines, combining mangrove replantation, low-crested breakwaters and sediment traps, and livelihood-support measures intended to reduce pressure on mangrove resources.

We conducted an ex-post evaluation across five sites using field observations of mangrove replantation areas and grey infrastructure, site-level assessment of hydro-geomorphological suitability, and interviews with project stakeholders and local communities. The case study was interpreted against a broader review of 198 mangrove restoration projects, used to identify recurrent mismatches between restoration techniques, ecological conditions and governance arrangements.

Results reveal contrasted performance across project components. Breakwaters reduced wave energy and promoted localized fine-sediment accretion, confirming the short-term functionality of some grey components. In contrast, mangrove replantation largely failed, with an average seedling survival rate of 1.5%, mainly due to unsuitable site selection and poor alignment with local hydro-geomorphological conditions. Socio-economic measures also showed uneven durability: only two income-generating activities remained functional, although local perceptions of the project were generally positive where interventions were better aligned with community needs and site dynamics. This case shows that coastal NbS performance cannot be inferred from replantation effort or survival rates alone. It depends on the joint fit between ecological suitability, morphosedimentary processes, infrastructure maintenance, governance capacity and local coconstruction.

Keywords: *Nature-based Solutions* *Coastal resilience* *Mangrove restoration*
Mangrove replantation *Green-grey infrastructure*

03. Community-led Nature-based Solutions for Coastal Resilience: Insights from Fanad Peninsula and Galway, Ireland

First author: Arsenia Da Cruz

Other authors: Kathy Reilly and Kevin Lynch

Affiliation: University of Galway – Ireland

Nature-based solutions (NbS) are increasingly recognised as effective, adaptive approaches for enhancing coastal resilience while delivering co-benefits for biodiversity and community well-being. This paper examines the role of community-led NbS through two Irish case studies: the Fanad Peninsula dune restoration initiatives in County Donegal in the north-west of Ireland, and current coastal management challenges at Silver Strand in Galway on the west coast. Using a qualitative research design focused on local community sense of place, connection to their place. The study draws on narrative interviews and community workshops, analysed through a thematic analysis framework, alongside field observations and secondary data.

The Fanad case highlights the effectiveness of community-driven dune rehabilitation, including marram grass planting and beach access management, in restoring geomorphological stability and strengthening local stewardship. Thematic findings show that impactful NbS are grounded in strong place attachment, intergenerational ties, social cohesion, and everyday connections to nature. Cultural heritage and local knowledge further reinforce environmental stewardship, while rural lifestyles and tourism dynamics shape both opportunities and trade-offs.

Climate change awareness emerges from lived experiences of environmental change, informing local adaptive practices. In contrast, Silver Strand points toward ongoing pressures from tourism, erosion, and infrastructure limitations, alongside governance and planning challenges. The findings suggest that while NbS provide flexible and cost-effective pathways for coastal protection, their long-term success depends on sustained participation, inclusive decision-making, and adaptive management embedded within local contexts.

Central to the paper's contribution is an acknowledged and critical understanding for the value of qualitative, community-informed methods in advancing NbS research, focusing on the importance of place-based, participatory approaches in operationalising localized adaptation for coastal resilience.

Keywords: *Community-led coastal adaptation* *Coastal resilience*
Coastal Nature-based Solutions

04. Implementing Nature-based Solutions on Coastal Wetlands through Living Labs: comparative insights from mangroves, Mediterranean and tropical Lagoons, and Atlantic Marshes

First authors: Thomas Leydier¹ and Adrien Le Guillou^{2,3}

Other authors: Olivia Guinobert⁴, Guillaume Marchand⁵, Elia Antonsanti⁶, Coralie Pauchet², Antoine Gardel^{7,8}, Stephane Ghiotti⁶, Tamatoa Bambridge⁵, Adélie Pomade², Vanina Pasqualini¹, Jean-Yves Meyer⁹ and Christophe Proisy⁴

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Coastal wetlands represent critical socio-ecological interfaces at the land-sea continuum, providing essential ecosystem services including coastal resilience, water purification, carbon sequestration, and nursery habitat support. Yet these environments face escalating pressures from climate change, sea-level rise, urban development, pollution, and invasive species, which threaten their ecological integrity and the dependent communities.

This study presents a comparative analysis of Nature-based Solutions (NbS) implemented across four contrasted coastal wetland systems, embedded within territorially anchored Living Lab frameworks: mangroves along the highly dynamic, mesotidal, muddy coast of French Guiana (MAGELLAN Living Lab) ; Mediterranean lagoons in Corsica (MEDCOAST Living Lab) ; Atlantic coastal marshes in Brittany (PONANT Living Lab), and a mosaic of coastal wetland types in the Windward Islands, French Polynesia (AMWI Living Lab).

Despite contrasting hydro-climatic regimes, ecological functioning, and socio-cultural contexts, these systems offer a productive comparative ground by illuminating how socio-cultural dynamics, ecological trajectories, and governance choices jointly shape the conditions under which NbS can be designed, accepted, and sustained across different ecosystems.

Each Living Lab draws on structured, co-created knowledge to activate transdisciplinary networks of stakeholders involved in coastal zone management. These networks combine ecological monitoring, socio-economic diagnostics, and actor engagement to translate scientific knowledge into adaptive management practices. NbS are thereby implemented across a gradient from protection to restoration and management, including hydrological connectivity restoration, invasive species control, vegetation-based ecological indicators, and integrated watershed-scale land-use strategies.

Our findings highlight that NbS effectiveness in dynamic coastal wetlands depends less on the nature of the intervention itself than on the institutional and social conditions enabling its co-construction and long-term implementation. The Living Lab approach emerges as a structuring framework for bridging the knowledge-action gap, fostering shared ecological understanding among researchers, managers, and local stakeholders, and supporting the integration of NbS into territorial planning and public policy processes.

Keywords: *Nature-based Solutions* *Coastal Wetlands* *Living Labs* *Socio-ecosystems*
Stakeholder coconstruction

05. Landscape controls on habitat diversity and carbon sequestration in Wadden Sea dike-foreland salt marshes and seagrass habitats

First author: Lasse Sander

Other authors: Nina Hildebrandt, Svenja Reents, and Seyieleno Cara Seleyi

Affiliation: Alfred-Wegener-Institute, Helmholtz Centre for Polar and Marine Research, Wadden Sea Research Station, List/Sylt – Germany

The Wadden Sea is the largest continuous tidal flat system in the world and recognized as a UNESCO world heritage site for its outstanding universal value as a transitional coastal environment. Despite scale, this uniqueness lies in the fact that natural processes proceed largely undisturbed across the domain and thereby create a multitude of dynamic habitats and landscapes.

Overall, the Wadden Sea plays a crucial role in nature conservation and coastal protection; however, the area remains under immense pressure from climate change, habitat loss, and centuries of human influence. Salt marshes and intertidal seagrass habitats are two important coastal vegetated ecosystems of the Wadden Sea and are often seen as pivotal indicators of stability and a good environmental status. From a socio-ecological perspective, both ecosystems hold a large potential to enhance biodiversity, to increase adaptive capacities, and to use their natural ability to sequester and store carbon.

Our investigations suggest that these potentials are neither entirely habitat specific nor spatially uniform, but ultimately remain dependent on the connected and dynamic character of the Wadden Sea. Based on two ongoing projects, we argue that the landscape context of a site—including its geomorphology, past evolution, and concrete spatial characteristics—exerts a first-order control on nature-based solution potentials. This is particularly the case for protected areas, where restoration occurs mostly unassisted or as a secondary product of reduced human influence.

The aim of this presentation is to showcase the value of integrated thinking that goes beyond features traditionally considered as inherent to coastal ecology. Changing landscapes and geomorphological dynamics should not be seen as expressions of ecosystem disturbance alone, but rather as important drivers of habitat diversity that influence the outcomes and long-term effectiveness of nature-based solutions.

Keywords: *Landscape evolution* *Coastal Geomorphology* *Tidal Environments*
Vegetated ecosystems *Wadden Sea* *Europe*

06. Mainstreaming biodiversity in evidence-based Nature-based Solutions for resilient coastal dunes

First author: Dries Bonte

Affiliation: Ghent University (Dept. Biology) – Belgium

Coastal zones are at the frontline of climate change, facing accelerating sea-level rise, erosion, and increasing pressure from urbanisation. Nature-based solutions (NbS) are widely promoted as sustainable alternatives to traditional grey infrastructure, yet their implementation often remains insufficiently grounded in ecological processes and quantitative evidence. Here, we present insights from the Horizon Europe DuneFront project, which develops evidence-based NbS through the co-design and evaluation of hybrid dune-dike systems across diverse European coastlines.

DuneFront advances the premise that biodiversity is not an added benefit, but a fundamental component of coastal protection. Coastal dunes emerge from bio-geomorphological feedbacks, where plant traits, vegetation dynamics, and sediment transport jointly determine system resilience. By integrating remote sensing, machine learning-based habitat mapping, and field surveys, we quantify how vegetation structure, species composition, and functional traits contribute to dune formation, stability, and ecological connectivity.

Across twelve demonstrator sites, our results show that restoring dynamic dune processes enhances both biodiversity and coastal safety, while enabling multiple ecosystem services such as recreation and habitat provision. However, European dune habitats remain highly degraded, with a large proportion in unfavourable conservation status, underscoring the urgency of scalable and robust interventions.

We demonstrate how *mainstreaming biodiversity* into coastal infrastructure design –via predictive digital twins, decision-support tools, and trait-based ecological modelling– enables the simultaneous optimisation of risk reduction, ecological restoration, and socio-economic benefits. By translating interdisciplinary evidence into practical design principles and policyrelevant metrics, DuneFront contributes to bridging the gap between science, policy, and implementation.

Our findings highlight that truly effective NbS require an explicit, evidence-based integration of biodiversity as a performance variable, rather than an outcome, thereby strengthening the credibility, scalability, and long-term resilience of coastal adaptation strategies.

Keywords: *Dune* *Dike* *Hybrid* *Biodiversity* *Socio-economic ecological evaluation*
Digital twin *DSS*

07. Mangrove forests as Nature-based Solutions for coastal resilience – potential and limiting conditions showcased through canopy gap dynamics

First author: Véronique Helfer¹

Other authors: Martin Zimmer^{1,2}, Dominic Wrieden¹ and Daniel Schürholz¹

Affiliations: ¹Leibniz Centre for Tropical Marine Research (ZMT) – Germany

²Faculty 2 Biology/Chemistry, University of Bremen – Germany

Mangrove forests, alike other coastal vegetated ecosystems, are often considered Naturebased Solutions (NbS) for climate change mitigation and/or adaptation, particularly in the context of coastal resilience. However, the resilience of mangrove ecosystems disturbances and/or stress gradients, induced for example by climate change effects, is still scarcely investigated. Studies thereof mainly rely on the assessment of mangrove forest extent over time through remote-sensing analysis, often without consideration of changes in community composition and/or species characteristics (e.g., functional traits). Further, while mangrove ecosystems might recover after exposure to disturbance and/or stress gradients, recovery speed might not be fast enough to ensure the maintenance of ecosystem processes and the provision of ecosystem services to coastal communities during this phase.

We will expose here the current understanding and knowledge gaps on mangrove forest resilience gathered through the systematic review of the dedicated literature on the topic. Variation in recovery speed will be showcased by the analysis of the dynamics of mangrove forest gaps closure, presenting new insights on gap canopy closure dynamics, and drivers thereof, in mangrove forests across the globe, assessed through visual inspection of Google Earth historical high-resolution images and manual gap delineation over time, versus automated gap detection workflow based on a timeseries of low-cost and lower-resolution satellite imagery. We will discuss the potential and limitations of both types of imageries in documenting mangrove forest resilience based on areal extent characteristics and other ecosystems properties.

Drawing on the gathered knowledge, the role of mangrove forests as NbS for enhanced coastal resilience will be critically discussed and research priorities for improved understanding and monitoring of mangrove forest resilience will be proposed, including the consideration of properties of interest.

Keywords: *Ecological resilience* *Canopy gap closure* *Remote sensing* *NICFI high*
Resolution images *Google Earth historical imagery* *Recovery rate*
Community composition and traits

II. LIST OF ABSTRACTS – POSTERS

The first author is the presenting author unless indicated otherwise.

01. Quantifying wave attenuation by coupled animal reefs and vegetal meadows: a temperate–tropical comparison using topobathymetric lidar and 2D hydrodynamic simulation

First author: Laurine Nogue¹

Other authors: Antoine Collin¹ and Pierre Stephan²

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Coastal wetlands deliver flagship nature-based solutions (NbS) for wave attenuation, yet most assessments isolate single habitats and overlook the synergistic protection arising where bioconstructed animal reefs front soft-bottom vegetal meadows. We quantify wave-energy dissipation across two functionally analogous reef-meadow continua spanning contrasting biogeographic settings: a temperate system in the Bay of Mont-Saint-Michel (France), where *Sabellaria alveolata* honeycomb reefs adjoin Atlantic salt marshes, and a tropical system in Guadeloupe (French Antilles), where coral reefs shelter *Rhizophora*–*Avicennia* mangrove forests.

Seamless land-to-seabed topography was acquired by airborne topobathymetric lidar, whose paired near-infrared (1064 nm) and green (532 nm) channels resolve the intertidal–subtidal transition at decimetric vertical accuracy. Derived digital terrain models, canopy heights, and surface-rugosity metrics parameterized spatially explicit bottom friction within a 2D hydrodynamic model, forced by tidal levels and representative storm / cyclone spectra. Simulations were run for reef-only, meadow-only, and coupled reef-meadow configurations to disentangle individual from emergent contributions to significant wave-height reduction.

At both sites, the coupled configuration is expected to dissipate substantially more incident energy than the additive sum of its components: the frontal reef triggers depth-induced breaking and elevated turbulence that the leeward meadow further attenuates through canopy drag. The temperate and tropical analogues let attenuation be partitioned and compared between fundamentally different reef builders and marsh versus mangrove canopies under their respective tidal and wave climates.

By mapping where and how much these animal-vegetal couplets buffer coastal hydrodynamics, this work provides transferable, lidar-driven evidence to prioritize and design hybrid NbS, reinforcing the case for protecting and restoring intact reef-meadow seascapes rather than their constituent habitats in isolation.

Keywords: *Sabellaria honeycomb reef* *Coral reef* *Salt marsh* *Mangrove forest*
Wave-energy dissipation *Topobathymetric lidar* *Mild-slope wave modelling*
Hybrid coastal protection *Reef-meadow continuum* *Coastal resilience*

02. The role of *Posidonia oceanica* banquettes in the sustainable coastal management of the Mediterranean coasts

First author: Ilaria Dentamare^{1,2}

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Posidonia oceanica, an endemic seagrass species of the Mediterranean Sea, plays a vital role in maintaining the health of coastal ecosystems. In addition, this seagrass provides a wide range of ecosystem services crucial for human well-being, particularly many “regulation and maintenance” services, as it contributes to coastal dynamics through wave attenuation, sediment retention, shoreline protection, carbon sequestration, and primary production. Among its lesser explored but ecologically significant features are the accumulations of dead leaves, commonly known as banquettes, an overlooked Nature-based Solution, able to provide a range of important ecosystem services, including shoreline protection, nutrient cycling, and carbon sequestration.

Despite their ecological value, banquettes, often overlooked, are frequently perceived as a nuisance in tourist areas, leading to their removal and disposal, usually in landfills. This practice not only disrupts the ecosystem services they provide but also increases management costs and contributes to greenhouse gas emissions through the decomposition of organic material. In contrast, preserving banquettes on-site would enable the maintenance of these essential ecosystem functions. In this context, our research aimed to develop an integrated methodology to assess the ecological and socio-economic implications of banquette removal.

The study focused on the coastal areas of the Campania region (Southern Italy), where banquettes are frequently removed. Laboratory analyses assessed carbon and nutrient content, highlighting the role of banquettes as carbon sinks. Cost-benefit analyses compare multiple management strategies, including on-site maintenance, landfill disposal, relocation, and reintroduction into the marine environment, indicating that non-removal approaches provide greater ecological benefits and support sustainable coastal management. Moreover, this research provides valuable insights for policymakers, emphasizing the importance of adopting management practices that prioritize the protection of coastal ecosystems.

Keywords: *Posidonia oceanica* banquettes *Nature-based Solutions* *Coastal resilience*
Coastal management *Seagrass*