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# Mangroves: Nature-based Solutions for Climate Adaptation

dare

# About Dare

Dare is an energy technology company, generating liquidity and value across global commodities markets. We combine deep trading expertise with proprietary technology utilising the power of data science to be the best-in-class.

Our understanding of the dynamics and counterparty requirements in volatile, data-intensive markets, is a key part of our edge.

We are extending our trading expertise into new geographies and connected commodities markets.

# Acknowledgements

Special thanks to our CEO Ayman Rahman for his dedication to the conservation of mangrove habitats. With his support, we have not only accelerated our efforts in safeguarding these vital ecosystems but also fostered strong partnerships with grassroots movements to create a positive and lasting impact.

We would also like to extend our sincere gratitude to Maksudur Rahman and the team from the Bangladesh Environment and Development Society 'BEDS'. Our partnership comes at a critical juncture where the need for community-led restoration has never been more pronounced.

Finally, we would like to recognise Nomita Mondol (pictured right) for her outstanding efforts. Nomita is one of the first women within the Khulna district to have established their own mangrove nurseries, defying societal expectations and empowering other women in the local community.



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# I ntroduction

Mangrove forests are located in the space where land meets sea. You can think of them as living between two worlds.

These unique and diverse ecosystems, characterised by salt-tolerant trees and shrubs, form dense habitats along tropical and sub-tropical coastlines, including parts of Africa, Asia, Australia, the Americas and the Pacific Islands.

Although not the only trees to withstand brackish waters, mangroves are uniquely adapted to thrive in intertidal zones where seawater and freshwater mix. Their waxy leaves help minimise salt absorption, allowing them to maintain a delicate balance of salinity within their tissues.

However, as an amphibious ecosystem, the mangrove has suffered from the impacts of both land and sea.

The sea poses formidable challenges, with erosion, storms and rising sea levels threatening the natural defence infrastructure provided by mangroves.

On the other hand, human activities such as deforestation, shrimp farming and mis-management of water resources exerts adverse effects on these critical ecosystems.



*Mangrove roots exposed to air during low tides*

It's estimated that more than half of the world's GDP – equivalent to USD ~58 trillion – is moderately or highly dependent on nature.

Spanning 14,070,000 hectares of land globally, mangroves forests are among the world's most economically valuable ecosystems.

# Ecosystem benefits

Beyond their adaptations to salinity, mangroves serve as crucial ecosystems to their surrounding areas.



## Carbon sequestration

Mangroves can store up to 4 times the amount of carbon as terrestrial trees.



## Biodiversity

Mangrove areas serve as a critical refuge for many species that have lost their original habitats.



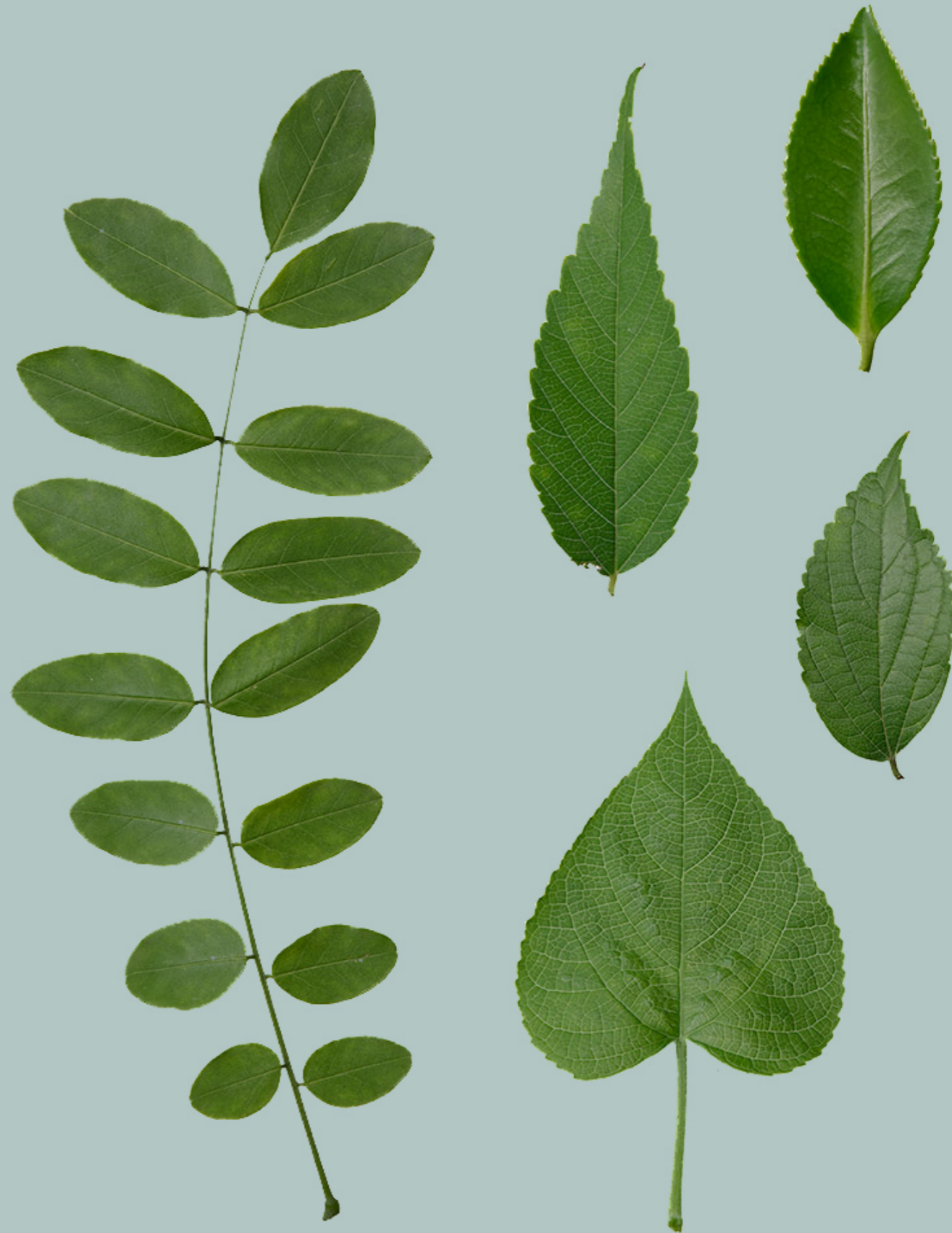
## Coastal defence

During storm surges and tsunamis, mangroves can significantly reduce the impact of waves on the coast.



## Provision of food and timber

Mangrove forests are considered a home to a large variety of fish, crab, shrimp and mollusc species.



# Mangrove loss and degradation

The United Nations 'UN' has declared 2021-2030 as the Decade of Ecological Restoration. For mangrove projects around the world, this has served as a rallying call in the fight against the escalating threats of mangrove area decline.

Whereas these forests once covered more than 20,000,000 hectares of coastal lands, they are now at risk of disappearing entirely within the next 100 years.

The Sundarbans – one of the largest of such forests – is undergoing extensive degradation of the health of its ecosystem and fragmentation of its landscape, which results in mangrove area decline, water and soil salinisation and loss of flora and fauna.

On a global scale, the rate of mangrove loss surpasses that of tropical rainforests or coral reefs, yet it often receives considerably less attention.

## Papua New Guinea (PNG)

In PNG and other Melanesian countries, the driving forces behind mangrove losses include:

- Shrimp aquaculture
- Overharvesting for timber
- Unsustainable fishing
- Conversion to development and coastal infrastructure e.g. ports



Since mangrove forests can store up to 4 times the amount of carbon than tropical forests – this is amongst the highest capacity of all blue carbon ecosystems – deforestation presents a significant risk to reducing and managing carbon emissions.

Under a business-as-usual scenario – where nothing is done to mitigate this risk – one study predicts that global emissions from mangrove loss could reach 2,391 Tg CO<sub>2</sub> by the end of the 21<sup>st</sup> century – the equivalent of 515,186,935 gasoline-powered passenger vehicles driven for one year.

And the negative effects do not stop there - where mangroves are removed to accommodate the rapidly expanding aquaculture industry, the threat to biodiversity becomes profound. Shrimp farms – which are linked to as much as 38% of global mangrove deforestation – require large amounts of water and are consequently found alongside rivers and estuaries. During the conversion of wetlands to shrimp farms, seawater is diverted inland to supply their ponds.



*Branches of dead mangrove trees*

This disturbs the balance between freshwater and seawater, to the point that tensions between rice and shrimp farmers have grown considerably over the years.

Korunamoyee Sardar – a local protestor who remains a symbol of the struggle for indigenous rights.

In the village of Harinkhola in Polder 22, Bangladesh, resistance to the expansion of the aquaculture industry was so acute that it led to the death of

# The Bangladeshi Sundarbans

In the river deltas of southern Bangladesh, rising sea levels have forced farmers to abandon their rice crops in droves and they have had to find other ways to make a living.

Instead, shrimp farms – which are endorsed by the Bangladeshi government and a host of development organisations including The World Bank – have taken precedence.

***“This shouldn’t be surprising. For many who reside near the coast, the aquaculture industry is their only source of income.”***

***- Maksudur Rahman, BEDS.***

The Food and Agriculture Organization ‘FAO’ of the UN estimate that about 4.5 million tonnes of farmed marine shrimp entered the international trade in 2019 – that is more than the amount caught by fishing.





In the south of Bengal, BEDS has adopted a community-led approach to restoring mangroves.

They work alongside local people to develop appropriate disaster and risk management protocols that protect both nature and communities. In addition to providing training and education on ecosystem management, BEDS equip locals with the resources to be able to grow their own mangrove nurseries independently.

BEDS has been actively involved in projects related to mangrove conservation and restoration in Bangladesh, particularly in the Sundarbans region, which is one of the world's largest mangrove forests and a UNESCO World Heritage Site. Their efforts aim to protect the rich biodiversity of the Sundarbans and the livelihoods of the local communities who depend on its resources.

Before pursuing any conservation project, BEDS begin by engaging the local people and organising a series of educational workshops.

This bottom-up approach fosters a sense of ownership and stewardship among the local people and communities, inspiring them to be active partners in preserving their environment for future generations.



# W

## omen and climate action

The climate crisis is not gender neutral. Women and girls experience more of its impact, which amplifies existing gender inequalities and poses unique challenges to their livelihoods, health and safety.

Particularly in developing countries, coastal communities are directly dependent on products and services gained from mangrove forest ecosystems including shellfish, timber, algae etc.

With mangrove forests acting as a lifeline for these communities, their disappearance translates into reduced access to essential resources, thereby affecting women's ability to support their families and secure livelihoods.

Moreover, as traditional roles often assign women the responsibility of water and food collection, the loss of mangroves disrupts these practices and forces women to travel greater distances to find resources, exposing them to additional risks and vulnerabilities.

- Women make up nearly half of the agricultural labor force in developing countries.
- When provided the same resources as men, women can increase agricultural yields by 20-30%, reducing hunger by 12-17%.
- In the Global South, 90% of women take the lead in feeding and running their homes.
- In regions where salinity in water sources exceeds 3 grams per litre, women are 40% more likely to develop hypertension compared to areas with lower salinity levels.
- Over the period 1981–2002, a sample of 141 countries found that in unequal-gender societies, more women die from disaster events than men.

# NOMITA MONDOL



Since starting her mangrove nursery, Nomita Mondol has seen great improvement to her life and community. Income earned from raising mangrove seedlings has helped her make improvements to the structural integrity of her home - which is especially important given the number of cyclones that take place in Bangladesh - and pay off her remaining debts.

But Nomita is more than just a success story. She represents resilience, determination and the spirit of environmental stewardship. Defying gender norms, Nomita demonstrates that women can be powerful agents of change in environmental conservation.

Although Nomita initially received training under BEDS' guidance, she now currently oversees the management of her mangrove nursery independently.

But in an environment where economic concerns outweigh other considerations, Nomita initially faced a lot of resistance from the local community.

Raising mangrove seedlings was seen as a secondary or less significant activity compared to other livelihood options that promised more immediate financial gains.

However, as a champion of climate adaptation, Nomita continued to advocate for the importance of restoring mangrove habitats. As a result, five more self-sufficient mangrove nurseries were set up by locals, who were inspired by Nomita's dedication and the growing awareness of the importance of mangrove restoration in the community.

When we first met Nomita in Bangladesh, she had just endured the devastating aftermath of Cyclone Sitrang. The cyclone's destructive force had left a profound impact on her and the community, resulting in the devastating loss of 15,000 of her seedlings in the nursery.

Despite this immense setback, Nomita's resilience and determination remained unwavering as she committed herself to rebuilding her nursery and continuing her mission to restore mangrove habitats.

In fact, during periods of high tides, Nomita has developed her own methods for protecting the mangrove seedlings. Seedlings are usually just a few inches tall and may have only a few leaves. At this stage, they are vulnerable and require specific conditions, such as proper water levels and salinity, to survive and establish themselves in the mangrove habitat.

Her journey from a learner to an empowered leader reflects the lasting impact of organisations like BEDS, which equip women with the tools and knowledge to take charge of their own futures and contribute to the protection of valuable natural resources.

Nomita is currently saving a portion of her income towards building a shelter for her mangrove seedlings.

# Looking forward

Globally, there are over 80,000 hectares of coastal land where mangroves have been lost but where restoration may be possible, with over two-thirds of these being highly restorable.

Mangrove restoration can support the implementation of many international agreements, such as:

- Paris Agreement to the United Nations Framework Convention on Climate Change
- Aichi Targets 14 and 15 to the Convention on Biological Diversity Implementation of the Convention on Wetlands
- Sustainable Development Goal 14 (Life Below Water) and 13 (Climate Action)

Dare is committed to supporting nature-based solutions that improve both environmental health and the overall livelihoods of communities most affected by climate change.

In partnership with BEDS, we are dedicated to securing a sustainable future for the region.



An aerial photograph of a tropical island. The island is covered in a dense, vibrant green forest. The water surrounding the island is a clear, bright turquoise color, showing some darker patches that might be coral reefs or sandbars. The overall scene is lush and serene.

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