Valuing nature: The ROA of an MPA

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Foreword

The ocean is not just a vast expanse of water – it's vital for climate mitigation and biodiversity, and a source of livelihoods and economic growth across our markets in Asia, Africa and the Middle East.

This is a critical year for the ocean, and momentum is building. The private sector has a key role to play - but to do this, we need to understand the true value of our ocean to channel capital towards its protection and conservation, and transition business practices to help make ocean use more sustainable.

That's why – coinciding with the Blue Economy and Finance Forum and the 2025 UN Ocean Conference - I'm pleased to share our latest report, **Valuing nature: The Return on Assets of a Marine Protected Area** ('The ROA of an MPA'). This report outlines the critical importance of mainstreaming nature considerations into financial decision-making, leveraging solutions like blue bonds and sustainability-linked loans to help scale investment into a thriving, sustainable blue economy. The report builds on our previous publication, **Towards a sustainable ocean: where there's a will, there's a wave**, which outlined over 70 investible activities or opportunities that support the transition towards a sustainable blue economy.

Global interest in valuing natural assets has been growing exponentially during the past 25 years. Although this report shows that a uniform valuation methodology does not yet exist, the good news is that more work in this space is coming to light. Today, some 90 countries globally have adopted the System of Environment Economic Accounting (SEEA), a framework that integrates economic and environmental data to provide a more comprehensive view of the relationships between the economy and the environment.

Alongside this, new solutions to support the development of a sustainable blue economy are gaining traction, including Marine Protected Areas (MPAs) and we outline the value of establishing well-managed MPAs. This covers economic value, through sectors like sustainable fishing, alongside wider benefits such as adaptation, resilience, and climate mitigation.

The publication concludes that economies across our footprint in Asia, Africa and the Middle East stand to benefit the most from the establishment of well- managed natural assets, and the development of a sustainable blue economy.

I hope that this report will help deepen your understanding of the ways in which the value of our natural capital can be assessed and considered across economies and financial decision-making.

Marisa Drew
Chief Sustainability Officer

01

Executive summary

Nature and the natural world play a central role in sustaining the global economy. However, markets often overlook this value in their financial analysis and planning. This is a missed opportunity, especially for developing economies, as it could be used to help raise funding for nature-based investment projects.

To help address this, our report explores the challenges and opportunities associated with the valuation of natural assets and sets out key considerations around how natural assets - especially marine ones - can be valued. Alongside this, the report looks at the wider benefits of accurately valuing nature within our financial system.

1. **The global economy depends on a sustainable natural world**

   The natural world plays a crucial role in sustaining the global economy, with the World Economic Forum estimating that 40 per cent of our global economic value has a moderate or high dependency on nature. Incorporating the value of natural assets into macroeconomic planning could be particularly beneficial for emerging market and fast-growing dynamic economies, as they seek to strengthen their sovereign balance sheets and improve access to external funding.

2. **Valuation of natural assets is highly complex**

   Research indicates that interest in nature valuation is growing exponentially, but there remain significant challenges, including the absence of highly detailed, location-based nature data and the wide range of available valuation methodologies. This report speaks to both the need for, and complexity of, nature valuation. The report outlines why, for nature valuation to be embedded into our financial system, a more uniform methodology to support this is needed.

3. **Marine ecosystems provide a range of valuable services**

   Marine ecosystem services such as mangroves, coral reefs and kelp forests have a projected value of more than USD1 trillion per year. Valuing such services may improve decision-making processes around marine and coastal management, helping local and national governments raise the capital needed to invest in protecting, preserving and sustainably managing marine ecosystems and the global blue economy.

4. **Developing marine protected areas benefits emerging markets**

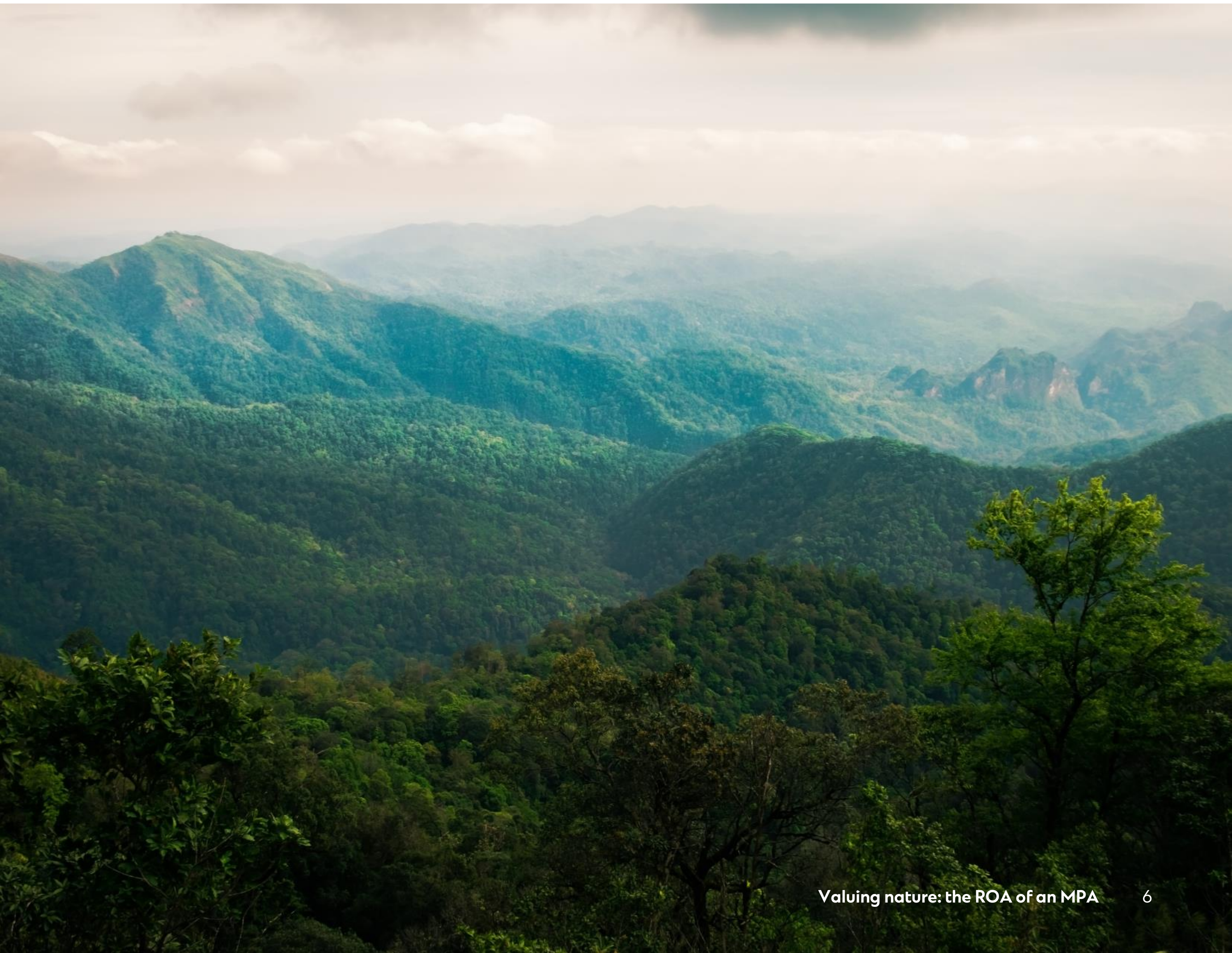
   This report unpacks how Marine Protected Areas (MPAs) can help make the use of our oceans more sustainable, and highlights that the global value of MPAs could reach USD1.5 trillion. The wide range of environmental and social benefits associated with MPAs make them highly relevant for markets across Asia, Africa and the Middle East. This report shows how 44 markets with vulnerable ocean ecosystems could create USD85 billion in value by developing MPAs.

5. **Valuing nature is critical for finance to scale**

   To improve the sustainable use of our oceans and support a sustainable blue economy, up to USD2.5 trillion in investment will be needed across emerging markets. This report shows that, by incorporating the value of natural assets into economic planning, markets can support the flow of capital to facilitate sustainable investment and outcomes and deliver sustainable and enduring growth.

02

The growing understanding of nature's value



Understanding of the importance of nature and biodiversity has grown in recent years. This started with the United Nations Conference on the Environment and Development (UNCED), also known as the Earth Summit, held in Rio de Janeiro in June 1992. Since then, it has been underpinned by the United Nations' Biodiversity Conference of the Parties (UN COP) process.

These convenings have supported critical milestones to help address environmental challenges and promote sustainable development. These include the adoption of the Kunming-Montreal Global Biodiversity Framework (GBF) and the establishment of The Taskforce on Nature-related Financial Disclosures (TNFD) - a market-led, science-based and government-supported global initiative to help embed nature into financial decision-making.

Nature is central to sustainable economic development

Despite this growing global focus, nature and biodiversity are still in decline. This needs to be urgently addressed, not least because the global economy is embedded in nature. The reality was set out in the landmark Dasgupta Review, also known as **The Economics of Biodiversity,** which found that our economies are deeply embedded in nature, not separate from it, and that our current unsustainable engagement with nature is endangering long-term global prosperity (Dasgupta, 2021).

As outlined below (Figure 1), nature provides society with a wide range of 'ecosystem services', including food, fresh water, climate and extreme weather regulation, pollution control and tourism.

Ecosystem services and functions

Ecosystem service	Ecosystem functions	Examples
Regulating greenhouse gas levels	Management of atmospheric chemical composition	CO_2/O_2 balance, SO_x levels
Reducing climate change impact	Management of global temperatures and precipitation	Reduction of greenhouse gas levels
Limiting disturbances	Capacitance, damping and integrity of ecosystem response to environmental fluctuations	Storm protection, flood control, drought recovery
Water management	Regulating hydrological flows	Provision of water for agricultural or industrial processes or transportation
Water supply	Storage and retention of water	Provisioning of water by watersheds, reservoirs and aquifers
Erosion control and sediment retention	Retention of soil within an ecosystem	Prevention of loss of soil by wind, runoff, storage of silt in lakes and wetlands
Soil formation	Soil formation processes	Weathering of rock and accumulation of organic material
Nutrient cycling	Storage, internal cycling, processing and acquisition of nutrients	Nitrogen fixation, N, P and other elemental or nutrient cycles
Waste treatment	Recovery of mobile nutrients and removal or breakdown of excess nutrients and compounds	Waste treatment, pollution control, detoxification
Pollination	Movement of floral gametes	Provisioning of pollinators for the reproduction of plant populations
Biological control	Trophic-dynamic regulation of populations	Keystone predator control of prey species, reduction of herbivory by top predators
Refugia	Habitat for resident and transient populations	Nurseries, habitat for migratory species
Food production	Production extractable as food	Fish, game, crops, nuts, fruits, subsistence farming or fishing
Raw materials	Primary production used as raw materials	Production of lumber, fuel or fodder
Genetic resources	Source of unique biological materials and products	Medicine, products for materials science, genes for resistance to plant pathogens and crop pests
Recreation	Opportunities for recreational activities	Eco-tourism, sport fishing, outdoor recreational activities
Cultural	Opportunities for non-commercial uses	Educational, spiritual or scientific values of ecosystems

Source: (Costanza & et al, 1997)

Figure 1

Sectors that are directly dependent on nature or that have supply chains depending on it include agriculture, construction, tourism, travel, real estate and retail. In 2020, the World Economic Forum (WEF) estimated that USD44 trillion of global economic value has a moderate or high dependency on ecosystem services (World Economic Forum, 2020).

Nature is especially relevant across emerging and fast-growing economies. According to the World Bank, natural capital such as forests, agricultural land, and fisheries account for 23 per cent of wealth in low-income countries and 10 per cent in low-to-middle-income countries (Johnson et al, 2021).

Furthermore, around 80 per cent of the global population living below the poverty line reside in rural areas and depend on biodiversity and ecosystem services for their livelihoods, with one-third of the global population heavily dependency on forests and forest products (FAO and UNEP, 2020).

Understanding nature's value may support economic stability

The impact of nature loss on human welfare and the global economy is interlinked with climate change. However, nature-related risks differ from climate-related risks and can be more acute when tipping points are reached. Climate-related risks are mostly driven by the accumulation of greenhouse gas emissions; however, nature loss is linked to the impact across many ecosystems.

Halting and reversing nature loss has a positive impact on human welfare and the global economy.

However, one of the key challenges associated with this is increasing finance flows sufficiently to fund the associated investment needs. This requires a clear understanding by all relevant stakeholders of the value that nature holds for society.

Over the past 25 years, the academic world has become increasingly engaged with valuing ecosystem services (Figure 2). This has also led to the development of the field known as 'ecological economics'. Various approaches towards ecosystem service valuation (ESV) have been developed, of which the macroeconomic framework suggested by the Dasgupta Review is one of the more high-profile examples (Gardes-Landolfini et al, 2024). The rest of this chapter outlines the key approaches that have been developed to account for and value ecosystem services. Despite the development of ESV to date, creating real impact will require a shift from developing theories and concepts towards practical usage or implementation of them (Liu et al, 2010).

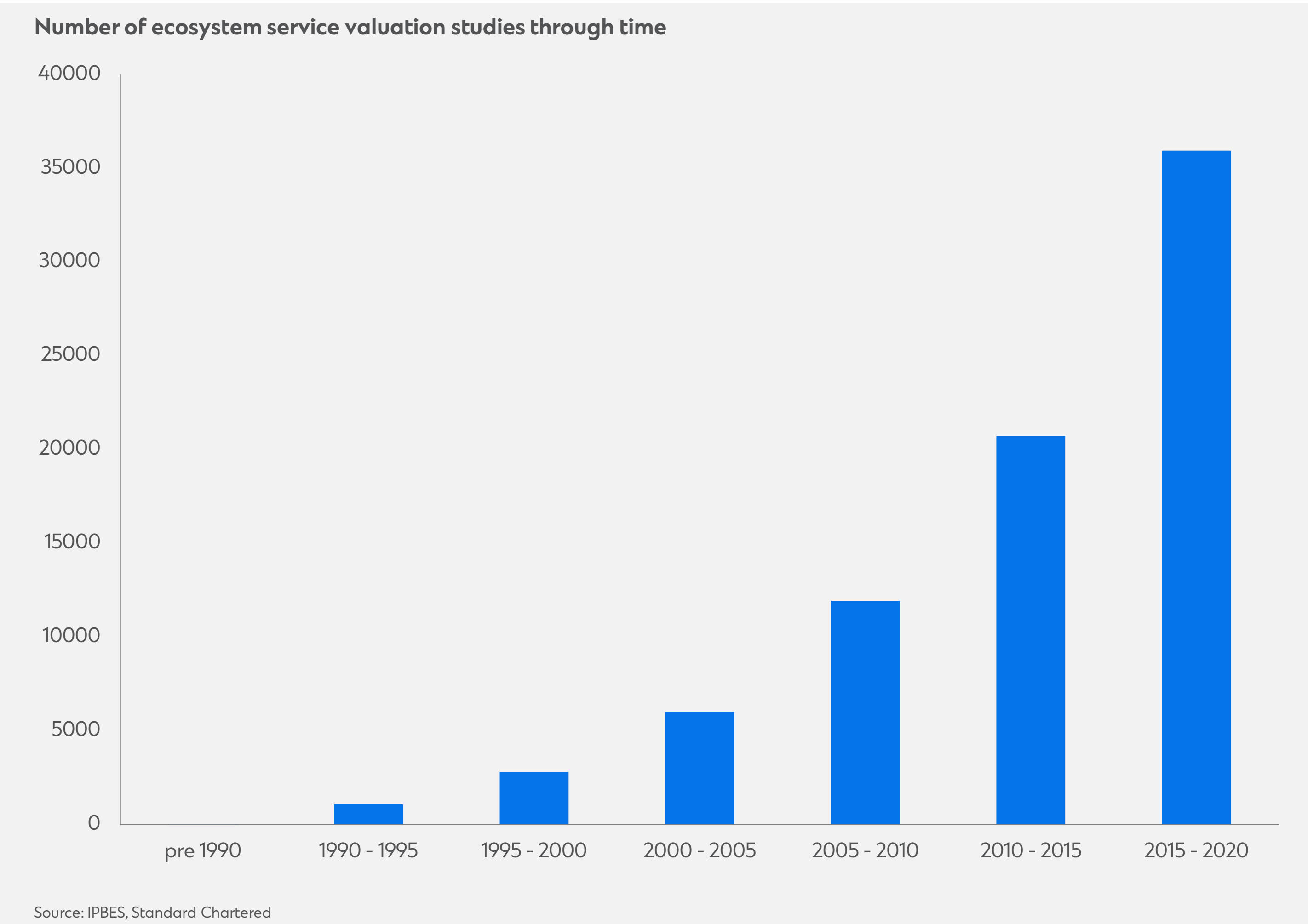


Figure 2

Accounting for ecosystem services

The need to develop a framework for valuing the contribution of nature-based services requires an understanding of how these services can be accounted for. We outline these accounting approaches first before exploring the valuation tools for nature-based services. While many approaches exist for classifying ecosystem services, the most common approach is that provided by the Millennium Ecosystem Assessment (Legesse, Degefa, and Soromessa, 2022). It divides ecosystem services into provisioning, regulating, supporting and cultural services.

Other bodies have also developed approaches for ecosystem accounting as well, and this report sets out some of the national-level assessment frameworks for quantifying and valuing nature and its contributions to people in Figure 3.

Comparison between nature accounting frameworks

Accounting framework	Brief description	Consistency with the System of National Accounts	Captures flows / stocks / both	Pros	Cons
SEEA	Consistent with the System of National Accounts to facilitate integration of environmental and economic statistics.	Monetary – Yes Physical – Yes	Captures flows and stocks of natural capital	Adopted by UN Statistics Department. Used by majority of studies (45% amongst 378 articles reviewed)	Limited specific guidance on valuation
Green GDP / Green accounting	First coined in late 1980s, Green GDP modifies existing net domestic product accounts by incorporating the cost of natural resource depletion and other negative impacts on the environment.	Monetary – No Physical – Yes (no focus / changes)	Captures flows of natural capital (extent of degradation and the cost of the degradation)	Incorporation of negative externalities of environmental degradation	Given the negative effect on GDP numbers, there was some resistance to the idea
Ecological footprint	Conceptualised in 1990, the Ecological Footprint is a measure of the amount of biologically productive areas a given population or product requires to produce the natural resources required for consumption and to absorb the waste produced.	Monetary – No Physical – No	Captures flows of natural capital and converts flows into a stock (area) metric	May be harmonised with the SEEA accounting framework via the National Footprint Accounts	Addresses specific aspects of the economy-environment relationship and should not be used in isolation

Source: Standard Chartered, SEEA, Bordt & Saner (2018)

Figure 3

System of Environmental-Economic Accounting

The System of Environmental-Economic Accounting (SEEA) was developed by the UN in partnership with the European Commission, the Food and Agriculture Organisation (FAO), the OECD, the IMF and the World Bank. It consists of two parts:

1. The SEEA Central Framework (SEEA CF) was adopted in 2012 and looks at environmental assets, their use in the economy and the returns to the environment in terms of waste, air and water emissions.
2. The SEEA Experimental Ecosystem Accounting (SEEA EA) was approved in 2021 and considers how individual environmental assets interact as part of natural processes within a certain spatial area. The SEEA presents information in physical and monetary terms regarding environmental stocks and flows between the environment and the economy, as well as economic activity related to the environment.

The SEEA uses a 'supply and use' table format for recording the estimated physical and monetary value of ecosystem services between ecosystem assets and economic units. The basic components (sources of supply, types of supply and consumers of supply) used as part of the SEEA are shown in Figure 4 (United Nations et al., 2021). The SEEA uses the Global Ecosystem Typology, as developed by the International Union for Conservation of Nature (IUCN), to classify the types of ecosystems that supply ecosystem services. For a more detailed breakdown of ecosystems as defined by the IUCN we refer to (Keith, Ferrer-Paris, Nicholson, Kingsford (eds), 2020). A detailed description of the range of services that can be provided by these ecosystems is shown in (United Nations et al,. 2021).

SEEA components used to record physical and monetary value of ecosystem services

Ecosystem service	Ecosystem functions	Examples
Terrestrial	**Provisioning services**	**Economic units**
Tropical-subtropical forests biome	Biomass provisioning	Industries
Temperate-boreal forests and woodlands biome	Crop biomass	Agriculture
Shrublands and shrubby woodlands biome	Grazed biomass	Forestry
Savannas and grasslands biome	Livestock biomass	Fisheries
Deserts and semi-deserts biome	Aquaculture biomass	Mining and quarrying
Polar-alpine biome	Wood biomass	Manufacturing
Intensive land-use biome	Wild fish and other natural aquatic biomass	Electricity, gas, steam and air conditioning
Freshwater	Wild animals, plants and other biomass	Water supply, sewerage, waste management and remediation activities
Rivers and streams biome	Genetic material services	Services
Lakes biome	Water supply	Other industrials
Artificial wetlands biome	Other provisioning services	Government consumption
Semi-confined transitional waters biome	**Regulating and maintenance services**	Household consumption
Marine	Global climate regulation	Exports - final ecosystem services
Marine shelf biome	Rainfall pattern regulation	**Ecosystem types**
Pelagic ocean waters biome	Local (micro and meso) climate regulation	Terrestrial
Deep sea floors biome	Air filtration	Freshwater
Anthropogenic marine biome	Soil quality regulation	Marine
Shorelines biome	Soil and sediment retention	Exports - intermediate services
Coastal shrublands and grasslands	Soil waste remediation	
Artificial shorelines	Water purification	
Brackish tidal biome	Water flow regulation	
	Flood control	
	Storm mitigation	
	Noise attenuation	
	Pollination	
	Biological control	
	Nursery population and habitat maintenance	
	Other regulation and maintenance	
	Cultural services	
	Recreation-related	
	Visual amenity	
	Education, scientific and research	
	Spiritual, artistic and symbolic	
	Other cultural	

Source: United Nations et al, 2021, Standard Chartered

Figure 4

Valuation of ecosystem services

One of the key challenges associated with halting and reversing nature loss is increasing finance flows sufficiently to fund the associated investment needs. This requires a clear understanding by all relevant stakeholders of the value that nature holds for society. While the previous section discussed how ecosystem services can be accounted for, this section provides details on how these services can be valued.

Growing understanding of the value of natural assets

In 1997, efforts began to value the contribution of natural ecosystem services, with estimates highlighting that the average global economic value of 17 ecosystem services was USD33 trillion, which compared with a global gross national product at the time of just USD18 trillion (Costanza et al., 1997). One key insight was that ecosystem services contributing to human welfare are often public goods and therefore accrue directly to humans without passing through the financial economy. This implies that ecosystem services do not form part of traditional financial analysis, which may in turn explain why policy makers have largely underappreciated the value of nature and the need to invest in it.

Over time, a range of nature-based assessments and valuation approaches have emerged, each with various methodologies (Figure 5). These approaches can be academically or institutionally oriented, may express value in monetary or non-monetary terms, may or may not be spatially specific or place-based, and may elicit value using direct or indirect techniques.

Timeline of major biodiversity and ecosystem service assessments

Year	Assessment
2005	MEA five thematic synthesis: ecosystem services and wellbeing
2009	US EAP – Science Advisory Board: Integrated expanded approach to ecological valuation
2010	TEEB assessment: Mainstreaming the values of biodiversity and ecosystem services into decision making
2011	UK National ecosystem assessment
2012	Corporate Ecosystem service review
2014	UK National ecosystem assessment (follow up)
2015	World Ocean Assessment 1
2016	IPBES Pollination assessment IPBES Scenarios and modelling assessment
2018	IPBES Land degradation and restoration assessment IPBES Regional assessments
2019	Global Environment Outlook (GEO-6) IPBES Global assessment of biodiversity and ecosystem services
2020	Global biodiversity outlook (GBO-5)
2021	Dasgupta review SEEA-EA World Ocean Assessment 2

Source: (Termansen, Jacobs, Mwampamba et al., 2022), Standard Chartered

Figure 5

In 2022, the Intergovernmental Science-Policy Platform for Biodiversity and Ecosystem Services (IPBES) provided an overview of the development of nature and biodiversity valuation approaches (Termansen, Jacobs, Mwampamba, et al., 2022). Their work identified four different types of valuation approaches: nature-based, statement-based, behaviour-based, and integrated valuation. The first three are driven by the source of information that drives the valuation, while the fourth brings together different types of value information. Ecosystem service valuation covers aspects of all four of these approaches.

The SEEA approach incorporates not just a recording of the volume of ecosystem services that are supplied and used but also their monetary value. Many ecosystem services are based on directly observed prices from actual markets. However, there are also several types of services for which market prices do not exist and therefore need to be estimated.

Two primary alternative methods exist for this: using market prices of similar or analogous products and using the cost of producing the service or product currently. The SEEA recommends that valuation methods for ecosystem services follow their preferred pricing order as highlighted in Figure 6.

SEEA preference order for valuation ecosystems

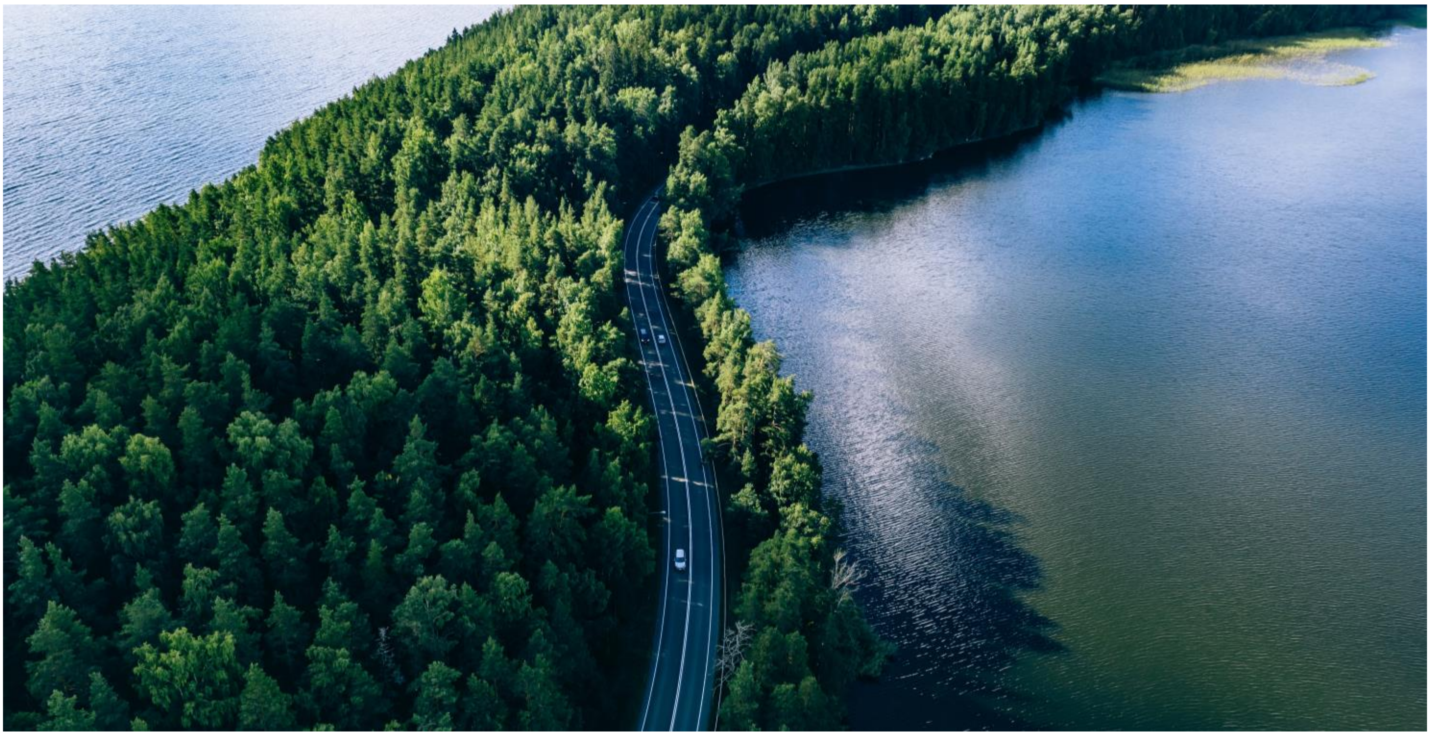
Valuation preference	2021
1 (most preferred)	Methods where the price for the ecosystem service is directly observable
2	Methods where the price for the ecosystem service is obtained from markets for similar goods and services
3	Methods where the price for the ecosystem service is embodied in a market transaction
4	Methods where the price for the ecosystem service is based on revealed expenditures (costs) for related goods and services
5	Methods where the price for the ecosystem service is based on expected expenditures or markets

Source: UN et at, (2021), Standard Chartered

Figure 6

Several techniques exist to value ecosystem services for which no market data is available. These techniques have been classified in several ways, but no formal typology has been adopted, which can lead to confusion (NCAVES and MAIA, 2022).

A useful overview of publications that provide guidance on the use of valuation methods and their key characteristics is included in Brander L., 2023. We show some of these characteristics in Figure 7.



Characteristics of primary valuation methods for ecosystem services (ES)

Valuation method	Approach	Application to ecosystem services	Examples	Limitations
Market prices	Prices for ES are directly observable	ES that are traded directly in markets	Fish, Carbon credits	Market prices can be distorted by subsidies
Public pricing	Public expenditure or incentives for ES as an indicator of value	ES for which there are public expenditures	Carbon sequestration valued using public expenditure on GHG emissions	No direct link to preferences of beneficiaries
Defensive expenditure	Expenditure on protection of ES	ES for which there is protection expenditure	Recreation and aesthetic value of MPAs	Only applicable where direct expenditures are made for environmental protection related to provision of ES.
Replacement cost	Estimate the cost of replacing an ES with a man-made service	ES that have man-made services	Coastal protection by mangroves (replaced by seawalls)	No direct relation to ES benefits. Risk of both over and under estimation of value.
Restoration cost	Estimate cost of restoring degraded ecosystems to ensure provision of ES	Any ES that can be provided by restored ecosystems	Tourism and aesthetic enjoyment provided by restored coral reefs	No direct relation to ES benefits. Risk of both over and under estimation of value.
Damage cost avoided	Estimate damage avoided due to ES	Ecosystems that provide protection to people/assets	Coastal protection by mangroves and coral reefs, Carbon sequestration that mitigates climate change	Difficult to quantify changes in risk of damages to changes in ecosystem condition
Social cost of carbon	Monetary value of damages cost by emitting carbon	Carbon storage and sequestration	Carbon sequestered and stored by microbes and stored in seafloor sediment	SCC has high modelling uncertainties
Opportunity cost	The next highest valued use of the resources used to produce an ES	All ecosystem services	The opportunity cost of ES from a conserved seabed MPA might be the foregone value of fishing	Measures the cost of providing ES instead of the benefit
Net factor income (residual value)	Revenue from sales of a marketed good with an ES input minus the cost of other inputs	Ecosystems that provide an input in the production of a marketed good	Commercial fisheries supported seabed habitats.	Tendency to overestimate values since all profits attributed to ES
Production function	Statistical estimation of production for a marketed good with an ES input	ES that provide an input in the production of a marketed good	Commercial fisheries supported seabed habitats.	Technically difficult. High data requirements
Hedonic pricing	Estimate influence of environmental characteristics on price of marketed goods	Environmental characteristics that vary across goods	Air quality moderated by ecosystems	Technically difficult. Limited to ES spatially related to property locations
Travel cost	Estimate demand for ES recreation sites using data on travel costs and visits	Recreational use of ecosystems	Drive tourism at coral reefs	Technically difficult and limited to valuation of recreation
Contingent valuation	Ask people their willingness to pay for ES through surveys	All ecosystem services	Existence and bequest values for biodiversity, tourism and recreation	Expensive. Risk of biases in design and analysis
Choice modelling	Ask people to make trade-offs between ES and other goods to elicit WTP	All ecosystem services	Existence and bequest values for biodiversity, tourism and recreation	Expensive. Risk of biases in design and analysis
Group/participatory valuation	Ask groups of stakeholders to state WTP for an ES through group discussions	All ecosystem services	Existence and bequest values for biodiversity, tourism and recreation	Risk of biases due to group dynamics

Source: Brander L. 2023, Standard Chartered

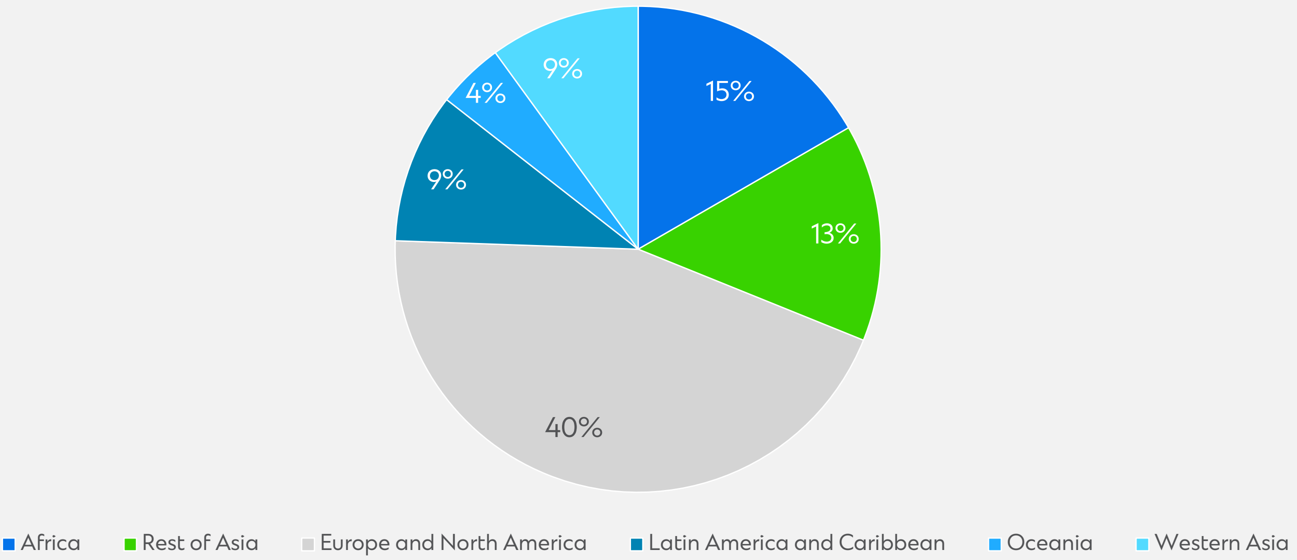
Figure 7

Adoption of the SEEA

The most recent assessment report of the adoption of SEEA indicates that 90 countries globally had implemented the SEEA in 2023 (United Nations, 2024). The US, Canada and European countries make up 44 per cent of the total, followed by Africa (17 per cent) (Figure 8). Interestingly, an additional 23 African countries aim to start implementing the SEEA, suggesting that the number of African countries reporting under the SEEA framework might be almost as large as Europe and North America combined (Figure 9).

Although the SEEA framework is being steadily adopted by more countries, we note that the extent to which nature is reflected in national accounts differs by region. All European and North American countries that have adopted SEEA regularly compile and disseminate these statistics according to the UN assessment report. In contrast, this is true for less than half of the participating countries in Africa and Latin America and the Caribbean. The overall UN data suggests that the adoption of nature-based accounting and valuation, while progressing, remains in the early stages of development.

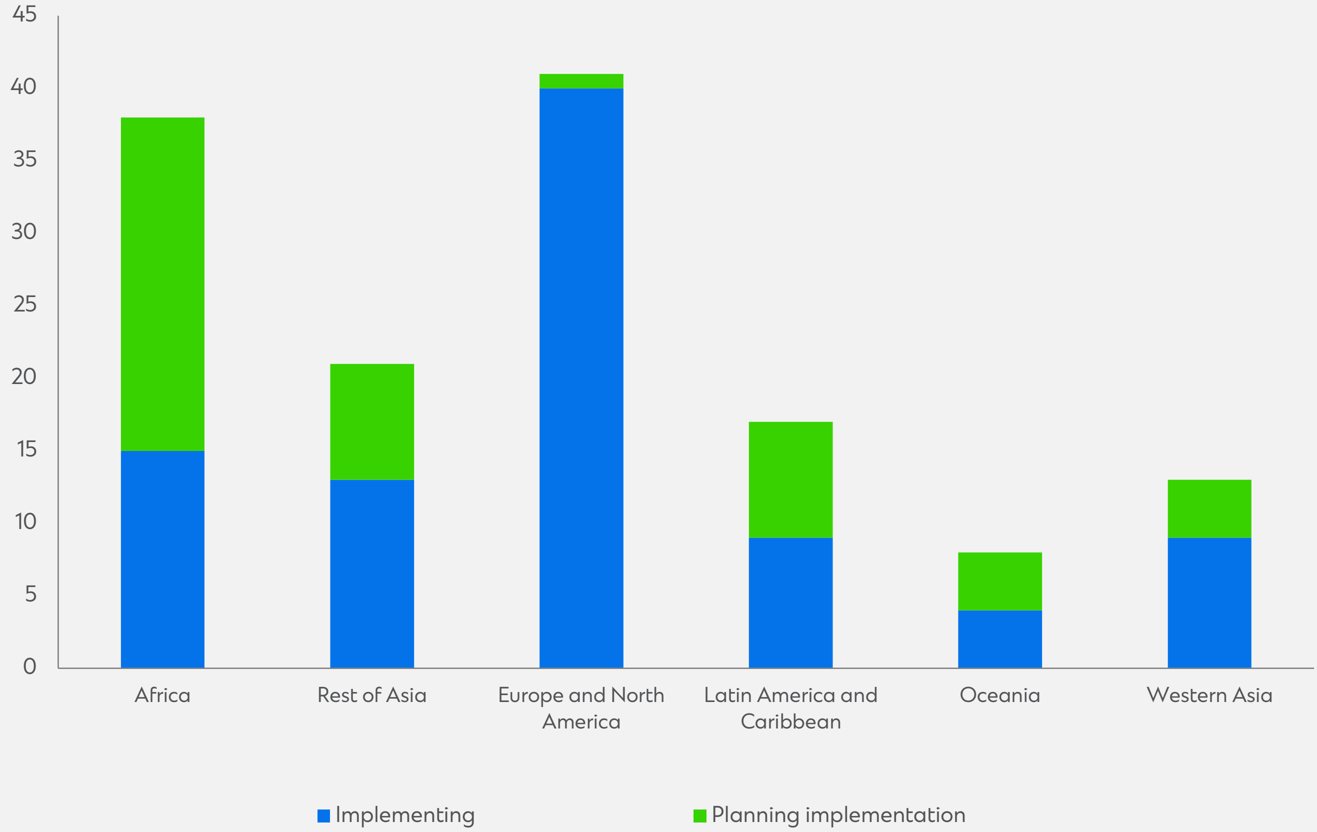
Countries that have implemented SEEA
Regional representation, as per UN definition 2023



Source: United Nations, Standard Chartered

Figure 8

SEEA: implementation planning by region
Number of countries by region, 2023



Source: United Nations, Standard Chartered

Figure 9

Most countries that make use of SEEA see climate change as one of the most significant policy-related priorities. Circular economy-related objectives matter most for Europe and North America and far less for countries in Africa and the rest of Asia. Biodiversity and Resource Management are most relevant for countries across developing economies, most notably Africa and the rest of Asia, but do not feature as prominently in the UN assessment report for European and North American countries (Figure 10).

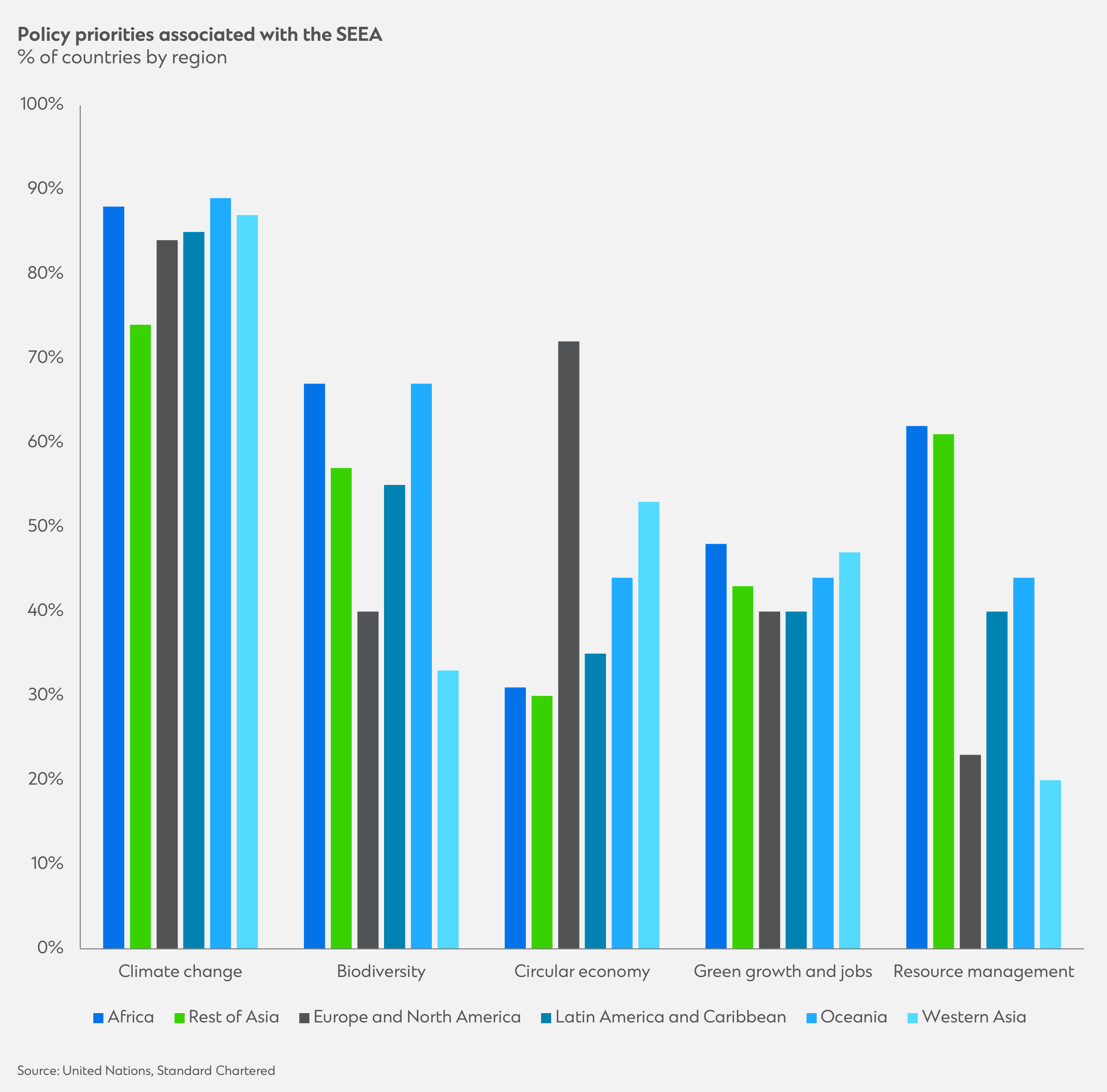


Figure 10

Example of ecosystem valuation: Gross Ecosystem Product

The concept of Gross Ecosystem Product (GEP) was introduced in 2020 to address the fact that Gross Domestic Product (GDP) fails to capture the contribution of nature to economic activity (Ouyang et al., 2020). Using the SEEA framework, GEP represents the aggregate measure of the value of ecosystem-related goods and services in a given region and in a specific accounting period. These services can be of a material (e.g. food, water supply), regulating (e.g. carbon sequestration, flood mitigation, soil retention), or non-material (e.g. ecotourism) nature. In their 2020 report, Ouyang et al. estimated the GEP of Qinghai Province in China by using market prices for ecosystem services where available, and by developing methods to estimate surrogate prices for services for which a market price was unavailable. Their approach uses integrated ecological-economic modelling, based on spatial data analysis, to predict the flow of ecosystem services. These flows are then valued using economic valuation methods. We show the conceptual approach taken by Ouyang et al. for valuing Qinghai's relevant ecosystem services in Figure 11.

Gross ecosystem product (GEP) approach
Overview of ecosystem services and valuation approach adopted by Ouyang et al.

Ecosystem service	Category	Items	Valuation approach
Market prices	Agricultural crops	Grains, beans, potato, oil, hemp, sugar, tobacco, herbs, vegetable, melon, fruit	The accounting value for these categories is estimated at the production volumes multiplied by the market price per unit for the produced products. Ouyang makes an adjustment to ensure that only the value of a product associated with the input from nature is incorporated and not that of labour or human input.
	Animal husbandry	Meat, dairy, other (e.g. eggs, honey)	
	Fishery	Breed aquatic	
	Forestry	Timber, other (e.g. ash, walnuts)	
	Nursery production	Flowering plants and seedlings	
	Water supply	Water resources (domestic, industrial and agricultural use within Qinghai and downstream provinces), hydropower production	
Regulating services	Soil retention	Erosion reduces land fertility and hydropower production and increases risk of local landslides	The accounting value of soil retention includes the reduced dredging cost in hydropower reservoirs and the reduced pollution treatment cost for the land
	Sandstorm prevention	Sandstorms impact human health	The value is equal to the reduction in sandstorm-related healthcare costs for the affected population due to the use of vegetation relative to the costs if there is no vegetation.
	Flood mitigation	Natural vegetation reduces the risk of flooding	Value equals the estimate for average downstream cost of floodings
	Air purification	Vegetation absorbs and filters hazardous air pollutants	Accounting value is the cost related to removing air pollutant emissions and avoided health damages
	Water purification	Pollutants and chemicals degrade water quality and impact human health	Accounting value is water treatment cost for removing pollutants and health impact as measured in disability-adjusted life years
	Carbon sequestration	Natural ecosystems store carbon and help mitigate the risk of climate change	Accounting value equals the amount of carbon stored by different ecosystems multiplied by a carbon price
Non-material services	Eco-tourism	Eco-tourism supports the local economy	Accounting value equals the estimated number of tourists multiplied by average spending per tourist

Source: Ouyang et al., 2020, Standard Chartered

Figure 11

Ouyang et al.'s calculations showed that Qinghai's GEP had increased by 127 per cent between 2000 and 2015, and that in 2015 the value of Qinghai's GEP was approximately 75 per cent of the region's GDP. The analysis also showed that Qinghai's GEP was large compared to its GDP because more than 70 per cent of its GEP value was exported to other regions for which it did not receive credits and which therefore did not boost the region's GDP.

GEP helps to mitigate risk from nature loss to the economy

Ouyang et al.'s work regarding GEP supports this report's finding that the value of nature is significant. GEP highlights the materiality of nature's contribution to a country's economy and in doing so also shows policymakers the degree of downside risk to their economy if nature loss is not halted or reversed. Estimating a region or country's GEP helps decision makers to better allocate resources and support their efforts to raise finance for sustainability-related projects.

Furthermore, understanding the contributors to a region or country's GEP and the differences with its GDP can also help in financial compensation discussions between regions or countries. This is especially relevant in relation to climate change mitigation and adaptation discussions.

GEP estimates can also form the basis for eco-compensation programs which can play a role in the conservation or restoration of ecosystem assets. They can also be used to help generate funds for poverty alleviation.

One aspect in relation to GEP that needs consideration is the risk that ecosystem services are undervalued, which would suggest that these services are less relevant to the broader economy than they really are. This is especially relevant in the case of freshwater supply, considering that water prices generally do not reflect the true costs of providing freshwater. An underappreciation of the service's true value might impact investments into it, which, in the case of water, straddles multiple risks including social, adaptation and climate.

Another feature of GEP is that its estimated value cannot simply be added to a country's GDP. One of the reasons for this is that it leads to double counting as some ecosystem services, such as agricultural production or fisheries, are also included in the calculation of GDP.

Corporate engagement with nature valuation likely to increase

Nature or ecosystem valuation tends to be approached from a sovereign perspective because a significant share of ecosystem services are of a public nature. However, businesses both rely on nature for inputs across their supply chain and can negatively impact it too through pollution, habitat destruction or overexploitation.

At present, companies do not incorporate the monetary value of their impact on nature into their profit and loss accounts or balance sheets. However, nature-based reporting and disclosure standards are being introduced. The most prominent global example of this are the standards proposed by the Taskforce on Nature-related Financial Disclosures (TNFD). Regional nature-related disclosure frameworks include the EU's Corporate Sustainability Reporting Directive (CSRD).

As nature-related accounting and valuation frameworks become more established, so will awareness of the extent to which the use of natural resources by certain sectors impacts the value of a country's natural assets. As such, markets will increasingly use these insights and develop additional legislation and policies to address this sovereign risk.

Stronger engagement from the corporate sector with nature is likely to occur as the understanding of the impact of nature's degradation on the value of their operations increases. This should help establish compensation mechanisms and protection schemes for corporates that deal with the impact of nature degradation on their assets or operations.

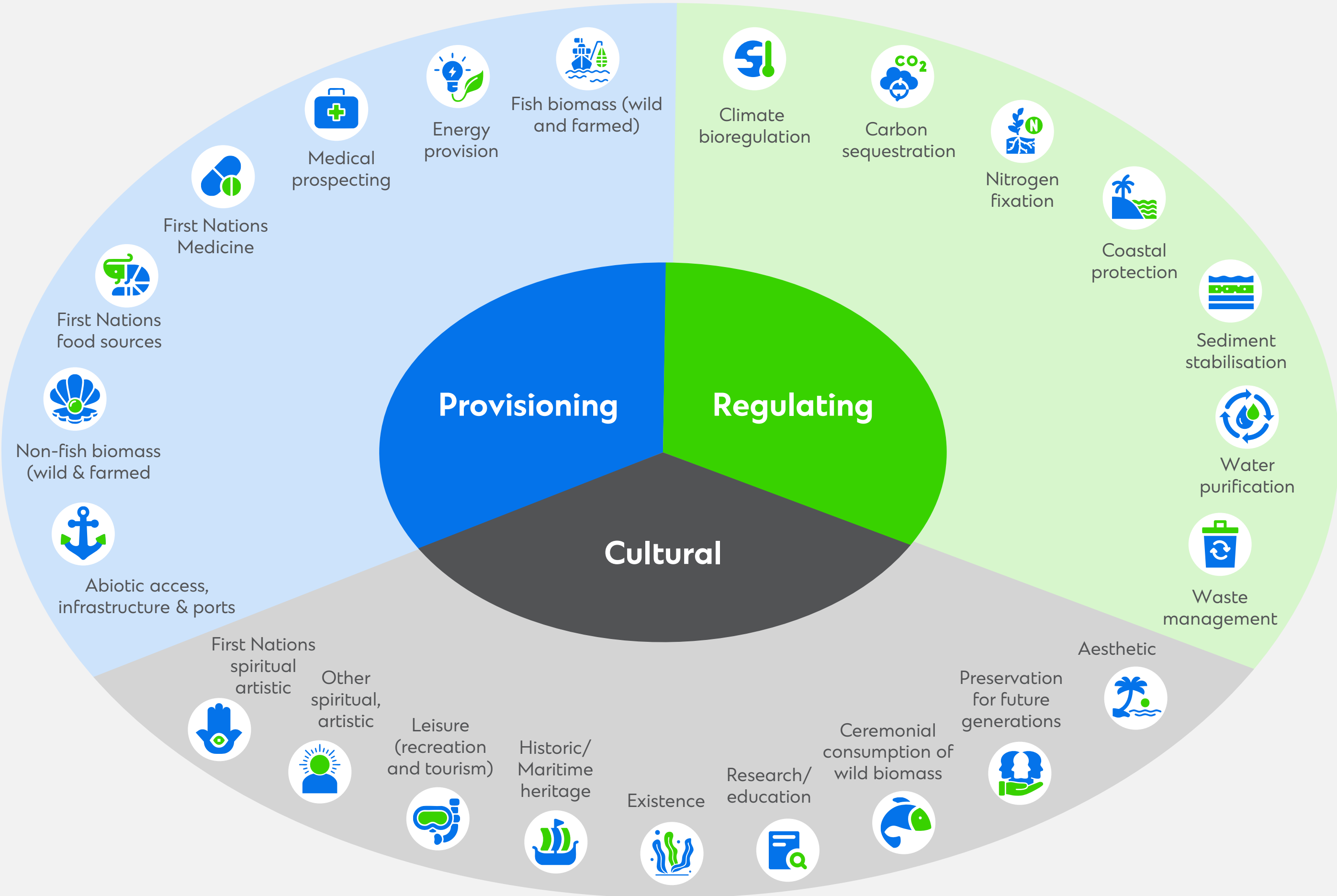
03

Valuing marine ecosystem services

The first section of this report outlined the approaches that have been developed for the accounting and valuation of ecosystem services. In this chapter, we explore how these apply to the subset of marine and coastal ecosystem services. Marine and coastal ecosystems offer a wide range of services that benefit the global economy. These include commercial fishing and aquaculture, raw materials, filtered water, reef and coastal wetland-based shore protection, ecotourism, and carbon sequestration (Figure 12).

Coastal ecosystems are under pressure from a range of developments including population growth, increasing demand for coastal or marine ecosystem services and more intensive industrialised farming and fishing practices. The use of our marine ecosystems also contributes to negative outcomes such as pollution, overfishing, waste generation, habitat destruction, reduced storm surge protection and biodiversity loss (De Valck et al., 2023).

Marine ecosystem services



Source: (De Valck et al., 2023), Standard Chartered

Figure 12

A sustainable blue economy holds significant value

Marine ecosystems form part of the blue economy, which constitutes all services provided by water-related systems including the oceans, rivers and lakes. In Towards a sustainable ocean: where there's a will there's a wave, research showed that adopting sustainable solutions across ocean restoration and conservation, shipping and transport, fishing and aquaculture, and offshore renewable energy could have a net economic benefit of more than USD15 trillion, representing around 15 per cent of global GDP (Figure 13).

Our research also showed that investing USD2.5 trillion in improving the sustainability of the blue economy could help mitigate more than 21 gigatonnes (Gt) of CO2 by 2050, which equates to around 40 per cent of current global greenhouse gas emissions (Figure 14).

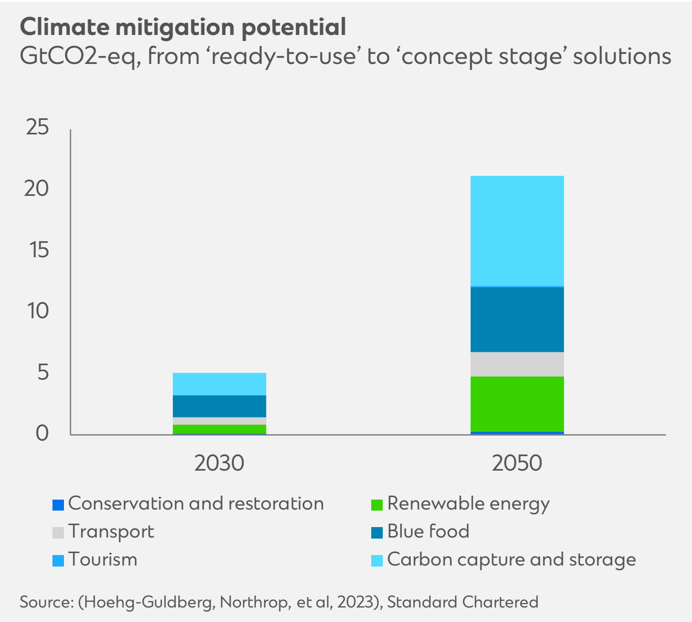


Figure 13

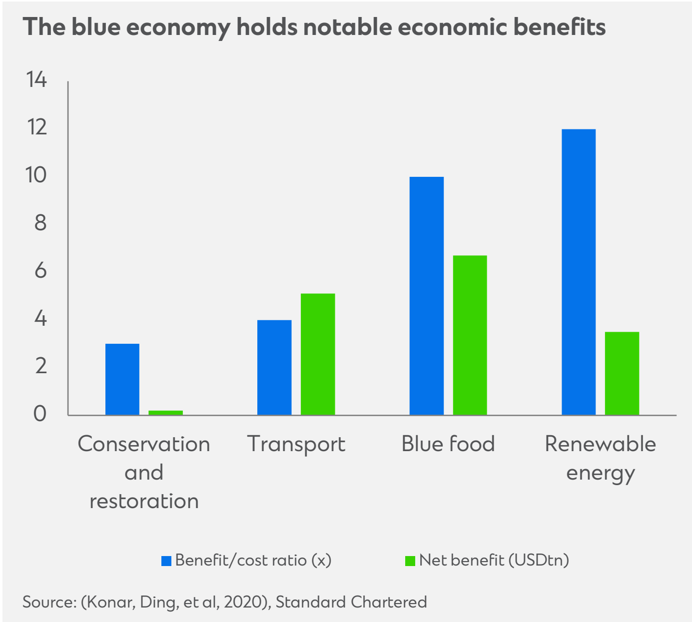


Figure 14

The relevance of the blue economy lies not just in its economic output, but also in its contribution to the UN's Sustainable Development Goals. It could be argued that protecting the ocean and supporting the sustainable use of its services will help to achieve the majority of the SDGs, not least SDG 14 (Life Below Water). A thriving and sustainable blue economy also advances social ambitions, particularly SDG 1 (No Poverty), SDG 2 (Zero Hunger) and SDG 8 (Decent Work).

By supporting coastal livelihoods and food security, marine sustainability initiatives contribute directly to coastal community resilience and wellbeing. Willingness to pay for the improvement of marine and freshwater ecosystems is high in almost 63 per cent of European countries. Importantly, this is higher than the corresponding estimates for more sustainable terrestrial ecosystems (Koundouri et al., 2022). This suggests that policy and investment proposals aimed at improving the sustainability of marine ecosystems will be supported, especially if these are based on properly-designed valuation assessments.

A template for marine ecosystem valuation

Valuing marine ecosystem services may help improve the decision-making process around marine and coastal management, which in turn may help accelerate the development of a sustainable blue economy. This may also help support efforts by local or national governments to raise funds needed to invest in improving the sustainability of marine ecosystems.

Performing a valuation for a marine or coastal ecosystem can be done using valuation methods such as the SEEA (described earlier). Other frameworks that have been used, especially before the introduction of SEEA, included the Total Economic Value (TEV) approach (Tinch & Mathieu, 2011).

Regardless of the chosen framework, valuing a marine ecosystem effectively involves answering a few key questions.

? **Where:** What specific spatial area of a marine ecosystem is being valued?

? **What:** What are the key ecosystem services that exist within the area being valued, how far do they extend and what is their current condition?

? **Who:** Who are the users or beneficiaries of the ecosystem services being valued in the area under focus?

? **When:** What is the timescale for the valuation exercise?

? **How:** Valuing a marine ecosystem service requires knowledge of the physical output of that service and the price or cost associated with it. Different valuation methods will be used for different ecosystem services.

The 'how' question puts a price on ecosystem services provided by a coastal marine area. This monetary value may, however, not fully capture the non-monetary value or importance that local populations of the area under focus attach to these services. This is particularly true for areas that have collective heritage or sociocultural values, that do not involve transactions but are important to the local population (De Valck et al., 2023), especially in coastal areas with First Nations or Indigenous peoples.

What: The most common marine ecosystem services

The valuation of marine ecosystems, including those that are part of marine protected areas, is a complex matter not least because of the wide range of services that these ecosystems can provide (as highlighted previously in Figure 12).

How: Methods applied to value marine ecosystem services

The previous chapter showed that there are a wide range of methods for valuing nature-based ecosystem services. Following a review of key literature, Figure 15 shows valuation methods that are typically used in relation to marine or coastal ecosystem services.
These include:

- **Market prices:** Valuing services where market prices exist mostly consists of multiplying production volumes with the price per unit. This applies for valuing fishing, aquaculture, and seaweed production as well as a range of energy sources such as offshore wind and biofuel. Valuing carbon sequestration can be performed using estimates for carbon stored, multiplied by carbon credit prices. The value of water supplied to households, businesses and agriculture can be valued by multiplying the amount supplied with the water price charged.
- **Travel cost:** Tourism and port usage can be valued by multiplying the number of arrivals with the cost or expenditure per arrival.
- **Damage cost avoided and cost of illness:** Mangroves, seagrasses, coral reefs and kelp forests provide coastal protection services. Valuing these can be done by estimating the total cost associated with flooding, drought, and sandstorms that would likely occur if these ecosystems were not restored or kept intact. These costs include damages to physical infrastructure and healthcare costs.
- **Contingent valuation:** Most cultural marine ecosystem services can only be valued indirectly as these services are not transacted. Contingent valuation methods ask people about their willingness to pay for these services if they had to. Choice modelling, which requires people to make a trade-off between ecosystem services, can also be used for valuing the aesthetic appeal of coastal areas or their relevance to consumers' spiritual and mental wellbeing.

Key marine ecosystem services and common related valuation methods

Marine ecosystem service	Description and examples	Valuation method
Provisioning services		
Food	Wild fishing, aquaculture, seaweed	Market prices
Medical prospecting	Components of medicinal/health products, discoveries pharmaceuticals	Market prices
Minerals and metals	Deep sea mining	Market prices
Renewable energy provision	Offshore wind energy, tidal and wave energy	Market prices
Trade and transport	Marine infrastructure, ports	Public pricing, travel cost
Water storage and provision	Water extraction in marine and coastal areas	Market prices, restoration cost
Other	Oil, gas, timber, biofuels, fibre, aquarium fish	Market prices
Regulating services		
Air purification	Mangroves can capture airborne particles and pollutants, absorb them and break them down into less harmful forms.	Hedonic pricing, cost of illness
Carbon sequestration	Carbon storage in living biomass in soil and offshore in water column and sediment. Mangroves, seaweed and seagrass are key enablers.	Market prices
Coastal protection	Reduction of waves and flood mitigation through coral reefs, mangrove forests and kelp forests	Replacement cost, damage cost avoided
Nitrogen fixation	Microbes convert di-Nitrogen gas to reactive nitrogen which plays an essential role in biological processes and have an influence on the capacity of the ocean to store carbon.	Damage cost avoided
Sediment stabilisation	Seagrass meadows, mangroves and tidal marshes provide coastal defence and encourage sediment stabilisation.	Replacement cost, damage cost avoided
Waste management	Breakdown of chemicals by marine microorganisms	Cost of illness, damage cost avoided
Water purification	Filtering of coastal water by shellfish	Cost of illness, damage cost avoided
Cultural services		
Aesthetic	The ocean's flora and fauna, coral reefs and seascapes provide people with a sense of tranquillity and peace.	Contingent valuation
Existence	Mangrove and seaweed forests serve as breeding habitat for fish	
Historic maritime heritage	Culture knowledge especially in relation to Indigenous people	Contingent valuation
Leisure	Ocean and coastal-related recreation and tourism activities	Travel cost
Mental health and wellbeing	Interaction with coastal and marine environments supports calmness, relaxation and revitalisation.	Contingent valuation
Research and education	Analysis of genetic material	
Spiritual and artistic	Use of marine landscapes in paintings, films etc.	Contingent valuation

Source: World Bank, De Valck et al. (2023), Tregarot et al. (2020), Standard Chartered

Figure 15

Private sector involvement helps drive nature valuation efforts

As the topic of nature accounting and valuation has developed over the years, so has an ecosystem of technical providers, consultants, and a suite of tools to assist in the nature accounting and valuation process. As activity among this ecosystem of external parties increases, the success of financing nature-based restoration and conservation efforts may be improved.

Marine ecosystem services valuation

As shown earlier in this report, ecosystem service valuation has become an increasingly popular topic as indicated by the number of studies published during the past few decades (Figure 2). Greater understanding of the role fulfilled by the ocean and its ecosystems explains why the valuation of marine ecosystems is also gaining in popularity. For the purpose of this report, we highlight a few examples of studies showing that key marine ecosystem services hold high value.

Coastal wetlands are valued at USD475 billion per year

Coastal wetlands provide a range of ecosystem services including coastal protection from the impact of tropical cyclones. Coastal wetlands reduce the impact of cyclones on nature and human lives by absorbing storm energy (Figure 17). Importantly, this is a capability that neither solid land nor open water provides (Simpson et al., 1981). The relevance for assessing the value of coastal wetlands in relation to reducing the damage of cyclones is high. Costanza et al. show that avoided storm damages from coastal wetlands had a value of USD23 billion per year for the US Atlantic and Gulf coast and USD53 billion and USD199 billion per year in the case of Australia and China, respectively. They estimated the mean global avoided damages from coastal wetlands at USD475 billion per year. The countries with the greatest annual avoided damages from coastal wetlands are the USA (USD200 billion), China (USD157 billion), Philippines (USD47 billion), Japan (USD24 billion) and Mexico (USD15 billion).

Coral reefs can reduce flood damages by USD130 billion

Coral reefs provide coastal protection services to people and property. The significance of this has been highlighted in studies including by (Beck et al., 2018). Their analysis suggests that reefs can reduce annual storm-related damages by more than USD4 billion and that the amount of flooded capital would double if reefs did not exist. They also estimate that avoided flood-related damages through coral reefs are greatest in Indonesia, the Philippines and Malaysia (Figure 16). Overall, in the case of 100-year events, the top one metre of coral reefs provides flood reduction benefits that total USD130 billion in avoided damages.

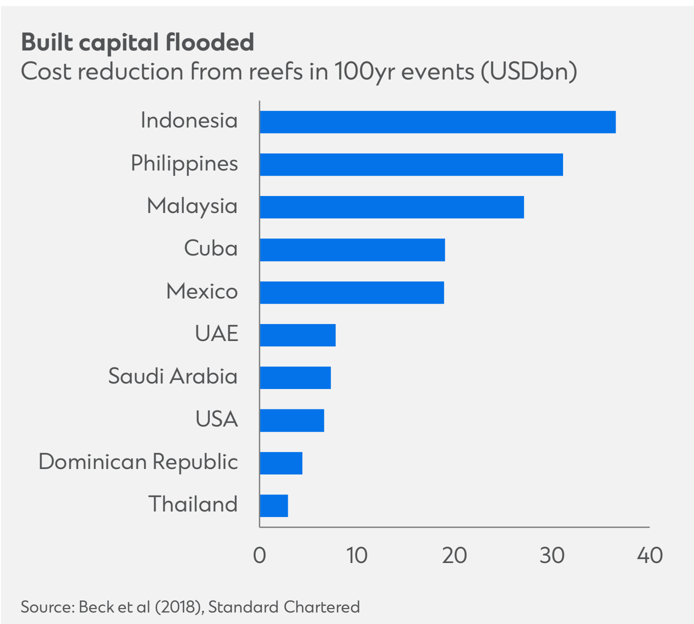


Figure 16

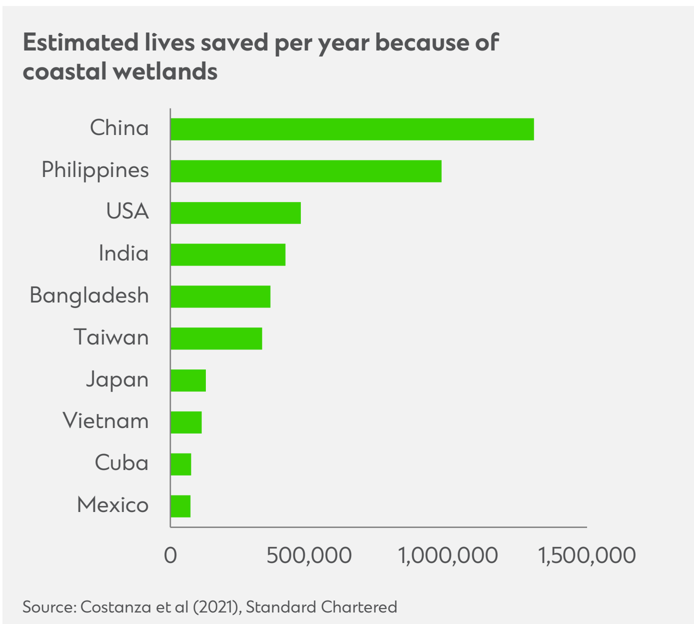


Figure 17

Marine kelp forests can be valued at USD500 billion per year

Kelp forests provide a wide range of ecosystem services as presented in our earlier publications. Kelp forests also provide habitat for fisheries, sequester carbon, release oxygen and help reduce marine nutrient pollution. Relatively little analysis has been done regarding the value that kelp forests have to people. However, the indications are that this value can be very significant. Recent research by Eger et al., 2023, shows the potential economic value of kelp forests associated with fishery production, carbon capture and nutrient recycling. They estimate that the average combined value of carbon storage, nutrient removal and fisheries services ranges from USD38,799 – 165,200 per hectare per year. Globally, they estimate a value for kelp forests of USD500 billion per year.

Blue carbon as potential value creator

Services provided by marine ecosystems that receive a lot of interest are typically those associated with food production, coastal protection and tourism or recreation. However, mangrove forests, seagrass beds, salt marshes and kelp forests also sequester carbon. Conservation and expansion of these ecosystems would help mitigate the impact of climate change, particularly if it leads to structural carbon storage. By sustainably conserving and restoring their marine ecosystems, developing countries could potentially create carbon credits, which may find demand from corporate buyers. For example, Salesforce has committed to purchasing a million tonnes of high-quality blue carbon credits from restoration efforts in mangroves or other marine ecosystems that are critical both for climate mitigation and resilience. This would allow developing countries to raise additional financing.

Marine ecosystems have high carbon storage capacity

Coastal ecosystems have significant carbon storage capacity. Although tidal marshes, seagrass meadows, mangrove forests and kelp forests account for less than one per cent of the ocean's surface area, they store at least 30 per cent of the seabed's organic carbon (World Ocean Review, 2024).

There is a wide variety of estimates regarding the carbon sequestration capacity of coastal ecosystems (Figure 18). This degree of uncertainty is high because many of the processes and interactions within these ecosystems are not yet fully understood. Nevertheless, coastal ecosystems remove up to 250 million tonnes of carbon per year from the atmosphere and the sea, according to the most recent World Ocean Review (2024). Restoring and conserving marine ecosystems can contribute to significant reductions in carbon emissions. Protecting existing coastal ecosystems could prevent up to 460 million tonnes of CO_2 emissions annually, whereas widespread restoration could remove an additional 1.1 billion tonnes of carbon dioxide per year from 2030 onwards (World Ocean Review, 2024).

Carbon sequestration capacity of key coastal ecosystems

Salt marshes	Mangroves	Seagrass meadows
Annual carbon storage (/ha)		
World Ocean Review	28kg – 17t	560kg – 11t
McLeod et al. 2011	18kg-17.1t	200kg-9.5t
Wang et al. 2021	1.7t	1.9t
Breithaupt et al. 2022		1.2-1.6t
Duarte and Chiscano 1999		

Source: World Ocean Review 2024, McLeod et al 2011, Wang et al 2021, Duarte and Chiscano 1999, Standard Chartered

Figure 18

The relative importance of restoring and conserving marine ecosystems from a carbon sequestration perspective can be highlighted through a comparison with terrestrial forests. Mean annual carbon burial rates for coastal ecosystems range between 138gC/m2 for seagrasses and 226gC/m2 in the case of mangroves (Figure 19). Terrestrial forests on the other hand store just 4-5.1gC/m2 per year (McLeod et al., 2011).

Location matters in terms of coastal ecosystem-related carbon sequestration as annual carbon sequestration rates differ substantially Research by Wang et al. suggests that, on average, countries across East Asia and Asia Pacific regions have carbon burial rates by country and region that are almost nine times higher than those located in the Middle East and North Africa (Figure 20).

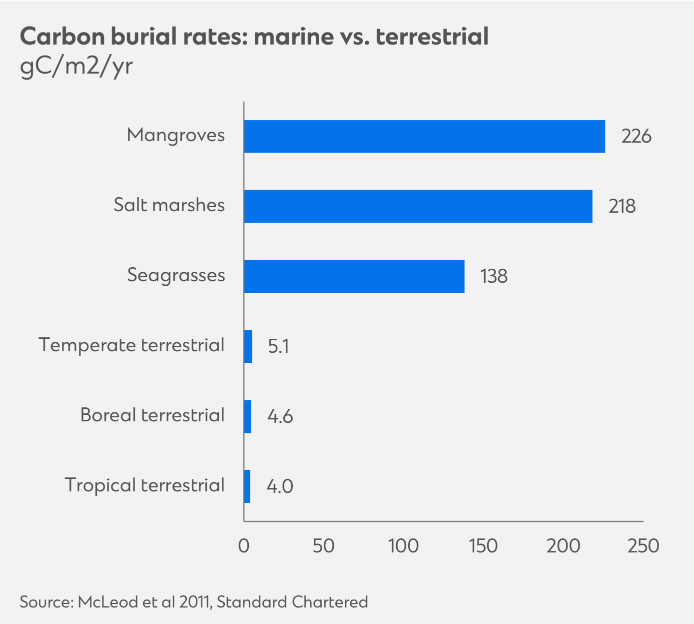


Figure 19

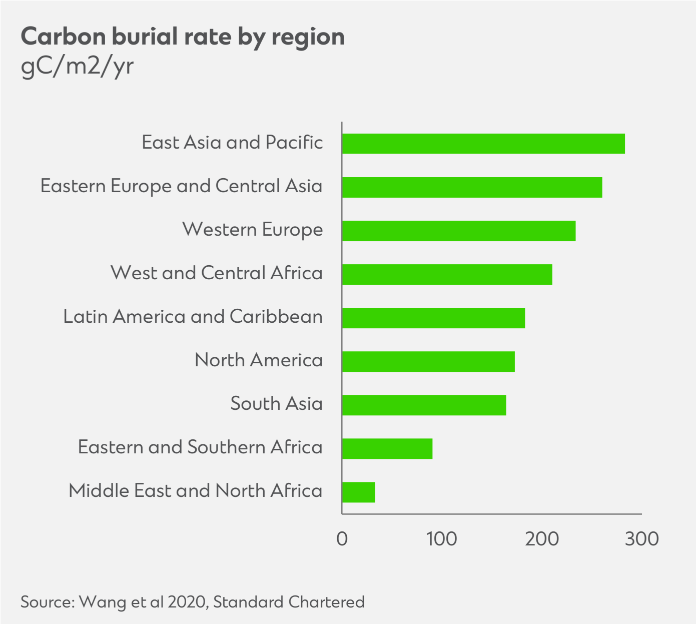


Figure 20

Analysis published in the latest edition of the World Ocean Review confirms that regional differences for carbon sequestration are high. The Review indicates that sequestration rates are highest for marine ecosystems in North America and Australia, and lower across South-West Africa and the western side of Latin America.

Marine conservation may benefit blue carbon

The need to restore and conserve coastal ecosystems is not just driven by the need to increase the amount of carbon that is stored annually, but also by the fact that the current degradation of coastal ecosystems reduces the amount of carbon being stored annually, as well as releasing stored carbon.

Analysis suggests that an average of 0.45Gt of carbon dioxide is being released annually because of the habitat destruction of vegetated coastal ecosystems (Pendleton et al., 2012). For reference, data from the World Resources Institute suggests that terrestrial deforestation-related emissions release reached 2.4Gt in 2023 (Link). In other words, coastal ecosystem emissions release represents almost 20 per cent of deforestation-related emissions release.

The conservation of marine ecosystems could substantially reduce these carbon emissions and therefore avoid their related cost to society. To put this in context, using a social cost of carbon of USD185 per tonne, as suggested by Rennert et al., 2022, implies that avoiding the average annual 0.45Gt of coastal ecosystem-related emissions would represent a total avoided cost of USD80 billion (Figures 21 and 22).

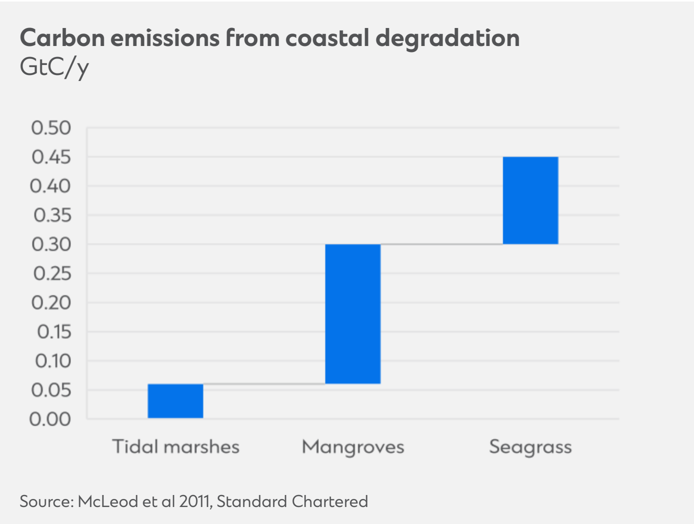


Figure 21

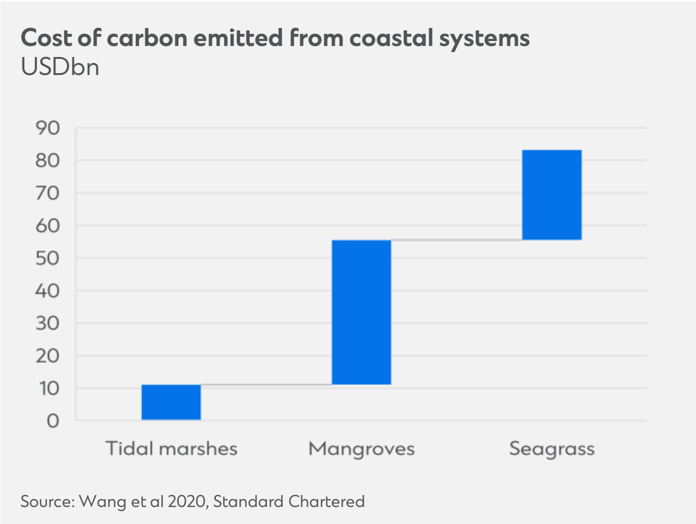
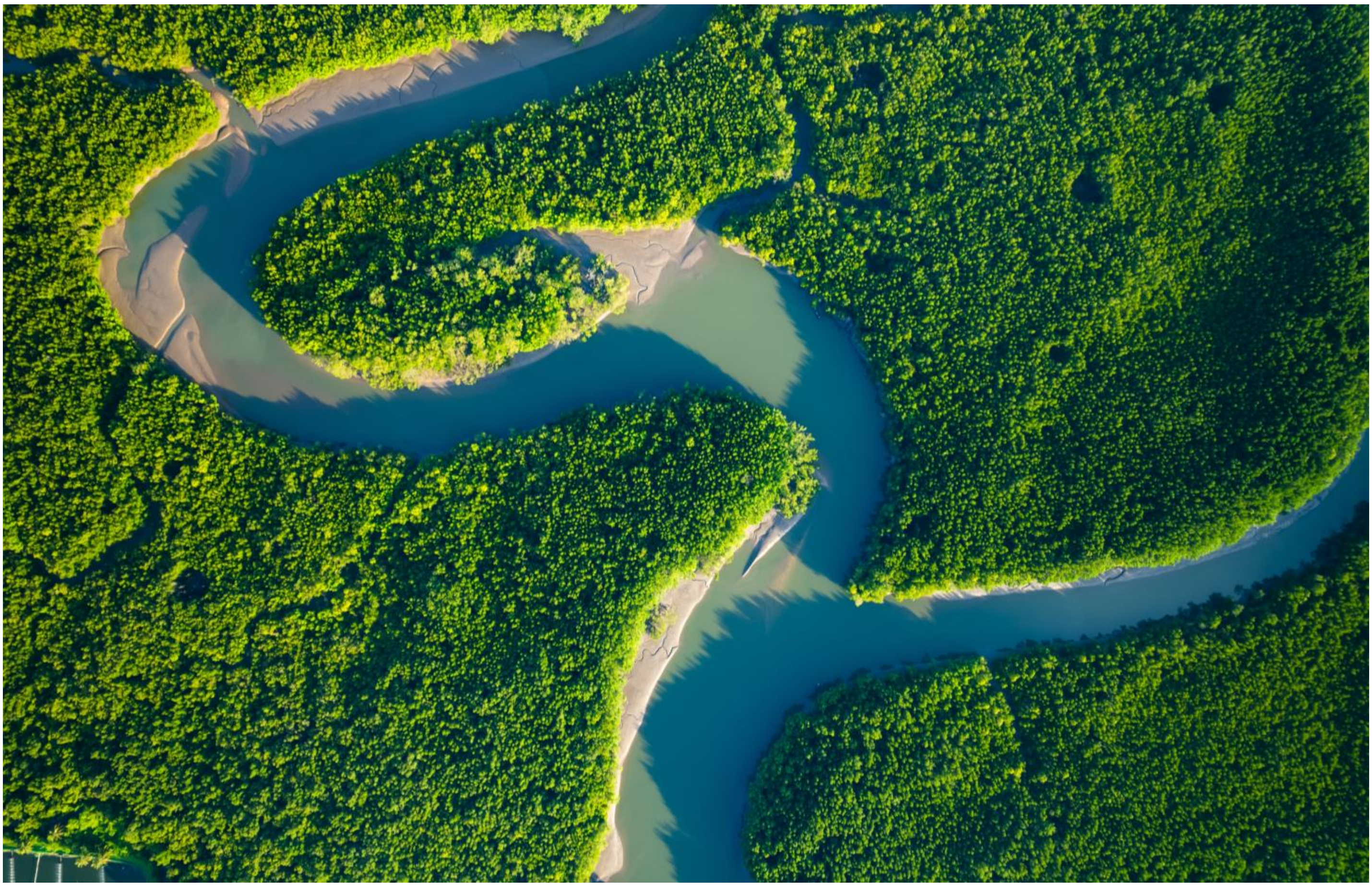


Figure 22

Potential value of mangrove-related carbon storage

To provide an indication of the potential that the restoration of marine ecosystems has, a simple scenario was modelled for the purposes of this report. Using mangrove coverage data by country from Bunting et al., 2022, the carbon storage potential over a 20-year period was calculated, assuming that the 28 countries responsible for 95 per cent of global mangrove loss since 1996 were to restore their mangrove forests to 1996 levels.

Our calculations indicate that a full restoration to 1996 levels for these countries could sequester almost 240 million tonnes of CO2 equivalent over a 20-year period. Indonesia, Australia and Mexico would make up more than 50 per cent of this. The restoration efforts could be part-funded through the creation of blue carbon credits. At present, the price for mangrove carbon credits can be up to USD30 per tonne of CO2 equivalent. This indicates that the mangrove restoration-related carbon sequestration potential of 240 million tonnes may yield more than USD7 billion in revenue. This estimate assumes that these carbon credits are able to secure a price of USD30 per tonne of CO2 equivalent. At present, that is uncertain considering that demand for nature-based voluntary carbon credits is low.



Spotlight on marine ecosystem valuation: Africa

Africa has over 30,000 km of coastline and is highly reliant on marine ecosystem services. However, the degradation of marine ecosystems in markets across the continent puts significant pressure on food production and local coastal economies. It also increases the chances of more drought, flooding and erosion which further limits the ability of coastal economies to develop. All of this has far reaching consequences for local coastal communities. These environmental challenges are also deeply intertwined with social and economic wellbeing. Beyond their pure economic value, Africa's marine ecosystems are foundational to community resilience. They support over 12 million people through jobs in Africa's small-scale fisheries, as well as millions more who depend on them for food and income. These ecosystems play a direct role in poverty alleviation, food security, and disaster resilience. Given their critical role in sustaining livelihoods, incorporating social and economic factors into marine ecosystem valuation is essential.

A monetary valuation of Africa's marine ecosystem services is one way to better integrate the continent's marine ecosystems and the blue economy into broader economic and political decision-making processes. It also helps in raising the capital needed to invest in making Africa's blue economy more sustainable.

Africa's marine ecosystems could be worth more than USD800 billion per year

Although ecosystem service valuation has become a more popular topic, there is a general lack of data and studies in relation to African coastal and marine ecosystem service valuation. One of the more recent studies of interest is that of Tregarot et al. (2020) whose analysis estimates the value provided to Africa's economy by mangroves, coral reefs, seagrass beds and kelp forests. Interestingly, they incorporate population density and growth rates to assess the pressures that ecosystems are likely to face (Tregarot, Touron-Gardic, Cornet, & Failler, 2020).

To value the services provided by a range of African large marine ecosystems, the authors used a transfer pricing approach. In other words, they used valuation estimates from articles and reports that analysed similar ecosystem services performed elsewhere and applied these in an African context. Based on this approach they estimate that the total value of mangroves, seagrass beds, coral reefs, and kelp forests for Africa is USD814 billion per year, with coral reefs representing 72 per cent of this.

Large marine ecosystem habitats with the highest value, according to Tregarot et al., are the Agulhas Current which runs from Mozambique to South Africa and the Red Sea (Figure 23). The reason why these two regions appear significantly more valuable than the others, according to Tregarot et al., relates not just to the size of their habitat, but more importantly to a greater representation of coral reefs than elsewhere. The data used by Tregarot et al. shows that services aided by coral reefs are on average worth USD34 million per year per km2. This compares to USD3.3 million per year per km2 and USD1.9 million per year per km2 in the case of mangroves and seagrass beds respectively. Their valuation of kelp forest-based services is just USD400,000 per year per km2. However, the approach taken by Tregarot et al. has a few disadvantages, including the limited set of estimates for ecosystem services that the authors used to value these services in an African context. Furthermore, the sources used to value specific ecosystem services can differ depending on the type of ecosystem being valued. One of the key requirements in performing a valuation of marine or coastal areas, therefore, is to ensure that a large and sufficiently consistent set of estimates is used for the ecosystem services being valued.

Irrespective of the uncertainties valuing African marine ecosystems, there is clearly material value in them. This value should be incorporated into government policies to support more effective strategies that help stop the decline of African marine ecosystems and allow them to recover.

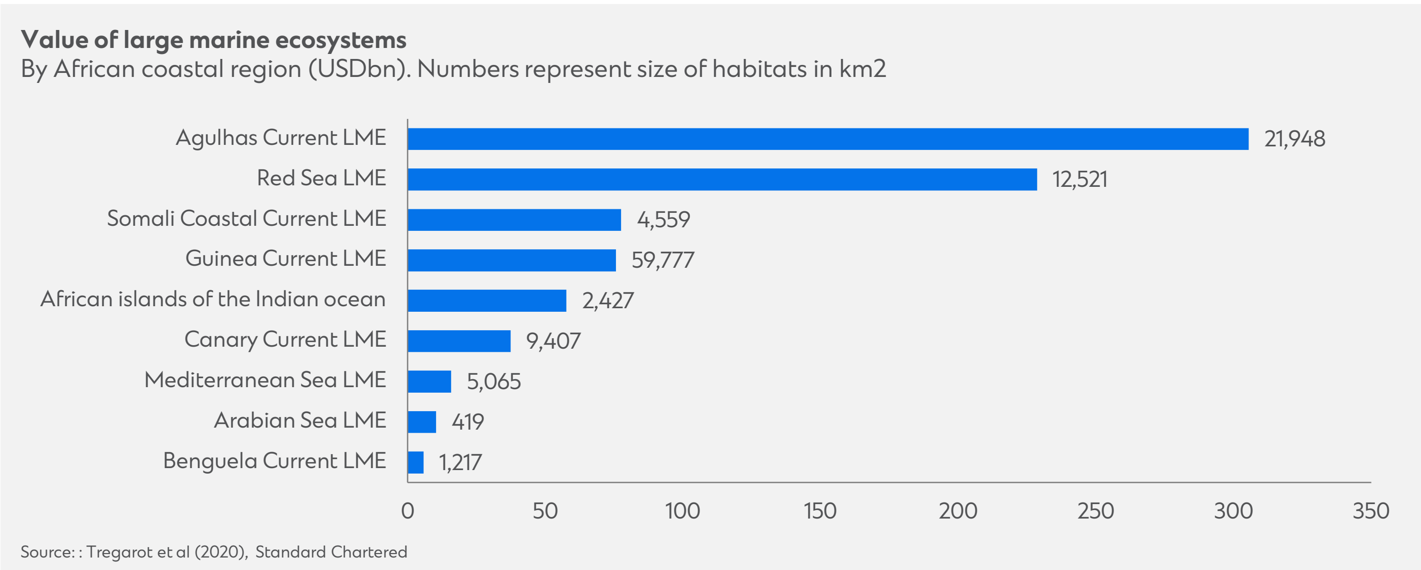


Figure 23

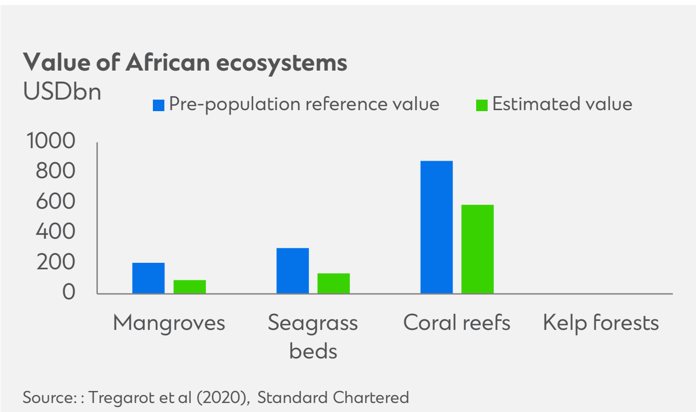


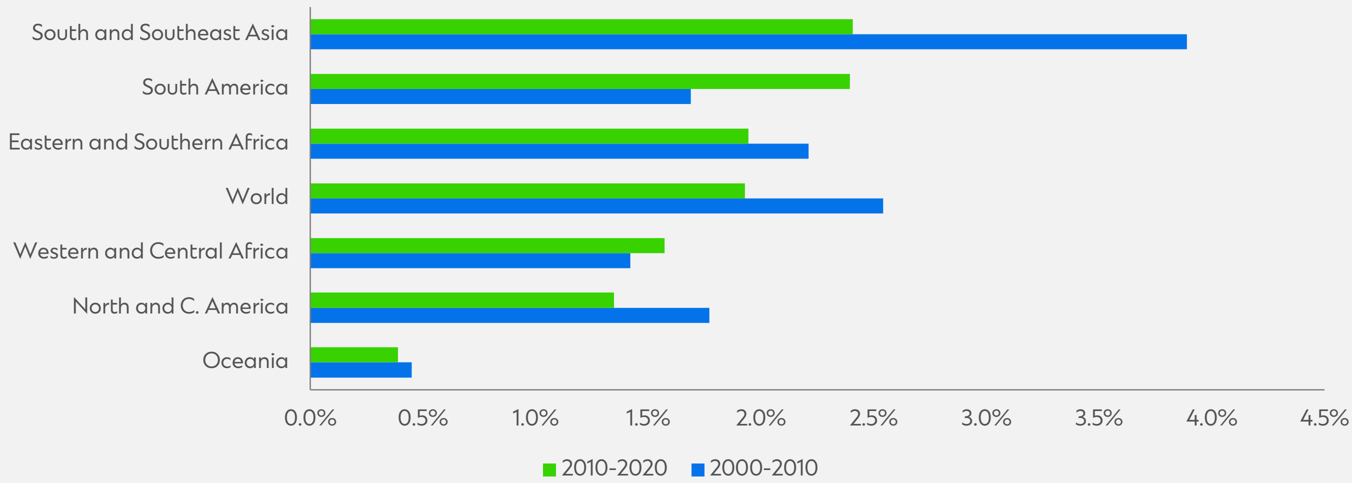
Figure 24

Blue carbon as potential value generator for Africa

Sequestering and avoiding new carbon emissions through coastal conservation and restoration efforts has value across coastal markets in Africa. Mangrove deforestation rates across the continent have not substantially improved since 2000 (Figure 25), but critical mangrove restoration and conservation can help reverse this process.

The cause of mangrove losses across Africa differs between countries (Contessa et al., 2023). Agricultural development - including ports, general clearing of mangrove forests and erosion – is a key driver. Estimates from Contessa et al. show that agriculture was the prime cause for mangrove losses in South Africa, Tanzania and Guinea (Figure 26). Erosion caused almost 90 per cent of the mangrove losses in Cameroon, while infrastructure development was the main cause for mangrove losses in The Gambia, Angola, and Côte d'Ivoire.

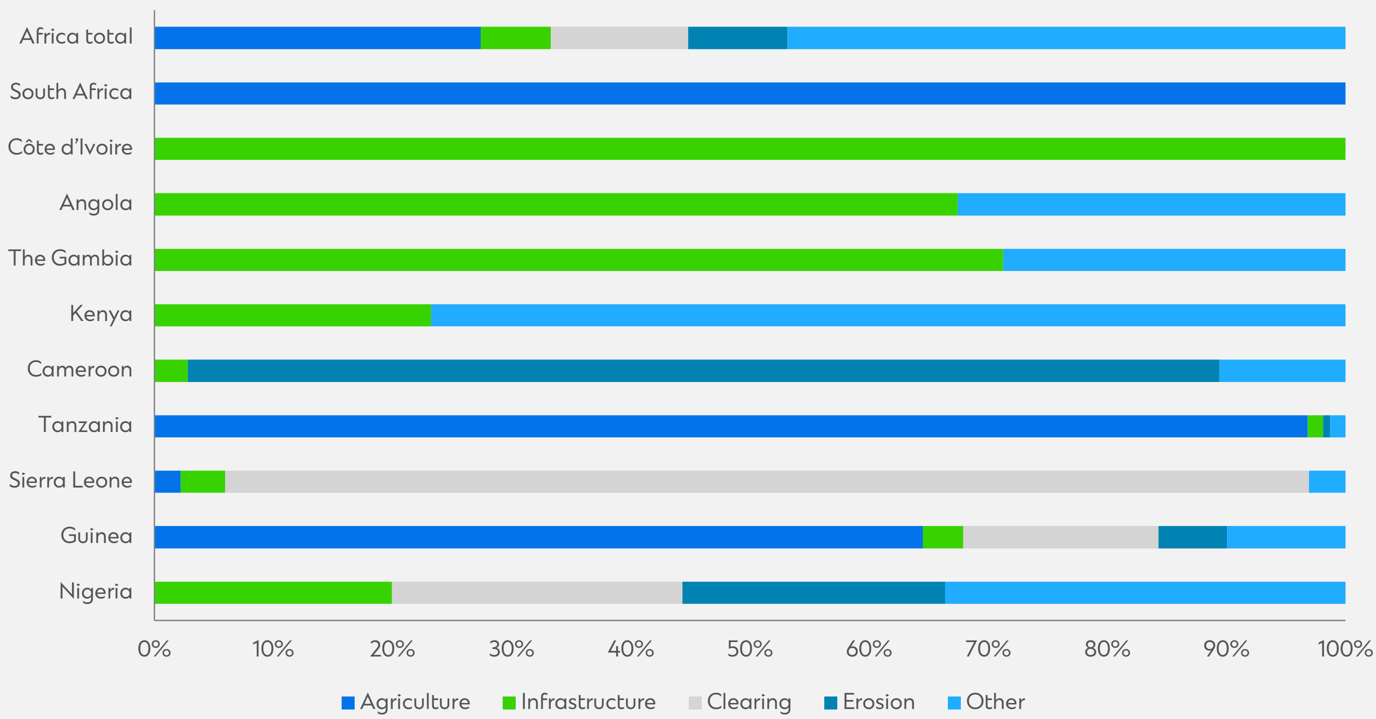
Mangrove forest loss across regions
% change per period



Source: Contessa et al 2023, Standard Chartered

Figure 25

Mangrove loss events by cause



Source: Contessa V et al 2023, Standard Chartered

Figure 26

Last year the International Union for Conservation of Nature (IUCN) released its first global assessment of the functioning of mangrove ecosystems. This analysis showed that 50 per cent of mangrove systems are at risk of collapse, while 20 per cent are at severe risk of collapse (see IUCN Red List of Mangrove Ecosystems). The impact of this on Africa as a region could be significant.

From 2016-2020, the 23 countries across the continent with the largest mangrove forests experienced average annual losses of 0.13 per cent (Bunting et al., 2023). The IUCN's assessment that 50 per cent of mangrove forests are at risk suggests that annual mangrove loss rates across Africa may accelerate unless governments take remedial action.

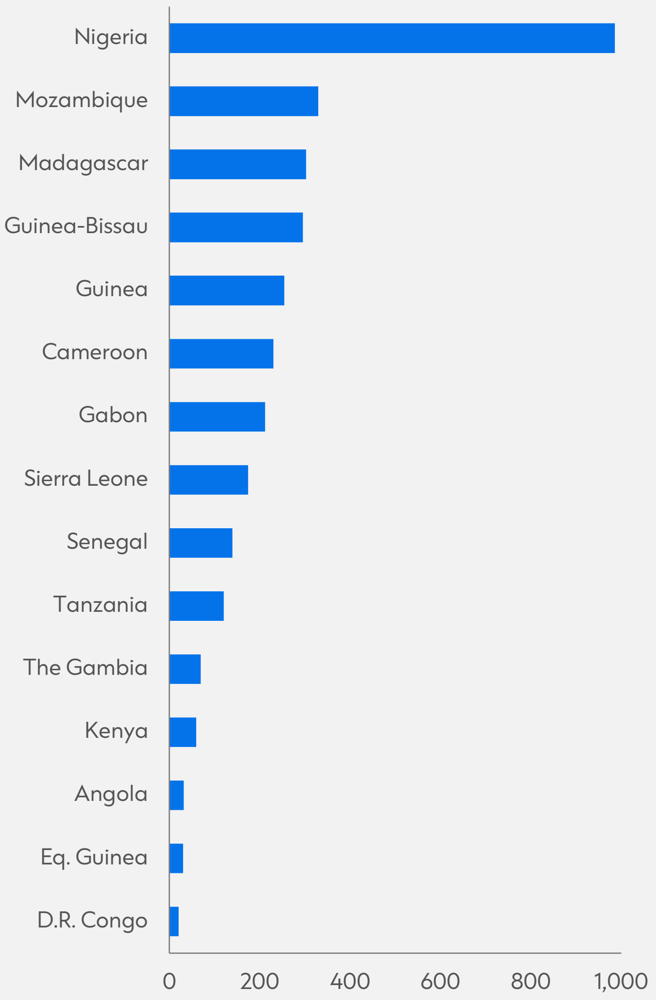
Conserving existing mangrove forests across Africa holds potential blue carbon value for exposed governments as this avoids emissions release. Using estimates for carbon storage by mangrove trees, annual loss rates and mangrove-related carbon prices allows us to estimate the annual value of avoiding carbon emissions through conserving existing mangrove forests. These can then be discounted to calculate a net present value of avoided mangrove-related carbon emissions by country.

Using data from Bunting et al., 2023, Bunting et al., 2022 and Bryan et al., 2020 on mangrove areas and mean carbon storage per hectare for 23 African countries, it can be assumed that annual loss rates will increase in a business-as-usual scenario to 0.25 per cent from the more recent 0.13 per cent across the region.

Calculations made for this report suggest that if markets were able to avoid further losses to their mangrove forests, the related carbon credits could be worth over USD3.3 billion for the region, if these credits were able to attract a price of USD30 per tonne of CO2eq.

The countries with the greatest potential in this area are Nigeria, Mozambique and Madagascar (Figure 27). Additional value is likely should carbon prices for quality mangrove-related projects increase. For example, a USD50/tCO2eq carbon price would imply an uplift in the value of the avoided carbon emissions to USD5.5 billion (Figure 28). As highlighted previously, these assumptions require a strong increase in demand for carbon credits. This in turn is uncertain unless mandatory incentive schemes for carbon credit buyers are established.

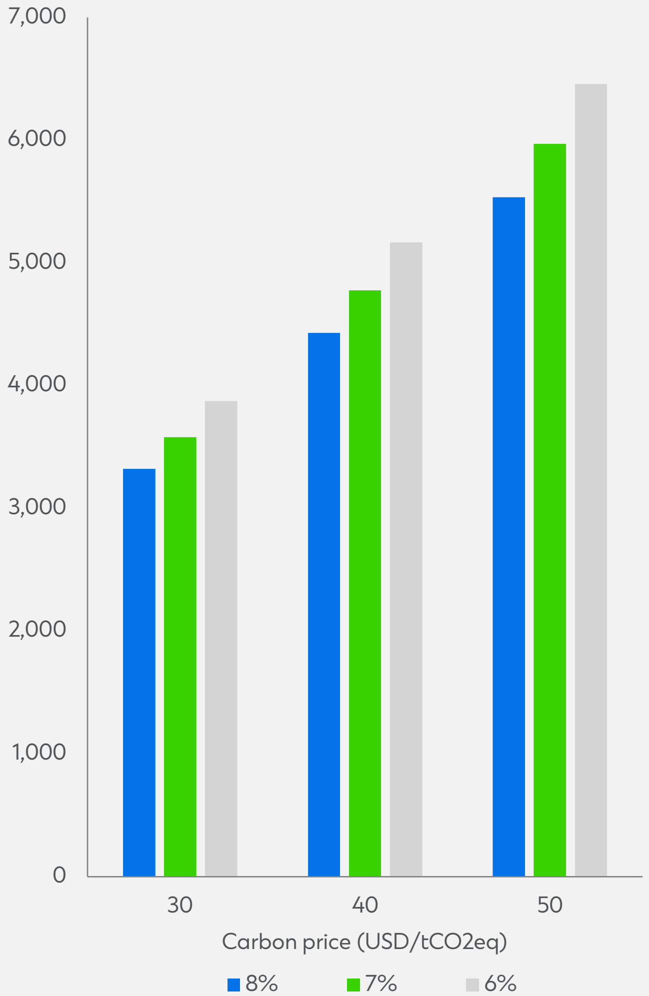
Valuing avoided carbon emissions
USDmn



Source: Bunting et al (2022 and 2023), Bryan et al (2020), Standard Chartered

Figure 27

Valuation scenarios for avoided carbon
USDmn for 23 African countries by discount rate



Source: Bunting et al (2022 and 2023), Standard Chartered

Figure 28

04

Developing MPAs to increase marine valuation

The previous chapter highlighted that marine ecosystem services can have significant value. But the key challenge for policymakers is how to optimise the quality of marine ecosystem services in order to capture as much of this value as possible. One ocean-based solution that is increasingly being promoted is the establishment of Marine Protected Areas (MPAs). In this chapter we outline how MPAs can help improve the quality of marine ecosystem services, what this means for the value of these areas and how developing countries in particular can benefit.

What is an MPA?

An MPA is an area of the sea or ocean that is designated by regulation for the long-term conservation of marine resources, ecosystem services or cultural heritage. The level of protection offered to these areas can differ significantly between different MPAs. So-called marine reserves or 'no-take' areas severely restrict fishing to protect the area's biodiversity, habitats or fisheries. MPAs can also be established that allow for a range of ecosystem services such as fishing, recreation and industrial activities to be developed as long as these stay within sustainability-based boundary conditions.

MPAs are known to deliver positive social and ecological outcomes. Increasingly though, MPAs are also believed to contribute to carbon sequestration and help improve the resilience of marine ecosystems (Jacquemont, Blasiak, Le Cam, Le Gouellec, & Claudet, 2022) Over the past 25 years the number of MPAs established globally, as well as the sea area covered by them, has risen substantially. Data from the Marine Protection Atlas indicates that c30mln km² of marine area is currently being protected which compares to less than 4mln km² at the start of the century (Figure 29). Despite this increase we note that much more progress needs to be made if long-term sustainability targets are to be achieved. For example, the MPA guide produced by the Marine Conservation Institute suggests that just 5.7 per cent of the world's total marine area is under some form of protection, while just 2.9 per cent is highly or fully protected. Just six of the 213 territories and countries listed in the MPA Atlas highly or fully protect more than 50 per cent of their marine areas, while 188 protect less than five per cent of their marine areas in this way. This includes the majority of the largest 15 marine areas globally (Figure 30). Another key aspect to note is that, for MPAs to be successful in terms of nature outcomes and associated economic benefits, they need to be effectively managed. This requires detailed marine spatial planning processes, and importantly, having the necessary financing set up to help establish and manage them.

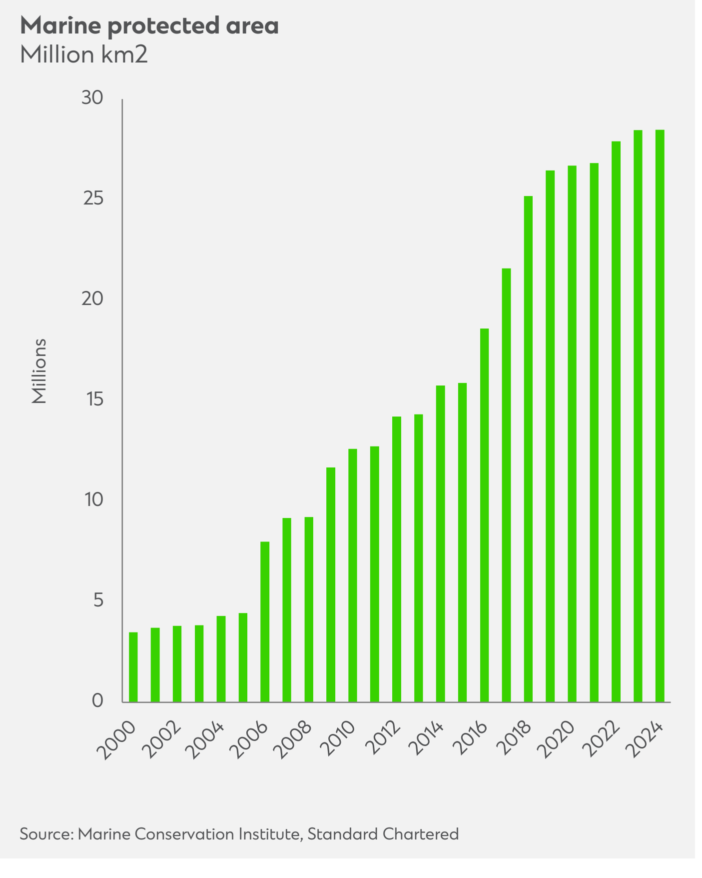


Figure 29

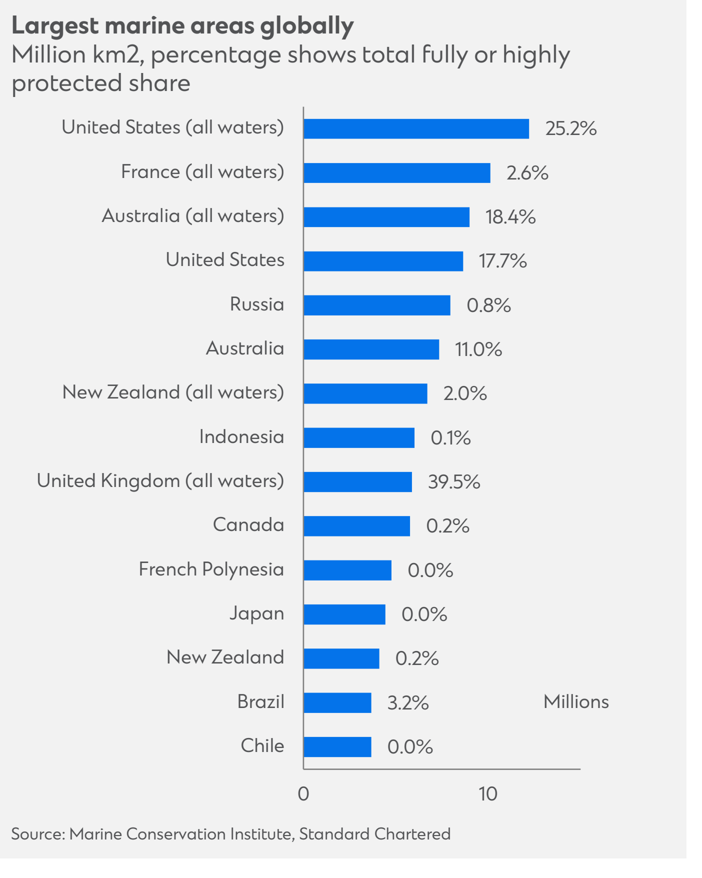


Figure 30

The benefits of an MPA

Recent work from Jacquement et al., 2022, provides a clear overview of the relevance and range of benefits that MPAs provide.

Marine conservation and carbon sequestration

Their review of 22,403 publications shows that marine conservation enhances most ecological and social climate pathways, that MPAs significantly increase carbon sequestration, coastal protection, biodiversity, and the reproductive capacity of marine organisms as well as fishers' catch and income. The ecological benefits delivered by MPAs have been studied for multiple decades. This shows that the biomass of species such as fish and crustaceans can be two to five times higher within MPAs compared to areas with extensive fishing (Davis et al., 2019).

Conserving or restoring seagrasses and mangrove forests significantly increases carbon sequestration compared to areas exposed to human pressure. In addition, untrawled seabeds retain higher levels of carbon than those exposed to trawling.

The impact of MPAs on ecological adaptation

The studies reviewed by Jacquement et al. also show that MPAs improve ecological adaptation through increased biodiversity and species richness, reproductive output and coastal protection.

Global conservation targets may boost the development of MPAs

The ocean is one of the world's most important ecosystems, but its health is in decline. In recent years several ocean-related policies or targets have been adopted by governments that may increase the number of MPAs. These policies and targets include the Convention on Biological Diversity (CBD), the Aichi Biodiversity Targets and the Sustainable Development Goals (SDGs). The most recent policy relevant for the development of MPAs is the Kunming-Montreal Global Biodiversity Framework. This framework includes 23 global biodiversity targets, the third of which is the so-called '30x30' target. This stipulates that by 2030, governments need to protect at least 30 per cent of their terrestrial, inland water, and coastal and marine areas, especially areas of particular importance for biodiversity and ecosystem functions and services.

Understanding the value of an MPA would boost their development

As highlighted earlier in this chapter, most countries have yet to meaningfully designate protected areas. Despite this, evidence suggests that while the benefits of MPAs are well understood, progress towards the 30x30 targets remains slow. More relevant to this report is the fact that establishing and operating MPAs requires capital and investment, which may be a factor in the slow progress around MPAs.

In addition, this slow progress can also be explained by the operational challenge of stepping up the funding needed to create, maintain and manage these MPAs. This is because the value generated by MPAs is not fully appreciated, and the governments and markets involved often face broader macroeconomic or debt challenges that make raising additional financing for an MPA more challenging.

Spotlight: The social dimension of MPAs

Marine ecosystems provide economic and environmental value. But beyond their ecological and financial benefits, marine ecosystems are also deeply tied to social outcomes. MPAs not only support biodiversity and climate resilience, but also serve as engines for sustainable livelihoods, food security, and cultural preservation—factors that are often overlooked in traditional valuation approaches. As frameworks for assessing marine ecosystem services evolve, including the social benefits is essential for fully understanding the broader impact that investments in marine conservation can generate. MPAs contribute to sustainable livelihoods by:

Supporting long-term employment in fishing and fisheries: MPAs enhance the stability and income resilience of fishing communities by ensuring fish populations can replenish and spill over into adjacent fishing zones. While most MPAs can allow regulated, sustainable fishing, even fully protected MPAs can also play a critical role in restoring fish stocks, which then benefit nearby fisheries.

Studies show that well-managed MPAs can increase fish biomass by up to 670 per cent within protected areas and boost fish stocks by as much as 90 per cent in surrounding fishing grounds, leading to higher and more sustainable income (Lester et al., 2009). In the Mesoamerican Reef Region, households near MPAs report higher fish catches and more stable earnings (Bennett, 2023), and communities living within six miles of an MPA experience on average 33 per cent higher wealth. Similarly, research in the Philippines found fish biomass inside MPAs to be twice as high as that in unprotected areas, directly benefiting small-scale fishers who depend on these stocks for income (Warne, 2022). By preventing overfishing and ensuring long-term resource availability, MPAs serve as economic safety nets, reducing the risk of industry collapse and reinforcing resilient livelihoods for coastal communities. Beyond fisheries, MPAs also create new livelihood opportunities in sustainable aquaculture and seaweed farming, further strengthening the economic resilience of the coastal communities.

Driving new job creation:
MPAs can serve as catalysts for new job creation, addressing persistent employment challenges in developing coastal economies, particularly concerning youth unemployment. By stimulating ecotourism, conservation efforts and sustainable marine industries, MPAs create employment opportunities beyond traditional fishing. For example, Australia's Great Barrier Reef Marine Park supports over 64,000 jobs annually (Queensland Government, 2018), encompassing roles such as local tour guides, hospitality workers and conservation-based enterprises. Similarly, MPAs encourage the development of alternative livelihoods that are less dependent on traditional fishing practices, including sustainable aquaculture, seaweed farming, and conservation-based employment such as park rangers and scientific research assistants.

In Indonesia, community-led seaweed farming initiatives have provided reliable and sustainable income for coastal residents, reducing dependence on fishing-based livelihoods and building resilience against climate shocks. By transitioning economies from extractive industries to regenerative and nature-based solutions, MPAs not only protect ecosystems but also foster resilient local economies, offering long-term employment solutions. Women play a critical role in small-scale fisheries, seafood processing and marine based enterprises, yet they are often the first to face job losses when marine resources are depleted. MPAs help safeguard women's livelihoods by stabilising fish stocks and creating new opportunities for employment.

With women making up nearly half of the global fisheries workforce, MPAs not only support environmental sustainability but also strengthen economic independence and resilience for women across coastal communities.

Supporting food security and nutrition: MPAs contribute to food security by ensuring the sustainability of fish populations that many coastal communities rely on for protein intake. As shown by Jacquement et al., fishers have reported increased catch per unit efforts in MPAs, as compared to areas that are not protected. By preventing overfishing and allowing ecosystems to regenerate, MPAs help sustain vital food resources for millions of people worldwide and improve social adaptive capacity through the increase of fishers' income levels. Small-scale fisheries, which supply nearly half of the global fish catch for human consumption, are especially dependent on healthy marine ecosystems.

Additionally, MPAs enhance resilience to climate change by protecting fish spawning and nursery habitats, helping fish stocks recover from climate disruptions such as ocean warming and extreme weather. The spillover effect from well-managed MPAs further increases fish stocks in adjacent areas, ensuring that coastal populations continue to have access to nutritious and sustainable seafood. The age and size of MPAs also positively correlates with resilience and spillover benefits. Over time, this reduces reliance on more costly imported food, strengthens local food systems, and provides greater long-term food security.

Preserving indigenous and local heritage: Many MPAs safeguard culturally significant marine areas, ensuring that Indigenous and local communities can maintain their traditional ways of life, while strengthening their role in conservation. The Chumash Heritage National Marine Sanctuary in California protects ancestral waters, enabling the Chumash people to continue their cultural and spiritual practices linked to the ocean (Sherriff, 2024).

Similarly, Palau's National Marine Sanctuary – the world's first nationwide MPA – builds upon traditional conservation methods, reinforcing Indigenous leadership in marine stewardship while preserving the historical fishing practices that have sustained the Palauan communities for generations. Increasingly, co-management MPA models are being adopted, where Indigenous groups work alongside governments to manage MPAs, ensuring conservation aligns with traditional knowledge and community projects.

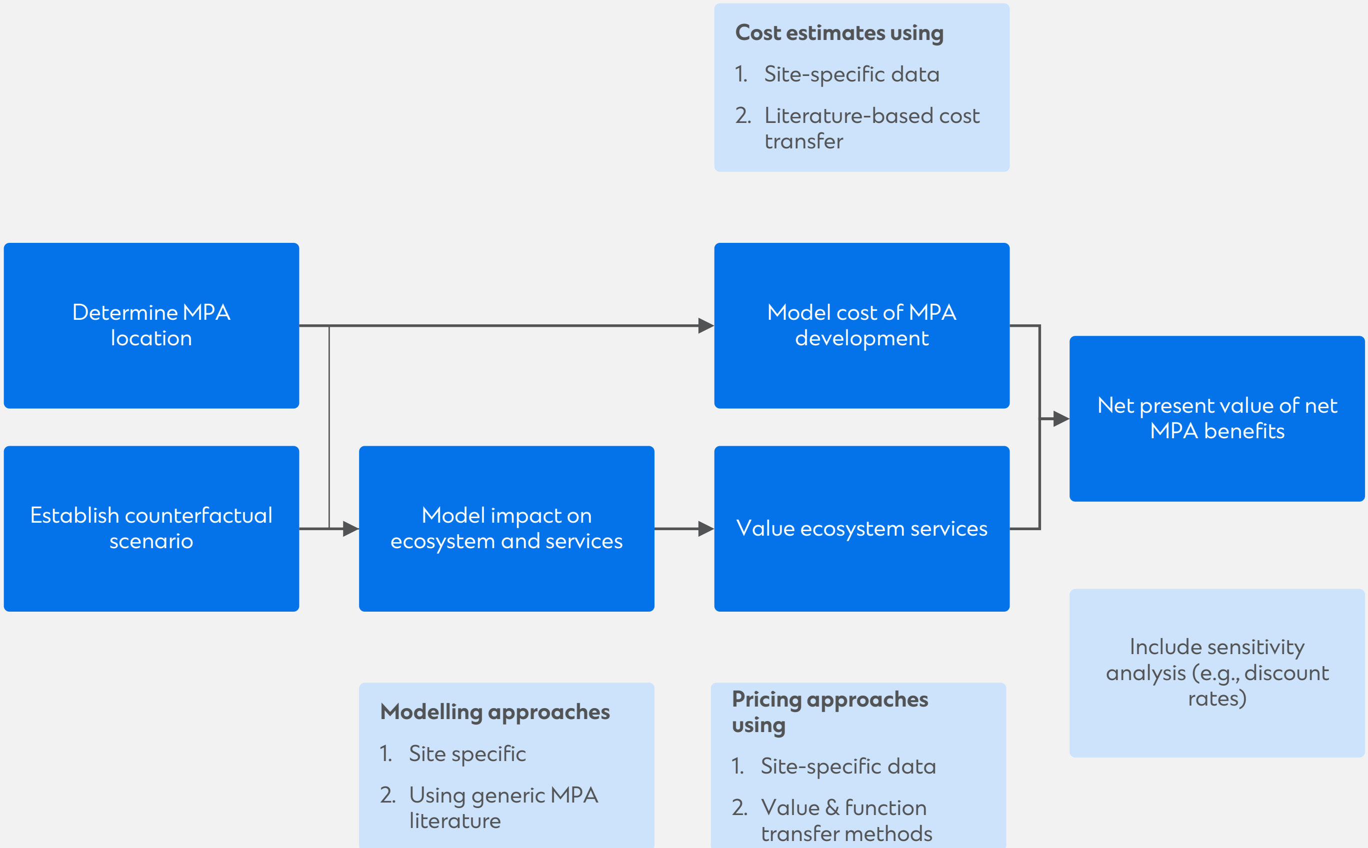
Fostering community engagement and education: MPAs serve as hubs for environmental education and community involvement, fostering a shared sense of responsibility for marine conservation. By actively involving local stakeholders in decision-making and conservation initiatives, MPAs help strengthen community buy-in and ensure long-term success. In Scotland, MPA designation has led to greater community participation in marine conservation initiatives, with local organisations playing an active role in monitoring biodiversity and educating the public on sustainable ocean management (The Scottish Government, 2020).

Engaging communities in MPA governance not only enhances compliance with regulations, but also empowers local stewards, ensuring conservation efforts remain effective and deeply rooted in people who depend on these ecosystems. All this strengthens the long-term success of conservation efforts.

A valuation framework for MPAs

While a marine protected area may undergo an ecosystem accounting and valuation exercise, this often gives a static value of the site at the time of study. For policy decision-making it is important to understand the added benefit of establishing an MPA, to conduct cost-benefit analyses and make informed policy decisions around setting up MPAs. Following an assessment of various MPA valuation studies, the graphic below in Figure 31 sets out considerations that could be used to value the benefits that establishing an MPA may bring.

Valuing the development of MPAs



Source: (Brander et al, 2024), Standard Chartered

Figure 31

Determining MPA locations

It is first important to select and understand the areas that might be considered for an MPA. This involves data collection of boundary maps, ecological characteristics, contextual factors such as users of the MPA, current activities and use intensity, neighbouring human populations, and policy contexts. Further criteria could also be adopted in selecting MPA locations depending on the objectives of the study. For example, if one is keen to understand the effects of establishing an MPA on a reef ecosystem, it would not be appropriate to include datapoints on a mangrove ecosystem.

Establishing a counterfactual scenario

In cases where an MPA has yet to be established, the counterfactual would be to understand the potential increments in ecosystem conditions and related service provision that establishing an MPA would provide. This could involve building several potential scenarios and determining the extent of ecosystem services offered in each of these scenarios.

It is important to note that these scenarios typically assume that the MPA is managed effectively and therefore is able to capture its full potential. In cases where an MPA has already been established, the counterfactual would be to establish the expected trajectory of ecosystem services if the MPA had not been established. This counterfactual could be based on extrapolations of previous levels of habitat degradation, or as above, a scenario based on a prior policy plan for the area before an MPA was established. For both cases, the benefit of the MPA would be expressed as the difference between the counterfactual and current scenarios.

Understanding the impact of an MPA on ecosystem services

As the implementation of an MPA brings about changes to the habitat and interactions with it, it is important to understand how these changes may lead to variations in ecosystem service provisions. It is therefore crucial to understand how establishing an MPA affects a range of ecosystem services - from the provision of food, raw materials and genetic resources, to regulating services like climate control and flood or storm protection, and cultural services such as tourism, education, spiritual enrichment - alongside carbon sequestration or emissions avoidance. A marine spatial planning process would allow a government to understand how the development of an MPA interacts with its broader marine ecosystem services. Ideally this analysis would use site-specific data for the MPA region in question. In the absence of this, the analysis can use parameter values drawn from studies of similar MPAs.

Estimating the costs of establishing the MPA

The costs of an MPA include not just those associated with setting up and maintaining it (e.g. CAPEX and operating expenses), but also the compliance and opportunity costs from activities that are restricted by the MPA.

Estimating the costs of establishing and operating an MPA should ideally use site-specific data. Important elements include labour and material costs, annual fee payments, infrastructure characteristics and fuel costs. In the absence of this, the analysis can also be performed by using literature-based cost functions for MPAs, adjusted for the site that is being assessed. Analysis of MPA cost functions suggests that economies of scale matter. In other words, developing larger MPAs tends to be cheaper on a hectare basis than developing smaller ones (McCrea-Strub et al., 2011) and (Balmford et al., The worldwide cost of marine protected areas, 2004).

Estimating the opportunity cost associated with a new MPA requires knowing how the MPA may restrict the volume and value of ecosystem services. For example, the MPA may restrict the intensity of activities such as fishing, shipping, oil, gas and mineral extraction, coastal tourism or offshore power generation. In the case of a no-take MPA, local communities and indigenous peoples who may be reliant on the area for food may face increasing food insecurity and decreased household incomes (Mann-Lang, et al., 2021). Consideration should also be given to non-monetary costs such as potential losses of traditional rights or spiritual experiences when areas are fully closed to existing users. Opportunity cost analysis should also consider the potential displacement of services to unprotected areas, as well as the likelihood of reduced supply leading to increased prices.

Valuing the benefits of MPA-related ecosystem services

The establishment of an MPA is designed to stop further degradation or improve the conditions of marine ecosystems. Marine ecosystems most often considered in such analyses include mangrove forests, coastal wetlands, kelp forests and coral reefs. Valuing the services these ecosystems provide requires two key elements:

Determine MPA-driven changes in ecosystem coverage: Here it is key to understand the size of the marine ecosystems within the proposed MPA and to model how this might change following the establishment of the MPA. These insights then have to be compared to estimates for the change in spatial extent of these marine ecosystems if no MPA were established.

Geographical coverage data for ecosystems might be provided by local or national government entities. Other sources include global geospatial data provided through institutions such as the World Resources Institute, the Nature Conservancy, the International Coral Reef Action Network and the UNEP World Conservation Monitoring Centre.

Modelling the change in spatial extent of MPA-protected marine ecosystems can be done using analysis from academic literature regarding the biophysical impact of establishing MPAs. Estimating how the spatial extent of marine ecosystems changes if no MPA is established can be done by using generic assumptions for the future loss of marine ecosystems, adjusted for risk factors that relate to the MPA area in question. These risk factors include human intervention parameters such as population density and GDP per capita, as well as infrastructure (e.g. roads and ports).

Value ecosystem services provided:

Estimating the value impact of establishing an MPA requires a comparison between the value of all ecosystem services provided by an MPA with the value of ecosystem services in case no MPA were established. This can be done in two ways:

Modelling of individual services: Although this is our preferred approach, it requires detailed volume and pricing data (using market and non-market methods) to model the provision of each individual service for a given area.

Benefit transfer modelling: If insufficient data exists to model individual services for the MPA site in question, or if a swift approach is needed, then a so-called *benefit transfer approach* may serve as a potential alternative. Benefit transfers adopt valuation estimates or functions from existing studies and apply them to the site in question.

There are two types of benefit transfers that may be adopted – value transfer and function transfer. Value transfers refer to the application of the monetary value derived from other sites to the MPA. We show examples of this for a range of ecosystem services in Figure 32.

While a value transfer approach may be relatively simple to establish, it is limited especially in addressing the differences between different sites. A function transfer may be more appropriate as this adopts the valuation equation used in the study sites rather than the valuation results. A function transfer approach calibrates the valuation function used from other research by incorporating the specific conditions of the MPA site being analysed. A benefit function approach is often used to estimate the value of a bundle of ecosystem services rather than a value for specific individual services. This may be acceptable, especially if insufficient data or insight exists to model services individually.

Valuation estimates for ecosystem services
International dollars per hectare per year, 2020 price level

Ecosystem service	Marine-based services		Ocean-based services	
	Value	Estimates	Value	Estimates
Provisioning services				
Food	244	93	319	280
Medicinal resources	999	1	NA	0
Ornamental resources	34	2	NA	0
Raw materials	2,147	6	180	135
Water	22	1	701	13
Regulating services				
Air quality regulation	NA	0	34	10
Climate regulation	51	19	156	63
Erosion prevention	399	12	1,538	21
Maintenance of genetic diversity	125	5	1,220	12
Maintenance of soil fertility	1,880	4	981	8
Moderation of extreme events	1,029	17	837	45
Regulation of water flows	NA	0	3	3
Waste treatment	1,510	14	1,047	60
Cultural services				
Aesthetic information	5,058	13	488	36
Existence, bequest values	990	152	923	23
Information for cognitive development	79	13	1,482	24
Inspiration for culture, art and design	917	1	0.1	17
Opportunities for recreation and tourism	190	336	1,049	154
Spiritual experience	38	1	2.3	2
Total	**15,711**	**690**	**10,971**	**907**

Source: Ecosystem Services Valuation Database, Brander et al (2024), Standard Chartered

Figure 32

Incorporating carbon: avoided emissions and sequestration

The establishment of an MPA may increase the amount of carbon that is sequestered relative to the base case. It may also avoid carbon from being released. The value of this needs to be incorporated when valuing an MPA. Multiplying the avoided loss of ecosystem extent through the implementation of an MPA relative to the base case with the carbon sequestration rate indicates the level of additional carbon sequestered.

The level of avoided carbon emissions can be calculated by multiplying the rate at which stored carbon is released in ecosystems with the avoided area loss of these systems.

Calculate the net present value of MPA-related net benefits

Having established the potential benefits and the implementation and operating costs associated with an MPA, the net present value of the MPA can be calculated by discounting the difference of the annual stream of future benefits and costs.

MPA costs per hectare decline rapidly as their size increases

Cost estimates for setting up and operating an MPA are not easy to find. In addition, no two MPAs are the same in terms of ecosystems, location, ecosystem service intensity etc. Research by McGowan et al., 2022, Brander et al., 2020, McCrea-Strub et al., 2011 and Balmford et al., 2004 provides some insight into the cost of establishing and operating MPAs in different areas and key drivers.

Establishment and management cost

Balmford et al. indicate that the 83 MPAs surveyed by them had median running or management costs of USD775 per km2 per year. Importantly, their work showed that the estimated total running costs for the 40 MPAs located in developing countries was more than 80 pe cent lower than those for the 43 MPAs located in developed nations. Their analysis also showed that the size of an MPA was the variable most significantly correlated with running costs. As a result, they concluded that MPA running costs per km2 would bemost greatly reduced by governments choosing to design a smaller number of large MPAs rather than a higher number of smaller ones.

McCrea-Strub et al. expanded Balmford's analysis by including the establishment costs of an MPA. Their review of 13 MPAs located in developed and emerging economies showed a very significant range of establishment cost per unit area. Most important, and similar to the work done by Balmford et al., their analysis showed that per unit area establishment costs decline as the size of an MPA grows (Figure 33). McCrea-Strub's analysis also indicates that management costs for MPAs range from USD600,000 in the case of 50km2 MPAs to USD4.8 million for those that have a size of one million km2.

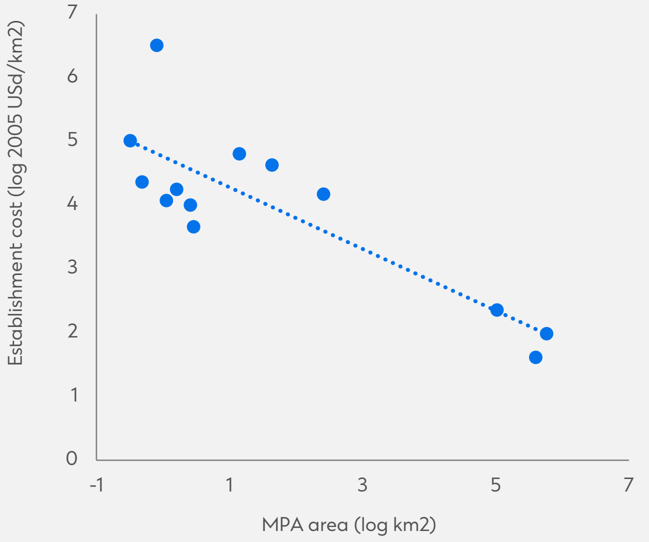
Based on McCrea-Strub et al.'s analysis, we calculated what the total cost of establishing and operating an MPA would be depending on its size. Assuming a 20-year operating period, we calculate that a 500km^2 MPA could cost USD22 million. Establishing the MPA would cost USD1.9 million, while operating such an MPA could cost USD1 million per year. While increasing the size of the MPA would increase total costs, the benefits of economies of scale are large. For example, increasing the size of an MPA 100x to 500,000km^2 would increase total costs by only 6.7x to USD149 million (Figure 34).

These calculations suggest that it makes financial sense to prioritise large MPAs over the establishment of many smaller ones. However, research has shown that the biodiversity of larger MPAs may be weaker than for smaller MPAs (Hollitzer, May, & Blowes, 2023).

One of the possible explanations for this is that enforcing regulation and compliance is more challenging for larger MPAs than for smaller ones. This suggests that for larger MPAs to offer their full benefits requires effective management and regulatory structures.

These establishment and management costs per MPA indicate that expanding the MPAs to reach the 30x30 targets is likely to give rise to substantial finance costs per nation. Estimates for this are provided by Waldron et al., Costs and economic impacts of expanding marine protected area systems to 30%, 2022. Their analysis indicates that annual management costs of a 30x30 system purely based on MPAs can reach USD7.9-14.4 billion. Up to USD4.5 billion of these costs may be faced by developing countries. Country-based cost estimates from The Nature Conservancy for MPAs suggest that for most countries, annual management costs of MPAs are likely to be in the tens of millions of dollars, although high-income countries could face substantially higher costs (McGowan et al., 2022).

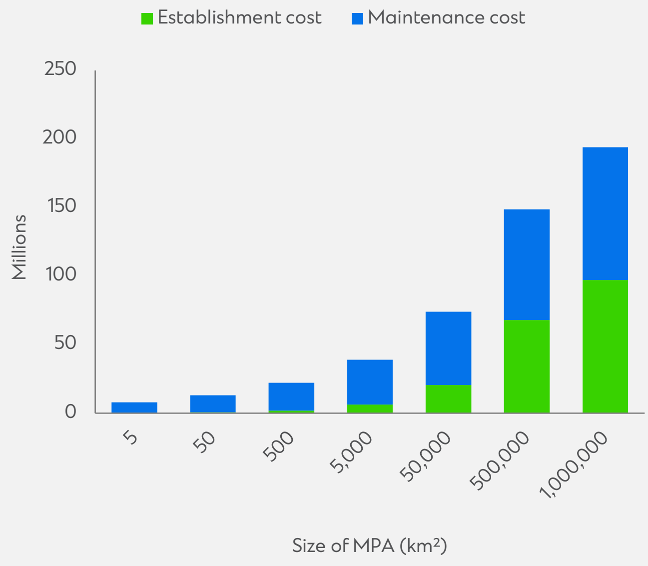
Establishment cost versus MPA size
Both axis shown in Log10



Source: McCrea-Strub et al, Standard Chartered

Figure 33

Total cost of an MPA
Assuming that the MPA is operated for 20 years (USDmn)



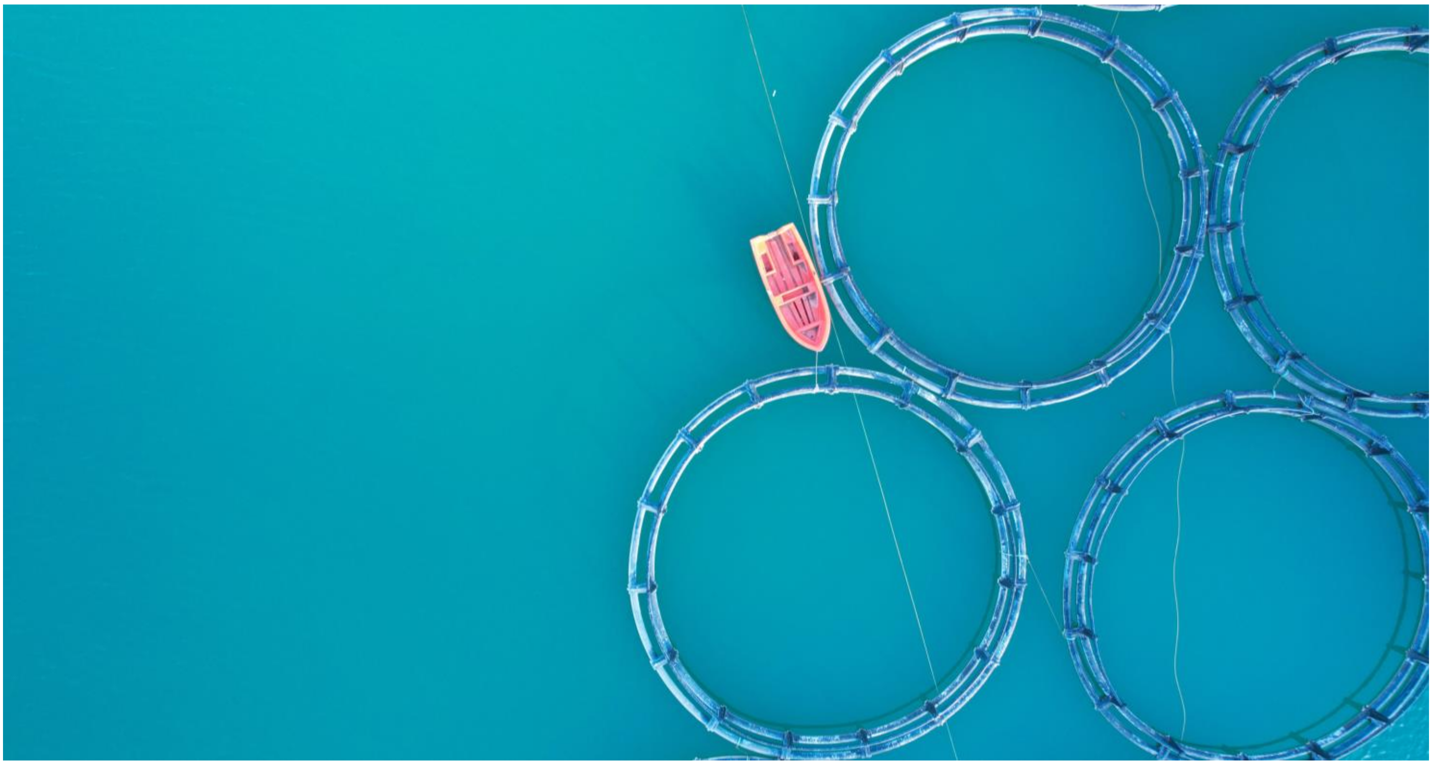
Source: McCrea-Strub, Standard Chartered

Figure 34

Opportunity costs

Our literature review shows that opportunity cost estimates most often focus just on fishing rather than on tourism, and other sectors.

Work from The Nature Conservancy suggests that highly protected MPAs can cause annual fishing-related opportunity costs to be more than USD200 million for middle-income countries. This would be significantly larger than the establishment and management costs for MPAs (McGowan et al., 2022). Fishing opportunity cost estimates (from Waldron et al., Costs and economic impacts of expanding marine protected area systems to 30%, 2022 are somewhat lower but still significant at between USD20-30 million per year per country. The net present value of global fishery-related opportunity costs is substantial at between USD257-777 billion (according to Brander et al., 2020).



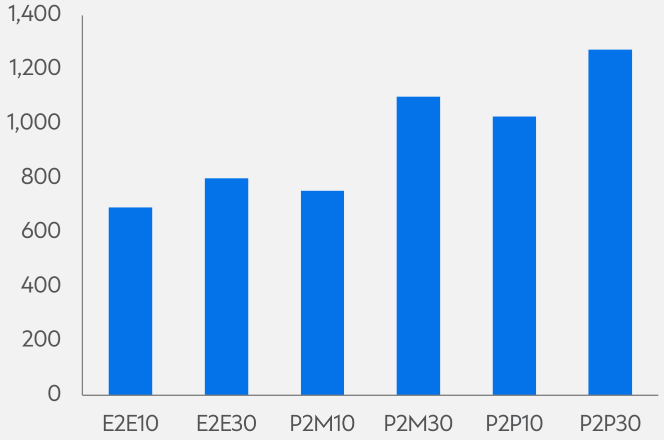
The total value of MPAs globally may reach USD1.5 trillion

Although the costs of establishing and managing MPAs may be significant, various sources suggest that this may well be offset by the potential revenue benefits from improved ecosystem services. Various studies highlight benefits associated with MPAs. Fishery-related benefits include increased catch, increased fish body size and spillover of larvae and adult fish to non-MPA sites. Economic benefits from MPA creation highlighted in studies include job creation (30-50 jobs per MPA), increased tourism revenues and greater spending in local MPA economies more broadly (Costello, 2023).

On a global scale, the benefits from improved coral and mangrove conditions can reach between USD692-1,274 billion according to research from Brander et al., 2020. (Figure 35). Furthermore, ocean-related tourism revenues may well reach USD197 billion per year, which would significantly offset the direct and opportunity costs associated with MPAs (Waldron et al., 2020). The total value of MPAs globally may therefore reach almost USD1.5 trillion.

Globally Brander et al. find that the net benefits of developing MPAs are between 50-170 per cent higher than the costs associated with establishing and operating MPAs (Figure 36). Their work also suggests that the benefits of establishing MPAs continue to outweigh the associated costs even with discount rates of up to ten per cent.

Total benefits for different MPA scenarios
USDbn, E2E "Easy to expand", P2M "Protect to mitigate" P2P "Protect to Preserve"



Source: Brander et al (2020), Standard Chartered

Figure 35

Benefit-cost ratio for different MPA scenarios
(x) E2E "Easy to expand", P2M "Protect to mitigate" P2P "Protect to Preserve"

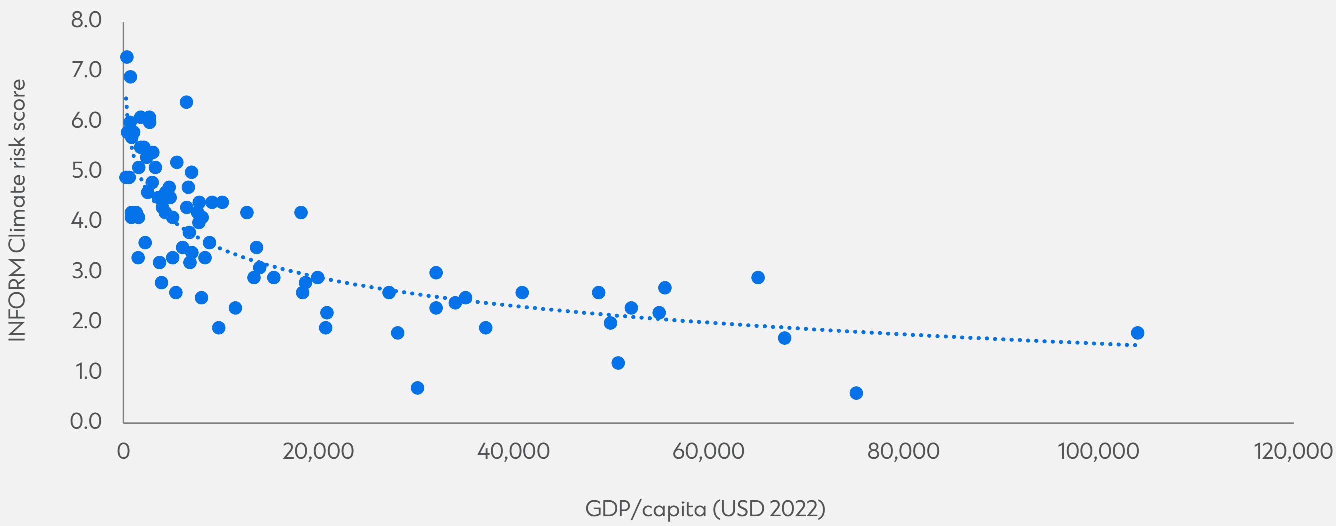
Source: Brander et al (2020), Standard Chartered

Figure 36

MPAs may help improve a country's credit rating

Calculations from the IMF suggest that countries with low per-capita wealth levels face greater risks from climate change than advanced economies (Figure 37). Countries with greater ecosystem vulnerability also tend to have less developed adaptation or mitigation strategies to help deal with potential climate impacts (Figure 38).

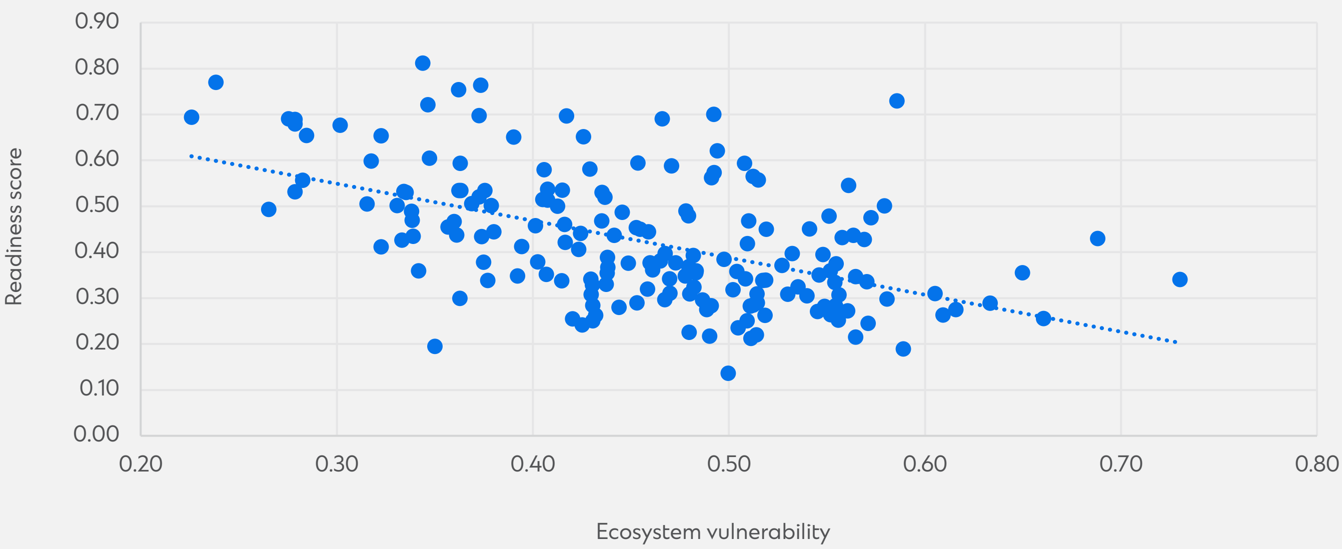
Low-income countries tend to face greater risk from climate change 2022



Source: IMF, Standard Chartered Bank

Figure 37

Countries with greater ecosystem vulnerability tend to have less developed adaptation strategies 2022



University of Notre Dame, Standard Chartered Bank

Figure 38

Generating sufficient capital to help fund adaptation and mitigation strategies can be a challenge for emerging markets across Asia, Africa, and the Middle East, especially those with stretched macroeconomic conditions or low credit ratings. One way to alleviate some of these challenges is for countries to value their natural assets and incorporate these into their macroeconomic and budgetary planning processes.

Markets with vulnerable ocean ecosystems could establish a thorough marine spatial planning process and create properly managed marine protected areas given that MPAs support adaptation strategies and create economic value. Funding the development and management of these MPAs could therefore be achieved by using their potential value to help access the growing sustainable debt market. For example, governments could use MPAs to issue green or blue bonds or loans.

Identifying countries that may benefit from valuing MPAs

Using data from the University of Notre Dame, this report identifies ocean-exposed markets that have above-average ecosystem vulnerability and below-average ability to leverage investments and convert these to adaptation actions.

Across Africa, Asia, the Caribbean and Latin America and Oceania, there are 44 markets that meet these criteria. Of these, 25 (or almost 60 per cent) are in Africa (Figures 39 and 40). Current long-term foreign currency debt ratings from rating agencies S&P and Moody's suggests that access to external funding is likely to be challenging for most of these countries as only three have a BBB rating. All the others either have a low or no credit rating, or are in a state of sovereign default.

Countries with marine areas that have above-average ecosystem vulnerability and below-average readiness
Africa, ranked by size of marine area

Ecosystem service	Ecosystem vulnerability	Readiness	Marine area (000km^2)	S&P debt rating	Moody's debt rating	Public debt (% of GDP)
Africa						
South Africa	0.48	0.35	1548	BB-	Ba2	71
Madagascar	0.61	0.26	1514	B-	NR	54
Mozambique	0.52	0.26	566	CCC+	Caa2	100
Namibia	0.46	0.38	562	NR	B1	70
Yemen	0.57	0.24	527	NR	NR	66
Angola	0.55	0.27	496	B-	B3	56
Libya	0.55	0.28	365	NR	NR	na
Liberia	0.55	0.28	252	NR	NR	54
Tanzania	0.53	0.31	242	NR	B1u	45
Ghana	0.48	0.35	228	SD	Caa2	93
Mauritania	0.48	0.36	173	NR	NR	50
Côte d'Ivoire	0.50	0.32	172	BB	Ba2	57
Sao Tome and Principe	0.53	0.37	165	NR	NR	na
Comores	0.49	0.28	164	NR	NR	28
Kenya	0.47	0.31	164	B-	Caa1	68
Sierra Leone	0.58	0.30	161	NR	NR	54
Guinea-Bissau	0.62	0.27	107	NR	NR	81
Guinea	0.48	0.31	102	NR	NR	40
Sudan	0.66	0.26	83	NR	NR	187
Eritrea	0.56	0.21	78	NR	NR	na
Benin	0.52	0.34	35	BB-	B1	54
Republic of the Congo	0.50	0.24	34	NR	NR	92
The Gambia	0.48	0.32	23	NR	NR	83
Togo	0.50	0.36	15	B	NR	67
Djibouti	0.54	0.32	7	NR	NR	37

Source: Notre Dame University, MPA, Bloomberg, World Bank, Standard Chartered. NR = Not Rated, na = not available

Figure 39

Countries with marine areas that have above-average ecosystem vulnerability and below-average readiness
Asia, Caribbean and Latin America and Oceania, ranked per region by size of marine area

Ecosystem service	Ecosystem vulnerability	Readiness	Marine area (000km²)	S&P debt rating	Moody's debt rating	Public debt (% of GDP)
Asia						
Indonesia	0.47	0.40	6,021	BBB	Baa2	**74**
India	0.55	0.39	2,324	BBB-u	Baa3	**82**
Myanmar	0.56	0.25	497	NR	NR	**62**
Pakistan	0.56	0.31	224	CCC+	Caa2	**76**
Bangladesh	0.49	0.27	112	B+	B2	**38**
Caribbean and Latin America						
Mexico	0.46	0.36	3187	BBB	Baa2	**54**
Ecuador	0.56	0.35	1078	B-	Caa3	**na**
Colombia	0.46	0.38	744	BB+	Baa2	**60**
Cuba	0.55	0.35	352	NR	NR	**na**
Nicaragua	0.56	0.27	214	B+	B2	**65**
Honduras	0.55	0.26	211	NR	NR	**53**
Barbados	0.51	0.59	185	B	B3	**116**
Guyana	0.51	0.34	139	NR	NR	**27**
Haiti	0.49	0.22	117	NR	NR	**30**
Guatemala	0.61	0.31	111	NR	NR	**29**
Belize	0.57	0.34	34	B-	Caa1	**67**
Oceania						
Papua New Guinea	0.63	0.29	2403	B-	B2	**48**
Solomon Islands	0.53	0.40	1605	NR	NR	**16**
Vanuatu	**0.50**	**0.38**	**811**	**NR**	**NR**	**44**

Source: Notre Dame University, MPA, Bloomberg, World Bank, Standard Chartered. NR = Not Rated, na = not available

Figure 40

Cost and benefit estimates for countries with MPA potential

Developing marine protected areas may be one way for the countries highlighted in Figures 37 and 38 to help mitigate and adapt to the impacts of climate change. The sustainable ecosystem services that these MPAs provide can strengthen local, coastal economies, while the value of these MPAs might be used to help support financing strategies for their establishment and maintenance. For each of the countries highlighted above, we have estimated what the potential financial benefits of an aggressive MPA development strategy might be.

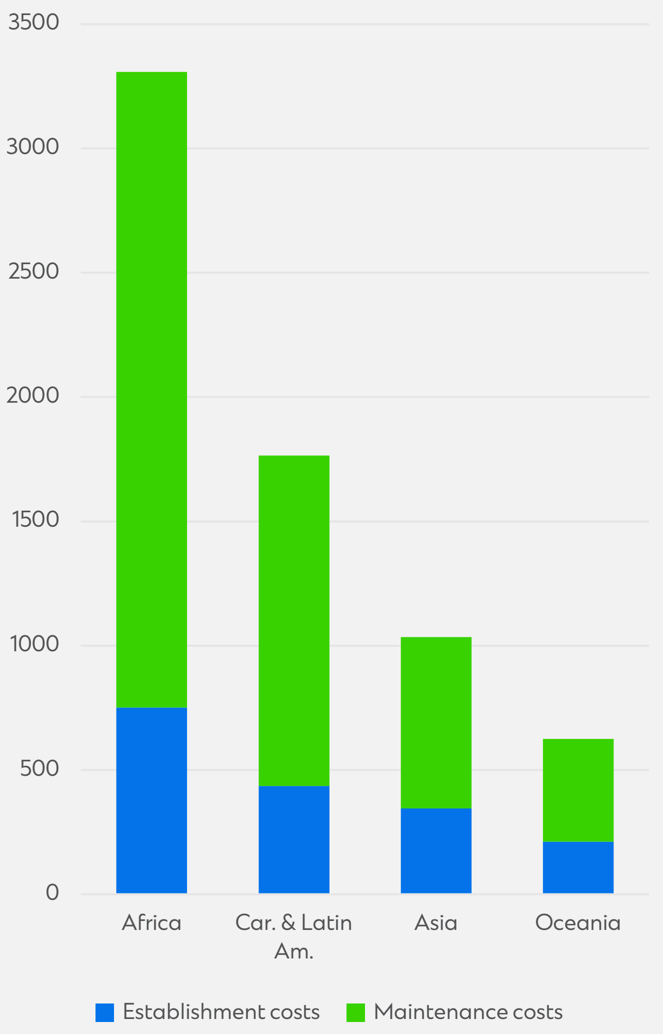
Establishing and managing MPAs may cost USD6.7 billion

To estimate the total costs associated with establishing and maintaining MPAs, we assume that every country will protect 30 per cent of its Exclusive Economic Zone (EEZ) through the use of MPAs. This provides us with the total maximum area that is available per country for MPA creation. We use data from McCrea-Strub et al. to estimate the potential costs associated with establishing and maintaining the MPAs across the 44 highlighted countries.

For the 25 African countries we calculate that turning 30 per cent of their EEZ into MPAs might cost USD3.3 billion. This consists of USD750 million in establishment costs and almost USD2.6 billion in total maintenance costs using a 25-year lifespan for the MPAs (Figure 41). We estimate that total MPA costs across all four regions is USD6.7 billion.

On an individual country level, we find that MPA-related costs are potentially highest for Indonesia at over USD400 million. For 20 countries we estimate that to convert 30 per cent of their EEZ into MPAs and manage these may cost each of them more than USD150 million (Figure 42).

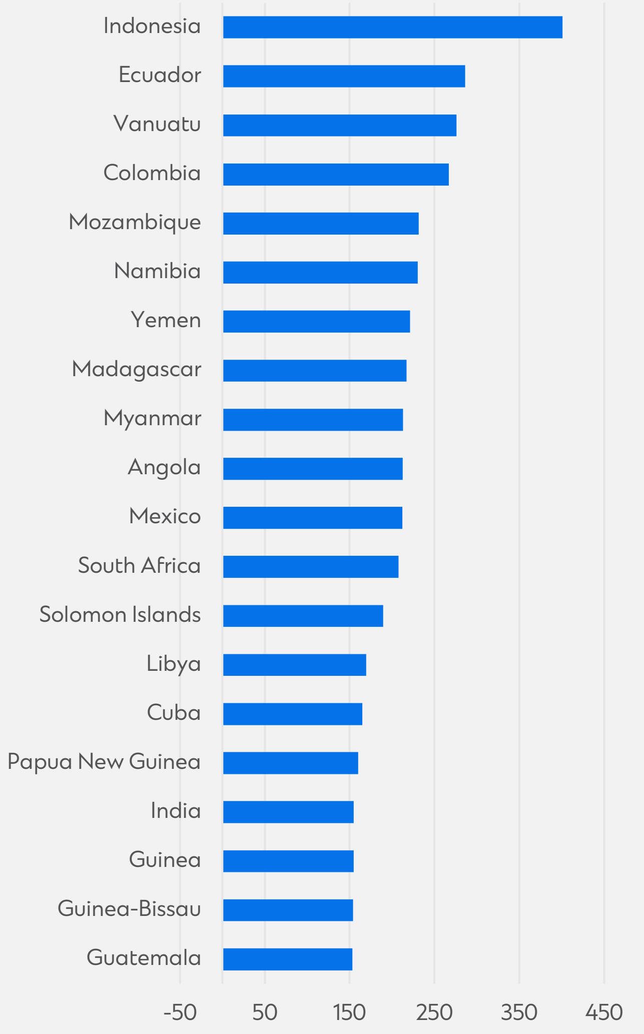
Potential costs associated with MPAs
USDm, assuming a 25-year operating period



Source: McCrea-Strub et al, Standard Chartered

Figure 41

Countries with the highest MPA costs
USDm, assuming a 25-year operating period



Source: McCrea-Strub et al, Standard Chartered

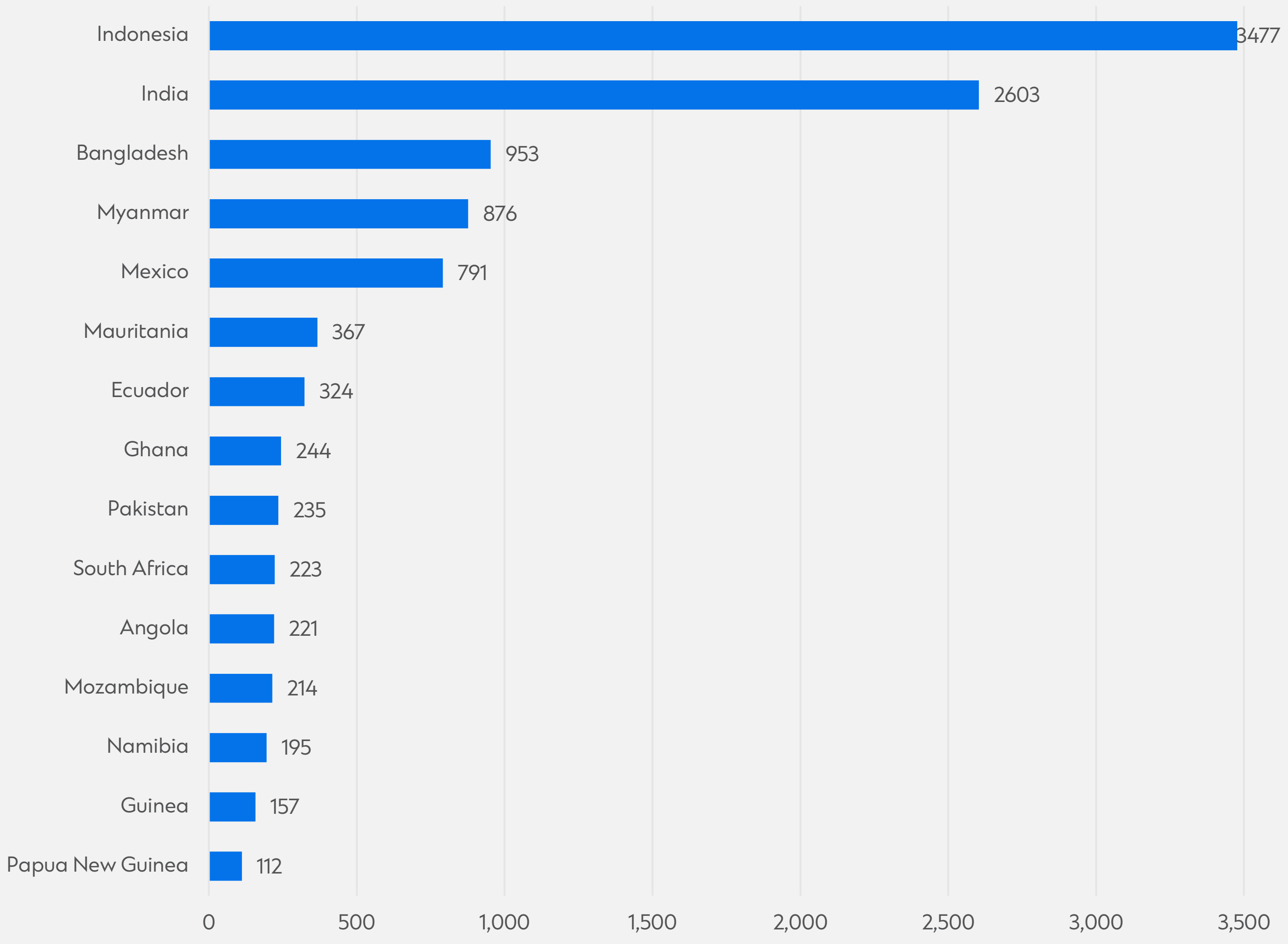
Figure 42

Fishing-related opportunity costs may reach USD11.9 billion per year

In addition to establishment and maintenance costs, creating MPAs also generates opportunity costs. These are typically incurred by other industries and communities and reflect the value or cost associated with activities that are restricted due to the establishment of an MPA. In the literature, opportunity cost estimates associated with MPAs typically focus on commercial fisheries. A general lack of data is often cited as the reason why opportunity costs associated with other activities such as tourism are excluded.

For this opportunity cost calculation, it is assumed that if a country converts 30 per cent of its EEZ into MPAs, it may see a reduction in its wild catch of 30 per cent. This would be an aggressive assumption given that it suggests that no wild fishing is allowed at all in the MPAs. We have used fish catch data by country from the FAO and the FAO's data on the value of wild catch for 2022 to estimate what the opportunity cost for each of the countries highlighted in Figure 42 would be. Our estimates suggest that the annual opportunity cost across all countries would be USD11.9 billion. Countries that would see the highest opportunity cost would be Indonesia (USD3.5 billion) and India (USD2.6 billion) as shown in Figure 43.

Fishing-related opportunity costs by country
USDmln



Source: FAO, Standard Chartered

Figure 43

Developing MPAs may create USD85 billion in value

This report shows that estimating the potential value of an MPA requires insight into the details of the relevant services (included in Figure 15) that are provided by marine ecosystems for a given country. For the purpose of this report, access to sufficient data for making such a calculation has been limited. Instead, we have used calculations from Brander et al., 2020, for the benefits associated with MPAs.

Brander's analysis provides a benefit-to-cost ratio for different MPA strategies. Their central scenario includes opportunity costs that are on average 9x the costs of establishing and maintaining MPAs. Our opportunity cost calculations on the other hand are typically less than 1x, suggesting that we assume lower opportunity costs than Brander et al. To estimate the potential benefit of establishing MPAs for our group of countries, we use the average benefit-to-cost ratio of 4.6 for the low-cost scenario as highlighted in Brander et al., 2020.

Based on our cost assumptions for each of the countries shown in Figure 43 and using a benefit-to-cost ratio of 4.6, we calculate that the total benefit of converting 30 per cent of the EEZ for these countries may yield a net benefit of USD85bn. Asia accounts for USD42 billion of this, driven by Indonesia and India, while the African countries account for USD25 billion. We show the 15 countries with the largest total benefit in Figure 44.

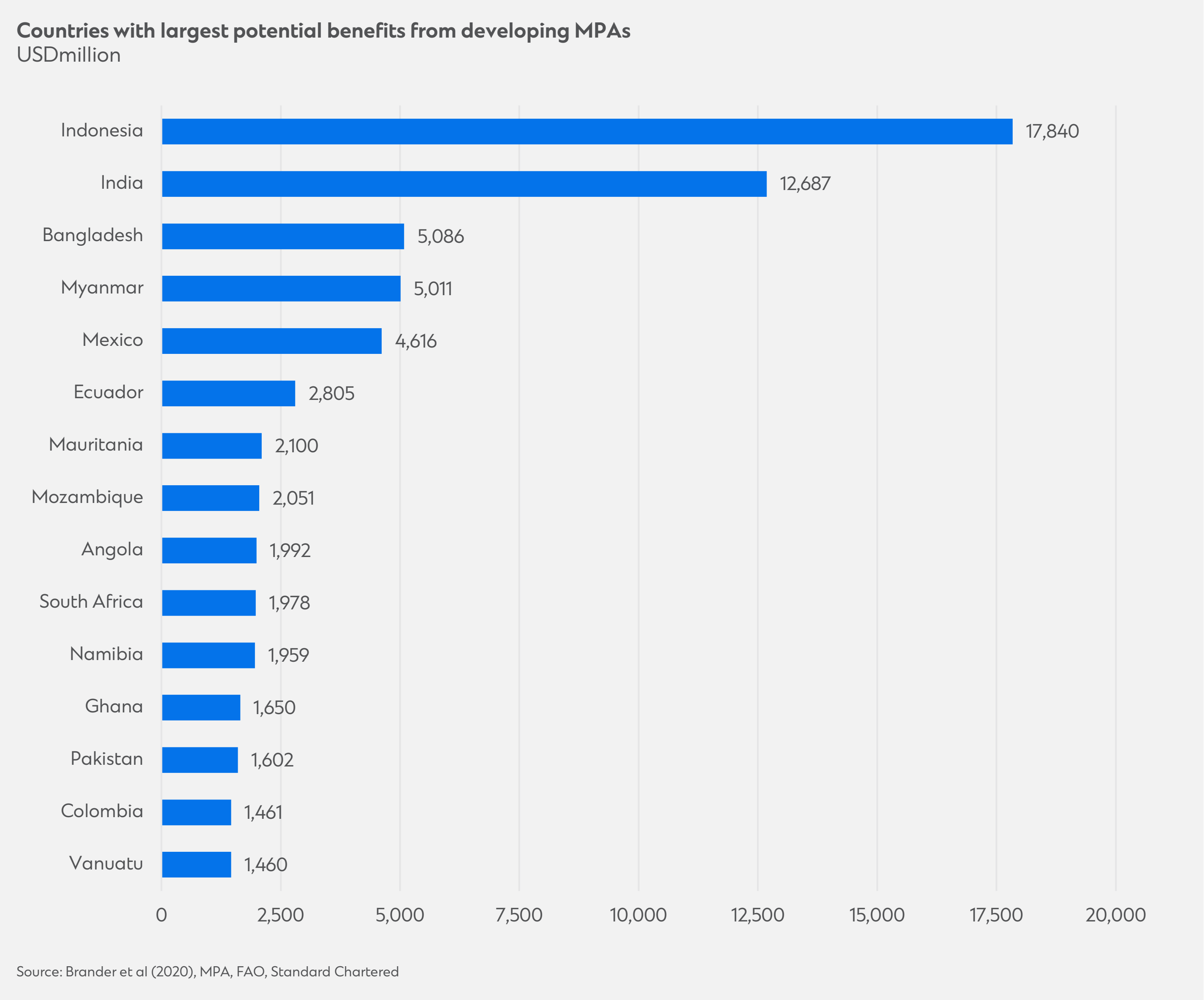


Figure 44

We note that these calculations only provide a rough estimate for the potential value of developing MPAs at scale due to the lack of country-specific data that covers all relevant cost and revenue-related drivers. A more detailed assessment of MPAs by country could well result in a higher valuation of MPAs for the countries shown in Figure 44. The key reason for this is that such an assessment would allow for the more difficult-to-value regulating and cultural services to be included too. The value of these services is often seen as higher than for the more often included provisioning services.

Conclusion

Our report concludes that emerging and fast growing economieswith ocean exposure across Asia, Africa and the Middle East stand to benefit from incorporating the contribution and value of their natural assets. This, in our view, assists economic planning, developing adaptation and mitigation strategies, and achieving improved social conditions.

The investment requirements associated with creating a more sustainable blue economy are significant, and funding these can be challenging, especially in markets that have below-average credit ratings or weaker macroeconomic conditions. In such markets, we argue that developing and effectively managing marine protected areas might just be one strategy worth pursuing. The potential value that could be created could not only improve environmental and social conditions, but also help improve their credit ratings.

04

Appendix

Eugène Klerk

Head of Sustainability Insights
Standard Chartered

eugene.klerk@sc.com

Eugène Klerk is the Head of Sustainability Insights at Standard Chartered. In this role, Eugène is responsible for generating and coordinating Standard Chartered's sustainability-related content.

Prior to his current role, Eugène was the Global Head of ESG Research at Standard Chartered. In this role, he was responsible for developing ESG related investment and trading strategies across the major asset classes. Eugène joined Standard Chartered from Credit Suisse, where for 10 years he was responsible for sustainable thematic and ESG research and managed the Global ESG research team. In addition Eugène was the head of the Sustainability pillar of the Credit Suisse Research Institute.

Eugène started his career in the mid 90s as an emerging markets fixed income and equity analyst. During this time, he was responsible for the EMEA Research team at Credit Suisse First Boston and he achieved multiple top 3 rankings in major surveys.

Eugène holds a Master's degree in applied mathematics.

Belle Mei Yi Tan

Nature Finance
Standard Chartered

bellemeiyi.tan@sc.com@sc.com

Belle Tan is part of the Nature Finance Hub at Standard Chartered. In this role, Belle supports research and analysis on the Hub's engagements, contributing to Standard Chartered's ambitions to mobilise finance for nature, in line with the Global Biodiversity Framework's mission to halt and reverse nature loss.

To promote the advancement of the nature finance ecosystem, Belle has contributed to several of the firm's thought leadership papers. Prior to joining Standard Chartered, Belle studied Environmental Science and Public Policy at the Nanyang Technological University of Singapore.

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