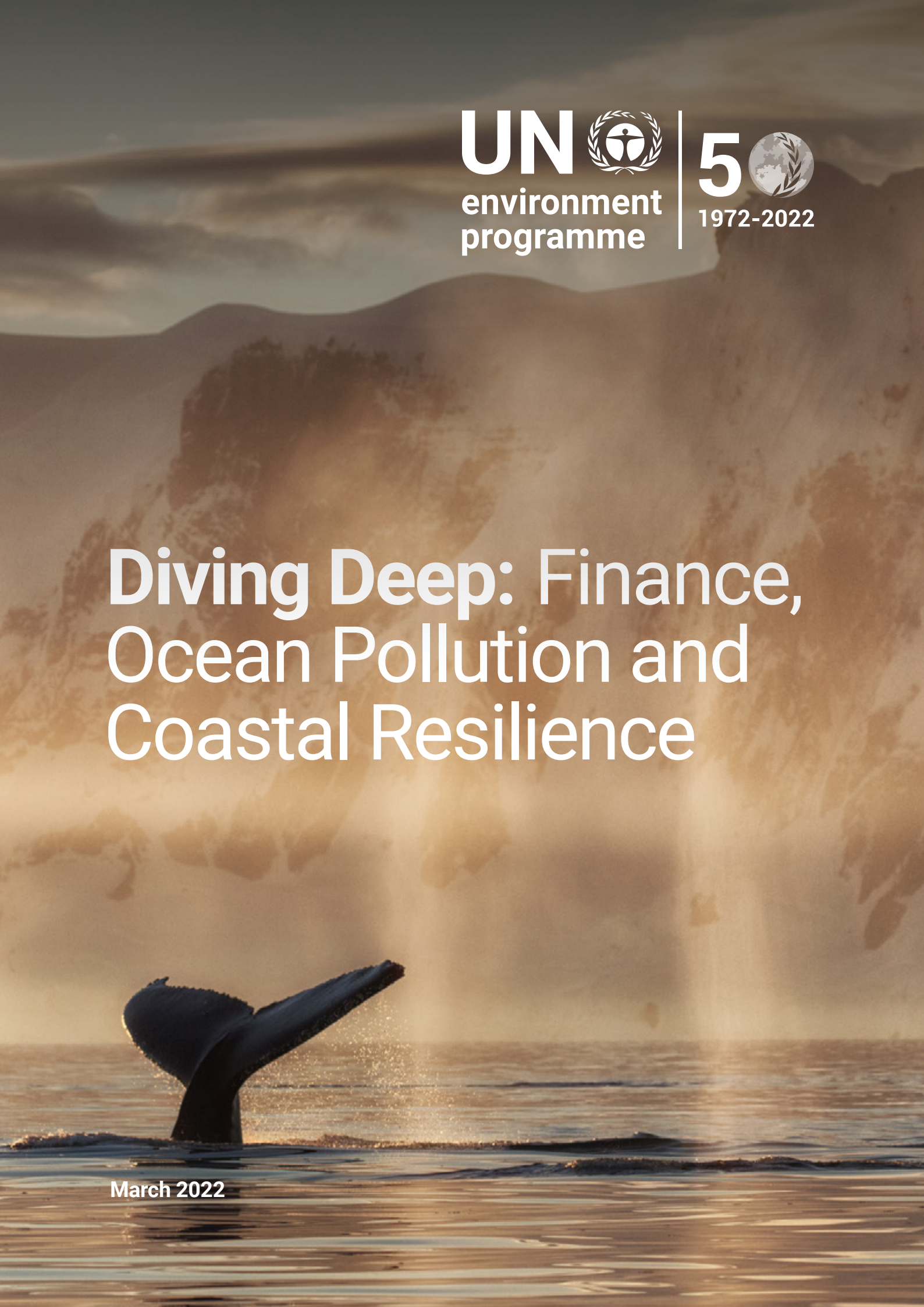

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Cover Image:

Antarctica | Photo by Cristina Mittermeier cristinamittermeier.com
The ebb and flow of sea ice, the heartbeat of our planet, regulates our global climate and fuels the constant cycle of currents across the world. As ice forms, most of the salt filters out until the water beneath the ice grows dense and cold enough to sink. It travels along the bottom of the ocean towards the equator while surface water travels from the equator to the poles, a process referred to as the global "conveyor belt".

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Foreword

Turn the Tide: How to use storytelling to shift financial priorities towards solutions to climate change.

To roam the last pristine corners of Earth where wild creatures still thrive is a privilege reserved for a lucky few: scientists, adventurers, explorers and, of course, photographers. I am one of those people, and I understand that although most people on this planet may never feel the kiss of Arctic air upon their cheeks, be dazzled by the aurora borealis shimmering across the sky or hear the blow of humpback whales in the distant seas, through images and stories we can all feel connected to the operating system of our planet: our natural capital.

From economies to ecosystems and from industry to biodiversity, we are all connected. I invite you to consider a new vision for our world—one where all stakeholders across society will come together to hold wild species and places sacred—to keep them untouched so they can remain wild and perform the functions necessary for life to exist. From the absorption of carbon dioxide and the creation of oxygen to the buffering of threats, like climate change and disease, these wild places in the ocean and on land will be critical to sustain all life on Earth. They will act as our carbon bank; one kept safely stored in living ecosystems and the creatures that inhabit them instead of being cashed out to satisfy the greed of a few.

As photographers, we strive to create visual stories, a celebration of nature presented as a humble tribute to the creatures that serve as our inspiration. Storytelling is important because the journey to bring our planet back to a state of “carbon balance” has been fraught with denialism and apathy. We need a hopeful and inspiring change in narrative, one that creates a paradigm shift full of excitement and possibility to encourage people worldwide to safeguard, rebuild and replenish one of our most valuable assets—the ocean.

COP 26 has served to swell momentum on the critical topic of climate change, with new commitments to a carbon-neutral world being announced daily, and the dream of renewable energy for all emerging as a reality. As we move in this direction, we must not forget that the ocean, our largest and most important ecosystem, provides at least one-quarter of the solution to decarbonization. However, pollution, habitat destruction, warming, acidification, and over-exploitation of the marine resources are causing a palpable decline in the ocean’s health. It is critical here and now that financial influences are directed towards the sustainability of the blue economy.

Just ten years ago, the idea of building blue economies was a far-fetched concept that no one was taking seriously. Today, it is estimated to stand at a global gross value-added of USD 1.5 trillion, a figure expected to double by 2030, making it a catalyst for why the global goal of achieving 30% ocean protection by 2030 is gaining traction. Financial institutions provide the financing, investment and insurance required to power ocean-related sectors, which means that the financial decisions made today affect the lives and livelihoods of future generations.

The Sustainable Blue Economy Finance Principles and their accompanying guidance documents such as this one provide a robust, resourceful and accessible approach for financial institutions to ensure they immediately scale up their positive impacts on the worlds' ocean-related industries and decrease negative impacts. To assist in these goals, I have contributed my photographs to this guidance, hoping that the stories told inspire all readers to remember that with 70% of its surface covered in water, the planet we need to protect is 'Ocean,' not 'Earth'.

The work of the nature photographer is to tell stories that build empathy, and we do so with the hope of creating a greater awareness of the responsibility of what it means to be a human. My photographs illustrate that the history of every living creature that has ever existed on this planet also lives within us. Embracing our responsibility to be honest stewards of our planet's limited resources is within our reach. They serve as an urgent reminder that we are inextricably linked to all other species on this planet and that we have the duty to act as the keepers of our fellow life forms. As photographers, the imperative to share our passion with others comes with an urgency to ensure that all wild creatures and all pristine places where we photograph have a place to be wild.

It is time for a cultural shift in our relationship with nature in our everyday lives: in our financial decisions, our policy actions, in the media, education, and all aspects of society. As photographers, if our stories and images can turn the world's newfound ambition into real commitment and action, we have every reason to be hopeful.

Cristina

Cristina Mittermeier
Cofounder and President of SeaLegacy and Only One

Madagascar | Photo by Cristina Mittermeier cristinamittermeier.com
Nature fills our hearts with awe as it showcases its might in both subtle and spectacular ways. A primordial engine, always stunning, always humbling, nature transforms the land, shapes the course of rivers, births entire mountains, and creates new life. Both this Vezo fisherwoman and I were captivated by the steely gray clouds of an approaching storm that rumbled over the coastline with menacing thunder.

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List of abbreviations and acronyms

AUM	Assets under management
BRI	Belt and Road Initiative
CAPEX	Capital expenditure
CGFI	UK Centre for Greening Finance
CTI	Climate Transition Index
DFC	United States International Development Finance Corporation
DPSIR	Driver, Pressure, State, Impact, Response
DRR	Disaster risk reduction
DRS	Deposit return systems
EEA	European Environment Agency
EEZ	Exclusive economic zone
EPR	Extended producer responsibility
ESG	Environmental, social and governance
ETP	Endangered, threatened and/or protected
EU	European Union
FI	Financial institution
FMCG	Fast-moving consumer goods
GDP	Gross domestic product
GHG	Greenhouse gas
GRI	Global Resilience Index
IFI	International financial institution
IPCC	Intergovernmental Panel on Climate Change
IRS	Informal recycling sector
ISIC	International Standard of Industrial Classification
IUCN	International Union for the Conservation of Nature
LMIC	Lower- and middle-income country
MSW	Municipal solid waste
MSWM	Municipal solid waste management
MUP	Multiple-use plastic
NbS	Nature-based Solutions
NDCs	Nationally Determined Contributions
NGO	Non-governmental organization
O&M	Operating and maintenance
ODA	Official Development Assistance
OECD	Organisation for Economic Co-operation and Development
OPEX	Operating expenditure
PPP	Public-private partnerships
PRB	Principles for Responsible Banking
PRI	Principles for Responsible Investment
PR	Producer responsibility
PS	Product stewardship
PSI	Principles for Sustainable Insurance
RISCO	Restoration Insurance Service Company
SBE	Sustainable Blue Economy
SBEFP	Sustainable Blue Economy Finance Principles
SDGs	UN Sustainable Development Goals
SOE	State-owned enterprise
SUP	Single-use plastic
SWM	Solid waste management
TNC	The Nature Conservancy
UNEP	UN Environment Programme
UNEP FI	UN Environment Programme Finance Initiative
UNFCCC	UN Framework Convention on Climate Change
WaRM	Waste and resources management
WWSID	Wasteaware World Survey of Investment Demand
WWF	World Wide Fund for Nature

Executive summary

The ocean covers the majority of our planet's surface, holding 97% of all our water and 80% of all life forms. Major ocean sectors such as waste management and coastal infrastructure collectively contribute to a 'blue' economy, estimated by the Organisation for Economic Co-operation and Development (OECD) at a global gross value added of USD 1.5trn in 2010. This blue economy has been projected to increase to USD 3trn by 2030, with some ocean industries set to grow faster than the global economy.

However, ocean health is under threat, faced with the triple crises of climate change, nature loss, and pollution, leaving industries, businesses and livelihoods exposed. With existing financing still largely directed towards unsustainable sectors and activities, it is becoming critical that ocean-linked sectors are rapidly transitioned towards sustainable pathways.

Banks, insurers and investors have a key role to play in financing the transition to a sustainable blue economy, helping to rebuild ocean prosperity and restore biodiversity to the ocean. Through their lending, underwriting and investment activities, as well as their client relationships, financial institutions have a major impact on ocean health and hold the power to accelerate and mainstream the sustainable transition of ocean-linked industries.

This follow-on guidance to Turning the Tide, released in early 2021, is a practical toolkit for financial institutions to pivot their activities towards financing a sustainable blue economy. It highlights how to avoid and mitigate environmental and social risks and impacts, and make the most of opportunities, when providing capital to companies or projects within the blue economy.

Two further key ocean sectors have been chosen for their established connection with the finance industry, with easy-to-follow guidance on how to approach financial activity related to:

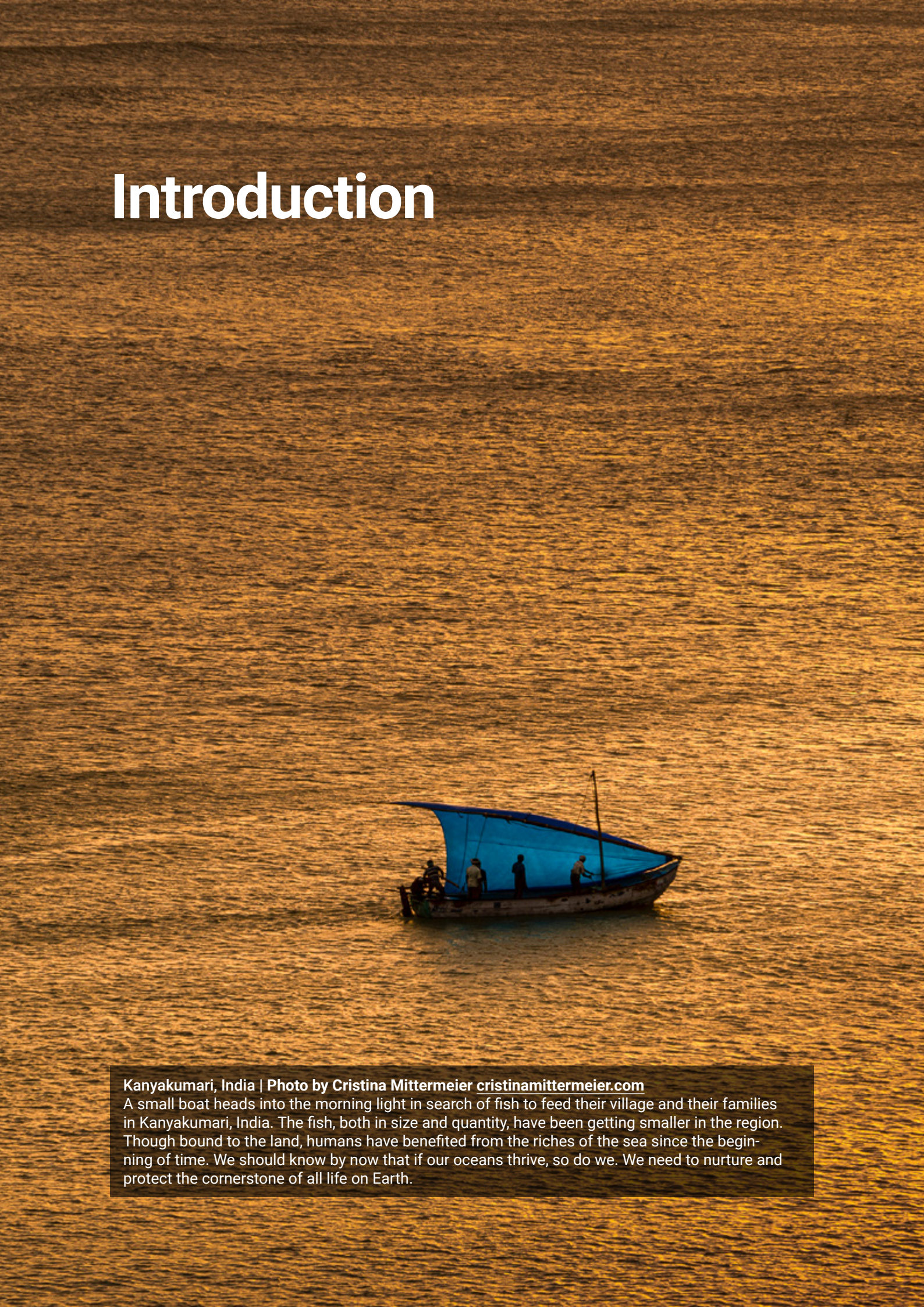
- Coastal infrastructure and resilience;
- Waste prevention and management.

The guidance provides a detailed breakdown of which activities to **seek out** as best-practices, which activities to **challenge**, and which activities to **avoid** financing completely due to their damaging nature.

It builds on the foundation of the Sustainable Blue Economy Finance Principles, a keystone for financing activities in the blue economy. Wide use of these principles will ensure ocean finance is delivered with sustainability at its core, so that profitability goes together with environmental and social stewardship.

The guidance is complementary to existing frameworks and literature, including UNEP FI's Principles for Responsible Banking (PRB) and Principles for Sustainable Insurance (PSI), as well as the Principles for Responsible Investment (PRI). It can be read in conjunction with its sister-publication *The Rising Tide: Mapping Ocean Finance for a New Decade* which explores current trends, frameworks and financial instruments that are successfully addressing ocean sustainability, highlighting new opportunities and gaps in the market.

Introduction



Kanyakumari, India | Photo by Cristina Mittermeier cristinamittermeier.com
A small boat heads into the morning light in search of fish to feed their village and their families in Kanyakumari, India. The fish, both in size and quantity, have been getting smaller in the region. Though bound to the land, humans have benefited from the riches of the sea since the beginning of time. We should know by now that if our oceans thrive, so do we. We need to nurture and protect the cornerstone of all life on Earth.

Context

It is well established that the ocean is a vital driver of planetary systems, a source of economic activity, livelihoods and food security. The Intergovernmental Panel on Climate Change (IPCC)'s 2019 special report on the ocean and cryosphere in a changing climate states:

> **"In addition to their role within the climate system, such as the uptake and redistribution of natural and anthropogenic carbon dioxide (CO2) and heat, as well as ecosystem support, services provided to people by the ocean and/or cryosphere include food and water supply, renewable energy, and benefits for health and well-being, cultural values, tourism, trade, and transport. The state of the ocean and cryosphere interacts with each aspect of sustainability reflected in the United Nations Sustainable Development Goals"**
>
> IPCC 2019

At the same time, the health of the global ocean is under threat from human activity, affecting climate change, pollution and nature loss, with existing financing being largely directed towards unsustainable sectors and activities. Finance for a sustainable ocean remains limited, with SDG 14 (Life Below Water) receiving the least Official Development Assistance (ODA) out of all the SDGs in 2017 (Pincet *et al.* 2019). Nevertheless, awareness of the key services and provisions provided by the ocean is increasing, as well as the recognition that continued ocean health decline inhibits prosperity (Laffoley *et al.* 2019).

In an effort to address this challenge, there have been several important developments in recent years, notably the creation of the Sustainable Blue Economy Finance Principles (SBEFP, 'The Principles'), which set out to define what financing[1] a healthy and resilient ocean looks like. These principles are the world's first global guiding framework for banks, insurers and investors to finance a sustainable blue economy (SBE). They promote the implementation of SDG 14 and set out ocean-specific guiding principles that support the financial industry to mainstream sustainability of ocean-based sectors. The Principles were developed by the European Commission, World Wide Fund for Nature (WWF), the World Resources Institute and the European Investment Bank.

To build on the momentum of the Principles and help translate ambition into action, the Sustainable Blue Economy Finance Initiative was launched at the Regional Roundtables on Sustainable Finance in Luxembourg in 2019. The UN Environment Programme Finance Initiative (UNEP FI) hosts the new platform bringing together financial institu-

1 Defined here and throughout this paper as capital deployed towards the sustainable blue economy, be it from investment, insurance or other financial services provided by banks, investors or insurance firms.

tions[2] (FIs) to work with scientists, corporates and civil society. The aim is to facilitate the adoption and implementation of the Principles, ensuring they become operational and useful for financial institutions worldwide. The initiative seeks to:

- Positively influence mainstream ocean-related investment, insurance and lending to drive development that underpins a sustainable blue economy;
- Catalyse finance sector engagement and practical action to adopt and implement the Principles to deliver a sustainable blue economy and support the ambitions of SDG 14;
- Develop concrete actions and outputs for insurers, lenders and investors to align lending, insurance and investment decisions with ocean health.

Box 1: What is the sustainable blue economy?

The Sustainable Blue Economy Finance Principles define a sustainable blue economy as one that "provides social and economic benefits for current and future generations; restores, protects and maintains diverse, productive and resilient ecosystems; and is based on clean technologies, renewable energy and circular material flows". It is an economy based on circularity, collaboration, resilience, opportunity and interdependence. Its growth is driven by investments that reduce carbon emissions and pollution, enhance energy efficiency, harness the power of natural capital and the benefits that these ecosystems provide, alongside halting the loss of biodiversity. Unsustainable economic activity in the context of marine and coastal environments is here referred to by contrast as the blue economy.

By this definition, and for the purposes of this document, the sustainable blue economy is a goal for the wider blue economy, and therefore excludes non-renewable extractive industries (e.g. offshore oil and gas, and deep-sea mining) as well as unsustainable practices in other sectors.

About this resource

The Principles provide a framework to inform financial decisions relating to the sustainable blue economy. If widely adopted, the Principles can help to transform how the ocean's assets are used and managed to secure healthy and resilient ecosystems, assuring future environmental, social and economic resilience while advancing nature-based solutions. However, it is critical that further sector-specific guidance, tools and metrics are provided to give financial institutions the resources they need to adopt and implement the Principles and have tangible positive impacts on the transition to a sustainable blue economy and ocean health.

2 A financial institution (FI) is a company engaged in the business of dealing with financial and monetary transactions such as deposits, loans, investments and currency exchange. In the context of this work, this includes banks, investors and insurers.

Box 2: What do we mean by finance for the sustainable blue economy?

Financial institutions can play a pivotal role in developing a sustainable blue economy, so it is important that the meaning of finance for the sustainable blue economy is clearly defined. This guidance defines it as "financial activity (including investment, insurance, banking and supporting intermediary activities) in, or in support of, the development of a sustainable blue economy, most notably through the application of the Sustainable Blue Economy Finance Principles in financial decision-making, Environmental, Social and Governance (ESG) frameworks, and reporting."

As such, it covers both finance being deployed directly to invest in SBE projects (e.g. into specific projects) as well as financial activity/capital being deployed to support the development of the SBE more broadly (e.g. activity by financial institutions to de-risk, promote or further mainstream investment into the SBE).

Whether or not finance is sustainable depends on the activities and decisions made by financial institutions, rather than any assessment of the virtue or value of the institution itself—provided it adheres to the Sustainable Blue Economy Finance Principles and the sector-specific guidance when making its decisions. Thus, on these terms, a bond issuance by a large corporation to finance sustainable shipping is as valid a means of finance for the SBE as an impact fund investing in a community-managed fishery, and one is not 'better' or 'more sustainable' than the other.

This guidance builds directly on the SBEFP and its ethos and seeks to apply these principles at a more granular level across sectors of the sustainable blue economy. The purpose of the guidance is to provide sector-specific, decision-useful information to **banks, investors and insurers** on how to avoid and mitigate environmental and social risks and impacts—and maximize opportunities—when providing capital to companies or projects within the blue economy. This second iteration builds on the sectoral focus of the first edition, *Turning the Tide* (UNEP FI 2021) and provides insights into two additional sectors of the blue economy:

- Coastal infrastructure and resilience;
- Waste prevention and management.

These sectors were chosen due to their scale and nature, as well as the central role they both play in economic development and impacts on environment and society.

Intended audience

The primary audience for this guidance is financial institutions (banks, insurers and investors) currently, or looking to become, active in the sustainable blue economy. The guidance aims to provide an initial framework for these institutions to consider how sustainability impacts and risks specific to the blue economy manifest within their own portfolios. Given the breadth of this subject matter and the relevance of sustainability considerations to a

broad array of stakeholders, this guidance may also be valuable for the public sector, inter-governmental organizations, academia, civil society, commerce and industry.

Approach

Figure 1: Guidance creation flow diagram

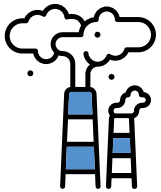
The guidance was developed following a bottom-up approach. A 'discovery' phase (Figure 1, point 1) entailed an extensive literature review and expert interviews. Based on the latest science, it identified the sector's impacts on environment and society, avoiding duplication of relevant existing resources. Impacts were identified following a modified DPSIR[3] framework that examined **drivers** of impact stemming from each sector, the different **pressures** these exert on environment and society, and the **impacts** these pressures create. While pressures are individual to the sectors, the collective impacts are common across the sectors for which financing guidance has been created.

3 DPSIR (Driver, Pressure, State, Impact, Response) is a framework to systematically approach impacts and describe the relationship between human activity and impact. It allows for a more precise assessment and understanding of how actions and activities affect the environment. It is based on a model originally developed by the Dutch National Institute of Public Health and Environment and later adopted by the European Environment Agency (EEA) (Institut Français de Recherche pour l'Exploitation de la Mer (IFREMER) 2004)..

Table 1 clarifies what is meant by the common impacts on environment and society, outlining each impact and offering examples on where it may materialize in practice.

Table 1: Table of impact definitions

Environmental impacts	Description	Examples
 **Loss or reduction in marine biodiversity including loss of endangered, threatened and protected species**	Loss or reduction of populations of a given species, or of a species as a whole, due to human impact. This includes endangered, threatened and protected (ETP) species as defined by the International Union for the Conservation of Nature (IUCN) Red List of Threatened Species and protections under applicable jurisdictions.	This may result from direct overexploitation such as overfishing, or indirectly as a consequence of other impacts, such as pollution impacts on marine biodiversity.
 **Loss of ecosystem resilience and provision of ecosystem services**	Loss or reduction in the ability of an ecosystem to provide specific benefits. These benefits, termed ecosystem services, include provisioning services such as oxygen production and carbon sequestration, as well as regulating services for the climate.	A particularly prominent ecosystem service is climate resilience (e.g. through coastal flood defence) where a loss of resilience has significant bearing on the ability to adapt to the impacts of climate change.
 **Loss or degradation of coastal and marine habitats**	Changes to the physical environment on which life depends.	This may result from temporary disturbance to the seabed because of dredging or trawling, or from more permanent change as a result of construction work (e.g. sea walls).
 **Reduction in animal welfare**	The consequences of human activity on the health of individual animals, both wild and farmed. It complements the impact on biodiversity, which looks at impacts on groups of animals and species. These impacts are closely linked and often appear together.	Reduction in animal welfare includes sources of stress for many organisms, typically as a result of pollution. This includes noise pollution from vessels and construction activity.

 **Increased GHG concentrations**	The role of greenhouse gas (GHG) emissions in contributing to climate change. While human activity affects the climate in many ways, as well as the capacity to offer resilience or adapt to climate change, this impact covers the output of GHG emissions into the atmosphere itself, raising concentrations that result in a changed climate.	This results from a broad range of human activity, including emissions from construction of a new sea wall or from waste management activity such as waste incineration.
 **Changes to marine biological, chemical and geological cycles**	The consequences of changes to biogeochemistry – the natural processes within the ocean that play a role in regulating the planet, such as the water, carbon and nitrogen cycles. While dependent on water chemistry, marine life also plays a role in these cycles. As such this is closely linked to loss of ecosystem services – though the consequences differ, focusing specifically on these global chemical regulation processes.	This may result from specific pollutants that affect marine biogeochemistry entering the environment from uncontrolled waste streams.
Social impacts	**Description**	**Examples**
 **Violation of human rights, including rights of indigenous communities**	The violation of any human right, including the rights of indigenous communities, in the process of development or financing of a given sector. This includes both specific and clear examples of human rights violations as well as more systemic human rights violations such as the impact of inequality of opportunities between social groups and genders.	An example of violation of human rights includes modern slavery in fishing or shipping.

 **Reduction or loss of access to sustainable and inclusive livelihoods**	The consequences of development on an individual or community's ability to attain and maintain livelihoods.	This impact may cover the consequences of new development affecting existing livelihoods – for example, new infrastructure physically preventing coastal communities from accessing the marine environment, or the removal of a mangrove forest undermining the fisheries on which coastal communities depend.
 **Increased likelihood of injury, disease or loss of life**	The consequence of an activity on the short- and long-term physical health of an individual or community as a result of development.	This may include the higher likelihood of injury as a result of unsafe, informal waste management practices in unregulated landfills, or the increased probability of fatal injury during unsafe construction.
 **Economic damage and loss of productivity**	While all these impacts ultimately lead to some form of economic damage and loss of productivity, this impact specifically examines the direct, proximate consequences of a given pressure on the economic output and productivity of an individual or an enterprise.	This may include economic damages and losses through a loss of livelihoods or a reduction in attractiveness of a coastal community due to a new development.
 **Inequality of opportunities on the basis of age, sex, disability, race, ethnicity, origin, religion or economic or other status**	Closely linked to the impact of human rights violations, this impact looks more specifically at instances where the development of a sector reinforces or establishes inequality of opportunities within and between communities and between individuals.	This may include gender imbalances in corporations across blue economy sectors, or racial discrimination in employment. This may also include unequal distribution of costs or benefits associated with a development.
 **Perceived degradation in cultural value of the environment**	The degradation of cultural value perceived by communities because of development or operation of a sector of the blue economy. This is distinct from the economic implications of the impact, and covers changes to the non-monetary value of an environment for local stakeholders.	For example, the installation of a new waste management facility that affects the enjoyment of a coastal view, or the degradation of a coral reef due to run-off of building materials impacting its cultural value to dependent communities.

A master list of pressures and impacts was then developed (Figure 1, point 2) for each sector. These were mapped against current and potential risks to financial institutions, and the materiality of these risks assessed. These risks cover five broad categories, as highlighted in Table 2.

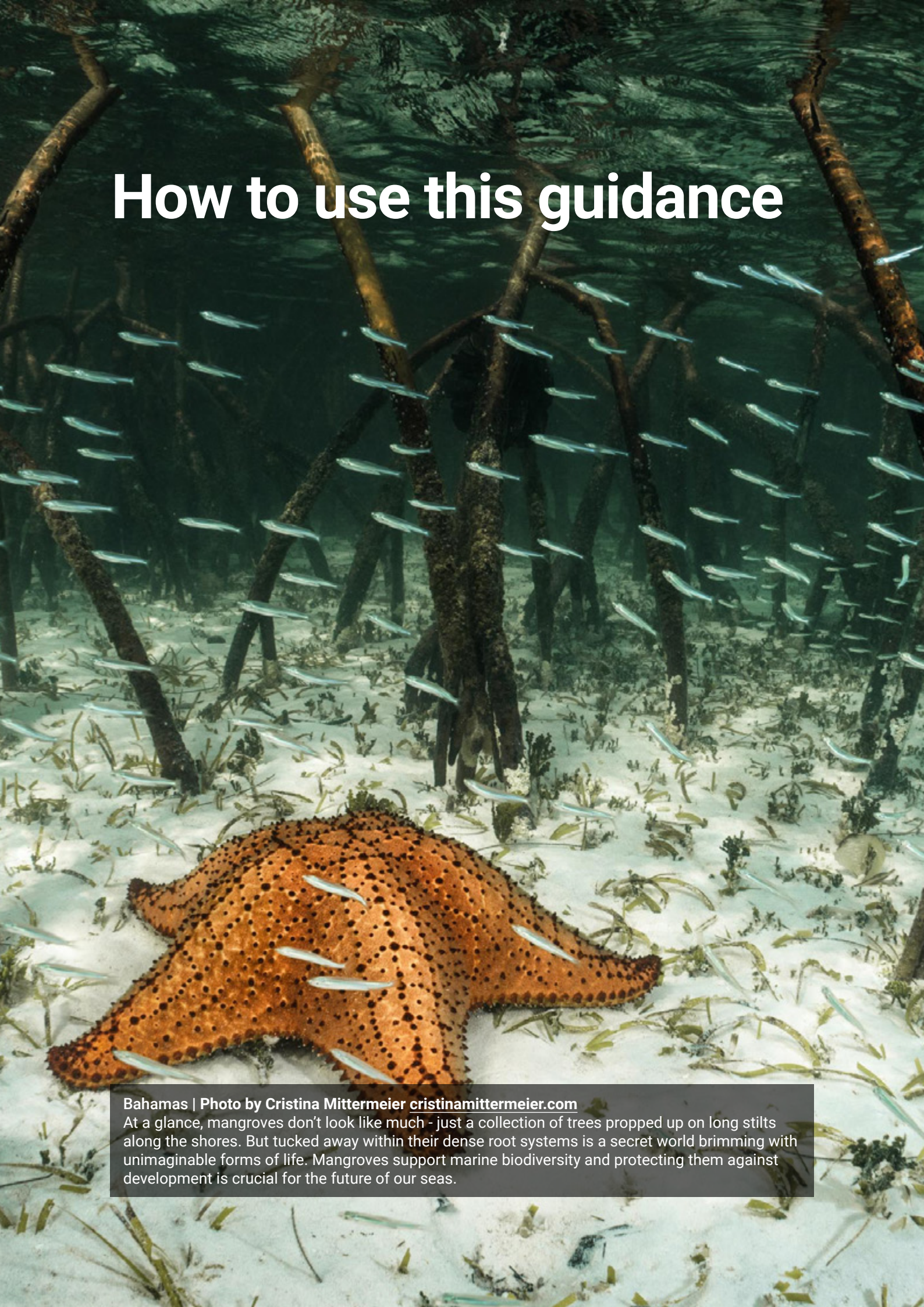
Table 2: Table of risk descriptions

Risk	Description	Example
Physical	The risk to physical assets, often related to the impacts of climate change	Increased physical damage to coastal assets (e.g. property) subsequent to tropical cyclones
Operational	The risk of interruption of ongoing activities, including supply chain operations, logistics and other disruption of business operations	Disruption to waste collection due to strikes
Market	The risk of changes to the market served by a sector or development, including shifts in demand or supply	Reduced consumer demand for products from companies not seen to be acting on ocean plastic
Regulatory	The risk of changes in the regulatory environment affecting the sector in question, including changes in how it may be taxed or subsidized	Policy change on requirements for use of Nature-based Solutions in coastal infrastructure
Reputational	The risk of change in public perception, manifesting as public campaigns, boycotts or purchasing decisions	Negative press coverage associated with brand exposure in marine plastic waste

The most critical categories of pressures (and the impacts they create) stemming from the sector were summarized (Figure 1, point 3) alongside the key risks that these impacts create for financial institutions. This prioritized set of pressures forms the basis of the development of criteria (Figure 1, point 4) for sustainable financing in this sector. The summary of key pressures, impacts and risks forms the basis of this guidance document. The criteria are featured in the accompanying Criteria Annex spreadsheets.

It is important to note that the resultant list of criteria for each sector is not a comprehensive review of all social and environmental pressures related to each sector; this would result in an unworkable set of guidance for institutions. Rather, where pressures are understood to be entirely related to their respective sector *and* to the blue economy, they are included under the criteria. Where pressures relate to the sector but are not unique to it *or* the blue economy, these are not included save for pressures related to climate change, which is considered too significant to exclude.

How to use this guidance



Bahamas | Photo by Cristina Mittermeier cristinamittermeier.com
At a glance, mangroves don't look like much - just a collection of trees propped up on long stilts along the shores. But tucked away within their dense root systems is a secret world brimming with unimaginable forms of life. Mangroves support marine biodiversity and protecting them against development is crucial for the future of our seas.

Readers are encouraged to examine the chapters covering sectors of interest from start to finish before engaging directly with the list of criteria, as these chapters provide sector-specific context on the linkages between pressures, impacts and risks outlined in the Approach section. Each chapter also includes case studies of current best practice and innovative approaches to financing sustainability in the different sectors.

Both chapters follow the same format and contain the same broad categories of information to enable consistency and standardization. The chapters cover the relationship between a pressure and its associated impacts following the modified DPSIR framework described in the Approach section and builds on this understanding to highlight how and why these pressures are material to financial institutions and what types of risk they represent. Where there is substantial differentiation within the sector between activities—for example in waste between production and management—these are broken down according to relevant sub-sectors.

Limitations of the guidance

This guidance is intended as a practical, working resource for financial institutions to assess their potential exposure to social and environmental risk factors within the sustainable blue economy and recommend actions based on indicators of the social and environmental pressures in these sectors. In this context**, the guidance does not offer investment advice or replace existing requirements for due diligence by financial institutions when engaging in the sustainable blue economy**. Rather, this resource is intended to guide financial institutions through some of the common and critical social and environmental challenges facing these sectors, thereby complementing existing reporting frameworks to assist institutions in their decision-making regarding the sustainable blue economy.

Though the guidance builds on the SBEFP, institutions that have signed up to these principles will not be in any way assessed against this guidance, nor are any of its recommendations mandatory. However, for each sector, the guidance and criteria for sustainability should be viewed in their entirety and treated as a single resource. Selecting individual criteria or indicators of behaviour and disregarding others is strongly discouraged to ensure a systemic and integrated view of sustainability in the blue economy and, critically, to ensure the management and mitigation of impacts and risks.

The guidance should be considered a living resource and work in progress, with improvements and iterations over time to expand its scope and applicability to be expected. As such, this document does not yet offer recommendations on behaviour and best practice beyond the sectors covered, neither does it offer specific metrics or benchmarks for sustainability for individual sectors and their social or environmental performance.

Using the sector-specific criteria

After reading the guidance chapters and absorbing the relationships between the sectors, their impacts on the environment and society and the materiality of these impacts, the reader can turn to the sector-specific criteria in the accompanying Criteria Annex spreadsheets. These build on the materiality of the sector's impacts and risks and offer specific recommendations designed to increase sustainability. These spreadsheets are explained here following an example of the coastal infrastructure criteria (Figure 2), which sets out the different elements of the guidance as they apply to specific areas and aspects of sustainability.

As described above, the sectors benefit from being broken into sub-sectors facing distinct issues. Where this occurs, it is indicated in the **Sub-Sector** column (Figure 2, point 1). Issues and activities common to all sub-sectors are labelled as 'common'.

The **Criterion** column (Figure 2, point 2) is dedicated to the criteria themselves. These are based closely on the pressures identified in the guidance chapters for each sector and denote a section of the guidance dedicated to a specific pressure, activity or set of issues. (In coastal infrastructure example below, the criterion is 'infrastructure planning and resilience'. Others may be 'habitat impacts or 'workforce')—categories of activities, pressures and issues within a sector.

The **Scenario** column (Figure 2, point 3) highlights a specific circumstance within the criterion's category that is relevant for a financial institution to consider—for example, the presence of a marine spatial planning process or how the siting of a wind farm was determined. The **Verification** column (Figure 2, point 4) provides guidance on how the state of this scenario (its presence or absence) may be determined, and what information sources are helpful.

On the basis of the presence or absence of a scenario, certain actions (5) are recommended. The **Action** column contains three different types of action:

- **Avoid**, where it is recommended financial institutions do not provide financing due to the severity of a given scenario;
- **Challenge**, where financial instititions are recommended to address a specific issue highlighted by an scenario, for example via engagement with a company or project developer; and
- **Seek out**, where a scenario denotes current best practice on a particular issue and where financing is encouraged.

For some scenarios, depending on the jurisdiction and state of the market, the action may be either an avoid or a challenge—these are denoted as such as 'Avoid/Challenge (market dependent)' with additional information provided in the recommendation column.

More specific guidance is offered in the 'recommendation' column (6), which provides additional context for the action. Here, specific language is used for each type of action:

- 'Do not finance' under the Avoid type;
- 'Require' for certain critical actions under the 'challenge' type and 'Encourage' for actions under the 'challenge' type that can be improved but are not considered critical to address; and
- 'Seek out', which uses the same language as its type.

The **Relevant principles** and **SDG targets** columns (Figure 2, point 7) link the specific scenario to the relevant Sustainable Blue Economy Finance Principles and Sustainable Development Goal targets, respectively. The **Resources** column (Figure 2, point 8) offers links to further reading on the specific issues addressed within the relevant scenario.

For coastal infrastructure, where relevant sustainability standards and criteria exist in the market, there is an additional **included in major market standards** column. This denotes whether and where a scenario corresponds to existing sustainability frameworks, in this case the Fast-Infra Sustainable Infrastructure Label and the International Union for the Conservation of Nature (IUCN) Global Standard for Nature-based Solutions.

Figure 2: Criteria table explained

Coastal resilience: Infrastructure and Nature-based Solutions

Sub-sector	Criterion	Scenario	Verification	Action	Recommendation	Included in major market standards?	"Relevant SBEFP (if the action and recommendation is taken, the following principles apply)"	"Sustainable Development Goal Reference (if the action and recommendation is taken, the following SDGs apply)"	Resources	
1. Infrastructure planning and location										
Grey infrastructure	1. Infrastructure planning and location	Evidence of planned construction of grey infrastructure in protected areas or areas of high conservation value by project developer.	Verify location of protected areas or areas of high conservation value in relevant jurisdiction.	**AVOID**	Do not finance grey infrastructure in protected areas or areas of high conservation value due to associated biodiversity losses.	Yes – FAST Sustainable Infrastructure Label Environmental Dimension: Protection and Enhancement of Biodiversity and the Natural Environment	1. Protective 2. Compliant 8. Purposeful	14.2 By 2020, sustainably manage and protect marine and coastal ecosystems to avoid significant adverse impacts, including by strengthening their resilience, and take action for their restoration in order to achieve healthy and productive oceans. 15.1 By 2020, ensure the conservation, restoration and sustainable use of terrestrial and inland freshwater ecosystems and their services, in particular forests, wetlands, mountains and drylands, in line with obligations under international agreements. 15.5 Take urgent and significant action to reduce the degradation of natural habitats, halt the loss of biodiversity and, by 2020, protect and prevent the extinction of threatened species.	IUCN World Database on Protected Areas	FAST-Infra Sustainable Infrastructure Label
Grey infrastructure	1. Infrastructure planning and location	Evidence of planned construction of grey infrastructure on greenfield sites by project developer.	Company disclosure. Third-party verification.	**CHALLENGE**	Require cost-benefit analysis of grey vs green infastructure solutions for the given site. Require developes to integrate Nature-based Solutions within infrastructure developments on greenfield sites	"Yes – FAST Sustainable Infrastructure Label Environmental Dimension: Protection and Enhancement of Biodiversity and the Natural Environment	"1. Protective 8. Purposeful 10. Precautionary 14. Science-led	9.1 Develop quality, reliable, sustainable and resilient infrastructure, including regional and transborder infrastructure, to support economic development and human well-being, with a focus on affordable and equitable access for all. 9.4 By 2030, upgrade infrastructure and retrofit industries to make them sustainable, with increased resource-use efficiency and greater adoption of clean and environmentally sound technologies and industrial processes, with all countries taking action in accordance with their respective capabilities. 14.2 By 2020, sustainability manage and protect marin and coastal ecosystems to void significant adverse impacts, including by strtengthening thei resilience, and take action for their restoration in order to achieve healthy and productive oceans. 15.5 Take urgent and significant action to reduce the degredation of natural habitats, halt the loss of biodiversity and, by 2020, protect and prevent the extinction of threatened species.	US EPA Green Infrastructure Cost-Benefit Resources	Green-Gray Community of Practice Practical Guide to Implementing Green-Gray Infrastructure
Nature-based Solutions	1. Infrastructure planning and location	Evidence of use of Nature-based Solutions to protect areas of cultural and natural heritage.	Third-party and NGO reporting.	**SEEK OUT**	Seek out opportunities to finance the protection of cultural and natural heritage through the use of Nature-based Solutions.	NA	1. Protective 4. Systemic 5. Inclusive 10. Precautionary	11.4 Strengthen efforts to protect and safeguard the world's cultural and natural heritage.	DUNAS Heritage	

KEY:

1. Sub-sectors break down the sectoral focus to apply more granularity
2. The criterion refers to a specific aspect of sustainability, closely linked to pressures
3. Scenario highlight a specific circumstance within a criterion of relevance to an FI
4. Verification suggests how the presence or absence of a scenario may be determined
5. Action indicates the type of response to make based on the presence of the scenario
6. Recommendation provides more detailed steps to take based on the action
7. Included in major market standards links the scenarios to existing criteria and indicators in other market standards (coastal infrastructure only)
8. Relevant Principle and Relevant SDG targets highlight linkages between the scenario and the SBEFP and SDG sustainability frameworks
9. Resources offer links for further reading around the topic

Relationship to other resources

This guidance is broadly supportive of—and intended to be a complementary resource to—existing frameworks for sustainable finance, notably UNEP FI's Principles for Responsible Banking (PRB)[4] and Principles for Sustainable Insurance (PSI),[5] as well as the Principles for Responsible Investment (PRI).[6]

Within the sectors and wherever possible, explicit reference is made to the synergies and complementarities between this guidance and the Sustainable Blue Economy Finance Principles on which they are based, the Sustainable Development Goals and their targets, and sector-specific leading sustainability standards.

As a first attempt at providing a guiding framework for sustainable finance across the sectors covered towards a very broad audience, this guidance should be considered a high-level framework for institutions to apply in their engagement with the sustainable blue economy. Readers are encouraged to look to additional resources for additional support on applying sustainability considerations at the level of specific types of institutions and financial services. An example is the PSI ESG Guide for Non-Life Insurance.[7]

4 The Principles for Responsible Banking are a unique framework for ensuring that signatory banks' strategy and practice align with the vision society has set out for its future in the Sustainable Development Goals and the Paris Climate Agreement.

5 The Principles for Sustainable Insurance serve as a global framework for the insurance industry to address environmental, social and governance (ESG) risks and opportunities—and a global initiative to strengthen the insurance industry's contribution as risk managers, insurers and investors to building resilient, inclusive and sustainable communities and economies.

6 The PRI is the world's leading proponent of responsible investment. It works to understand the investment implications of environmental, social and governance (ESG) factors; and to support its international network of investor signatories in incorporating these factors into their investment and ownership decisions.

7 unepfi.org/psi/wp-content/uploads/2020/06/PSI-ESG-guide-for-non-life-insurance.pdf

Coastal resilience: Infrastructure and Nature-based Solutions

Bahamas | Photo by Cristina Mittermeier cristinamittermeier.com
Mangroves settle into lush green colonies that trap debris in their tangled roots. The incredible powers they possess, from providing sanctuaries for many species to protecting countless homes from hurricanes and tsunamis could be part of the solution to our most urgent challenges posed by climate change.

Sector and financial overview

For the purposes of this guidance, coastal resilience: infrastructure and nature-based solutions ('coastal infrastructure') refers to the physical assets along a coastline that serve to protect populations and development from a variety of natural hazards, including storm surge and sea level rise; saltwater intrusion; land subsidence; and coastal erosion.[8] It is important to highlight that this includes climate-related hazards. As such, it does not include infrastructure for which the primary focus is another service, such as transport or energy.

This infrastructure is designed and constructed to reduce the risks associated with natural hazards, and the probability of a natural hazard resulting in significant damage—for example by lowering the likelihood of a major flood event resulting in significant damage from a 1-in-100-year incidence to a 1-in-1,000- or 1-in-10,000-year incidence. As a result, an important dimension to financing coastal infrastructure is the risk of failure of the infrastructure, either due to a 1-in-1,000-year event occurring, or because the impacts of climate change have altered the probability of a disaster—or the viability of the infrastructure—after it was constructed. While coastal infrastructure has always been needed to protect coastal development from hazards, the increasing number of extreme events as a result of climate change make it necessary to transition current infrastructure development—which is largely based on statistical values such as 100-year flooding frequencies that may no longer hold true—to a more resilient, climate-adaptive approach. It is clear that efforts on climate adaptation and resilience, as well as disaster risk reduction (DRR), are very closely intertwined with coastal infrastructure, and are central to the narrative on this sector.

The need for finance for coastal adaptation is great: an estimated USD 40–170 billion are required *annually* by the end of the century (Nichols *et al.* 2019), depending on climate and protection scenarios, in the face of ongoing coastal development. Put differently, the investment requirement for coastal infrastructure between 2015 and 2100 to mitigate the worst impacts of sea level rise and coastal flooding amounts to approximately USD 18.3 trillion under the most pessimistic climate scenario. Current financing is at a fraction of these cost estimates—coastal infrastructure was financed at approximately USD 1 billion per year in 2014 (Bisaro and Hinkel 2018).

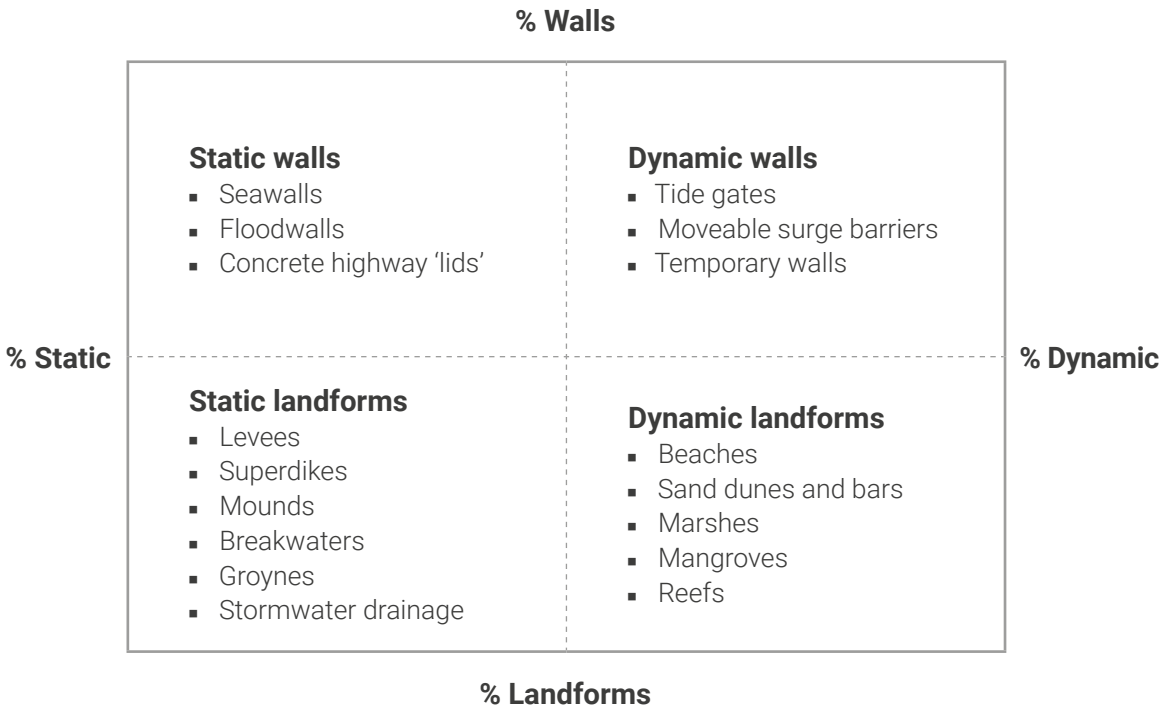
Nevertheless, growing international focus on infrastructure development financing, particularly through globally oriented programmes such as the Belt and Road Initiative (BRI) and its forthcoming European counterpart Global Gateway, underline an increase in momentum, and emphasize the significant volumes of capital that will be allocated towards development, and the attendant need for greater coastal infrastructure and climate adaptation as a result. In this context, it is especially important to understand the impacts of the development of coastal infrastructure on environment and society, and how best these can be managed by financial institutions.

8 Note: Other resources may refer to this as 'coastal defence'. This term is not used here as it may create confusion with 'defensive infrastructure', which refers to military assets. At the same time, many institutions include energy and transport infrastructure under the broad term 'coastal infrastructure', which this report does not cover.

What is coastal infrastructure?

Figure 3 parameterizes the scope of what is meant by coastal infrastructure along two axes, which creates a solution space for infrastructure options:

Figure 3: Coastal infastructure typology



Adapted from: Coastal infrastructure: a typology for the next century of adaptation to sea-level rise. (Hill 2015)

The X-axis provides a spectrum of infrastructure from static (i.e. fixed and unchanging) to dynamic (i.e. moveable, or evolving over time) solutions. The Y-axis explores the spectrum between walls (strictly linear infrastructure) and landforms (broader, non-linear and more expansive types of infrastructure). This provides the universe of infrastructure solutions to which the guidance may apply.[9]

9 Please note that scale of infrastructure solutions, although an important frame through which to consider Nature-based Solutions in particular, is not highlighted in this typology. Most coastal Nature-based Solutions for coastal defence will be of a similar, large scale with the distinctions in approach to small-scale infrastructure being less relevant.

Nature-based Solutions as coastal infrastructure

Nature-based Solutions (NbS) are defined by the International Union for the Conservation of Nature (IUCN) as

> **"actions to protect, sustainably manage, and restore natural or modified ecosystems, that address societal challenges effectively and adaptively, simultaneously providing human well-being and biodiversity benefits"**
>
> **IUCN 2016**

NbS[10] can serve a critical infrastructure function along coastlines. Coastal ecosystems such as mangroves, coral reefs and sand dunes can protect inland communities and development against sea-level rise and natural hazards such as tropical cyclones that bring intense wind, rainfall, or storm surge (Browder *et al.* 2019). A key advantage of NbS is the social and environmental co-benefits that they can provide, including ecosystem services such as carbon sequestration, food production and recreational opportunities. In turn, these can support livelihoods (Green-Gray Community of Practice 2020) that may increase their financial attractiveness (Kok *et al.* 2021).

In addition, NbS are more adaptable over time, which is critical in the face of a complex, changing and less predictable climate, leaving open options for future development. For example, once a concrete sea wall is installed, it is hard to change and tends to create a 'path dependency' that limits future development to continue in the same direction. In contrast, Nature-based Solutions build resilience and adaptive capacity in the context of climate change, creating a compelling case for their application to be scaled up and woven into coastal infrastructure worldwide, wherever applicable.

Leaving these 'adaptation pathways' open in coastal systems is considered a powerful climate adaptation tool for policy makers to support decision-making on infrastructure needs (Werners *et al.* 2021). Adaptation pathways featuring NbS solutions are especially recommended due to their co-benefits. Implementing a decision-making approach that includes adaptation pathways (in addition to existing cost-benefit approaches) to navigate uncertainty around climate change is recommended (De Ruig *et al.* 2019). While specific data on the cost-benefit of NbS, particularly in a coastal context, is limited, evidence from terrestrial flood defence analogues suggest net present values for infrastructure solutions including Nature-based Solutions can be higher than for grey infrastructure (European Environment Agency 2017). To support the growing evidence base of the value and co-benefits of NbS, the University of Oxford maintains the Nature-based Solutions Evidence Platform, compiling literature and case studies demonstrating the effectiveness of NbS in addressing climate change impacts.

10 There is some overlap here with related terminology on climate adaptation and resilience, including Ecosystem-based Adaptation (European Commission 2019) and Building with Nature.

On this basis, NbS are a particularly important source of potential infrastructure solutions in coastal environments and are the focus of a growing body of work and evidence pointing to their added value in building coastal resilience and providing vital ecosystem services (Bouw and Van Eekelen eds. 2020; IUCN 2020; Thiele *et al.* 2020; Hijdra *et al.* 2021). NbS are therefore a crucial component to consider as part of coastal infrastructure financing.[11]

Nature-based Solutions range from natural ecosystems to human-made infrastructure with natural elements. While there is no clear consensus on the types of NbS that exist, and they may be combined for integrated approaches to coastal resilience, each carries different impacts and risks for financial institutions. For this reason, they are here split out and categorized (alongside human-made grey infrastructure) into the following sub-sectors, building on the definitions used by The Nature Conservancy (TNC 2019):

Grey infrastructure

- **Purely human-made**: Often produces 'wall' type solutions, either static or dynamic, such as a concrete sea wall, groyne, flood gate or storm-surge barrier. Often, though not exclusively, found in urban environments. The Oosterscheldekering in the Netherlands and Thames Barrier in the United Kingdom are well-known examples of dynamic grey infrastructure.

Nature-based solutions

- **Green infrastructure**: Grey infrastructure incorporating natural systems or elements, such as an artificial reef or a sea wall with interwoven mangroves. Can be found across the entire scope of infrastructure solutions. The Living Seawall project in Australia's Sydney Harbour provides a clear example of a green infrastructure solution.
- **Nature-based infrastructure**: An engineered infrastructure solution using natural systems, such as construction of a dune system or taking advantage of longshore drift via sand motors,[12] thereby utilising existing natural processes. Primarily found as landforms, either static or dynamic. This also includes what is referred to as 'managed realignment', where room is given back to nature, e.g. to reduce flood risk. Examples include the Medmerry scheme for coastal realignment and construction of hybrid dunes in Barcelona for urban coastal defence.
- **Natural infrastructure:** The infrastructure services provided by projects including unaltered and actively managed[13] natural ecosystems, such as the saltwater retention and flood defence services provided by protected mangrove forests. All natural systems are dynamic given that natural infrastructure can only provide 'dynamic landform' solutions. The United States National Oceanic and Atmospheric Administration (NOAA) refers here to 'living shorelines' and encourages these as alternatives to grey infrastructure (NOAA 2019).

11 This is aligned with the EU Taxonomy's environmental objectives and technical screening criteria which highlight the importance of using Nature-based Solutions in climate adaptation (European Commission 2020a).

12 Such as the one developed on the coastline of the Netherlands

13 In this context this refers to the management of natural systems to maximise specific benefits, for example maintaining a mangrove forest to ensure its flood protection function is optimised (International Institute for Sustainable Development (IISD) 2018).

Increasingly, Nature-based Solutions that can be integrated into coastal infrastructure, are a priority for both public sector entities and international financial institutions (IFIs) financing coastal infrastructure in developing country contexts (Hijdra *et al.* 2021). Worldwide, NbS are viewed as a key contributor to climate adaptation and mitigation, with growing momentum to include NbS within states' Nationally Determined Contributions (NDCs) in the United Nations Framework Convention on Climate Change (UNFCCC) process (WWF UK 2021). In addition, it has been estimated that nature-based infrastructure may be up to 50% cheaper than traditional infrastructure even when providing the same service (IISD 2021). However, these cost savings and added benefits are very difficult to quantify precisely, particularly in comparison with well-assessed and costed grey infrastructure. As a result, NbS opportunities are comparatively poorly understood and thus captured by governments and investors. Increasingly, models are being piloted to build a financial case for NbS implementation between public and private actors, notably through capturing the opportunities provided by co-benefits (Kok *et al.* 2021).

A key concern in using and marketing NbS as solutions is the potential to misunderstand the opportunities for NbS by overselling something 'green' as being the best outcome by default. NbS are not a panacea and may not always be applicable. For example, if there is no physical space for planting a mangrove, developing this as a natural infrastructure solution is not an option. In some instances, grey infrastructure will remain the most cost-effective outcome, though here there may be further opportunities for green infrastructure to improve on the outcomes of a grey solution. What infrastructure type is best suited to a given situation will be heavily influenced by local conditions, though a helpful heuristic here is to aim to include as much NbS in infrastructure as is possible.

At the same time, some concerns over greenwashing also exist, for example through marketing a solution as 'green' despite limited application of natural systems or elements to a development (Gałecka-Drozda *et al.* 2021). This becomes especially significant in the marketing of co-benefits such as carbon sequestration as part of an infrastructure solution where there is no evidence to support this, or through focusing on carbon sequestration as a climate solution that negates the importance of emissions reductions and climate adaptation (Seddon *et al.* 2020).

Building on such concerns, how Nature-based Solutions are monitored for their efficacy, the impact they may have, as well as the ways in which they are governed are important for financial institutions to consider in the context of financing decisions. It is important to demonstrate benefits, estimate avoided costs, build political willingness and highlight positive externalities for Nature-based Solutions to overcome barriers to their financing and build appetite for their use (Sarabi *et al.* 2020; Wetlands International 2021). Fortunately, indicators and frameworks for assessing implementation of NbS co-benefits have been developed to support the monitoring and accountability of NbS and realise their legitimacy as viable solutions for coastal infrastructure (Raymond *et al.* 2017; European Commission 2021).

Stakeholder engagement, an adaptive approach to management as well as transparent and inclusive processes are central pillars of effective NbS, in addition to capturing co-benefits and balancing trade-offs, and must be prioritised as key ESG themes in financing NbS. While not specific to coastal infrastructure, these are included as criteria of what constitutes a Nature-based Solution by the IUCN Nature-based Solutions standard, a global framework for verification and scaling up of NbS (IUCN 2020).

In light of this, and in an effort to build clarity on Nature-based Solutions in the coastal infrastructure space, UNEP FI recommends financial institutions also examine the Global Standard for Nature-based Solutions (IUCN 2020) in addition to this guidance to assess whether a project qualifies as an NbS and to support stakeholder dialogue.

To further support these linkages, the criteria developed for this guidance (see criteria annex) are mapped against the IUCN Global Standard wherever applicable.

Box 3: Blue carbon

Blue carbon—the sequestration potential of coastal and marine carbon sinks for atmospheric carbon—is a growing area of interest, due both to the high sequestration potential of coastal and marine ecosystems (Grimsditch *et al.* 2013) and their interplay with coastal infrastructure.

Natural infrastructure, particularly in the case of mangroves, salt marshes and seagrass meadows, provide coastal flood defence as well as functioning as efficient carbon sinks, contributing to climate mitigation efforts (UNEP and IUCN 2021). Their conservation therefore creates multiple linked benefits, as the integrity of the ecosystem (e.g. a mangrove forest) improves its capacity to deliver services, including both the ability to draw carbon from the atmosphere as well as enhancing its flood defence infrastructure functions. Capturing the value of the potential of these ecosystems to draw down and store carbon presents an additional route towards valuing and financing this natural capital—including for its infrastructure benefits. It is estimated that mangrove forests, if valued at a carbon price reflecting their co-benefits as infrastructure and source of livelihoods, could return up to USD 11.8 billion in profit as carbon sinks against a global investment of USD 11.1 billion for restoration of the world's mangroves (728,421ha) (Earth Security 2021a).

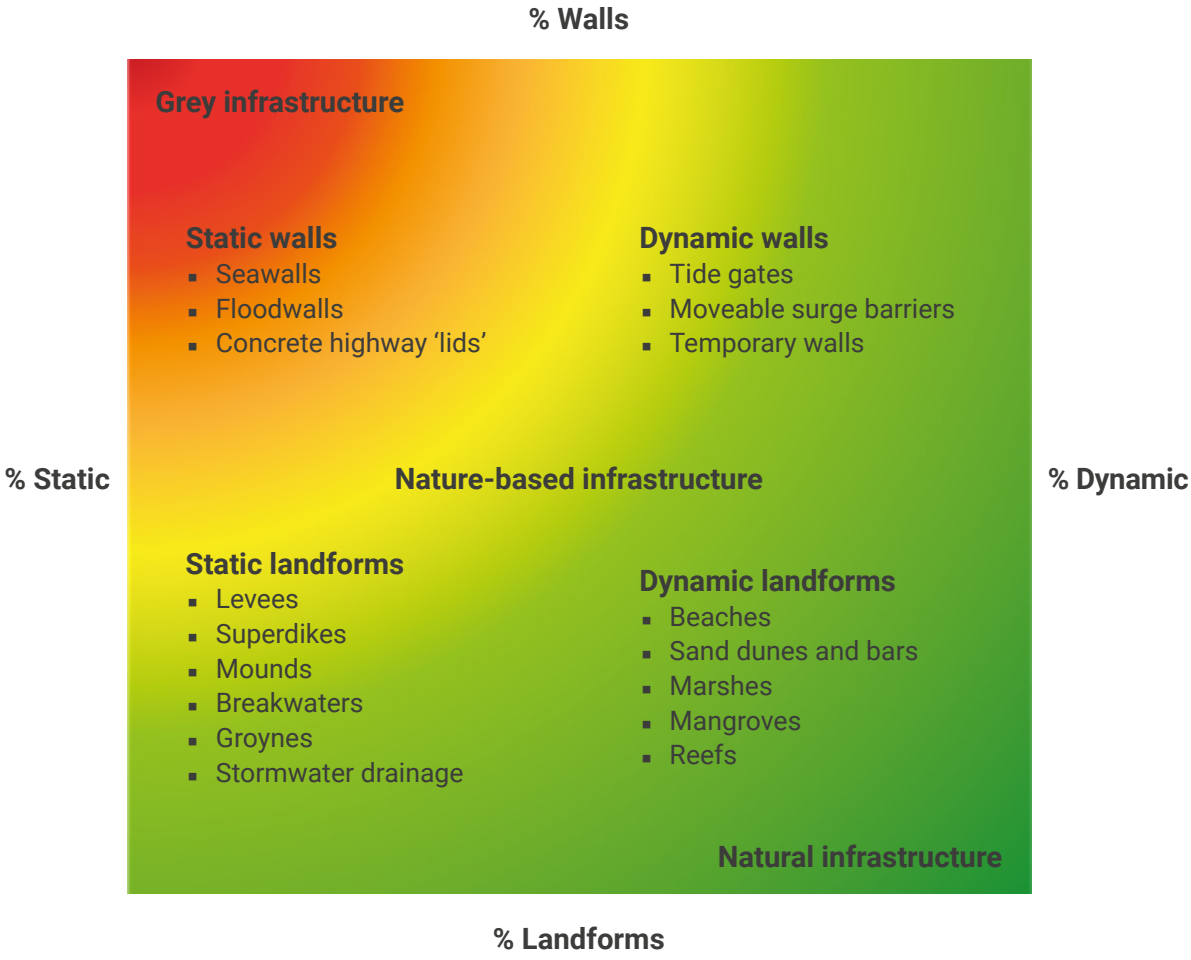
While there is significant interest in the development of a blue carbon market, there remain several constraints to its development:

- Based on current carbon prices, revenue from carbon sequestration alone is insufficient to cover fixed transaction costs for financing blue carbon ecosystems, apart from very large project areas.
- The lack of large-scale wetlands ready to receive financing limits project supply and development of a market for blue carbon.
- Land ownership in blue carbon ecosystems, incentives for participation in blue carbon schemes and the implications this has for ownership over carbon credits, remains to be resolved and will differ from one jurisdiction to the next.

Nevertheless, there are initiatives exploring the viability of financing coastal infrastructure through valuing and capturing blue carbon and integrating it into the global carbon market. One example is a social enterprise being established by Conservation International to assess and monetize the risk reduction to coastal assets resulting from mangrove conservation and restoration, while simultaneously valuing the carbon storage benefits of mangroves. Restoration Insurance Service Company (RISCO)'s approach is based on valuation of the ecosystem services derived from mangroves, modelling specific sites with high flood reduction benefits to prioritize these, together with local communities, for restoration and conservation activity. This conservation service, and the site-specific flood reduction benefits it generates, will be sold to insurance companies, who pay an annual fee for access to the information. In parallel, RISCO will generate and sell blue carbon credits to organizations based on their validated conservation and restoration efforts. Pilot work has been completed in the Philippines, with the aim of establishing RISCO in mangrove-rich countries including Vietnam, Indonesia and Costa Rica (Climate Finance Lab 2019; Ocean Risk and Resilience Action Alliance 2020).

Figure 4 links the Nature-based Solutions spectrum to the coastal infrastructure solution space, where red denotes grey infrastructure, deep green denotes natural infrastructure, and nature-based infrastructure exists in the space between.

Figure 4: Coastal Nature-based Solutions typology



Adapted from: Coastal infrastructure: a typology for the next century of adaptation to sea-level rise. (Hill 2015)

Please note that while grey, nature-based and natural infrastructure are here distinguished from one another for illustrative and practical purposes, in reality they represent a spectrum of solutions, as highlighted by the Green-Gray Community of Practice (2020).

Thus, this guidance serves to: highlight the benefits of NbS as infrastructure solutions; examine the impacts of grey infrastructure where it remains applicable; and identify what best practice to seek out, including integrating NbS wherever possible. The guidance does not focus on the development of co-benefits themselves—such as developing aquaculture on the basis of a mangrove forest's services—as this would be covered by existing guidance on seafood.

Financing the sector

Like other infrastructure sectors, coastal infrastructure is typically capital-intensive, with long timelines for development, operation and maintenance of the assets. Unlike other infrastructure assets, it does not generate revenue itself, but produces potential savings by reducing the risks associated with natural hazards—potentially reducing damage

costs by 2–3 orders of magnitude (OECD 2019). As a result, coastal infrastructure is typically developed and financed by the public sector. This creates some unique scoping considerations for this guidance to ensure it is helpful to private financial institutions—particularly given the financing gap for infrastructure needs worldwide, the financial barriers to coastal adaptation (Kok *et al.* 2021) and the opportunities for sustainable financing this presents.

Private financial institutions can influence how infrastructure is developed and how natural capital is valued, with opportunities for both fixed income and equity investment, banking and insurance. However, despite a clear indication of the need for greater capital for coastal infrastructure, the potential scale for private finance is difficult to estimate.[14]

There are several ways in which private finance can interact with the public sector on coastal infrastructure (Bisaro and Hinkel 2018), such as:

- public-private partnerships (PPP) in the form of long-term contracting (especially relevant for institutional investors);
- privatization of public-sector activity;
- taking minority shares in state-owned enterprises (SOE).

The latter two are relevant for listed equity investors. There is a clear role for banking and insurance in market-building and offering financing for property developers who are important stakeholders in shaping and benefiting from coastal infrastructure. Finally, there are significant opportunities for concessional financing and blended opportunities across public and private capital to apply to coastal infrastructure.

Here, distinctions in financing are made based on what role the financial institution might play in coastal infrastructure. This guidance applies to all of these approaches.

Direct financing—Private sector and public-private partnership

One of the most direct ways financial institutions can engage with coastal infrastructure is by financing activity that is directly linked to the private sector, or which the public sector has relinquished to the private sector. The distinct stages of an infrastructure project (development, construction, operation and maintenance) present opportunities for venture/strategic/impact equity through to growth capital, into longer-term, more conservative debt. Those representing these different elements of capital can influence the way infrastructure is developed, built and operated, including through promoting NbS and encouraging progress towards net zero by 2050. Activities here include:

- Financing contractors or project developers who deliver infrastructure development for a public client;
- Financing public-private partnership through, for example, property developers tasked with developing infrastructure as part of their development portfolio;

14 This is a result both of the difficulty in pinpointing what opportunities for public-private partnership exist globally, and of inconsistencies in how coastal infrastructure is defined. Most private finance resources and frameworks, including infrastructure sustainability standards, examine energy and transport infrastructure under this term as these are clearly linked to revenue-generating activity.

- Financing a developer active in a related sector (e.g. ports, coastal tourism) that is developing coastal infrastructure as part of their activity or is leveraging the co-benefits associated with NbS (see discussion below on linkages to other sustainable blue economy sectors).

Direct financing—Public sector

This includes financing for public sector entities tasked with both capital and operating and maintenance (O&M) costs for infrastructure, the latter of which are significant. By 2030, the cost of maintaining existing and future coastal infrastructure is estimated at between 0.02% and 0.07% of lower- and middle-income country (LMIC)'s GDP every year (Rozenberg and Fay 2019). Activities here include:

- Financing public sector entities capitalizing public works on the bond market (sovereign, though in particular municipal, bonds). In the United States where this market is most mature, 54% of the country's largest cities have issued bonds to fund resilience projects such as seawall construction and restoration, and improving stormwater drainage (Earth Security 2021b);
- Arranging and implementing debt conversions for conservation outcomes including coastal infrastructure, unlocking capital for the public sector—for example through the 2021 Belize debt conversion (see the case study on The Nature Conservancy debt conversion, Belize).

Risk management—Shaping the market

This refers specifically to the role financial institutions can play in influencing how coastal infrastructure is developed as price-makers:

- Adjusting cost of capital for development in areas affected by coastal infrastructure (for example by either decreasing or increasing premiums depending on whether the infrastructure includes NbS and how this changes risk—especially physical risk).
- Stipulating infrastructure requirements, for example assessing the feasibility of including NbS within infrastructure as part of loan covenants.

Risk management—Insurance

Specifically in the context of insurance, finance has a role to play in capturing the value of infrastructure (particularly where this is natural infrastructure) and the services it provides by extending insurance coverage against it, to enable finance to flow:

- Offering risk assessment services related to insurance that assess the value at risk along coastlines in the context of climate change and the resilience offerings of different infrastructure types,[15] reducing uncertainty and unlocking development potential;
- Offering insurance instruments that value and finance the recovery of ecosystem services for natural infrastructure (e.g. parametric insurance, see Box 4).

15 To an extent, this may act as a double-edged sword—where the insurance sector concludes an area is no longer insurable at viable rates, such assessment may amplify existing vulnerability and reduce access to finance. If not adequately backstopped or guaranteed by the public sector, financial institutions may exit from vulnerable markets.

Box 4: Insurance and risk

Risk is central to how financial institutions engage with coastal infrastructure, particularly given the need to adapt and increase coastal resilience to natural hazards and sea-level rise associated with climate change. USD 100 trillion in assets are at risk due to inadequate insurance, and by 2100 the land flooded under a 100-year storm event will increase by 64% under a high-emissions scenario (RCP 8.5) (Thiele ***v*** 2020). While all financial institutions are familiar with risk and how to manage it, the insurance sector has developed a particular sensitivity to the nuances of different risks, including climate and other environmental risks, to develop financial services to minimize and mitigate against them. These include (non-life) indemnity insurance, more innovative parametric insurances, as well as risk analytics, including risk assessment indices and value-at-risk analyses. In this context, insurance has an important role to play in financing coastal infrastructure, both in shaping the market and providing financial cover.

The insurance sector provides tools and methodologies to think about valuation, value at risk and managing risk that are helpful in building resilience. This is particularly relevant in the context of prioritizing Nature-based Solutions and the role they can play along coastlines to safeguard communities and maximize conservation. One example is the parallel roles of a mangrove forest as defensive infrastructure, carbon sink, and source of livelihoods and food security that offers resilience against climate change impacts and reduces biodiversity loss. Parametric insurance is a particularly valuable tool to explore here, especially in the context of emerging economies. It enables the rapid unlocking of capital, for example for conservation and restoration efforts for coastal communities and natural infrastructure in a post-disaster context. At the same time, the coverage provided by such products improves the financial stability and creditworthiness of associated communities, increasing their attractiveness for further financing and development.

The risk indices developed by the insurance sector also offer a valuable database to inform decision-makers (both public and private) about the risks associated with development and policy decisions. Notably in the context of climate resilience, the Global Resilience Index (GRI), under development through a coalition of institutions within the UK Centre for Greening Finance and Investment (CGFI), aims to provide a complete set of consistent financial risk metrics for key natural hazards and the physical risk they represent in every country and territory in the world (CGFI 2021). Similarly, the Climate Transition Index (CTI) has been developed to quantify the impact of a Paris-aligned climate transition on equity portfolios to support the transition to net zero for financial institutions (Willis Towers Watson 2021). These tools are vital for all financial institutions to understand their potential risk exposure in the context of the climate transition broadly, and coastal infrastructure specifically.

For the insurance sector, this guidance aims to provide a sense of the key social and environmental impacts in coastal infrastructure and a basis for considering how both risk analytics and insurance policies can support the further development of NbS and a sustainable approach to infrastructure development.

In light of the above, while the entry points are indirect, there are nevertheless several ways in which private financial institutions can influence coastal infrastructure development and use. As a result, there are several environmental and social impacts for financial institutions to be aware of to support decision-making for sustainability.

Key environmental and social impacts and dependencies

Impacts on the environment and society from coastal infrastructure stem from its construction, operation and maintenance (O&M) and, where applicable, deconstruction. This applies primarily to grey infrastructure, where there are human-engineered components to the infrastructure that require development, and to a lesser extent to green and nature-based infrastructure.[16] For the development/value capture of natural infrastructure, which is based on almost entirely intact ecosystems with limited human interference, impacts are largely restricted to restoration activity and efforts to protect and maintain existing systems, for example in site rehabilitation or repair in the aftermath of a storm or flood.

Key pressures exerted by coastal infrastructure development focus on the destruction, degradation and disruption of the natural environment and a reduction in economic opportunities for local communities. Most of these pressures are most strongly exerted during the construction phase. In addition, more abstract pressures stemming from coastal infrastructure development include path dependency, which undermines long-term ecosystem resilience by preventing the ability of a coast to adapt to changing circumstances when continuing to develop historical approaches to static grey infrastructure in particular (Nunn *et al.* 2021). These pressures are compounded, notably in the case of grey and green infrastructure, by how carbon intensive the infrastructure is, particularly where carbon-intensive concrete (Ellis *et al.* 2019) is used in construction, contributing to atmospheric GHG concentrations.

Coastal infrastructure is unique in comparison to other sectors for which SBE guidance has been developed, as its primary function is risk reduction as opposed to revenue generation. As a result, in terms of its key environmental and social impacts, it is necessary to consider both the impacts associated with its development and operation (i.e. its endogenous impacts, in line with the guidance produced for the other sectors) as well as the impacts associated with the infrastructure *failing* in its risk reduction role, which may be due to external pressures (i.e. exogenous impacts). Most infrastructure is rated against a specific probability of a natural hazard exceeding the defensive capability of the infrastructure. For example, a dike may add value by reducing a flood risk from a 1-in-100-year event to a 1-in-1,000 or 1-in-10,000-year event. Given the impacts of climate change on coastal environments, particularly through sea level rise and increased storm

16 It is important to highlight here that Nature-based Solutions can mitigate the impacts associated with infrastructure development as well as restore local habitats (Hijdra *et al.*2021) and provide co-benefits discussed previously. As a result, the criteria developed for this sector will strongly feature Nature-based Solutions as opportunities to mitigate the impacts of grey and human-based infrastructure.

surge, the risks of infrastructure no longer providing adequate cover or acceptable probability of failure increase, in turn creating significant social and environmental impacts in the event the infrastructure fails.

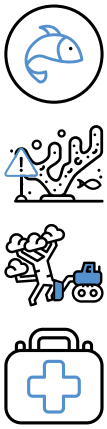
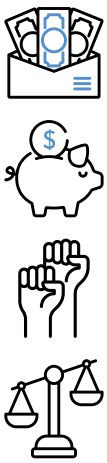
While the methodology for this guidance is focused on endogenous impacts, this is nevertheless highlighted as a key pressure here as it carries distinct impacts that are relevant for financial institutions to consider. This is also reflected in the next section on risk and materiality of these impacts.

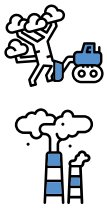
Nature-based Solutions can offer solutions to many of the pressures associated with the sector–notably destruction of coastal environment, interruption of natural processes, leaching and chemical pollution, as well as path dependency—in addition to the co-benefits they provide. This is particularly the case in the context of natural infrastructure, i.e. ecosystems left intact for their defensive services, such as coral reefs and mangrove forests. Nevertheless, green and nature-based infrastructure still involve a degree of human engineering and alteration of the natural environment, which generate impacts on environment and society. To reiterate an earlier point, what infrastructure type is best suited to a given situation will be heavily influenced by local conditions. This is an important consideration in examining approaches to coastal infrastructure as a whole, and the need to carefully assess trade-offs, benefits and co-benefits between different infrastructure options—for example in cost-effectiveness or protective capacity. While decisions on what type of infrastructure to pursue rest largely with the public sector, a better understanding of the benefits of, and opportunities for, Nature-based Solutions (as well as the uncertainty surrounding their quantifiable impacts) enable financial institutions to evaluate projects more clearly and offer a basis on which to build engagement for nature-positive outcomes with project developers and public bodies wherever possible.

Table 3 offers an overview of the key pressures associated with coastal infrastructure and their impacts on environment and society, along with an indication of which sub-sectors are likely to generate these pressures. Note that natural infrastructure features less prominently in this table than the other sub-sectors due to the reduced engineering footprint of maintaining a natural system.

Table 3: Pressures and impacts of coastal infrastructure

Key pressures	Applicable sub-sector (indirect or less likely applicability)	Impacts	Explanation
Destruction of coastal environment	Grey Green Nature-based		Particularly on greenfield sites, construction of coastal infrastructure comes at the expense of existing coastal and inshore marine habitats, which may be destroyed or degraded as a result, in addition to a loss in connectivity in natural habitats. This will reduce the climate resilience (as well as any carbon sequestration potential, as in the case of mangrove forests) of the surrounding area. This is especially significant in or near protected areas or areas of High Conservation Value.
	Grey Green Nature-based		Destruction of habitat may affect opportunities for local livelihoods, for example through destruction of fish nursery grounds affecting fishing opportunities. Depending on local context, these impacts may disproportionately affect different social groups, particularly on the basis of gender and/or wealth.
Disruption of natural processes	Grey Green Nature-based		Grey or green infrastructure development, and to a lesser extent nature-based infrastructure development can disrupt natural dynamics, such as flooding, wave action, currents, sediment transport, plant propagation and animal movements that affect biodiversity and resilience. Over time, this can fundamentally change erosion patterns affecting habitats both at and away from the site of infrastructure development.
Generation of noise, light, vibration and heat pollution during construction	Grey Green Nature-based		Heat, light, vibration and noise during both construction and operation and maintenance of infrastructure assets affect both human and animal welfare in the vicinity of the development.

Leaching and chemical pollution	Grey Green (Nature-based) (Natural)		Pollutants associated with construction (including building material such as concrete, sealants, adhesives and other chemicals) may leach into the environment, affecting habitats, animal welfare and local community health, reducing fitness and lowering the resilience of the ecosystem to any further shocks. While strongly associated with grey and green infrastructure, leaching and chemical pollution may occur for nature-based and natural infrastructure where deconstruction and remediation of the built environment is required.
Displacement	Grey Green (Nature-based) (Natural)		Designation of new infrastructure sites may conflict with existing economic activity and residential areas for local communities, and impede future development opportunities. Where such development lacks consultation or compensation, this may constitute a human rights violation. Depending on local context, these impacts may disproportionately affect different social groups, particularly on the basis of gender and/or wealth.
Loss of access	Grey Green Nature-based (Natural)		Infrastructure development along a coastline that is used by adjacent communities can result in loss of physical access to marine resources on which these communities depend, incurring economic costs and loss of livelihoods, for example in fishing or tourism. Depending on local context, these impacts may disproportionately affect different social groups, particularly on the basis of gender and/or wealth. Similarly, loss of access to sites that are considered sacred or of particular cultural significance may constitute a violation of rights of local communities and a perceived degradation in the value of the environment. While strongly associated with grey and green infrastructure, loss of access may occur for nature-based and natural infrastructure where deconstruction and remediation of the built environment is required.
Hazardous work	Grey Green Nature-based		Unsafe working environments risk injury and loss of life for workers as well as local communities, with attendant economic damage and loss of productivity. Depending on local context, these impacts may disproportionately affect different social groups, particularly on the basis of gender and/or wealth.

Path dependency	Grey (Green)		When developing grey or green infrastructure, which has a long lifespan and modifies the immediate environment significantly, this can create path dependency for this type of infrastructure to exist—e.g. a created wall will necessitate a higher wall in future. This carries significant costs and undermines the resilience of the ecosystem. Where the chosen infrastructure development is carbon intensive, for example due to the use of concrete in its production, this also creates lock-in to future carbon intensive activity to maintain and further develop the infrastructure throughout its lifetime.
Failure	Grey Green Nature-based Natural		Infrastructure is calibrated against the likelihood of events of a given magnitude. Where events exceed this magnitude, and in particular where the likelihood of more extreme events increases, the infrastructure is likely to fail, with impacts on ecosystems and societies. The significance of this pressure will vary depending on the specific purpose of the infrastructure and its location, with failure in urban areas especially significant. The impacts associated with infrastructure failure may arise as a consequence of any of the sub-sectors failing.

Relationship to other sectors of the blue economy

Coastal infrastructure is often developed in association with the development of other sectors, notably ports, for which guidance already exists. In this context, the guidance on coastal infrastructure is deeply intertwined with other developments that take place along the coast. As a result, this guidance can act as a stand-alone resource for financial institutions looking at infrastructure in isolation, or as a supplement to infrastructure for related and existing guidance chapters. This is particularly relevant in the context of leveraging co-benefits from NbS, for example in building opportunities for financing sustainable seafood in tandem with conserving a coral reef for its infrastructure benefits.

There is also a particularly strong interaction between coastal infrastructure and extractive industries, notably dredging, and to a lesser extent fishing which is closely associated both with collecting raw materials for infrastructure construction (e.g. sand), and with shaping the marine environment (either deliberately in the case of dredging or consequentially in the case of trawl fishing). The reader is encouraged to consult existing guidance for other sectors, notably on seafood and tourism, where these sectors interact. In the context of dredging, particularly where infrastructure solutions such as beach nourishment rely on dredging aggregate materials the reader is encouraged to closely consult both this infrastructure guidance and the briefing paper on harmful marine extractives for such activities.

Outlining materiality

This section articulates how and why the above impacts present material risks for financial institutions, which serves as a basis for the criteria and recommendations offered in the Criteria Annex spreadsheet. Note that these risks are specific to the social and environmental impacts associated with coastal infrastructure highlighted in this guidance. Other risks in the sector, such as liquidity, credit, and country risk are not directly covered in this resource and remain for financial institutions to assess through their existing due diligence processes.

Risks facing coastal infrastructure are significant, both in terms of the endogenous risks associated with the pressures exerted during construction, operation and maintenance (notably for grey and green infrastructure), as well as the exogenous risks associated with infrastructure failure, regardless of whether the infrastructure is grey or a Nature-based Solution.[17] This latter point is particularly relevant in the context of natural disasters against which many types of coastal infrastructure are designed to defend.

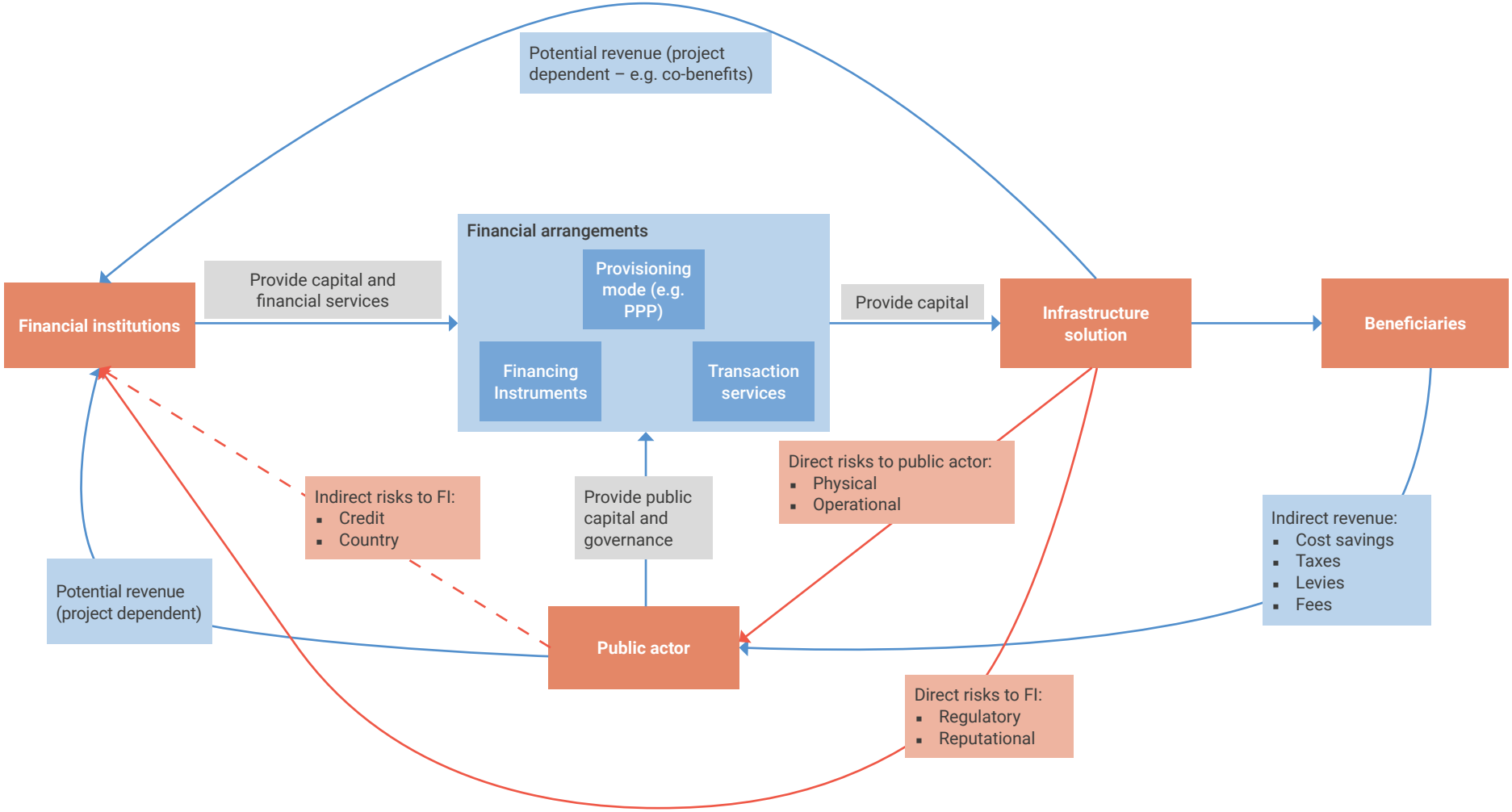
17 The methodology used by this guidance was originally developed to address endogenous impacts and risks in a sector, presenting a limitation to its applicability to exogenous risks such as climate change to which coastal infrastructure must respond. Nevertheless, this chapter makes a first attempt at framing these risks and offering guidance to financial institutions despite these constraints.

As a function both of its public good nature and need to respond to exogenous risks, risk in coastal infrastructure for financial institutions is often less direct than may be the case in other guidance sectors. While reputational and, (depending on liability and jurisdiction) regulatory risk for financial institutions still exists, physical and operational risk are more likely to be borne directly by the public sector,[18] e.g. in the case of infrastructure failure. Such risks are still material to financial institutions—though here, they present as country and credit risk where the public sector may have diminished capacity to service its financing obligations, e.g. in the aftermath of a disaster.[19] This relationship is illustrated in Figure 5.

18 Though not always—in PPPs, these risks may be shared (Tanis and Vergeer 2008).

19 Simultaneously, it is worth recognizing that this presents an opportunity for developing and extending insurance policies and risk pools for post-disaster financing for affected public bodies to ensure they can continue to service their debt obligations. This is the basis for many parametric insurance instruments to manage catastrophe risk. These policies may in turn focus on development and preferential rates for Nature-based Solutions and resilience in post-disaster recovery.

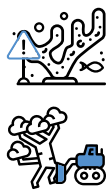
Figure 5: Illustration of relationship between direct and indirect risks, coastal infrastructure.

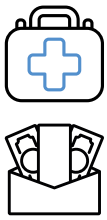


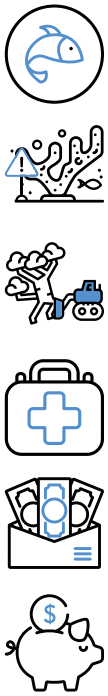
Adapted from a graphic originally featured in Bisaro and Hinkel (2018).

Table 4 outlines the risk categories associated with each key pressure in the sector and provides an overview of why these risks are material to financial institutions. As highlighted above, an important dimension to coastal infrastructure is the role for Nature-based Solutions (NbS) in mitigating impacts and therefore reducing risks for financial institutions. As a result, some of the below risks can be mitigated through integration or prioritization of NbS within coastal infrastructure. Given the primacy of climate adaptation in future financing for coastal infrastructure, it is particularly critical for this sector to build on sound valuation of assets, particularly in the context of nature-based and natural infrastructure, where the ecosystem services provided by nature underpin a resilient coastline. Clear valuation of these services is essential to building a complete picture of the materiality of risks facing coastal infrastructure financing, particularly in the context of failure of infrastructure, which in itself becomes more likely in the context of climate change.

Table 4: Overview of coastal infrastructure risks and materiality

Key pressures	Impacts	Risks	Explanation
Destruction of coastal environment		Reputational; Physical	Destruction of natural systems may reduce the long-term resilience of coastal infrastructure, even where it is replaced with a grey infrastructure alternative, creating potential physical risk. Increasingly, replacing natural systems with human-made alternatives may be considered unacceptable by the public.
		Reputational	Adverse impacts on coastal communities from infrastructure development and any unrest this may lead to may present reputational risk.
Disruption of natural processes		Physical; Operational; Reputational	Reduction in resilience because of infrastructure disrupting ecosystem services may reduce the operational effectiveness of infrastructure and present physical risks where this is linked to a reduction in protective services. Potential reputational risk may result from NGO or civil society objections to loss of biodiversity.

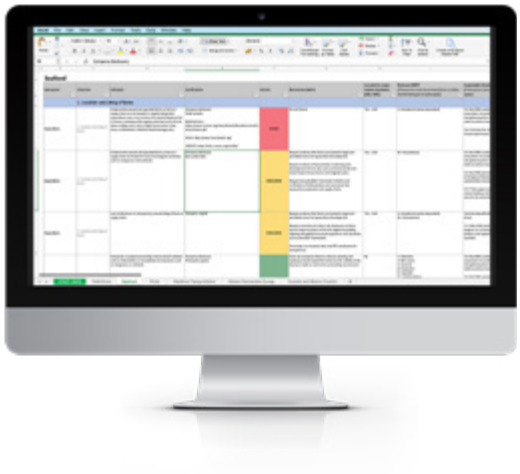
Leaching and chemical pollution		Regulatory; Operational; Reputational	New regulation of pollutants associated with construction are a source of regulatory risk for infrastructure construction, as is a failure to comply with existing regulations. Pollution and long-term leaching from infrastructure may undermine the infrastructure services provided by surrounding ecosystems, reducing resilience and presenting an operational risk. Pollution may be considered unacceptably impactful on coastal and marine habitats by the public, representing reputational risk, particularly in residential and recreational areas.
Displacement		Regulatory; Reputational	Based on regulations, there exists potential liability related to community displacement, particularly where this has happened in the absence of consultation or compensation. Where community displacement is picked up in the media this may be a source of significant reputational risk.
Loss of access		Reputational	Substantial reputational risk may exist where construction impacts cultural heritage.
Hazardous work		Regulatory	Depending on regulations, there is a risk of potential compensation costs associated with economic damage from unsafe working environments. Risk of potential liability related to injury and chronic health problems may manifest because of infrastructure development work. In addition, reputational risk may manifest because of any injury or loss of life associated with the development.
Path dependency		Physical; Operational	Operational risk may arise where the infrastructure is no longer fit for purpose and cannot provide the services it was designed for. Long-term physical risk may arise when path dependency impedes ecosystem resilience.

Failure		Physical; Regulatory; Reputational	Infrastructure failing in the face of natural disaster presents significant physical risks to assets. Infrastructure failing in the face of natural disaster presents significant potential liability over impacts elsewhere, depending on the jurisdiction. Infrastructure failure and the attendant consequences for human lives may carry significant reputational risk.

Criteria for sustainable financing

Based on the impacts and their materiality outlined above, the attached Criteria Annex for the sustainable financing of coastal infrastructure and resilience is proposed. This list of criteria and their associated scenarios offer recommendations for financial institutions. These recommendations are to: avoid the worst scenarios, challenge areas for improvement, or seek out best practice.

Within the criteria, reference is also made to how these meet the specific Sustainable Blue Economy Finance Principles, the SDGs, as well as where these align with existing standards that are relevant for coastal infrastructure. These are the aforementioned criteria of the IUCN Global Standard for Nature-based Solutions, as well as the FAST-Infra Sustainable Infrastructure Label and its criteria indicators, which was launched in late 2021 and endorsed by institutions representing over USD 100 trillion in AUM (Climate Policy Initiative 2021). While the label covers a broad range of sustainable infrastructure types and is not exclusive to coastal infrastructure as outlined in this chapter, its criteria and indicators are nevertheless a useful investor-oriented framework that build on International Finance Corporation (IFC) Performance Standards and are aligned with both EU Taxonomy and Sustainable Finance Disclosure Regulation (SFDR) frameworks.



Refer to the Criteria Annex for more detailed information

From risk to opportunity

In considering the entry points for financial institutions in coastal infrastructure and the importance of Nature-based Solutions in building climate resilience and mitigating many of the risks associated with coastal infrastructure development, it is clear there are opportunities for sustainable financing. As articulated in a recent publication on capturing natural infrastructure opportunities:

> **"We must stop the cycle of investing into projects that drive further climate change, have little resilience to this change, and then generate long-term maintenance and fiscal burdens."**
>
> **Feagin *et al.* 2021, p1362**

In the context of post-Covid-19 pandemic response and the number of initiatives worldwide to *build back better* or focus on a *green new deal* for recovery, with clear capital costs and rising debt-to-GDP ratios worldwide (Feagin *et al.* 2021), the expected capital costs associated with infrastructure throughout the remainder of the 21st century appear particularly challenging to address. Despite this, and in response to continued development and the impacts of climate change, there is a clear narrative emerging for integrating nature and NbS in coastal infrastructure. This is especially the case in developing country contexts where their cost-effectiveness and lower upfront capital requirements make NbS an attractive option both for their climate resilience as well as their applicability in cases of limited fiscal headroom, where access to debt financing for traditional grey infrastructure may be severely constrained (ibid). Nevertheless, there are technical challenges associated with implementing Nature-based Solutions that require technical assistance and support for them to be scaled up worldwide.

Increasingly, examples are emerging both of innovation in NbS for coastal infrastructure as well as ways in which financial institutions are increasingly engaging with the sector. The below case studies illustrate innovative financing mechanisms for coastal infrastructure and NbS that suggest potential ways forward for financing sustainable approaches.

Case studies

Earth Security and HSBC mangrove bond

In Australia, commercial bank HSBC is working with Earth Security to develop a template for their concept of a 'mangrove bond' to finance mangrove conservation and restoration (Earth Security 2021b). This follows Earth Security's 2021 analysis translating the values of mangroves as NbS into an investable asset, which was co-funded by HSBC among other partners. (Earth Security 2021a). The framework explores the use of green bonds to raise capital for climate adaptation, fisheries and blue carbon opportunities, exploring its application to current modes of green finance by regional governments. The concept builds on the precedent of municipal bonds for coastal adaptation in the United States and Scandinavia, for example the 2017 Miami Forever Bond, which raised USD 400 million to finance projects to combat sea level rise and flooding, allocating USD 192 million towards green-grey infrastructure, including mangrove protection and restoration. This more recent concept seeks to strengthen the focus of these instruments on the underlying value of nature-based solutions.

Earth Security intends to use the resulting framework to scale the concept across multiple mangrove-rich countries and is developing a global financing initiative to drive its replication. Bonds typically work for large-scale financing of USD 50 million and above, whereas mangrove conservation efforts and projects are typically well below this threshold. To offset this disparity, a series of aggregation models are being explored, from pooling projects with other types of green investments, to aggregating projects across multiple local and regional governments; in order to spread risks for investors while extending finance across multiple geographic locations.

The Nature Conservancy debt conversion, Belize

US-based NGO The Nature Conservancy (TNC) announced the financial close of a new USD 364 million financing for Belize in late 2021, designed to reduce the country's debt burden and unlock USD 180 million for marine conservation over 20 years. The debt conversion, which was spearheaded by TNC and arranged and executed by Credit Suisse, enables the government of Belize to repurchase and retire existing external commercial debt (of USD 553 million), generating substantial debt stock and debt service savings, a portion of which will be channelled towards marine conservation. As part of the deal, the government committed to funding more than USD 4 million annually into an independent domestic conservation fund, in addition to pre-funding USD 24 million towards the fund's endowment from the proceeds of the new financing. the latter will allow the fund to continue its grant-making activities beyond the 20-year horizon of the transaction. TNC also worked with WTW (a broker) and MunichRe (insurer of record) to obtain parametric insurance for the government, which pays the next semi-annual debt service payment if certain pre-defined weather events occur (regardless of actual damage).

Building on the success of the prior TNC-led Seychelles' debt conversion in 2016, this transaction represents the largest debt restructuring for marine conservation to date, and includes among its objectives the conservation of 30% of Belize's Exclusive Economic Zone (EEZ). Protected areas are expected to provide coverage over coral reefs, coastal mangroves and other critical habitats. Similarly to the conversion for the Seychelles, the Belizean conservation fund will be responsible for evaluating community, business, government, and NGO funding requests towards eligible blue economy uses. In addition to benefiting Belize's ocean, which is home to the UNESCO World Heritage listed Mesoamerican Reef, the protection associated with this project is expected to enhance resilience in coastal communities by safeguarding the natural infrastructure provided by mangroves and coral reefs (The Nature Conservancy 2021). The first funds are expected to flow by the end of 2022.

The deal was made based on refinancing Belize's $553 million 'superbond', its sole international commercial credit instrument, which had been trading at a deep discount reflecting the country's high indebtedness. As a result, TNC had the opportunity to conceptualize a buy-back of the superbond and its replacement with a new issuance at more favourable rates and terms. Backed by TNC's new financing, the government offered creditors to buy back the superbond at 55 cents on the dollar. The existing creditors accepted this cash offer, in part because of the associated willingness by the government to enter into and fund ambitious conservation commitments.

Central to the success of the transaction, alongside the role played by Credit Suisse in arranging the new financing, was the role of the United States International Development Finance Corporation (DFC). The DFC extended political risk insurance to the new transaction, allowing it to obtain a Moody's investment grade credit rating of AA-. This significantly de-risked the new deal, resulting in affordable all-in cost of financing to Belize. DFC's willingness to extend the insurance was based in part on their desire to see greater financing for climate resilience, which the institution is keen to replicate in other markets. Following the transaction, the country credit rating of Belize was upgraded from Selective Default to B-, reflecting the improved credit profile of the country (The Nature Conservancy 2022, personal communication 6 January).

Waste prevention and management

Azores | Photo by Cristina Mittermeier cristinamittermeier.com
The waste crisis is a truly global issue, and its causes and consequences must be addressed comprehensively and consistently. Not taking action is no longer an option anywhere In the world.

Sector and financial overview

This chapter addresses waste prevention and management, focusing on municipal solid waste in relation to the blue economy. The activities undertaken by producers (i.e. those placing products and packaging onto the market, a proportion of which will become waste post-consumption) and managers (those involved in the day-to-day practice of collecting, transferring, recycling, recovering, and disposing of waste) are distinguished. The chapter excludes non-municipal waste streams, e.g. industrial and agricultural waste, and also excludes pollution from microplastics arising from wastewater management and other sources.

In terms of its GDP contribution, a well-developed waste and resources management (WaRM) sector can be equivalent in size to the fisheries and aquaculture sector, and to the water sector in terms of job potential in coastal communities (Resources and Waste Advisory Group 2015). Financing municipal solid waste management therefore contributes directly and indirectly to the sustainable blue economy.

Waste management

Waste[20] can be defined as any substance that is surplus to the needs of the owner/generator and is discarded, irrespective of whether it has a potential to be reduced, reused, recovered or recycled. Another way of looking at waste is that it is resource that has fallen out of the economic cycle of production and consumption—an unwanted by-product and output resulting from linear economic inefficiency.

Municipal solid waste (MSW) includes waste generated from: households, commerce and trade, small businesses, office buildings and institutions (schools, hospitals, government buildings). It also includes bulky waste (e.g. white goods, old furniture, mattresses) and waste from selected municipal services, e.g. waste from park and garden maintenance, street cleaning services (street sweepings, the content of litter containers, market cleansing waste).

Municipal solid waste management (MSWM) is an essential utility service and a basic pre-requisite of public health and environmental protection. However, despite the critical role of waste management in maintaining public health, at least two billion people globally do not have access to a collection service (UNEP 2015). The absence of regular and reliable MSW collection results in citizens 'self-managing' their waste, often by open burning, littering and open dumping, including directly into drains and watercourses. Uncollected waste blocks drains and exacerbates local flooding. This, in turn, creates opportunities for disease vectors (i.e. insects and vermin) to establish. A further one billion people do not have access to a complete waste management service where the

20 Waste streams are diverse and include municipal solid waste, construction and demolition waste, agricultural and animal waste, industrial and mining waste, hazardous and health care waste, and other specific waste-types and fractions such as waste packaging, textiles, vehicles, tyres, bulky items including furniture and mattresses, electrical and electronic equipment, oils, batteries and sewage sludge. Municipal solid waste prevention and management is the focus of this chapter.

collected materials are directed to, and managed in, controlled facilities. Waste from these communities is either uncollected and self-managed or managed within incomplete MSWM systems that rely on uncontrolled disposal sites.[21]

Box 5: A note on criminality

The WaRM sector suffers from significant criminality including internationally operating organized crime networks. Waste crime is particularly evident within and from high income countries. Rogue operators receiving payments for waste 'management' services may, in fact, be illegally disposing of waste, or exporting it to jurisdictions with even weaker regulation and control systems. Illegal international trade in waste violates the Basel Convention on Control of Transboundary Movements of Hazardous Wastes and their Disposal. Monitoring, auditing and enforcement of penalties relating to illegal waste activities is challenging, not least because not all parties have ratified the convention and reporting from those that have remains voluntary.

Scale of the waste problem

MSW generation rates fluctuate widely from 0.1 to 4.5 kilograms per capita per day. An estimated 2.1 billion tonnes of municipal solid waste were generated in 2016, and this number is expected to grow to 3.4 billion tonnes by 2050 under a business-as-usual scenario. The total quantity of waste generated in low-income countries is expected to more than triple by 2050 (World Bank 2018).

Plastics represent an important fraction of MSW, ranging between 7–20% of total MSW by weight, and a significantly larger proportion of the total by volume. Studies have estimated that of MSW generated within 50 km of the coast, 275 million tons per year was plastic, and around 8 million tonnes of that plastic waste leaked into the ocean (Jambeck *et al.* 2015; UNEP 2018). Incremental contribution from rivers is estimated to add a further two million tonnes of plastic waste (Lebreton *et al.* 2017), meaning a total of 10 million tonnes per year of plastic waste is estimated to enter the ocean. A further source estimates that annual plastic flows to the ocean are expected to grow from 11 million metric tons (range: 9 million-14 million metric tons per year) in 2016 to 29 million metric tons in 2040 (range: 23 million-37 million metric tons per year) (Pew and SYSTEMIQ 2020).

In other words, of the total plastic waste generated, around 3% is estimated to find its way into global marine ecosystems. This is equivalent to 1 kg of plastic per year from every human being, or the total plastic waste generated by a population of nearly 400 million people, being dumped into the global ocean on a consistent basis, day by day, year on year. Furthermore, it has been calculated that the lifecycle of the plastics supply chain generates 1.8 billion tonnes of GHG emissions a year. If it were a country, it would be the fifth-highest emitter in the world (WWF 2021a).

21 These uncontrolled disposal sites are often located along waterways and in flood plains, along administrative boundaries and national borders; uninhabited areas where waste is 'out of sight, out of mind' and left to accumulate and gradually disperse into nature.

The economic impact of waste pollution on marine natural capital has been estimated at between USD 3,300–33,000 for each tonne of plastic waste entering the ocean (Beaumont *et al.* 2019). In the context of the estimated 10 million tonnes of plastic entering the environment each year, the upper estimate adds up to a staggering USD 330 billion annual loss to the global economy, most acutely affecting coastal communities.

While data accuracy and modelling assumptions can be questioned, and much work is needed to improve the veracity of data and forecasting, the impact of waste pollution is an issue of truly global proportions requiring serious attention from investors in the sustainable blue economy.

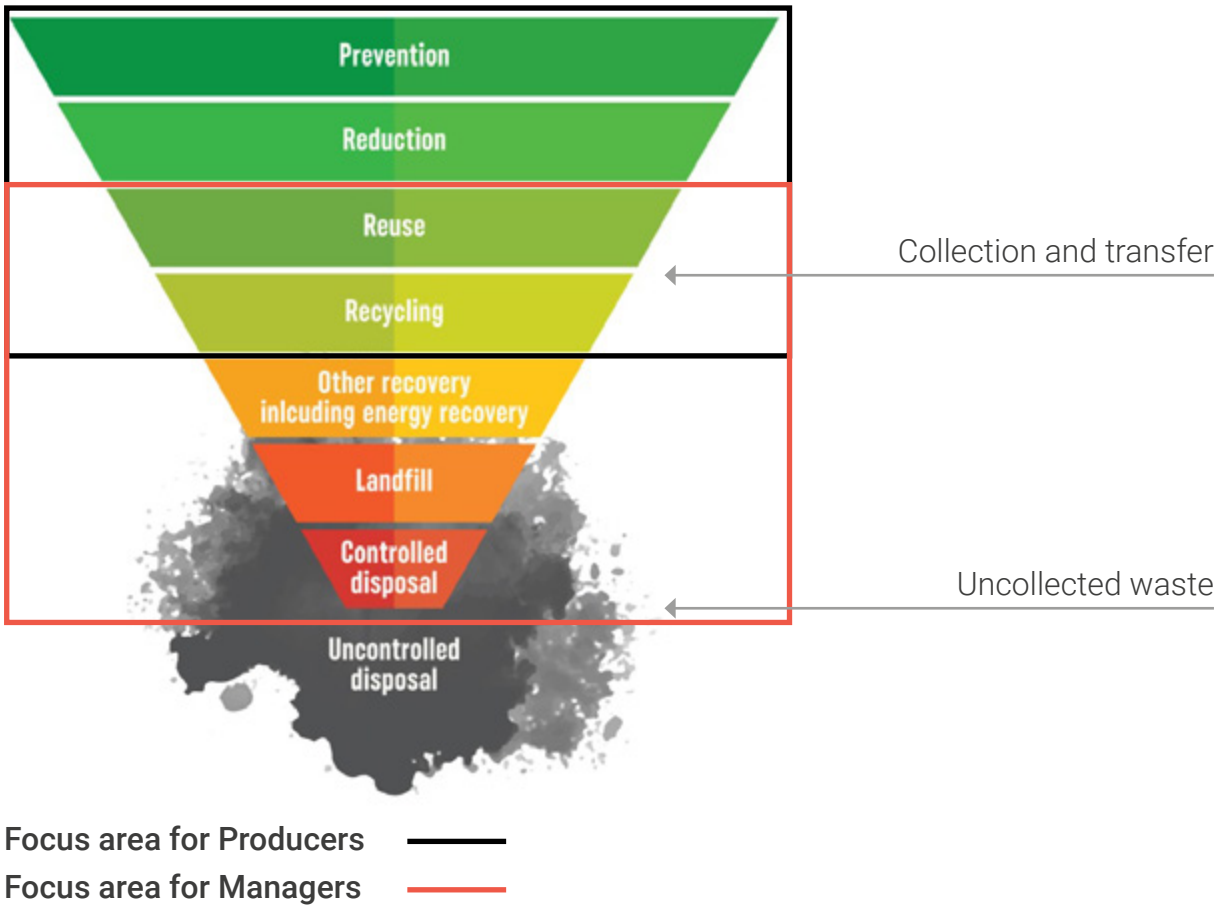
Within the broad category of waste management, it is helpful to clarify core concepts, including the waste management hierarchy and the product cycle, and how this guidance relates to both.

The waste management hierarchy

Waste management policies, plans and practices around the world are guided by the so-called waste management hierarchy. This guidance uses the version of the waste management hierarchy shown in Figure 6.

Waste collection and transfer, while not formally represented on the hierarchy, is integral to all but the top two tiers. Extending collection to all in society is the most essential and fundamental way to protect the ocean and coasts, especially in regions where there is a high risk of waste leaking into waterways. This is a fragmented area—collection providers/waste recipients include the regional, city and local authorities (public sector), and private operators of varying sizes including community-based organizations, micro-enterprises and the informal recycling sector.

Figure 6 'Inverted triangle' representation of waste hierarchy



The inverted triangle representation was first used by Wilson (1996). This version is adapted from Whiteman *et al.* (2021), which in turn was adapted UNEP and International Solid Waste Association (ISWA) (2015). Graphic: Ecuson Studio.

Table 5 shows the activities associated with municipal solid waste management include collection, sorting, reprocessing/recycling, recovery and disposal.

Table 5: Scope of managers' sub-sector

Collection	Reuse/Recycling	Other Recovery	Disposal
Service chain: collection, transfer and transport	Reuse	Energy output (including anaerobic digestion, landfill gas)	Environmentally sound management landfill
Reuse—Recycling chain: source segregate, sort, compact, bale and transport	Recycling: domestic—export (*ref. Basel Convention and SDG 15.1*)	Materials output (including composting and anaerobic digestion)	Controlled landfill

The product life cycle

The product life cycle broadly consists of the following stages:

1. **Upstream**: research and development, design, raw material sourcing and production, manufacture of products and packaging
2. **Distribution**: preparation, packing and filling, product/component delivery
3. **Downstream**: assembly, preparation for market, placement on the market, retail

The sequence and relationship between the upstream manufacture, distribution and downstream supply activities is specific to the individual producer and product.

These life cycle stages, some lasting up to several decades, encompass the product emerging from research and development, design and manufacture, extraction and processing of raw materials for component parts and finally, placement for sale on the market. In Table 6 the blocks coloured green are included in the scope of this chapter, while those coloured red are excluded.

Table 6: Scope of producers' sub-sector

Upstream	Distribution	Downstream
Research and Development	Preparation	Assembly
Design	Packing and filling	Preparation for market
Raw material manufacture	Transboundary movement of substrates, components and products	Placement on the market
Manufacture	Substrate, product and component reception	Retail

Producer responsibility

Extended producer responsibility (EPR) and product stewardship (PS) are increasingly being applied to fund and enhance the recycling/recovery performance of waste management systems. In this chapter these two approaches are grouped together into a single category of producer responsibility (PR). The basic premise of PR is that producers of products (i.e. those companies that place products on to the market) take a proportionate responsibility for organizing and financing the back-end systems to manage waste from their products' post-consumption, while incentivizing a reduction in material placed on the market through redesign, encouraging greater use of recycled content and increasing the recyclability of materials used.

Producer responsibility for packaging and packaging waste is mandatory across the EU and is in operation either as a voluntary or mandatory mechanism in other countries. PR is gaining ground in policy discourse, both nationally and globally, as the preferred instrument for incentivizing producer behaviour change and, in some applications, can be explicitly linked to efforts to prevent plastic pollution, e.g. through fee modulation to incentivize the use of widely recyclable plastics. The use of PR is growing in application

and complexity, with producers required to contribute considerably more in terms of costs and potentially having greater influence on how funds are used.

There is an evident disconnect between the countries where PR for packaging waste (including plastic packaging) has been applied, and those countries where it has not been applied and have turned into prevailing hotspots of plastic waste leakage into the ocean. Producers of fast-moving consumer goods (FMCG), who benefit from selling their products in those vulnerable markets, have, until recently, been largely absent from active discourse on how to improve waste management in lower-income countries.

Solutions to address the nature of waste generation are being explored worldwide, placing an ever-greater focus on the upstream design of products and the delivery systems to markets. Under the Ellen Macarthur Foundation's New Plastic Economy Global Commitment, 200 businesses accounting for more than 20% of the global annual plastic packaging use have signed on to 2025 targets.[22]

Encouragingly, momentum is building towards the adoption of a negotiations mandate for a legally binding UN treaty on plastic pollution that harnesses the full potential of common rules and regulations to set a robust and effective global response to plastic pollution. It would create a level playing field and supports the scaling of circular economy solutions by preventing fragmented action across geographies. Over 2 million people, 70 companies and more than ¾ of UN member states are calling for a UN Treaty to stop plastic pollution (World Wide Fund for Nature, Ellen MacArthur Foundation and Boston Consulting Group 2021).

Box 6: Alternatives to fossil-derived plastics

There has been a focus in recent years on innovation relating to "alternatives" to fossil-derived plastics, often referred to as bio-based, bio-sourced, compostable or biodegradable plastics (amongst other terms). The nomenclature relating to these materials is still confusing, with terms often being used interchangeably, promoting misunderstanding. While more evidence is needed on the extent of environmental and social benefits of these alternative materials, financing for scalability is of key importance. The potential plethora of plastic alternatives entering the markets will add complexity in the already challenging domain of recovery and recycling of plastics, however. Innovation is much needed in this domain. Principles for responsible sourcing of these alternative plastics can be guided by WWF's Bioplastic Feedstock Alliance.

22 See the Global Commitment website (ellenmacarthurfoundation.org/global-commitment/overview) for more information.

Moving to waste prevention

According to the *Global Resources Outlook 2019*, the extraction and processing of natural resources accounts for more than 90 per cent of our biodiversity loss and water stress and approximately 50% of climate change impacts (UNEP 2019). These statistics add weight to the imperative need for a paradigm shift from 'waste' management towards one of 'resource' management embedded within a circular economy.[23] Producer responsibility, described above, is an example of a policy that seeks to embed this new mindset. A resource management approach views resource scarcity as important and seeks opportunities to gain competitive advantage through circular economy solutions. A circular economy has the potential to create positive environmental and societal benefits and functions within planetary boundaries, supported by principles of sustainable development and an alternative consumption narrative (Velenturf and Purnell 2021). There is also a need for more proactive and circular resource management throughout the value chain, including end-of-life management of waste, from collection, sorting and recycling to repair, repurposing and remanufacturing.

Waste management systems are increasingly expensive in the global north and transboundary waste export governance is becoming more stringent. These pressures are driving the industry everywhere to innovate: from identifying opportunities for industrial symbiosis (where waste materials from one industry become raw materials for another) to repurposing and upcycling within a circular economy framework that compensates for a lack of economies of scale otherwise achieved through transboundary movement.

Critical for achieving resource efficiency and circular economy ambitions is the target setting process. Understanding this topic is increasingly important for financial institutions—readers are recommended to examine UNEP FI's Guidance on Resource Efficiency and Circular Economy Target Setting as part of the Principles for Responsible Banking (PRB) framework. This report provides a step-by-step guide for banks interested in increasing the sustainable use of resources such as energy, waste, water and raw materials and building a circular economy, where waste and pollution are eliminated, products and materials are kept in use at their highest value and natural systems are regenerated (UNEP FI 2021a).

Consumer responsibility

The cultural backdrop underpinning challenges for this sector is the ever-increasing consumption of products that consumers often perceive as having short-term value. As the eventual generators of waste by proxy of their consumption, consumer habits, preferences (including for convenience) and behaviour fundamentally influence not only the types of products that are placed on the market by producers, but also the nature of the arising waste streams. Conversely, it can also be argued that consumption habits are influenced by the products and services identified as desirable by businesses through their consumer insights research and placed on the market to drive growth. Ultimately, there is an interdependency between businesses and citizens that drives the growth in consumption.

23 The circular economy can be defined as a regenerative system, driven by renewable energy, that replaces the current linear 'take-make-dispose' industrial model. Materials are instead maintained in the economy and resources are shared, while waste and negative impacts are designed out.

Regardless of the dynamic that occurs, the result is the globalization of the "throwaway society". The adoption of the 'prevention at source' principle urgently needs to replace this outdated paradigm. This principle, requiring preventive measures be taken to anticipate and avoid environmental damage before it happens, should be placed front and centre of government and corporate policy. This is especially relevant with regards to tackling the scourge of plastic pollution in the ocean, and the environmental health and safety conditions in low-income and slum communities.

Understanding consumption trends can be a valuable indicator of the nature of emerging waste streams that will need to be managed to mitigate risks to the sustainable blue economy. Knowledge of the materials that make-up these potentially problematic waste streams can serve to inform financial institutions interested in this sector, for example the growing mountain of technological waste, rich with rare earth metals and chemicals. Learning lessons from systems that deal with well-established waste streams such as packaging, factoring in circular economy principles from the outset and forward planning such as creating economically viable markets for recovered and recycled materials, could help to ease demand for waste management services, and improve their effectiveness.

Deposit Return Systems

Deposit Return Systems (DRS) are an effective way to incentivize consumers to return high quality materials back into the production system. This traditional method of returning packaging materials has largely been replaced by single use packaging over recent generations. Well-designed DRS can achieve extremely high (90%+) return rates for packaging materials placed on the market, with knock-on effects including reduction of litter and facilitating collections of cleaner and higher quality, source-separated materials. DRS are a unique policy approach, requiring participation from both producers and citizens to ensure impactful results.

Financing the sector

Waste management services are a net cost activity, the long-term sustainability of which depends on revenue from the primary generators of waste. This principle is justification for the so-called 'polluter pays principle'. Revenues from the sale of recovered materials, e.g. recyclables or energy extracted from municipal solid waste incineration, rarely cover more than a fraction of the costs of the waste management system. It is critical for banks, insurers and investors to understand that the financials of the waste and resources management sector are essentially underpinned by revenues from waste generators who often pay for services indirectly, for example, through participation in voluntary or mandatory EPR (or not at all). Affordability of user charges and a strong regulatory and institutional enabling environment are key to attracting finance.

The key problem is that most of the current costs associated with waste are externalized. Effective policies that properly price waste creation are lacking, and producers are not paying the full costs associated with waste arising from their products. Instead, most of these costs are being paid by society at large and the environment. Discussion of the definition of 'full costs' is ongoing, with stakeholders challenging what they constitute based on their individual perspectives.

Financial frameworks, especially the ability of city governments to collect and retain revenue to sustain operational, maintenance and investment costs, are severely lacking in many countries, constraining the ability to attract private sector investment. City governments tend to keep local service charges low, which engenders a strong dependency on fiscal transfers from state budgetary sources. A lack of rights and responsibilities for municipal authorities to collect own-source revenue severely constrains their ability to invest in the equipment and infrastructure needed to extend and improve services. There is therefore a huge need for finance in the WaRM sector.

Due to the need for different operational and technical solutions and the complex cost and revenue structures of the WaRM sector, financing comes from multiple sources—typically across four broad categories: public financing, private financing, public-private partnerships, and donors and grants (BioEnergy Consult 2020).

IFIs currently investing in whole waste management systems

International Financial Institutions (IFI) typically invest in the whole waste management system, analysing cost recovery of operations and capital costs over the lifetime of investments. This will depend on the level of affordability but also on the willingness of the authorities to impose tariff reforms. Depending on the income level of the country and the policy context, revenues from user charges (or taxes) and from sale of output from recycling and recovery may finance investments at least partially if not completely. To meet the affordability threshold of the required investments, co-financing in the form of grants is often required from public local and national sources.

Private finance

Private finance in the waste and resources management sector tends to be forthcoming in countries where the sector framework conditions, and the services operating within that framework, are well established, making the likelihood of a successful and profitable venture more tangible. However, establishing an entire system more likely requires a blended financing approach; for example, an initial capital investment alongside a mix of longer-term revenue sources dependent on public sector action (user charges or taxes, sale of system outputs, cross-subsidies from users or from other services such as street cleaning, green space management or seasonal services).

Using fiscal instruments to encourage investment

In many countries, private finance 'back-end' waste recovery and disposal infrastructure is underpinned by fiscal instruments such as landfill taxes, recycling credits, and preferential feed-in tariffs for energy generated from waste and supplied into the electricity grid or district heating. The use of preferential feed-in tariffs has, for instance, catalysed the transformation of the Chinese waste management industry over the past 10–15 years, resulting in a massive upsurge in domestic investment and increasing international investment. See the case study on Transformational investment in Chinese waste management systems.

Greatest investment demand for front-end collection systems

When looking at total capital expenditure demand over a 10–15-year period, investing in 'front-end' collection systems represents the largest share of investment demand in almost all development contexts (Wasteaware 2022). This is also well aligned to the instinct of city mayors and managers—to maintain clean, waste-free urban environments that contribute to the health and happiness of citizens. Despite this, continuing population influx and the resulting generated waste, along with factors such as affordability, make waste collection service coverage a challenge in many of the world's most rapidly developing cities. (UNEP and ISWA 2015).

Financing waste prevention

Because waste prevention initiatives are more commonly conceived by businesses, they tend to be financed at a pace dictated by an individual business' commercial environment. By contrast, waste management services are primarily dependent on recurring capital expenditure, financed mostly by public funds, but in some higher income countries from private funds anchored to waste management infrastructure, supply and service contracts.

Financing on the 'producer' side plays a role in waste prevention. A focus on waste prevention can be stimulated by regulatory signals and fiscal policies such as increasing the cost of waste management by tightening regulatory controls on product standards. However, regardless of the regulatory and policy framework, specific waste prevention measures must originate at the research and development stage, including the product design phase and be factored in as part of consumer marketing proposition decision-making.

Opportunities to finance the circular economy

Emerging opportunities for private finance include repair and repurpose hubs, reuse systems and remanufacture activities. Additional opportunities include supporting businesses with ambitions to restructure current operating models. These include moving away from the linear and transactional marketing and selling of goods and towards more circular models such as offering and guaranteeing high quality services that take responsibility for maintaining and repairing goods sold. Financing opportunities in upstream producer activities that ultimately have a positive, material impact on down-

stream solid waste management may also exist. Such initiatives include design for repair; business models favouring maintenance, sharing and co-ownership; and waste management contracts with fees based on waste reduction targets rather than amount of waste handled.

The continued growth of innovation-led start-ups present investment opportunities. Start-ups of relevance to waste prevention include businesses seeking to launch alternative technologies to tackle unsustainable resource consumption—for example, renewable materials that decouple the use of plastics from fossil-fuels, highly durable or highly recyclable materials, or technology advancements for waste recovery that support a circular economy.

Investing in technologies

There is a tendency amongst private investors to search for a technological fix—a quick-win 'solution' such as importing a new technology to solve a 'problem'. Targeted 'green' finance from banks, insurers and investors in the waste sector has tended to focus on high-tech investments, with the anticipation of a short-term return on investment. There is a strong interest in financing/underwriting advanced thermal recovery technologies, in many cases targeting the application of such technologies to lower-income cities and countries. Such projects are often insufficiently geared to the local realities and are rarely underpinned by feasibility studies that take into account existing local waste collection service coverage, volume and type of waste. As a result, these projects often fail to mature.

Furthermore, such projects often promote the application of advanced thermal recovery and chemical recycling technologies (such as gasification and pyrolysis) that are not yet proven on a commercial scale for municipal solid waste, even in high-income countries. Nor are they proven to be beneficial overall from an environmental perspective, yet they continue to attract large investments. Of more concern, the focus on end-of-life solutions, including the emergence of these technologies, does little to encourage a reduction in plastic usage and shift the overarching systems away from a dependency on these materials (Breaking the Plastic Wave 2020).

Provided there is an enabling policy environment and no issues with affordability to pay user charges, larger recycling and recovery solutions can be attractive investment projects and create opportunities for commercial financing and Public Private Partnership (PPP) projects. For such arrangements to work, there needs to be a competent local authority or an established producer responsibility system. In addition, appropriate (and consistent) gate fees need to be built into the contract to assure the financial viability of larger investments.

Box 7: Plastic crediting

An emerging but controversial area of finance is plastic crediting. Conceptually, a plastic credit is a transferable unit that represents a specific quantity of plastic waste that has been removed from the environment—similar in principle to the more established practice of carbon crediting. Through the purchase of credits, a business could, in theory, balance their plastic footprint and claim 'plastic neutrality'. However, at this nascent stage of development, it is not yet known whether this approach can or will deliver transformational impact on this issue.

Despite good intentions, the organizations currently operating in this space are doing so without an agreed global standard, methodology framework or operational transparency. In the absence of these crucial factors, there is a risk that involvement in plastic crediting and claims of plastic neutrality could be viewed as greenwashing, allowing companies to offset their plastic footprint while continuing to pollute with business-as-usual. Because plastic crediting schemes are not integrated into national/local waste management systems, they risk undermining progress on introducing policies such as EPR—a proven and effective policy intervention for financing waste management activities—or even displacing EPR completely.

Plastic crediting is not a replacement for robust plastic waste reduction strategies. However, if properly developed, it could form part of a holistic approach by businesses and policymakers to tackle the plastic pollution crisis. With the correct measures and governance in place, plastic crediting could support the development of circular plastic systems. However, the legitimacy, environmental benefits and social accountability of these activities need to be monitored if they are to deliver transformational impacts (WWF 2021c).

Programmatic financing

The case for programmatic financing is strengthening, especially within the framework of climate financing mechanisms. While such approaches are in their infancy, the aim is to increase the impact of climate finance while reducing the transaction costs of leveraging that investment into place. The approval of the Paris Agreement Article 6 Rulebook at COP26 creates opportunities for climate finance in the waste sector as part of international emission trading, but only time will tell how national frameworks and carbon markets will respond. This mechanism may present an opportunity for an output-based financing model if emission reduction credits from waste projects are once again deemed valuable on the market. Alternative routes to scaling up financing include incorporating waste sector requirements within wider and integrated urban infrastructure programmes/projects, such as Smart or Green Cities Programmes.

Key environmental and social impacts and dependencies

When considering its contribution to combating global environmental issues such as climate change and marine pollution, waste prevention and management is somewhat unique. It is estimated that current consumption, production and waste management practices contribute 45% to global GHG emissions (Ellen MacArthur Foundation 2021). While the transition to renewable energy sources remains an imperative for tackling climate change, more responsible use of resources can also play its part in tackling the climate and nature crises. According to recent research from the EU, circularity in the building sector could cut emissions by 61% (Braticius 2020). Overall this mitigation potential could be about 30% of global emissions (UNEP and ISWA 2015).

Deficiencies in waste management are responsible for by far the largest proportion of macroplastic waste emissions to the ocean and are a major source of microplastics (McKinsey Center for Business and Environment and Ocean Conservancy 2015; Schmidt *et al.* 2017). Plastic waste leaked into marine ecosystems can persist for decades, damaging biodiversity and compromising animal welfare, and having social and economic impacts. Worryingly, the scale of impacts, including monetary, of marine plastic pollution on most, if not all, ecosystem services is becoming increasingly apparent (Beaumont *et al.* 2019). Fundamentally, the impacts come down to two central issues: the failure to collect waste and the leakage of waste streams into the environment.

Failure to collect waste

The failure to collect waste usually happens when the local SWM service is overwhelmed; the infrastructure and equipment necessary for effective community services is underfunded, under-performing and cannot keep pace with the physical demand for waste collection. Rapidly expanding urban populations, insufficient and inadequate data, poor urban planning, and the expansion of informal settlements that are difficult to service with conventional waste collection vehicles—these are all major causes of deficiencies in waste collection service coverage.

Communities without regular and reliable collection systems are forced to self-manage waste, by open burning and/or dumping of waste on nearby open plots of land, in public drainage systems and water channels. The subsequent effects on public health and the quality of the environment can be devastating for citizens and detrimental to local community cohesion.

Urban areas blighted by uncollected waste are the ideal breeding ground for vectors of disease. Piles of decomposing material become feeding grounds for vermin, and clogged drains create standing pools of water, providing ideal conditions for insects to lay eggs and thrive. One outcome from this situation is disease outbreaks that can sweep through whole town and city populations, often crippling entire communities.

The informal recycling sector (IRS) plays an important role in compensating for gaps in formal waste services, by helping to recover resources and manage materials that should be managed by local government bodies. The estimated 20 million informal

recyclers play a crucial role in providing what is often the only waste collection available in some cities. For many people living in slums, shanty towns, favelas or informal settlements, recovering, recycling, reusing, sharing and transforming are a matter of survival (Marino 2021). Furthermore, the impacts from unmanaged and mismanaged waste disproportionately impact already marginalized communities, including women and children. Workers in waste management frequently suffer from a high incidence of occupational health impairments including musculoskeletal problems, nerve damage, respiratory issues, wounds and infections, and in extreme cases, loss of life. A link can be made between a high incidence of respiratory disease in communities with proximity to uncontrolled disposal sites where waste is openly burned (Verma 2016).

Sadly, child labour is not uncommon, especially in the informal recycling sector. Children working as waste pickers sell recovered materials to supplement their, and their families', livelihoods. It is not uncommon to see children working on uncontrolled disposal sites in appalling conditions.

Leakage of waste into the environment

Leakage of waste into the environment has numerous negative impacts. Leakages into soil and waterbeds can block drainage, aggravate flooding during storm events, and be carried over into waterways and float downstream, eventually reaching the ocean.

Plastics decay slowly into smaller and smaller particles (i.e. microplastics), affecting the quality of marine environments, impacting animal welfare and inadvertently being ingested by humans (e.g. via drinking water, eating seafood or airborne particles).

Building upon the two central issues identified in the SWM sector, the pressures and their impacts on the environment and society are listed in Table 7.

Table 7: Pressures and impacts of waste prevention and management

Pressures	Impacts	Explanations
No end-of-life considerations when research-ing, developing and designing products		Production and consumption generate waste that is highly likely to leak to marine environments. Birds, fish, mammals and turtles ingest and become entangled in marine litter. Contaminating the food chain with plastic puts fish and shellfish stocks, and their prey, at risk of lethal or sub-lethal harm affecting population levels of the species.
		Marine plastic impacts all ecosystem services, including provision-ing services (genetic materials, plant or animal materials, fibres, aquaculture or wild seafood), regulatory services (climate regulation, water conditions, pest/disease control, life cycle maintenance, medi-ation of flows and wastes) and cultural heritage (heritage, recre-ational, sacred, physical, scientific, educational use).
		Most damaging to animal welfare are plastic products/packag-ing that end up as marine litter. Animals can ingest it, or become ensnared and constricted, reducing their welfare and potentially killing them.
		Marine waste, especially plastic, reduces the ocean's potential to sequestrate carbon. It takes hundreds of years to break down ocean plastic through sunlight and heat, releasing GHGs in the process. Also, zooplankton—thought to play a critical role in carbon sequestra-tion (Ferguson 2018)—are affected.
		Many products can alter the biochemical content of waterbodies: electronic waste can seep heavy, polluting metals such as lead; there can be traces of chemical products in dumped plastic containers; plastics do not degrade, but break down into microplastics etc. Algae and bacteria proliferate changing the marine biological, chemi-cal and geological cycles.
		The ecosystem service loss caused by marine litter translates into loss of access to sustainable livelihoods from fishing, aquaculture, tourism, etc.
Extensive use of single-use plastics		Extensive use of single-use plastic favours littering and the leakage of litter to marine environment. Birds, fish, mammals and turtles ingest and become entangled in marine litter. Contaminating the food chain with plastic puts fish and shellfish stocks, and their prey, at risk of lethal or sub-lethal harm affecting population levels of the species.
		Marine plastic impacts all ecosystem services, including provision-ing services (genetic materials, plant or animal materials, fibres, aquaculture or wild seafood), regulatory services (climate regulation, water conditions, pest/disease control, life cycle maintenance, medi-ation of flows and wastes) and cultural heritage (heritage, recre-ational, sacred, physical, scientific, educational use).
		Most damaging towards animal welfare are plastic products leaked into marine environment. Animals can ingest it or become ensnared and constricted, reducing their welfare and potentially killing them.

Pressures	Impacts	Explanations
		Marine waste, especially plastic, reduces the ocean's potential to sequestrate carbon. It takes hundreds of years to break down ocean plastic through sunlight and heat, releasing GHGs in the process. Also, zooplankton—thought to play a critical role in carbon sequestration (Ferguson 2018)—are affected
		The ecosystem service loss caused by marine litter translates into loss of access to sustainable livelihoods from fishing, aquaculture, tourism, etc.
Losses of substrate into the environment during transport		Loss of substrate into the environment during transport results in marine litter, especially through accidents during sea-based transport. Marine litter may also occur during land- or river-based transport, as substrate may be washed into the sea. Birds, fish, mammals and turtles ingest and become entangled in marine litter. Contaminating the food chain with plastic puts fish and shellfish stocks, and their prey, at risk of lethal or sub-lethal harm affecting population levels of the species.
		Marine litter, especially plastic, impacts all ecosystem services, including provisioning services (genetic materials, plant or animal materials, fibres, aquaculture or wild seafood), regulatory services (climate regulation, water conditions, pest/disease control, life cycle maintenance, mediation of flows and wastes) and cultural heritage (heritage, recreational, sacred, physical, scientific, educational use).
		Plastic marine litter is most damaging to animal welfare. Animals can ingest it or become ensnared and constricted, reducing their welfare and potentially killing them.
		Marine litter, especially plastic, does not decompose in marine environments. Instead, it degrades into smaller and smaller components (i.e. microplastics). Algae and bacteria proliferate, changing the marine biological, chemical and geological cycles. Plastics are a stressor, and can act in concert with other environmental stressors such as those arising from other pollutants, changing ocean temperatures, ocean acidification, and the overexploitation of marine resources.
		The ecosystem service loss caused by marine litter translates into loss of access to sustainable livelihoods from fishing, aquaculture, tourism, etc.

Pressures	Impacts	Explanations
Product placement in markets where the capability to handle the generated waste streams is lacking		Where the capability of handling generated waste is lacking, there is a higher likelihood of waste mismanagement and littering. Large quantities of waste are likely to leak into the environment and become marine litter. Marine animal welfare is severely hindered through ingestion or entanglement. Contaminating the food chain with plastic puts fish and shellfish stocks, and their prey, at risk of lethal or sub-lethal harm affecting population levels of the species.
		Marine litter, especially plastic, impacts all ecosystem services, including provisioning services (genetic materials, plant or animal materials, fibres, aquaculture or wild seafood), regulatory services (climate regulation, water conditions, pest/disease control, life cycle maintenance, mediation of flows and wastes) and cultural heritage (heritage, recreational, sacred, physical, scientific, educational use).
		Marine waste, especially plastic, reduces the ocean's potential to sequestrate carbon. It takes hundreds of years to break down ocean plastic through sunlight and heat, releasing GHGs in the process. Also, zooplankton—thought to play a critical role in carbon sequestration (Ferguson 2018)—are affected. Mismanagement of waste results in GHG emissions through methane generation in landfills, black carbon emissions through open burning and missed opportunities in the recycling and recovery chain to replace high embedded carbon virgin materials with secondary materials or to switch fuel.
		Product placement encourages consumerism where the generated waste cannot be handled properly by the public SWM services. This creates marine litter and reduces quality of life in unsanitary settlements in coastal areas. This in turn will decrease the livelihoods of local communities by impacting their health, environment, community and business opportunities.
		Mismanaged waste serves as a vector for infections and diseases, a breeding ground for vermin, a water contamination source etc. Uncollected waste that ends up in ditches and open sanitation sewage systems clogs waterways and aggravates negative health impacts.
		Mismanaged waste represents missed opportunities to extract material and resource value of materials. Health issues prevalent in affected communities result in loss of productivity and related economic damage.
		Failure of collection and waste management services are most common in peri-urban, suburban and rural areas, where income levels are low and communities vulnerable. It is often women and children who must self-manage waste as part of household chores, either by carrying it to faraway disposal or collection points or burning/burying it in unsanitary conditions that affect their health.

Pressures	Impacts	Explanations
The sale of products banned in one market in a different market with looser environmental policies		Moving products sold in a market where there are regulations banning their sale to an alternative market that does not have the same restrictions in place can shift the waste generation to the new market with looser environmental policies and control. This can result in additional waste being generated and leaked into the environment. Birds, fish, mammals and turtles ingest and become entangled in marine litter. Contaminating the food chain with plastic puts fish and shellfish stocks, and their prey, at risk of lethal or sub-lethal harm affecting population levels of the species.
		Marine litter, especially plastic, impacts all ecosystem services, including provisioning services (genetic materials, plant or animal materials, fibres, aquaculture or wild seafood), regulatory services (climate regulation, water conditions, pest/disease control, life cycle maintenance, mediation of flows and wastes) and cultural heritage (heritage, recreational, sacred, physical, scientific, educational use).
		In extreme cases, exporting products banned when they become waste and are difficult or impossible to treat, may impact communities in extreme ways. The leaked waste may endanger heritage, sacred places, traditions and customs linked to nature and the marine environment of indigenous communities.
		Banned products generate difficult-to-manage waste. In certain places such as small islands, this may damage livelihoods, especially for communities that depend on fishing, seafood or beach tourism.
Placement on the market of containers with chemicals and toxic materials		An indirect but significant impact of plastic pollution is the potential chemicals and toxic materials that leak into the oceans, contaminating water and negatively impacting biodiversity.
		Ecosystems that have been heavily contaminated with chemical products take years to recover. Until then, the provision of ecosystem services is stopped.
		Changes in the chemical balance of waterbodies can be fatal for some species of marine wildlife. In some cases, they may damage the marine ecosystem food chain and harm all species.
		Traces of chemical products remain in their containers (if they are not openly dumped) in waterbodies, where their presence changes the chemical and biological characteristics of the marine environment.
		Contamination of the marine ecosystem reduces the ecosystem services. Communities depending on services, such as fishing, aquaculture, beach tourism, and the recreational value of the sea will lose access to livelihoods.
		Changes in the chemical balance of waterbodies damages marine habitats, affecting indigenous species. This may increase the prevalence of disease in local communities exposed to the contaminated marine environment, for example through ingesting contaminated wild fish and seafood.

Pressures	Impacts	Explanations
Insufficient waste collection and transfer		Uncollected waste blocks drainage, causes flooding during storm-water events, localized dumping, open burning, and leakage during collection and transport. Large quantities of waste are likely to leak into the environment and become marine litter. Birds, fish, mammals and turtles ingest and become entangled in marine litter. Contaminating the food chain with plastic puts fish and shellfish stocks, and their prey, at risk of lethal or sub-lethal harm affecting population levels of the species.
		Marine litter, especially plastic, impacts all ecosystem services, including provisioning services (genetic materials, plant or animal materials, fibres, aquaculture or wild seafood), regulatory services (climate regulation, water conditions, pest/disease control, life cycle maintenance, mediation of flows and wastes) and cultural heritage (heritage, recreational, sacred, physical, scientific, educational use).
		Most damaging to animal welfare is plastic marine litter. Animals can ingest it or become ensnared and constricted, reducing their welfare and potentially killing them.
		Marine waste, especially plastic, reduces the ocean's potential to sequestrate carbon. It takes hundreds of years to break down ocean plastic through sunlight and heat, releasing GHGs in the process. Also, zooplankton—thought to play a critical role in carbon sequestration (Ferguson 2018)—are affected. Mismanagement of waste results in GHG emissions through methane generation in landfills, black carbon emissions through open burning and missed opportunities in the recycling and recovery chain to replace high embedded carbon virgin materials with secondary materials or to switch fuel.
		Marine litter, especially plastic, does not decompose in marine environments. Instead, it degrades into smaller and smaller components (i.e. microplastics). Algae and bacteria proliferate, changing the marine biological, chemical and geological cycles. Plastics are a stressor, and can act in concert with other environmental stressors such as those arising from other pollutants, changing ocean temperatures, ocean acidification, and the overexploitation of marine resources.
		The ecosystem service loss caused by marine litter translates into loss of access to sustainable livelihoods from fishing, aquaculture, tourism, etc.
		Waste that is collected but escapes the MSW service chain, or that is not promptly transported from collection points, generates poor living conditions for affected communities, causing bad odour, vectors for infection, health or fire hazards.
		Failure of collection and waste management services are most common in peri-urban, suburban and rural areas, where income levels are low and communities vulnerable. It is often women and children who must self-manage waste as part of household chores, either by carrying it to faraway disposal or collection points or burning/burying it in unsanitary conditions that affect their health.

Pressures	Impacts	Explanations
Insufficient capacity in recycling systems and/or markets for recovered materials		A good recycling system, and supporting demand for recovered secondary raw materials, creates a pull effect for recyclable materials. In communities without recycling systems, plastic and other dry recyclables may be left uncollected and leak into the marine environment. Birds, fish, mammals and turtles ingest and become entangled in marine litter. Contaminating the food chain with plastic puts fish and shellfish stocks, and their prey, at risk of lethal or sub-lethal harm affecting population levels of the species.
		Marine litter, especially plastic, impacts all ecosystem services, including provisioning services (genetic materials, plant or animal materials, fibres, aquaculture or wild seafood), regulatory services (climate regulation, water conditions, pest/disease control, life cycle maintenance, mediation of flows and wastes) and cultural heritage (heritage, recreational, sacred, physical, scientific, educational use).
		Plastic marine litter is most damaging to animal welfare, but other dry recyclables have negative impacts. Animals can ingest it or become ensnared and constricted, reducing their welfare and potentially killing them.
		Marine waste, especially plastic, reduces the ocean's potential to sequestrate carbon. It takes hundreds of years to break down ocean plastic through sunlight and heat, releasing GHGs in the process. Also, zooplankton—thought to play a critical role in carbon sequestration (Ferguson 2018)—are affected. A lack of recycling results in GHG emissions through black carbon emissions, open burning and missed opportunities in the recycling and recovery chain to replace high embedded carbon virgin materials with secondary materials.
		Marine litter, especially plastic, does not decompose in marine environments. Instead, it degrades into smaller and smaller components (i.e. microplastics). Algae and bacteria proliferate, changing marine biological, chemical and geological cycles. Plastics are a stressor, and can act in concert with other environmental stressors such as those arising from other pollutants, changing ocean temperatures, ocean acidification, and the overexploitation of marine resources.
		The ecosystem service loss caused by marine litter translates into loss of access to sustainable livelihoods from fishing, aquaculture, tourism, etc. Also, lack of or insufficient recycling leads to loss of access to sustainable and inclusive livelihoods for formal and informal recyclers.
		Waste that ends up in a landfill or the ocean is a lost resource, an economic damage and a loss of resource productivity. Recycling systems employ people from vulnerable groups and offer them a legal and stable income. Uncaptured recyclables result in reduced opportunities for urban unskilled and poor to work in the recycling chain and escape poverty.

Pressures	Impacts	Explanations
Choice of new technologies solely based on feasibility or technological considerations		Choosing solely on technological considerations may result in heavy investment in a facility that needs 10–20 years of operation to generate profit. This may result in stagnating sector development, and lost opportunities and productivity in the waste sector.
Uncontrolled disposal		Waste from uncontrolled disposal and illegal dumps is easily washed to river ways, finding its way to marine environments. Birds, fish, mammals and turtles ingest and become entangled in marine litter. Contaminating the food chain with plastic puts fish and shellfish stocks, and their prey, at risk of lethal or sub-lethal harm affecting population levels of the species.
		Marine litter impacts all ecosystem services, including provisioning services (genetic materials, plant or animal materials, fibres, aquaculture or wild seafood), regulatory services (climate regulation, water conditions, pest/disease control, life cycle maintenance, mediation of flows and wastes) and cultural heritage (heritage, recreational, sacred, physical, scientific, educational use).
		Where uncontrolled disposal sites are close to or on the shore, the coastal and marine habitats are degraded by the presence of the waste through contamination of soil, air and water.
		Marine animal welfare is severely hindered by plastic waste (e.g. through ingestion or entanglement) that originated from uncontrolled disposal or illegal dumpsites.
		Where illegal disposal and uncontrolled disposal sites are close to or on the shore, communities may lose access to sustainable and inclusive livelihoods linked to the damaged ecosystem services. These include loss of access to healthy food, loss of physical access to the sea, loss of recreational value and beach tourism and damage to shipping.
		Accumulation of waste and uncontrolled disposal have a negative health impact on the population for example through leachate contaminating the water supply, favouring the spreading of vector borne diseases and fire hazards. Waste collection workers who transport dispose waste on uncontrolled or illegal sites are especially exposed to health and safety hazards.
		Uncontrolled disposal sites or illegal disposal is typically established at the periphery of settlements in the vicinity of poor neighbourhoods. This increases the negative pressure and stigma on vulnerable groups, and degrades the value of local land and real estate.
		Uncontrolled and illegal disposal sites generate a perceived or real degradation of the cultural value of environment. Such sites attract negative attention from local communities and active opposition and complaint.

Pressures	Impacts	Explanations
Transboundary movement of waste		It is not uncommon for exported waste to leak in transit or be mismanaged in the importing country. Such waste may end up in marine environments. Birds, fish, mammals and turtles ingest and become entangled in marine litter. Contaminating the food chain with plastic puts fish and shellfish stocks, and their prey, at risk of lethal or sub-lethal harm affecting population levels of the species.
		Marine litter impacts all ecosystem services, including provisioning services (genetic materials, plant or animal materials, fibres, aquaculture or wild seafood), regulatory services (climate regulation, water conditions, pest/disease control, life cycle maintenance, mediation of flows and wastes) and cultural heritage (heritage, recreational, sacred, physical, scientific, educational use).
		Marine animal welfare is severely hindered by plastic waste (e.g. through ingestion or entanglement) that originated from leakage from transboundary movement of waste.
		Marine litter, especially plastic, does not decompose in marine environments. Instead, it degrades into smaller and smaller components (i.e. microplastics). Algae and bacteria proliferate changing the marine biological, chemical and geological cycles. Plastics are a stressor, and can act in concert with other environmental stressors such as those arising from other pollutants, changing ocean temperatures, ocean acidification, and the overexploitation of marine resources.
		Transboundary movement of waste can reduce access to recyclable/recoverable materials, impacting the livelihoods of the local population. Imported waste may place additional pressure on municipal waste management services without sufficiently developed recycling/recovery systems, and thus not compensate livelihood losses.
		Incurring the operational costs associated with waste imported from other countries/regions strains the budgets of local MSW service operators. This creates economic damage and a loss of productivity to waste service operators.
Lack of, or ineffective, environmental education, awareness and behaviour change campaigns		It is difficult for individuals choose more sustainable and less GHG-intensive alternatives if they are not empowered to be conscious of their personal carbon footprints and to make an informed decision. Lack of awareness may result in wasteful and carbon intense consumption and waste management.
		New measures in MSW systems (e.g. service provision in new areas, waste source segregation) rely on the compliance of serviced residents. Otherwise, the measures fail to produce the expected outcomes, further straining the operational costs of the system and the possibility for cost recovery.
		The personal consumption and disposal habits of individuals have a significant impact on waste generation in modern, consumer society. Where individuals are not conscious of the environmental impacts of their own actions and the marine litter that results, waste prevention or reduction measures have limited success. This generates a perceived or real degradation of the environment and its value.

Pressures	Impacts	Explanations
Failure to include the informal recycling sector		The informal recycling sector offers an alternative to self-management of waste in vulnerable communities, preventing waste leakages that would otherwise arise from mismanagement of waste, especially recyclables, and have a negative impact on marine ecosystems.
		The informal recycling sector provides collection services in areas that would otherwise not have access to the formal MSW system. This reduces public health hazards normally associated with self-management of waste and increases access to sustainable livelihoods in underserviced communities. The informal sector gains access to sustainable livelihood in inclusive recycling systems.
		Workers in the informal recycling sector often report societal marginalization, many of them being part of vulnerable social groups from low-income communities. Gender and social issues also arise from the overrepresentation of women, and from the presence of child labour. Excluding such groups from recycling systems will further deepen inequality between social groups and based on gender.
		In low- and lower-middle-income countries, informal waste collection and recovery activities may be the only way for marginalized individuals to earn a stable income. Failing to include the informal sector in waste management activities will reduce the likelihood that urban poor and marginalized groups will have access to a livelihood and escape poverty or extreme poverty.

Outlining materiality

This section serves to articulate how and why the above impacts present material risks for financial institutions, which serves as a basis for the criteria and recommendations offered in the companion Criteria Annex. Note that these risks are specific to the social and environmental impacts associated with waste management highlighted in this guidance.

Risks facing waste management and prevention are significant. These stem from risks associated with pressures exerted by the choices made by our 'throwaway culture' through designing products, the prevalence of single-use plastics and lack of infrastructure to collect, transfer, recycle, recover and dispose of waste safely.

Risks in waste management for financial institutions relate to the externalized nature of the costs, where funding for waste management is underpinned by revenues from waste generators who often pay for services indirectly (or not at all).

Waste management is a net cost activity. Revenues from the sale of recovered materials, e.g. recyclables or energy extracted from municipal solid waste incineration, rarely cover more than a fraction of the costs of the waste management system. Affordability of user charges and a strong regulatory and institution enabling environment are preconditions for investment opportunities and are not necessarily in place.

In many locations, the cost of 'waste' continues to be externalized rather than embedded into the price of products. Producers need to accept their responsibilities in the markets where they place their products to avoid risking their global reputation and long-term competitiveness.

Table 8 outlines the risk categories associated with each key pressure in the sector, including those related to upstream producer activities, and an overview of why these risks are material to financial institutions.

Table 8: Impacts and risks of waste prevention and management

Pressures	Impacts	Risks	
No end-of-life considerations when research-ing, developing and designing products		Regulatory	Products designed with no end-of-life considerations are more likely to have a limited useful life, become waste and leak into the marine environment. Once identified and traced back to producers this can lead to moratoriums and have an impact on revenues.
		Reputational	Marine litter that damages animals or has other negative impacts is increasingly being traced to producer and place of origin. Marine litter is currently the second most widely referenced public environ-mental concern; therefore the reputational risk is high and may impact revenues.
		Market	Products can lose their competitive edge in markets where consumers place a high value on environmen-tal responsibility, placing business revenues at risk.
		Physical	Businesses will soon be required to report on scope 3 downstream supply chain emissions. This will mean disclosing GHG emissions from waste management activities and may include marine plastic pollution impacts. This can become a cost to companies that are subject to quotas, emission trading schemes or carbon tax.
Extensive use of single-use plastics		Regulatory	New regulations to phase out single-use plastics (SUPs) or to move towards reusable packaging and products may render the production and distribution of SUPs unlawful.
		Reputational	Plastic products/packaging that have low recovery potential and are harming marine animals are being identified, widely publicized, and connected clearly to producers and origin.
		Market	Technological innovation, research into new materials and new marketing strategies are shifting markets towards new, more sustainable packaging materials.

Pressures	Impacts	Risks	
		Physical	Downstream scope 3 emissions will likely become part of the GHG emissions reported by companies. When this happens, disclosure of GHG inventories will include emissions from waste and plastic waste entering the oceans. This could become a cost to companies that are subject to quotas, emission trading schemes or carbon tax.
Losses of substrate into the environment during transport	   	Regulatory	International treaties and regulation on accidental pollution may tighten and be applied to loss of substrate (e.g. as a result of plastic polymer nurdles).
		Reputational	Substrate loss may not be frequent, but it can be very severe and a major source of environmental pollution. If traced back to the polluter, this can lead to local and international reputational risk of associated companies.
		Physical	Substrate leakage can damage transport equipment and cause further losses to the producers and transporters.
		Reputational	Public pressure to prevent chemical and biological changes may be connected to substrate loss because—though rare—the impacts are severe.
Product placement in markets where the capability to handle the generated waste streams is lacking	   	Regulatory	Products sold in locations that are unable to handle waste are more likely to leak into the marine environment. Once identified and traced back to producers this can lead to moratoriums and have an impact on revenues.
		Reputational	Marine litter that damages animals or has other negative impacts is increasingly being traced to producer and place of origin. Marine litter is currently the second most widely referenced public environmental concern, therefore the global reputational risk associated is high and may impact revenues.
		Market	Products sold in locations that are unable to handle waste may lose consumers elsewhere in the global market as people become more aware of the link between marine litter, development issues and placement of products.
		Physical	Downstream scope 3 emissions will likely become part of the GHG emissions reported by companies. When this happens, disclosure of GHG inventories will include emissions from waste and plastic waste entering the oceans. This can become a cost to companies that are subject to quotas, emission trading schemes or carbon tax.

Pressures	Impacts	Risks	
		Reputational	Impacts on isolated, marginalized and vulnerable groups can lead to crises affecting company reputations globally.
		Market	Deterioration of livelihoods, decreased access to services and worsening living conditions reduce purchasing power. The targeted consumers for certain products may suffer from the negative impacts leading to reduced demand (e.g. overuse of SUP and packaged products in tourist areas that are not able to handle the waste generated).
		Operational	Staff in locations where livelihoods and access to services are deteriorating, and living conditions worsening, become less productive.
		Operational	As livelihoods deteriorate, access to services decreases and living conditions worsen, health is impacted. Workers who may be involved in products or retail or other jobs in the value chain of producers may become less productive.
		Regulatory	New regulations introducing EPR or imposing recycling targets impact marginally increase product costs; free riders (i.e. those that are not paying into the EPR system or exploit loopholes in the system) may gain competitive advantage.
The sale of products banned in one market in a different market with looser environmental policies		Regulatory	Product bans limit or eliminate revenue potential.
		Reputational	Marine litter that damages animals or has other negative impacts is increasingly being traced to producer and place of origin. Marine litter is currently the second most widely referenced public environmental concern; therefore the reputational risk is high and may impact revenues.
		Reputational	Impacts on isolated, marginalized and vulnerable groups can lead to crises affecting company reputations globally.

Pressures	Impacts	Risks	
Placement on the market of containers with chemicals and toxic materials		Regulatory	Products that leak into the marine environment may be identified and traced back to producers. This can lead to moratoriums and have an impact on revenues.
		Reputational	Products leaked into the environment causing high negative impacts are traceable to the producer and place of origin. Marine litter is currently the second most widely referenced public environmental concern, contamination from marine litter is widely known, therefore the global reputational risk associated is high and will likely impact revenues.
		Market	Producers placing products in markets that cannot handle the waste products, may lose consumers elsewhere in the global market as people become more aware of the link between marine litter and chemical contamination.
		Reputational	Contamination from marine litter may impact entire communities, leading to loss of producer reputation.
		Reputational	When contamination causes health risks and risks to life, the reputational risks are high and will likely lead to loss of revenues.
Insufficient waste collection and transfer		Reputational	Marine litter is increasingly linked to a deficiency in collection services. Reputational risks are increasing for producers who fail to contribute to establishing collection services or product/packaging take-back systems.
		Regulatory	National GHG emissions associated with the waste sector are linked partially to insufficient collection service, self-management of waste and open burning. As countries draw up their Nationally Determined Contributions, the waste sector is often targeted This creates an obligation for the sector to reduce emissions.

Pressures	Impacts	Risks	
		Reputational	Marine litter is increasingly linked to deficiency in collection services. Reputational risk is increasing for producers who fail to contribute to establishing collection services or product/packaging take-back systems.
		Operational	As livelihoods deteriorate, access to services decreases and living conditions worsen, health is impacted. Waste collection workers, often from vulnerable communities, may be more affected, risking the integrity of the waste collection service.
Insufficient capacity in recycling systems and/or markets for recovered materials		Reputational	Marine litter is increasingly linked to deficiency in collection services, and lack of markets for secondary recovered materials. Reputational risk is increasing for producers who fail to contribute to establishing recycling services, including product/packaging take-back systems. The effects on the marine ecosystem and environment are increasingly being documented and publicized.
		Regulatory	National GHG emissions associated with the waste sector are linked partially to insufficient recycling. As countries draw up their Nationally Determined Contributions, the waste sector is often targeted. This creates an obligation for the sector to reduce emissions.
		Operational	Lack of recycling causes loss of non-tariff revenues in the waste management system.
		Reputational	The complex social impacts of low levels of recycling receive attention in the media and can cause reputational risk.

Pressures	Impacts	Risks	
Choice of new technologies solely based on feasibility or technological considerations		Reputational	Contentious and unpopular technologies (e.g. incineration and other thermal recovery technologies) that cannot be financially sustained or do not have the public's approval may be boycotted.
		Operational	Lack of integration of new technologies into the existing MSW systems (e.g. to be able to ensure adequate feedstock) may bring the entire system to an operational halt, or stagnate development in the sector, damaging service performance and revenues.
Uncontrolled disposal		Reputational	Risk is high for private investors in waste management companies who operate failing or uncontrolled disposal sites.
		Operational	As livelihoods deteriorate, access to services decrease and living conditions worsen, health is impacted. Waste collection workers, often from vulnerable communities, may be more affected, risking the integrity of the waste disposal service.
		Reputational	Uncontrolled disposal sites may gain significant negative attention. This will negatively impact cities, financing institutions, operators involved in the waste management system.
Transboundary movement of waste		Regulatory	International treaties and regulations on transboundary movement of waste may tighten as attention to the global waste crisis increases.
		Reputational	Transboundary movement of waste can easily leak and generate pollution. If traced back to the polluter, this will cause local and international reputational risk and may affect underlying financials of associated companies worldwide.
		Reputational	Importing waste into locations that lack waste management systems risks the reputation of the companies involved.
		Operational	The risk is for waste managers operating in countries of destination as they may not be able to handle the types and quantities of waste and imported.

Pressures	Impacts	Risks	
Lack of, or ineffective, environmental education, awareness and behaviour change campaigns		Market	Introducing new MSW systems requires behavioural change from citizens. If this does not happen the system will perform poorly, the service users will fail to see the value of the service, and the feasibility of the new measure will suffer.
		Reputational	Public outcry when the MSW system does not function well.
		Operational	Failure to deliver services in areas that are difficult to access, or where informal services have been previously provided, presents operational risk to the entire waste management system.
		Reputational	When designing new services, reputation risks can result from lack of attention to: the social and gender aspects of the informal recycling sector, opportunity and access to livelihood, and occupational health and safety.
Failure to include the informal recycling sector		Operational	Enhanced leakages due to lack of integration of formal and informal services leads to disruption, potentially risking the integrity of the entire waste management system.
		Reputational	When designing new services, lack of attention to the social and gender aspects of the informal recycling sector risks livelihoods for the poorest and most marginalized of society, sometimes disproportionately affecting women.

Criteria for sustainable financing

Based on the impacts and their materiality outlined above, the attached Criteria Annex for the sustainable financing of the solid waste and resources management sector is proposed. This list of criteria and their associated scenarios offer recommendations for financial institutions. These recommendations are to: **avoid** the worst scenarios, **challenge** areas for improvement, or **seek out** best practice.

Refer to the Criteria Annex for more detailed information

From risk to opportunity

As a sector, waste and resources management offers huge potential to contribute positively to a sustainable blue economy. Sustainable waste management not only protects the environment but also provides a public health service. The sector is also primed for innovation in new financing, business and operator models.

Banks, investors and insurers can make the most of these opportunities by providing finance packages that support businesses in the waste and resources management sector to grow and contribute to a sustainable future, helping the world to achieve the Sustainable Development Goals, in particular goals 11, 12 and 14.

Extending waste collection to all in society is the most essential and fundamental step to protecting the ocean, especially in regions where there is a high risk of waste leaking into waterways.

Financing only waste management solutions and infrastructure will help but, on its own, will not bring about the desired systems change. The huge gap in demand for waste management services and infrastructure—and the sector reforms and investments necessary to protect public health, decrease GHG emissions and control plastic pollution of the ocean—represents a challenge of truly global proportions.

Thus, reducing pressure on waste management services through waste prevention is critical. Rethinking business models and systems—the way products are designed and delivered into markets—giving consumers choices that help them contribute to a more sustainable and equitable future and capitalizing on the emerging era of conscious consumerism has to be a central focus for any business to maintain their competitiveness in the future global marketplace.

With an overwhelming range of options available to facilitate a shift to a circular economy, attracting finance for a single initiative is fiercely competitive. It is critical for financial institutions to consider how actions can ultimately lead to impactful systems transformation.

Compelling, yet unproven technology innovations must not distract from, or undermine efforts to address the fundamental issue in this sector. These innovations threaten to disrupt much-needed development of local SWM systems and risks the livelihoods of informal collectors. The ripple effects of poor investment decisions can paralyse the development progress of municipal solid waste management systems for several years.

A key to sustainable financing in the WaRM sector is to focus on supporting waste management 'systems' rather than just 'technologies', especially in those countries where there is a significant lack of policy maturity. Systems approaches enable risks to be properly understood, categorized and managed; whereas, purely technology-centred approaches tend to encounter enhanced risk from lack of alignment and integration with supply-side cultural, social and political aspects of waste generation and management practices.

Financial institutions who ask the right questions, using this guidance as a basis, and extend their due diligence beyond what is usual by considering the side- and after-effects of activities undertaken by the businesses they finance, will make the biggest positive contribution towards protecting the marine environment and the transition to a sustainable blue economy.

Case studies

This section presents four case studies of initiatives in the waste and resources management sector that demonstrate how targeted finance and innovative business models in sustainable and resilient waste value chains can drive progress, while addressing the risks and impacts discussed above.

Mr. Green Africa

Mr. Green Africa (MGA) is an integrated plastics recycling company based in Kenya that collects, sorts, and recycles plastic waste into high-quality post-consumer recyclates. These recylates are then sold as a substitute for imported fossil fuel-based plastics to help close the loop on plastic waste. The company works closely with waste pickers in the region, paying a higher and more stable income through a fair trade plastic waste sourcing model. During the period 2022–2025, MGA expects to:

1. Recover and recycle approximately 70,000 tonnes of plastic waste
2. Create approximately 200 more direct jobs
3. Improve the working conditions of 5,000 waste pickers
4. Engage more than 250,000 consumers in separation at source programs.

In December 2021, Minderoo Foundation, along with four other impact investors and Dow Chemical Venture Capital, invested in MGA, the first recycling company in Africa to be a Certified B Corporation. This commitment is part of a major funding boost from impact-driven investors and key industry stakeholders to scale the Kenya-based plastics recycling pioneer across the continent (Minderoo Foundation 2022, personal communication 25 January).

Takeaways

- There is huge need for higher-risk venture capital in low and low-middle income countries where plastic leakage rate is highest
- Current capital flows in the waste management sector in these countries is being mostly fulfilled by philanthropic capital, family offices and corporate venture capital arms
- There is a need to de-risk and prove business models in the waste management sector in high leakage countries to crowd in finance from institutional investors and banks.

Transformational investment in Chinese waste management systems

Waste management systems in China have seen a comprehensive overhaul since 2005, with a public-private partnership approach to development forming the basis of new waste infrastructure investment. This has resulted in an increase in total investment from USD 8.4 billion in 2006–2010 to USD 33.6 billion for the period 2016–2020. The transformation of the Chinese waste management industry has been catalysed by a series of major policy milestones, including the Renewable Energy Law of 2005, which introduced a preferential feed in tariff subsidy for the energy generated by waste incineration plants.

Much of the private sector investment in China's waste management has been into the 'back end', predominantly into incineration with energy recovery. Typically, where municipal solid waste incinerators are privately owned, these are established under a public private partnership agreement between the city and the investor, where the former provides land and the security of supply of waste and the latter provides the investment capital (World Bank 2019). Financing approaches sometimes feature support from multilateral development banks, including the ADB and World Bank, to raise capital.

In recent years, Chinese policy is shifting investment towards implementing 'front-end' waste management systems to meet established national targets for in certain cities. For example, in Ningbo a World Bank project for USD 420 million in financing (including USD 150 million in lending) for MSW aims to be complemented by private finance of USD 82 million. This will be managed through special purpose vehicles (SPVs), which will implement financing for waste separation at source, transfer and recycling, with a focus on plastics and higher value recyclables (World Bank 2021).

Takeaways

- The transformation of the Chinese waste management industry has been driven by a combination of public finance for front-end waste collection and transfer systems, and private finance for back-end waste recovery and disposal systems.
- Targeted policy initiatives are necessary to catalyse transformation in the financing of waste management systems.
- Massive upscaling of private as well as public finance has enabled China to leapfrog many of the world's previously leading countries in the quality and level of sophistication of waste management systems.
- Multilateral development banks and other sources of concessional finance can play an important role in catalysing and scaling up private finance for MSW.
- The Chinese waste management industry now exports knowledge, technologies and skills, and is set to play a key role in future improvements to waste management systems globally.

Algramo

Algramo is a Chilean start-up dedicated to eliminating the need for single-use plastic packaging, by co-developing reusable packaging systems for the world's largest fast moving consumer goods (FMCG) companies and retailers. Its approach aligns with the waste prevention aspects of circular economy principles, by providing reusable packaging solutions to deliver products from well-known global brands to citizens in both emerging and developed markets. In 2021, Algramo's top refill customer with just one product—laundry detergent—refilled their bottle more than 30 times. This one customer, with one product, eliminated the need for over 4kg of virgin plastic. Having consolidated its business model in Chile, Algramo are now seeking expansion into the US, the UK, Mexico and Indonesia.

To date, Closed Loop Partners' Venture Capital Group and other venture capital funds have financed Algramo. Algramo's investors have also helped them connect with the FMCG and technology sectors. The involvement of Closed Loop Partners has had a catalytic effect by helping Algramo navigate the complexity and challenges of integrating innovative technology from a start-up into the complex supply chains of global brands. The ability to deliver this integration is critical to the success of reuse and refill systems and the waste prevention agenda.

In mid-2021 Algramo closed a USD 9 million series A investment round. Series B investment is due to commence in the latter part of 2022 and will enable the scale-up of reusable packaging systems in key markets in the Americas, Asia, and Europe.

Takeaways

- Innovation and impact synergies can happen when emerging technologies have the financial capital to scale, alongside the ability for their technology to be integrated into the supply chains of global brands.
- Careful consideration guided by human-centred design is critical to ensuring that refill systems meet the specific and unique needs of individual markets. For example, in Indonesia, smaller-sized reusable packaging has been deliberately chosen to directly compete with the sachets commonly used in that market.

Project STOP

Co-founded in 2017 by Austrian plastic recycler Borealis and SYSTEMIQ, Project STOP has used a 'system enabler' approach to roll out circular waste collection to more than 200,000 people (most for the first time) in three cities in East Java and Bali. The project is supported by a number of strategic partners located throughout the plastics supply chain, the Alliance to End Plastic Waste, Norwegian Embassy of Foreign Affairs, NOVA Chem, Nestle, Borouge and Siegwerk.

With an approach that sets up financially sustainable, locally owned waste systems, to date it has provided stable employment to 215 waste workers, collected 12,000 tonnes of waste and stopped more than 11,000 tonnes of waste from polluting the environment. It is on track to roll out collection to over 450,000 people by the end of 2021.

In addition to this, in 2022 the project will start rolling out waste services to 1.4 million people in the regency of Banyuwangi in East Java. The CAPEX and the start-up OPEX is financed through a mixture of public grants and corporate donations. The OPEX, covered by the programme for the first two years, is ultimately covered by a mixture of household fees, material sales and government subsidy.

Takeaways

- Project STOP cities innovate in the blending of financing from government subsidy, international development grants and producers.
- Project STOP is a 'first-mover' initiative to implement waste collection systems in lower-income communities with financial support from FMCG companies.
- Blending financing between producers, public authorities and international development grants can catalyse rapid extension of collection services to communities, and result in significant reduction of plastic pollution.
- Ultimately the long-term sustainability of the waste management systems depends on demonstrating service reliability, initiating cost recovery and building public awareness.

Salish Sea | Photo by Cristina Mittermeier cristinamittermeier.com
A stellar sea lion in the Salish Sea falls victim to abandoned fishing debris. Waste finds its way into our oceans in a multitude of ways. The impact resulting from it is devastating not only for marine life, including mammals, but humans as well. Without a healthy ocean, we cannot have a healthy planet.

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