earth security

FINANCING THE EARTH'S ASSETS

THE CASE FOR MANGROVES AS A NATURE-BASED CLIMATE SOLUTION

Content

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Earth Security guides investment decision-makers to align global capital with the value of the Earth's assets.

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EXECUTIVE SUMMARY
WE NEED TO MOVE FASTER AND BE BOLDER IN INVESTING IN NATURE'S ASSETS

There is a window of opportunity to think on a bigger scale about the role of nature-based solutions in the fight against climate change. This report presents the business case and the practical proposals to mobilise global finance for nature-based climate solutions, alongside the creation of more agile institutions that can help align global economic development with the value of natural assets.

Mangroves are dense coastal forests covering the planet's tropical and sub-tropical belt. They are one of nature's most productive carbon assets, and can sequester carbon up to 400% faster than land-based tropical rainforests. They are a vital asset for companies, investors and countries to deliver 'net-zero' carbon commitments, while halting the runaway extinction of biodiversity.

The value of mangroves goes well beyond carbon. By acting as protective coastal barriers to cities, they save an estimated USD 65 billion a year in storm and flood damages.

They also provide breeding grounds for thousands of commercially-fished marine species that sustain local economies, particularly in Asia. But for all their worth, 50% of the world's mangrove assets are already gone.

What remains is disappearing quickly under the weight of unsustainable urban pressures and of investment models in agriculture, aquaculture and infrastructure that do not recognise their value. This report provides the evidence to guide investment decision-makers to embed these values in these investments to achieve greater resilience.

Mangroves dancing in the sunset in Walakiri Beach in East Sumba, Indonesia.
Harry Pieters / Mangrove Action Project

EXECUTIVE SUMMARY
A STEP-CHANGE IN NATURE INVESTMENT

Section 1

There are over 700,000 hectares of restorable potential for mangroves globally. We estimate that the investment needed to fully restore mangroves on this global scale is USD 11.1 billion over a 20-year period.[1] **A regeneration on this scale could capture 380 million tCO_2 by 2040.**

Just 25 countries account for most of the remaining mangroves, as well as its restorable potential. They should be seen as 'sovereign natural asset owners'. Indeed, they can leverage the value of their mangroves to meet their own decarbonisation targets or use them to earn income through carbon trading — especially as emerging bilateral carbon trading agreements that are expected to play a greater role in global decarbonisation.

However, in order to benefit, these governments must recognise the value of their mangrove stocks in their **Nationally Determined Contributions** (NDCs), as they update these for COP26 in 2021.

Section 2

Section 2 concludes that the current price of carbon in voluntary markets is not high enough to deliver the financing that is needed for conservation and regeneration at scale. The carbon price must at least double to USD 29/tCO_2.

At a carbon price scenario of USD 60/tCO_2, roughly four times today's price, the investment in full regeneration of mangroves could return a profit of USD 11.8 billion over 20 years. In the short-term, project developers and intermediaries should focus on creating a premium price for blue carbon. This can be done by reflecting tangible values that mangroves provide 'beyond carbon' — for example in climate adaptation, as this report describes in more detail.

There also needs to be greater market transparency, which builds the confidence of investors that the funds are reaching conservation projects on the ground. This section provides an important input for the **Task Force for Scaling Voluntary Carbon Markets**. Nature-based carbon must trade at price levels that can generate the funding needed to sustain ecosystem regeneration activities and outcomes.

Section 3

Section 3 quantifies the financial value that mangroves offer to investors. It provides a framework that can be directly embedded into investment decision-making, illustrated with a case study we developed in collaboration with CDC Group.

The investment made by a wind power project in Pakistan to restore mangroves on site could return 20 times the value in the protection of physical assets against coastal erosion, saving the project developer and its investors up to USD 7 million over the project's 25-year timeframe. The materiality of mangroves to investment supports the work of the **Task Force for Nature-related Financial Disclosures** (TNFD) in 2021.

This section explores further ways to invest in mangroves, in particular focusing on opportunities for nature-based investment funds; the issuance of blue bonds; the development of insurance and reinsurance products; carbon markets; and the use of strategic philanthropy.

Section 4

In Section 4, we identify 40 locations around the world, which together account for close to 70% of global mangroves still standing, and outline a global solution. We envision an agile institution that can move faster in aggregating conservation and regeneration efforts across the planet's last mangrove frontier.

These locations include a diverse group of cities, from Jayapura in Indonesia, to Miami in the US, Brisbane in Australia, Belem in Brazil and Puerto Princesa in the Philippines. Despite their enormous differences, these cities can all use mangrove assets to cost-effectively increase their climate resilience.

We recommend the creation of the **Mangroves 40 Cities Network** (M40 Cities) to act as a global safety net that coordinates the collective action of their mayors, accelerates knowledge and replication on regeneration projects and pathways — such as city masterplanning and the use of mangroves as green infrastructure — and, crucially, facilitates the aggregation and allocation of municipal financing.

Section 5

To drive financing to these cities, we propose a mangrove-themed municipal fund for climate adaptation. Such a fund would mobilise financing for mangrove regeneration on a global scale while spreading investment risks.

We document examples of green municipal finance being used for mangrove regeneration. However, financing for adaptation remains less than 5% of total climate finance for cities. Green municipal bonds, a financial product that is familiar to investors, offer a way forward. A **Municipal Mangrove Bond Fund** could give municipalities access to finance for projects involving mangrove regeneration and cost-effective green infrastructure, and enable them to provide blue carbon offsets.

Such a fund would provide access to the 40 municipal locations holding mangrove stock globally, from Miami to Mongla (in Bangladesh). The varying levels of municipal creditworthiness in this diverse group would enable the fund to spread risk across developed and emerging markets, and create a product suitable for global fixed income markets.

EXECUTIVE SUMMARY
A CALL TO ACTION

The report is a call to action to invest in mangroves as a global asset. It sets out the business case; multiple pathways to integrate their value into investment decisions; and innovative proposals that could align global investment with the protection of this global natural asset.

The recommendations in Section 5 offer practical steps for various types of investors. This section outlines specific roles and actions that can be taken by philanthropists, banks, investors, companies, insurers, reinsurers, and global climate funds to take these recommendations forward.

We encourage leaders and decision-makers in these institutions to use this report to advocate internally and to pursue at least one of the recommended actions for their sector throughout 2021.

Earth Security engaged with more than 100 people in 60 institutions across finance and investment, policy and conservation science. The consultation involved interviews and webinars with champions and leaders from banks and investment funds, insurance and reinsurance, multilateral finance and development finance institutions, conservation NGOs and foundations active in nature financing, municipal mayors in climate vulnerable regions, and carbon project developers and intermediaries.

Such is the diversity of the ecosystem needed to bring about a step-change in nature investment.

We have worked closely with our sponsors, the Swiss Agency for Development and Co-operation, HSBC, the UBS Optimus Foundation and CDC Group. We are grateful for their support for our 2020 programme and their partnership. The views and opinions expressed in this report remain solely those of Earth Security.

Mangroves and coral reef in Southeast Misool, Raja Ampat, Indonesia.
Burt Jones / Maurine Shimlock
Secret Sea Visions / Mangrove Action Project

1

MANGROVES AS AN ASSET

Aerial view of the largest mangrove forest in the world in the Sundarbans, Bangladesh. Mahmud Alam/Shutterstock

1.1
KEY FACTS: A VALUABLE GLOBAL ASSET

Mangroves are one of nature's carbon sequestration powerhouses — fixing carbon through their roots underwater. But their value goes far beyond carbon. They can be up to 50 times more cost-effective than cement seawalls at protecting coastlines against extreme weather and they are a safe breeding ground for thousands of marine species that support local economies.

1
A carbon sequestration powerhouse

Every year, mangroves sequester 32 million tonnes of carbon.[2] Worldwide, restoring deforested mangroves could store an extra 380 million tonnes of carbon over 20 years: 61 million tonnes in above-ground biomass and 319 million tonnes of soil organic carbon.[3]

The world's mangrove forests hold around 4.2 billion tonnes of carbon.[4] Destroying them releases more CO_2 per hectare than any other type of deforestation.[5] In the Dominican Republic, converting one hectare of mangrove forest to shrimp farming releases the same level of CO_2 emissions as converting 11.5 hectares of tropical dry forest to cattle pasture.[6]

Between 2000 and 2012, global carbon emissions due to mangrove clearance may have been as high as 317 million tonnes, or 24 million tonnes annually.[7] Together, Indonesia, Malaysia and Myanmar accounted for 77% of the global loss in mangrove organic carbon stock loss over this period.[8]

" In 2017, mangroves prevented USD 1.5 billion in flood damages in Florida, protecting over half a million people during Hurricane Irma. Damages were 25% lower in counties where mangroves were present." [25]

2
A protective shield against weather extremes

100 metres of mangrove forests along the coast can reduce the intensity of tidal wave energy by almost 70%, and contain the flooding depth of a tsunami by 30%.[9] Mangroves are at the frontlines of coastal protection: in tandem with coral reefs and seagrass, they reduce the power of tidal waves and storm surges, containing coastal erosion.

Without mangroves, flood damages globally would cost an additional USD 65 billion, and 15 million more people would be at risk of floods each year.[10] They are cost-effective structures for coastal protection, which could yield USD 1 trillion in net benefits between 2020 and 2030 for climate adaptation.[11]

Mangroves are a key asset for climate vulnerable countries: in the Philippines, they reduce annual damages to property from extreme weather events by 28%, saving up to USD 1 billion. In Florida, mangroves prevented USD 1.5 billion in flood damages and protected over half a million people during Hurricane Irma in 2017. In counties where mangroves were present, damages were 25% lower.[12]

3
A safe breeding ground for marine biodiversity

Mangroves provide breeding grounds for marine biodiversity. 80% of global fish populations depend on healthy mangrove ecosystems.[13] In South East Asia, some commercial prawn species are entirely dependent on mangrove forests to survive.[14] Over the past 20 years, global aquaculture production has expanded by 50% and shrimp aquaculture is now the world's fastest-growing protein source.[15]

In Vietnam, shrimp farmers more than doubled their income by adopting integrated mangrove-shrimp farming practices.[16] These practices use mangroves to increase the productivity, profitability and resilience of shrimp farms. In the Gulf of California, Mexico, each hectare of mangrove generates up to USD 50,000 a year in mangrove-associated fish and blue crab, bringing an estimated USD 19 million in income annually to local fishers.[17]

The largest mangrove ecosystem in the western hemisphere, the Everglades National Park in Florida, USA, generates USD 135.5 million/year in tourism revenues, supporting nearly 2,000 local jobs.[18] In the six countries of the so-called 'Coral Triangle' in the Pacific Ocean tourism was expected to quadruple in value by 2025 as a result of the demand for eco-tourism, in estimates drawn before the Covid-19 pandemic.[19]

4
An infrastructure for water and food security

Few people associate mangroves with freshwater and food security. However, mangrove depletion is a key driver of saltwater intrusion in coastal agricultural regions. The salinisation of groundwater occurs when overuse of groundwater is coupled with seawater encroaching into land due to coastal erosion. The salinisation of soil is a major threat to global food production.

Densely populated delta regions that rely on agriculture will be most affected by mangrove loss – this includes countries such as Vietnam, India and Bangladesh.[20] 50% of Vietnam's population and most of its best agricultural land are in the Red River and Mekong River deltas. In Bangladesh's coastal belt, home to 35 million people, 105.6 million hectares of arable land are affected by salinization, with levels of salinity on course to increase between now and 2050, in some areas by nearly 70%.[21]

In the lower Mekong Delta in Vietnam, saline intrusion affects 100,000 hectares of paddy rice fields every year, out of a total 650,000 hectares. In 2015, farmers lost USD 45 million to salinity.[22] Saltwater intrusion is expected to hit agricultural yields in coastal areas of Africa, which account for 9% of the continent's rice production.[23] Saltwater intrusion can also undermine the integrity of buildings and infrastructure, increasing maintenance and repair costs. In coastal Bangladesh, spending on road maintenance could rise by as much as 252% due to increased salinity.[24]

CASE STUDY

AN INTEGRATED NATURE-BASED SOLUTION: CARBON, CLIMATE RESILIENCE, WATER & FOOD SECURITY

Aerial view of mangrove forest in the Saloum Delta National Park, Joal Fadiout, Senegal. Curioso.Photography / Shutterstock

In Senegal, the NGO Océanium and the food company Danone partnered in 2009 on what has become one of the world's largest mangrove regeneration projects.

The project has replanted 10,000 hectares with 79 million mangrove trees, mobilising 350 local villages and 200,000 local people. The Livelihoods Fund provided USD 4 million in upfront funding for project preparation, replanting and scientific validation and will finance project monitoring and evaluation until 2029.

The new trees will store 600,000 tonnes of carbon over the project's 20-year lifespan, which Danone — and now other companies investing through The Livelihoods Fund — can use to reduce their global carbon footprint while having a significant local impact.

The protection the mangroves offer against saltwater intrusion is helping communities rehabilitate abandoned rice fields, strengthening local livelihoods and food security for artisanal fishermen. Following the restoration of mangroves in the Casamance and Sine Saloum estuaries of Senegal, 84% of households reported lower saltwater intrusion into their rice fields.

Rice paddies that had been impacted by saline intrusion saw yields increase by an average of 10%, while 15% of fields that had been abandoned due to excessive salt were restored to cultivation. Local people catch 4,200 more tonnes of fish, shrimp and oysters every year.[26] Verra, the carbon certification body, has certified that the project has already sequestered more than 160,000 tonnes of CO_2 out of the 600,000 tonnes expected over its 20-year lifespan.[27]

1.2
HURRY, HALF OF THE WORLD'S MANGROVES ARE ALREADY GONE

Despite their potential, mangroves are one of the planet's most threatened ecosystems and are currently being lost at a rate of 2%/year, faster than coral reefs and all other forest types, including tropical and sub-tropical forests.[28] [29]

Southeast Asia contains almost half of the global mangrove area, but is a hotspot for mangrove deforestation.[30] Mangrove losses account for up to 10% of global emissions from deforestation and annual economic losses of USD 4—19 billion.[31] The Global Mangroves Alliance reports that 50% of the world's mangroves have been lost in the last 50 years.[32]

Climate change is exacerbating this loss. In Bangladesh, Cyclone Amphan recently damaged 40% of the country's mangroves, reducing their ability to act as a critical defence against sea level rise and typhoons.[33] In Australia in 2015, extreme heat and drought led to the worst mass dieback of mangroves ever recorded, affecting 2,000 km of coastline in the Gulf of Carpentaria.[34]

The drivers of mangrove destruction

Aquaculture

Aquaculture is estimated to account for one-third of global mangrove loss, mainly due to the impact of shrimp farms.[35] Over the past 20 years, global aquaculture production has expanded by 50%. In South East Asia, aquaculture, including shrimp and fish farming, accounted for 30% of mangrove loss between 2000 and 2012.[36] In Indonesia, home to 17% of the world's mangroves, aquaculture, primarily for shrimp production, was responsible for 50% of mangrove deforestation during the 1980s and 1990s.[37]

Rice and palm oil

Rice production accounted for more than 20% of total mangrove loss in South East Asia between 2000 and 2012. The conversion of mangroves to oil palm plantations in Malaysia and Indonesia is also a major threat. Between 2000 and 2012, some 38% of mangroves in Malaysia, 40% in Thailand and 16% in Indonesia were converted to oil palm plantations. In Myanmar, 2.2% (14,619 ha) of existing mangrove has been lost per year since 2000. 88% of this was due to conversion to rice agriculture.[38]

Urban development

Mangroves are being lost as land is cleared for infrastructure and real estate projects, or illegal logging for fuelwood and construction. Pollution, including fertilizer runoff and siltation from land-based activities, is a major factor. The resulting sediments, solid waste and oil smother and block the aerial roots that mangroves rely on for oxygen. An estimated 64% of the world's mangrove forests are within 25 km of a large urban centre, placing them at critical risk from future urban development.[39] Singapore, which has increased its territory by 24% in the last 50 years through land reclamation, has seen mangrove area decline from an estimated 6,340 hectares in 1953 to 644 hectares by 2011.[40]

Climate change

Changes to air temperature, rainfall patterns and ocean acidification can hinder mangroves' ability to survive. Abrupt and gradual changes in sea level also cause significant losses. In 2015, up to 2,000 km of mangroves were damaged or died near the Gulf of Carpentaria in Australia's Northern Territory, due to extreme heat, a temporary fall in sea level, drought and two cyclones. This was the worst mass dieback of mangroves recorded.[41]

Singapore has used land reclamation to increase its territory by 24% in the last 50 years, reducing its mangroves from an estimated 6,340 hectares in 1953 to 644 hectares by 2011.

2

THE SIZE OF THE PRIZE FOR MANGROVES

Mangrove Bedul Ecotourism, 2,300 hectares of intact mangroves in the Alas Purwo National Park, Indonesia.
Harry Pieters / Mangrove Action Project

2.1
THE PRIZE FOR MANGROVES

Mangroves, alongside seagrasses and tidal salt marshes, are a powerful 'blue carbon' ecosystem. Every year, mangroves sequester 32 million tonnes of carbon, but could sequester more than ten times that amount if restored to their former extent globally. Blue carbon credits are a novel and attractive way to finance the costs of restoration, but realising their potential will require carbon prices to reflect the true value of mangroves.

The true price of blue carbon

The surge in corporate pledges to achieve carbon neutrality seen throughout 2020 is expected to continue, increasing the demand for nature-based carbon sequestration, as well as the price of carbon in voluntary carbon markets.

The Task Force on Scaling Voluntary Carbon Markets says these markets still need to grow between 15 and 160 times in order to meet the Paris Agreement target of limiting global warming to 1.5 degrees Celsius.[42]

And while average carbon offset prices were largely unchanged in 2019, according to Ecosystem Marketplace, prices for nature-based emissions projects rose 30%. The differentiation shows that the latter's environmental credentials can attract price premiums against other types of offsets.[43]

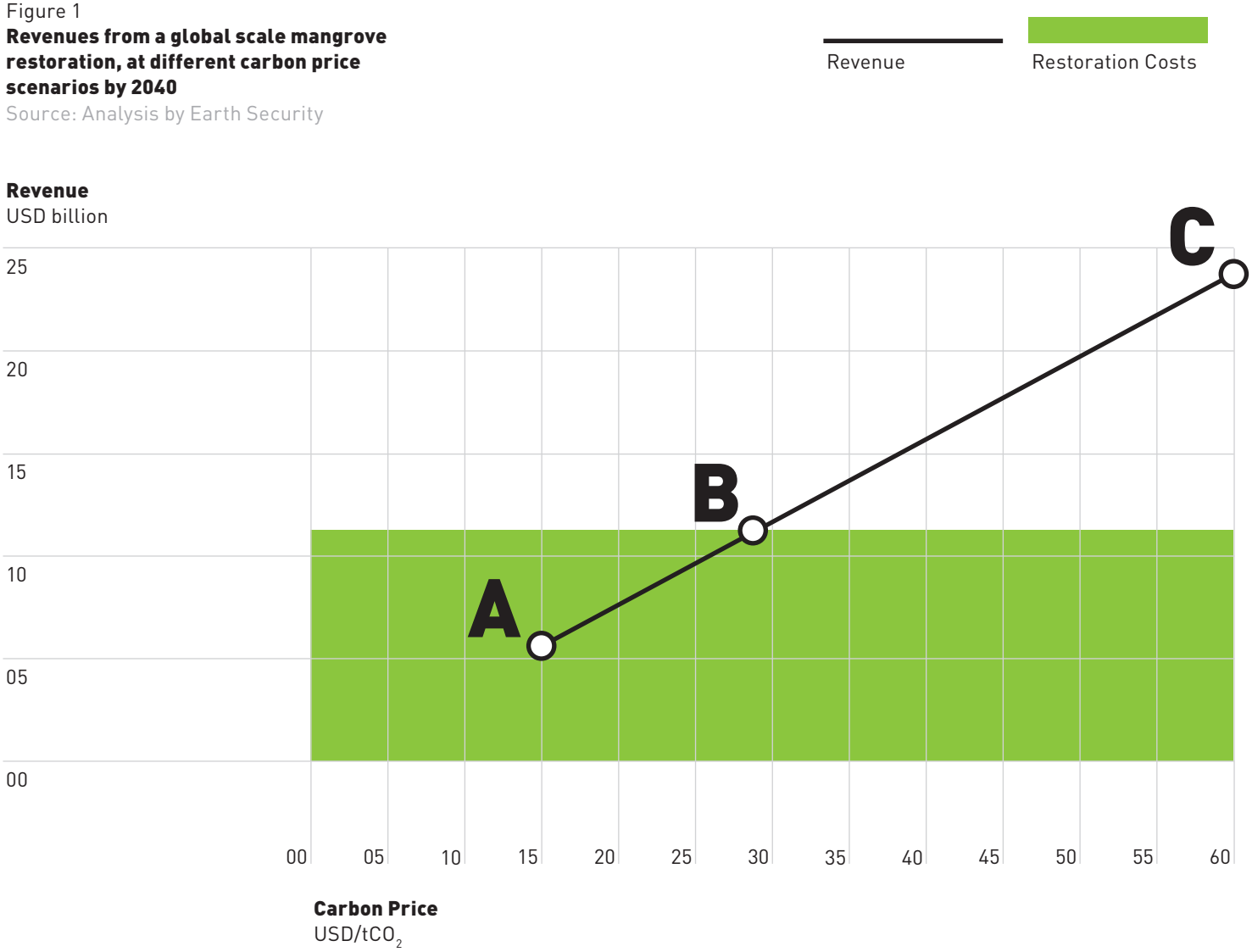
'Blue carbon' refers to carbon captured by coastal and marine ecosystems. Mangroves are a blue carbon powerhouse. Compared to terrestrial forests, mangroves sequester carbon faster; they also store carbon by trapping sediment between their roots as the tides rise and fall. This keeps carbon locked up for centuries to millennia, resulting in very large carbon stocks.[44]

The Mapping Ocean Wealth Explorer estimates that the total restorable area for mangroves is 728,421 hectares globally. Over 90% of this area is concentrated in just 25 countries.[45] We estimate that for an average restoration period of 20 years, with total restoration costs of USD 15,200/ha (USD 9,500/ha for the first five years and additional USD 1,900/ha every five years), the complete restoration of mangroves globally could cost an estimated USD 11.1 billion (see 'Assumptions' on page 13).

This could sequester up to 17.2 million tCO_2 annually. Factoring the increase in carbon sequestration that takes place with the growth and aging of habitats, we estimate that fully restored mangroves could sequester up to 380 million tCO_2 over the 20-year period.

However, at current carbon prices of USD 10—15/tCO_2 carbon credits alone are not able to finance the restoration efforts on this scale. The following pricing scenarios are presented, illustrated by Figure 1 (page 12).

Figure 1
Revenues from a global scale mangrove restoration, at different carbon price scenarios by 2040
Source: Analysis by Earth Security



Scenario A

The carbon price remains close to the current level of USD 15, generating total revenue of USD 5.7 billion and at a cost of regeneration of USD 11.1 billion, leading to a loss of USD 5.4 billion over the 20-year period.

Scenario B

A carbon price at USD 29 provides a break-even point for the investment of USD 11.1 billion over 20 years.

Scenario C

If the carbon price quadruples to USD 60, carbon markets return USD 22.8 billion in carbon offsets, creating a surplus of USD 11.7 billion over a 20-year period.

Beyond carbon: creating a premium for blue carbon

The analysis above suggests a carbon price of more than USD 29/tCO2 is needed to cover the costs of global regeneration. Despite rapid development, voluntary carbon markets are still nascent. The determination of carbon credit prices is still an evolving process that depends on project characteristics and the value that investors in those credits perceive they are creating.

According to Gold Standard, the valuation of projects is always somewhat subjective. The group says that carbon credits from cookstove projects in sub-Saharan Africa often sell at a higher price than carbon credits from renewable energy in Europe. This is due to the value over and above carbon that a project is seen to deliver and the impact investors in those credits can have on local communities.[46]

Taking the social benefits of mangroves into account, one study suggests that blue carbon from mangroves could be priced at USD 417/tCO_2 — 40 times higher than the current price of carbon — to reflect the full set of benefits beyond carbon.[47]

A premium price for blue carbon credits would enable investors to better incorporate the wider local benefits of their investment. As the case study in the next section illustrates in more detail, other forms of value provided by mangroves include lifting local income for poor fishing communities, cutting the cost of infrastructure maintenance due to the coastal protection they offer, and improving the regulation of water flows, water pollutants and sedimentation.

This value beyond carbon is expected to generate new types of credits that bundle climate adaptation benefits for coastal resilience together with carbon credits for corporate buyers. For example, Verra and The Nature Conservancy (TNC) have been working on a third-party verified framework that will be published in 2021 for a 'Blue Carbon Resilience Credit'.

This model provides a standardised approach for blue carbon credits to bundle the adaptation and mitigation benefits of projects. They would consider mitigation metrics in the form of avoided CO_2e emissions, together with adaptation metrics in the form of flood protection benefits. TNC estimates that Blue Carbon Resilience Credits could mobilise up to USD 320 million per year for coastal conservation and restoration projects as corporate demand grows.[48]

Assumptions
The following assumptions have been made in the analysis:

Timeframe
The analysis assumes that blue carbon credits are generated and issued every 5 years, but no precise data exists on the progressive biological growth of the total mangrove stock throughout the period and the subsequent sequestration potential in intervening timeframes. The figures are therefore presented on a 20-year aggregate, which is the typical length of mangrove restoration projects.

Restoration costs
The estimated restoration costs per hectare are based on Earth Security's analysis of 120 restoration projects worldwide. Average mangrove restoration costs are calculated to be USD 9,500/ha for the first five years, and an additional USD 1,900/ha (20%) every five years. The figure covers plot assessment, pre-planting, preparing seedlings, planting, costs and monitoring, sampling methods, replanting dead trees, and monitoring planted mangroves. This reflects the vast majority of projects reviewed. In practice, restoration costs are context- and project-specific. For example, very high staffing costs can lead to projects with costs of more than USD 100,000/ha, although these have been found to be outliers.

Survival rates
The analysis assumes a successful restoration with survival rates of 85–90% after the initial 3–4 years, which includes early re-planting in early years for mangroves that have not taken hold.[49] [50] Successful projects that follow scientific guidance on restoration tend to have high survival rates. Projects that do not follow the science, and get mangrove species and planting methods wrong, can have survival rates as low as 10%. (See Appendix 'Mangrove Restoration for Investors 101' on page 56.)

Carbon price
The analysis assumes that the carbon price will not change over time. In practice, there is uncertainty about the trajectory of carbon prices and they will fluctuate in price over time, leading to varying financial return figures.

Getting the restoration of mangroves right

Despite their potential, the world is awash with failed mangrove restoration projects.

Many things can go wrong, from the mangrove species that are planted, the methods used in a particular ecological setting, and the quality of relationships with local stakeholders and authorities.

Following the science is critical to improving the success rate of restoration projects. Projects that do not follow scientific and conservation best practice can have mangrove survival rates as low as 10%. Successful projects on the other hand can achieve 85–90% survival rates after 3–4 years.[51] [52]

The appendix outlines best practices in mangrove restoration that investors should be aware of as they look to leverage the value of this natural asset.

Sponges, growing on mangroves in Indonesia, help to protect mangrove roots and absorb CO_2
Alvaro Herrero Lopez-Beltran / Mangrove Action Project

CASE STUDY

THE PRICE OF BLUE CARBON MUST BE HIGHER TO SUPPORT REGENERATION

Fishermen and villagers collecting wild honey in the Sundarbans, India. Dhritiman Mukherjee / Mangrove Action Project

In 2018, the tech giant Apple partnered with Conservation International Colombia, marine and coastal research institute INVEMAR, local government organisations, and CVS (Coporación autónoma regional del Valle del Sinú) to protect and restore 11,000 hectares of mangrove forests in the Cispatá Bay, Colombia.

Apple supported the NGO consortium to protect and restore the mangroves in collaboration with the communities and helped to develop pioneering methodologies to calculate the carbon sequestered in soils in and around the coastal forests, as well as above-ground biomass.[53]

The project is expected to sequester roughly 1.2 million tonnes of CO_2 over its 30-year lifetime. In addition, it will deliver a range of biodiversity, hydrological, social and cultural returns.

The project is currently undergoing verification. Carbon credits will be issued by VERRA (a leading developer and manager of carbon standards) and certified under their Verified Carbon Standard (VCS) and Climate, Community and Biodiversity Standard (CCBS). Credits are expected to be sold in the voluntary carbon market for prices between USD 5–10 / tonne. The first phase (2014–2018) is expected to generate 68,779 credits.

However, at these market prices, the sale of the 'blue carbon' would cover 20–30% of project costs; the potential funding gaps would need to be covered through a combination of grants and revenues, including tourism fees.[54]

2.2
SOVEREIGN NATURAL ASSET OWNERS

The role of climate policy in realising the value of mangroves

While mangroves are found in over 100 countries in tropical and sub-tropical zones, just 25 countries hold almost 90% of the planet's total mangrove area, as well as its restorable potential.

Coastal ecosystems are being overlooked by global climate finance. They account for just 1% of the total climate finance flows for adaptation from public and private actors. In 2017–2018, climate finance surpassed half a trillion dollars — USD 579 billion, 25% higher than in 2015–2016. However, just USD 300 million in adaptation climate finance went to coastal protection, 0.05% of total global climate finance.[55]

Mangroves can be an effective tool for nature-based adaptation and mitigation. They can also give mangrove-holding countries a wider set of opportunities for climate finance and bilateral carbon trading.

There is significant variability in carbon density across different types of mangrove forests. Countries with large mangrove forests, such as Bangladesh, do not always have equivalently large carbon stocks.[56] Considering differences in carbon productivity across countries will be essential to any global financing strategy.

These differences in carbon density are embedded into the calculations in Figure 3 (opposite). These show the potential financial benefits that different countries could derive from investing at scale in regenerating their mangroves, at different carbon price scenarios.

Figure 2
Total carbon sequestration potential from restored mangroves, country-level estimates
Source: Mapping Ocean Wealth Explorer

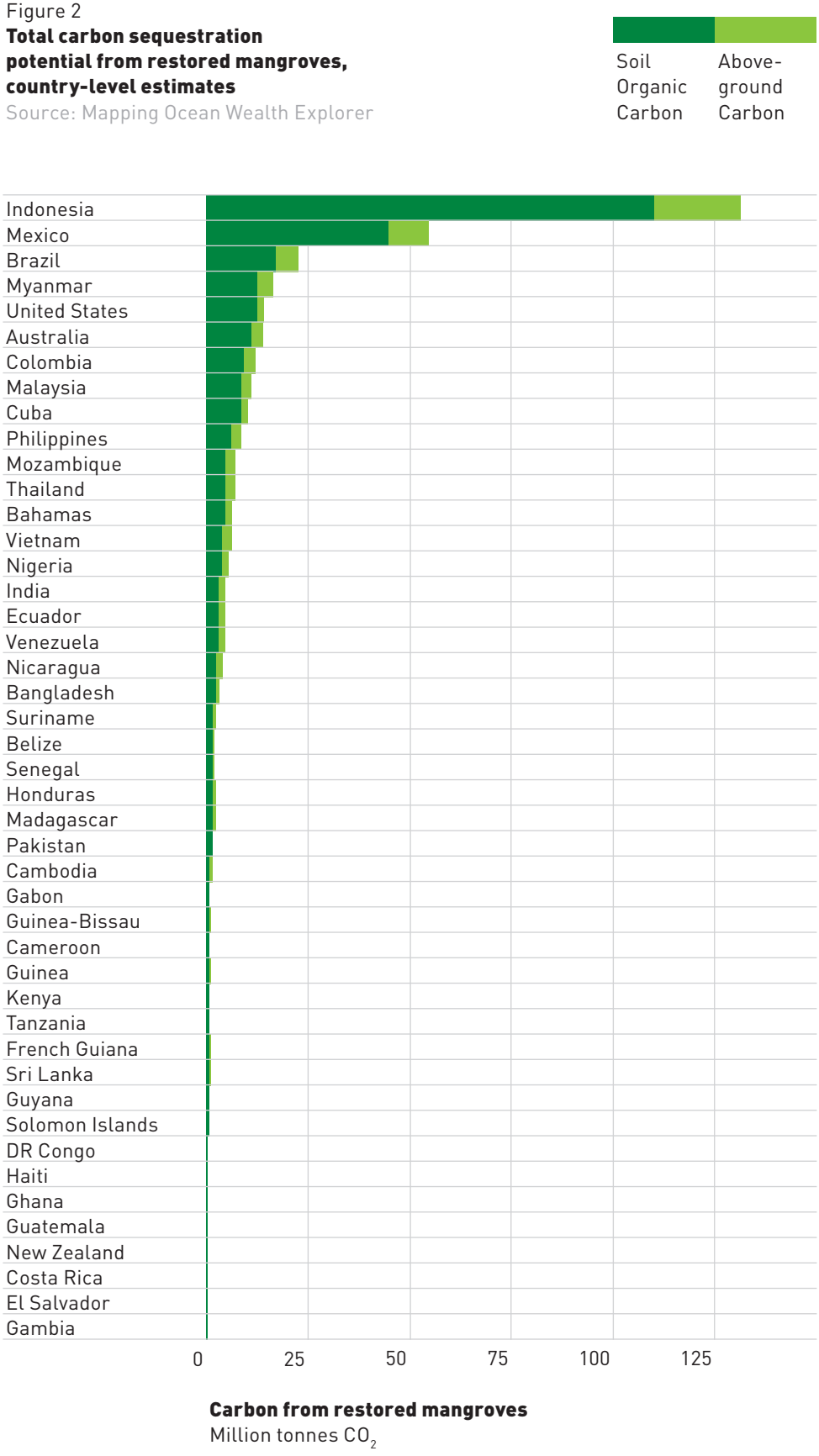


Figure 3
The 25 countries holding over 90% of the total mangroves and restorable potential

Country	**Total Mangrove Coverage** Hectares [a]	**Total Restorable Area** Hectares [a]	**Global Restorable Area** %	**Carbon Sequestration Potential** Million tonnes of CO_2 [a b]	**Expected return at carbon price of USD 60 per tonne** USD millions [c]	**Flood Protection Benefits** USD billions [d]	**Inclusion of mangroves in NDC** [e] A Adaptation M Mitigation
Indonesia	2,703,410	186,611	23.8	136	5,332	0.32	No
Mexico	974,353	145,505	18.5	57	1,191	7.42	Yes A + M
Brazil	1,096,412	49,081	6.3	23	623	0.72	No
Myanmar	491,957	43,571	5.6	17	352	0.14	Yes A
Australia	972,461	33,635	4.3	15	370	0.79	No
Mozambique	293,991	25,899	3.3	8	66	1.94	No
United States	188,790	22,688	2.9	15	560	11.31	No
Colombia	226,598	21,605	2.8	12	411	0.03	No
Thailand	232,683	17,471	2.2	7	164	0.15	No
Vietnam	159,883	17,405	2.2	6	120	6.45	Yes A
Malaysia	468,599	16,764	2.1	12	464	0.14	No
Cuba	337,046	16,019	2.0	11	417	0.59	Yes A
Philippines	270,822	15,647	2.0	9	300	0.76	No
India	346,713	15,241	1.9	6	100	7.84	Yes A
Bangladesh	411,120	13,799	1.8	4	6	1.56	Yes A + M
Venezuela	280,730	12,020	1.5	5	138	0.07	No
Nigeria	650,576	10,993	1.4	6	187	0.21	No
Ecuador	146,488	10,709	1.4	5	160	0.22	Yes A
Nicaragua	87,589	10,393	1.3	4	104	0.03	Yes A + M
Madagascar	261,177	8,039	1.0	3	57	0.36	Yes A + M
Senegal	123,390	7,827	1.0	3	69	0.03	Yes A + M
Bahamas	97,263	7,114	0.9	7	308	1.55	Yes A + M
Honduras	50,150	7,036	0.9	3	80	0.02	Yes A
Suriname	76,591	6,827	0.9	3	95	0.70	Yes A + M
Belize	43,316	6,522	0.8	3	91	0.50	Yes A + M

a Estimates by Mapping Ocean Wealth Explorer.
b Estimated carbon sequestration potential from restored mangroves in million tCO_2.
c Estimated financial return on trading carbon credits from restoration at a carbon price of USD 60 / tCO_2.
d Estimated benefits of mangroves from avoided flooding to property.[57]
e Mangroves included in a country's Nationally Determined Contributions (NDC). While not explicitly mentioning mangroves in their NDCs, some countries may include blue carbon, coastal ecosystems or mangroves in other climate instruments. For example, Indonesia includes mangrove forests within their planned jurisdictional-scale REDD+ program and Brazil includes areas with mangroves (Cerrado and Amazon) in their REDD+ program. Australia has reported mangroves within its forest category in its GHG inventory and the US Interagency working group is developing an inventory for blue carbon.[58]

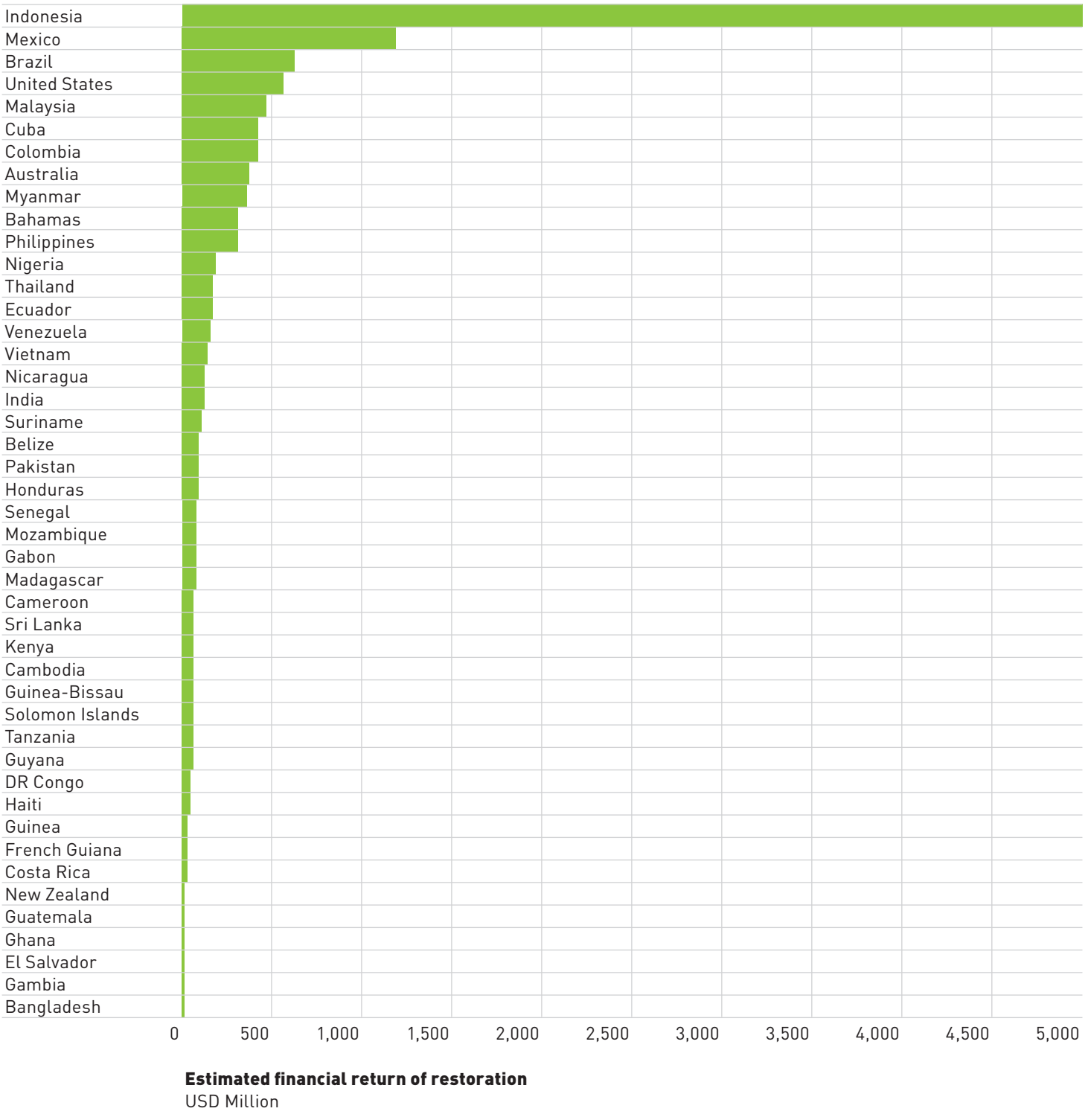
Regeneration financing potential at different carbon price scenarios

Figure 4
Financial return of mangrove restoration at a carbon price of USD 30 per tonne CO_2
Source: Earth Security analysis and Mapping Ocean Wealth Explorer

USD 30/tCO_2

The ability of mangroves to sequester carbon varies from country to country, depending on local ecosystem conditions and the carbon density of mangrove types. The following graphs show the financial potential of each individual country at different carbon pricing scenarios.

Figure 5
Financial return of mangrove restoration at a carbon price of USD 60 per tonne CO_2
Source: Earth Security analysis and Mapping Ocean Wealth Explorer



Key insights and implications for COP26

Mangroves for Mexico

None of the top 10 countries in terms of restorable area of mangroves, except Mexico, have included the carbon mitigation potential of mangroves in their NDCs. This gives Mexico the opportunity to be at the forefront of bilateral mangrove-related carbon financing deals from 2021 onwards.

It also suggests that the other countries (Indonesia, Brazil, Myanmar, Australia, Mozambique, US, Colombia, Thailand, and Vietnam) should include mangroves in their greenhouse gas and national forest inventories as they revise their Nationally Determined Contributions (NDCs) for COP26.

The United States, the country in the world with the most to win from the flood protection benefits of mangroves, would do well to recognise their potential as a natural asset for climate adaptation.

Avoiding double-counting

As companies and investors develop ambitious climate and nature-based investments and seek to buy carbon credits from these countries' mangroves, these countries must ensure that emissions reductions from these mangrove stocks are not double-counted. The avoidance of double counting should be a priority for governments as they develop regulations and markets to constrain and monetise GHG emissions given the ongoing fragmentation of global carbon markets.[59]

The UNFCCC Standing Committee on Finance

Countries will be able to trade emissions reductions under co-operative agreements developed under Article 6 of the Paris Agreement. While blue carbon credits are currently only sold in the voluntary carbon markets, they are expected to start trading in South Korea's emissions trading scheme (compliance market) in 2021 — a precedent that COP26 may use to amplify this trend.[60]

COP26 will be the first time nature-based solutions are on the agenda of the UNFCCC Standing Committee on Finance, a platform for public and private sector stakeholders to promote linkages to mobilise climate finance. Mangroves give a series of countries the opportunity to benefit from opportunities if blue carbon prices can finance the necessary restoration costs.

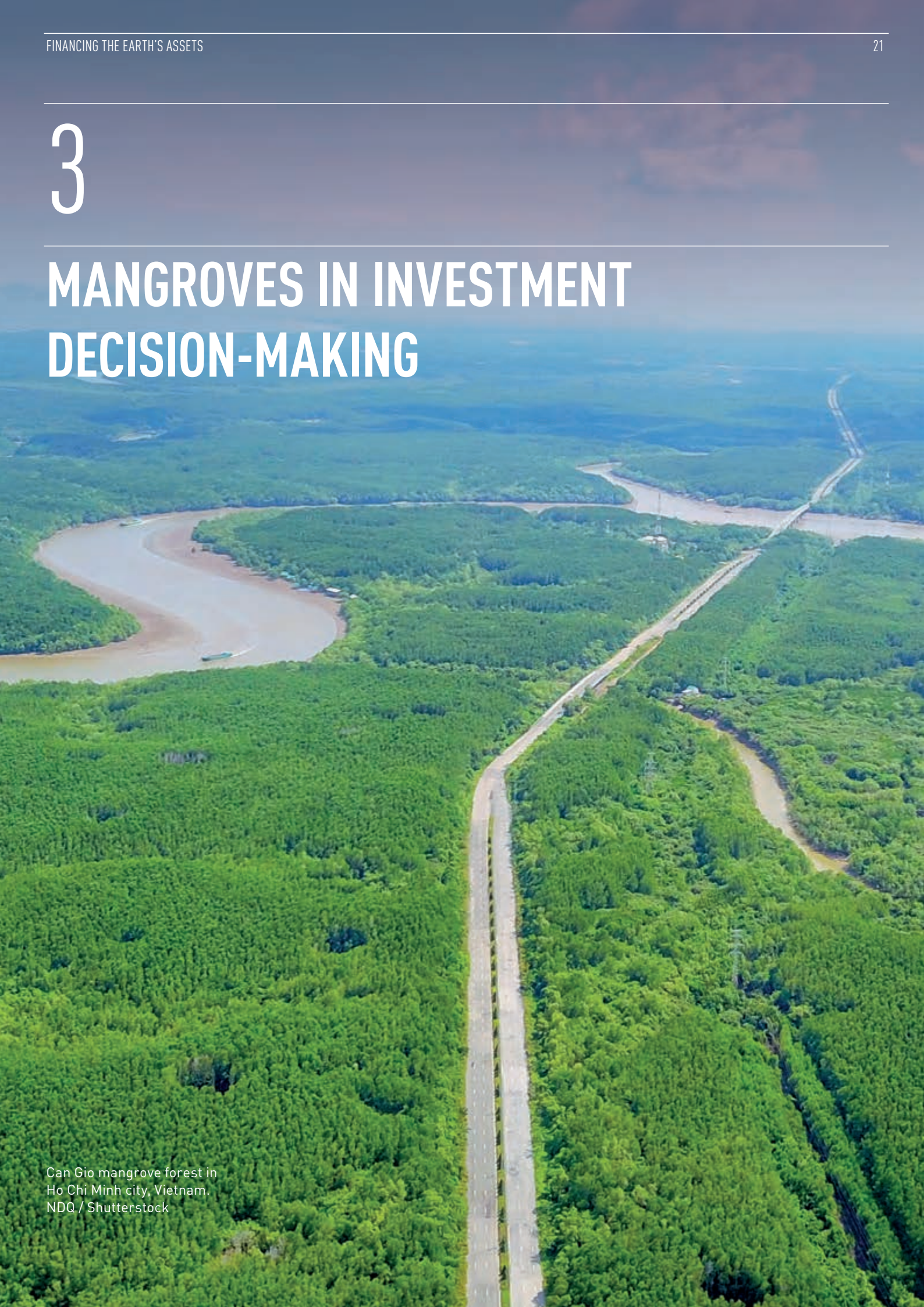
Getting all 25 'mangrove nations' up to speed

Only 14 of the top 25 countries have recognised their potential as a climate solution in their Nationally Determined Contributions (NDCs). Only eight of these countries (Mexico, Bangladesh, Nicaragua, Madagascar, Suriname, Senegal, The Bahamas, and Belize) have explicitly recognised the carbon sequestration capabilities of mangroves in their national strategies, while six only consider their adaptation potential.

Eleven countries do not even mention mangroves in their NDCs — Indonesia, Brazil, Australia, Mozambique, USA, Colombia, Malaysia, Thailand, the Philippines, Venezuela, and Nigeria — although Australia and the US are including blue carbon in their GHG inventory and Brazil and Indonesia include mangroves in their REDD+ programs. As these countries prepare their NDC updates for COP26, they must recognise the significant carbon value their mangroves contain, while safeguarding against double counting. This can be done through closer co-operation with the International Partnership for Blue Carbon, which supports countries to integrate blue carbon into NDCs and improve the guidance for measuring blue carbon stocks.[61] [62] Doing so will increase the opportunities to tap into climate finance, including access to innovative financing mechanisms such as blue sovereign bonds.[63] [64]

3

MANGROVES IN INVESTMENT DECISION-MAKING



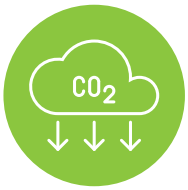
Can Gio mangrove forest in Ho Chi Minh city, Vietnam. NDQ / Shutterstock

3.1 FIVE VALUE DRIVERS FOR INVESTMENT

Measuring the economic benefits provided by mangroves is key to realising their potential as a natural asset. Earth Security has identified five areas where mangroves can provide value to companies and investors, depending on the circumstances.

These benefits, presented in the framework below, can be incorporated into the decision-making process of investors in any type of coastal development, across infrastructure, energy, agriculture or urban development.

Figure 6
Five areas of investment value for mangroves



Value	**Carbon sequestration**	**Asset protection**
Function	**A powerful carbon sink that supports business decarbonisation goals, including through voluntary carbon markets.**	**A natural barrier that provides cost-effective protection against coastal and tidal erosion, storms and natural hazards.**
Business case	Investing in nature-based solutions (NBS) such as mangroves is becoming a valuable tool for companies to offset residual emissions that are harder to eliminate in the short term. Danone has been a pioneer in investing in NBS, including mangroves, since 2010. In 2011, the company created the Livelihoods Fund, an independent entity that is open to other corporates. Nine other companies are currently members, including Credit Agricole, Hermes and Michelin. The fund supports three mangrove restoration projects in Senegal, India and Indonesia, which between them are projected to restore 18,420 hectares of mangrove forest and sequester 3.2 million tonnes of CO_2e.[65] [66]	Infrastructure firm CH2M has estimated that in the Philippines over a 15-year investment period, conserving mangroves and coral reefs can be 50 times more cost-effective as a coastal protection investment than building a cement seawall.[67] By 2030, property damage due to coastal storm surges and sea level rise is set to increase by a factor of 10, making investments in these green infrastructures increasingly important.[68] Mangroves are the cheapest restoration option, costing on average 3.6 times less than other coastal ecosystems.[69] In Vietnam, the restoration of 8,961 hectares of mangrove forests alongside a 100km dyke line in the country's most disaster-prone coastal provinces reduced dyke maintenance by USD 7 million/year.[70]
Value metrics	Value of carbon offsets generated (USD)	Reduced CAPEX infrastructure construction (USD)
	Tonnes of carbon sequestered (annually)	Reduced OPEX infrastructure maintenance (USD/year)
	CO_2 emissions avoided ($MgCO_2$ /year)	Reduced insurance costs due to lower risk (USD/year)

Balance sheet

A tool to maintain the value of land, economic activities such as tourism and premium prices from certified produce. Intact mangroves can increase the value of land.

In Abu Dhabi, engineering firm Arup led a redesign of the 120 hectares Tamouh Reem Downtown project, preserving mangroves to support a cooler microclimate, remove the cost of a planned sea wall, canal and dredging, and reduce costs for maintaining the natural park.[71] In Indonesia, shrimp farming has been one of the main drivers of mangrove deforestation. If left intact, Boston Consulting Group estimates that Indonesian mangroves could add up to USD 8,000/ha per year to shrimp farmer incomes through increased yields, higher premium prices for certified production and the sale of carbon offset credits.[72]

Increase in land value (USD)

Increase in sustainable production premium (USD/year)

Increased income from tourism (USD/year)

Community development

An asset to improve livelihoods of local communities supporting incomes, sustainable fishing and agriculture.

Better management of local mangroves can increase household incomes, for example through higher seafood yields. In Senegal, following the large-scale restoration of mangroves by the Livelihoods Fund, 84% of households reported a decrease of saltwater intrusion into their rice fields; 15% of rice fields that had been abandoned due to excessive salt were restored to cultivation and today 4,200 additional tonnes of fish, shrimp and oysters are caught by local people every year.[73] In Pakistan, mangrove restoration by coastal wind power project, ZPL, enabled local fishermen to double their catch of high-value shrimp for the export market, doubling their income from USD 4,500 to USD 9,000/year.

Increase in local community income and value of product (No. of people / income growth)

Number of local jobs and enterprises created

Reduced costs from local community conflicts (USD/year)

Regulatory requirements

A tool for cost-effective site remediation and restoration to meet regulatory standards and investors' environmental requirements.

Mangrove conservation and restoration provide nature-based remediation value, for industries such as extractives, energy, and infrastructure that are subject to stringent environmental regulations.[74] In Panama City, Suez replanted 23 hectares of mangroves to offset 10 hectares affected by the construction of a wastewater plant.[75] In Australia, Origin Energy and ConocoPhillips included over 40 hectares of mangroves in an environmental management plan for an LNG project in order to meet the state's marine offset requirements.[76] Mangroves also act as natural water filters for fertilisers, toxins and pollutants, with an estimated service as high as USD 582,000/km/year.[77] In the Potengi Estuary, Brazil, mangroves help filter heavy metals, which would otherwise cost the tannery industry an additional USD 13 million in remediation, or USD 10,280/ha.[78] [79]

Reduced regulatory costs (permitting, fines) (USD/year)

Reduced remediation costs (cost benefit ratio of mangrove restoration v other remediation options) (USD/year)

Improved access to international capital (by meeting international investment E&S performance standards)

3.2 CASE STUDY
ZEPHYR POWER LIMITED

The investment in the restoration of mangroves by a wind power project in Pakistan could return 20 times the value in the protection of physical assets against coastal erosion, saving the project developer and its investors up to USD 7 million over the project's 25-year timeframe, while doubling the income of local communities.

Wind turbines on the Zephyr Power site, Sindh Province, Pakistan. Hasan Halai

Earth Security worked in collaboration with CDC Group and Zephyr Power Limited to assess the value that mangroves provide to the investment project as a nature-based solution. It has estimated the return on investment that this regeneration could accrue for the project over the next 25 years of operation.[80]

The Project

In 2017 Zephyr Power Limited (ZPL) began the construction of a 50 MW wind power project, located near Bhambore, Gharo approximately 60km from Karachi, Pakistan. The project is built on the Indus River Delta – the 5th largest delta system in the world and the 7th largest mangrove ecosystem.

The project, which became operational in 2019, has 25 wind turbines. CDC Group invested USD 41 million for the construction of the project making it the largest shareholder in ZPL.

The project site is predominantly barren inter-tidal mudflats and mangrove. It had become degraded due to the cutting of mangroves for firewood, fishing, crabbing and camel grazing by the local communities, who depend on them for their livelihood. This over-harvesting increases the long-term risk of the project due to coastal erosion, climate change and the rise in sea level.

Early on, CDC Group and ZPL recognised the importance of improving the site's ecological value, and the role that mangroves could play in increasing the project's climate resilience and bringing broader benefits to local communities.

At the start of construction, ZPL, in partnership with the Government of Sindh's Forestry Department, implemented guidelines to protect what remained of the ecosystem, and to plant new mangroves strategically around the site. These successfully seeded to create a site rich in mangroves.

The site's ecological value was incorporated into the design, engineering and construction of the civil infrastructure (i.e. road network, creek crossings, etc.). A proactive mangrove protection and rehabilitation programme, coupled with a community involvement plan, were central to the project's plan to mitigate its social and environmental impact. This has helped the project to evolve from an impact mitigation plan into a proactive build-up of ecological assets.

The collaboration with the local government helped to raise awareness among local communities of the value of mangrove protection. Today, ZPL's CEO Kumayl Khaleeli sees that the site is flourishing: "Our partners see that these are decisions we make every day. The plan has been moulded as the project has grown and as we see the site settle over time."

Figure 7
Key Facts: ZPL

Project company	**Zephyr Power (Pvt.) Limited (ZPL)**
Capacity	**50 MW wind power project**
Location	**Deh Kalar Sarkari (Bhambore, Gharo), Taluka Mirpur Sakro, District Thatta, Sindh Province, Pakistan**
Site	**1,028 hectares**
Habitat types	**Intertidal mud flat (predominant) and degraded mangrove forest**
Operations	**Commenced on March 28, 2019**
Sponsors	**CDC Group and 3 local investors**
Lenders	**CDC Group, FMO and United Bank Limited**

THE INVESTMENT VALUE OF MANGROVES

1
Asset protection

Pakistan is one of the world's five most vulnerable countries to climate change. Rising sea levels increase the risks to ZPL's infrastructure.[81] The site is located in a tidal delta, meaning that water levels rise and fall across the site over the course of a day and vary in height due to the seasonality of high tides. This can wear down the civil infrastructure, such as roads and wind turbine platforms, so that they require frequent maintenance.

Mangroves act as a natural physical barrier protecting the infrastructure by strengthening the soil conditions and acting as a buffer against the water flow. In turn, this reduces damage to the infrastructure, which cuts maintenance costs for the business. The flood protection value provided by mangroves in the Sindh delta region ranges from USD 3,500/ha for areas near Port Qasim, to USD 11,900/ha close to Karachi.[82]

The project's assets are situated in a tidal area that is regularly inundated during high tides and highly exposed to the impacts of climate change, including sea level rise, increased flooding and erosion.

The stone pitching in the internal road network (large inter-locked stones that are set in mortar), which protects civil infrastructure such as roads, wind turbine platforms and submarine cabling, is exposed to erosion and damage during high tide season. In a strong high tide season, the worst-case outcome is the loss of the internal road and wind turbine platforms, requiring frequent maintenance.

Increased mangrove coverage has improved site stability and reduced soil erosion, providing asset protection from regular tidal erosion, as well as from extreme storms and sea-level rise. The mangroves are estimated to save USD 35,000 – USD 40,000 a year in maintenance costs (USD 1 million over the 25-year asset lifetime).

The physical assets that are protected by mangroves would cost USD 6 million to replace (USD 3 million to replace road infrastructure; USD 3 million for complete replacement of submarine cable).

2
Local economy

The project is close to more than half a dozen small coastal communities that depend on subsistence artisan fishing, selling their catch to local market intermediaries. The catch has dwindled over recent years due to worsening ecological conditions. As a result of the project's conservation and regeneration efforts, local fishermen have begun to see a substantial increase in fish, shrimp and crab populations, creating direct economic value for local communities. The regeneration programme has generated some limited local employment, but following its success, ZPL plans to cultivate its own mangrove seedlings by setting up a nursery, which would provide additional livelihoods.

Around 60 local community members access site tidal creeks daily to catch fish, crabs, and shrimp. The company's access roads have improved access to fishing grounds. Community outreach activities are increasing community awareness of the value of sustainably using mangroves for fuelwood and fishing.

"We know that nature-based solutions have a tangible value in helping project assets to become more resilient to climate change. Our partnership with Earth Security is looking at these economic values more systematically and showing other global investors how they can benefit from integrating nature-based approaches in their projects."

Nik Stone, ESG manager, CDC Group

3
Regulatory requirements

As a result of mangrove restoration and improved management, local fishermen have reported a doubling of the catch for higher value shrimps, from 5kg to 10kg a day. The communities sell this shrimp species to an intermediary for USD 2.5/kg. The increased yield is almost doubling the annual income of 60 fishermen from USD 4,500 to USD 9,000/year (giving the community an additional USD 270,000/year on aggregate).

In addition, ZPL will employ 10 local people full-time (at a salary of USD 105/month) to help manage and secure the replanted areas, in a region where employment opportunities are limited. This will create income for the community of around USD 12,600/year — a total of USD 315,000 over 25 years.

The mangrove protection and restoration programme has enabled ZPL to meet the environmental requirements of international investors, in line with the IFC Performance Standards. It has also established a deeper co-operation between the project developer and CDC Group on the integration of nature-based climate solutions into the latter's investment strategy.

ZPL's CEO recognised early the value that improved ecological health and mangrove restoration could provide to the project. He worked in close collaboration with CDC Group and IUCN Pakistan to develop the project's Habitat Monitoring and Management Report (HMMR) to address the biodiversity impacts of the construction of 25 turbines, one control building and 13 km of access roads.

The HMMR covers 918.7 hectares, which are home to eight local communities. The HMMR ensured that construction minimised any further damage, and where possible improved natural drainage. It also offset the unavoidable impact of the project to 1.2 hectares of mangroves on site by planting 14 hectares of mangroves, and protecting and monitoring a range of wildlife and community impacts.[83]

Mangroves regenerating on the Zephyr Power site. Haider Mukhi

Figure 8
The return on investment of mangrove restoration for ZPL

Item	**Description**	**Regeneration Investment** USD, 25 years	**Cost Savings** USD, 25 years	**Additional Value** USD, 25 years
Initial costs for the mangrove programme	Baseline studies and stakeholder engagement	50,000		
Staff costs for the mangrove nursery and monitoring	2 full-time employees (USD 105/month/employee)	63,000		
Projected direct costs for regenerating 14 hectares on site	USD 17,100/ha for 25 years *	239,400		
Asset replacement costs without protection of mangroves	Road (USD 3 million) Submarine cable (USD 3 million) **		6,000,000	
Additional maintenance cost estimated without factoring the protection of mangroves	USD 35,000 – 40,000/year **		1,000,000	
Additional economic value generated for local communities over 25 years	Additional income of USD 270,000/year for 60 fisherfolk from increased yields of export shrimp is USD 6.75 million, plus USD 315,000 in direct employment over 25 years **			7,065,000
Total		**352,400**	**7,000,000**	**7,065,000**
Net value to the project's investment			**6,647,600**	
Net value to the project's investment plus the local community				**13,712,600**

* The estimated restoration costs per hectare are based on Earth Security's analysis of 120 restoration projects worldwide. Average mangrove restoration costs are calculated to be USD 9,500/ha for the first five years, and additional USD 1,900/ha (20%) every five years. The figure covers plot assessment, pre-planting, preparing seedlings, planting, costs and monitoring, sampling methods, replanting dead trees, and monitoring planted mangroves. This reflects the vast majority of projects reviewed. In practice, restoration costs are context- and project-specific. For example, very high staffing costs can lead projects to have costs of more than USD 100,000 per hectare, although these have been found to be outliers.

** Based on interviews with CDC Group and Zephyr Power Limited combining project materials and the gathering of anecdotal evidence, and projected over the 25-year lifespan of the asset.

TIMELINE

From biodiversity offsets to 'natural asset'

What started for ZPL as biodiversity management has evolved into a strategic investment in a natural asset, which could increase the area of mangrove regeneration by five times the original plan.

A mangrove nursery is to be established on site to support ZPL's re-planting of 14 hectares of mangroves over the next two years, which would take the total regenerated mangrove coverage to 64 hectares — almost five times the amount originally planned.

ZPL will also review local fishing practices and nets used by fishermen to prevent immature catches that would slow environmental rehabilitation.

2016

CDC Group and other international investors make biodiversity conservation a key lending requirement. ZPL designs and implements a habitat mitigation programme to offset any negative impacts of construction and increase climate resilience. The project achieves financial close in May 10, 2017.

2017

ZPL implements site procedures to protect existing mangroves after observing an increase in fishing due to the construction of the internal road network, in areas previously not accessible. ZPL also collaborates with the Government of Sindh's Forest Department, providing its site for the regeneration of 30 hectares of mangroves in line with the government plan. The collaboration helps to engage local communities and raise awareness of the benefits of protecting mangroves.

2018

ZPL establishes a partnership with IUCN Pakistan, to co-develop a Habitat Monitoring and Management Report (HMMR), which calculates the environmental impacts and defines the suite of interventions to promote ecosystem enhancement.

2019

The project starts to operate in March. The Forestry Department continues planting additional areas. ZPL continues to maintain site procedures as previous planting of mangroves sprout and mature.

2020

Thanks to the co-operation with the Sindh Forest Department, early results include 50ha with increased mangrove coverage on site. The recolonization of mangroves is expected to improve water flow and natural draining patterns on site, helping the mangroves regenerate naturally. Local fishermen are already seeing a significant increase in catch.

3.3
FIVE KEY MARKETS FOR MANGROVES

There are five areas of opportunity for finance and investment in mangrove assets:

Aerial view of a maze of mangrove forest in Siargao Island, the Philippines
Janos Leo G. Andanar / Mangrove Action Project

1
NATURE-BASED INVESTMENT FUNDS

Investment funds are a practical entry point for investors to fund revenue-generating conservation enterprises that conserve and restore mangroves.

A number of innovative equity-based funds, rarely exceeding USD 100 million in size, have sought to generate market-based returns while protecting mangroves. They include the USD 22 million Meloy Fund, launched by Rare — a conservation NGO — and the USD 132 million Sustainable Ocean Fund (SOF), launched by Althelia in 2016 and managed by Mirova Natural Capital. The SOF invests in companies and projects with positive impact on ocean resilience in emerging markets, including sustainable seafood, blue infrastructure and ocean conservation.

Investors at first close included the European Investment Bank, AXA Investment Managers, the Inter-American Development Bank, the FMO and the Caprock Group. SOF aims to protect at least 17,500 ha of mangroves from deforestation and degradation, amounting to more than 9 million tonnes CO_2e at the fund level.[84] Investors in these funds need to take a long-term horizon (8–12 years) and be willing to take outsized risk to attain a commercial financial return alongside environmental and social impact.[85]

Investors can integrate the value of mangroves by investing in sustainable aquaculture models that rely on them as a nature-based production asset.

Shrimp aquaculture, a USD 45 billion industry, is now the world's fastest-growing protein source and most valuable farmed seafood commodity.[86] While this has been one of the leading drivers of mangrove deforestation in Asia, mangroves can offer an important resilience path to the industry.

In Indonesia, Boston Consulting Group estimates that mangroves could add up to USD 8,000/ha/year to shrimp farming by increasing yields, improving water quality, raising premium prices for certified production and through the sale of carbon offset credits.[87] Investment funds should leverage conservation to drive performance. For example, the Meloy Fund provides debt and equity investments of USD 500,000 — USD 2 million to fishing-related enterprises with a conservation impact on 1.2 million hectares of coastal habitat, including mangroves, in the Philippines and Indonesia.[88] Its USD 1 million investment in Philippines-based Meliomarin, a vertically integrated aquaculture company, will support better management of 12,000 hectares of marine and mangrove area that will lead to USD 2.5 million in additional income to 16,000 local fishermen by 2021.[89]

Aqua-spark, an open-ended fund in the Netherlands, is looking to capitalise on industry growth while reversing environmental damage. It aims to raise up to USD 300 million over the next 10 years and is making initial investments of USD 250,000 — USD 5 million in up to 80 sustainable aquaculture companies that will have a positive impact on coastal ecosystems and mangroves within 10 years.[90]

Technology companies will increasingly offer investment opportunities based on increasing the efficiency and scale of bio-carbon markets.

New technologies, in particular those helping to scale bio-carbon finance, are becoming part of the new landscape of natural capital investing. Remote sensing and the use of drones in regeneration efforts, for example, can improve the scale and cost-efficiency of blue carbon sequestration projects. Artificial intelligence and blockchain applications can reduce transaction costs and aggregate small-scale projects. High costs for monitoring and verifying blue carbon mangrove projects are a barrier to the rapid scaling of carbon offsets in this space and these services are expected to be in higher demand as these markets develop.[91] Remote sensing can reduce the time and effort needed to measure coastal vegetation structure and blue carbon — from several days needed for field surveys to just a few hours.[92]

The Global Mangrove Trust is developing GROVE: FSL. This crowd-funding platform and blockchain verification system aims to cut third-party verification costs for small-scale mangrove conservation and restoration projects and help to scale the market for blue carbon finance.[93] GROVE: FSL is partnering with DBS Bank to mobilise USD 38 million in commercial capital from corporates and individuals in three years to finance over 10,000 hectares of mangroves that could sequester up to 8.2 million tCO_2e.[94] Pachama, a US-based tech start-up, raised USD 4.1 million from Silicon Valley investment firms Saltwater and Lowercase Capital to develop a technology-verified marketplace for forest carbon offsets by using machine learning on a combination of satellite, drone, and lidar images to calculate the size and volume of trees to remotely verify and monitor carbon storage.[95]

2
BLUE BONDS

Blue bonds have emerged as an effective way to channel private finance towards the blue economy in both the private and public markets.

Blue bonds, a sub-set of the green and climate bonds market, raise capital to finance activities earmarked for the blue economy: sustainable fisheries, coastal infrastructure, or marine protected areas.[96] Blue bonds are new to the market, representing less than 1% of green and climate bond issuance.[97]

The first blue bond was issued in 2018 by the Republic of the Seychelles, a USD 15 million 10-year bond with a 6.5% coupon created with the support of The Nature Conservancy, which was privately placed with TIAA, Prudential Financial and Calvert Impact Capital. Proceeds from the bond are directed to projects that improve coastal and marine management of coral reefs and mangroves and the implementation of the government's Marine Spatial Plan.[98] Since 2018, a further six blue bonds from sovereign and government-backed entities have been issued. These include a USD 200 million Nordic Blue Bond to rehabilitate the Baltic sea and a number of World Bank 'Sustainable Development Bonds' issuances with HSBC, Credit Suisse and Morgan Stanley as lead managers that support SDG 14 (Life Below Water). The Bank of China recently issued a USD 500 million 10-year 'Blue Bond' that will finance off-shore renewable energy and water management projects.

Mangrove conservation and regeneration, in particular in countries identified in this report, offer effective projects for the use of blue bond proceeds.

Blue bonds can be used to finance mangrove regeneration, yielding economic benefits that range from climate adaptation, carbon sequestration, fish stocks replenishment and tourism. As part of marine protected areas (MPAs) they can help increase fish stocks by 400% over a decade.[99]

Blue Finance, with support from the Sustainable Ocean Fund, has secured an 8-year USD 2.5 million bond to finance the Arrecifes del Sureste Marine Protected Area (MPA) in the Dominican Republic. The project is expected to generate income from user fees and blue carbon credits. Blue Finance plans to replicate this model across 20 MPAs in developing countries by 2030.[100] Blue bonds should also consider focusing on greening aquaculture. Regenerative aquaculture, done through integrated mangrove-shrimp production models, can protect mangroves while helping to transform an industry that is expected to grow significantly in coming decades. These regenerative aquaculture models can restore mangroves, reduce upfront investment costs for inputs, and improve water quality, helping to control salinity intrusion and bio-filtration ecosystem services.

Alune Aqua and Conservation International are developing a USD 50 million 5-year Regenerative 'Mangrove Shrimp Bond' to regenerate 510 ha of mangroves and generate 60,100 tonnes of blue carbon credits in addition to selling certified shrimp for the export market.[101] Blue bonds at sovereign or industry level could allow investors to participate in sustainable economic growth.

Sovereign and sub-sovereign blue bond issuances, such as municipal finance, are key to the blue economy, but require aggregation to scale.

Although not labelled as a 'blue bond', the USD 400 million Miami Forever Bond is just that. This municipal instrument will direct USD 192 million of proceeds to 'green-grey infrastructure', including sea walls and replanting mangroves, in order to mitigate the impacts of sea-level rise and flooding.[102] Leveraging the municipal bond market for conservation finance — a market worth almost USD 4 trillion in the US alone — can offer a pathway for exponential growth.[103] Financing aggregation is key to achieving issuances for the public fixed income markets. TNC's 'Blue Bonds for Conservation' programme builds on the success of the sovereign issuance in the Seychelles, and will launch 20 debt conversions over the next five years aiming to raise USD 1.6 billion and create 1.5 million square miles of new marine protected areas globally.[104]

The Pacific Islands Forum Fisheries Agency and the Office of the Pacific Ocean Commissioner are also planning to aggregate activities for sustainable fisheries and MPAs across 11 Pacific countries to develop a Pacific Ocean Bond.[105]

3
INSURERS AND RISK FINANCE PROVIDERS

The flood protection benefits of mangroves, which reduce flood damages by an estimated USD 65bn/year globally, offer insurers a route to innovate with nature-based solutions.[106]

In the last 10 years, private insurance companies have paid out more than USD 300 billion for coastal storm damage.[107] The protective benefits provided by coastal ecosystems to insured assets is a relatively new space, but set to become more important as climate change impacts increase. The Nature Conservancy (TNC) and SwissRe pioneered a 'reef insurance' model in Quintana Roo, Mexico linking hurricane insurance payouts to the restoration of coral reefs.[108] These parametric insurance products require a good baseline of data, which is harder for mangroves, where such data is not yet readily available.

The Ocean Risk and Resilience Action Alliance (ORRAA), a collaboration between AXA XL, TNC, Conservation International, WWF, Rare, Ocean Unite and Willis Towers Watson, aims to develop a mangrove insurance product for the Caribbean in the coming months.[109] An initial baseline study, developed by TNC, the University of California, Santa Cruz and AXA XL, proposes a mangrove parametric insurance policy based on wind speed and paired with a traditional indemnity policy to cover both short-term and longer-term restoration actions.[110] Munich Re is also working with the University of California Santa Cruz and TNC Risk Management Solutions to develop Resilience Risk Transfer (RRT) Solution, which would embed nature-based solutions for coastal properties exposed to storm surges. Munich Re will pilot RRT Solution with a range of nature-based solutions, including wetlands and mangroves, in the Mississippi River basin.[111]

Innovative risk finance instruments are using mangroves to improve insurance products and pricing models.

In the Philippines, Conservation International is developing the Restoration Insurance Service Company (RISCO) for Coastal Risk Reduction. It is a social enterprise that seeks to invest in mangrove conservation and restoration in areas with high-value coastal assets. RISCO was originally seen as a way to use the protection services of mangroves to reduce insurance premiums. However, premium prices in the Philippines were already too low for this approach to work. Therefore, RISCO is looking to secure USD 10 million in annual fees from insurance companies that directly benefit from the increased protective functions of mangroves for insured coastal assets and USD 10 million in blue carbon credits over 10 years. Fees raised will fund community-based wetland conservation and restoration activities directly linked to risk reduction. The pilot aims to cover 4,600 hectares of mangrove forest in the Philippines to reduce flood risks for 7,000 people.[112]

In Florida, TNC has developed a methodology to identify and quantify the protective values of mangroves as natural infrastructure that could be integrated in the Federal Emergency Management Agency (FEMA) community rating system to bundle credits for wetland conservation and restoration with existing space preservation credits.[113]

Multilateral regional insurance funds can leverage mangrove protection and regeneration as a cost-effective tool to reduce disaster risk.

According to the Caribbean Catastrophic Risk Insurance Facility, reef and mangrove restoration are among the most cost-effective approaches for coastal risk reduction and adaptation.[114] From 2012 to 2018, the World Bank provided USD 2 billion to 76 disaster risk management projects that integrated nature-based solutions, including USD 225,000 to nature-based solutions including mangrove restoration under the Greater Paramaribo Flood Risk Management project in Suriname.[115] However, regional insurance facilities set up by donors and private insurance companies to deal with climate risks are not making enough use of this approach and could take a more proactive approach to improve the capital available for mangrove protection and regeneration.

These include the Caribbean Catastrophe Risk Insurance Facility, the Africa Risk Capacity, the Southeast Asia Disaster Risk Insurance Facility and the Pacific Catastrophe Risk Assessment and Financing Initiative Insurance Program.[116] They could include mangrove-specific policies under the umbrella of catastrophe insurance, or offer mangrove restoration as a conditional clause in hurricane or typhoon insurance programmes, to incentivise investments in natural infrastructure to improve disaster resilience and post-hurricane recovery.[117]

4
CARBON MARKET PROJECT DEVELOPERS AND INVESTORS

Patient capital funds that provide upfront capital for mangrove restoration will be a key driver of the blue carbon segment in voluntary carbon markets.

For example, the Livelihoods Carbon Fund is an impact investment fund seeking to develop carbon credits that create a broader range of social and environmental benefits. 13 companies, including Danone, Mars, SAP, Veolia, and Hermes have invested in the fund, which provides EUR 2–6 million in finance for large-scale landscape restoration projects (5,000–10,000 hectares) of degraded ecosystems. It is financing three mangrove restoration projects in Senegal, India and Indonesia, which between them are projected to restore 18,420 hectares of mangrove forest and sequester 3.2 million tonnes of CO_2e.[118]

The Third fund (LCF3) has a deployment target of EUR 100 million to deliver up to 23 million carbon offsets over 20 years. Crucially, it will extend participation to investors by distributing an annual cash-based dividend. The fund will enable companies to define long-term carbon purchasing commitments according to their decarbonisation commitment.[119]

The value of mangroves can be better positioned to drive a 'premium price' for blue carbon in voluntary carbon markets.

The social, economic and biodiversity benefits of mangroves — i.e. their value beyond just carbon — often leads to price premiums in carbon markets. This is opening the opportunity to develop new types of credits that can bundle together climate adaptation benefits for coastal resilience with carbon credits for corporate buyers.

For example, Verra and TNC have been working on a third-party verified framework that will be published in 2021 for a 'Blue Carbon Resilience Credit'. The credit lays out a standardised approach to bundling the adaptation and mitigation benefits of projects, integrating mitigation metrics in the form of avoided CO_2e emissions and adaptation metrics in the form of flood protection benefits. TNC estimates that Blue Carbon Resilience Credits could mobilise up to USD 320 million/year for coastal conservation and restoration projects as corporate demand grows.[120]

Preparing for the growth of the compliance carbon market, as new developments bring these markets closer to recognising blue carbon.

Carbon offsets can fetch higher prices in the compliance markets, but at present few compliance markets accept credits from forestry or wetland offsets. The publication of VCS Methodology for Tidal Wetland and Seagrass Restoration in 2020 improves the rigour of mangrove conservation projects that can issue credits and provides a standardised methodology that could be accepted within a registry for the regulated markets.[121]

VNV Advisory, a project developer, has partnered with Worldview International Foundation to scale its existing Myanmar mangrove conservation and reforestation under the CDM AR-AM0014 (Large Scale A/R) methodology.[122] The project is set to restore 4,550 hectares of mangroves and sequester 14 million tonnes of CO_2e over 20 years. It is expected to become the first blue carbon project to sell credits in the compliance market. According to Carbon Pulse, the South Korean state-owned power utility, Korea Power Company (KEPCO), and trading firm Ecoeye, are investing in the mangrove reforestation project in Myanmar that will be registered under the Clean Development Mechanism (CDM) and generate offsets eligible in the Korean emissions trading scheme (ETS) — a compliance market.[123]

5
PHILANTHROPISTS AND FOUNDATIONS

Philanthropists are playing a key role in helping to unlock private sector conservation finance.

A number of foundations have used philanthropic grants to 'crowd in' conservation finance mechanisms. The MacArthur Foundation provided more than USD 1 million in grants to Blue Ventures, which were used to finance pre-feasibility and project preparation studies for carbon certifications, protecting 1,200 hectares of mangroves and generating 1,300 tonnes of blue carbon credits a year in Tahiry Honko, Madagascar.[124]

Upfront finance has been critical to support blue carbon regeneration projects, from pre-project preparation phases to covering costs in the initial years before credits can be generated. The MAVA Foundation provided multi-year support to Guinea-Bissau to quantify blue carbon stocks for 181,200 hectares of mangroves before securing REDD+ financing.[125] Philanthropists help to create markets by supporting advancements in science, as well as new business model piloting. The Gordon and Betty Moore Foundation has supported research into systems that could decouple seafood production from mangrove destruction and other environmental damage.[126]

Corporate foundations have also been important to advancing blue carbon methodologies and the science of mangrove conservation. HSBC Australia provided grants to the Blue Carbon Lab for the 'Mapping Ocean Wealth' research programme, which helped to quantify the value of Australia's coastal wetlands. The research created a business case for HSBC Australia to buy 'Reef Credits', a tradable unit that quantifies and values projects to improve water quality flowing onto the Great Barrier Reef.[127]

Philanthropic capital drives innovative finance approaches.

The pipeline of bankable and scalable projects remains sparse.[128] Mangrove conservation projects tend to be small scale and illiquid, often run by communities, governments and NGOs that are not designing projects with private investors in mind.[129] Investable projects often require technical assistance, low-cost debt, long-term and early-stage funding. These requirements are near-impossible to fund via market mechanisms. For example, IUCN's Blue Natural Capital Financing Facility (BNCFF) is leveraging donor finance to provide interim financing and support early stage blue natural capital projects to become investable.

In Indonesia, BNCFF is supporting Forest Carbon to carry out a feasibility study for restoring 15,000 hectares of mangroves in West Kalimantan and raise investment capital.[130] The Global Innovation Lab for Climate Finance — a donor collective supported by the Rockefeller Foundation and Bloomberg Philanthropies amongst others — has supported a number of early-stage financing vehicles in the blue carbon and finance space, including the development of RISCO and GROVE: FSL. IUCN, the Global Environment Facility (GEF), Mirova Natural Capital, and the Coalition of Private Investment in Conservation (CPIC) have partnered to develop the Nature+ Accelerator Fund.

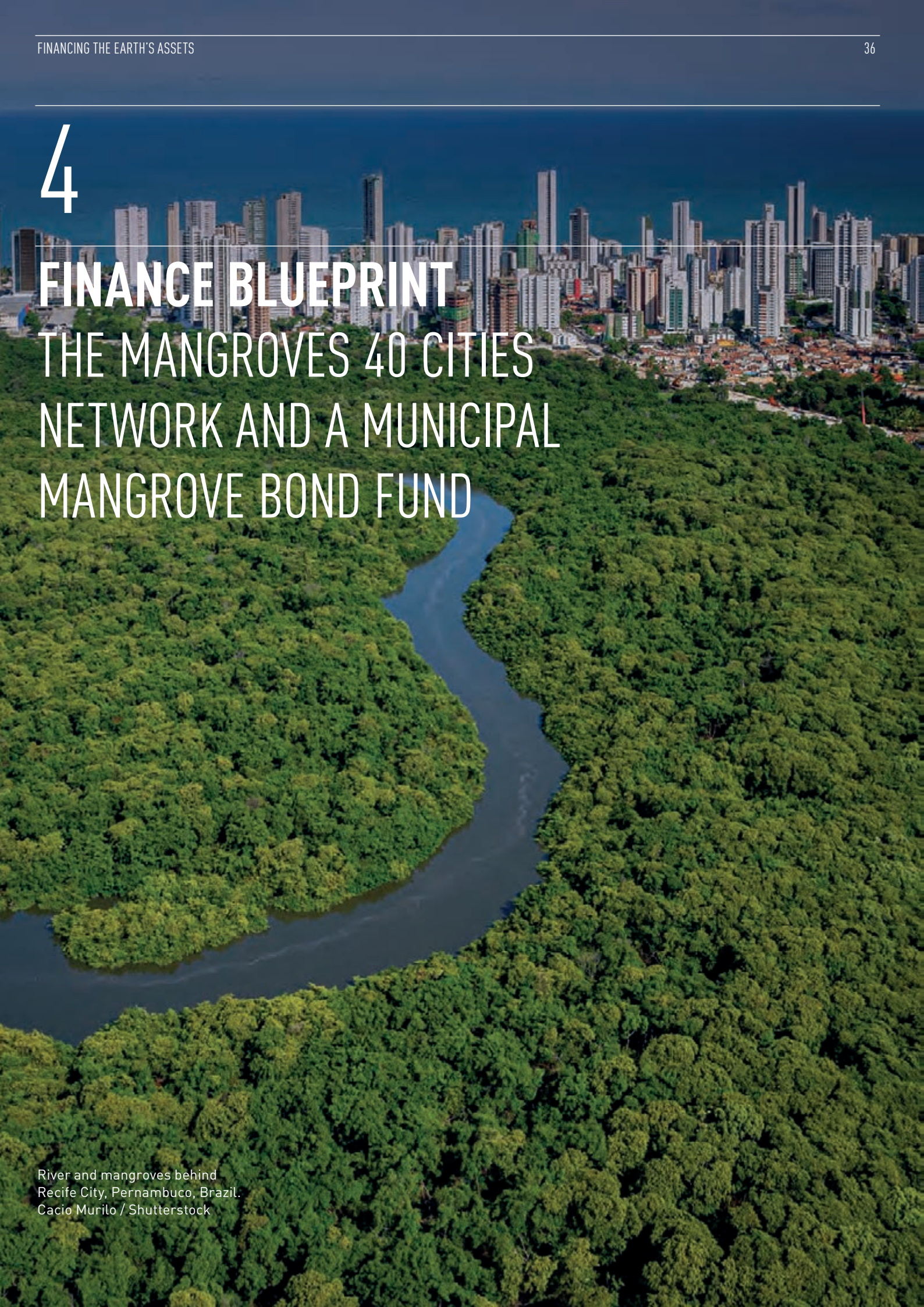
The Fund will leverage USD 8m in first loss junior equity from GEF to raise a further USD 42 million for the Fund that will accelerate a portfolio of scalable, financially viable nature-based projects, including MPAs, blue carbon projects and sustainable aquaculture.[131]

Grants used as guarantees to attract investors have also effectively shown they can lower the risk of pioneering financing vehicles and make them more attractive for private finance.[132] For example, a USD 6 million seed investment from the GEF and a partial debt guarantee from US International Development Finance Corporation (DFC), enabled the Meloy Fund to raise investment from FMO, JPMorgan Chase and Encourage Capital among others.[133]

For the Seychelles blue bond, more than USD 10 million in de-risking was required to complete the transaction. This included grants of USD 5 million from the Leonardo DiCaprio Foundation and the Grantham Foundation to help the government buy back USD 22 million in debt, a repayment guarantee from the World Bank, a concessional loan from the GEF to cover coupon payments, and political risk insurance for arbitration default cover from the DFC.[134]

4

FINANCE BLUEPRINT
THE MANGROVES 40 CITIES NETWORK AND A MUNICIPAL MANGROVE BOND FUND



River and mangroves behind Recife City, Pernambuco, Brazil.
Cacio Murilo / Shutterstock

4.1
CREATING THE MANGROVES 40 CITIES NETWORK (M40 CITIES)

The world's remaining mangrove stocks are concentrated in 750 regions around the planet's tropical and sub-tropical belt. Of these, just 40 locations account for almost 70% of the mangroves still standing, and which currently store some 3 billion tonnes CO2e. An agile initiative that coordinates, aggregates and accelerates collective action among these locations could also provide a pathway to finance mangroves on a planetary scale.

Mangroves and rivers with the volcanic island of Nosy Komba, Madagascar.
Christopher Scarffe / Mangrove Action Project

Most of these 40 locations identified contain at least one urban centre where coastal, estuarine or riverine mangrove ecosystems are present.

There are medium-sized and larger cities, including Brisbane (Queensland, Australia), Miami and Jacksonville (Florida, USA), alongside municipalities in Brazil, Indonesia, Malaysia, Papua New Guinea, Myanmar, Bangladesh and Mexico.[135] These cities differ in the size of their economies; their creditworthiness and ability to borrow from capital markets, and technical capabilities needed to tap effectively into climate finance. However, they share common challenges of making urban development more climate resilient; and for all of them mangroves can be a cost-effective asset for urban development and climate adaptation.

Cities are emerging as increasingly important political and economic building blocks for the global economy, cities' networks are an opportunity to share knowledge, accelerate political leadership and collective action, and co-ordinate climate financing opportunities.

Examples include C40 Cities, a group that has grown from 40 to 96 cities around the world, and ICLEI, a global network of more than 1,200 municipalities acting on climate change. These networks have shown the value of co-ordinating mechanisms that can mobilise and support mayors and their administrations to accelerate climate action, and organise global collective action in new ways.[136] [137]

The concept also builds on Earth Security's work in the Philippines, one of the world's most exposed countries to climate change. Funded by Germany's Federal Ministry for the Environment, Conservation and Nuclear Safety (BMUB), Earth Security has developed a programme in collaboration with the Asian Institute of Management (AIM) in Manila. Launched in 2020, the Bridging Leaders' Initiative for Climate Resilience (BLICR), hosted by AIM, brings together 10 mayors from local municipalities that are most vulnerable to climate change and 10 private sector companies, which are seeking to build greater climate resilience in their operations.

Panoramic of Estero Bay with mangrove islands in Bonita Springs, Florida.
SunflowerMomma / Shutterstock

One of the participants in our programme is Alfredo Coro, Municipal Vice Mayor of the Municipality of Del Carmen, in the Siargao Islands in the Philippines. Mr. Coro has been at the forefront of mangrove regeneration projects in their locality. He sees first-hand the value that these green infrastructures bring in terms of climate resilience and the local economy. But also recognises that to be sustainable, municipalities must find new ways to tap into climate finance and private sector green investment.

Through the programme, the group of mayors and companies are discovering each other. They are partnering to develop financing mechanisms to support municipalities to invest in nature-based climate adaptation faster and over the longer-term.

Drawing on these models, we propose the development of M40 Cities: a network of municipalities located along the planet's mangrove belt. The M40 would increase knowledge transfer, activate collective action and support the aggregation of financing opportunities. To begin with, the M40 does not need to be a new institution – it can be created as a programme of an existing structure such as C40s or ICLEI. A process must follow to engage prospective municipalities, identify common areas of interest, based on how they currently approach mangroves in their city masterplans and infrastructure blueprints; establish how these options could be financed in new ways, including through the establishment of a dedicated municipal finance fund, and establish an agile institutional format for the development of the M40 Cities.

We see this programme as an opportunity not just to connect the leadership and opportunities available for mayors, but also to help global decision-makers in climate finance funds to 'visualise' the opportunity to invest in mangrove regeneration on a planetary scale. The network would also allow the aggregation of financing opportunities, for which we propose the establishment of a 'municipal mangrove bond fund'.

Figure 9
The M40 Cities
Municipalities accounting for the majority of mangroves reserves

Country	**Regions**	**Largest city with mangroves** [A]	**Blue carbon stock** [A] Million tonnes CO_2e	**Global total** [A] %	**Primary governmental responsibility for mangroves**	**Subnational entities allowed to borrow externally** [B]
Indonesia	Papua	Jayapura	329	7.77	Central	No
	Irian Jaya Barat	Sorong	237	5.61		
	Kalimantan Timur	Balikpapan	96	2.26		
	Maluku	Kota Ambon	93	2.19		
	Sumatera Selatan	—	82	1.93		
	Riau	Dumai	74	1.75		
	Kalimantan Utara	Tarakan	63	1.50		
	Kalimantan Barat	Singkawang	63	1.49		
	Bangka-Belitung	Pangkal Pinang	32	0.75		
	Sulawesi Tenggara	Kendari	29	0.68		
	Kalimantan Selatan	—	28	0.65		
	Kepulauan Riau	Batam	25	0.60		
Brazil	Maranhão	Sao Luis	155	3.66	Central	Yes
	Pará	Belem	107	2.52		
	Amapá	—	76	1.80		
Malaysia	Sabah	Sandakan	137	3.25	Central	Yes
	Sarawak	Kuching	74	1.74		
Papua New Guinea	Gulf	Kerema	122	2.89	Central	—
	Central	Port Moresby	27	0.65		
	Western	Daru	26	0.60		
Myanmar	Tanintharyi	Myeik	88	2.07	Central	Yes
Australia	Queensland	Brisbane	81	1.91	Subnational	Yes
	Northern Territory	Darwin	54	1.27		

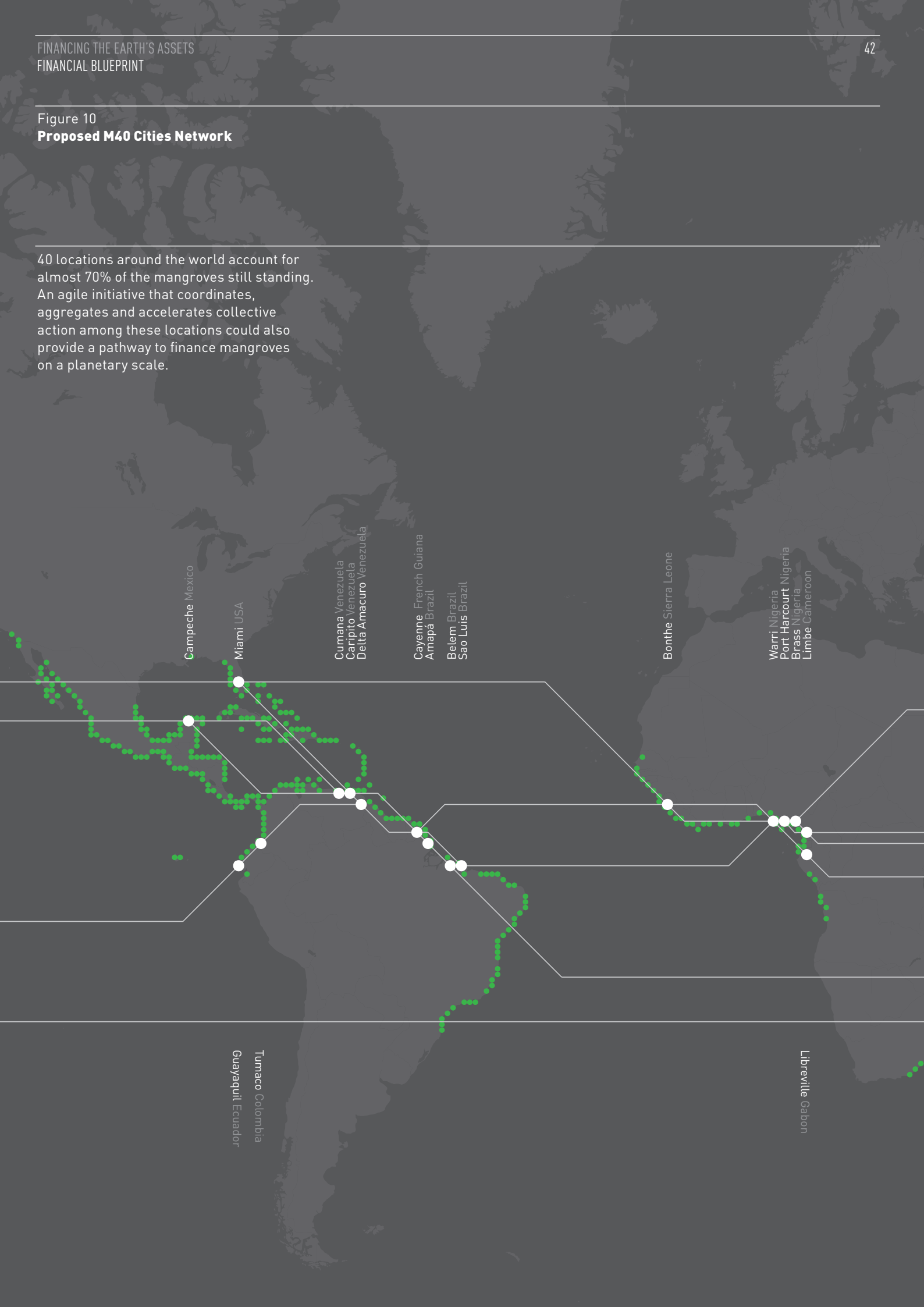
[A] 'Global carbon stocks and potential emissions due to mangrove deforestation from 2000 to 2012', Stuart Hamilton and Daniel Friess, Nature Climate Change (8), 2018.

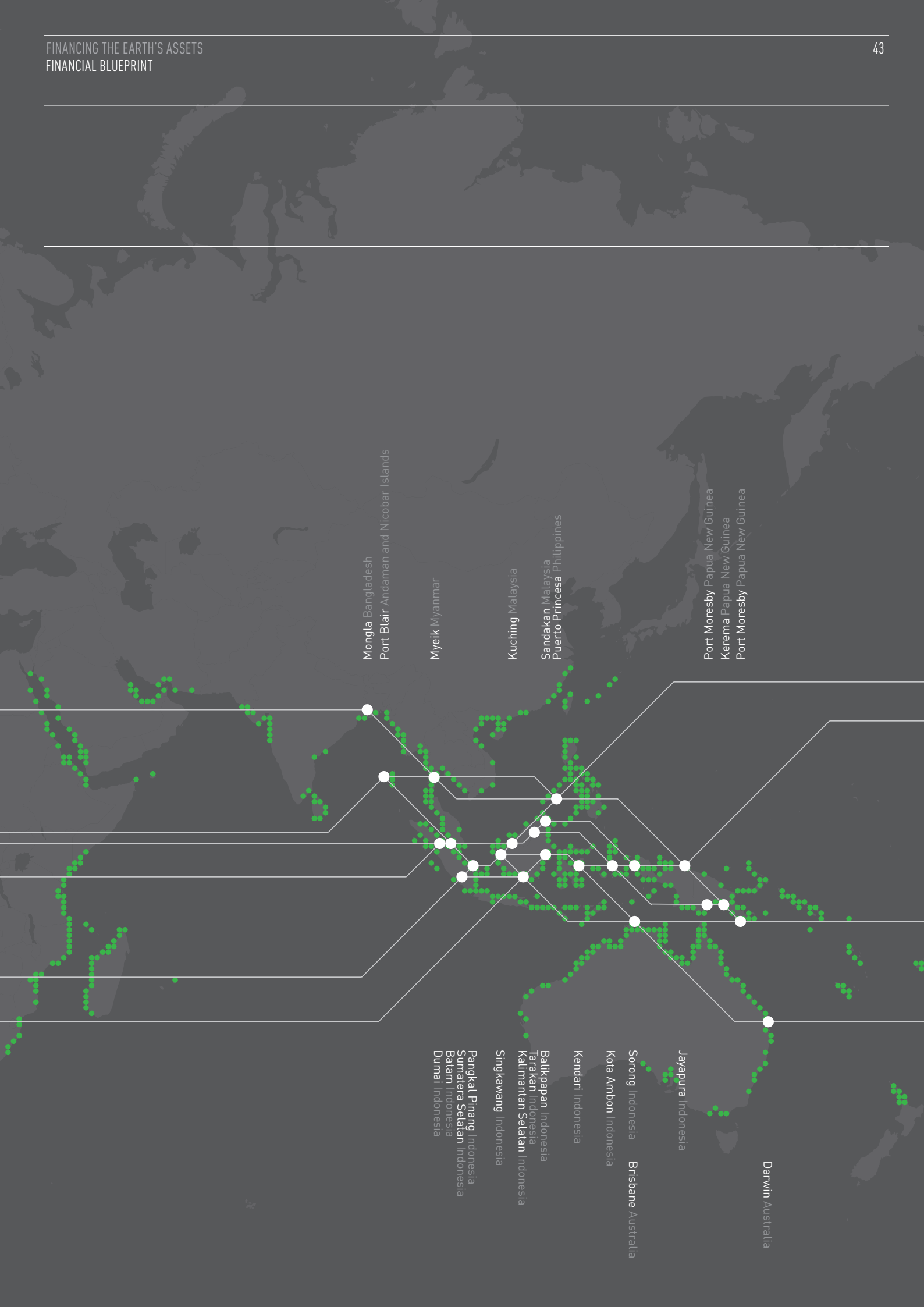
[B] '2019 Report Key Findings', World Observatory on Subnational Government Finance and Investment (SNG-WOFI), Organization for Economic Cooperation and Development (OECD), 2019.

Country	Regions	Largest city with mangroves [A]	Blue carbon stock [A] Million tonnes CO_2e	Global total [A] %	Primary governmental responsibility for mangroves	Subnational entities allowed to borrow externally [B]
United States	Florida	Miami	74	1.75	Subnational	Yes
Bangladesh	Khulna	Mongla	66	1.56	Central	Yes
Mexico	Campeche	Campeche	56	1.31	Mixed	No
Nigeria	Bayelsa	Brass	52	1.23	Subnational	Yes
	Delta	Warri	41	0.96		
	Rivers	Port Harcourt	26	0.61		
Venezuela	Delta Amacuro	—	50	1.18	Central	No
	Monagas	Caripito	30	0.72		
	Sucre	Cumana	24	0.57		
Gabon	Estuaire	Libreville	44	1.05	Central	Yes
Ecuador	Guayas	Guayaquil	40	0.95	Central	—
Colombia	Nariño	Tumaco	37	0.88	Subnational	Yes
Cameroon	Sud-Ouest	Limbe	33	0.77	Central	No
French Guiana	Cayenne	Cayenne	32	0.76	Subnational	Yes
India	Andaman & Nicobar	Port Blair	26	0.61	Subnational	Yes
Philippines	Palawan	Puerto Princesa	24	0.57	Central	Yes
Sierra Leone	Southern	Bonthe	24	0.56	Central	Yes

Figure 10
Proposed M40 Cities Network

40 locations around the world account for almost 70% of the mangroves still standing. An agile initiative that coordinates, aggregates and accelerates collective action among these locations could also provide a pathway to finance mangroves on a planetary scale.




Mongla Bangladesh
Port Blair Andaman and Nicobar Islands
Myeik Myanmar
Kuching Malaysia
Sandakan Malaysia
Puerto Princesa Philippines
Port Moresby Papua New Guinea
Kerema Papua New Guinea
Port Moresby Papua New Guinea
Darwin Australia
Jayapura Indonesia
Sorong Indonesia
Brisbane Australia
Kota Ambon Indonesia
Kendari Indonesia
Balikpapan Indonesia
Tarakan Indonesia
Kalimantan Selatan Indonesia
Singkawang Indonesia
Pangkal Pinang Indonesia
Sumatera Selatan Indonesia
Batam Indonesia
Dumai Indonesia

4.2
ACCELERATING MUNICIPAL FINANCE FOR CLIMATE ADAPTATION

Coastal cities are in dire need of adaptation finance.

Average flood-related losses suffered by the world's 136 largest coastal cities are expected to rise to USD 52 billion per year by 2050. If risks of sea-level rise and sinking land are taken into account, total losses could be as high as USD 1 trillion.[138]

In the US alone, USD 400 billion will be needed to protect coastal municipalities and cities by 2040.[139] Municipal-level financing of climate adaptation and resilience projects is however in its nascence. Out of 1,143 climate-related projects in cities identified by the C40 Cities Finance Facility, fewer than 4%, are for climate change adaptation.[140] Although the gap exists for both developed and emerging economies, the latter struggle even more to access finance for low-carbon and climate resilience projects. Globally, just 2% of green financing goes to cities in emerging markets.[141]

Overall, global financing needs for climate-resilient infrastructure are expected to reach USD 93 trillion by 2030 — 70% of which will be in rapidly developing urban areas.[142]

Mangroves provide coastal municipalities with a cost-effective climate solution.

In China, urban development proposals for Jiangdong New District, Haikou, on the island of Hainan, include plans to restore and protect China's largest mangrove forest, integrating it into city protection and flood management planning.[143]

In the Philippines, the municipality of Del Carmen, Surigao del Norte raised USD 1.3 million from public funds, private sector corporations and ODA to conserve and rehabilitate 5,000 hectares of mangrove forest, reduce illegal and destructive activities in 44,000 hectares of municipal waters, diversify local livelihoods, and improve access to market for local fishers.[144] Interventions in Siargao have reduced mangrove felling by 100% and its restoration efforts have an 80% survival rate. Fish stocks have increased by 200% and, pre-COVID pandemic, poverty fell by 20% through the development of new livelihoods including ecotourism and fishing.[145]

Municipalities need more capacity to overcome barriers to climate finance.

Despite evidence for the cost-effectiveness of mangrove conservation and restoration in protecting coastal assets, in many municipalities where mangroves are concentrated, budgets cannot cover any additional expenditure, and tax revenues are often insufficient even to meet the costs of providing basic services.

In Abidjan, Cote d'Ivoire — a coastal city highly vulnerable to flooding and sea-level rise — the per capita municipal budget is just USD 0.02, compared to USD 813 in Cape Town, South Africa.[146] The inability to raise external finance is a further constraint. C40 Cities found that half of its member cities in low and middle-income countries, including coastal cities such as Dar es Salaam, Ho Chi Minh City, Jakarta and Mumbai, either find it difficult to borrow or cannot do so without sovereign oversight or approval.[147] Even where cities in the developing world are permitted to access finance, 96% are unable to do so in international markets because of their low creditworthiness (due to high debt ratios, low capital reserves, limited revenue sources, and restricted revenue-raising powers) or a lack of credit rating, severely constraining their ability to raise the funds for climate-related projects.[148] This is due to poor financial record-keeping and low transparency, high levels of debt and poor revenue collection, and an inadequate credit history.[149]

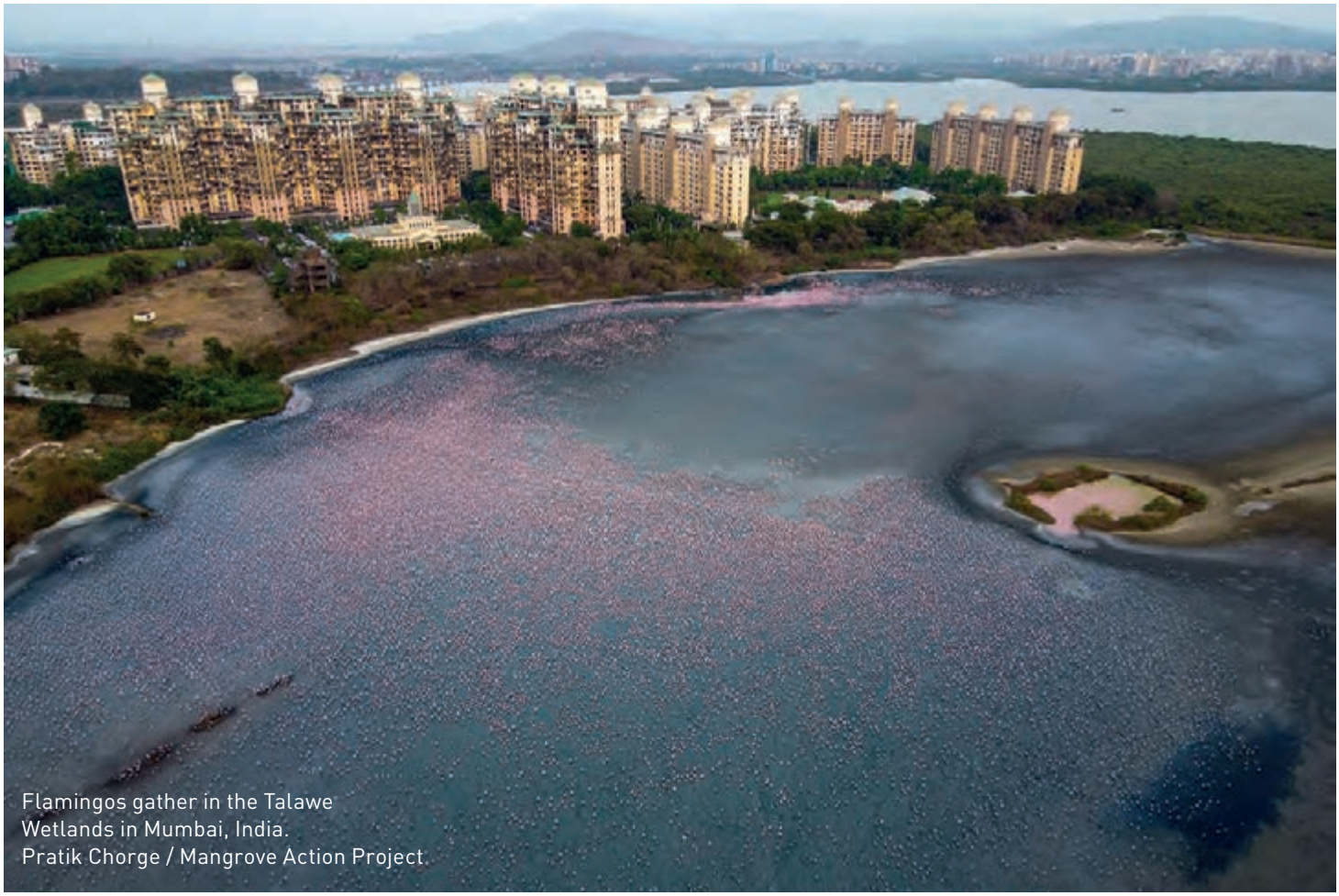
"New pathways to unlock climate finance for municipalities are vital for us to achieve a resilient blue economy locally."

Alfredo Coro, Municipal Vice Mayor, Municipality of Del Carmen, the Siargao Islands in the Philippines

"Municipal green bonds" have significant potential to finance climate adaptation.

The municipal bond (muni-bond) market is one of the best recognised segments of global fixed-income markets. The US muni-bond market, valued at USD 3.8 trillion, is the world's largest and most vibrant market, including both state and municipal issuances. 54% of the country's largest cities have issued bonds to fund resilience projects, such as seawall construction and restoration and improving stormwater drainage.[150]

In less developed markets, the muni-bond climate resilience market is also starting to grow. In India, eight local governments have raised USD 463 million through municipal bond issuance for infrastructure projects and the Ministry of Housing and Urban Development is helping municipalities to improve their credit ratings to help them attract investment.[151] Muni-bonds are seen as a good tool to invest in climate resilient infrastructure, particularly in cities with high credit ratings. Some of these, including Mumbai and Kolkata, are located in or near coastal areas, where mangrove conservation and restoration are key components for climate resilience.[152]



Flamingos gather in the Talawe Wetlands in Mumbai, India.
Pratik Chorge / Mangrove Action Project

4.3
THE BUSINESS CASE FOR A MUNICIPAL MANGROVE BOND FUND

Based on the above, we propose the development of a municipal mangrove bond fund. This would provide a mechanism for municipalities to access finance for climate adaptation projects that use mangrove regeneration to provide green infrastructure and blue carbon offsets. A fund that aggregates financing of many municipal locations would allow investors to spread investment risk across developed and emerging markets, while reaching the global scale needed for a product to be viable in global fixed income markets. The business case for such a fund is as follows:

Municipal bonds have already been used to finance mangrove restoration.

The US muni-bond market finances two-thirds of all infrastructure improvements in the country.[153] Some coastal municipalities are experimenting with issuing bonds to fund climate resilience. In 2017, residents of the city of Miami approved the city's plan to issue the USD 400 million Miami Forever Bond. USD 192 million will be used to fund projects to combat sea-level rise and flooding, including mangrove protection and restoration.[154]

The city's Downtown Development Authority (DDA) proposes planting mangroves as part of a plan to restore the city's seawall that will be funded through the bond.[155] The state of Louisiana is reported to be considering issuing an environmental impact bond to fund its Coastal Master Plan, that comprises USD 50 billion in wetland and coastal restoration and protection projects over the next 50 years.[156]

Municipal bond issuances need the support of local residents, particularly if taxes or rates will be increased to help finance the bond. In Miami voters were asked for their support to either repurpose an existing bond that was about to expire or to introduce a new 3% property tax to pay for the bond.[157]

Widespread citizen and stakeholder support also helped to attract additional finance from other public and private sources, and to ensure continued multi-stakeholder involvement in activities funded by the bond.[158] For blue carbon projects, local buy-in with individual or communal owners of blue carbon ecosystems is critical.

Funds that aggregate municipal climate finance can create economies of scale

The proposal for a Municipal Mangrove Bond fund follows the example of the Nordic Investment Bank for the Baltic Blue Bond and Kommuninvest in Sweden. These bodies aggregate projects across multiple municipalities or countries into one bond issuance or fund to raise finance that is then lent to cities and regions. These aggregated projects can scale to an issuance size and length that is attractive to the fixed income market, namely USD 200 million — USD 500 million for a 10-year bond. Developing a loan-aggregating mechanism can help to increase funding opportunities for smaller municipalities that lack credit ratings or track record.

By aggregating single green loans into one fund, Kommuninvest allows smaller municipalities to access green financing opportunities at a lower cost that would otherwise be out of reach.[159] The USD 220 million Nordic–Baltic Blue Bond issued by the Nordic Investment Bank directed proceeds to eight countries, Denmark, Estonia, Finland, Iceland, Latvia, Lithuania, Norway and Sweden, in order to finance projects that would reduce pollution of the Baltic Sea.[160]

The United Nations Capital Development Fund (UNCDF) has developed the International Municipal Investment Fund (IMIF), which is due to launch in 2021. The fund aims to support resilient urban infrastructure, especially in Least Developed Countries (LDCs), mobilising finance from national and international capital markets to fund projects of up to USD 25 million.

The UNCDF fund's manager, Meridiam, and the Rockefeller Foundation, will develop a screening mechanism to help prospective investors evaluate the climate resilience impact of investable projects.[161] [162]

Municipal-led projects must ensure rigorous transparency and accounting standards so that funds go to the projects for which they have been earmarked. Clear and well-defined eligibility criteria are important to assure investors that their projects can deliver impact and are both technically and financially viable.[163] In the case of mangrove restoration, which has a range of risks and challenges, we recommend that a technical working group such as the IUCN Specialist Group on Mangroves is involved to provide quality assurance on the development of a screening mechanism and eligibility criteria.

Capacity building and risk finance can support a municipal pipeline of investable projects

For less developed municipalities, UNCDF's IMIF combines a fund with a municipal capacity building programme. Such a combined approach is vital to build a pipeline of projects for mangrove restoration in developing countries. The proceeds from the issuance of a mangrove bond would be earmarked by municipalities to finance projects aimed at mangrove restoration and regeneration, including wastewater treatment plants that reduce mangrove pollution, sustainable fishing and aquaculture projects that use mangroves as a part of a sustainable production model, and the rehabilitation and re-planting of mangroves for blue carbon sequestration and commercialising offset credits in carbon markets.

The varying levels of technical capacity to access climate finance and implement such projects, means that providing technical assistance alongside finance is essential. Technical support would help municipalities to develop bankable blue carbon projects based on scientific best-practice, identify and secure agreements with blue carbon stakeholders, and monitor project outcomes. Capacity building is needed to raise and manage external finance through financial management controls and governance.

UNCDF's Local Climate Adaptive Living Facility (LoCAL), which provides performance-based climate resilience grants, capacity building and operational support to local governments in LDCs to finance climate adaptation projects could help to build capacity. The facility is currently working with 280 local governments in 23 countries and has helped fund nearly 1,000 climate adaptation investments, mobilising a total of USD 84.3 million since 2014. In Ghana and Bangladesh, this has included support for mangrove projects.[164]

In addition, blended finance can help de-risk investments in less developed municipalities. This may include risk guarantees or first-loss financing tranches from a development bank to improve a bond's credit rating and lower the costs of capital for recipients. Other forms of risk financing have been successfully implemented in the blue finance space, including political risk insurance, as provided by the US Development Finance Corporation to support the issuance of the Republic of the Seychelles' sovereign blue bond.[165]

In East Kenya, BHP Billiton provided insurance as an intermediary 'off-taker' for carbon credits in a USD 152 million forest protection bond issued by the IFC for a REDD+ project that paid interest payments in the form of cash or carbon credits. Although not for blue carbon, BHP Billiton committed to buy carbon credits in the case that bondholders decided to be paid in cash, demonstrating a strategic and catalytic use of donor or philanthropic capital.[166]

Multiple cash-flows can be used to repay mangrove bonds

A total of 22 cities, including coastal cities such as Melbourne and Rio de Janeiro, have made net-zero commitments as part of their membership of the Carbon Neutral Cities Alliance, committing to reduce greenhouse gas emissions by 80–100% by 2050. Some cities are experimenting with blue carbon financing as a way to diversify their revenue streams and help to meet the financial cost of their environmental commitments.

For example, in 2016 Yokohama City in Japan introduced the Yokohama Blue Carbon Offset scheme to secure payments from local companies and tourists for blue carbon offsets from its urban coastline.[167] The Australian state of Victoria has an emissions reduction target of net zero by 2050, and is exploring the role of blue carbon in achieving this.[168] For wealthier cities, property taxes can also provide a cash flow for financing protective infrastructure, such as sea walls. Where infrastructure investment leads to lower insurance premiums, municipalities can also cost the difference into municipal property taxes. The tax income received from tourism such as hotels, visiting fees to protected areas, and other tourist facilities benefiting from the value of mangroves, can also provide cash flow to finance a bond.

Blue carbon projects for the voluntary or compliance markets can run for an initial four years before income can be realised. High upfront costs for project design, baseline studies, planting and management, and certification, mean that patient money is vital to their success. The Blue Natural Capital Financing Facility (BNCFF) has proposed a way around this by creating a 'blue carbon matching grant'. Provided by philanthropists or multilateral finance from the Green Climate Fund, these grants can help municipalities to cover the first few years of coupon repayments for a mangrove bond, until carbon and other forms of income can be realised.

National governments can borrow at a sovereign level on behalf of municipalities

To use municipal bonds for climate finance, municipalities must be able to borrow directly from capital markets, without the intermediation of central governments. This is not the case for Indonesian municipalities — a key country for the M40 proposal given its concentration of mangrove stocks. However, nationally, the Republic of Indonesia has been at the forefront of the sovereign green bond movement.

First issued in March 2018, a USD 1.25 billion 'green sukuk' made Indonesia the fifth nation globally to place a green sovereign issue and the first to use the sukuk format. A sukuk is an interest-free bond that generates returns to investors without infringing the principles of Islamic law (Shariah). According to the Climate Bonds Initiative, the green sukuk could channel the USD 2 trillion Islamic finance market towards green finance. Indonesia's green bond issuance reached USD 2.7 billion as of April 2019, making it the largest borrower among ASEAN countries, accounting for 39% of total ASEAN issuance.[169]

A municipal mangrove bond proposal should allow Indonesia to approach this as a sovereign green bond that earmarks the proceeds for mangrove restoration in key municipalities in the global M40 network.

CASE STUDY
INNOVATIVE CITY FINANCING FOR CLIMATE RESILIENCE

The Miami Forever Bond

Miami is one of the most exposed cities to climate change globally. The city of over 2 million people has already experienced almost six inches of sea-level rise and a 350% increase in flooding since the mid-90s.[170] The benefits of Florida mangroves during Hurricane Irma were estimated to be up to USD 47,000/ha.[171]

The Miami Downtown Development Authority estimated that integrating a mangrove 'living shoreline' with a cement sea wall would increase net present value by USD 116 million and reduce the costs of a 10-year storm by USD 148 million, compared to a cement sea wall investment only.[172] The USD 400 million Miami Forever Bond is set to direct USD 192 million of proceeds to green-grey infrastructure, including sea-walls and replanting mangroves, in order to mitigate the impacts of sea-level rise and flooding, in a first for municipal bonds.[173]

The Yokohama Blue Carbon Offsets

Yokohama, the second largest city in Japan and home to one of the largest international ports, lies on the south-eastern coast of Japan's main island, and has faced an increasing number and severity of typhoons and flooding.[174] In 2011, the city initiated the Yokohama Blue Carbon Project to estimate the carbon sequestered in its urban coastline and quantify the economic value generated by its coastal ecosystem, primarily seaweed forests.

In 2016, the city introduced the Yokohama Blue Carbon Offset scheme to secure payments from local companies and tourists for blue carbon offsets from its urban coastline.[175] The project is now quantifying the risk reduction benefits of mangroves and other coastal ecosystems and is implementing projects to improve coastal management and boost local production and consumption of seaweed.[176]

Mangroves of the Godavari River Delta in East Godavari District, Andra Pradesh, India.
Srikanth Mannepuri / Mangrove Action Project

5 RECOMMENDATIONS

Roots and new shoots in Cartagena's Mangrove Swamp, Colombia.
Mariano Gaspar / Shutterstock

5.1
CALL TO ACTION

The call to action provides recommendations for philanthropists, banks, investors, insurers, governments and global climate funds. Each has a unique role to play in realising the full potential of mangroves as a global nature-based climate solution.

1
Create the 'Mangroves 40 Cities Network' (M40 Cities) to act as a global safety net

We identify 40 cities that are closest to the mangrove stocks. These cities could not be more different from one another, but all face the common challenge of aligning their urban development and financing with protecting their mangrove assets. A **Mangroves 40 Cities Network** (M40 Cities) could act as a global safety net to protect the last mangrove frontier.

The proposal builds on the model of the C40 Cities for climate change, which has shown how the city level can be an effective unit for climate action and climate finance. The M40 Cities Network can accelerate the collective action of mayors, share knowledge on regeneration projects and pathways, and facilitate the aggregation of municipal financing through a Mangrove Municipal Bond Fund. Philanthropists have a key role to play in mobilising this agile institutional format. Models such as C40 and ICLEI, a network of over 1,000 municipalities acting on climate change, provide a design template, and a potential partner.

2
Develop a Municipal Mangrove Bond Fund to finance adaptation for cities

Coastal cities are in dire need of climate adaptation finance. Average flood-related losses suffered by the world's 136 largest coastal cities are expected to rise to USD 52 billion/year by 2050. Mangroves provide coastal municipalities with a cost-effective climate solution. The Miami Downtown Development Authority estimated that benefits of integrating a mangrove 'living shoreline' with a cement sea-wall amounted to an increase in USD 116 million in net present value and reduced the costs of a storm by USD 148 million. From the Nordic Investment Bank to the UN Capital Development Fund, municipal-level climate finance offers a unique opportunity for innovation with a fixed income product that is familiar to investors.

The **Municipal Mangrove Bond Fund** could finance municipal climate adaptation projects through mangrove regeneration and provide cost-effective green infrastructure and blue carbon offsets. A bond fund providing access to the 40 municipal locations holding mangrove stock globally, from Miami to Guayaquil, would provide the opportunity to pool together different levels of investment risk across developed and emerging markets, reaching the global scale needed for a product to be viable in global fixed income markets.

3
Create a premium price for 'blue carbon' for voluntary carbon markets to deliver

Current carbon prices are not high enough to finance the restoration of mangroves at a global scale. This report presents a series of price scenarios and suggests that the price of carbon must be at least USD 29/tCO_2 to cover the costs of global regeneration. How the price of carbon credits is determined is linked to the perceived value creation. A premium price for blue carbon should be established by a collaboration of project developers, intermediaries and investors, based on the value that mangroves have beyond carbon (e.g. increasing local income for fishing communities, lower costs of maintaining infrastructure due to their coastal protection function, or increased regulation of water flows, water pollutants and sedimentation).

Setting a price of carbon high enough to generate cashflow for conservation should be a central recommendation of the **Task Force for Scaling Voluntary Carbon Markets** throughout 2021. The Nature Conservancy estimates that blue carbon credits integrating both carbon mitigation and adaptation could mobilise up to USD 320 million/year for coastal conservation and restoration projects as corporate demand grows.

4
Integrate the economic value of mangroves in nature-based investments

As the case study in section 3 shows, the investment in restoring mangroves by a wind power project in Pakistan could return 20 times the investment value by protecting physical assets against coastal erosion. This could save the project developer and its investors up to USD 7 million over the project's 25-year timeframe, while doubling local communities' income. The section outlines a framework that enables investors to integrate the value that mangroves can provide to coastal investment projects, from infrastructure to aquaculture.

In identifying and quantifying how mangroves are materially relevant to investors and investment projects, we hope to provide an input to the work of the **Task Force for Nature-related Financial Disclosure** (TNFD) in 2021, as TNFD helps financial institutions to protect natural capital. In addition, we identify five areas where mangroves offer investors tangible opportunities to invest in the blue economy, such as natural capital investment funds, blue bond issuance, innovation in carbon markets, the provision of insurance and risk finance, and strategic philanthropy.

5
Leverage the power of mangroves for carbon finance at COP26

Just 25 countries account for over 90% of the mangrove stock and the restorable area. Governments have the opportunity to increase access to climate finance and create cost-effective ways of achieving their climate commitments. This includes the bilateral carbon offsetting agreements expected to be central to the **UN Framework Convention on Climate Change** (UNFCCC) under Article 6 of the Paris Agreement.

In order to leverage these opportunities, governments must clearly recognize the mitigation and adaptation value of mangroves in their Nationally Determined Contributions (NDCs) — yet 11 of these 25 countries do not mention them at all. COP26, due to be held in 2021 under the joint auspices of the governments of the UK and Italy, offers an opportunity to discuss how countries holding natural assets of great climate significance, such as mangroves, can use them in carbon trading mechanisms in a way that avoids double counting. COP26 will be the first time that nature-based solutions feature on the agenda of the UNFCCC Standing Committee on Finance. This committee must acknowledge that the current blue carbon price is a barrier to regeneration.

As these 25 countries prepare their NDC updates for COP26, they must recognise the significant carbon value they hold in their mangroves and create the necessary arrangements to avoid 'double counting' of carbon offsets. This can be done through closer co-operation with the International Partnership for Blue Carbon, which supports countries to integrate blue carbon into NDCs. Doing so will increase opportunities to tap into climate finance, including access to innovative financing mechanisms such as blue sovereign bonds.

5.2
WHAT INVESTMENT DECISION-MAKERS CAN DO

Philanthropists

Philanthropy will continue to be a vital source of funding for mangrove conservation and restoration, as well as catalysing new financing models for their regeneration. In addition, philanthropists can:

— Support the formation and operation of an M40 Cities Network, creating an agile global institution that can rapidly connect all the vital locations for mangrove restoration around the world, to accelerate the initiatives of local mayors.

— Support the project preparation phase of the M40 Mangrove Municipal Bond Fund, where philanthropic funding can build the technical capacity of municipalities. Patient capital and grants will be critical to help some municipalities to cover the first few years of investment and coupon repayments for a mangrove bond, until carbon and other forms of income can be realised.

— Use grant funding to provide guarantees for carbon credit purchases over initial years if the price of carbon falls below a pre-agreed level, and therefore de-risk investments in a municipal bond fund.

Investors and companies

The tangible investment value of mangroves is as relevant to mainstream companies and investors financing coastal infrastructure, real estate, fishing and aquaculture projects as it is to specialised investment funds focusing on natural capital and sustainable development. Both investors and companies can:

— Implement nature-based carbon offsetting in net-zero commitments in a way that goes beyond the value of carbon, creating local value for climate adaptation, inclusive economic development and biodiversity protection.

— Integrate the value of ecosystem services provided by mangroves in investment projects, considering the return on investment that financing mangrove conservation or regeneration can have for a project.

— Consider mangroves strategically when investing in the 'blue economy', including building sustainable aquaculture or regeneration tech portfolios for natural capital investments funds; using the proceeds of blue bonds for mangroves; developing innovative risk finance models and insurance.

— Disseminate the key messages to educate a broader audience, including institutional investors, on how carbon offsetting can go beyond treating carbon simply as a commodity.

Insurers and reinsurers

Insurers are already actively experimenting, through the myriad of new products and partnerships described in the report, to realise the value of nature in boosting resilience. In addition, insurers, reinsurers and multilateral risk finance providers can:

— Create a model that prices mangroves' climate risk mitigation value to the 25 countries with the highest mangrove density (given their tropical location, they are also among the most exposed to weather extremes). Reinsurance companies could, for example, model the impact that removing mangroves would have on their future sovereign risk pricing. Improved data will enable reinsurance companies to develop nature-based insurance products that account for the health of mangrove ecosystems and identify where best to invest in restoration.

— Deploy insurance capital to invest in mangrove restoration as a risk mitigation measure, through regional insurance facilities operating in areas with high mangrove density. These include the African Risk Capacity, the Caribbean Catastrophe Risk Insurance Facility, the Southeast Asia Disaster Risk Insurance Facility and the Pacific Catastrophe Risk Assessment and Financing Initiative Insurance Program. Given the importance of mangroves to climate adaptation in these regions, these insurance facilities should have a policy position on mangrove conservation and regeneration of country clients, in order to send a signal to governments.

Banks

Banks play an important role in emerging blue finance markets by launching blue bonds, acting as agents for blue investment funds and supporting innovative financing facilities. This is how they can leverage the value of mangroves:

— Invest in mangroves on a global scale as a carbon mitigation tool to achieve their own corporate net-zero commitments, in a way that quantifies the 'value beyond carbon' of mangrove regeneration for local economic development and biodiversity. This will set an important precedent for how carbon markets should approach blue carbon pricing and values.

— Support clients (corporates, sovereigns and sub-sovereigns) to develop blue bonds based on the value of mangroves. This can embed mangrove restoration in a local economic strategy, to counter the economic pressures threatening mangrove environments. For example, blue bond proceeds can finance infrastructure projects for flood management or sustainable business models of mangrove-shrimp aquaculture. Throughout the process, banks should ensure projects are based on scientific standards and mangrove conservation methods (see Appendix).

— Look for opportunities to leverage the value of mangroves in green finance deals to coastal cities. Investments containing mangrove regeneration can be included in any form of municipal green adaptation finance for relevant coastal cities in tropical and sub-tropical regions. Secondly, carry out a feasibility, design and development study to assess the creation of a thematic mangrove bond fund that can aggregate financing deals for cities and spread the risk by investing in both developed and emerging markets.

Multilateral climate funds

Just USD 300 million was committed to climate adaptation finance for coastal protection in 2017-2018 — just 5% of total adaptation finance, and only 0.05% of all global climate finance from public and private actors. Mangroves are one of the most cost-effective tools to increase climate resilience, and should be earmarked within adaptation budgets, which need to grow significantly. Until global carbon markets grow to the scale and pricing levels required, global climate finance can fill this gap. Funds such as the Global Climate Fund, the Global Environment Facility, the Adaptation Fund, and the Special Climate Funds, can:

— Provide concessional finance to local governments to integrate mangroves into development plans for coastal infrastructure projects, promote regenerative integrated mangrove-shrimp aquaculture, and develop marine protected areas. Success indicators on mangrove regeneration outcomes should be attached to all such project proposals.

— Make investing in mangrove assets by a cornerstone of climate adaptation financing support, incentivising recipient countries to look at mangrove regeneration seriously and at scale in order to qualify for coastal climate adaptation finance.

— Provide risk capital, such as first-loss guarantees, to de-risk and scale blue financing mechanisms that are trying to leverage the climate adaptation value of mangroves.

— Support the creation of the proposed Municipal Mangrove Bond Fund, by financing capacity building for local governments and using capital to de-risk the mechanism through guarantees or first-loss financing tranches. This will improve the bond's credit rating and lower the costs of capital for recipient municipalities in less developed countries, such as Papua New Guinea, Bangladesh and Gabon.

Women collecting oysters in the mangroves, Bijagos Islands, Guinea-Bissau.
Ricci Shryock / Mangrove Action Project

APPENDIX
MANGROVES RESTORATION 101 FOR INVESTORS
SUPPORTING SCIENCE-BASED MANGROVE CONSERVATION AND RESTORATION

Mangrove survival rates in restoration projects can be as high as 80–90% for well-managed projects, and as low as 10% for those that do not follow conservation science best practices.[177]

To improve the chances of success, experts advise that projects should prioritise mangrove conservation and facilitated natural mangrove recovery and recruitment over replanting, and projects should improve local development opportunities in order to create long-term conditions for local conservation.

When assessing mangrove investments, corporates and investors should always ensure that the following principles are met:

Principles

1
Restore in the right conditions and using the right methods

Replanting must take into account the right blend of mangrove species to plant, sedimentation patterns, the interaction of mangrove ecosystems with other coastal ecosystems, as well as appropriate planting for the local hydrological context, given local tides, levels of inundation, wave and typhoon patterns and impacts of climate change.[178]

Further guidance
Wetlands International
'Mangrove restoration: to plant or not to plant?'

2
Avoid 'green grabbing'

Mangrove projects are highly dependent on local community support, and must start with a thorough understanding and recognition of local tenure rights, including indigenous rights and practices.[179] A lack of community involvement or negotiated benefit-sharing has been linked to unsuccessful restoration projects.[180] Incentives for local communities can include the creation of alternative income-earning opportunities.[181]

Further guidance
UN Environment
'Blue Carbon Code of Conduct'

3
Co-manage to enforce mangrove protection

Legislation, policies and institutional structures linked to the legal status and use of mangrove resources can be ambiguous and fall in a regulatory vacuum between marine and terrestrial government agencies.[182] Engaging the help of a local 'champion', such as a mayor or NGO, is critical to create the political will and long-term co-management between local communities and local governments that are needed for success.[183]

Further guidance
Mangrove Action Project
'Guidance on Community-Based Ecological Mangrove Restoration techniques'

4
Take a 'ridge to reef' approach

To succeed in the long-term, interventions must address the drivers of mangrove degradation and destruction, removing pressures that led to the initial mangrove loss or that impede natural regeneration. This could include overharvesting by local communities, deforestation driven by economic development projects, or pollution and waste from upstream industrial or urban activities that can also affect survival rates and natural recruitment rates.[184]

Further guidance
IUCN
'Ridge to Reef (R2R) Initiative'

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IDOM Environment
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