

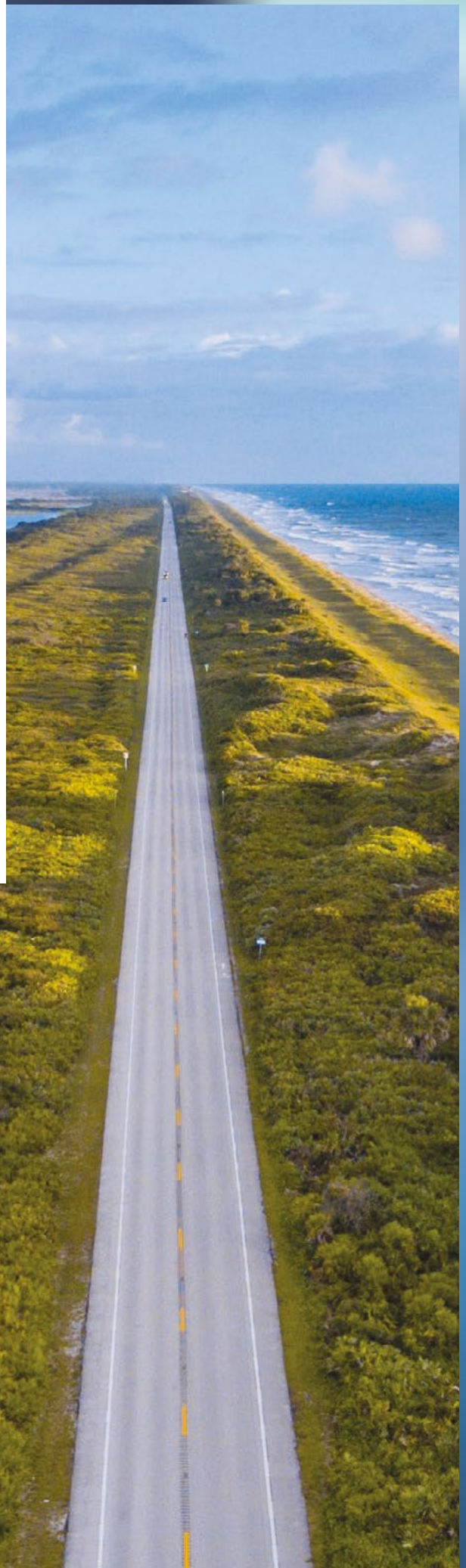
Innovative Approaches for Strengthening Coastal and Ocean Adaptation

Integrating Technology and Nature-based Solutions

The United Nations Framework Convention on Climate Change (UNFCCC) Technology Executive Committee (TEC), the UNFCCC Nairobi Work Programme (NWP) Expert Group on Oceans, International Union for Conservation of Nature (IUCN), and the Friends of Ecosystem-based Adaptation (FEBA) Network



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United Nations Framework Convention on Climate Change, the Kyoto Protocol and the Paris Agreement

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Innovative Approaches for Strengthening Coastal and Ocean Adaptation

Adaptation, technology, ocean

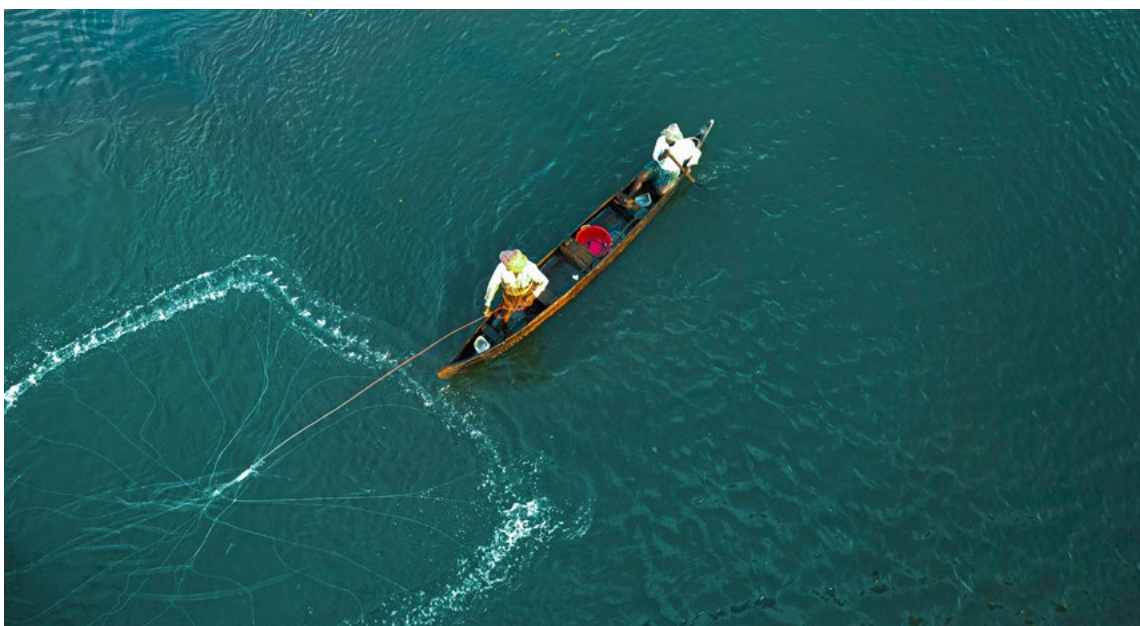
To address the progressive impacts and challenges of climate change, there is an urgent need to adopt innovative adaptation approaches such as those that integrate both technology and nature to enhance the resilience of coastal and ocean-dependent communities. This policy brief summarizes actions and recommendations for scaling up innovative approaches to achieve multiple benefits for people and nature. The findings are based on the outcomes of a series of events on integrated adaptation approaches organized by [UNFCCC Technology Executive Committee \(TEC\)](#), [UNFCCC Nairobi Work Programme \(NWP\) Expert Group on Oceans](#), [International Union for Conservation of Nature \(IUCN\)](#), and the [Friends of Ecosystem-based Adaptation \(FEBA\) Network](#) in 2021 as part of [Technology Day](#).¹

Key findings

Innovative climate adaptation approaches that integrate both technology and nature-based solutions offer the potential to be more robust, comprehensive, and cost-effective than either solution alone. In coastal and the ocean contexts, these solutions include early warning systems for extreme events, hybrid approaches to reduce the impacts of storm surges and sea level rise such as restoration of coastal vegetation alongside engineered seawalls, investments in nature-based infrastructure, new technologies to reduce harmful fishing practices, ecosystem-based marine spatial planning with coherent networks of marine protected areas, and coastal hazard mapping. However, despite the pressing adaptation needs of coastal and island communities, knowledge, capacity, and financing gaps and challenges prevent the widespread implementation and mainstreaming of these integrated approaches.

This policy brief provides an overview of the value of integrated adaptation solutions and the challenges and opportunities to increasing their uptake and scaling, including through interdisciplinary and cross-sectoral approaches based on partnerships; supportive policy and regulatory frameworks; sustained, innovative and accessible financing; and use of evidence-based targets.

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¹ See Annex for details on the event series and background.

The key findings of this brief include the need to:

- **Undertake co-production of localized adaptation solutions** that combine scientific, local and indigenous knowledge, engage diverse stakeholders, and distribute benefits equitably across and within communities.
- **Collaborate on transdisciplinary research and encourage mutual learning through long term monitoring and evaluation programs.** This will facilitate the development of robust evidence, data, and standards that document the role of natural assets, coastal and marine nature-based solutions (NbS), and green-gray infrastructure to support coastal and marine climate adaptation outcomes.
- **Address the barriers that restrict access to financing,** including perceptions of and risks associated with innovative and nature-based approaches, in order to scale up integrated adaptation solutions.
- **Foster enabling policy and regulatory frameworks** to support the uptake and implementation of integrated adaptation solutions in national climate strategies, local planning and regulations, and international standards and codes for civil engineering and construction.
- **Build cross-sectoral partnerships, including with the private sector,** to exchange knowledge and ideas, develop innovative technologies, and bolster the business case for integrated adaptation solutions.

Background

Forty percent of the world's growing population and approximately sixty percent of the world's urban areas with populations of over five million people are located in coastal zones within 100 kilometers of the coastline (UNFCCC 2020). The ocean and coastal areas are hubs of socioeconomic

and societal activity. They are important sources of food and water, renewable energy, cultural values, tourism, trade, and transport, as well as habitats for immense biodiversity (IPCC 2019). Coastal ecosystems play a critical role in supporting and protecting communities and infrastructure, including through mitigation of storm surge and wave energy, erosion reduction, sediment capture, food provision, and carbon sequestration.

Coastal areas are highly vulnerable to the impacts of climate change. More than 600 million people reside in coastal zones that are less than 10 meters above sea level (UNFCCC 2020), leaving many coastal communities and Small Island Developing States (SIDS) particularly vulnerable to a combination of slow-onset climate impacts, including sea level rise, coastal erosion, warming the ocean temperatures and the ocean acidification, and fast-onset hazards, including extreme weather events such as storm surges and tropical cyclones (Mycoo et al., 2022). These climate impacts are further exacerbated by parallel challenges of ecosystem degradation, unsustainable resource use, and pollution, which reduce the capacity of coastal ecosystems to serve as a buffer against storm surges and tropical cyclones and to ensure food security. The need for effective adaptation strategies is clear and urgent.

Climate adaptation investments have been traditionally heavy on engineered infrastructure such as levees and seawalls. However, while this infrastructure provides immediate protection, it can often be expensive to build, maintain, and replace, and can create unintended negative impacts. Such business-as-usual approaches on their own may not be sufficient in the face of the accelerating climate risks facing coastal communities and ecosystems. Integrated adaptation approaches incorporating natural systems can offer cost-effective, multiple benefit solutions, while better addressing climate risks for long-term resilience outcomes. Countries already recognize the importance of these varied approaches to adaptation. As the ocean and coastal zones worldwide face an onslaught of climate change impacts, innovative approaches will be crucial for en-

hancing the resilience of ecosystems and communities and meeting the goals of the Paris Agreement.

Diverse adaptation technologies have advanced rapidly in recent years. Meanwhile, in response to growing recognition that ecosystems and biodiversity are both at risk from, and crucial for, addressing global challenges, the concept of nature-based solutions has risen in prominence in the international policy agenda.

For example, conservation or restoration of coastal and marine habitats, particularly mangroves, salt marshes, seagrasses, and coral reefs, can substantially reduce exposure and vulnerability, providing natural protection from risks. Mangrove ecosystems alone provide flood protection benefits exceeding \$US 65 billion per year and protecting more than 15 million people (Menendez

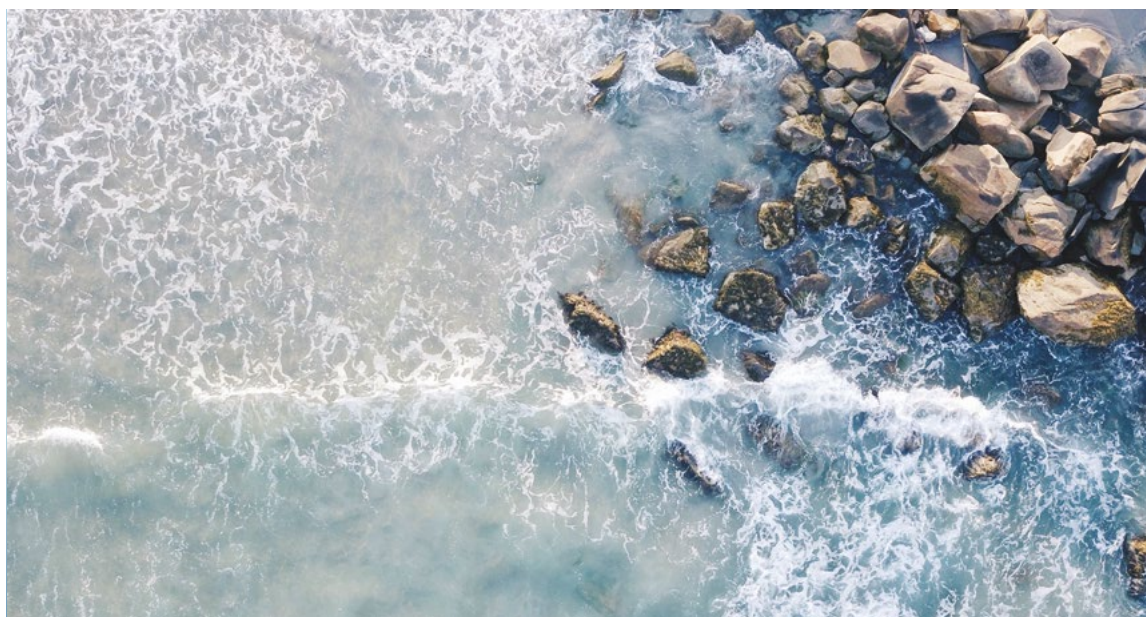
et al., 2020). Such nature-based solutions can complement other approaches for building climate resilience, including economic, social, infrastructural, and technological means. While the term nature-based solutions is new, the concept of protecting biodiversity and ecosystem services for human well-being is not, and is deeply rooted in local and indigenous practices.

Integrated technological and ecosystem-based approaches to climate change adaptation already exist in practice around the world, but they need to be mainstreamed and scaled in order to address climate hazards facing coastal and the ocean areas. Such integrated technological and ecosystem-based adaptation strategies offer an opportunity to optimize not only for adaptation effectiveness but also cost, durability, sustainability, and co-benefits for people and nature (Box 1).

“Nature-based solutions are 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 well-being, ecosystem services and resilience and biodiversity benefits”

([UNEP/EA.5/Res.5](#))

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BOX 1 INTEGRATING TECHNOLOGY AND NATURE INTO ADAPTATION SOLUTIONS: AN INNOVATIVE APPROACH

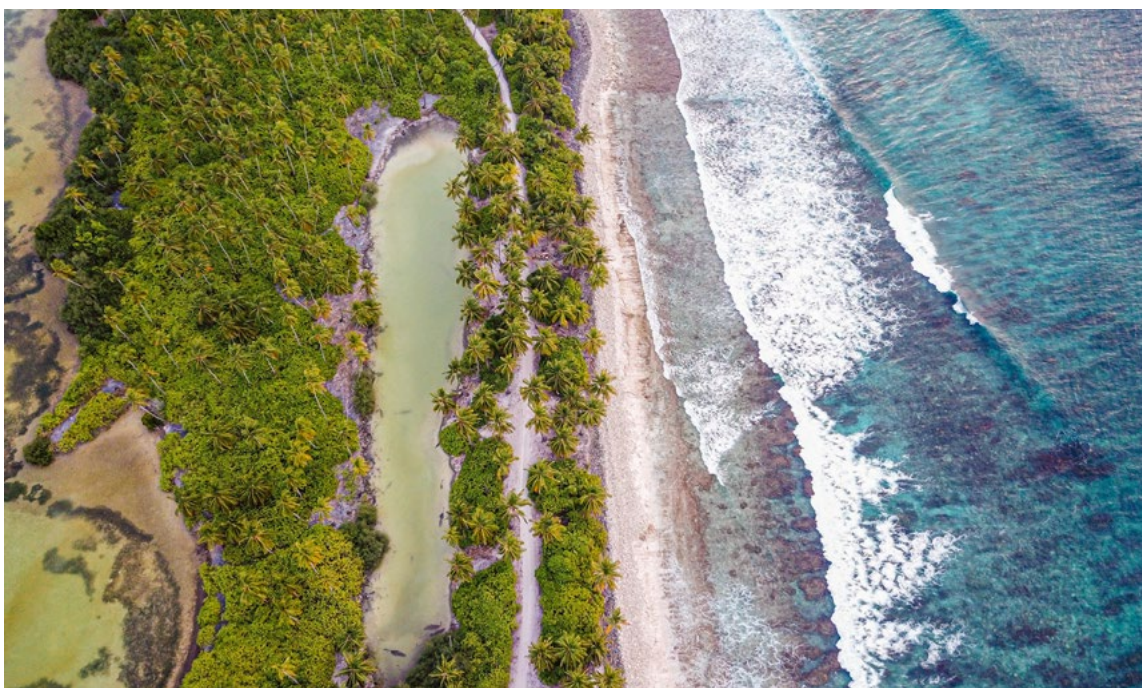
A diverse array of technologies can be used for managing ocean and coastal zone risks.

Hard technologies, or hardware, refer to physical tools and infrastructure, such as seawalls and dykes; *soft technologies, or software*, refer to the processes, knowledge and skills required in using the technology, such as improvement of coastal risk and adaptive management efficiency; and *organizational technologies, or orgware*, refer to the ownership and institutional arrangements pertaining to technology, such as coordinated cross-sectoral and regional planning (UNFCCC 2020).

As the increasing impacts of climate change present a moving target, business-as-usual and siloed approaches will be insufficient. Integrating nature and technology into adaptation solutions can lead to multiple benefits for communities and for nature: they can be more effective, cost-effective, sustainable, durable, attractive, and acceptable to local communities than hard, soft, organisational, or green approaches alone.

Innovation is not without risks – some well-intentioned actions could lead to maladaptation, inequitable allocation of resources, or loss of livelihoods. Implementing environmental and social safeguards appropriate for the local context is an important step towards avoiding maladaptation and the exacerbation of inequities in any adaptation strategy.

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INNOVATIVE APPROACHES TO COASTAL ADAPTATION



E. Abian

Overview of innovative approaches

Innovative adaptation approaches can include:

- **Ecosystem-based adaptation (EbA) and Ecosystem-based disaster risk reduction (Eco-DRR)** are types of nature-based solutions that use biodiversity and ecosystem services as part of an overall adaptation strategy to help people to adapt to the adverse effects of climate change and to reduce disaster risks. **EbA and Eco-DRR** approaches are centred on the conservation, sustainable management, and restoration

of ecosystems, such as rehabilitation of mangroves, seagrass meadows, coral reefs and tidal marshes, to reduce the vulnerability of human communities to the impact of climate-related hazards such as storm and flood damage, coastal erosion, salinisation of freshwater resources, and loss of agricultural productivity. In addition to climate adaptation benefits, EbA and Eco-DRR approaches can offer numerous economic, social, and environmental co-benefits, such as carbon sequestration and enhanced fish stocks.

- **Hybrid approaches** combine ecosystem-based and engineered adaptation approaches with a broad emphasis on sustainable development in densely populated coastal zones (UNFCCC 2020). Hybrid approaches, such as green-gray infrastructure, are often multi-sectoral, interdisciplinary efforts which integrate “green” ecosystem structures and functions with “gray” infrastructure. Some examples include living shorelines, constructed water quality treatment wetlands, or salt marsh restoration paired with dykes, which combine the wave attenuation and flood control properties of natural ecosystems with the immediate benefits of engineered structures. Hybrid approaches can also extend the lifespan of gray infrastructure while supporting co-benefits such as regulating water quality, supporting fisheries, and sequestering carbon. Case studies and guidance can be found in [‘The Practical Guide to Implementing Green-Gray Infrastructure’](#), the [‘International Guidelines on Natural and Nature-Based Features for Flood Risk Management’](#) and the [‘Engineering with Nature Atlas’](#).
- **Early warning systems (EWS)** monitor environmental and other conditions to forecast, detect, and help communities prepare and respond to emergencies and changes in the local environment. [Early warning systems](#) can be developed using remote sensing together with in situ environmental data collection, and can utilise and incorporate indigenous ecological knowledge to improve accuracy, increase participation of community members, and enhance communication.
- **Cross-sectoral approaches** such as integrated coastal zone management (ICZM), [marine spatial planning \(MSP\)](#), [Source-to-Sea \(S2S\) management](#), [Ridge to Reef](#), [ecosystem approach to fisheries/aquaculture](#), and marine protected areas (MPAs) bring together diverse stakeholders for a comprehensive and integrated approach to planning and management of coastal and marine areas. An ecosystem-based approach to MSP and ICZM can transform how

coastal and marine spaces are managed by national and regional actors, and increase the ability to integrate and adapt to multisectoral changes to ensure a long-term sustainable balance between people and nature. Case studies can be found at [‘The European MSP Platform’](#) and [‘The Global MSP’](#).

- **Coastal hazard and flood risk mapping** analyze factors including topography, water levels, tides, storm surge, erosion, ecosystem condition and protective features to model risks to coastal communities and inform management decisions.

Examples of innovative approaches

The ‘Technology Day’ event series highlighted that a broad suite of innovative approaches are being applied and scaled up across different countries. Examples from various practitioners, and from the wider literature, include:

- The U.S. Army Corps of Engineers [Engineering with Nature \(EWN\)](#) initiative uses a collaborative and cost-effective approach to infrastructure development that combines engineering with natural processes to deliver economic, social and environmental benefits. EWN approaches have been implemented to restore marshland and aquatic habitats, maintain navigation channels, manage flood risk, adapt to sea level rise, restore marshland and aquatic habitats, maintain navigation channels, and protect against hurricanes and other coastal hazards.
- The Netherlands Department of Waterways and Public Works has implemented a governance framework in the Netherlands with mandatory periodic inspections of sea walls and storm surge barriers as part of the Netherlands [Building with Nature \(BwN\)](#) approach, in which natural processes deliver a number of benefits, such as protection against flooding and coastal erosion, resilience to climate change, and opportunities for nature and recreation. Innovative BwN initiatives include [Room for the River](#), which has restored natural floodplains

to better manage peak river discharges, and the [Sand Motor](#) initiative, a pilot project for natural coastal protection against storm surges that also provides habitat restoration and recreation and which was designed with heavy stakeholder engagement.

- The [Pilot Program for Climate Resilience](#) is a flagship initiative under the [Climate Investment Funds](#) (CIF), which has a USD 1.2 billion portfolio of adaptation projects across 28 countries, including investments in technological infrastructure and nature-based solutions in coastal areas. CIF finance has been used to pilot flood-resilient crop varieties in coastal areas and to establish a network of agribusinesses for enhancing the resilience of small-holder farmers.
- The ‘[Rebuild by Design](#)’ design competition model has produced innovative hybrid adaptation solutions, such as a series of offshore ‘living breakwaters’ on the southeast shoreline of Staten Island, New York, that provide habitat for marine life while providing a buffer against wave damage, flooding and erosion. Conceived as part of the Hurricane Sandy recovery, this initiative has been replicated internationally by the United States Agency for International Development (USAID), the Swedish International Development Cooperation Agency (SIDA) and The Rockefeller Foundation, developing the [Global Partnership for Resilience](#) based on the Rebuild by Design competition model and collaborative approach.
- Conservation International and partners’ Green-Gray Infrastructure Program has built pilot projects that combine [mangrove restoration with breakwaters in the Philippines](#), developed engineering guidance for designing [mangrove restoration areas with seawalls in Guyana](#), and is piloting a [Climate Smart Shrimp approach in Indonesia](#) to couple the sustainable intensification of shrimp aquaculture production with the restoration of mangroves where a portion of the restoration area is designed as a water quality treatment wetland for pond effluent.

Daniel Klein on Unsplash



- The [Copernicus Climate Change Service \(C3S\) for European Storm Surge](#) provides high quality climate data on storms in European coastal seas. The data generated will improve awareness of changes in storminess and its impact due to climate change and will support long-term decision-making processes for a variety of coastal sectors and issues.
- Pilot projects in Palau are exploring ways to preserve culturally and economically significant taro cultivation in the face of saltwater intrusion from increasing sea level rise, including testing salt-tolerant taro varieties and trials for upland cultivation. [Palau's taro fields](#) contribute to food security, help maintain matrilineal land inheritance customs and protect coral reefs by trapping sediment.
- The [Resilient Fishing](#) initiative in Peru works to implement selective fishing techniques and improve fishing gear, reducing vulnerability and enhancing the resilience of artisanal fisheries while strengthening ancestral knowledge in combination with modern technological systems such as EWS for flooding and harmful algal blooms.
- Constitutional mandates can provide for conservation of nature, such as the protection of the Sundarbans mangroves in Bangladesh, which shelter nearby communities from sea level rise and disasters. A new [Regional Office of the Global Centre on Adaptation \(GCA\)](#) has been established in Dhaka, Bangladesh, focusing on scaling up nature-based solutions to enhance infrastructure resilience.
- The “[Resilient Islands, Resilient Communities](#)” project in Kiribati adopts a [ridge to reef](#) approach and aims to improve biodiversity conservation and landscape/seascape level management (land, forest and marine ecosystem-based adaptation management) to enhance socio-ecological resilience to climate variability and change. Among other aims, the project seeks to ensure the sustainability of Kiribati's nearshore fisheries in lagoons and coastal areas that provide essential food, livelihood, nutrition, income and employment benefits.

John Greene / Conservation International



GAPS, CHALLENGES AND OPPORTUNITIES



Coral Reef Alliance

Despite the many potential advantages and benefits of integrating technology and nature-based solutions for adaptation, gaps and challenges persist that hinder widespread implementation of actions. They include single disciplinary approaches to problem-solving, as opposed to interdisciplinary approaches; a lack of investments and funding for green-gray infrastructure, particularly in coastal zones; and lack of wide acceptance of integrated solutions.

Transitioning from siloed approaches to transdisciplinary, cross-sectoral, and partnership-driven approaches

Too often, there is limited communication and knowledge exchange between different actors, including practitioners implementing adaptation initiatives, local and regional government decision-makers, the private sector, and indigenous peoples and local communities. Breaking silos between these

actors – and across various disciplines and sectors – is a critical first step in achieving successful integrated adaptation solutions. To accomplish this, diverse stakeholders must engage in transdisciplinary approaches and mutual learning beyond the project level and embed integrated adaptation solutions across sectors including (but not limited to) agriculture, aquaculture and fisheries, tourism, water security, urban planning, and environment and disaster risk management. For example, state-led national marine spatial plans can harmonize cross-sectoral policies and timelines with the involvement of stakeholders in all phases of the process, enabling ecosystem-based marine spatial planning with effective management of MPAs to deliver direct benefits to sectors like fisheries and tourism.

From rigid regulations to supportive policies and regulatory frameworks

Implementation of integrated adaptation solutions can be hampered by restrictive regulatory and legal frameworks, ranging from local land-use regulations and building codes to national climate policies, funding mechanisms, and engineering guides and standards. Creating space for adaptive policies and strengthening enabling regulatory frameworks, as well as supporting new regulations, while ensuring adherence to environmental and social standards, can greatly facilitate the funding, approval, and implementation of integrated adaptation solutions. For example, local governments can update existing regulatory frameworks (such as municipal land use planning and zoning, building codes, and safety regulations) and incorporate opportunities into local ordinances to create enabling conditions for green-gray solutions. National governments can provide the resources and capacity required to develop and enforce such laws and regulations at a local level.

From inadequate, project-based funding to sustained, innovative and accessible financing

Within the context of climate adaptation finance, funding has traditionally been allocated to gray and engineered infrastructure rather than nature-based and integrated solutions. Despite the high potential impact and cost-effectiveness of nature-based solutions for adaptation, to date only 5% of global climate finance flows are spent on adaptation, with only 1.4% thereof utilizing nature-based solutions for adaptation (WRI 2021, UNEP 2021). At the same time, an estimated USD 94 trillion will be spent on infrastructure globally over the next 20 years; enhanced political drive could direct substantial investment toward green-gray adaptation approaches (Global Green-Gray Community of Practice 2020).

Funding for integrated adaptation solutions is constrained by real and perceived risks and trade-offs, and overcoming these barriers involves developing financial strategies and engaging the public, finance and insurance sectors to reduce or distribute risks. Public, private, and blended finance can play a crucial role in de-risking investment in integrated adaptation solutions and enable flexibility in implementation through concessional capital and loans, grants, guarantees, political risk insurance and other mechanisms such as technical assistance. Blended finance and concessional finance, for example, may be provided at lower interest rates and allow enhanced flexibility and financial feasibility. The diversification and accessibility of climate finance would help the most vulnerable and facilitate local interventions to achieve national adaptation objectives. Examples of replicable financing mechanisms to scale up innovative adaptation solutions in Latin America and the Caribbean can be found [here](#).

From lack of evidence-based decision-making to standardized targets and monitoring frameworks

Lack of long-term monitoring and evaluation programs and standardized reporting frameworks for integrated adaptation solutions results in inconsistent and inadequate markers of progress. Embedding more concrete, evidence-based targets in long-term, participatory monitoring, evaluation and learning programs will enable the full

assessment of benefits that integrated adaptation solutions may yield for society and for nature while limiting trade-offs. Benchmark data of targets and actual results over time is fundamental to giving confidence to and attracting more investors, thus better incentivizing these integrated adaptation solutions. Availability of quality, in-depth data would significantly shorten due diligence timelines for investors and allow for improved pricing as different projects can be benchmarked against existing projects.

Circular



ACCELERATING THE UPTAKE AND SCALING UP OF INNOVATIVE APPROACHES

Srikanth Manneपुरi / Ocean Image Bank

Experts and practitioners agree that many of the examples and tools needed for upscaling the innovative approaches discussed above are already available, but will require sufficient data, technical and financial capacity to implement, as well as collaborative partnerships with multiple stakeholders and enabling policy, legal and regulatory frameworks. For example, several cost-benefit analyses and decision support tools have been developed to assess different adaptation options, but they may rely on data that are unavailable or require specialized technical skills (Chevallier et al., 2019). This is where capacity building

and technology transfer, particularly in developing countries, is critically important to support integrated adaptation solutions.

Political leadership is crucial for driving change. Better coordination across governments at the local and national levels, and their planning and budget departments, are fundamental to accelerating the implementation of innovative approaches. Furthermore, environmental and social safeguards should be strengthened to avoid maladaptation, respect rights, and enhance local adoption and acceptance (CBD 2019).

National and international climate resilience frameworks are impactful when they are translated to the local level by providing access to resources – technical, legal, policy, financial and more – to support community-led planning and implementation. Planning and implementation must also engage local stakeholders throughout and be flexible and adaptable to local and regional circumstances, including ecosystems, cultures, institutions and economies. For example, restoration of coastal vegetated areas could include native species selected by indigenous peoples and monitored through participatory mechanisms (Lee et al., 2021).

Further, synergies between climate mitigation and adaptation – such as in renewable energy projects – should be considered to enhance the co-benefits and impacts of these innovative approaches, as well as to unlock new funding opportunities. Carbon markets are increasingly providing green-gray approaches with alternative sources of funding, such as the City Forest Credits program in multiple [City Forest Credits](#).

Michael M on Unsplash



RECOMMENDATIONS FOR ACTIONS AND FURTHER WORK



Caitlin Bailey, GFOE, The Hidden Ocean 2016: Chukchi Borderlands

Policymakers, international organizations, finance institutions, the private sector, research institutes and academia, non-governmental organizations (NGOs), UNFCCC bodies and processes, and other UN bodies and ongoing processes all have a role to play in accelerating the uptake and scaling up of innovative adaptation solutions. While all actors must move beyond respective silos and seek collaborations with diverse stakeholders, there are key actions each set of actors can take to advance these approaches.

Recommendations for policymakers including national and local governments:

- **Integrated adaptation solutions should be embedded into climate-related policies as well as other sectors, such as agriculture, fisheries, tourism, water security and disaster risk management.** This includes integration formulation and implementation of National Adaptation Plans (NAPs) and Nationally Determined Contributions (NDCs), coastal risk reduction measures under the Sendai Framework, national

blue economy initiatives, marine spatial plans, fisheries management and aquaculture development, coastal and marine protected areas, development planning, and pandemic recovery. The mainstreaming of integrated adaptation solutions will also require inter- and intragovernmental coordination and integration for both financing and effective implementation.

- **National policies must be translated into localized adaptation action**, including creating an enabling environment for delivering implementation finance. This includes the careful consideration of synergies and trade-offs between implementation of adaptation actions, social and environmental safeguards, and long-term monitoring, evaluation and learning accompanied by adaptive management.
- **Governance and technical capacities of relevant national and local management institutions** need to be strengthened to enable the adoption and effective implementation of integrated adaptation solutions.
- **Policies should prioritize the most vulnerable communities, societal groups and ecosystems.** Further work is needed to strengthen gender considerations, including gender-responsive adaptation planning; meaningfully include local and indigenous communities; and support the involvement of youth group constituencies in the development of co-designed adaptation strategies.

Recommendations for public and private finance institutions:

- **Public, private and blended finance can play a crucial role in facilitating investment in integrated adaptation solutions** by strengthening enabling conditions through local financiers and banks, identifying un-met risk mitigation needs, providing guarantees and insurance, and supporting project developers in demonstrating the value of innovative approaches

(e.g., through pilot projects). Public finance can provide funding for technical assistance to produce the data, metrics and valuations needed to build a robust case for costs and benefits of integrated adaptation approaches, which will in turn will give private investors the confidence required to invest.

- **Private finance institutions can support by engaging early on in risk reduction, commercializing promising integrated adaptation approaches, and scaling up these approaches.** This can include structuring robust revenue streams associated with the project and leveraging the public sector and multilateral and other blended finance providers for risk-sharing. For projects to attract private sector equity, loans and other investments, project developers require technical assistance to structure projects and improve the ability of financiers to assess the risk and return profiles of these projects. For example, in the Philippines, the private sector is developing operational business models and recommendations for integrating EbA across different sectors and engaging in strategic dialogues for developing a long-term strategy for private-public partnerships (JBF Centre 2021).
- **The accessibility of sustainable finance, especially for communities most affected by climate change, must be improved.** Vulnerable coastal and island populations, such as SIDS, urgently need access to international climate finance for adaptation. Financial institutions should support the longer-term costs of adaptation actions beyond initial investments and operating costs including for ongoing monitoring, evaluation and learning. To do so, actors could consider a range of financing instruments beyond grants, including equity, loans and private sector investments in the blue economy (GIZ 2018), e.g. through the emerging environmental and social bond markets.

Recommendations for non-governmental and community-based organizations:

- National and international non-governmental organizations (NGOs) as well as community-based organizations (CBOs) should seek to **actively pursue meaningful participation of and leadership by local communities and vulnerable groups, including youth, women, and indigenous peoples, at all stages of design, planning, implementation and monitoring of adaptation interventions.** For example, the “[Blue Green Protectors Programme](#)” in Sri Lanka, initiated by the SLYCAN Trust, focuses on youth engagement in climate adaptation initiatives through mangrove conservation and restoration as a thematic area under the Global Youth Forum on Climate Change (Karunaratne 2021).
- **NGOs and CBOs should develop and cultivate partnerships with one another as well as with other diverse**

stakeholders – ranging from academia to the private sector, practitioners, donors and policymakers – to **improve enabling environments, access to funding, knowledge exchange and technology transfer.** For example, the [Nature-based Infrastructure Global Resource Centre](#) brings together key partners to establish a business case for Nature-Based Infrastructure (NBI), including data, training, and sector-specific valuations based on innovations in systems thinking and financial modelling.

- **Provide resources for informing evidence-based targets and monitoring design and create a data clearinghouse to manage, consolidate, and share collected monitoring data.** For example, the [International Stormwater Best Management Practices Database](#) compiles publicly available data on project performance and cost that can inform policy and engineering standards.

Fredrik Öhlander on Unsplash



Recommendations for academia and research institutes:

- Research focused on diverse adaptation technologies will **help build a robust evidence-base on the effectiveness, viability and multiple benefits of integrated adaptation approaches**. This requires collaborations across disciplines, including the social sciences and humanities, physical and environmental sciences, engineering, and economics, as well as resources to undertake such research.
- **Enhanced collaboration between researchers, academia, and local stakeholders through communities of practice** and diverse project consortia should ensure innovations are inclusive, relevant and consider local needs and conditions – while also highlighting and translating the most up to date science for policymakers. Communities of practice such as the [Adaptation Research Alliance](#) can foster knowledge and technology co-creation processes based on the open and equitable dialogue between scientific, local and indigenous knowledge systems, and share and disseminate best practices and knowledge with decision-makers.

Recommendations for practitioners:

- Civil engineers, architects, natural resource managers, landscape and habitat restoration experts and other practitioners should engage in **cross-sectoral exchange of knowledge and best approaches through communities of practice and innovative partnerships**. Knowledge exchanges can occur through participation in interdisciplinary networks such as the [Global Green-Gray Community of Practice](#).
- It is critical to **meaningfully engage diverse local stakeholders, including local communities, indigenous peoples, youth, women, and marginalized groups**. Participatory consultations and integration of local knowledge may take more time upfront but will contribute to the sustainability and effectiveness of and local support for interventions, increasing the

likelihood of long-term provision of adaptation benefits and the preservation of cultural knowledge and products.

Opportunities under the UNFCCC process:

Building on the new mandates from Glasgow, the following are opportunities under the UNFCCC process to facilitate actions that strengthen the resilience of coastal settlements and the ocean ecosystems.

- One of the objectives of the [Glasgow Sharm-El Sheik Work Programme](#) (GlaSS) on the [Global Goal on Adaptation](#) (GGA) is to enhance national planning and implementation of adaptation actions through the process to formulate and implement NAPs and through NDCs and adaptation communications. GGA presents an important opportunity to demonstrate national implementation of integrated adaptation approaches, innovative information services and climate services.
- The [COP26 outcomes](#) invite relevant work programs and constituted bodies under the UNFCCC to consider how to integrate and strengthen ocean-based actions in their existing mandates and workplan. The outcomes also establish a recurring Ocean and Climate Change dialogue held by the Chair of the [Subsidiary Body for Scientific and Technological Advice](#) (SBSTA) starting in June 2022 to discuss strengthening ocean-based climate action, creating impetus for the uptake and scaling of integrated adaptation solutions.
- [SBSTA 52-56 outcomes](#) invited the NWP to develop relevant sector-specific guidance to help identify sources of support, including financial, technological and capacity-building. This outcome provides an opportunity to follow up on some of the recommendations with the NWP thematic expert group on the ocean. Parties have opportunities to integrate this guidance in the context of formulating and implementing NAPs and in their NDCs. NAPs and NDCs are critical entry points for Parties to communicate and address their national priorities and needs, influencing the level of resources attached to adaptation actions.

- The [Standing Committee on Finance](#) provides a platform for a wide range of climate finance stakeholders, including from governments, climate funds, financial institutions, civil society, think tanks and the private sector, to exchange information and promote linkages and coherence in the mobilization and delivery of climate finance. In 2021–2022, the Standing Committee on Finance Forum focused on the topic of Financing nature-based solutions.
- The [Santiago Expert Network](#) catalyzes the technical assistance of relevant organizations, bodies, networks and experts, for the implementation of relevant approaches for averting, minimize and addressing loss and damage at the local, national and regional level, in developing countries that are particularly vulnerable to the adverse effects of climate change.

Opportunities to promote coherence with other UN processes

- The [UN Decade of Ocean Science for Sustainable Development](#) (2021–2030) provides a framework to facilitate and convene partnerships of diverse stakeholders around common the ocean science priorities, leverage investment for the ocean research, and strengthen the enabling environment for the ocean science including transfer of marine

technology and capacity development. Innovative collaborations for integrated adaptation solutions are critical for contributing to a comprehensive understanding of the ocean communities and ecosystems, mobilizing of resources, and increasing uptake and mainstreaming at the science-policy interface.

- The [UN Decade on Ecosystem Restoration](#) (2021–2030) aims to prevent, halt and reverse the degradation of ecosystems across the globe. Restoring the ocean and coasts will require reducing pressure on those ecosystems as well as making both ecosystems and communities more resilient in the face of global change, from sustainable fisheries to reducing waste and pollution, protecting urban coastal ecosystems, and conserving and restoring coral reefs, mangroves and wetlands. Integrated adaptation approaches will be required to meet these goals sustainably and cost-effectively while providing multiple benefits to coastal and island communities. Adaptation solutions that integrate nature-based solutions and technology can also contribute to the [implementation of the Sendai Framework for Disaster Risk Reduction](#) by addressing underlying drivers of risk from unsustainable resource use and ecosystem degradation while incorporating the innovative tools of adaptation technologies.

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ANNEX

To respond to knowledge gaps in implementing innovative adaptation strategies, the [TEC](#), [NWP Expert Group on Oceans](#), [IUCN](#) and [FEBA](#) organized a series of events on integrated adaptation approaches in 2021 as part of ‘[Technology Day](#)’. Panelists representing diverse expertise from civil society, financial institutions, the private sector, academia, together with national government representatives discussed innovative approaches to deploy, disseminate and scale up adaptation technologies in particular sectors to enhance the resilience of the ocean and coastal ecosystems and communities to climate change. This event series explored, in sequence: i) Promoting, learning and ex-

amples of integrating both technology and nature for adaptation outcomes; ii) Opportunities for uptake and upscaling; and iii) Policy integration, finance, and capacity building. In this policy brief, the outcomes of this unique sequential event series are summarized, including identification of a broad array of challenges and recommendations for improving upscaling of innovative adaptation approaches that integrate technology and nature-based solutions.

To learn more about the event series and outcomes of the events, visit the ‘[Technology Day](#)’ and [FEBA](#) event pages and see the table below.

‘TECHNOLOGY DAY’ EVENT SERIES

6 Sep 2021 (IUCN World Conservation Congress, Marseille)	Ecosystems and technology: Innovative approaches to strengthening coastal and the ocean adaptation
13 Oct 2021 (informal SBSTA event in the lead up to COP26)	National policy, local action: Scaling up integrated approaches to strengthen coastal and the ocean adaptation
8 Nov 2021 (side event at COP26, Glasgow)	The best of both worlds: Uniting adaptation technologies and nature-based solutions to enhance coastal and the ocean resilience

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TEC

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TECHNOLOGY EXECUTIVE COMMITTEE (TEC)

The TEC is the policy arm of the Technology Mechanism under the United Nations Framework Convention on Climate Change (UNFCCC). It focuses on identifying policies that can accelerate the development and transfer of low-emission and climate resilient technologies. The TEC and the Climate Technology Centre and Network (CTCN) form the Technology Mechanism, which also serves the Paris Agreement. The Technology Executive Committee may be contacted through the United Nations Climate Change Secretariat.

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NAIROBI WORK PROGRAMME – OCEANS, COASTAL AREAS AND ECOSYSTEMS

Oceans, coastal areas and ecosystems, including mega deltas, coral reefs and mangroves are amongst the priority areas under the Nairobi Work Programme (NWP), the UNFCCC knowledge-to-action hub for adaptation and resilience. The NWP expert group on the ocean has worked together since 2019 to find synergies to strengthen adaptation knowledge networks and address support of specific knowledge needs for Least Developed Countries (LDCs) and Small Islands Developing States (SIDS), while also collaborating with the constituted bodies under the UNFCCC process.

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IUCN

IUCN is a membership Union composed of both government and civil society organisations. It harnesses the experience, resources and reach of its more than 1,500 Member organisations and the input of more than 18,000 experts. IUCN is the global authority on the status of the natural world and the measures needed to safeguard it.

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FRIENDS OF EBA (FEBA):

FEBA is a global collaborative network of 98 agencies and organisations involved in Ecosystem-based Adaptation (EbA) working jointly to share experiences and knowledge, to improve the implementation of EbA activities on the ground, and to raise awareness and understanding of nature-based solutions in adaptation planning processes and multilateral policy frameworks. FEBA convenes the global adaptation community around expert working groups, technical workshops, and high-level events. The CBD COP recognizes FEBA as a key partner “to support Parties in their efforts to promote ecosystem-based approaches to climate change adaptation” (Decision 14/5).

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