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Blue Infrastructure Finance:

A new approach, integrating Nature-based Solutions for coastal resilience

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Government Offices of Sweden
Ministry of the Environment and Energy

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March 2020

A concept report commissioned by IUCN's Global Marine and Polar Programme, and prepared by Torsten Thiele, and, in alphabetic order, Gerard Alleng, Andreas Biermann, Emily Corwin, Stephen Crooks, Philip Fieldhouse, Dorothée Herr, Nathanial Matthews, Nathalie Roth, Aparna Shrivastava, Moritz von Unger, and Jürgen Zeitlberger.

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Other reports in this series include:

Blue Bonds: Financing Resilience of Coastal Ecosystems and Sustainable Growth. Key Points for Enhancing Finance Action

Blue Natural Capital Positive Impacts Framework

Preface

Coastal and marine ecosystems, such as mangroves, coral reefs and seagrasses, are critical to human well-being and global biodiversity. Infrastructure investments have a significant and increasing impact on these zones.

This paper argues that a focus on Nature-based Solutions (NbS), as part of a blue infrastructure finance approach, can help to deliver measurably better outcomes.

A key objective of this paper is to familiarise developers, policy makers and financiers with a robust approach to developing blue infrastructure in coastal areas: what is NbS, what are resilience planning approaches and what are means for blue infrastructure finance.

The paper argues that standards and principles for developing and financing blue infrastructure and appropriate blended finance instruments can help to overcome remaining bottlenecks, scale up these approaches and attract more private financing into blue infrastructure.

An important audience for the report are therefore private sector investors and multilateral financing institutions that are key to infrastructure finance.

Convincing these critical stakeholders that blue infrastructure finance is not only possible and desirable but that it is both feasible and, ultimately, also financially more attractive is critical to achieve a just transition to sustainability.

This report is the result of joint work by experts with a wide range of backgrounds, from finance, engineering and conservation, both in the public and private sector. Such a multi-stakeholder approach is most apt to address the blue infrastructure finance challenge ahead.

Acronyms and abbreviations

ABM	Adaptation Benefit Mechanism
ADB	Asian Development Bank
AFD	Agence Française de Développement
AFDB	African Development Bank
AMI	Advanced Metering Infrastructure
BCRC	Blue Carbon Resilience Credit
BNC	Blue Natural Capital
BNCFF	Blue Natural Capital Financing Facility
CBA	Cost-Benefit-Analysis
CBF	Caribbean Biodiversity Fund
CBD	Convention on Biological Diversity
CSR	Corporate Social Responsibility
DFI	Development Finance Instiution
EEZ	Exclusive Economic Zone
EIA	Environmental Impact Assessment
EBRD	European Bank for Reconstruction and Development
ESF	Environmental and Social Framework
ESG	Environmental, Social and Governance
FDI	Foreign Direct Investment
FFEM	Fonds Français pour l'Environnement Mondial
GCF	Green Climate Fund
GEF	Global Environment Fund
GHG	Greenhouse Gas
IADB	InterAmerican Development Bank
IFC	International Finance Corporation
IKI	Internationale Klimainitiative
IPCC	International Panel on Climate Change
LDC	Least Developed Countries
MDB	Multilateral Development Bank
MPA	Marine Protected Area
NbS	Nature-based Solutions
NCFF	Natural Capital Financing Facility
NDC	Nationally Determined Contributions
ODA	Official Development Assistance
ORRAA	Ocean Risk and Resilience Action Alliance
PPP	Public-Private-Partnerships
SDG	Sustainable Development Goal
SIDS	Small Islands Developing States
UNFCCC	United Nations Framework Convention on Climate Change
VCS	Voluntary Carbon Standard

Terminology / Concepts

Natural Capital is another term for the stock of renewable and non-renewable resources (e.g. plants, animals, air, water, soils, and minerals) that combine to yield a flow of benefits to people (Definition Natural Capital Coalition).

Blue Natural Capital: - the wealth of ecosystem services – including air, food, water, energy, shelter, medicine, as well as crucial climate change mitigation, adaptation and resilience benefits – provided by coastal and marine habitats.

Natural Capital Accounting – Accounts focus on measuring & valuing the stock of renewable and non-renewable natural capital assets that combine to yield a flow of benefits to people. Natural Capital Accounts are a specific type of natural capital assessment. (Natural Capital Coalition)

Natural Capital Assessments – Assessment is the method most typically used in the private sector. The majority of assessments will use natural capital information to answer a specific question, or inform a decision. The aim is not about collecting a set of indicators, and it is uncommon to collect information without a specific application in mind. Often assessments measure & value the flow of ecosystem service benefits, as opposed to measuring & valuing the natural capital stock. Assessments often inform internal decisions rather than disclosure (Natural Capital Coalition).

Nature-based Solutions. Actions to protect, manage and restore natural or modified ecosystems, which address societal challenges, effectively and adaptively, providing human well-being and biodiversity benefits (Definition IUCN).

Resilience. The capacity of social, economic and environmental systems to cope with a hazardous event or trend or disturbance, responding or re-organising in ways that maintain their essential function, identity and structure, while also maintaining the capacity for adaptation, learning and transformation (Definition IPCC).

Risk of climate-related impacts results from the interaction of climate related hazards (including hazardous events and trends) with the vulnerability and exposure of human and natural systems. Changes in both the climate system and socioeconomic processes including adaptation and mitigation are drivers of hazards, exposure, and vulnerability (Definition IPCC).

Hazard. The potential occurrence of a natural or human-induced physical event that may cause loss of life, injury, or other health impacts, as well as damage and loss to property, infrastructure, livelihoods, service provision, and environmental resources.

Vulnerability. The propensity or predisposition to be adversely affected.

1. Introduction and context

Infrastructure provides people with access to clean, safe water for drinking and cooking, and power/energy for lighting and heating their homes. Roads and railways enable them to get to work and thus provide for their families. Transport infrastructure, including air- and sea-ports, also allows firms to reach the markets needed to trade their goods and services domestically and across international boundaries. Telecommunications networks are at the core of the data-driven networked economy of the 21th century. Adequate infrastructure is still lacking in many parts of the world, leading to massive investment needs.

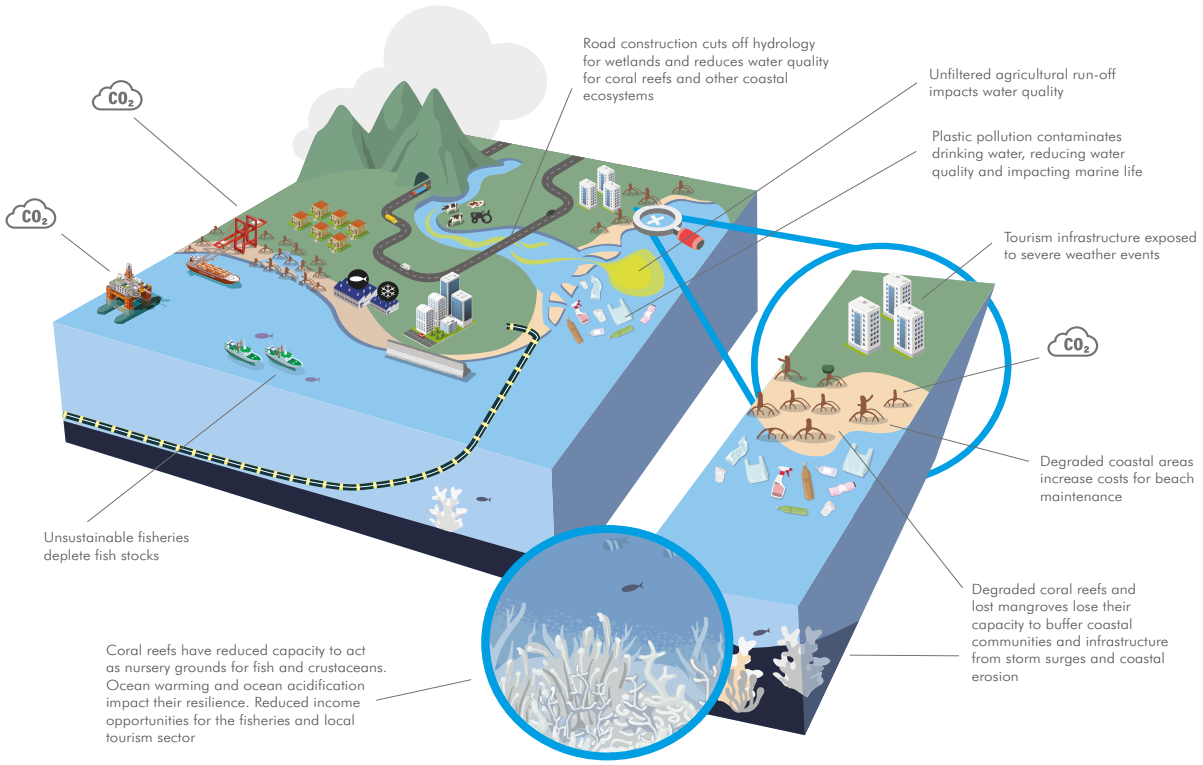
While infrastructure is key to economic and social development it often has negative environmental impacts. Coastal and marine life is in particular at risk[1] to be damaged (Graph 1).

According to a recent report USD 94 trillion need to be spent on infrastructure by 2040[2]. It is worth discussing[3] whether this estimate of USD 94 trillion needed for infrastructure could be significantly reduced through an early emphasis on integrated blue infrastructure. A recent study suggests that a cost-efficient focus on integrated climate solutions would reduce long-term expenditure needs[4] so we will need to focus on effective partnering for investment in climate-resilient infrastructure at scale[5].

Building this infrastructure may help to reduce some of the pressures on the environment from pollution and waste but is likely to add other pressures to biodiversity, climate and landscapes Around 70% of global greenhouse gas emissions come from carbon-intensive infrastructure[6]. Redesigning this infrastructure to achieve net-zero emissions – and channelling investments for that purpose – is a critical challenge and need.

1 https://www.nature.com/articles/s41467-019-12808-z
2 Jessop, S. (2017). World needs $94 trillion spent on infrastructure by 2040: report' [online news].
3 Hallegatte, S. et al. (2018), "Discussion Paper", in *The Economics of (and Obstacles to) Aligning Development and Climate Change Adaptation, Global Commission on Adaptation*, https://cdn.gca.org/assets/2018-10/18_WP_GCA_Economics_1001_final.pdf
4 https://voxeu.org/article/climate-policy-when-starting-most-expensive-option-makes-sense
5 https://www.oecd-ilibrary.org/sites/5099ad91-en/1/2/1/index.html?itemId=/content/publication/5099ad91-en&_csp_=139eb04e670dfebe384475ec4a221770&itemIGO=oecd&itemContentType=book#chapter-d1e490
6 Bhattacharya, A., Oppenheim, J. and Stern, N. (2015). Driving sustainable development through better infrastructure: Key elements of a transformation program. Brookings Global Working Paper Series.

Graph 1. Coastal infrastructure without NbS



It is paramount to keep negative impacts on Blue Natural Capital (BNC) from new or refurbished roads, rail- and waterways, ports and docking stations, and other coastal infrastructure to a minimum, whilst focusing on positive impacts. Equally important is the value enhancement that healthy BNC can bring to coastal infrastructure investments, systematically tailoring such investments towards the implementation of the Sustainable Development Goals (SDGs) under the Agenda 2030, including in particular SDG 13 on Climate and SDG 14 on Life under Water, supporting global biodiversity targets[7], and the challenges arising from the global climate emergency.

The concept of BNC can help to provide an overall framing approach to deliver better outcomes for people and nature, integrating (blue) nature-based solutions as well as economic efficiency. By focusing on blue infrastructure finance, we aim to highlight sustainable infrastructure finance opportunities that support resilience and biodiversity. For developing countries these opportunities include enhanced access to international climate finance sources.

7 IUCN WCPA Task Force 'Beyond the Aichi Targets' [website].

Yet, specific barriers for securing adequate resources to finance blue infrastructure projects hamper quick progress:

- Lack of evidence to demonstrate how ecology and infrastructure interact or can interact (flooding and walls, wetlands and roads, and so on) to achieve synergistic outcomes;
- Lack of experience, standards and sufficient examples to overcome institutional emphasis in favour of purely conventional or 'proven' grey infrastructure; linked to
    - Confidence based on historic data globally that grey infrastructure will deliver required benefits;
    - Failure to recognize or tendency to underestimate long term maintenance or decommission costs and responsibilities, and
    - Higher design tolerances of grey infrastructure potentially leading to long term project failure or unforeseen upgrade costs (e.g. reduced flood protection benefits of levees with higher rates of sea level rise or reservoir storage capacity driven by upstream water or sediment management).

- Lack of granular, site-specific knowledge of specific infrastructure risks and nature based risk mitigation strategies (such as to reduce flooding and the exposure to sea-level rise);
- Lack of confidence within the broader audience and the finance community in particular that nature based solutions will provide the predicted protection and ecosystem benefits;
- Lack of dedicated finance facilities focusing on developing BNC projects and offering blended finance solutions;
- Lack of institutional models and arrangements capable of channelling finance to stakeholders concerned; and
- Lack of partnership models for delivering those projects, especially at a land- / seascape level.

This paper suggests that blended finance solutions can help de-risk nature-based blue infrastructure investments and attract private impact investors. The concept of blue infrastructure is based in the mitigation hierarchy[8], suggesting that to avoid and minimise negative impact has priority. A clear framework on blue finance for financial institutions lending to infrastructure projects as well as for developers and investors of such projects in coastal and marine areas, in particular in developing countries, is required. This paper provides initial ideas of what could be included and what needs to be addressed by such a framework.

The paper has been written by a suite of co-authors and further informed and reviewed by various experts (see acknowledgement section) participating in a workshop held December 2019 (see Annex 1).

8 https://www.icmm.com/website/publications/pdfs/biodiversity/cross-sector-guide-mitigation-hierarchy

2. Blue Natural Capital

Blue Natural Capital (BNC) refers to the wealth of ecosystem services provided by coastal and marine habitats – including food, water, energy, shelter, medicine, as well as crucial climate change mitigation, adaptation and resilience benefits. BNC projects and investments[9] seek to protect, restore and conserve these natural ecosystems and to safeguard their ecosystem services.

Infrastructure can impact ecosystems, habitats and biodiversity in a number of ways, which unless well-planned can often have negative consequences. In order to reconcile infrastructure design and implementation, as a first step, investment projects need to be assessed in regard to the concept of no net loss of biodiversity[10], and even work towards net gain to biodiversity and ecosystem integrity (see Info Box on NbS Standard).

Beyond this first screening in relation to negative biodiversity and climate impacts we need to identify how infrastructure finance can be used to achieve positive impacts. **Nature-based Solutions (NbS) in infrastructure can help to pro-actively protect ecosystems and habitats in a way that address the ocean-climate-biodiversity nexus holistically, with particular benefits in transition scenarios such as those driven by climate change. Additionally, nature based solutions have the potential to make infrastructure more resilient to climate change effects and add longer-term value to infrastructure assets.**

Nature-based Solutions

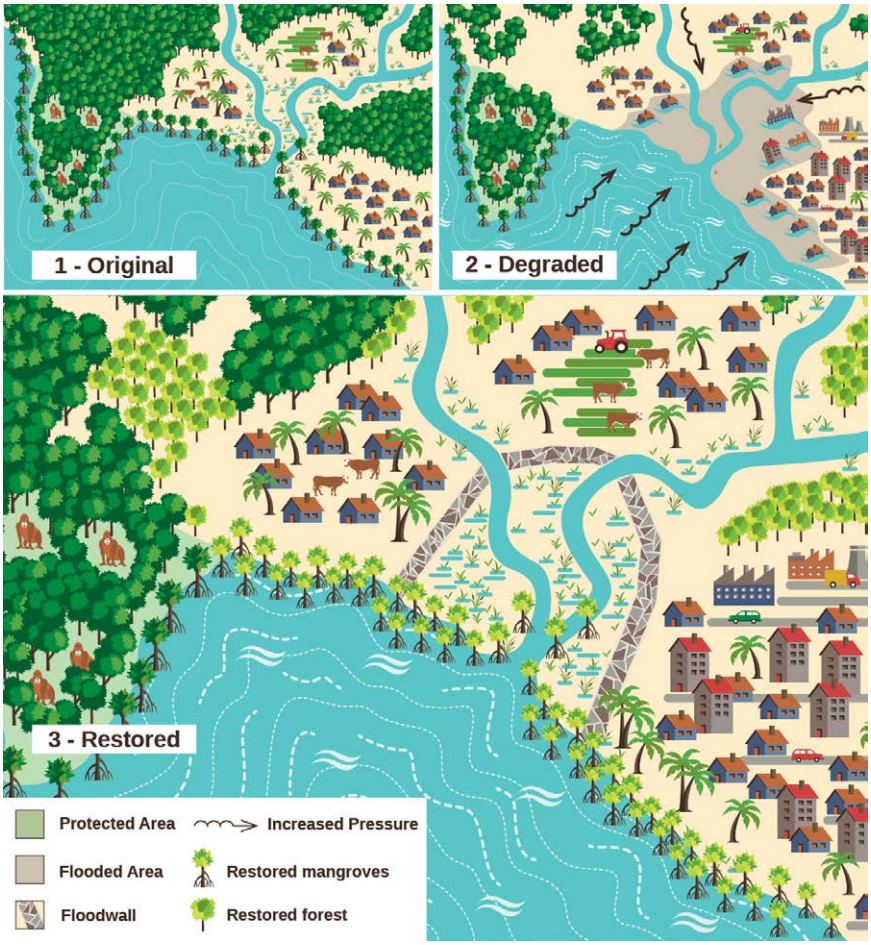
9 https://bluenaturalcapital.org

10 zu Ermgassen, S.O.S.E. et al (2019) The Role of "No Net Loss" Policies in Conserving Biodiversity Threatened by the Global Infrastructure Boom One Earth Perspective. One Earth; Volume 1, Issue 3, 22 November 2019, Pages 305-315.

The IUCN definition for Nature-based Solutions (NbS) is as follows: "Actions to protect, manage and restore natural or modified ecosystems, which address societal challenges, effectively and adaptively, providing human well-being and biodiversity benefits"[11].

In its simplest form, a NbS example with a coastal focus is provided in the picture sequence below- Graph 2. Picture 1 shows an ecologically mostly intact landscape with low-impact human settlement. Picture 2 shows an aggravated state of degradation of the coastal ecosystem. Critically, the depletion of the natural habitat and biodiversity goes hand in hand with higher risks of storm surges, waves and flooding for the human settlements. Picture 3 provides a NbS in the form of restoration of the coastal mangrove forest, which decreases the risk of disasters and provides additional benefits in terms of economic development. NbS are complementary and work in synergy to other types of solutions as exemplified in this picture by the floodwall, which has been used in addition to mangrove restoration, done in such a way so as not to negatively affect biodiversity.

Graph 2: Coastal Nature-based Solution



Source: Cohen-Shacham et al. 2016[12]

11 IUCN Resolution 069 on Defining Nature-based Solutions
12 Cohen-Shacham, E., Walters, G., Janzen, C. and Maginnis, S. (eds.) (2016). Nature-based Solutions to address global societal challenges. Gland, Switzerland: IUCN. xiii + 97pp.

Another contemporary NbS example comes from an Oyster Reef Storm Protection intervention in New York that addresses water pollution, biodiversity loss and disasters. This is a USD 60 million project, "Living Breakwaters", approved by the federal government, which will grow oysters offshore from Staten Island. Oyster reefs can provide a habitat for species, purify water (studies have shown each one can filter 50 gallons of water each day[13]) and provide protection from storms. Another example is provided by the technique to integrate wetland restoration with rock breakwaters, which combines the wave attenuation and flood control value of wetlands with the benefits of engineered structures to stabilize the coastal zone.

Further examples are:

- Wetlands, including mangroves, help manage floods and tidal surges and thus protect nearby physical infrastructure/assets such as ports and roads.
- Lakes and wetlands regulate flows and store water, thereby reducing volumes of water that must be stored in built reservoirs and hence cutting the cost of built water storage investments.
- Dams benefit from forests that stabilize soils and hold back erosion upstream, protecting infrastructure, decreasing maintenance costs.
- Decreased re-insurance costs for coastal infrastructure for which NbS such as coral reef restoration, has decreased the risks of damage from disasters.
- Big cities are making substantial payments to upstream land managers in their watershed to improve land-use practices and thereby ensure the provision of high-quality drinking water, as well as avert the need to build costly water-purification facilities.
- Maintaining city swamps that perform sewage-treatment capacity (filtering organic waste and other effluent derived from cities) could prevent the local government from building and maintaining a high cost water-purification facility.

NbS are in synergy with their landscapes, seeking complementarity with different types of approaches to ensure that the societal challenges are addressed while biodiversity is maintained or enhanced.

NbS often happen in a hybrid context. Graph 6 (chapter 3.4) illustrates how blue infrastructure projects are meant to be designed with a holistic view, integrating the broader land and seascape, based on and integrating NbS.

13 http://nrcsolutions.org/oyster-reefs/

IUCN NbS Standard

IUCN is in the process of finalizing the Global Standard for NbS[14]. The purpose is to:

1. Incentivize demand and responsiveness to the approach;
2. Create a common language and understanding to engage new stakeholders;
3. Safeguard nature from overexploitation; and
4. Embed a framework for maximum impact for positive gains towards biodiversity-human wellbeing.

The goal is to mainstream NbS into business as usual. The standard will be a tool to achieve this while managing risks of further unsustainable use of natural resources, increased inequity in the world and the loss of potential of NbS if inaccurately identified NbS dilute the evidence base and business case.

Currently the 8 criteria stand as follows:

1. NbS effectively address societal challenges
2. Design of NbS is informed by scale
3. NbS result in net gain to biodiversity and ecosystem integrity
4. NbS are economically viable
5. NbS is based on inclusive, transparent and empowering governance processes
6. NbS equitably balances trade-offs between achievement of its primary goal(s) and the continued provision of multiple benefits
7. NbS are managed adaptively, based on evidence
8. NbS are sustainable and mainstreamed within an appropriate jurisdictional context

2.1 Assessing and reporting natural capital

Natural capital assessment is a critical step in the infrastructure planning process. Several efforts are underway to provide data and methodologies.

Natural Capital assessment[15], according the Natural Capital Coalition, is the method most typically used in the private sector. The majority of assessments will use natural capital information to answer a specific question, or inform a decision. The aim is not about collecting a set of indicators, and it is uncommon to collect information without a specific application in mind. Often assessments measure and value the flow of ecosystem service benefits, as opposed to measuring and valuing the natural capital stock. Assessments often inform internal decisions rather than disclosure.

14 The final standard and its governance structure will be launched at the IUCN World Conservation Congress in June 2020, in Marseille, France. https://www.iucn.org/news/nature-based-solutions/202002/iucn-council-adopts-first-ever-global-standard-nature-based-solutions

15 vàv Natural Capital Accounting, see terminology box.

Infrastructure developers and financiers require clear guidance on how to safeguard coastal and marine areas, reducing stressors on the ocean, coastal and marine ecosystems. **Developers and investors need to know how their investments negatively impact coastal and marine environments, and what mitigation action needs to be taken.**

Natural Capital Protocol

The Natural Capital Protocol responds to this gap by offering an internationally standardized framework for the identification, measurement, and valuation of impacts and dependencies on natural capital in order to inform organizational decisions[16].

A general way to integrate biodiversity-related financial risk into the risk assessment processes is to follow the Natural Capital Protocol. Four steps are envisioned.

Step	Description
Frame: Why?	✔ Consider why an assessment should be carried out
Scope: What?	✔ Define objective and scope of the assessment
Measure and Value: How?	✔ Measure the impact drivers and/or dependencies ✔ Measure changes in the state of natural capital ✔ Value impact and/or dependencies
Apply: What next?	✔ Interpret and test the result ✔ Take action

Source: Natural Capital Coalition, Connecting Finance and Natural Capital. A supplement to the Natural Capital Protocol (2018)

Mitigating Biodiversity Impacts Associated with Solar and Wind Energy

A forthcoming IUCN publication.

While renewable energy plays a critical role in mitigating climate change, even clean energy sources, like wind and solar, can also impact biodiversity through disturbance and loss of habitat, the generation of noise pollution, collision and other indirect pressures. Therefore, despite the intrinsic and much-needed positive contribution of these renewable technologies to a clean energy future, renewable energy projects need to address the associated risks to biodiversity,

16 https://naturalcapitalcoalition.org/natural-capital-protocol/

throughout the entire project life-cycle -- from design and permitting to the operational and decommissioning phases.

To address the biodiversity risks associated to solar and wind energy projects, IUCN has partnered with EDF, EDP and Shell to establish today's best available measures to mitigate impacts on biodiversity associated with solar and wind power (on-shore and off-shore) projects, along the entire life cycle of a project at the project and landscape level.

As part of this effort, this project will identify key factors that support the screening of biodiversity and ecosystem services risks for solar and wind at early project development stages; best practices for the mitigation of biodiversity risks and impacts of solar and wind power (terrestrial and off-shore); and recommendations for creating supportive regulatory and lending frameworks.

Carefully planned and well-sited wind and solar projects can help avoid most potential biodiversity impacts. Whereas, poorly managed, unmitigated risks can lead to significant biodiversity impacts and raise stakeholder concerns, both real and perceived. Applying good biodiversity mitigation practice will therefore help facilitate renewables development, not impede it.

Climate resilient infrastructure finance ought to deliver win-win solutions, especially in developing countries. **Developers and investors need to focus on optimising positive impact and value of infrastructure.** Knowing and being able to measure your positive impacts across the board (environment, social and development) is critical also for the ever increasing need to report on the SDGs.

Simple SDG reporting helps only so much, as almost all investments in grey infrastructure can be justified on the basis of at least one or two SDGs, if looked at in isolation. Applying systemic, robust and precise metrics, by contrast, creates potential for meeting the SDGs in a comprehensive sense through the adoption of strategies that prioritise cross-sectoral infrastructure investments and policies in the energy, water, wastewater and solid waste sectors[17].

IUCN has particular expertise around the sustainable management of coastal habitats such as mangroves, seagrasses and reefs, the implementation of BNC projects, and the precise measurement of BNC gains and losses. **The Blue Natural Capital Positive Impacts Framework[18] (BNC+) allows to screen, shape and evaluate infrastructure investments for their positive blue impacts.**

17 Adshead, D, Thacker, S, Fuldauer, LI, Hall, JW (2019). Delivering on the Sustainable Development Goals through long-term infrastructure planning. Global Environmental Change Volume 59, November 2019, 101975

18 https://bluenaturalcapital.org/wp2018/wp-content/uploads/2019/03/BNC-Framework_final.pdf

BNC+ is designed to build on methodologies, such as SURE[19] and GIB[20], with the aim to help guide financial institutions and other stakeholders through their investments and to improve coastal and marine infrastructure developments.

The Nature Conservancy and others, for instance, have also developed methodologies to map ocean wealth in specific locations[21]. The high carbon content of mangroves, seagrasses and saltmarshes – often referred to as "blue carbon" – can be scientifically assessed and methodologies are being developed to measure the climate mitigation benefit of conservation and restoration intervention and account for uncertainties from disturbances or reversal events[22].

Oyster breakwater reefs promote adjacent mudflat stability and salt marsh growth in a monsoon dominated subtropical coast

Three self-sustaining breakwater oyster reefs were established on an eroding mudflat on Kutubdia Island, Bangladesh. Over four seasons, it was found that the 0.6m-high reefs attenuated wave energy by 95-100% when water levels were up to around 0.5m, whilst wave energy was partially dissipated with water levels of 0.5-1.0m depending on water level and wave height. Sediment accumulated on the landward side of the reefs, with erosion levels 54% lower than control sites. The attenuation of waves and reduction in erosion is also thought to explain the expansion of coastal salt marshes, which further stabilised adjacent sediment. This study provides evidence that constructed oyster reefs can provide sustainable protection against coastal erosion, requiring less maintenance than earthen embankments and providing benefits for coastal biodiversity and fisheries[23]. Science paper here.

Geospatial information for BNC

The need for clarity around the location of marine and coastal habitats has inspired the development of **Ocean+ Habitats**, an evolving platform that tracks the distribution and conservation status of some of these essential coastal wetlands. **UNEP WCMC** is currently working towards the launch of a revamped platform during the **IUCN World Conservation Congress** in Marseille in June 2020, which will provide national and regional statistics on warm- and cold-water corals, saltmarshes, mangroves and seagrass habitats around the world, and connecting

19 https://sure-standard.org/
20 https://gib-foundation.org/
21 for example for South Australia see; https://www.natureaustralia.org.au/content/dam/tnc/nature/en/documents/australia/MOW_Report_Web.pdf
22 Macreadie, P.I. et al. (2019). The future of Blue Carbon science. Nature communications, 10(1), pp.1-13.
23 https://www.naturebasedsolutionsinitiative.org/news/oyster-breakwater-reefs-promote-adjacent-mudflat-stability-and-salt-marsh-growth-in-a-monsoon-dominated-subtropical-coast/

them with the **World Database on Protected Areas** to illustrate overlapping areas of protection.

2.2 NbS and the Paris Agreement

International climate policy development – concentrated in and around the 2015 Paris Agreement – is a clear driver for NbS, as well as for NbS and climate resilient infrastructure (see more on infrastructure finance via the Paris Agreement in chapter 4.6).

The preamble to the Agreement notes '...the importance of ensuring the integrity of all ecosystems, including oceans, and the protection of biodiversity'. In 2019, the Intergovernmental Panel on Climate Change (IPCC), which is the UN body for assessing the science related to climate change, issued its Special Report on the Ocean and Cryosphere in a Changing Climate (2019) highlighting the urgency for countries to implement mitigation and adaptation actions relating to the ocean[24]. The IPCC report claims there is rising popularity of ecosystem-based and hybrid approaches combining ecosystems and built infrastructure.

The report also points to challenges for coastal nature based solutions in high temperature scenarios, not all NbS will offer a permanent solution in specific locations and circumstances. Seagrasses, for instance, are expected to be tolerant only to a limited temperature increase[25]. Marine heatwaves will have a significant impact on ecosystem health[26].

Coastal systems not only store massive amounts of carbon (much of it at risk of release) and offer additional CO_2 sequestration opportunities, but also deliver several adaptation and coastal protection benefits. The increased awareness of the importance of coastal systems for both adaptation and mitigation are reflected in the submissions of the National Determined Contributions (NDCs), which are the national top-level policy and action plans meant to implement the Paris Agreement on the national level of signatories[27].

Amongst the 195 parties to the Paris Agreement, 28 countries included some kind of reference to coastal wetlands in their mitigation actions, while 59 countries included coastal ecosystems or coastal zones in their adaptation strategies[28] and refer in

24 IPCC (2019). Summary for Policymakers. In: *IPCC Special Report on the Ocean and Cryosphere in a Changing Climate*. H.-O. Pörtner et al. (eds.)

25 Straub, S.C. et al. (2019). Resistance, Extinction, and Everything in Between – The Diverse Responses of Seaweeds to Marine Heatwaves. Frontiers in Marine Science, 6, p.763.

26 Oliver, E.C. et al. (2019). Projected marine heatwaves in the 21st century and the potential for ecological impact. Frontiers in Marine Science, 6, p.734.

27 Seddon, N., Sengupta, S., García-Espinosa, M., Hauler, I., Herr, D. and Rizvi, A.R. (2019). Nature-based Solutions in Nationally Determined Contributions: Synthesis and recommendations for enhancing climate ambition and action by 2020. Gland, Switzerland and Oxford, UK: IUCN and University of Oxford.

28 http://ndcpartnership.org/news/understanding-blue-carbon-requests-ndc-partnership

their NDCs to at least one blue carbon ecosystem such as seagrass, salt marshes and mangroves[29]. 70% of the 161 NDCs submitted to the UNFCCC included marine or ocean-related topics. Countries expressed concerns over coastal impacts (95 NDCs), ocean warming impacts (77 NDCs), and fisheries impacts (72 NDCs). 103 NDCs focus on climate change impacts and adaptation needs in marine areas, 45 refer mangrove conservation and restoration, 28 focus on coral reefs for adaptation. A number of NDCs already aim to adopt marine biodiversity preservation, creation of marine protected areas (MPAs) and utilization of conservation and ecosystem-based management in their adaptation strategies[30]. However, some countries with large Exclusive Economic Zones (EEZ) such as Australia, and Brazil and even a number of Pacific island states have not done so yet. This implies there is plenty of scope for countries to raise climate ambition relating to oceans in future NDCs.

Approximately 80% of governments submitted *conditional* targets to achieve their NDCs, i.e. these targets are subject to stipulations such as access to international finance, technology transfer and international cooperation[31]. Some of these conditional targets also pertain to marine or coastal areas. For instance, Djibouti, a coastal nation bordering the Red Sea and the Gulf of Aden has a strong ocean focus. The NDC includes a plan for a tidal power plant as a renewable energy source but conditional on the provision of additional finance. Antigua and Barbuda have identified wetlands and watershed areas as sectors with high mitigation potential and aim to protect them by 2030 as carbon sinks conditional on receiving support[32]. Haiti, also a coastal nation, aims to protect, conserve and extend mangrove forests by 2030, create marine protected areas, develop a national strategy for adaptation in coastal areas, among others if supported[33]. Senegal aims to protect and reforest 4,000 ha/yr of mangroves if they receive financial assistance[34].

The critical role of mangroves in building coastal resilience

Flooding has often been dealt with through structural measures such as dams, dykes, and reservoirs with concrete seawalls. These expensive, single-focused approaches tend to be driven by top-down governance that does not consult local communities, and they often have negative impacts on the environment, including on fisheries and access to fishing. Furthermore, such structural methods are failing to cope with increasingly unpredictable weather patterns and rising sea levels.

29 Herr, D. and Landis, E. (2016). Coastal blue carbon ecosystems. Opportunities for Nationally Determined Contributions. Policy Brief. Gland, Switzerland: IUCN and Washington, DC, USA: TNC.
30 Gallo, N.D., Victor, D.G. and Levin, L.A. (2017). Ocean commitments under the Paris Agreement. Nature Climate Change, 7(11), p.833.
31 King, L.C. and Van Den Bergh, J.C.J.M. (2019). Normalisation of Paris agreement NDCs to enhance transparency and ambition. Environmental Research Letters, 14(8), p.084008.
32 Antigua and Barbuda (2015). Intended Nationally Determined Contribution' Communication to the UNFCCC.
33 World Bank Group (2016) Haiti - (Intended) Nationally Determined Contribution.
34 World Bank Group (2016) Senegal - (Intended) Nationally Determined Contribution.

The Global Resilience Partnership has worked with two partners, Sudeesa and Seacology in Sri Lanka to protect and restore mangroves, and educate communities, school children, and even tourists about the importance of these ecosystems. The goal is to help build the capacity of women to protect and restore mangroves. In doing so, the communities are enhancing and promoting the ecosystem functions of mangroves, which provide environmental benefits and contribute to coastal protection, livelihoods, and well-being. The project started in 2015 and by 2020 it will have trained 15,000 women in a five-day training programme that covers mangrove conservation as well as how to develop a business plan and financial planning. Those who attend the training are eligible for a microloan to put their business plan into action. Mangroves do not fully protect coastal communities from tsunamis and flooding, but they dampen the effects of extreme events and provide many other benefits for coastal communities. And the interest in protecting and restoring these coastal ecosystems has increased in recent years. But not all succeed in their efforts. Wetlands International recently reported that although mangrove planting is hugely popular, many efforts fail to establish sizeable, diverse, functional, and self-sustaining mangrove forests due to weak or no involvement of the community, mono-species planting, and poor choice of location. Finding a sustainable model for funding can also be a challenge. **Many projects rely on external funding and would not be able to sustain themselves. Hence, there is a critical need for innovative financial and insurance products to help protect mangroves recognizing their diversity of benefits.**

While the Paris Agreement and the NDC process allows to drive country-led climate related policies and related regulations. Few hard rules exist that would require cross-border investment to go into blue infrastructure rather than the grey sort (see chapters 5.3 and 5.5).

Ecosystem-based adaptation (EbA) in the Caribbean

The Caribbean is considered a biodiversity hotspot. Its marine and terrestrial ecosystems are home to many endemic animal and plant species. This biodiversity is also an important economic factor for the local population, mainly through tourism and fishing. Coastal ecosystems, especially coral reefs and mangrove forests, make an important contribution to mitigating the negative effects of climate change, for example by reducing the destructive force of increasingly severe tropical storms. However, these ecosystems are exposed to numerous anthropogenic threats and climate-related changes, including unsustainable forms of fishing and tourism or coral death. At the same time, many Small Island Development States (SIDS) in the Caribbean have little financial scope for urgently needed climate protection and adaptation measures.

Thus, the Federal Ministry of Environment's International Climate Initiative through KfW, the German Development Bank, contributed EUR 25.5 million to the Caribbean Biodiversity Fund (CBF) in order to finance ecosystem-based adaptation measures in the region. The facility set up as a redemption fund under the umbrella of the CBF is intended to complement the existing endowment fund (whose capital stock will be maintained over the long term). By promoting measures for the protection, improved use and rehabilitation of coastal ecosystems relevant to adaptation (especially coral reefs, mangroves and seagrass beds), the aim is to help reduce the vulnerability of SIDS to the negative impacts of climate change.

Following the 1st call for proposals, 11 organizations were granted in total USD 12 million for implementation of EbA solutions within the marine and coastal zones of 10 Caribbean countries. The projects will provide a range of actions including protected areas' management, restoration and rehabilitation of ecosystems, reduction of land-based stressors, measures to reduce physical damage and pressures on ecosystems, installation of artificial reefs and hybrid solutions relevant to the EbA approach.


CALLAO

3. Resilience concepts for coastal infrastructure

3.1 The challenge and cost of climate change for coastal infrastructure

Extreme weather events[35] brought about by climate change are one of the most dangerous risks facing humanity.[36] Sea level rise and associated floods and storm surges are posing major challenges for coastal communities and infrastructure around the world, with risks accelerating as oceans rise. By 2050, it is estimated that over 570 low-lying coastal cities will face sea level rise of at least 0.5 meters resulting in over 800 million people at increased risk from storm surges[37]. By 2100, the IPCC Special Report on Global Warming of 1.5°C estimates that it is almost certain we will experience one meter of sea-level rise and lose 70-90% of coral reefs that play a critical role in buffering waves and reducing storm surge. [38]

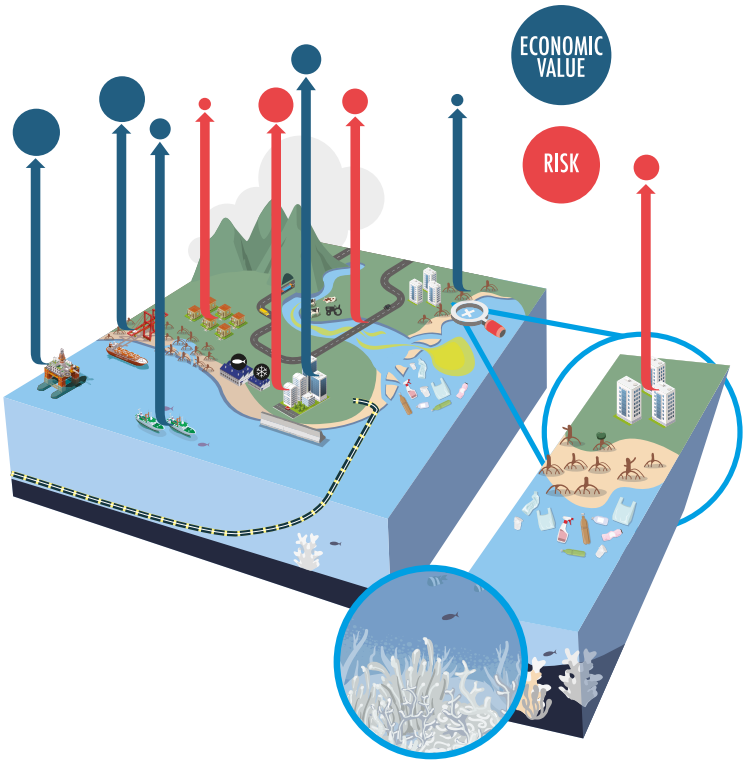
Apart from the significant human and environmental costs, from an economic perspective, the costs of inaction are enormous. It is estimated that flood damage, especially to infrastructure, under sea level rise of 1.3 metres would be equivalent to 4% of world GDP annually (USD 4 trillion annually).[39] From an insurance perspective, USD 100 trillion of global infrastructure is at risk due to inadequate insurance (see Graph 3). By 2100, the land flooded under a 100-year storm event will increase by 64% under high emissions scenario (RCP 8.5) leaving an additional 1.9 million homes worth a combined USD 882 billion at risk of being underwater in the US alone. Current actuarial and other risk assessment models rely on historical data to predict these risks and hence are often inaccurate. When infrastructure is impacted, it is the taxpayers and states that bear the brunt of the costs due to limited insurance and high subsidies. Coupled with global climate change, rising population growth is increasing the demand on global infrastructure, especially in urban and coastal areas. Even if we limit temperatures to 1.5°C, sea level rise will be a challenge for the near future because of locked-in emissions that will strain or overwhelm existing infrastructure.

Compounding impacts of sea level rise are increasing demand for freshwater. By 2030 global demand for freshwater will be 40% greater than the available resources.[40] According to the World Economic Forum, a 'water crises' driven by environmental

35 World Meteorological Organization (WMO) 'Statement on the State of the Global Climate in 2017' [online report], (2018). Available at: https://library.wmo.int/doc_num.php?explnum_id=4453 (Accessed: 14 January 2020)
36 Thacker, S. et al., Infrastructure for sustainable development, Nature Sustainability 2, 324-331
37 IPCC AR5 – Synthesis Climate Change Report - https://www.ipcc.ch/report/ar5/syr/
38 Nauels, A. et al. (2019). Attributing long-term sea-level rise to Paris Agreement emission pledges. Proceedings of the National Academy of Sciences, 116(47), pp.23487-23492. https://doi.org/10.1073/pnas.1907461116.
39 Ichinko T, Drouet L, Vrontisi Z, Hof A, Hinkel J, Mochizuki J, Bosetti V, Fragkiadakis K, Van Vuuren D, Lincke D (2019). Economy-wide effects of coastal flooding due to sea level rise: A multi-model simultaneous treatment of mitigation, adaptation, and residual impacts. Environmental Research Communications DOI: https://doi.org/10.1088/2515-7620/ab6368
40 Gerten, D., Hoff, H., Rockström, J., Jägermeyr, J., Kummu, M. and Pastor, A.V., 2013. Towards a revised planetary boundary for consumptive freshwater use: role of environmental flow requirements. Current Opinion in Environmental Sustainability, 5(6), pp.551-558.

degradation and climate change are a top 10 threat to global society. The 'South Asia' and 'Middle East and Northern Africa' regions are the most vulnerable, demonstrating that both the richest and poorest nations of the world are unified by water management issues. Existing water-related coastal infrastructure will need adapting and upgrading to cope, but doing so in established urban environments is a complex technical challenge. To adapt existing infrastructure to meet increasing demand alone would cost USD 3.3tn per year; however, even this will not be sufficient to protect against climate change effects.

Despite the enormous challenges and urgent reality of rising seas, too little is being done to build resilient coastal infrastructure. Many governments have information on the potential difficulties ahead although there remains uncertainty around the magnitude and pace of change. This uncertainty is compounded by the fact that the costs of investing in resilient coastal infrastructure are incurred immediately and are often significant, while the economic benefits are only realized when a risk, such as a storm event, is mitigated or reduced. The combination of uncertainty and time lag between the costs and the benefits of risk reduction often delays or stymies the mobilization of resources or the political will to act. Only a few OECD countries have, for example, dedicated funding for coastal adaptation and resilience.



Graph 3. Conventional approach to infrastructure

Development is focused on individual assets with identified predictable cash flows. Benefits and services from nature are largely ignored. Negative impacts on services from nature are not internalised into the CBA.

Other economic opportunities are missed. There is vulnerability to external factors like natural disasters, extreme weather events and slow on-set events such as sea-level rise.

Arrows and circles for illustration only.

For the people who live on or near the coasts, this inaction will be particularly devastating. Loss of life and livelihoods will be significant. There is also a key gender dimension to this inaction as women are disproportionately affected by disasters such as flooding. They commonly experience more social, cultural, economic, and political disadvantages that can result in higher mortality rates during disasters, and higher poverty rates after due to more unemployment and the lack of legal rights such as land ownership. Women also face greater psychological stress during and after a disaster because of their caretaker role in the family.

There could further be significant ripple effects of inaction across economies and markets. Many developing countries that are vulnerable to the risks of sea level rise due to vulnerable coastal infrastructure have attracted considerable investments in infrastructure and resources in recent decades. When the impacts of sea level rise start to accumulate, especially in the Least Developed Countries (LDCs), there will be a significant risk of capital flight and this will have repercussions across middle class markets and on the poor and vulnerable.

Strategies that build coastal resilience are in line with the SDGs, which set indicators and targets for tackling global sustainability issues such as health and wellbeing, clean water and sanitation, climate action and life on land/life below water. Designing coastal infrastructure to meet the SDG targets would improve its resilience to climate change and associated sea level rise while providing wider co-benefits.

3.2 Resilience for coastal infrastructure

To prepare for this new reality we must adopt resilience approaches to coastal infrastructure[41]. Traditional coastal infrastructure approaches typically base the projection of future needs on past events and the premise that the past could reliably predict the future. The majority of coastal infrastructure, for example, is based on concrete structures that are rigid and built to specifications that do not allow flexibility to changing conditions. So many of the current infrastructure approaches designed to deal with sea level rise are not able to meet the demands of an increasingly volatile world that climate change is creating.

Resilience approaches are a fundamentally different approach to traditional coastal infrastructure. At its core, resilience requires systemic thinking, flexibility and inclusive decision making. While there remains a lack of common definition and taxonomy for resilience, the IPCC defines resilience as: the capacity of social, economic and environmental systems to cope with a hazardous event or trend or disturbance, responding or re-organising in ways that maintain their essential function, identity and structure, while also maintaining the capacity for adaptation, learning and transformation.

41 Thacker, S. et al. (2019). Infrastructure for sustainable development. Nature Sustainability, 2(4), p.324.

In order to interpret this definition of resilience into a more practical approach for resilient coastal infrastructure investments, the climate resilience principles of the Climate Bonds Initiative help provide useful guidance (see Table 1).

Table 1. Summary of Climate Bonds Initiative Resilience Principles

Summary of Climate Bonds Initiative Resilience Principles
Assets and activities being invested in must have clearly defined boundaries and identify interdependencies for assessing climate risks and resilience impacts.
Physical climate risk assessments for assets and activities being invested in must be undertaken throughout the full operating life of the asset or activity.
Risk reduction measures for the identified climate resilience risks to ensure the asset or activity is fit-for-purpose, and does no significant harm to the resilience of the system of which it is a part, taking into account the asset or activity's boundaries, interdependencies and sector.
The climate resilience benefits of system focused assets and activities should be assessed and demonstrated, using specific and quantifiable performance standards or thresholds to serve as benchmarks for expected benefits to the broader system.
Mitigation and trade-offs must be assessed. Mitigation requirements may be lowered or considered inconsequential for climate resilience focused assets or activities whose resilience benefits considerably outweigh associated emissions.
Issuers should have a viable plan to undertake ongoing monitoring of climate risks and benefits linked to the assets and activities to enable them to determine whether they continue to be fit-for-purpose and maintain any climate resilience benefits as climate hazards, exposures and vulnerabilities evolve.

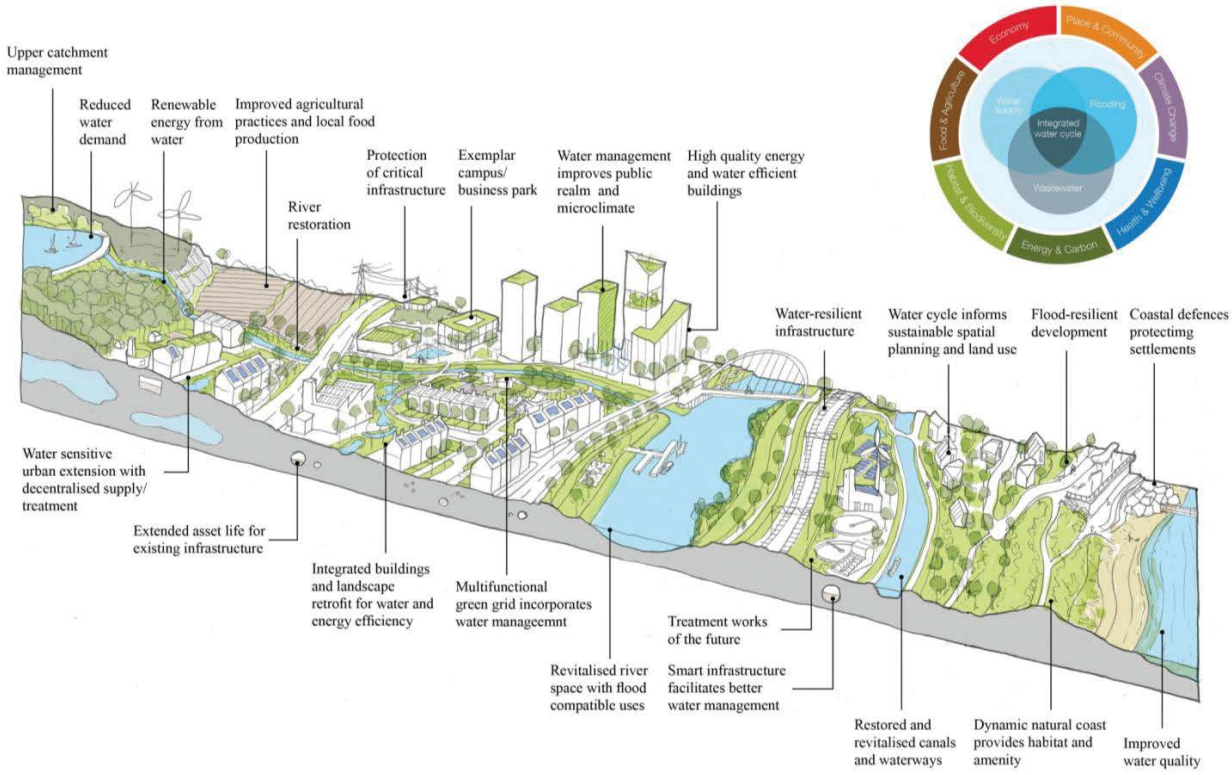
3.3 Engineering resilience

Engineers face a significant challenge to adapt infrastructure to meet demand in increasingly complex environments, to high specifications of climate resilience and where investment in global infrastructure is significantly lower than what is necessary to achieve this. How can engineers ensure that infrastructure is designed to be resilient?

The most effective way to ensure infrastructure is sustainable is by adopting a resilience approach to strategic infrastructure provision of ecosystem services. Taking the water management as an example, at the highest level, a resilience-based approach recognises that a piece of infrastructure acts as a targeted 'intervention' at a particular point in the water cycle and wider landscape considerations of the project defines the requirements for infrastructure from the start. Under natural circumstances, water is used by various components within the water cycle, replenished and then re-used in model that echoes a circular economy. The system promotes the retention of the natural resource within the economy, and its subsequent regeneration within the

natural system. Given the importance of water to society[42], interventions should seek to optimise these functions of the water cycle rather than acting as a barrier to them (Graph 4).

Graph 4: The water cycle and a typical watershed showing the potential for green-grey coastal infrastructure



Source: Arup

To achieve this, baseline water assessments will identify and map different components of a water catchment in terms of its quality, quantity, spatial and temporal characteristics, as well as the demands placed on the system and the infrastructure within it. Both grey (i.e. sea walls) and green (i.e. habitats) infrastructure can be identified in terms of their role in the catchment, the services they provide and the associated value they bring. To fully understand whether infrastructure is being designed to improve resilience, interventions in the water cycle[43] should be considered in terms of their functions within the wider system and whether characteristics of water therein are improved.

Having understood the requirements placed upon, and constraints of, the water cycle, the type of infrastructure intervention should then be decided upon. This can be done

42 Ichinko T, Drouet L, Vrontisi Z, Hof A, Hinkel J, Mochizuki J, Bosetti V, Fragkiadakis K, Van Vuuren D, Lincke D (2019). Economy-wide effects of coastal flooding due to sea level rise: A multi-model simultaneous treatment of mitigation, adaptation, and residual impacts. Environmental Research Communications DOI: https://doi.org/10.1088/2515-7620/ab6368

43 Gerten, D. et al. (2013). Towards a revised planetary boundary for consumptive freshwater use: role of environmental flow requirements. Current Opinion in Environmental Sustainability, 5(6), pp.551-558.

so as to maximise the co-benefits as well as the core functional requirement of the infrastructure. At this point it is possible to determine the infrastructure-specific design measures that may be used. For example, resilient coastal infrastructure is increasingly harnessing the value of ecosystem services through integrating green and grey infrastructure, and planning concepts such as the Biodiversity Net Gain (BNG) principle. BNG requires that developments have a net increase in the overall state of biodiversity. Knowledge of the benefits, feasibility and costs of both green and grey infrastructure solutions should be known to engineers and planners, and applying approaches such as BNG is one way to learn lessons about integrating green and grey. This knowledge can also build an evidence base to demonstrate that novel approaches to resilient infrastructure are effective versus traditional approaches. For clients and investors, sharing this knowledge could be key to de-risk investments in novel approaches.

Integrated green and grey solutions also constitute a measure to reduce impacts of development in a way that is favourably recognized under regulatory Environmental Impact Assessments (EIA). EIA is the process for assessing the impacts of a project on aspects of the environment, such as air quality, greenhouse gas (GHG) emissions and population health. Embedding this type of mitigation into design is the most effective way to ensure projects can have positive environmental outcomes.

ECOncrete

ECOncrete®[44] provides a suit of bio-enhancing concrete admix materials and science-based designs which increase biodiversity and richness floral and faunal communities, while adding strength and longevity and complying with all standards for marine construction. Key features are:

- A substantial reduced carbon footprint reduction, up to 80% less, compared to Standard Portland cement-based concrete;
- Increased biodiversity and species richness;
- Enhanced biological processes such as biocalcification and photosynthesis which facilitate CO_2 assimilation; and
- Gains an average of 2.5 kg of biogenic build-up per m^2/year.

3.4 Nature-based 'green-grey' infrastructure solutions

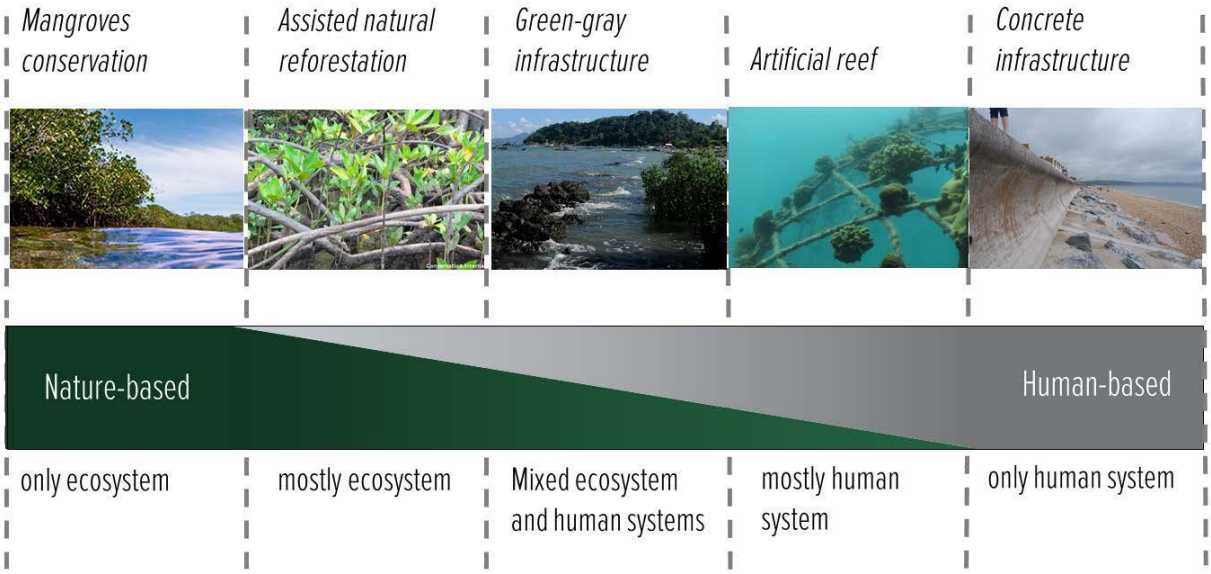
Green-grey infrastructure combines the conservation and/or restoration of ecosystems with the selective use of conventional engineering approaches to provide people with solutions that deliver climate change resilience and adaptation benefits (see Graph 5). Green-grey approaches blend strategic use of "green" networks of natural and working landscapes and other open spaces so conserving ecosystem functions and values

44 https://solarimpulse.com/efficient-solutions/econcrete

with "grey" human-engineered techniques. As such, communities can recognize the benefits of both solutions while minimizing the limitations of using either green or grey infrastructure individually. For example, integrating wetland restoration with living shoreline approaches to breakwaters, combines the wave attenuation and flood control value of wetlands with the benefits of engineered structures to stabilize the coastal zone. The combined solution can be more comprehensive, robust and cost-effective than either solution alone. These blended solutions can provide a host of multi-benefits:

- Habitat for fish and other aquatic species
- Employment opportunities for example, through enhanced fisheries
- Coastal protection to absorb and buffer wave energy and storm surge
- Carbon sequestration, by conserving or restoring wetlands that capture and store five times more carbon than tropical rainforests, and
- Improving water quality by filtering rainwater or storm water.

Graph 5: Green to grey infrastructure spectrum



Source: Conservation International

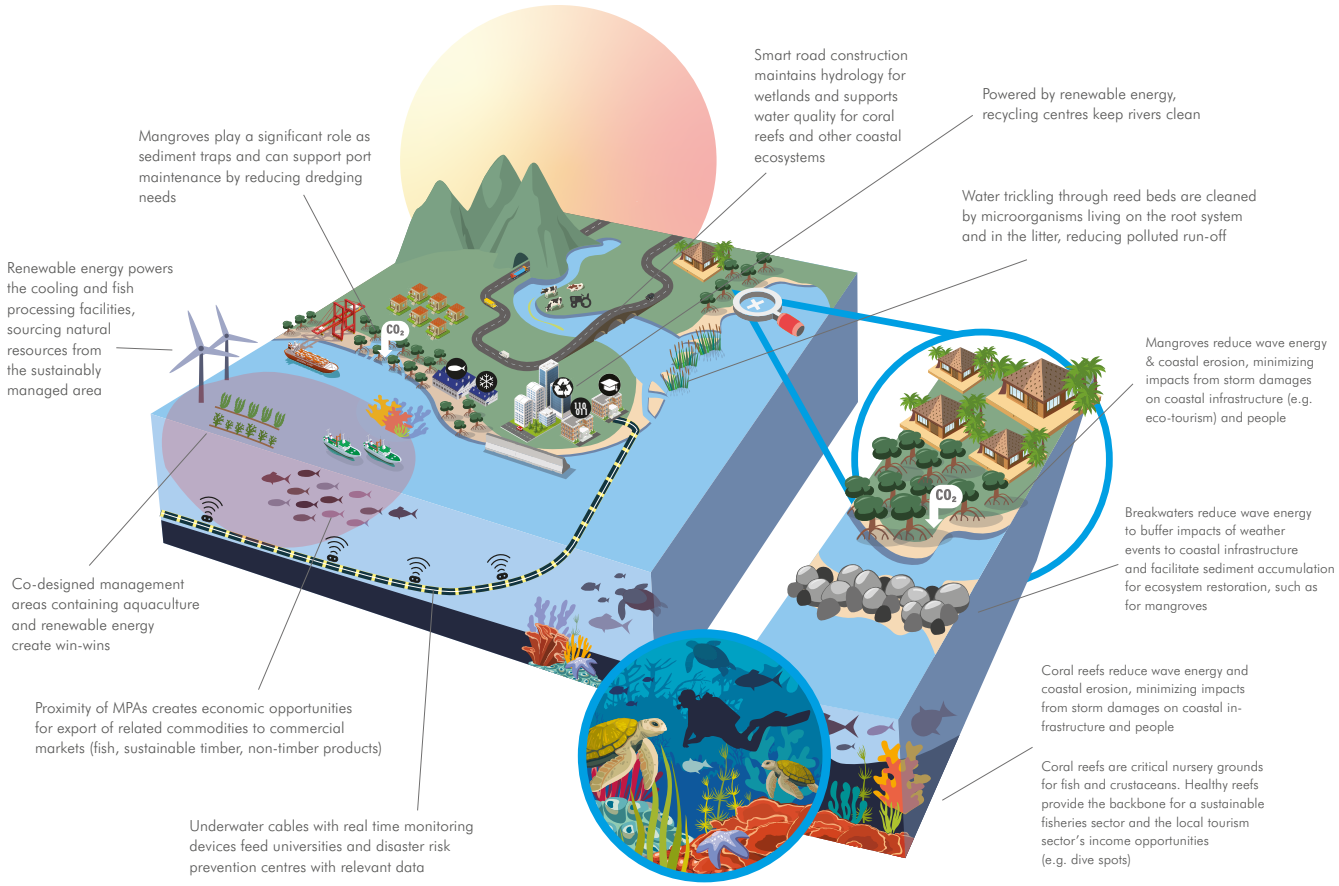
Green-grey infrastructure[45] is often a cost effective alternative to conventional engineering solutions, especially when considering the environmental and social co-benefits. For example, the installation of breakwaters that mimic the natural environment provide coastal marine habitat, provide protection to coastal wetlands allowing for sediment stabilization and carbon storage, together reducing wave energy and protecting coastal communities and assets from storm surges.

Nature-based approaches also scale across the landscape. Often thought of in terms of individual elements of a management approach (e.g. a wetlands restoration), nature-

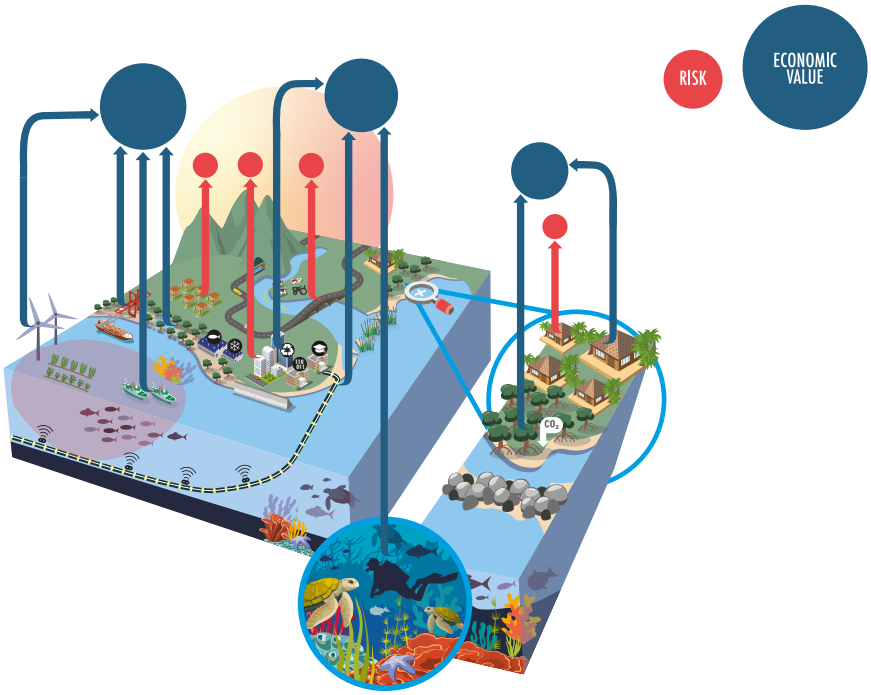
45 Browder, G; Ozment, S; Rehberger Bescos, I. et al. (2019). Integrating Green and Gray : Creating Next Generation Infrastructure. Washington, DC: World Bank and World Resources Institute. © World Bank and World Resources Institute. https://openknowledge.worldbank.org/handle/10986/31430 License: CC BY 4.0 https://www.worldbank.org/en/news/feature/2019/03/21/green-and-gray

based approaches recognize interconnectivity of actions that may stretch from the upper coast to the open ocean (e.g. allowing for lowering and storing floodwaters across the landscape) (see Graph 6).

Graph 6: Coastal infrastructure with NbS (Blue Infrastructure)



Graph 7. Integrating NbS into infrastructure planning



Development is focused on delivering a broader range of economic values, strengthening also human, social and natural capital. Benefits and services of nature are identified, integrated and internalised. This improves economic opportunities across sectors, reduce risk, and increases resiliency against external factors.

For example, well-managed mangroves and coral reefs increase fishing harvests, provide tourism opportunities, and protects coastal assets and people from natural disasters and coastal erosion.

Arrows and circles for illustration only.

For example, the Shenzen Sea Wall[46]: Coastal Resilience Strategy included a number of proposed interventions to provide coastal defence while maximising the benefit to biodiversity and broader ecosystem resilience. Analysis of historic mapping data identified the optimum locations for habitat interventions, such as coral reef restoration and specifically engineered pots to encourage mangrove growth, and their potential ecosystem services benefits. This process was informed throughout by an ecosystem services assessment, following principles of biodiversity net gain to maximise the integration of nature-based solutions in infrastructure at both a strategic and local level.

At a similar scale, the Shang Qin Huai EcoWetlands masterplan used an integrated team of ecologists, landscape architects and hydrological engineers to design a 11km^2 area of the Yangtze River floodplain, providing biodiversity benefits, flood resilience and reduced water pollution.

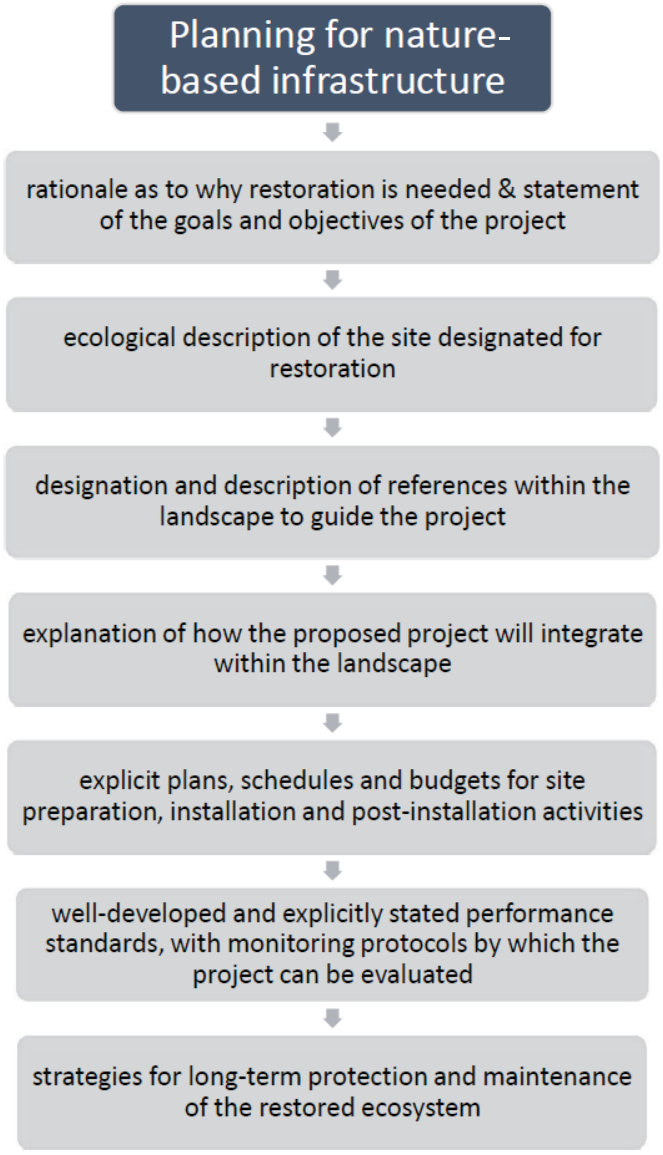
46 Arup is proud to have contributed to all of the projects referenced in this chapter, including the Shenzen Sea Wall, Shang Qin Huai Masterplan, Newton Creek urban stormwater management, Climate Bonds Initiative and BIOFIN Thailand. Special thanks to all those who contributed by way of project examples or other resources: Jenny Dunwoody, Robin Campbell, Stephen Fraser, Austin Brown, Lizzie Gardner, Neil Harwood, Jason Fairbairn, Borbala Trifunovics, Pete Gabriel, Tom Gray, Siraj Tahir, and Louise Ellis.

3.5 Resilience in natural infrastructure project planning and implementation

The application of structured planning gained firm traction in the practice of ecosystem restoration as natural infrastructure. Yet, application remains concentrated in regions of the world with the luxury of resources to build science- and practice-based experience. This knowledge has greatly improved the success of natural infrastructure projects, building confidence in the outcome, which in turn has encouraged increased funding (measured in billions of US dollars) and scaling up of planning and implementation efforts.

Structure in natural infrastructure planning is critical to improving the likelihood of successful outcomes, and for learning why an outcome was fully, partially or not achieved.

Planners might consider documenting the following elements:



3.6 Challenges, opportunities and financial pathways to scale

What will it take to redesign our entire approach to infrastructure for an era of climate insecurity? There is an immense need for resilient nature-based solutions like green-grey infrastructure, but there are challenges to achieve implementation at a large scale. One challenge is the need to **de-risk investment in nature-based and hybrid solutions by building confidence within a broad audience that they will provide the predicted protection and ecosystem benefits.** To do that, investment in pilot projects is needed to build the science and evidence base. There is an urgent need to collaborate with communities to develop and implement nature-based adaptation approaches, and to pilot, learn and adaptively manage these systems. That information will generate standards for implementation and maintenance, and evidence of performance needed to de-risk large scale investment.

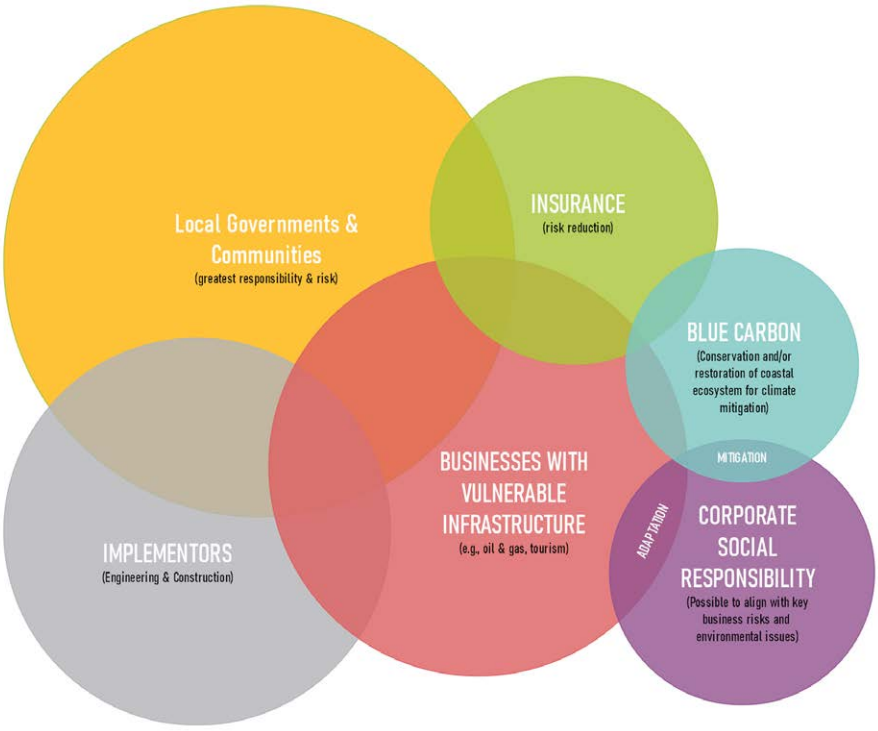
Programs such as the UN Biodiversity Finance Initiative (BIOFIN) can help achieve this. **BIOFIN combines technical analysis of biodiversity at a country-wide level with overarching frameworks and activities to increase investment in biodiversity through a Biodiversity Finance Plan**. Through the BIOFIN framework, integrated green-grey infrastructure projects could attract funding to improve this evidence base while measurably improving national-scale biodiversity and providing climate resilient infrastructure.

Another path to de-risk investment is to balance the risk and reward among project proponents. Alternative and innovative procurement models can distribute risk among those involved in an infrastructure project. For example, in an Integrated Project Delivery approach the relevant project stakeholders, from funder, government, designer, engineer, contractor, and/or community organization enter a multi-party agreement to distribute risk and optimize project results. Experimenting with this, and other, procurement models could accelerate the implementation of relatively un-tested green-grey infrastructure approaches.

3.7 Collaboration as the foundation of resilience building

Given the criticality of systemic thinking, flexibility and inclusive decision making to resilience approaches, a prerequisite for surfacing and scaling resilient coastal infrastructure is accelerating and leveraging cooperative actions between communities and the private and public sectors (Graph 8).

Graph 8. Stakeholder alliances



Source: Conservation International

Blended finance will channel the financing solutions but all stakeholders (industries, public authorities, communities, NGOs, etc.) need to work together towards one comprehensive goal – each financed from different sources and motivated by different benefits, albeit complementary and intertwined.

Ocean Risk and Resilience Action Alliance (ORRAA)

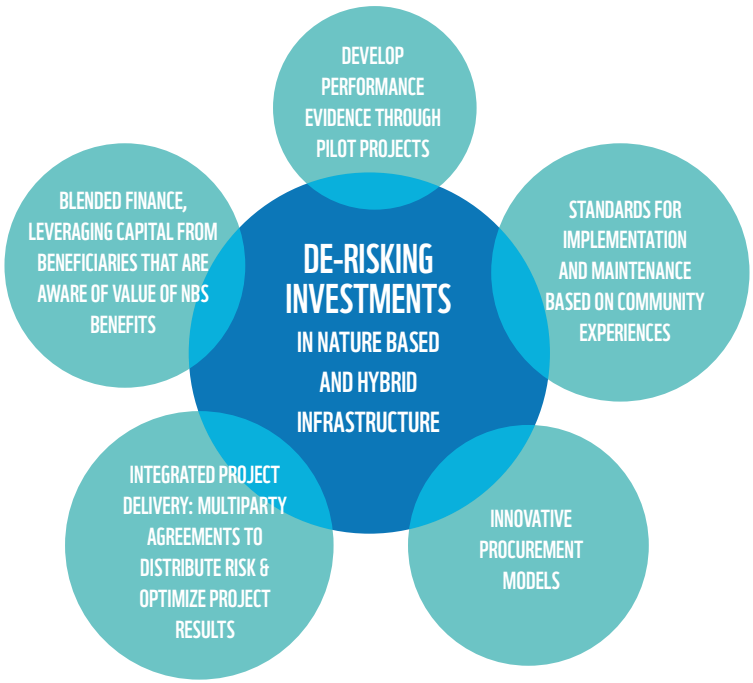
The United Nations has called for a transformative response by the finance and insurance industries to reduce the exposure and vulnerability of those most at threat: the coastal ecosystems and communities in developing countries and Small Island Developing States (SIDS). The Ocean Risk and Resilience Action Alliance (ORRAA) has been created as a multi-sector collaboration between public and private sector organizations to respond to this call by driving investment into coastal natural capital through ground-breaking finance products that incentivise blended finance and private investment into the regions and communities that need it most. This includes investments into mangroves, coral reefs, seagrass beds, saltmarshes and other coastal habitats which are universally undervalued for their resilience and broader economic, societal and ecological importance, yet are key to building long term resilience to the threats of ocean derived risk for millions of people.

Engineers, consultants, designers and planners have a wide scope within which they can contribute to designing and promoting resilient coastal infrastructure. Engaging with clients and encouraging the perspective that water management issues are catchment-wide can help promote more sustainable approaches to infrastructure design. Designing with nature to support habitats, improve biodiversity and move towards a reliance on ecosystem services brings social, wellbeing, economic and environmental benefits. Finally, ensuring that the evidence supports good design to meet Paris Agreement or SDG targets gives lenders the confidence that nature-based resilient coastal infrastructure solutions can perform well, both for society and commercially.

Highlighted by Colgan et al. (2017)[47] stated that the largest barriers for securing adequate resources [to finance natural infrastructure projects] are: identifying locations where natural infrastructure can play a significant role in flood risk reduction; developing the experience and standards to overcome institutional biases in favour or 'proven' grey infrastructure; and developing institutional arrangements capable of matching available funding with the needs of individual situations.

Financing should be applied where there is confidence that successful outcomes for projects will be achieved, or where the risks of failure are known and acceptable. In the case of nature-based solutions there are specific services that are driving project implementation, around with other ecosystem services. **It is important to be able to convey the resilience underpinning of a project, the risks of project failure and the economic value compared to alternative grey approaches or no action at all.**

Graph 9. De-risking investment in nature-based and hybrid infrastructure



47 Colgan, C.S., Beck, M.W. and Narayan, S. (2017). Financing Natural Infrastructure for Coastal Flood Damage Reduction. Lloyd's Tercentenary Research Foundation, London.

4. Financing Blue Infrastructure

4.1 The role of Multilateral Development Banks

4.1.1 A changing approach to MDBs investing in sustainable infrastructure

MDBs are playing a key role in delivering the substantial investment needs of developing countries in the field of sustainable infrastructure. With the already noticeable impact of a changing climate, and the long lifetime of typical infrastructure assets, these investments now have to achieve the additional twin aims of delivering mitigation impacts, while being resilient to climate change. This is in addition to the traditional aim of MDB finance of delivering human development aims.

In order to integrate the climate and development aims, the UN has developed the SGDs, which are the currency in which the attainment of a range of aims is measured. While they need to be further operationalized, in particular in regards to tracking and monitoring and evaluation, they provide the overall framework in which MDB investment in sustainable infrastructure is now taking place.

MDB investments typically deliver against a number of SDGs, because MDBs are already pursuing projects that lead to positive results with respect to a range of environmental, economic, social, health, inclusion, financial, fiscal and/or governance-related aspects.

Many MDBs are adapting their approach to infrastructure finance in order to enable their investments to be fully integrated into national and transboundary infrastructure at the system level, rather than continuing to think in traditional investment terms of financing by sector, e.g. energy or transport infrastructure. Electrification of transport is the most obvious and near-term example for this. MDBs no longer consider investments in road networks and power networks on a stand-alone basis but also consider wider impacts on a societal level. Another example is in smart grids and advanced metering infrastructure (AMI)[48], where integration can improve situational awareness and support rapid restoration after disasters.[49] A good example is the European Bank for Reconstruction and Development (EBRD) with the recent creation of a Sustainable Infrastructure Group combining power and energy, transport, social and municipal infrastructure.

At the same time, delivering the investments in sustainable infrastructure will depend on the enabling framework. This ranges from power sector regulation to Public-Private-Partnerships (PPP) legislation to municipal budget rules, to name just a few areas, and is multifaceted. Many MDBs, through their access to special expertise and by virtue of

48 AMI is an integrated system of smart meters, communications networks, and data management systems that enables two-way communication between utilities and customers

49 Hallegatte, S., Rentschler, J., Rozenberg, J. (2019). Lifelines : The Resilient Infrastructure Opportunity. Sustainable Infrastructure. Washington, DC: World Bank.

their role in development, provide advice and expertise to ensure that governments can create adequate enabling environments. Other MDBs are working with national development institutions to support local capital markets that can support more sustainable blue infrastructure finance.

Finally, in order to deliver sustainability, much of the investment may require additional elements that are less affordable to infrastructure users in developing countries, such as electric buses instead of diesel, or renewable energy solutions that carry higher upfront cost. In these cases, MDBs can access bilateral and multilateral donor sources, either externally or in-house, to address affordability constraints.

A revised approach to investing in sustainable infrastructure that leverages these abilities will see MDBs:

- proactively seek out system-level linkages between sustainability solutions, including renewables as well as nature-based solutions;
- offer clients and countries policy dialogue to deliver policies that promote legal and regulatory change to enable this, such as regulations that create positive economic externalities and minimise rent-seeking behaviour; and
- create blended finance packages for clients and use other donor resources in a targeted and economically efficient manner in line with the international Finance Corporation's (IFC) principles.

4.1.2 MDB's catalytic finance and blended finance

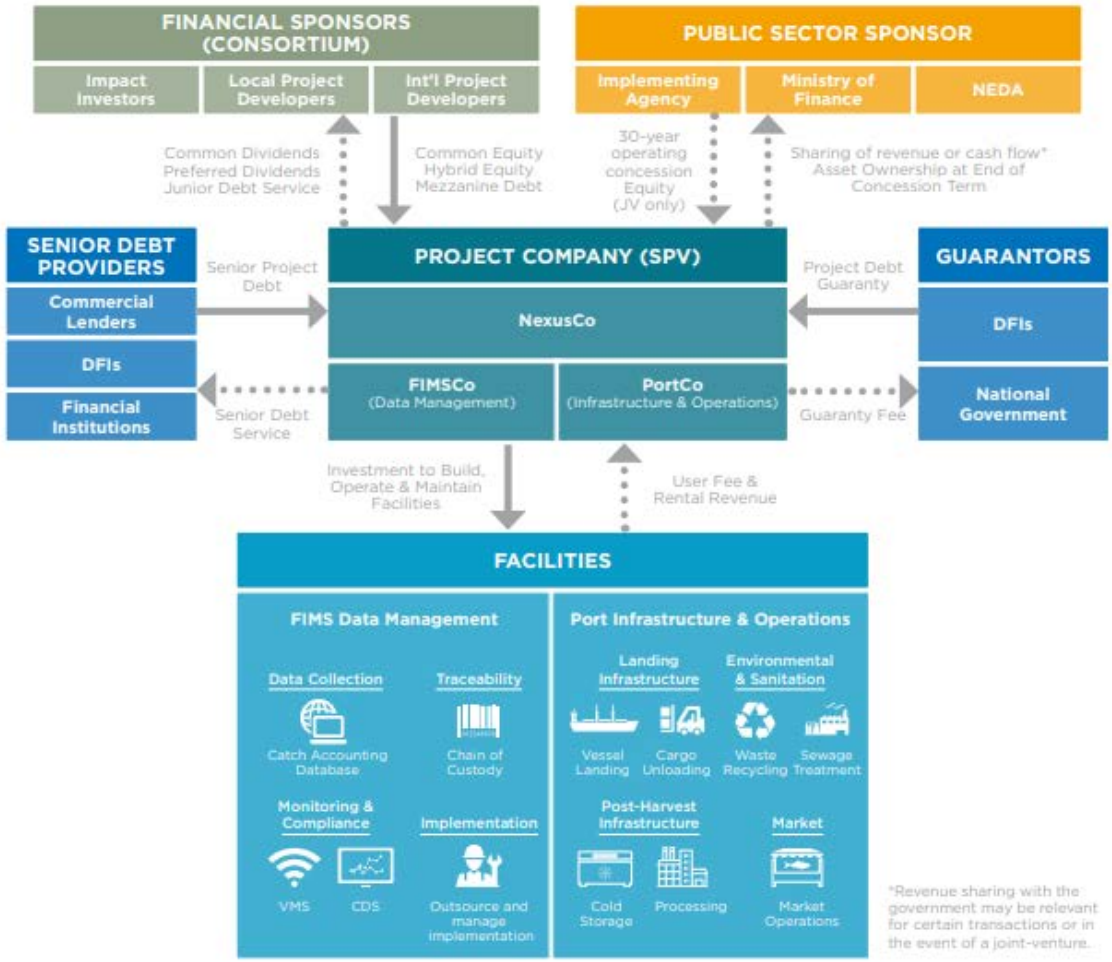
MDBs have the ability to provide suitably priced, long-term sovereign finance for their countries of operations, which reduces the overall cost of infrastructure delivery. For countries that are classed as having lower income, some MDBs are able to provide discounted sovereign finance, either directly, or by blending the standard loan with a concessional financial product.

Given the needs of developing countries, and the operational model of MDBs, which is primarily focused on the provision of sovereign finance, it is however not possible for MDBs, even with donor support, to provide all the financing that is necessary. Other sources of investment are needed. This means that at a significant part of the sustainable infrastructure requirements in developing countries will have to be delivered through the private sector, with MDBs either acting as a catalyst in ensuring that the risks for investors remain bearable or as a trailblazer, creating new markets and demonstrating the potential for new investments. **For the implementation of blue infrastructure, based on NbS, to reach scale, it needs to become the daily bread-and-butter for a broad range of private financiers.**

For large-scale, long-lived infrastructure projects which include blue infrastructure, various delivery models could be envisaged that cover the catalyst role, including long-term concessions, or PPP models. These are more likely to generate income over the

long term, and therefore be not just environmentally, but also financially sustainable, and generate government income through taxes.

Graph 10: Example of a blue PPP, Philippines



Source: Encourage Capital 2016. [50]

Nevertheless, structuring such investments is complex, and in many countries with higher country risk, private investors will need assurance through the participation and support of a multilateral partner. MDBs can be honest brokers between governments and the private sector, enabling investment structuring that takes into account the needs of the country and the investor.

The development of a solid pipeline of nature based, blue infrastructure projects is key to success in this. New MDB-led platforms are now rapidly emerging specifically targeting the **preparation of sustainable infrastructure projects in developing countries**, often using public donor funding. Examples are the recently announced

50 Encourage Capital (2016). Investing For Sustainable Global Fisheries. http://investinvibrantoceans.org/wp-content/uploads/documents/Nexus_Blue_Strategy_FINAL_1-11-16.pdf

collaboration of the Asian Development Bank with Infrastructure Asia to create the Innovative Finance Lab for Sustainable Infrastructure, which will complement the ASEAN Catalytic Green Finance Facility (ACGF). This Lab aims to accelerate collaboration with the private sector to improve policy making capacities and foster the adoption of innovative and green finance models in local and municipal infrastructure projects in ASEAN countries[51]. Similarly the City Climate Finance GAP Fund announced at the 2019 Climate Action Summit will be set up to provide donor funding for the development and preparation of climate friendly and resilient infrastructure projects on the municipal level in developing countries. **Nature-based, blue infrastructure projects are fully compatible with the mandate of many of such initiatives and MBDs could consider to include them in the scope of these project preparation efforts, if there is a demonstrated pipeline of bankable projects**.

Alongside project preparation and structuring support, **catalytic capital from public sources** and philanthropy can be used in the form of blended finance to increase private sector investment into sustainable infrastructure. **Blended finance is a structuring approach** that allows different types of capital (whether public, impact, or commercially oriented), to invest alongside each other while each achieves its own objectives (financial, development, or social impacts, or a blend)[52]. The goal of the blended finance approach is to increase the amount of capital directed toward socially important investments. **Blended finance models have been identified as a key approach to help transition to sustainable landscapes, scaled-up adaptation finance[53] and are also a key model to increase resilience through nature based solutions in blue infrastructure**[54].

At the project level, grant and concessional resources from bilateral or multilateral donors can be used to bring down the cost, and thereby enhance the affordability of infrastructure. Utilising these resources alongside their ordinary capital resources, MDBs can get involved in blended finance structures as junior equity provider or first loss equity provider in layered capital investment funds alongside private investors. Such structures are proven through established and performing funds like the EU Green for Growth Fund, the Land Degradation Neutrality Fund or the Athelia/Mirova Sustainable Ocean Fund and could be extended to dedicated investment funds targeting BNC investments as parts of dedicated sustainable infrastructure funds.

ADB launched its Action Plan for Healthy Oceans and Sustainable Blue Economies in May 2019.

It aims to scale up investments and technical assistance to USD 5 billion between 2019–2024. The action plan highlights four focus areas, including sustainable

51 This facility aims to mobilize USD 1.3 billion from ASEAN Infrastructure Fund and various development finance institutions.
52 "Blended Finance." Convergence, www.convergence.finance/blended-finance
53 Global Commission on Adaptation, UNEP Finance Initiative (2019), Driving Finance today for the Climate Resilient Society of Tomorrow.
54 Rode, J, Pinzon, A, Stabile, MCC et al. (2019), Why 'blended finance' could help transitions to sustainable landscapes: Lessons from the Unlocking Forest Finance project. Vol 37 Science Direct.

coastal infrastructure and ecosystem management and rehabilitation. ADB also launched an Oceans Financing Initiative, which aims to leverage ADB and donor funds and technical assistance, along with innovative financing instruments, to create "bankable" investment opportunities and attract financing from a range of sources, including the private sector. The initiative is first being piloted in Southeast Asia with support from the ASEAN Catalytic Green Finance Facility (ACGF) (under the ASEAN Infrastructure Fund), the Republic of Korea, and World Wide Fund for Nature. The Republic of Korea has pledged USD 355 million for the ACGF with a focus on projects to boost ocean health.

4.1.3 ESG standards and procurement principles

Environmental, social and governance (ESG) considerations are at the core of sustainable investing. With growing emphasis on sustainability, ESG and infrastructure investments should go hand in hand. MDBs are different from commercial lenders in that they are operating under enforceable standards for environmental and social impact mitigation, and can therefore assure high environmental and social quality standards of investments. This will also become increasingly important to prevent mal-adaptation. Without MDB involvement, governments would have to rely on contractual or voluntary commitments, which are less easy to obtain and maybe more costly, or indeed impossible, to enforce.

MDBs already incorporate biodiversity and nature considerations into their projects. The World Bank, for example, applies its Environmental and Social Framework (ESF)[55] since October 2018 to all new World Bank investment project financing. The ESF, based on 10 environmental and social standards, has been introduced to better manage environmental and social risks of projects and to improve development outcomes. The application of Standard 6, "Biodiversity Conservation and Sustainable Management of Living Natural Resources" is especially relevant for infrastructure investments in coastal zones to move towards integrating BNC to maintain the benefits from ecosystem services. This standard is also included in the IFC Environmental and Social Performance Standards, which are most widely adopted ESG standards for private infrastructure investments and related investments funds. ESG standards help infrastructure clients mitigate risks by advising them on how to build their overall environmental and social management capacity.

Where MDBs and Development Finance Institutions (DFIs) are managing trust funds earmarked to project development and preparation these can support project preparation funding with an appropriate focus on and integration of Nature-based Solutions (NbS) in promising coastal infrastructure. Screening tools can help investment officers and engineers working with their clients such as municipalities, cities, port operators, private coastal developers to make them aware of cost-effective NbS opportunities.

55 https://www.worldbank.org/en/projects-operations/environmental-and-social-framework

While infrastructure developers are guided by the above mentioned E&S standards and new data sets e.g. the World Bank Sovereign ESG data portal, they may lack the capacity to fully integrate biodiversity and ecosystem service considerations into their analysis project preparation. This is especially true for BNC integration. **In order to deliver BNC projects in a safe and sustainable manner, there is a clear need for BNC training of E&S experts.**

On the procurement side, working with MDBs provides assurance that bidding and procurement are undertaken according to best practice, and that any related complaints will be handled transparently and robustly. In particular in developing countries with weaker governance, this can make the difference between having few, or many bidders for contracts.

4.1.4 Implementation, monitoring and enforcement

MDBs normally have well-developed implementation models, under which clients are being given support during the investment preparation and investment phase, to ensure that the project is being implemented correctly. The establishment of Project Implementation Units is standard practice and can substantially help clients to deliver high-quality, fully compliant investments.

They also allow the project owner to systematically track and report on project impacts in a coherent and transparent manner, in line with international established frameworks. Post-investment, MDBs have the ability to undertake in-depth evaluations that allow the country and other stakeholders to better derive lessons learnt from the investment, understand how specific challenges were addressed and overcome, and apply these lessons at future investments.

4.2 Global institutional and regulatory frameworks

International rules and standards governing infrastructure investments and promoting green and blue investments over grey ones have to be strengthened, and foreign direct investment (FDI) needs to be attuned to the imperatives of sustainable green/blue finance. Whilst many governments continue to promote investments in extractive growth, which can damage natural landscapes through inappropriate infrastructure development and concessions, others are reorganising their national strategies towards sustainable development, renewable energy and a circular economy. Firms are likewise making this transition by a more systematic assessment of their impacts and focusing on long-term resilience, as the recent Microsoft announcement[56] shows.

56 https://www.forbes.com/sites/arielcohen/2020/01/24/microsoft-joins-the-corporate-race-to-zero-carbon/#224343bf29e5

4.3 Governments: roles and needs

Host country governments, in their roles as urban planner, large infrastructure developer and investor, play a vital part in integrating BNC assessments very early on in the project development phase. Institutional capacity, that is the ability to design, select, procure and implement infrastructure projects effectively, is crucial and often missing on the government level. In countries with limited institutional capacity[57] to deliver infrastructure, the priority is to increase technical capacity[58] to design and implement projects through targeted technical assistance. Donor governments using bilateral or multi-lateral grant channels (ODA or climate finance) can subsidise the additional project preparation costs for blue infrastructure investments to incentivise the integration of nature-based solutions.

Clear and aligned public policies that mandate climate resilience requirements for coastal infrastructure investments are required. Furthermore, infrastructure data policies need to cover the entire infrastructure life cycle, and include NbS/natural capital relevant data. Long-term investors that make climate resilience a pre-condition for investment[59] can reduce maintenance and future damage costs due to climate change.

4.4 Impact investors

The financing demands for global infrastructure are large and growing. Because of its environmental and social benefits, green/blue infrastructure opens new finance opportunities both from public sources via grants and subsidies, or from private sources, such as mission-driven investors that can help tackle this financing gap. Unlocking these new sources of capital, both public and private, can help meet the significant infrastructure investment needs - equivalent to 4.5% of GDP in developing countries - over the next 15 years.[60] Blended financing options involving impact investments, have been described in section 4.1.2. As new impact funds focus on coastal opportunities they can provide an important role in engaging through their investment companies and directly in this development.

Yet, they face distinct barriers themselves:

- Lack of NbS-based infrastructure project deals overall; associated with lack of clarity around land-tenure, property rights, access rights, user rights and permitting issues:
- Lack of scalable NbS-based infrastructure deals;

57 Chaudhury, M. (2017). Strategies for reducing vulnerability and building resilience to environmental and natural disasters in developing countries .Written for Expert Group Meeting on Strategies for Eradicating Poverty to Achieve Sustainable Development for All, New York, May 8-11, 2017. World Resources Institute.
58 https://sustainabledevelopment.un.org/topics/capacity-building
59 Golnaraghi, M. (2019). Investing in climate-resilient decarbonised infrastructure to meet socio-economic and climate change goals. Geneva Association Research Brief.
60 Rozenberg, J. et al. (2019). From A Rocky Road to Smooth Sailing : Building Transport Resilience to Natural Disasters. Background paper for Lifelines. World Bank, Washington, DC.

- Lack of mature NbS-based infrastructure deals. The limited number of projects available are mostly very innovative, based on new technologies (better suited for venture capital) and with high market risk (e.g. no off-take agreements). This calls for additional technical assistance facilities to support proper project development (see also chapter 5.1).
- Lack of clarity/understanding how the benefits of conservation/NbS reach investors. Proper financial models to calculate returns are key.

Impact investors are only one actor in this field. A broad group of private finance providers has to adopt the approaches discussed in this paper.

4.5 Setting international standards

Developing standards for infrastructure project finance will allow us to address key stressors through investments into areas such as wastewater management and coastal resilience. All new investments into transport, logistics, renewable energy grids, data and communications infrastructure likewise need to be designed to address adaptation and transition challenges.

Expert Working Group on Sustainable Infrastructure[61]

In March 2019, the United Nations Environment Assembly (UNEA) passed a resolution on sustainable infrastructure (UNEP/EA.4/L.6) that recognizes infrastructure's centrality to the 2030 Agenda on Sustainable Development. Among other things, it requests that UN Environment prepare a report on best practices for sustainable infrastructure, drawing on the wide body of existing normative guidance and identifying any gaps in the existing knowledge.

In response to UNEA Resolution 4/6, UN Environment has convened an Expert Working Group to lead the work on this task. While there are many existing tools, approaches, standards, guidelines, norms, and other forms of guidance that can be used to support assessment and decision-making for infrastructure development, there is currently no one set of internationally applicable guidance that countries can to use to support their planning and development of sustainable infrastructure.

To address this gap, the Expert Working Group intends to produce a consolidated normative guidance document for integrated approaches to the planning and development of sustainable infrastructure.

61 https://www.unenvironment.org/explore-topics/green-economy/what-we-do/economic-and-fiscal-policy/sustainable-infrastructure

G20 and infrastructure[62]

The Group of Twenty (G20) was established in 1999 as a forum for governments and central banks from the 19 largest national economies and the European Union to discuss policy relating to the promotion of international financial stability and coordination of economic policy.

Infrastructure has been a priority for several G20 Presidencies and in 2014 the Global Infrastructure Hub (GI Hub) was established by the G20.

The G20 Principles for quality infrastructure investment can be found here.

A clear framework for financial institutions lending to infrastructure projects as well as the developers and investors of such projects in coastal and marine areas, in particular in developing countries, is thus needed. Such an approach is also supported by a recent blue paper issued by the High Level Panel[63]. This framework must include a broad range of stakeholders such as through knowledge transfer hubs[64] and it has to be based on a broader framing along seascape and coastal resilience. The water infrastructure criteria under the climate bonds initiative[65] are such an example. They focus on the ability of the asset to be robust and flexible in the face of ongoing and potential climate impacts, and the sustainability of the relationship between the asset and upstream and downstream ecosystems as climate shifts continue to evolve. Likewise, the Climate Resilience Principles provide a framework for assessing investments[66].

In Europe, the European Union legislators have recently agreed[67] on a classification system ("taxonomy") for sustainable economic activities and investments to be used by governments and financial market participants when reporting on their sustainable investment activities. The taxonomy includes six environmental objectives, all of which are relevant for blue habitats ranging from climate change mitigation to climate change adaptation to the restoration of biodiversity. One of objectives explicitly refers to "sustainable use and protection of water and marine resources". Specific guidance under the taxonomy will be developed over the coming years. The ongoing work offers the opportunity to firmly establish the concept of blue infrastructure within the taxonomy and to formulate investment blueprints that respond to the taxonomy by tailoring coastal infrastructure projects at large along their climate adaptation, mitigation and biodiversity values.

62 https://www.gihub.org/about/g20-infrastructure-outcomes/
63 High Level Panel on Sustainable Ocean Economy - particularly https://www.oceanpanel.org/blue-papers/coastal-development-managing-resilience-restoration-and-infrastructure-coastlines
64 IORA Blue Carbon Hub [website]. Available at: https://research.csiro.au/iora-blue-carbon-hub/
65 https://www.climatebonds.net/files/files/Climate%20Bonds%20Water%20Infrastructure%20Full%20Criteria.pdf
66 https://www.climatebonds.net/climate-resilience-principles
67 Proposal for a Regulation of the European Parliament and of the Council on the establishment of a framework to facilitate sustainable investment (Approval of the final compromise text), Council of the European Union, 14970/19 (17 December 2019).

Voluntary sustainable infrastructure standards, like SURE Standard (GIB), have a focus on promoting nature based solutions in infrastructure. Private investment – by far the most important source of cross-border funding for infrastructure – has few regulatory contours that would promote investments in green and blue infrastructure.

Periodically, the OECD issues guidance by way of a "Sector Understandings" under what is called the "*Arrangement*", a gentleman's agreement by industrialized countries governing the provision of export credits. Since 2012, a Sector Understanding is in place concerning renewable energy, climate change and the water sector. However, the specific scope is focused on energy generation (Ocean energy sources included), energy efficiency measures, and carbon capture and storage. It regards renewable energy, climate change and water as one sector next to a range of others (shipping, aircraft, nuclear, rail and coal-fired electricity generation), instead of a cross-sectoral commitment.

Treaties on trade and investment arguably have the biggest impact on the directions international private investments take. It is good news, then, that these treaties are increasingly concerned with questions of sustainable development and matters of environmental protection[68]. This also extends to unilateral trade measures such as the EU's "Generalised System of Preferences" (GSP), which allows products from 90 developing countries to attract less or no duties on their importation into the EU.

However, in many respects, this is an uneasy alliance. While environmental regimes generally seek to transform existing growth patterns and are concerned with the long-term, exemplified in climate resilient growth paths, international trade and investment law remains concerned with economic growth in general and with facilitating trade flows. It is therefore not surprising that some of the discourse concerning the relationship between the two disciplines has focused on potential conflicts and challenges. Environmental measures from 'extraterritorial' expansions of emission trading systems to sustainability standards for fish and agricultural products including biofuels, domestic support for green jobs and border carbon adjustments have – for instance – all been questioned on their compatibility under international trade law.

Much less attention has been paid to the potential for conceptual linkages and to constellations in which both trade law and a nature-based agenda complement each other, notably in the field of green and blue investments, rather than contradict or undermine each other. This explains the mostly passive placement of sustainability issues in trade and investment agreements. It also explains why sustainability issues, when they do become real and concrete concerns in a specific trade/investment relation, are often the subject of critique, if not outright legal challenges. A scenario approach such as the ARUP 2050 scenarios report can help to show how incentives creates different outcomes[69].

68 Beharry, C. and Kuritzky, M. (2015). Going Green: Managing the Environment Through International Investment Arbitration. *American University Int'l Law Review, 30,* p.383.
69 ARUP (2019). 2050 Scenarios: four plausible futures'.

4.6 The Paris Agreement and blue infrastructure finance

The Paris Agreement provides a starting point towards bridging the gap between finance available and finance needed for blue infrastructure. Relevant in this regard is on one hand Article 2.1c of the Paris Agreement which aims at "…making finance flows consistent with a pathway to low greenhouse gas emissions and climate-resilient development…". This concept calls for the entire financing and investment portfolios, beyond the part that are directly beneficial for the climate, to be consistent with the long-term goals of the Paris Agreement[70]. In line with this goal, new products have been developed over the past years on the level of bank lending for water projects[71], standards for water-related activities financed through climate bonds as well as specific blue bonds financing marine restoration[72]. As referred to earlier in this report and in line with the transformation of financial flows, the EU taxonomy for sustainable finance[73] targeting the sustainable use and protection of marine resources, can be used in infrastructure finance to give clarity to investors of the contribution of the financed project or an investment vehicle to preserving Blue Natural Capital.

Indonesia Flood Resilience Impact Bond & Zurich Flood Resilience Alliance

Pekalongan City and Regency, on the North Coast of Central Java, Indonesia has a population of over 1,176,000, and is among a growing number of coastal areas in Asia suffering from extreme flood events. Coastal areas are losing land to the sea with several neighborhoods experiencing permanent inundation. Flooding has led to cascading negative effects on the population. Farmers and fishermen/women are particularly vulnerable to flooding, causing them to lose their livelihoods, be faced with chronic water-borne health illness and live in poverty. Over the past decade, coastal flooding impacts have worsened in both areas.

Modeling off of an environmental impact bond issued by the municipality in Washington DC to address combined sewage overflow through the implementation of green infrastructure, Mercy Corps is developing a flood resilience impact bond (results-based financing mechanism) to support the development of nature based solutions in Pekalongan. A recently concluded concept development study has mapped relevant regulatory conditions, potential transaction participants and potential interventions that will be financed by the mechanism. Having identified all this, further work is needed to transform this theoretical foundation into practice so that an instrument can be issued.

70 International Development Finance Club (2018). IDFC Position Paper, Aligning with the Paris Agreement.
71 UNFCCC Standing Committee on Finance (2018). 2018 Biennial Assessment and Overview of Climate Finance Flows.
72 Roth, N. ,Thiele, T. and von Unger, M. (2019). Blue Bonds: Financing Resilience of Coastal Ecosystems. A technical guideline prepared for IUCN GMPP.
73 EU Technical Expert Group on Sustainable Finance (2019). Taxonomy Technical Report.; Taxonomy: Final report of the Technical Expert Group on Sustainable Finance (2020)

Mercy Corps is a member of the Zurich Flood Resilience Alliance, a partnership of nine organisations from both the public and private sectors with a shared vision: to prevent floods from devastating the lives of the world's most vulnerable people. The Alliance shares common visions with BNCFF to advance practice and advocacy of resilience and, in particular, blue finance.

There is significant scope to tailor adaptation and mitigation projects in a way that they support the development of blue infrastructure rendering the ability to access climate finance originating from various funds of the United Nations Framework Convention on Climate Change (UNFCCC). These include the Green Climate Fund (GCF), the Global Environment Facility (GEF)[74] and the Adaptation Fund. All of these funds have the mandate to serve the financing of the Paris Agreement and are relevant to the development of blue infrastructure. To access such financing, project developers can consider designing coastal infrastructure projects that aim at building the resilience of ocean and coastal zones with significant emphasis on nature-based solutions and integrating conservation measures to deliver multi-use infrastructure and multiple sustainable development benefits. Priority can also be given to mitigation components such as enhancement of natural carbon sinks via wholesale mangrove and seagrass protection.

The GEF Adaptation Program has investment in projects aiming to reduce the vulnerability of coastal communities and infrastructure to the effects of climate change such as sea-level rise, storms, floods, etc. through better land-use planning, climate-resilient coastal infrastructure and sustainable management of natural infrastructure. The Least Developed Country Fund and the Special Climate Change Fund made investments to the tune of 13 per cent and 11 per cent respectively of total financing to promote climate-resilient, integrated coastal zone management[75]. More recently, the GCF approved funding of USD 43 million for a UNDP-supported project to boost climate resilience for millions living in India's coastal communities. Project activities focus on the restoration and conservation of over 15,000 hectares of mangroves, coral reefs, seagrasses and salt marshes[76].

A recent World Bank cost benefit analysis showed based on 3,000 scenarios that the net present value of such investments over the lifetime of new infrastructure assets -- or, equivalently, the cost of inaction -- exceeds USD 2 trillion in 75 percent of the scenarios and that climate change makes the strengthening of infrastructure assets even more important, doubling the median benefit-cost ratio[77].

74 UNFCCC Climate Finance in the negotiations [website].
75 GEF (2018). GEF Programming Strategy on Adaptation to Climate Change for the LDCF and the SCCF and Operational Improvements.
76 UNDP (2018). Green Climate Fund approves US$43 million for UNDP-supported project to boost climate resilience for millions living in India's coastal communities [press release].
77 Hallegatte, S.; Rozenberg, J.; Rentschler, J. et al. (2019). Strengthening New Infrastructure Assets: A Cost-Benefit Analysis. Policy Research Working Paper;No. 8896. World Bank, Washington, DC.

Bilateral initiatives, regional and multilateral channels

There are several climate-related bilateral initiatives, regional and multilateral channels[78] to help developing countries in mitigation and adaptation to climate change, which can also support blue infrastructure projects. These include, for example, Internationale Klimaschutzinitiative (IKI) (Germany), and NEFCO (Nordic countries). Additionally, bilateral development co-operation and Official Development Assistance (ODA) from bilateral donor funds such as those by the Agence Française de Développement (AFD) and Fonds Français pour l'Environnement Global (FFEM) (France), and multilateral donors can also play a critical role in financing sustainable blue infrastructures. Such support is especially important for Small Island Developing States, where concessional financing is crucial given their challenges in mobilizing domestic and other sources of finance. Countries could also have access to innovative debt instruments, such as countercyclical loans (allowing debt service to fall in the event of a major shock)[79].

There are also new upcoming international initiatives such as the multi-donor trust fund of the World Bank aiming towards improvement of coastal resilience, known as PROBLUE which is part of the World Bank's active Blue Economy portfolio valued at around USD 3.7 billion, with a further USD 1.5 billion in the pipeline[80]. Furthermore, the European Investment Bank and EU's LIFE Program funds the Natural Capital Financing Facility (NCFF), which is a €100–120 million revolving fund primarily promoting biodiversity and nature-based adaptation. This fund offers financing for blue infrastructure for government agencies and private businesses located in the EU-28 countries[81] without having a specific blue focus.

Anticipating the magnitude of funding needed to deliver on the Paris Agreement, Agenda 2030 and SDGs including the Ocean Goal 14 several new concepts of financial mechanisms have come up or are under development. These include impact bonds to fund the protection of ecosystems[82], blue bonds to promote investment in adaptation and marine biodiversity[83] sustainable development bonds for ocean and coasts[84], coral reefs[85] as well initial concepts of resilience bonds linked to catastrophe bonds. Some of these structures use concessional funding from the UNFCCC funds serving the Paris

78 UNFCCC (2016) Bilateral and Multilateral Funding [website].
79 Kulkarni, R. (2018). Innovative financing and regional dialogue are central for a thriving 'blue economy". UNDP [online blog].
80 The World Bank (2018). World Bank Announces New Global Fund for Healthy Oceans.
81 World Bank (2018). Financing a Resilient Urban Future: A Policy Brief on World Bank and Global Experience on Financing Climate-Resilient Urban Infrastructure. Washington, D.C. World Bank Group.
82 Nicola, D.J. (2013). Environmental Impact Bonds (CASE i3 Working Paper #1). Duke University's Fuqua School of Business p.17.
83 Roth, N. ,Thiele, T. and von Unger, M. (2019). Blue Bonds: Financing Resilience of Coastal Ecosystems. A technical guideline prepared for IUCN GMPP.IUCN, Gland, Switzerland.
84 The Asset (2019). World Bank, Credit Suisse partner on US$28.6 million 'ocean' bond'. Environment Social Governance [online forum].
85 Iyer, V. et al. (2018). Finance Tools for Coral Reef Conservation: A Guide. Wildlife Conservation Society with the assistance of the Conservation Finance Alliance.

Agreement like the 2018 Seychelles Blue Bond, which used a concessional loan from GEF to cover coupon repayments, and a repayment guarantee from the World Bank for part of the principles. **Such new blended finance solutions help de-risk nature-based blue infrastructure investments and attract private impact investors.**

Regardless of the availability of various options for financing blue infrastructure, there is a need to scale up such infrastructure financing significantly. **Current ODA spending does not reflect the importance of the sustainable blue economy or coastal infrastructure.** Out of the USD 18.8 billion in concessional finance received by the small island developing states (SIDS), only USD 1.15 billion (6.1%) went to sectors relating to the ocean economy[86]. It's a similar percentage for multilateral development bank financing. Comparing Joint Reports on Multilateral Development Banks' Climate Finance reveals that coastal and riverine infrastructure projects received USD 973 million in 2016 amounted to USD 130 million in 2018[87].

In addition to climate finance flows originating from the UNFCCC funds, bilateral and multi-lateral channels, **carbon market mechanisms can contribute to filling some of the gaps between financing needed for blue infrastructure and the financing available.** Blue infrastructure integrates sustainability considerations and is essential for the protection of blue carbon ecosystems (i.e. mangroves, salt marshes and seagrasses). Blue infrastructure projects can help maintain valuable carbon storage in these ecosystems or actively build carbon storage through sequestration of carbon from the atmosphere by afforestation/reforestation activities. Carbon market mechanisms allow the monetization of the mitigation ecosystem services of BNC projects thus generating additional revenue streams, which improves the financial viability of blue infrastructure projects. A good number of infrastructure lenders, especially development banks have sufficient experience to lend against such additional carbon revenue streams. Impact investors too might be willing to invest in such projects against solid emission reduction purchase agreements. In some cases, carbon buyers might also be willing to pay in advance for future delivery of emission reductions.

California Example

In 2006, California proposition 84 (Bonds for Flood Control and Water Supply Improvements) was authorized to sell USD 5.4 billion in general obligation bonds for water and flood control projects, waterways and natural resource protection, water pollution and contamination control, state and local park improvements, public access to natural resources, and water conservation efforts.

With an aggressive stance on tackling climate change on the ballot for 2020 is the California Bonds for Climate Resiliency Projects Initiative, which would authorize USD 7.8 Bn in bonds for projects related to climate resilience: 1) USD 3.5 bn for

86 OECD (2018). Innovative Approaches to Building Resilient Coastal Infrastructure, OECD Environment Policy Papers, No. 13, OECD Publishing, Paris..
87 Joint Multilateral Development Banks (2018). Climate Finance. EBRD, London, UK.

"wildfire prevention and community resilience from climate impacts"; 2)USD 2.2 bn for "safe drinking water, protecting water supply and water quality from climate risks"; 3) USD 1 bn for "protecting fish and wildlife from climate risks"; 4) USD 200 m for "protecting agricultural land from climate risks"; 5) USD 770m for "protecting coastal lands, bays, and oceans from climate risks"; and 6) USD 230 m for "climate resilience, workforce development, and education."

This level of financing is achieved because of the rigorous science-led planning approach However, learning must continue with focus on increased understanding of quantified standards and tolerances that encourage engineers to include nature-based solutions more completely with, or instead, of traditional grey infrastructure fall-backs.

Article 6 mechanisms of the Paris Agreement allows for such emission reduction trading in a bi-lateral way (Art.6.2. cooperative approach) or under a multi-lateral mechanism (Art. 6.4). Functioning as an additional financing mechanism, Parties can utilize Article 6 cooperative approaches to develop and implement coastal carbon interventions that can be integrated both under the Paris Agreement and within the UNFCCC framework[88]. Demand and supply for carbon credits under the Paris Agreement will be dependent on the rules and modalities for implementation of the Art. 6 mechanisms, currently being negotiated at the UNFCCC, with results to be expected at UNFCCC COP26 in Glasgow. Key elements to be negotiated centre around ensuring environmental integrity, additionality, avoidance of double counting and fostering ambition.

Voluntary carbon market

Financing support for emission reductions in blue carbon projects can also be found in the voluntary carbon markets. Methodologies under the voluntary carbon markets (particularly Verra, formerly known as the Verified Carbon Standard (VCS), or Plan Vivo) offer higher flexibility, often with reduced costs for the required carbon accounting, verification and certification processes. In this sense, they can address the needs of communities and project developers better. The demand for voluntary carbon offsets has grown significantly over the past year with Corporate Social Responsibility (CSR) being the main driver. Especially the tourism sector and the marine transport sector seem to be interested in buying offsets from coastal ecosystem projects and sellers report prices that have the potential to make some blue carbon projects commercially viable. It needs to be pointed out that the voluntary carbon markets will also undergo some changes in the transition towards the Paris Agreement regime with claims on carbon neutrality being more difficult to achieve without full support by the host countries.

88 Herr, D. et al. (2018). Coastal Blue Carbon and Art. 6, Implications and opportunities. Climate Focus and IUCN.

5. Overcoming challenges and gaps in financing the blue infrastructure projects

5.1 Shortage of bankable projects

One of the biggest challenges in channelling financing to NbS based blue infrastructure projects is the availability and level of readiness of such projects for financing. Whilst initiatives like the Blue Natural Capital Financing Facility (BNCFF) are providing support for the later stages of project preparation, most of the blue infrastructure projects globally are still at an early design and development stage and need further engagement and initial development, with appropriate preparation support. In addition, potential cash flow components such as blue carbon trading or results based finance still suffer from a lack of sufficient track record to find broader acceptance among financiers. This especially applies to transactions involving avoided emissions and soil carbon stocks, where methodologies for blue carbon trading are at final stages of development and will only be tested in the near future. On the other hand, good track record has already been built in the past years for blue carbon afforestation and reforestation projects of mangroves, which command a good demand in the carbon markets. Blue carbon trading can provide meaningful cash incomes for carefully designed projects in specific locations and under some carbon trading regimes. However in some countries the necessary carbon volumes and the price threshold might be insufficient to achieve investable project propositions. Whilst buyers are increasingly interested in achieving these higher values and verification standards are in place, the supply of such projects is still limited and early project development support is strongly needed. Thus, the next few years will be crucial for the evolution of blue carbon markets contributing to blue infrastructure.

Blue infrastructure requires significant design efforts and alignment in regulatory formats. Planning laws need to be adjusted to fully reflect these opportunities, incentivize desired NbS development while dis-incentivizing suboptimal are even harmful activities that do not capture the value of nature. Local authorities and development banks are especially called out to step-up efforts in integrating blue aspects and nature-based solutions in coastal infrastructure from the early concept stage onwards. Sponge cities are one of several interesting approaches to utilise wetlands as shown in the proposed Green Infrastructure Master Plan for Udon Thani in Thailand[89]. Donors are increasingly mobilizing public climate funds for project preparation on city and municipality level. Efforts such as the R20 Initiative or the upcoming City Climate Finance Gap Fund have important roles to play by including Blue Natural Capital-based considerations in designs and concepts of Paris Agreement aligned local infrastructure projects.

89 McCartney, M et al. (2020). Fighting floods with 'sponge cities'.

Blue Natural Capital Financing Facility (BNCFF)

In order to accelerate the flow of capital into Blue Natural Capital (BNC) projects, the Blue Natural Capital Financing Facility (BNCFF) has been launched by IUCN. The primary purpose of BNCFF is to support the development of sound, investable BNC projects with clear ecosystem service benefits based on multiple income streams and appropriate risk-return profiles. The BNCFF provides project developers and owners of small companies with technical assistance to prepare and structure projects from an early stage into bankable investments with the objective of reducing risk and accessing appropriate sources of finance. The BNCFF model is innovative because it seeks to blend different types of finance and assistance (grants, guarantees, loans, impact investment and technical assistance) from different sources for different project elements, each with a corresponding rate of return and risk profile.

The approach BNCFF has adopted initially is to identify promising pilot projects and small and medium sized enterprises (SMEs) and help them to develop and grow. These pilot projects can subsequently be scaled-up to offer larger scale business opportunities.

With regards to the specific challenges of marine and coastal projects, the BNCFF facilitates the integration of complementary project components that are necessary for sustainable development, particularly with regards to development that moves towards more climate-resilient coasts and coastal communities.

For more information, please visit www.bluenaturalcapital.org

5.2 Shortage of capital dedicated to blue infrastructure projects

Capital for traditional bankable infrastructure projects is widely available in the market. However, available capital is often not channelled to blue infrastructure, due to unfamiliarity with the opportunities (e.g. nascent technologies such as tidal or wave energy), lack of sizeable cash flows in the short term from goods and services, perceived risks due to governance and land ownership and longer-term uncertainties surrounding nature-based solutions under unpredictable climate change scenarios. Many of these challenges can be overcome by offering blended finance solutions, where grant and concessional funding from public or private climate finance sources will be mobilized to reduce identified risks. The World Bank ProBlue programme[90] and the Asian Development Bank's Action Plan for Healthy Oceans, Sustainable Blue Economies[91] provide exciting new avenues to support blue infrastructure efforts.

90 https://www.worldbank.org/en/programs/problue
91 https://sdg.iisd.org/news/adb-launches-usd-5-billion-action-plan-for-healthy-oceans-sustainable-blue-economies/

Blended finance has traditionally mostly been applied to the energy (including renewables), banking, financial services and transport sector[92]. Blending in conservation finance is at an earlier-stage and most efforts so far focus on sustainable agriculture and sustainable forestry/reforestation (sustainable aquaculture and ecotourism make up only 17% and 10% respectively of the recorded transactions). Such transactions are mostly located in Latin America and the Caribbean. The majority of blended conservation finance transactions take place within pooled vehicle structures, quite large in size[93] (USD 50-250 million, average USD 87 million). Blending for conservation and nature-based solutions can be done on different levels:

- Design stage grants: very key for early-stage conservation projects.
- Technical assistance funds: for further project preparation, to build the capacity of investments to reach specific financial and impact returns.
- Guarantees / Risk insurance: commonly applied to bonds and notes for infrastructure projects.
- Concessional capital: loans with lower or flexible interest rates, junior equity, commonly provided by development agencies, multi-donor funds, and some foundations and NGOs. MDBs and DFIs have also deployed concessional capital to such conservation finance transactions, primarily from donor funds under management, alongside their commercial investments.

By combining proactively a wider coastal landscape approach in the planning stages, blue infrastructure projects can aim to bring multiple partners and revenue streams into the project structure and use blended finance approaches to address in particular early stage transaction cost/risk challenges.

5.3 Mechanisms for payments for ecosystem services, especially climate mitigation, adaptation and biodiversity

Specific mechanisms for the ecosystem services provided by the nature-based solutions in blue infrastructure could provide meaningful additional revenues to the project sponsors. Blue carbon credits are already traded. While promising developments are on the horizon to further monetize blue carbon stock enhancements, blue carbon credits still have some way to go to become routinely integrated into financing structures of larger sustainable infrastructure financiers. The broader range of services that could be monetized from blue carbon systems still have to be identified and further advanced for trading and results-based monetization. The broader range of services that could be monetized however, still have to be identified and advanced for trading. Adaptation and resilience credits as well as biodiversity certificates could all be part of such a mix. One concept would be to set up a dedicated results payment facility for ecosystem services for blue infrastructure projects, starting with mitigation benefits.

92 Basile, I. and J. Dutra (2019). Blended Finance Funds and Facilities: 2018 Survey Results. OECD Development Co-operation Working Papers, No. 59, OECD Publishing, Paris..
93 Convergence (2019) Blending in Conservation Finance.

Climate mitigation benefits could be sold as offsets[94] to private sector companies or as NDC compliance tools to bi-lateral Art. 6.2. government buyers or even certain philanthropies or private actors in the impact space. International public climate funding could be mobilized to guarantee some of the risks of such payments for ecosystem services transactions, bringing the cash flows for longer-term benefits forward to create short-term revenues to satisfy investors in BNC restoration.

Adaptation Benefit Mechanism (ABM)

Few adaptation responses and technologies in developing countries are financially attractive to the private sector. Some can yield revenues but they may be delayed, are high risk and/or require up front investment and they face other barriers.

The Adaptation Benefit Mechanism (ABM) is an innovative mechanism for mobilizing new and additional public and private sector finance for enhanced climate change adaptation action. It has the potential to speed up transformation to low-carbon, resilient and sustainable development of the host countries by giving value to resilience.

ABM will de-risk and incentivize investments by facilitating payments for delivery of Adaptation Benefits. ABM will certify the social, economic and environmental benefits of adaptation activities. The value of adaptation action captured in these certificates, including the incremental costs of generating the benefits, will be promoted to potential investors or lenders. The expectation is that verified certificates of the benefits of specific adaptation activities issued by a reputable international organization and based on sound methodological and technical work, in consultations with stakeholders and with the approval of the host country government will guarantee the credibility of the adaptation activities and increase their attractiveness to potential investors or lenders.

While payments for adaptation benefits are still at early concept stages, some initiatives worth mentioning include the adaptation benefit mechanism developed by the African Development Bank[95], the Blue Carbon Resilience credit explored by The Nature Conservancy together with the Ocean Risk and Resilience Action Alliance (ORRAA)[96]. Blue Carbon Resilience Credit (BCRC)[97] is a combined blue carbon and resilience credit, where corporations seeking to offset their carbon footprint can buy credits to advance adaptation for vulnerable communities and fund coastal restoration and conservation projects. BCRC integrates mitigation metrics in the form of avoided CO_2 equivalent emissions; and adaptation metrics in the form of flood protection benefits

94 Certificates of host country NDC fulfilment contributions
95 African Development Bank Adaptation Benefit Mechanism (ABM) [website].
96 www.oceanriskalliance.org
97 The Global Innovation Lab for Climate Finance Blue Carbon Resilience Credit [website].

that a wetland provides nearby coastal communities[98]. A third-party verified framework ensures purchaser confidence and offers purchasers the added benefit of quantifying their contributions to SDG Goal 13: Climate Action.

Nature-based, blue infrastructure solutions need clear avenues to finance for their implementation and piloting. A market-based approach, using for example Natural Capital Accounting Standards, implemented in parallel with government incentives and/or tax mechanisms could open new funding sources. Government actions to incentivize companies and guide governments' own investments to integrate ecosystems into infrastructure projects could include:

- Requiring infrastructure projects receiving public funding to dedicate a portion of those investments to nature-based or hybrid solutions. In this way, governments would facilitate finance for green infrastructure integration into all relevant infrastructure projects;
- Providing incentives to businesses funding and/or applying green-grey solutions to reduce climate vulnerabilities. For example, a private landowner or business could receive tax credits by conserving and/or restoring marsh ecosystems in combination with reinforcing sea walls, with the purpose of protecting vulnerable coastal infrastructure; and
- Establishing a standard practice to integrate nature-based adaptation solutions into natural disaster response and recovery efforts, occurring both in pre- and post-disaster phases.

These examples show that, with appropriate measures, initial implementation challenges for blue infrastructure projects can be overcome and as common practices emerge these can be replicated more effectively.

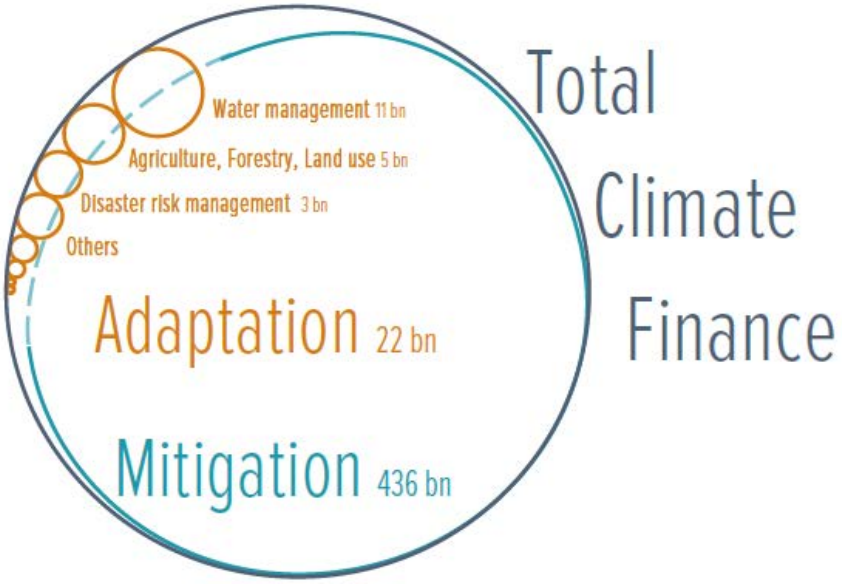
5.4 Private adaptation finance still nascent

The private sector accounts for 54% of the global climate finance for 2015/2016. Private sector investors encompass a variety of actors, including individual investors, private venture capitalists, or institutional investors (e.g. pension funds, insurance companies). However, due to tracking challenges, the private sector investments for adaptation and more specifically nature-based investments remain insufficiently documented. The private sector plays an important role in complementing constrained public finance for adaptation by leveraging innovation, expertise, and financial resources. In addition, the private sector itself is increasingly responsive to the risks and opportunities resulting from climate change. Often private companies invest in adaptation measures to reduce the climate risk of physical damages to their business assets, operations, and supply chains. However, private sector adaptation strategies using nature remain very limited (3%)[99].

98 Hendrick, G. (2020). Ocean risk and resilience- Jan/Feb issue, Leader's Edge Magazine.
99 Goldstein et al. 2018 (Nature Climate Change): The private sector's climate change risk and adaptation blind spots

Private sector investments in adaptation typically use the same instruments of traditional business investments. The main opportunities of engagement include lending funds for initiating adaptation, developing technologies and services to reduce climate vulnerability, and providing insurance to manage risks. Private investments for nature-based adaptation might be more likely to occur as co-benefits, for example resulting from saving measures that reduced the use of water or electricity that can be used for other adaptation purposes. Such adaptation benefits can be explicitly part of impact investments that aim to generate social and environmental impact alongside a financial return. In addition, preserving ecosystems might also be a form of insurance against future climate change risks. Studies have revealed private interests related to nature for some specific activities, namely climate-smart agriculture, eco-tourism, and improved water and forest management.[100]

Graph 11. Adaptation in Agriculture, Forestry and Land-use represents a small proportion (USD 5 billion) of the total climate finance in 2015/2016 (USD 463 billion)

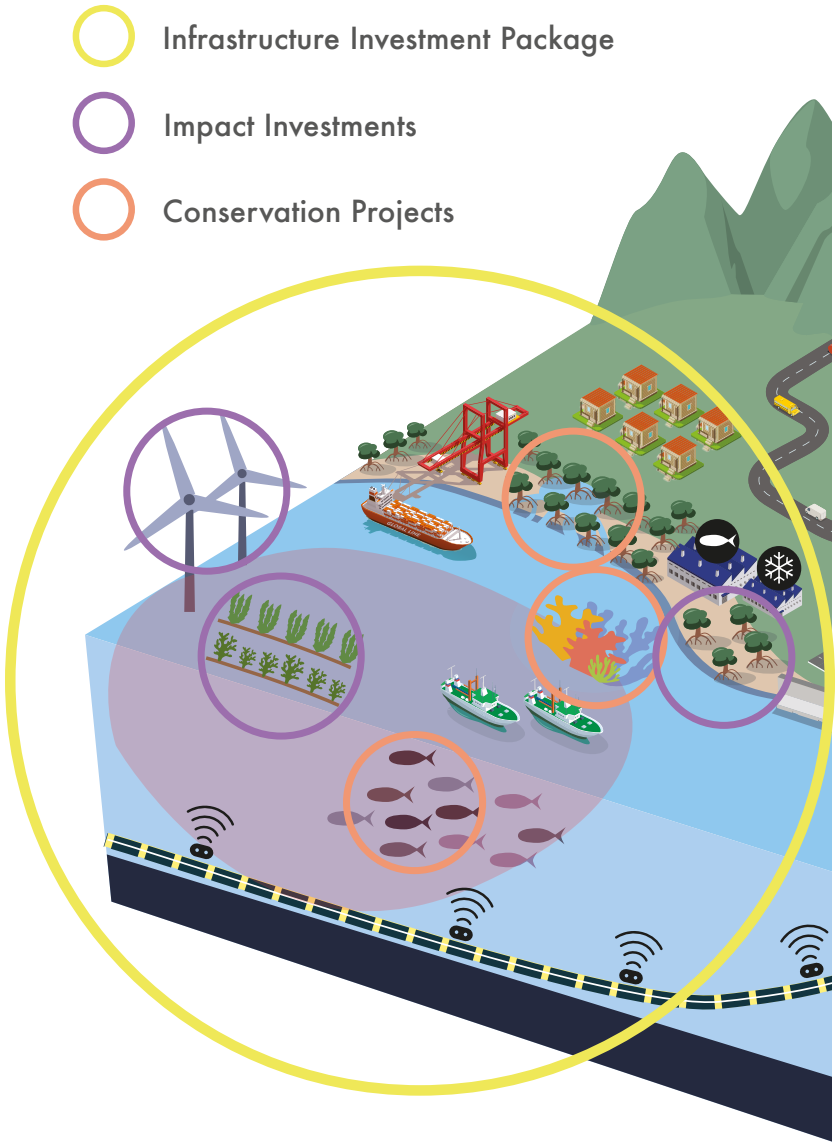


Other orange circles: other crosscutting adaptation, infrastructure & energy, policy & capacity building, coastal protection.
Data: Climate Policy Initiative (2018).

100 Fedele G., Donatti C.I., Corwin E., Pangilinan M.J., Roberts K., Lewins M., Andrade A., Olvera D., Frazee S., Grover M., Lalaina Rakotobe Z., Rambeloson A. (2019), Nature-based Transformative Adaptation: a practical handbook, Conservation International, Arlington, VA, USA.

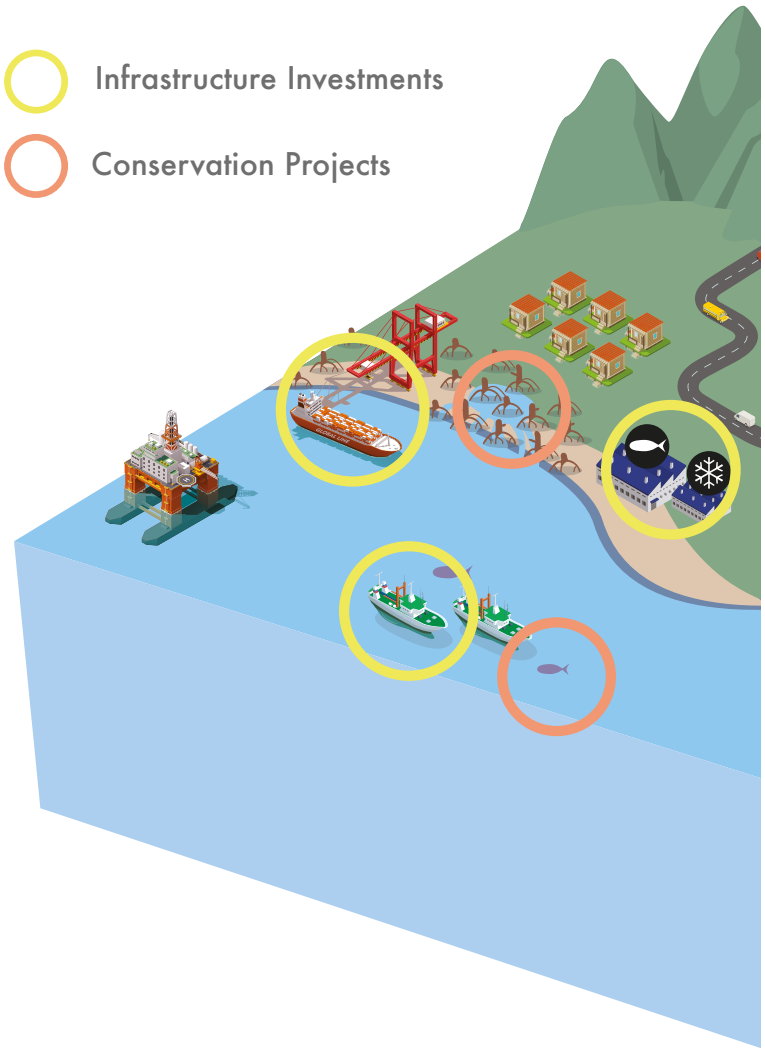
6. Key take-aways

New blended finance solutions (Graph 12) (compared to convention investment formats (Graph 13)) can help de-risk blue infrastructure investments based on NbS while attracting a broader range of financiers, including private impact investors.



Graph 12. Blue infrastructure finance

Blue infrastructure projects are designed with a holistic view, integrating the broader land and seascape, financing a wider range of project components that optimise green-grey infrastructure. Conservation project components funded in parallel reduce other risks. New revenue generating opportunities for local communities are created. Investment opportunities for impact investors and other private sector partners are promoted.



Graph 13. Conventional investment

Investments focus on grey infrastructure only.

Conservation projects are funded by donors and/or public funding in isolation and have limited reach. There are limited revenue generating opportunities for local communities, conservation projects don't maximise on communities community involvement and few investment possibilities exist for private financiers, including impact investors.

Recommendations for project developers:

- Cost Benefit Analysis of resilient, NbS infrastructure shows that the economic benefits of resilient infrastructure investments from reducing climate risks provide a long-term return, which far exceed the cost of investment.
- Engineers need to be able to adapt infrastructure to meet increasingly complex environments with higher specifications of resilience. Applying systems-based, robust and precise metrics creates potential for addressing the SDGs in a comprehensive way.
- Analysing coastal resilience at a granular level can help to optimise blue natural infrastructure components that for instance can play a significant role in flood risk reduction. Developing this experience and setting appropriate standards will help to overcome institutional biases in favour of traditional grey infrastructure.

Recommendations for policy makers:

- Delivering blue infrastructure investments will depend greatly on the enabling framework that is created by national, regional and municipal governments.
- Countries need to establish clear and aligned public policies to mandate climate resilience requirements, infrastructure data policies need to cover the entire infrastructure life cycle and long-term investors need to make climate resilience a precondition for investment.
- Climate-related bilateral initiatives, regional and multilateral channels set up to help developing countries in mitigation and adaptation to climate change should be used to support blue infrastructure projects.

Recommendations for infrastructure financiers:

- Clear frameworks are needed for financial institutions lending to infrastructure projects as well as investors of such projects in coastal and marine areas. Carbon market mechanisms can contribute to filling some of the gaps between financing needed for blue infrastructure and the financing available.
- MDBs can play a key role in delivering the substantial investment needs of developing countries in the field of blue, sustainable infrastructure.
- Engaging with additional private sector partners, including impact investors, as well as local communities, environmental NGOs and civil society will not only help to address ESG risks but will also deliver additional revenue opportunities that can support the overall resilience of blue infrastructure approaches.
- MDBs have a role to play in helping prepare blue infrastructure projects through using bi-lateral or multi-lateral trust funds.

Annex 1: Blue Infrastructure Finance Workshop

Process

An initial group of 10 authors undertook significant preparatory work based on a wide range of relevant expertise, including finance, conservation, engineering, disaster risk and coastal resilience and other disciplines. They prepared initial two-page concept papers as well as input to the overall paper. An equal number of additional external experts were invited to join the authors at a half-day workshop at the margins of the 25th meeting of the Conference of the Parties (COP25) of the United Nations Framework Convention on Climate Change (UNFCCC) in 2019 in Madrid to debate these concepts and discuss the best way forward.

Workshop description

Workshop participants engaged with the concepts covered in this paper and provided feedback and suggestions based on the questions outlined below.

Session 1: Blue Infrastructure Finance: Overall Approach
The first session of the workshop introduced the terms and looked at the overall conceptual approach to help establish a common understanding, with the specific task to see how blue infrastructure investments are not confined to the mitigation of negative impacts but can act as a targeted format and incentive for the delivery of sustainable finance solutions.

Critical questions asked: What is Blue Natural Capital? How does it relate to infrastructure? What are nature-based solutions? Is there an international regulatory framework to incentivize blue infrastructure investments? How can we use specific innovative blue finance mechanisms to support nature-based solutions?

Session 2: Infrastructure and Resilience: Underlying Projects
The second session looked at a range of infrastructure design approaches, taking into account engineering concepts, conservation objectives and societal goals, with the view to optimising coastal resilience in the context of the global climate emergency.

Critical questions asked: What is resilient infrastructure? How to design critical infrastructure under climate change? How to integrate approaches of "grey and green"? How can green/blue infrastructure and NbS integrate climate resilience and disaster risk? How can forward-looking scenarios best be used to plan for future blue infrastructure?

Session 3: Financing Blue Infrastructure
The third session looked in more detail at sustainable infrastructure finance approaches, in particular from multilateral finance institutions. It discussed financial products and processes and identify opportunities and bottlenecks.

Critical questions asked: How can blue infrastructure best be financed? What is the approach taken by multilateral development banks to date? What are the key constraints? Are the bottlenecks in the capital structures or in the available funding? What is the investor perspective? How do these considerations fit within the broader infrastructure finance context?

Final Session: Conclusions and Next Steps
The final session drew conclusions and agreed on next steps so that the concept paper can be finalised.

Critical questions asked: On which areas have we found consensus? Which aspects need further research? What can be the contribution of IUCN to standards and processes? What are the key messages for the concept paper? How can it have the best impact?

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