هيئة البيئة - أبوظبي
Environment Agency - ABU DHABI

مبادرة القرم أبوظبي
Abu Dhabi Mangrove Initiative

1st International Mangrove Conservation and Restoration Conference

10 - 12 December 2024

Outcomes Report

unesco

Emirates Nature WWF

Mangrove Specialist Group

IUCN

ZSL

GLOBAL MANGROVE ALLIANCE

UN environment programme

Wetlands INTERNATIONAL

GBC

University of St Andrews

2021 2030 United Nations Decade of Ocean Science for Sustainable Development

MAP

UNITED NATIONS DECADE ON ECOSYSTEM RESTORATION 2021-2030

Setting the Stage for Restoration

Delegates to the 1st International Mangrove Conservation and Restoration Conference (IMCRC), representing governments, research institutions, non-governmental organisations, civil society, and the private sector from across the globe, gathered in Abu Dhabi in December 2024. The IMCRC was hosted by the UAE under the leadership of **the Environment Agency - Abu Dhabi** in partnership with **The Global Mangrove Alliance, the IUCN Mangrove Specialist Group, ZSL, Wetlands International, Mangrove Action Project, Emirates Nature-WWF, University of Cambridge, The United Nations Environment Program (UNEP), the United Nations Decade on Ecosystem Restoration, the United Nations Educational, Scientific and Cultural Organization (UNESCO), University of St. Andrews and the Global Ocean Decade Programme for Blue Carbon.** The conference underscored the urgent need to accelerate global efforts on mangrove conservation and restoration. Involving over 300 participants, the conference featured plenary discussions, contributed talks and practical workshops from experts from 82 countries.

The urgency is clear. The speed of mangrove loss has declined in recent years, but substantial areas are still being converted and climate change will continue to impact coasts and communities, and we stand at a turning point. Yet, the opportunity is equally immense. Leading scientists at the IMCRC conference highlighted that over 800,000 hectares of mangroves are available for restoration globally, including 160,000 hectares of disused aquaculture ponds in Southeast Asia alone, of which at least 100,000 hectares are potentially restorable. Research has provided us with the information to achieve this ambition, from understanding the root causes of loss and degradation to setting clear goals, selecting the right approaches, and implementing long-term monitoring. However, **critical gaps remain**—including **inadequate community involvement, land tenure complexities, misguided restoration targets and interventions, and insufficient funding mechanisms.**

The discussions over the three days reinforced a crucial truth: **mangrove restoration is not just about planting trees**—it is about restoring entire ecosystems and the services they provide to people and nature. Mangrove conservation and restoration is also not just about locking away carbon—it is critical to sustain resilient coastal communities in an uncertain future. Success depends on integrating **science, implementation, and people,** ensuring restoration efforts are socially just, ecologically sound, and financially sustainable.

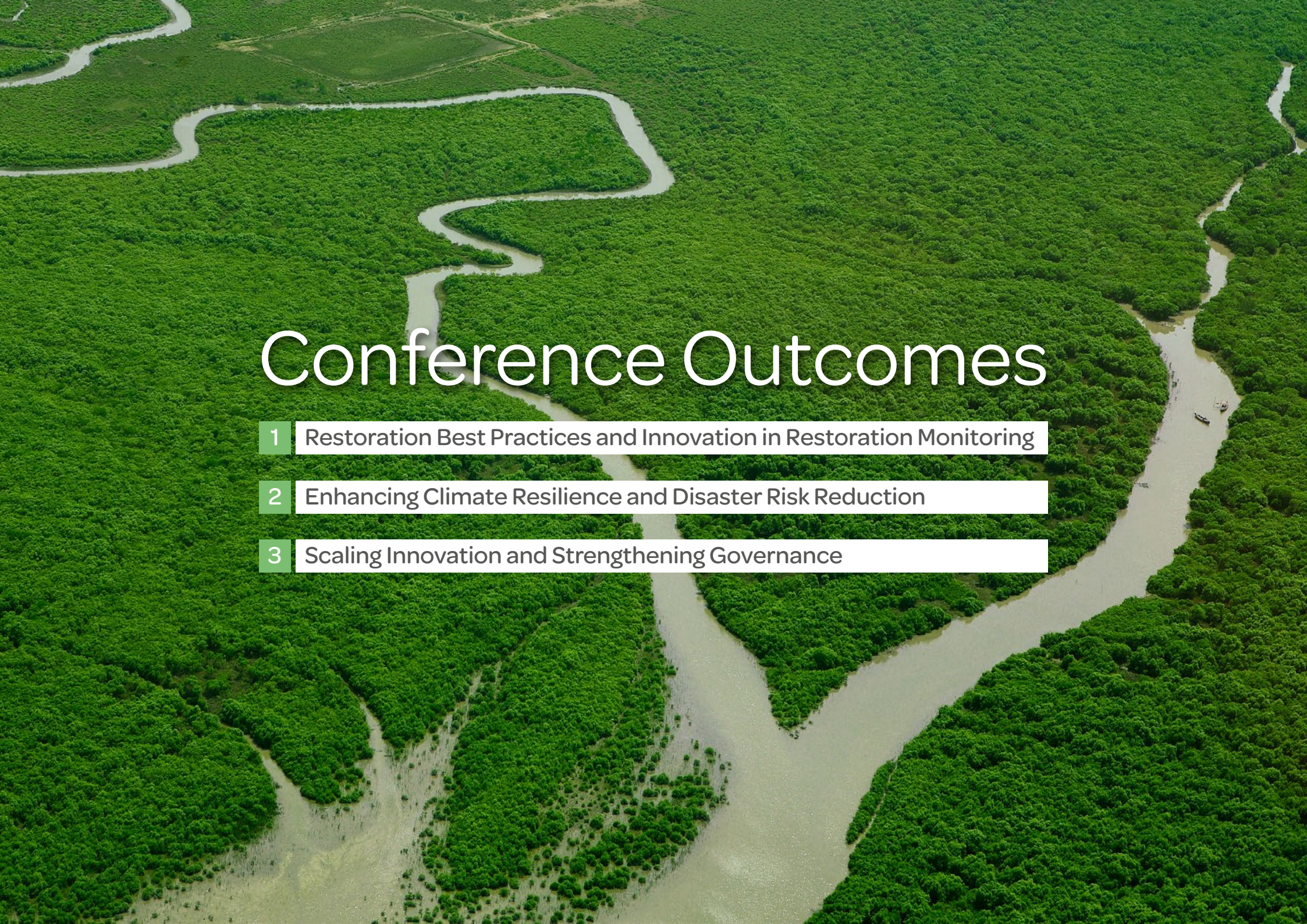
This document reflects the outcomes of the IMCRC conference and our collective commitment to advancing global mangrove conservation and restoration efforts in alignment with the objectives of the Mangrove Breakthrough[1], The Abu Dhabi Mangrove Initiative[2] and The Global Mangrove Alliance[2*].

Mangrove restoration is not just about planting trees—

it is about restoring entire ecosystems and the services they provide

to people and nature.

[1] www.mangrovebreakthrough.com
[2] ADMI | Home
[2*] www.mangrovealliance.org



Conference Outcomes

1. Restoration Best Practices and Innovation in Restoration Monitoring
2. Enhancing Climate Resilience and Disaster Risk Reduction
3. Scaling Innovation and Strengthening Governance

1

Restoration Best Practices and Innovation in Restoration Monitoring

ACTION 1

Prioritising Protection First, then Science-based Restoration

While mangrove restoration is an important tool, it rarely returns ecosystems to their full functionality. **The immediate priority must be to safeguard intact mangrove forests and their biodiversity from further destruction.** Stronger governance, effective enforcement, and sustainable land-use policies are essential to prevent further loss. Expanding marine protected areas and ensuring that they are effective will further enhance the resilience of these ecosystems against climate change and human pressures.

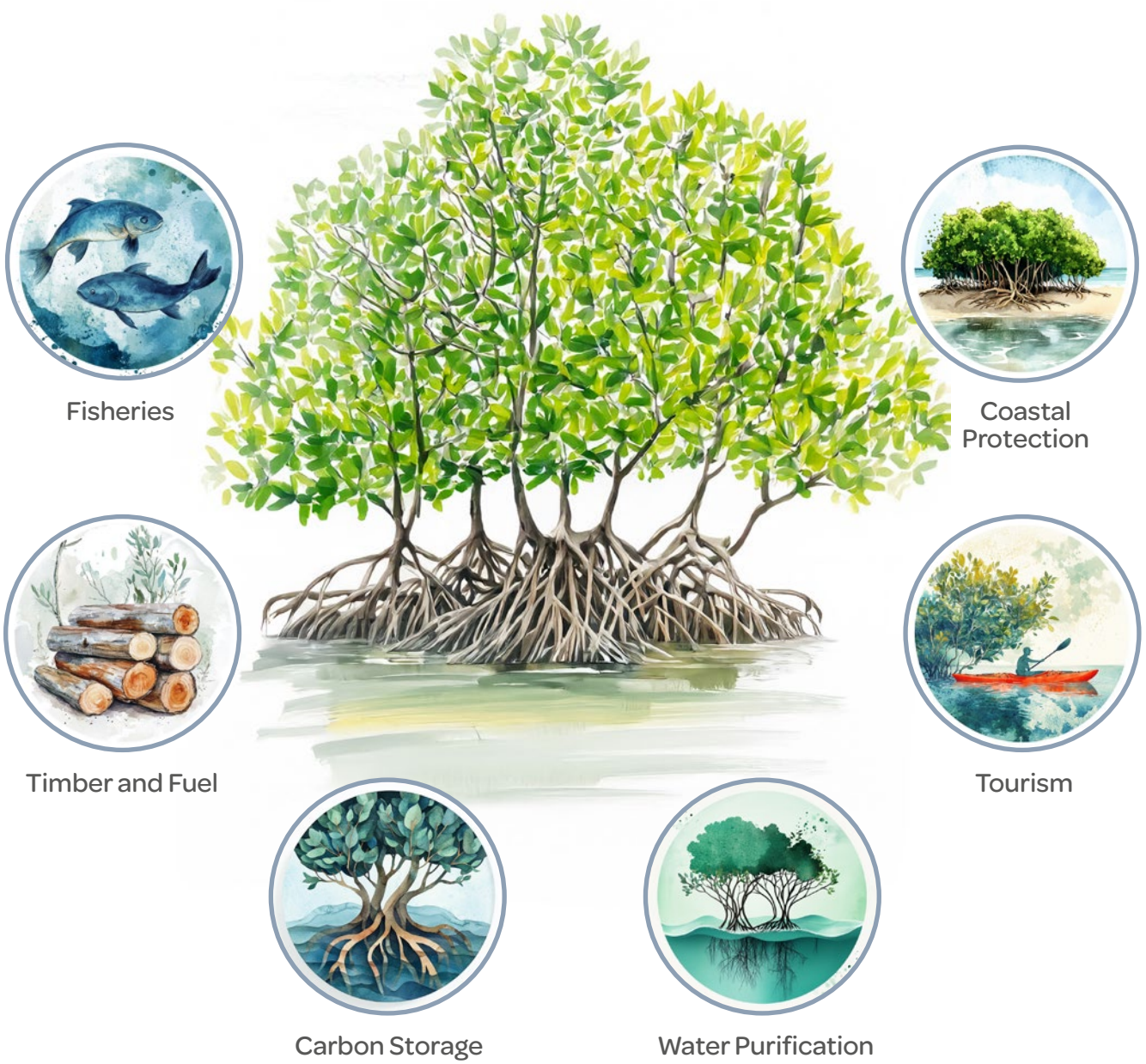
Restoration should always be a secondary measure, applied strategically where substantial degradation or loss has occurred. To ensure long-term success, restoration efforts should follow best-practice principles such as **Ecological Mangrove Restoration (EMR)**— focusing on restoring natural conditions rather than defaulting to mass planting initiatives in inappropriate locations to achieve scale.

To ensure long-term success, restoration efforts should follow best-practice principles such as Ecological Mangrove Restoration (EMR) — focusing on restoring natural conditions rather than defaulting to mass planting initiatives in inappropriate locations to achieve scale.

Why Ecologically Restored Mangroves Survive and Function Better

Mangrove restoration works best when we restore the natural conditions that allow these forests to regenerate on their own. Instead of simply planting trees, it is more effective to ensure that water flows properly, the soil is healthy, and the area is connected to other coastal ecosystems. When these conditions are in place, mangrove propagules and seeds are naturally carried in by the tides and settle in the right locations, growing into diverse and resilient forests. These thriving ecosystems provide stronger coastal protection, better fish habitats, and long-term climate benefits. In contrast, planting trees in unsuitable areas often leads to weak, unhealthy forests that fail to deliver these important benefits.

Instead of simply planting trees, it is more effective to ensure that water flows properly, the soil is healthy, and the area is connected to other coastal ecosystems.



Restoring hydrological processes – as demonstrated in Guinea Bissau – is vital for carbon sequestration, natural regrowth, and long-term climate resilience. It helps ecosystems regenerate and adapt more effectively to changing environmental conditions. Keeping the land at a stable elevation is important to prevent habitats from collapsing due to rising sea levels and changes in land use. This highlights the need for science-based hydrological rehabilitation in restoration efforts.

ACTION 2

Rethinking Restoration Targets and Interventions

Traditional restoration targets often focus on the number of hectares planted or propagules distributed. However, this approach can lead to perverse incentives, where efforts prioritise short-term outcomes over long-term ecological success. Instead, restoration targets should be 1) **set by area based on reliable data and restoration potential and** 2) **measured against the area under effective restoration, and against the extent to which desired benefits for nature and people return**

and remain in place, ensuring that interventions result in self-sustaining, functional ecosystems rather than short-term tree cover.

For example, after the 2004 Indian Ocean tsunami, Sri Lanka launched large-scale mangrove restoration projects, but over 80% failed due to poor site selection, including planting in unsuitable water depths and areas where mangroves did not historically grow[3]. Similarly, in the Philippines, decades of mangrove rehabilitation efforts were often unsuccessful due to improper site selection, single-species plantations, and lack of post-planting management[4].

A shift is needed towards **evidence-based socio-ecological restoration and meaningful local community involvement.** Instead of focusing on large-scale planting, restoration efforts should address the root causes of mangrove loss, remove stressors, and promote natural regeneration whenever possible. Effective restoration requires a site-specific approach, considering factors such as hydrology, sedimentation, nutrient availability, salinity and habitat suitability. Additionally, broader threats - such as infrastructure development, coastal engineering projects and upstream interventions - must be considered, alongside socio-economic considerations like land tenure, policies, planning, and local livelihoods. **A one-size-fits-all approach is inadequate; restoration must be adaptive and tailored to each unique landscape.**

A well-defined Restoration Roadmap should guide interventions in three key steps. First, it is essential to identify and address the causes of mangrove loss, whether due to biophysical changes, such as disrupted water flow, coastal erosion, or changes in salinity, or socio-political factors, like weak policies, local dependence on mangrove resources, low enforcement capacity, or coastal development. Next, **restoring natural water flow and land elevation** to create the right conditions for mangroves to grow, ensuring they receive the appropriate tidal water and nutrients to thrive. Only then, if natural propagule supply is limited or sediment stabilisation is needed, should propagules be spread in hydrological channels to accelerate natural regeneration and introduce mangrove species beyond the initial pioneers. Care is taken to always avoid planting in non-mangrove habitats (such as mudflats). Faunal communities, such as crabs and gastropods, are also essential for ecosystem recovery. Ensuring connectivity to healthy sites not only facilitates natural recruitment and improves restoration success but also **promotes a holistic ecosystem approach.** Taking a seascape/landscape approach, rather than focusing solely on mangroves allows consideration of associated habitats, such as seagrasses and coral reefs, maximising resilience and long-term ecological benefits.

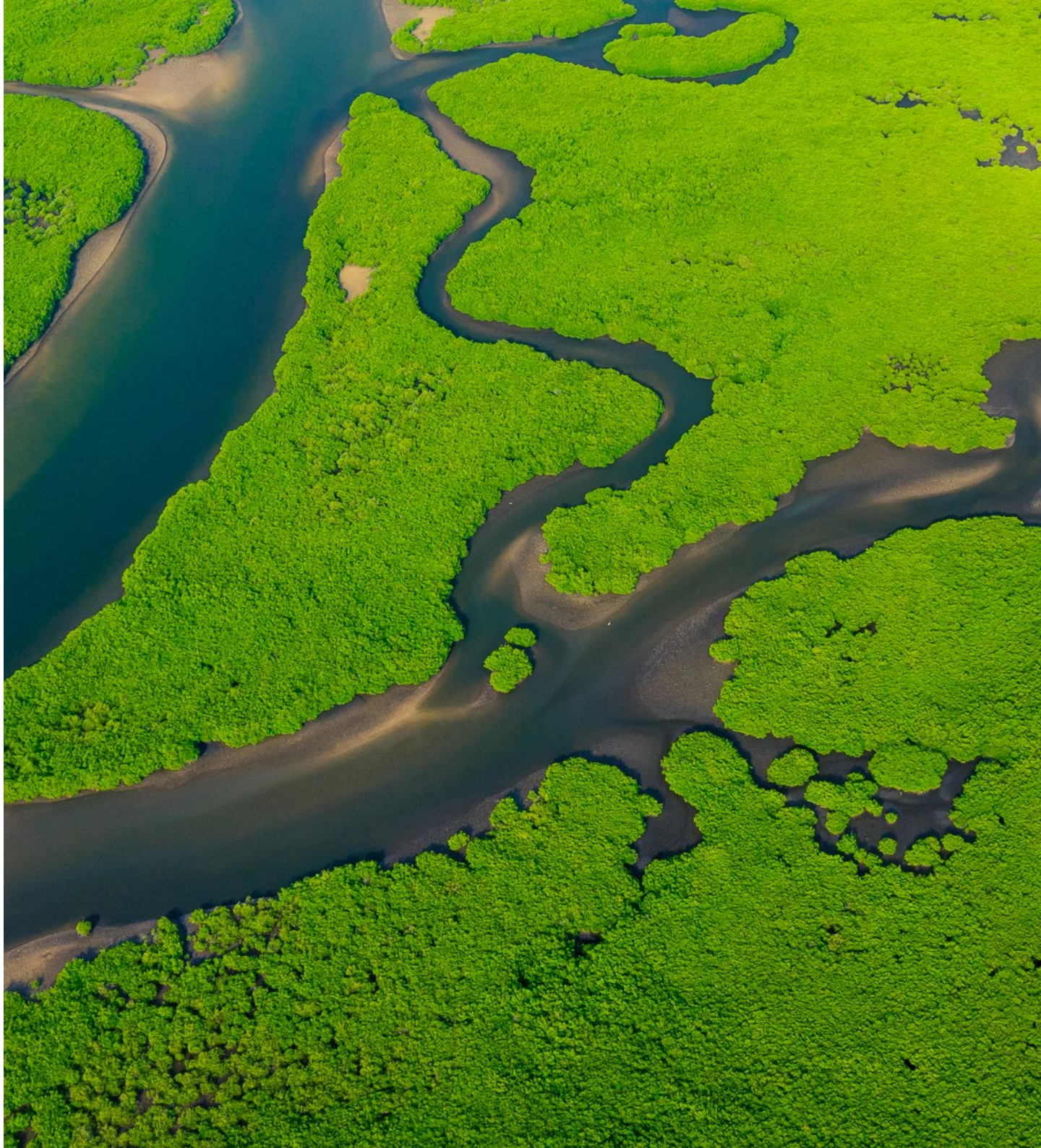
Effective restoration requires a site-specific approach, considering factors such as hydrology, sedimentation, nutrient availability, salinity and habitat suitability.

[3] Kodikara et al., 2017 Have mangrove restoration projects worked? An in-depth study in Sri Lanka: Evaluation of mangrove restoration in Sri Lanka.

[4] Primavera et al., 2011 Development and conservation of Philippine mangroves: institutional issues. Ecol. Econ.

2

Enhancing Climate Resilience and Disaster Risk Reduction



ACTION 3

Strengthening Policy Frameworks for Coastal Resilience

Policy-driven protection of coastal ecosystems is critical. For example, the Philippines' proposed **National Coastal Greenbelt Bill** demonstrates how legislation can drive large-scale ecosystem protection, mitigating storm damage and coastal erosion. Adopting and enforcing similar frameworks globally can enhance the role of mangroves in disaster risk reduction.

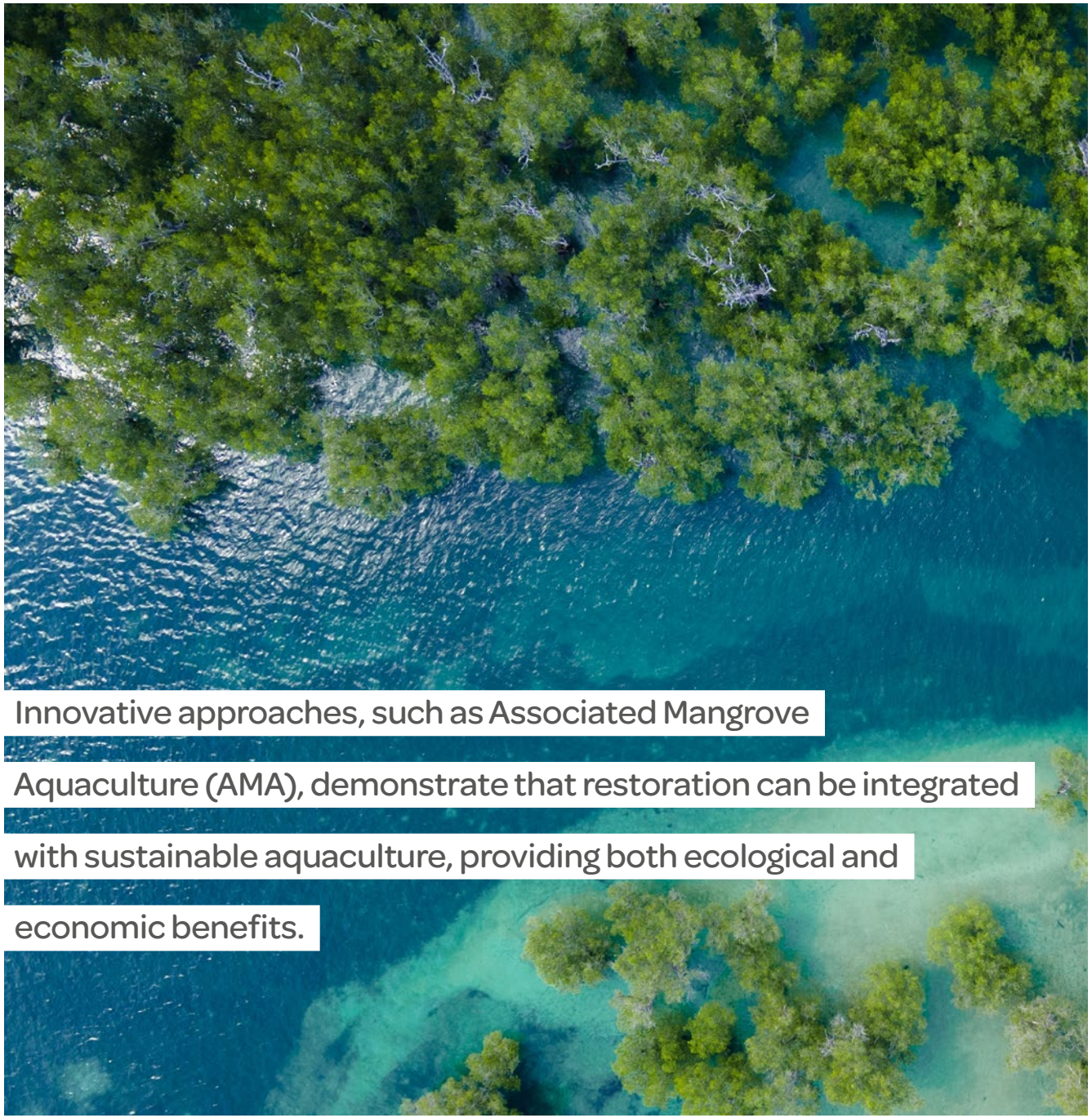
To further support decision-making, natural capital assessments and scenario development can help identify priority restoration areas where ecosystem services—such as storm protection, carbon sequestration, and fisheries support—are maximised. For instance, Belize's Integrated Coastal Zone Management Plan used these tools to protect and restore its coastal ecosystems, ensuring long-term resilience and sustainability. However, a significant gap remains in current policies and projects, as few incorporate climate change impact modeling and sea-level rise projections. This limits their ability to address future challenges and ensure the long-term viability of restoration efforts. A key recommendation from the conference is to integrate these critical elements into restoration planning. By identifying areas, often in the upper intertidal zone, that are likely to remain suitable for mangroves under changing climatic conditions, governments and stakeholders can proactively designate land for conservation and restoration. **This forward-looking approach ensures the continued provision of critical ecosystem services in the face of climate change.**

ACTION 4

Advancing Innovative Restoration Solutions

A hybrid approach that integrates nature-based solutions with engineered infrastructure can significantly enhance coastal resilience. Techniques such as **permeable breakwaters**[5], **bamboo fencing to trap sediment** can enable natural mangrove restoration to stabilise shorelines, reduce erosion, and facilitate sediment accumulation in degraded areas.

Innovative approaches, such as **Associated Mangrove Aquaculture (AMA),** demonstrate that restoration can be integrated with sustainable aquaculture, providing both ecological and economic benefits. In Indonesia, projects have shown that combining environmentally friendly aquaculture practices with restoration enhances fish production while simultaneously restoring degraded mangrove areas.



[5] Furukawa K, et al. 2019. A community based mangrove rehabilitation of high energy coasts in Pedada Bay, Philippines. Journal of Tropical Forest Research, 3, 36–53. https://www.wetlands.org/publication/technical-guidelines-permeable-structures/

ACTION 5

Driving Forward Scientific Research Efforts on Arabian Mangroves

Scientific knowledge on Arabian mangroves is limited and under-represented in global literature. Addressing knowledge gaps will help ensure that regional mangrove science is better communicated to inform management and conservation efforts.

Driving forward scientific research requires a dedicated research network and a holistic approach that can help facilitate the sharing of expertise, data, and resources, enabling a unified understanding of mangrove ecosystems and their adaptations to the extreme climate of the Arabian region.

Research could focus on various fields, including species diversity in mangrove habitats, fisheries and mangrove linkages, ecosystem functioning, and connectivity with adjacent habitats such as saltmarshes and seagrass beds. Research to understand how mangroves will adapt to future climate change impacts, such as sea-level rise and temperature, could help predict and mitigate impacts in this environmentally extreme region.

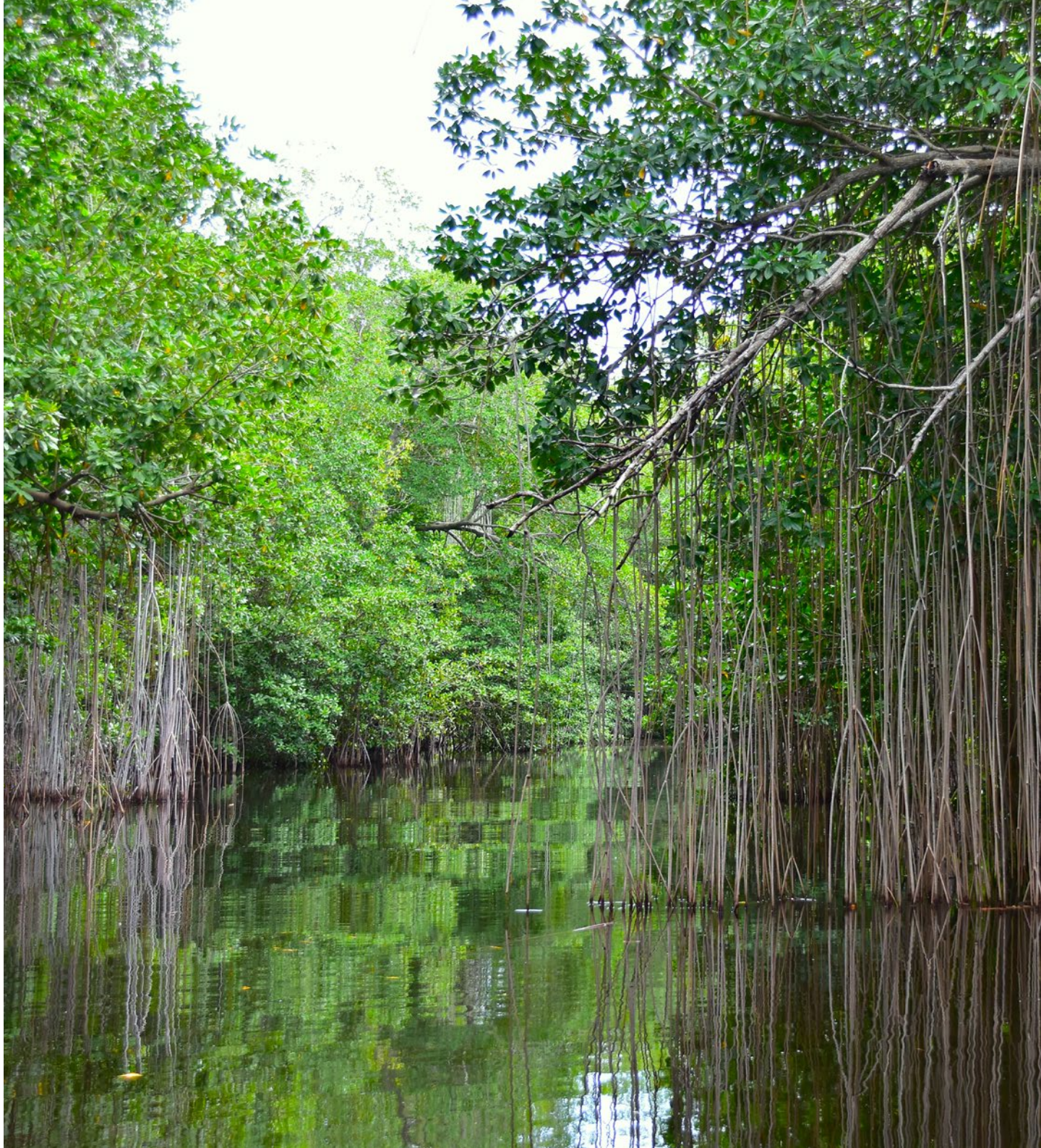
Restoration in the Arabian region has traditionally relied on planting, without sufficient data being collected to assess the results of these programmes. More studies at the local and regional levels are needed to assess the impact of existing or ongoing restoration programmes and develop regional indicators for assessing recovery and long-term benefits. The conference highlighted that successful mangrove restoration in the Arabian region should account for habitat variety and connectivity, focus on the establishment of a functional restored mangrove forest that is self-sustaining, and be science-based, planned and implemented according to published and peer-reviewed best practice.

Mangrove restoration differs from afforestation. Plantation programmes that have become commercial ventures in the region should be reconsidered and potentially regulated, particularly to assess whether they are beneficial and **to ensure they do not encroach on existing natural habitat or impact the natural regeneration of existing mangroves through excessive seed collection.** Habitat types such as saltmarsh and intertidal mudflats provide important ecosystem services and functions including carbon sequestration and supporting biodiversity by serving as key feeding and roosting areas for wading bird species and thus should not be converted to mangroves. The objective of any mangrove restoration program in the Arabian region should be to enhance recovery, restore hydrology and remove or reduce the source of pressures on coastal ecosystems instead of creating mangroves in areas where they did not previously occur.

Habitat types such as saltmarsh and intertidal mudflats provide important ecosystem services and functions including carbon sequestration and supporting biodiversity by serving as key feeding and roosting areas for wading bird species and thus should not be converted to mangroves.

3

Scaling Innovation and Strengthening Governance



ACTION 6

Driving Cost-effective Restoration through Innovation

Scaling up mangrove restoration requires cost-effective, innovative techniques. Approaches such as **modified dispersal centers**[6] and biodegradable materials for deep lagoon restoration offer scalable solutions that can be replicated in different ecological contexts. **Sargassum has shown promise as a compost** for promoting mangrove seedling growth in Jamaica. This innovative use of Sargassum offers a sustainable solution for managing persistent inundations while supporting mangrove restoration and addressing the challenges faced by coastal communities affected by these blooms.

In high-impact areas, such as typhoon-prone regions of the Philippines, science-based assisted natural regeneration[7] (planting) has been used —guided by clear methodologies that ensure survival and ecological integration.

[6] Trench, C. *et al.* 2022. *Application of Stranded Pelagic Sargassum Biomass as Compost for Seedling Production in the Context of Mangrove Restoration.* Frontiers in Environmental Science

[7] Primavera *et al.*, 2012. *MANUAL ON COMMUNITY-BASED MANGROVE REHABILITATION Mangrove Manual Series No.1,* 17.

ACTION 7

Enhancing Monitoring for Long-term Success

A major challenge is securing the resources needed to continue monitoring beyond a project's funding lifespan. On average, mangrove restoration projects are monitored for less than 5 years, which is generally not sufficient for mangroves to reach maturity. However, blue carbon crediting programmes require monitoring for the lifetime of the crediting period (20+ years) and in some cases beyond to ensure permanence of any carbon removals claimed, with the expectation that carbon finance be used to cover those costs. Planning and budgeting for long-term monitoring is key to success.

The development of remote sensing, AI-driven data analysis, and community-based monitoring have the potential to transform how mangrove restoration success is measured. However, true success cannot be determined by short-term survival rates alone. **Restoration efforts must adopt a long-term perspective, using well-defined indicators that capture both ecological and socio-economic outcomes.** Key metrics should include biodiversity recovery, sustainable livelihoods that reduce pressure on mangroves, and the restoration of ecosystem services such as flood protection and carbon sequestration. While vegetation may regrow within five years, the full recovery of ecosystem functions can take decades. **Monitoring frameworks must move beyond simple tree counts to assess overall ecosystem health, ensuring adaptive management and long-term resilience.**

Remote sensing tools for monitoring mangroves, such as The Global Mangrove Watch provides near real-time information on where and what changes there are to mangroves across the world, giving coastal and park managers, conservationists, policymakers and practitioners the evidence needed to respond to illegal logging, pinpoint the causes of local mangrove loss and track restoration progress. The Global Mangrove Watch has also developed a universal reporting toolkit, The Mangrove Restoration Tracker Tool (MRTT) for monitoring that allows projects to record information throughout the lifetime of a mangrove restoration project. This includes details about the site background and pre-restoration baseline, the restoration interventions and project costs, and post-restoration monitoring, which incorporates socio-economic and ecological factors.

Remote sensing tools for monitoring mangroves, such as The Global Mangrove Watch provides near real-time information on where and what changes there are to mangroves across the world, giving coastal and park managers, conservationists, policymakers and practitioners the evidence needed to respond to illegal logging, pinpoint the causes of local mangrove loss and track restoration progress.

Examples of Indicators for Mangrove Restoration Projects [Adapted from Cadier *et al.* (2020)]

Atttribute Category	Sub-attribute Category	Indicator
Structural diversity	Vegetation community structure	Percentage of the site covered by natural recruitment after hydrological restoration, or percentage of planted trees that have survived.
		Number of plant species compared to reference sites.
		Natural recruitment of trees occurring within the project area with seedling density at or above levels in reference sites.
	Faunal community structure	Number of faunal species and density of individuals of species (species richness and abundance) compared to reference sites.
	Bacterial community structure	Bacterial diversity and distribution comparable reference Sites.
	Algal structure	Algal diversity and distribution comparable to reference sites.
Ecosystem function	Provisioning ecosystem services	The levels of natural resources being generated from the project area leg.. alternative ivelihoods developed, fish stocks and biodiversity values increasing).
	Carbon storage ard primary productivity	The level of carbon storage in sediments and biomass is increasing at the target rate.
	Nutrient levels	Nutrient levels are within natural ranges found in reference sites.
	Sediment dynamics	Erosion rates are comparable to reference sites.
Species composition	Vegetation diversity and distribution	Number of vegetation species present, percentage area cover, and distribution of species. compared to reference sites.
	Fauna diversity and distribution	Fauna species richness/diversity compared to reference sit4 threatened species presence.
	Bacterial diversity and distribution	Bacterial genetic diversity
Physical conditions	Soil	Soil physiochemical conditions are similar to reference sites.
	Water	Water physiochemical variables are similar to reference sites,
Absence of threats	Pollution	Pollution levels comparable to reference sites.
	Biological	Biological threats (e.g., invasive species, pathogens) are absent from the restoration area.
	Exploitation by people	Extraction of resources is sustainable compared to the baseline or reference sites.
External exchanges	Linkages and connectivity for hydrology and tidal inundation	Hydraulic connectivity has been restored and is similar to reference sites

ACTION 8

Empowering Communities and Strengthening Governance

Successful mangrove restoration depends on local communities. Experiences from Indonesia[8], Kenya, Mexico, and Guinea Bissau[9] demonstrate that involving communities from planning to implementation leads to long-term project sustainability.

Livelihoods diversification—such as via sustainable fisheries and eco-tourism—can ensure that communities are active stakeholders in mangrove conservation and restoration programmes, with clearly defined land ownership and use rights that empower them to manage and benefit from these ecosystems sustainably as pieces of a long-term puzzle.

Governments must also play a role in integrating mangrove conservation into national policies and developing a stronger regulatory framework governing restoration practices. **Political will and legislative support** are needed to secure financial and regulatory backing for large-scale restoration.

Finally, **capacity building and knowledge exchange are critical**. Strengthening local to global partnerships will accelerate restoration through improved technical training, data sharing, and policy alignment.

[8] Wetlands International (2024). *Demonstrating and upscaling Ecological Mangrove Restoration in North Kalimantan, Indonesia.* Available from: Demonstrating and upscaling Ecological Mangrove Restoration in North Kalimantan, Indonesia - Wetlands International

[9] Wetlands International (2024). *Large scale implementation of best practice mangrove restoration in Guinea Bissau.* Available from: Large scale implementation of best practice mangrove restoration in Guinea Bissau - Wetlands International

ACTION 9

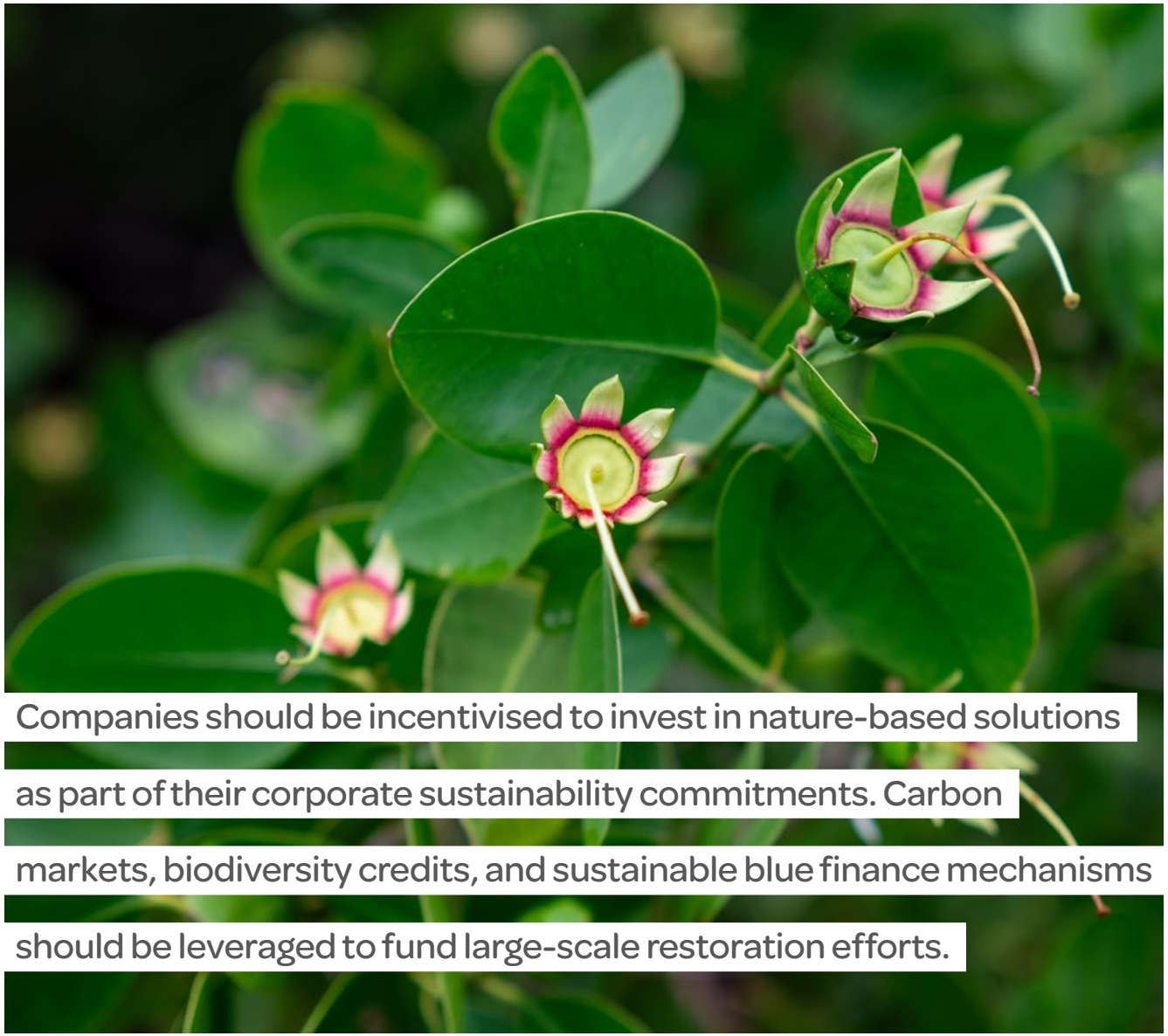
Bridging the Finance and Implementation Gap

A major theme of the conference was the need to scale up financing. The Mangrove Breakthrough (MB)—introduced at COP27—seeks to mobilise $4 billion for mangrove conservation and restoration, bridging the gap between local practitioners and global financial mechanisms. While voluntary carbon markets play a role, the panel discussions stressed the importance of valuing the full suite of ecosystem services that mangroves provide, beyond just carbon sequestration. The reality is stark: **$8 trillion in investment is needed to tackle the biodiversity crisis, and annual financing for nature must quadruple by 2050.** Small-scale projects alone cannot meet this challenge—scaling up investment is key.

ACTION 10

Incentivising Private Sector Engagement

The role of the private sector in mangrove conservation must be significantly expanded. Companies should be incentivised to invest in nature-based solutions as part of their corporate sustainability commitments. Carbon markets, biodiversity credits, and sustainable blue finance mechanisms should be leveraged to fund large-scale restoration efforts.



NEXT STEPS

A Unified Commitment to Mangrove Protection

This conference marks the continuation of a global movement to protect and restore mangroves. Through collaborative science, policy innovation, and inclusive community engagement, we can ensure that mangroves continue to provide their critical services to people and nature.

We call on governments, private sector leaders, research institutions, and civil society to:

1. Commit to ambitious, success based mangrove conservation and restoration as a nature-based solution for mitigation and adaptation.
2. Integrate mangrove conservation and restoration into national and regional climate mitigation, adaptation, disaster risk reduction and biodiversity conservation policies.
3. Focus on protecting and conserving existing mangrove forests as the first and most effective step in restoration.
4. Ensure that restoration efforts enhance biodiversity and ecosystem functionality.
5. Adopt science-based, community-led ecological restoration as the cornerstone of mangrove recovery efforts, moving beyond mass monoculture planting toward approaches that restore ecosystem functionality. By integrating the latest scientific insights[10] and actively involving local communities, restoration efforts can achieve greater long-term success, aligning with the six guiding principles of the Best Practice Guidelines for Mangrove Restoration[11] and the High-Quality Blue Carbon Practitioners Guide[12].
6. Support innovation by allocating dedicated funding for long-term monitoring, data collection, and restoration techniques, while also leveraging additional costs for pioneering approaches to mangrove restoration and facilitating their transition into mainstream application.
7. Scale up funding for community-led restoration efforts that prioritise local livelihoods and ecological sustainability.
8. Promote private sector investment in nature-based solutions.
9. Strengthen global cooperation and knowledge sharing through initiatives such as the Mangrove Breakthrough, The Global Mangrove Alliance and The Abu Dhabi Mangrove Initiative.
10. Actively engage in the World Network of Biosphere Reserves, which spans 759 sites across 136 countries and covers 7.67 million km² — home to over 300 million people. Expanding and effectively managing coastal Biosphere Reserves is crucial to restoring the balance between humans and nature. Strengthening participation in this global network enhances biodiversity, combats climate change, reduces pollution, and supports sustainable development.
11. Foster regional and international collaborations to scale up impact.

[10] Wetlands International (2024). Video series "How to effectively restore mangroves" Available from: Mangrove Restoration Series. - YouTube

[11] The Global Mangrove Alliance (2023). The Best Practice Guidelines for Mangrove Restoration Available from: https://www.mangrovealliance.org/best-practice-guidelines-for-mangrove-restoration/

[12] Ocean Risk and Resilience Action Alliance (2025). High-Quality Blue Carbon Practitioners Guide. Available from: https://oceanriskalliance.org/resource/launching-the-high-quality-blue-carbon-practitioners-guide/

هيئة البيئة - أبوظبي
Environment Agency - ABU DHABI

مبادرة القرم أبوظبي
Abu Dhabi Mangrove Initiative