LSE
GLOBAL
POLICY LAB

From "Green" to "Blue Finance"
Integrating the Ocean into the Global Climate Finance Architecture

A collaboration between the LSE Institute of Global Affairs and the LSE Grantham Research Institute on Climate Change and the Environment with contributions from academics, researchers and organisations addressing the strongly interlinked climate threat and the health of the Ocean.

LSE Institute of Global Affairs

IN PARTNERSHIP WITH

Grantham Research Institute on Climate Change and the Environment

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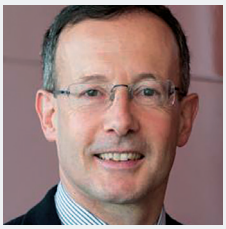
The LSE Global Policy Lab this time turns to climate and the Ocean emphasizing the need for innovative finance. Like climate, the Ocean links up all continents; what Jacques Cousteau called the "great unifier." But it is also vital in the fight against climate change. The IPCC Special Report on the Ocean and Cryosphere in a Changing Climate issued on September 25 2019 confirmed the fundamental role the Ocean plays in regulating global temperatures. For decades, the Ocean has been absorbing 20-30 percent of our carbon emissions and 90 percent of our excess heat. That contribution is now at risk.

To address the current challenges to the health of the Ocean, urgent policy action is required, including comprehensive governance and finance measures. In this issue we partner with the LSE Grantham Research Institute to bring together academics, researchers and advocates of reform. The focus on Ocean solutions allows us to consider the climate challenge in a holistic way. The contributions provide, from very different perspectives, a range of important policy responses.

The IPCC Special Report reveals the benefits of ambitious and effective adaptation for sustainable development and, conversely, the escalating costs and risks of delayed action. The authors in this issue provide insights into what actions are needed and how to implement them.

The bleaching of coral reefs is only one of many potentially irreversible changes currently affecting vital ocean ecosystems. Alex Rogers, Science Director for REV Ocean, shows how



climate change is reversing some gains from improved fishery management in advanced economies, but more seriously is driving away fish populations from the warmer waters in the developing world.

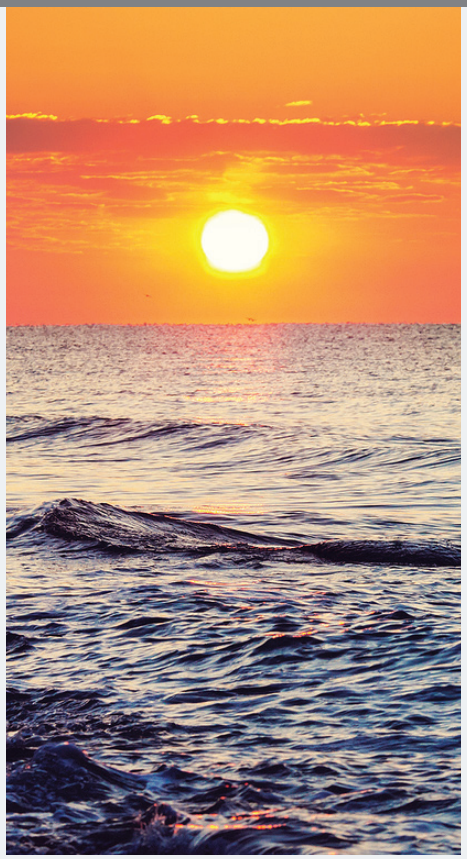
Scientists studying low-lying islands and coral reefs recognise that the Ocean has long been the canary in the climate coal mine, sending early warnings of inundated land and bleached coral. Sébastien Treyer and Julien Rochette argue that the Ocean cannot magically solve the climate crisis. This requires a profound transformation of our economy and development models. But like the hummingbird in the famous tale, a little action in the Ocean could make an outsized contribution to the global effort towards climate change mitigation and adaptation. Ocean-related measures must be part of the next generation of Nationally Determined Commitments under the COP.

Transparency around climate information is an important part of achieving coordinated action. Michael Mason argues that Ocean governance arrangements are often too fragmented across administrative and sectoral boundaries to provide the necessary integrated responses to climate-related changes. What is needed is a global regime of climate transparency, designed to generate and use information according to the planetary needs of earth systems governance.

Short of a global regime NGOs have taken their own initiatives. Perhaps the most ambitious effort is that of Climate Transparency which aims to track implementation in the G20. In presenting their latest CT's Programme Director Gerd Leipold notes that these countries are dramatically behind on the 2030 sustainability agenda. Energy-related emissions of these countries grew again, by 1.8 percent in 2018, because growth was higher than anticipated and because fossil-fuels grew quicker than renewable energy.

Finance is a critical part of responding to these threats. Integrating the Ocean into the global financial architecture is long overdue. The increased awareness of the climate threat to the Ocean must now urgently be translated into effective action on an unprecedented scale. Erik Berglof and Andrés Velasco argue that the international financial institutions can provide capital and know-how, but most of all they much help crowd in private capital and the innovative capacity of civil society, globally and locally.

Torsten Thiele shows how by integrating the "blue" into international climate finance we can move towards a global blue deal that addresses the challenges of climate transition, in particular, for coastal regions and ecosystems. Many of the innovations in "green finance" translate directly to "blue finance", but there are also specific features of the Ocean and



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local and regional mitigation measures that matter.

Finding innovative financing solutions is particularly important for small island developing states. Angelique Pouponneau provides a Seychelles perspective on how financing for climate-smart development is key to their survival. They are particularly exposed and need to be at the forefront of blue finance solutions.

Africa will also bear the brunt of climate change and its impact on the Ocean. In a project to understand better the climate of Southern and Central Africa Declan Conway, explains how we have been able to better integrate local variations in climate model, but massive uncertainty still remains. Adaptation is the key to climate policies in Africa and approaches must be deployable from one area to another.

One industry that is grappling with climate and the Ocean, perhaps more than any other part of the finance is insurance. Karen Sack, Chip Cunliffe and Nathanial Matthews of the Ocean Risk Resilience Action Alliance (ORRAA) outline a new way to engage with the insurance sector to develop innovative products to address risk perceptions in investing into coastal natural capital.

Another example of an insurance industry initiative is the Zurich Flood Resilience Alliance, a "holistic" approach to resilience working with more than 100 communities across 13 countries. Swenja Surminski and Michael Szoenyi argue that this example shows how local decision-makers can build resilience using natural capital and the ecosystem services it provides as well as human, financial, social and physical capital.

Many of the solutions to climate change and mitigating its impact on the Ocean require lateral thinking and collaboration across sectors and policy areas. Oliver Walker, Justine Schafer and Swenja Surminski illustrate these "concomitant challenges" involving shipping and insurance. The former industry is a major emitter of carbon and the latter is broadly exposed to the impacts of the sector and any future regulation or standards adopted by the industry. The shipping industry can adapt by serving new markets, adopting new technologies and complying with its own new standards. Active engagement with the insurance industry will be necessary to facilitate this transition.

The fight against climate change, particularly in its impact on the Ocean, will never be won without the active participation of China. Zhongying Pang addresses the Chinese puzzle in global governance. A sustainable development of China's marine economy will be critical to achieve global climate goals, but Chinese participation is also critical to the delivery on the "Blue Partnership", agreed at the UN Ocean Conference in 2017. President Xi's "Shared Marine Future" must be translated into multilateral action.

We may need new institutions that specifically address the challenges associated with the Ocean. Nishan Degnarain makes the case for agile Regional Ocean Sustainability Banks as practical tools to deliver ocean solutions. He also calls for a systemic view with acupuncture pressure points—a "bold and holistic" Ocean finance approach. He wants to engage new industries in a sustainable Ocean economy and encourage new financial instruments and tools for "blue risk" management. ◆

The Ocean and Climate Change:
The Rising Cost of Global Inaction

Alex David Rogers

Science Director, REV Ocean; Senior Research Fellow, Sommerville College, University of Oxford

In the early 1980s the ocean crossed a tipping point driven by rising temperatures. This was the first recorded incidence of global mass coral bleaching. The symbiotic algae living in the tissues of corals which provide them with their nutritional needs, are expelled as a result of anomalously high temperatures. The corals often die as a result. Since then there have been 6 major global mass bleaching events including the 1997/1998 event which is estimated to have killed 16% of the world's coral reefs. The recent mass bleaching of 2014 to 2017 may exceed this event in its severity. As a result, coral reefs are probably the most threatened ecosystem on Earth. They are also one of the most valuable with reef-associated fisheries, coastal protection and tourism running into hundreds of billions of US dollars in value.

There is less awareness of the effects of rising ocean temperatures on other coastal marine ecosystems. Seagrass beds, mangrove forests and canopy-forming seaweeds are all killed directly or indirectly by high temperatures, particularly episodic events known as marine heat waves. All of these ecosystems not only provide coastal protection and critical habitat for marine life, including commercially valuable species, but they can also store large quantities of carbon. As with forest fires, when these habitat-forming organisms die off not only are their carbon sequestration capacities lost but large quantities of CO2 can be released. These ecosystems are also on the move, changing patterns of distribution by moving towards polar latitudes.

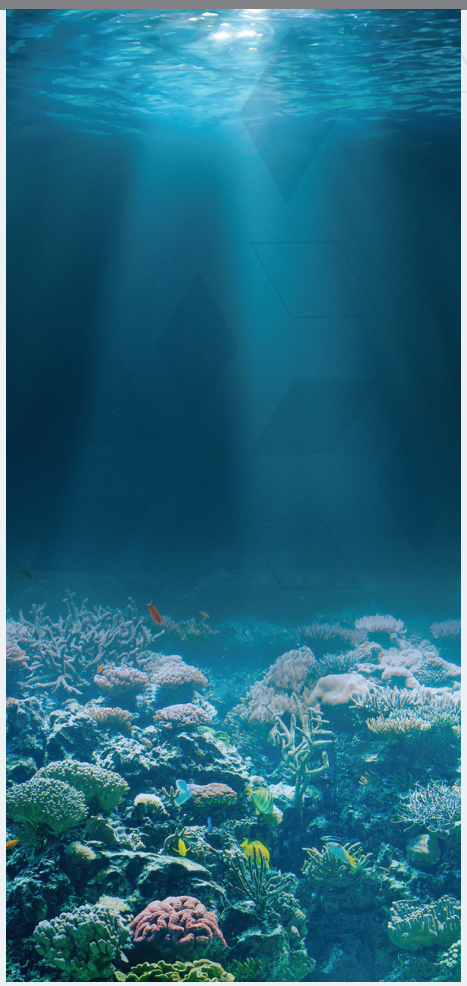
Fish are also heading towards the poles and away from low to warm

temperate latitudes where many of the developing countries most dependent on fishing as a source of income, livelihoods and nutrition are located. The recent dispute between the EU, Iceland, the Faroes and Norway over shifting North Atlantic mackerel stocks demonstrate the how unprepared our systems of governance are for management of ocean resources in the face of climate change. The fish are also likely to get smaller, a physiological effect of rising temperatures, reducing the productivity of stocks. Overall, this is likely to result in a climate driven decline in fish production compounded by overfishing and illegal, unregulated and unrecorded (IUU) fishing with significant implications for global food security.

Climate change has other symptoms as well. Sea level rise is now predicted to reach more than a meter by the turn of the century. It is a direct threat to coastal wetlands such as mangrove forests and saltmarshes which will lose substantial area through drowning. This is especially the case where coastal development prevents transgression, the landward movement of such ecosystems. Engineering projects on rivers, such as dams, also choke the supply of sediments to these ecosystems, preventing them from increasing their elevation and making them more vulnerable to rising sea level. The intensity of severe weather events is also increasing and these are also highly destructive to coastal ecosystems.

The ocean has absorbed about a third of human CO2 emissions since the industrial revolution. This CO2 is converted to carbonic acid in seawater lowering its pH. A side effect of this is an alteration in the carbonate equilibrium in seawater reducing the availability of calcium carbonate for building shells and skeletons. For corals this may mean weakened skeletons and reduced growth rates making reefs more vulnerable to intense cyclones and less able to recover from mass bleaching events. For other organisms the effects are less clear but weakened shells may mean a higher vulnerability to predators and alteration of marine food webs in ways that are difficult to predict.

Increasing temperatures also mean that seawater carries less oxygen. It also reduces the tendency for mixing of shallow waters with deep, nutrient rich water layers over large areas of the ocean, a process called stratification. Microscopic algae, or phytoplankton in the surface layers of the ocean, the base of the food chain, are dependent on a supply of nutrients, particularly nitrates, to maintain their growth. Overall this means a decline in primary production in the ocean. Whilst this will be compensated for at polar latitudes by



disintegrating ice shelves and declining sea ice duration leaving more ocean area for phytoplankton production, the effect is unlikely to completely offset the effects of thermal stratification. Declining oxygen levels are also leading to the expansion of the oxygen minimum zone, the depths in the ocean where oxygen levels fall to low values, generally between 200 and 1000m depth. Observations indicate that the vertical expansion of low oxygen waters in the tropics is compressing habitat for large ocean predatory fish like marlin which need oxygen-rich waters. In the coastal zone where the runoff of agrochemicals, particularly fertilisers, can produce un-natural blooms of algae which are broken down by bacteria the ocean, can become very oxygen poor (hypoxic) or even anoxic (no oxygen). These dead zones are likely to expand as a result of warming. In some parts of the ocean, the proximity of oxygen poor and low pH waters near to the coast have caused mass mortality of marine life including aquaculture species such as oysters during upwelling events (e.g. western coast of the USA).

The IPCC Special Reports on Global Warming of 1.5°C, published in 2018 and Oceans and Cryosphere, published in 2019 deliver very clear messages with respect to climate change impacts on the ocean. The first is that failure to keep global temperatures at or below 1.5°C of warming will have increasingly severe impacts on marine ecosystems. Even at 1.5°C 70-90% of coral reefs may be lost as a result of ocean warming and other climate change impacts. At 2.0°C this will rise to 99%. Other marine ecosystems such as seagrasses, mangroves, and salt marshes will be progressively destroyed if emissions continue to rise, with positive feedbacks on atmospheric CO2 levels. Also, as emissions rise, options for adaptation reduce. Even if protected, coral reefs will die and efforts to restore or allow transgression of ecosystems such as coastal wetlands will be overwhelmed by rising temperatures, sea level and extreme storm events. Efforts to increase the efficacy of fisheries management are showing success, particularly in the waters of wealthy states such as off North America, Europe and Australasia. However, these efforts will be increasingly undermined by climate impacts if emissions are not reduced drastically. The economic costs, costs to livelihoods and elevated risks to coastal infrastructure and human society are a threat to lives and global security. Those most exposed include populations of developing coastal states, especially island nations who are highly dependent on fishing and/or tourism and who are most exposed to increasing impacts of sea level rise and extreme weather events. ◆

Climate change has other symptoms as well. Sea level rise is now predicted to reach more than a meter by the turn of the century.

Professor Alex Rogers is a marine ecologist who has undertaken research over the last 30 years on biodiversity hotspots in the ocean including both warm-water and cold-water coral reefs, seamounts and deep-sea hydrothermal vents. He has worked on ocean policy particularly related to areas beyond national jurisdiction. During his career he led the biodiversity research program at British Antarctic Survey, an independent ocean research group at the Zoological Society of London and was Professor of Conservation Biology at the University of Oxford's Department of Zoology from 2010 to 2019. He has also advised intergovernmental organisations, including the International Union for Conservation of Nature (IUCN) and the UN Division of Oceans and Law of the Sea (UN DOALOS), as well as non-governmental organisations including Greenpeace, the World Wildlife Fund for Nature, the Deep-Sea Conservation Coalition and Pew-Bertarelli Global Ocean Commission. Alex now works as Science Director for REV Ocean, a new not-for-profit organisation undertaking research to find solutions to major ocean problems including those caused by plastic pollution, climate change and overfishing. REV Ocean are currently constructing the world's largest multipurpose research vessel to support scientists globally undertaking research in its core thematic areas.

From Canary to Hummingbird:
The Ocean vs the Climate Crisis

Sébastien Treyer
Executive Director, IDDRI, Sciences Po Paris

Julien Rochette
Ocean Programme Director, IDDRI, Sciences Po Paris

Unbeknown to most, the ocean has been quietly absorbing 20-30% of our carbon emissions and 90% of our excess heat for decades. In its recently released Special Report on the Ocean and Cryosphere in a Changing Climate (SROCC), the Intergovernmental Panel on Climate Change (IPCC) sounds the alarm: the ocean is warming and acidifying, while sea-level is rising due to increasing rates of ice loss from the Greenland and Antarctic ice sheets. These drastic changes are compounded by the longstanding threats faced by the ocean—pollution, habitats destruction and unsustainable fishing, for example. These impacts affect marine life, ecosystems services, and the livelihoods and well-being of millions of people. Fish are migrating, dead zones are growing and major economic sectors, such as tourism or aquaculture, are at risk.

The solution to fight climate change is well known: rapid decarbonisation. The ocean can play an active role in this global effort. The ocean is not only a victim of climate change, but also part of the solution.

As the backbone of international trade, the shipping industry contributes to around 2% of anthropogenic CO2 emissions, and this figure is expected to significantly increase in the coming years. Solutions however exist to improve ocean-based transport efficiency and limit GHG emissions, especially through the introduction of low or zero-carbon fuels. Similarly, shifting to clean energy in the fisheries and aquaculture sectors can make a significant contribution to reducing GHG emissions. The ocean also offers great opportunities to develop renewable energy, through offshore wind installations or wave and tidal power for instance.

Perhaps most importantly, the ocean is a major carbon sink. Mangroves, tidal marshes, and seagrass meadows are known for their sequestration capacities and, according to the IPCC, the restoration of these ecosystems could provide climate change mitigation "through increased carbon uptake and storage of around 0.5% of current global emissions annually". Crucially, improving the ocean's "Blue Carbon" capacity provides many co-benefits: biodiversity conservation, improved water quality and increased resilience of ecosystems and communities in the face of extreme weather and coastal hazards.

In recent years, many initiatives have sought to raise awareness of the role of the ocean in the climate system and put ocean issues on the agenda of international climate change processes. Identifying opportunities for synergies between mitigation, adaptation and ocean ecosystem protection, as well as potential risks and trade-offs to be avoided, scientists have highlighted ocean-based solutions for climate action and recent processes, such as the Because the Ocean Initiative or the High Level Panel for a Sustainable Economy, have provided States with guidelines to include ocean-based measures into their Nationally Determined Contributions (NDCs) and National Adaptation Plans.

The 25th Conference of Parties to the United Nations Framework Convention on Climate Change, to be held next 2-13 December under the Chilean presidency, offers an opportunity to build on these recent initiatives and scale up efforts to include marine components in mitigation and adaptation strategies. In particular, the so-called "Blue COP" should increase the States' understanding of the role of the ocean in climate change strategies and promote the inclusion of ocean-related measures into the next generation of NDCs. But the climate change negotiations cannot be left alone to determine the fate of the ocean: many intergovernmental organisations already have a mandate on marine issues and a key role to play. This is obvious for the International Maritime Organization, where strategies towards the reduction of shipping emissions are discussed, but regional organisations can also contribute to climate change mitigation—e.g. through the conservation of Blue Carbon ecosystems—and adaptation, by anticipating the economic and human consequences of fisheries on the move for instance. And let's hope that the current negotiations for a treaty on high seas biodiversity will provide half of our Blue Planet a regime able to increase the resilience of marine ecosystems.

Scientists studying low-lying islands and coral reefs recognise that the ocean has long been the canary in the climate coal mine, sending early warnings of inundated land and bleached coral. The ocean cannot magically solve the climate crisis, which requires a profound transformation of our economy

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and development models. But, like the hummingbird in the famous tale, a little action in the ocean could make an outsized contribution to the global effort towards climate change mitigation and adaptation. This could become true if such ocean-based solutions are designed well enough to play as trigger of transformative change in key sectors of the economy or in the economic model of whole regions. In this regard, there is an opportunity for ocean economies (those regions or countries where maritime or coastal sectors are critical for the economy) to be front-runners of the transformation to a decarbonised and resilient society, at a time when it is very important to reinforce political leadership in climate action. ◆

Read the IDDR policy brief on ocean and climate change: "Gattuso et al., 2019, Opportunities for increasing ocean action in climate strategies, IDDRI Policy Brief 2 / November 2019": https://www.iddri.org/en/publications-and-events/policy-brief/opportunities-increasing-ocean-action-climate-strategies)

Sébastien Treyer is the Executive Director of IDDRI, the Institute for Sustainable Development and International relations, based at Sciences Po Paris. A graduate from Ecole Polytechnique and AgroParisTech, with a PhD in environment management, he is a specialist of foresight for public policies and international negotiations on sustainable development. Before joining IDDRI, he has been active as a civil servant for the French ministry for the environment and French research institutes.

Julien Rochette is the Ocean programme director of IDDRI, the Institute for Sustainable Development and International relations, based at Sciences Po Paris. A lawyer specialized in marine issues, his work has led him to invest particularly in regional organizations, especially in the Mediterranean, the Western Indian Ocean, West Africa and the Pacific. Julien holds a doctorate in public law (University of Nantes, France) and public international law (University of Milan, Italy) and joined Iddri in September 2007.

The Politics of Transparency in Global Climate Governance

Michael Mason

**Associate Professor, Department of Geography & Environment;
Director, Middle East Centre, London School of Economics and Political Science**

Transparency, defined here as information disclosure, has become a central attribute in global climate governance as a way to monitor and/or reward various actors' climate change commitments and performance.

The prospect for climate transparency is linked to the increasingly fragmented nature of climate governance – encompassing multilaterally negotiated treaties, transnational municipal networks, subnational actors, bilateral agreements, and voluntary corporate initiatives. In these diverse contexts, the demand and supply of transparency is multi-directional, flowing from and to a wide array of state and non-state actors, rather than only from governments to interested publics. As such, the rationales for furthering transparency, and the governance benefits to be derived from disclosure, necessarily also vary and may even clash with each other.

In the past decade, prompted above all by the evolution of reporting and review processes within the UN Framework Convention on Climate Change (UNFCCC), we can observe three drivers of transparency in global climate governance:

1. Democratisation: the disclosure of climate-related information to enhance a right-to-know, accountability, choice, and participation;
2. Technocratisation: the disclosure of (expert-led scientific) information on climate change matters to rationalise decision-making;
3. Marketisation: the disclosure of climate-related information to ascribe economic value to environmental services, compensate for performance, or facilitate market exchanges.

Climate transparency is inextricably linked to political and normative disagreements about these drivers of disclosure, which impact on transparency goals – whose actions should be made transparent, by whom, and to what end? Thus, disclosure is itself a site of contestation, rather than a neutral means to help transcend political conflicts over climate change governance. Public and private climate governance arrangements occupy particular zones of overlap between diverse rationales and practices of disclosure, so climate transparency cannot necessarily be mapped by straightforward, binary ascriptions of public and private authority.

The democratisation driver for increased transparency of states on their climate actions has principally emerged from global Northern states, supported by civil society organisations. In an international context, the penetration of climate transparency in the UNFCCC reflects wider transparency norms in public international law (e.g. prior notification and access to information), but it is also constrained by the primacy of voluntary consent in rule-making. UNFCCC parties agree on their own rules of transparency, and agreement over these rules encompasses non-democratic parties with political cultures often hostile to information disclosure. National self-reporting of climate mitigation and adaptation activities, which allows significant discretion and control by parties over climate information disclosed, is well-established. This "sovereignty sensitivity" of UNFCCC decision-making limits the scope and meaningfulness of transparency norms within a state-to-state reporting framework, though modest gains in review processes for inter-state accountability have been realised by the "enhanced transparency framework" of the 2015 Paris Agreement; for example, the "Facilitative Sharing of Views" process, whereby update reports by developing countries are subject to public questioning over their climate actions by other UNFCCC parties. At the same time, increased transparency of developed country climate commitments has permitted more open scrutiny of these states' mitigation and adaptation actions under the "pledge and review" reporting system of the Paris Agreement.

The increasing professionalisation of climate transparency has seen democratising imperatives tempered by rationalist managerial norms of technocratisation, in which climate information presented as "public" is often restricted or rendered opaque to outsiders by the scientific and

technical discourse surrounding UNFCCC reporting and review systems or, in voluntary climate governance, by the managerial and financial auditing interests of subscribing organisations (e.g. the Carbon Disclosure Project). In multilateral climate governance, politically contested issues are often deflected, in the implementation phase, into a (seemingly apolitical) technocratic focus on building bureaucratic capacities, in order to enhance the scope and "soundness" of disclosed information as a means to rationalise decisions. The technocratic rationale for transparency also plays a part in private climate governance systems. Indeed, it has acquired increasing importance in carbon offset markets – particularly voluntary markets – in the wake of carbon fraud and widely acknowledged deficits in the credibility of carbon offset information. As such, the technocratisation of (private) climate transparency can provide a necessary role in the development of systems of professional auditing and certification pertaining to the release and use of climate data.

Another major impetus for climate transparency arises from the privileging of market-based solutions to climate change. For climate governance, this marketisation means interpreting transparency in terms of the information entitlements and needs primarily of market-based actors (e.g. the climate risk disclosure rules of the US Securities and Exchange Commission). Market-relevant transparency can and is solicited from both public and private actors, as well as individual citizens (e.g. personal carbon budgeting or offsetting). Use of a marketisation rationale can also be consistent with state-based, multilaterally negotiated governance architectures—as with disclosure requirements underpinning the smooth functioning of market-based flexibility mechanisms, such as the Clean Development Mechanism within the UNFCCC. However, the marketisation of climate governance may also displace, and crowd out, the development of public legal

Climate transparency is inextricably linked to political and normative disagreements about these drivers of disclosure, which impact on transparency goals – whose actions should be made transparent, by whom, and to what end?

obligations (both nationally and internationally) on the disclosure of relevant climate information. The more information on climate risk is appropriated as a private good – as in the evolution of carbon markets – the less likely it is that affected parties can participate in decision-making about the desirability or direction of climate governance choices. Indeed, the privatised transparency of voluntary carbon offsets has exacerbated the concerns of civil society actors, and many states, over the credibility of wider carbon markets and global climate governance more generally.

Climate transparency arrangements in the UNFCCC are skewed towards national reporting (state-state account giving), while private climate reporting initiatives have focused on corporate greenhouse gas emissions and other climate-related actions. There is a need for greater integration of transparency systems across domains of public and private authority, addressing above all the climate information needs of global planetary governance. This is particularly evident for the climate change-sensitive management of the oceans, including that majority area (60%) of the oceans – the high seas – outside the jurisdiction of states and therefore state reporting of climate actions. In its Special Report on the Ocean and Cryosphere in a Changing Climate (2019), the Intergovernmental Panel on Climate Change argues that the enabling conditions for effective adaptation to climate impacts requires the coordinated utilisation of climate information in decision-making. Ocean-related governance arrangements are, in many contexts, seen as too fragmented across administrative and sectoral boundaries to provide integrated responses to climate-related changes in ocean regions. A coordinated, global regime of climate transparency, designed to generate and use information according to the planetary needs of earth systems governance, is not on the horizon. ◆

Michael Mason is an Associate Professor in the Department of Geography and Environment. At LSE he is also Director of the Middle East Centre and an Associate of the Grantham Research Institute for Climate Change and the Environment. His research interests encompass environmental politics and governance, notably issues of accountability, transparency and security. Alongside articles in a wide range of academic journals, he is the author of Environmental Democracy (1999) and The New Accountability: Environmental Responsibility across Borders (2005). He is also co-editor (with Amit Mor) of Renewable Energy in the Middle East (2009) and (with Aarti Gupta) Transparency in Global Environmental Governance (2014).

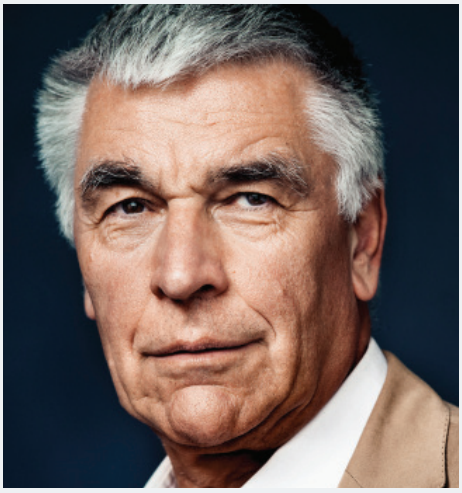
The G20:
The Reluctant Climate Leader

Gerd Leipold
Programme Director, Climate Transparency

The G20 countries are the natural international grouping to offer bold leadership for the international community to prevent the dangers of climate change. Two thirds of the world's population live in G20 countries, about 85% of the global GDP is earned by them and they are responsible for about 80% of the global greenhouse gas emissions. The most powerful countries in the world are part of the G20 and while they cannot and should not replace the international UN climate negotiations, they could and should be the political, economic, and technological leaders in the fight against climate change. If they succeed to reduce emissions to net zero by 2050, there is a reasonable chance that global temperature increases could be kept below the 1.50 C limit.

Unfortunately, the recent climate performance of the G20 countries does not give confidence that they are taking on this leadership role, which those countries most of risk can rightfully expect.

As a recent "Brown to Green Report" of Climate Transparency has shown, the energy related emissions of the G20 grew again in 2018 by 1.8%. This can be explained by the high economic growth and the fact that fossil-fuel energy supply grew stronger than renewable energy. In 9 of the G20 countries—Australia, Canada, China, India, Indonesia, Russia, South Africa, South Korea, and the United States—the energy supply from fossil fuels grew, mostly because of increased fuel usage in transportation and higher electricity demand. This is in line with the long-term trend. Renewable energy has been an amazing success story, but its growth has been outstripped by increased use of fossil fuels. In 2018, still 82% of the energy demand came from fossil fuels. If one would look at energy consumption, however, the share of renewables is substantially higher as they have hardly any conversion losses, whereas the conversion losses of fossil fuels are in the order of 60%.



Mathias Bothor//photoselection

The NDCs, the Nationally Determined Contributions of countries required under the Paris Agreement, where countries communicate their intended actions, are by far not ambitious enough to keep temperature increase close to 1.50 C. The recent IPCC 1.50 C report specifies emission reduction needed by 2030 and 2050. This report now allows defining benchmarks (as done in the Brown to Green Report) for the most important sectors, a crucial instrument with which countries can design their policy measures.

The ambition of existing NDCs of G20 countries is too low for the world to avoid dangerous climate change. The recent Climate Summit of the UN Secretary General in September 2019 did not bring much progress, in spite of the urging of António Guterres. The next and important milestone will be the year 2020, in which countries are required by the Paris Agreement to update their NDCs. It will be the litmus test, whether the G20 countries are responding to the climate crisis and act on the concerns of millions of people. Independent assessments of countries' plans and actions, as performed by Climate Transparency in the Brown to Green Report or the World Resources Institute, are important instruments to create comparability and to stimulate learning and competition.

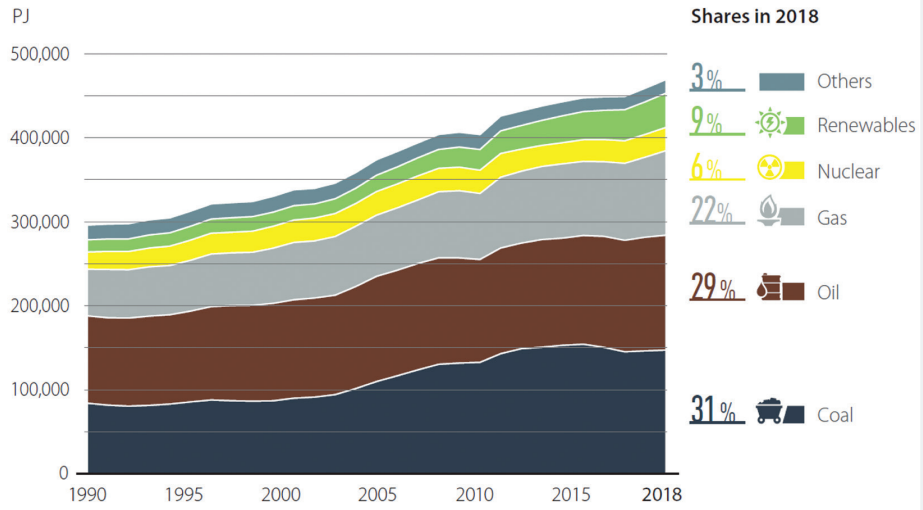
Mark Carney, governor of the Bank of England, has repeatedly pointed out that climate change is as much an economic risk as an environmental risk. With their mandate of safeguarding the global financial system, the G20 have therefore a strong reason to take steps for protecting the climate. For years they advocated the reduction of fossil fuel subsidies, but actions have been rather timid. Though in 2017 one could observe a slight reduction of fossil fuel subsidies. G20 countries, most prominently China, Japan and Korea, are also playing a major role in financing coal plants in other countries. A laudable initiative of the Financial Stability Board of the G20, the Task Force on Climate Related Financial Disclosures (TCFD) has come up with specific guidelines for companies to declare the risks due to climate change. These important guidelines are increasingly recognised and applied on a voluntary basis, their effectiveness would become stronger, if they were to be made mandatory

as for example in France. Agreement in the G20 to make climate risk disclosures compulsory would be a sign that the G20 is willing to lead in the fight against climate change.

There are good economic reasons for firm climate action to keep the temperature increase to 1.50 C. Already now, extreme weather events lead to around 16,000 deaths and economic losses of USD $ 142 billion in G20 countries every year. Limiting the global temperature increase to 1.50 C would reduce negative impacts across sectors in G20 countries by over 70%. For example, it cuts down the average drought length by 68% and the number of days above 35°C per year from 50 to 30. And it also limits the growing season's shrinkage and the reduction of rainfall, as well as substantially diminishing the risk of heat waves that ravage crops.

Climate change has progressed too far for countries to argue, who should act first. Rather, they all need to agree to act fast. The G20, who between them have biggest share of global emissions, have the responsibility to speed up their action to prevent dangerous climate change, safeguard the world's economy and reap the benefits of climate action for this and future generations. ◆

Fossil fuels rose again in 2018: 82% of the G20 energy mix still comes from fossil fuels



Dr. Gerd Leipold led the international environmental organization Greenpeace as Executive Director between 2001 and 2009. At present, he coordinates the Climate Transparency Partnership, which analyses the climate action of the G20 countries in the yearly "Brown to Green Report." He studied physics and oceanography in Munich, Hamburg, and San Diego.

Integrating the Ocean into the Global Financial Architecture

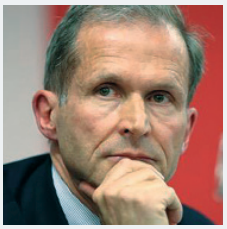
Erik Berglof
Professor, Director, Institute of Global Affairs, London School of Economics and Political Science

Andrés Velasco
Dean of the School of Public Policy, London School of Economics and Political Science

The climate threat to the Ocean, like other challenges to the global commons, often leaves the poor more exposed and invariably more vulnerable. The international community has a critical role to play both in supporting developing countries in protecting the global commons, and through their own national actions. The G20 Eminent Persons Group on Global Financial Governance recently proposed a range of reforms to improve the effectiveness of the institutions of international financial system in protecting the global commons. These proposals also apply to the Ocean climate challenge.

Total infrastructure capital around the world is expected to double in the next 15 years. How and with what technology that investment takes place will have a profound influence on the global commons, including on climate and the Ocean. The international financial institutions (IFIs) have an essential and urgent role to play in ensuring the quality and sustainability of that investment. Like other global challenges, the Ocean climate challenge spans national borders and requires international action to provide the public goods (transnational and local) to respond to these threats.

Some of the necessary measures are about mitigation and, as such, about pure public goods where everyone's contribution adds up. But much of the investment, particularly in poorer countries, is in adaptation, where the required public goods are more likely to be national and sometimes regional, and the bulk of what is required is likely to be private investment to enhance resilience. The different



nature of the public and private goods needed to address the Ocean climate challenge have important implications for how efforts should be coordinated, and for the allocation of responsibilities across institutions.

The activities aimed at addressing the Ocean climate challenge must be integrated into the core programs of IFIs, and coordinated within country platforms owned by national governments. IFIs have a critical role to play in setting global standards and developing market-based approaches that would crowd in the private sector. They should also encourage the adoption of standards regarding the disclosure of risks and help countries incorporate actions to address the Ocean climate challenge into their growth strategies and investment plans, and assist them in adopting a consistent approach across the government.

Climate action, including in the Ocean space, should be coordinated on a global platform led by the UNFCCC Secretariat as the UN guardian agency and the World Bank with the broadest reach among the MDBs. Together they should be responsible for identifying gaps in the global response, such as climate change adaptation, and coordinating and leveraging on the key players. An effective international response requires strong action within and across countries, and across the UN agencies, IFIs and other relevant bodies including philanthropies and the private sector. The regional development banks also have significant capabilities that could be applied.

The UN agencies have a normative function in most areas, defining goals, setting standards and providing political legitimacy. They are also in many instances first responders in emergencies and crises. The IFIs play different key roles, based on their comparative advantage in policy advice and derisking of investments, mobilizing finance, building resilience and strengthening countries' implementation capacity. The private sector has a crucial role to play and its collaboration with the MDB system should be strengthened. The philanthropies, often working with the private sector and NGOs, are a source of important innovation, experimentation and establishing systems for measuring impact.

The current scale of activities falls dramatically short of what is needed given the urgency and magnitude of the climate challenge and the degradation of ecosystems in the Ocean. Climate finance is very fragmented, and the need for streamlining is urgent. The recent replenishment of the Green Climate Fund, which helps developing countries is a positive sign, but it doesn't fill the gap left after the withdrawal of Trump administration (along with Australia and Russia).

The IFIs together with the specialized UN agencies, should collaborate to collect data and

undertake the analytical work necessary to develop early warning indicators, and prevention and resilience plans. The philanthropies with more risk absorption capacity play an important role in funding R&D and innovation. For example, in response to the West African Ebola virus epidemic (2013-2016), Wellcome Trust played an important role in the development of vaccines – a risky activity which is difficult for MDBs to engage in.

The MDBs are best positioned to crowd in private resources into the Ocean climate responses. In addition to their regular financing, MDBs should develop contingent public finance facilities and system-wide insurance instruments which are key to fast disbursement and launching support operations. There are many models from other areas that could be applied to the Ocean space, for example, the Bangladesh Delta Plan is a long-term integrated plan that brings together programs for water and food security, economic growth and environmental sustainability. The World Bank and the Netherlands have brought together experience and adapted to Bangladesh's need.

There is significant untapped potential in the combined data and knowledge of the IFIs that can be used to develop early warning indicators and design appropriate prevention and resilience programs. IFIs are also uniquely positioned to ensure that their programs and projects embed appropriate prevention, preparedness, and resilience mechanisms, including helping the most vulnerable adapt to climate change, and early and effective response to the deterioration of Ocean ecosystems. The IDB's Emerging and Sustainable Cities Program combines environmental, urban and fiscal sustainability and governance, particularly in relation to sustainable infrastructure.

A new cooperative international order must also enable mobilization of flexible coalitions of countries and institutions around specific global or regional commons. The Bangladesh Delta Plan exemplifies how multilateral organizations, bilateral partners and national authorities can join forces and avoid fragmented efforts for greater long term impact. The Global Commission on Adaptation, which delivered its final report, is another example of how a coalition of partners can come together on a critical challenge.

Integrating the Ocean into the global financial architecture is long overdue. Recent events calling attention to the climate threat to the Ocean, and the associated reduction in its capacity to absorb carbon and excess heat, are very much welcome, but the increased awareness must now urgently be translated into effective action on an unprecedented scale. The IFIs can provide capital and know-how, but most of all they help crowd in private capital and the innovative capacity of civil society, globally and locally. ◆

Erik Berglof is the Director of the Institute of Global Affairs (IGA) and its Global Policy Lab at the London School of Economics and Political Science (LSE). He has published widely in top journals on economic and political transition, corporate governance, financial development and EU reform. He was a member of the Secretariat for the G20 Eminent Persons Group on Global Financial Governance (2017-18) and subsequently a member of the High-Level Wise Persons Group on European Development Finance Architecture (2018-2019). Prior to joining LSE, Professor Berglof was the Chief Economist and Special Adviser to the President of the European Bank for Reconstruction and Development (EBRD) and Director of the Stockholm Institute of Transition Economics (SITE) and Professor at the Stockholm School of Economics. He is also a Non-Resident Fellow at the Brookings Institution, a Research Fellow of the Centre for Economic Policy Research (CEPR) and Senior Fellow of the European Council for Foreign Affairs (ECFR). In 2013, he was awarded the Leontief Medal for his contributions to economic reform.

Andrés Velasco is the Dean of the School of Public Policy at the London School of Economics and Political Science. In 2017-18 he was a member of the G20 Eminent Persons Group. During 2015-16 he co-chaired the Global Panel on the Future of the Multilateral Lending Institutions. In 2013-16 he was a member of the Global Oceans Commission. Professor Velasco was a presidential candidate in Chile in 2013. He also was the Minister of Finance of Chile between March 2006 and March 2010. During his tenure he was recognized as Latin American Finance Minister of the Year by several international publications. His work to save Chile´s copper windfall and create a rainy-day fund was highlighted in the Financial Times, the Economist, the Wall StreetJournal and Bloomberg, among many others.

Adding "Blue" to International Climate Finance

Torsten Thiele
Visiting Fellow, Institute of Global Affairs, London School of Economics and Political Science

Global marine ecosystems are rapidly degrading as a result of overfishing, pollution, climate change and lack of adequate regulatory protection. As the largest "global common", the global ocean makes up 2/3rd of the planet As our knowledge of the ocean advances we are increasingly able to assess impacts and apply market-based pricing mechanisms. This allows the design of new financing structures that can offer sustainable investment opportunities in protecting and developing a healthy ocean. Climate finance tools need to be aligned appropriately so as to direct funding to ocean solutions. The concept of blue natural capital provides a way to analyze the marine space in economic terms for the benefit of the protection of marine life.

Natural coastal ecosystems, including wetlands, mangroves, salt marshes and sea grass meadows, provide significant benefits to coastal communities as well as globally. They act as carbon sinks, helping to mitigate greenhouse gas emissions, and they also assist in adaptation to climate change by delivering protection from storms, by trapping sediments and preventing erosion. The amount of carbon they sequester in their biomass and subsoil is significant and these natural habitats act as breeding and nursery grounds for many fish species. Locals and tourists treasure the aesthetics and recreational value of beaches and coasts, providing important sources of income.

Already a significant number of countries have included coastal wetlands in their nationally determined contributions (NDCs), suggesting Mitigation and Adaptation actions including in the blue carbon space

will play a part in delivering on their climate goals. Payment for ecosystem services is an emerging resource management tool that provides incentives for behavioral changes to increase the provision of ecosystem services, e.g., by discouraging overharvesting of resources or destruction and degradation of habitat.

On the back of coastal adaptation knowledge, a number of efforts have been made to develop nature-based solutions. However, the expertise of engineers, the broader knowledge base and the evidence of NBS effectiveness is still sparse, thus, public and blended finance is required to grow both the evidence base and subsequently the demand for NBS solutions and investment therein, with the need of some funders, e.g. climate funds, to demonstrate that a project addresses climate risk adaptation as well as development goals.

There is considerable scope for near-shore marine restoration to contribute to both maintaining and rebuilding the coastal margins in particular of small island and large ocean states to enhance their capacity for long-term coastal protection. These values need to be incorporated into national accounting strategies and coastal adaptation planning. Development banks, DFIs and multilateral climate funds can play a vital role in helping countries to deliver on their NDCs.

For Innovative Finance Mechanisms for coastal habitat protection to emerge at scale they need to be consistent with the wider efforts around sustainable finance. The Sustainable Blue Economy Finance Principles now host4d at UNEP-FI provide such specific guidance to funders.

The Climate Bond Initiative's Adaptation and Resilience Principles will in future provide guidance for determining which projects and assets are compatible with a climate resilient economy and therefore should be certified under the Climate Bonds Standard.

Innovative financing, including accessing capital markets, represents a promising opportunity for delivering ocean solutions, including for critically threatened ecosystems. Environmental impact and sustainability bonds for coastal resilience and nature-based infrastructure can provide formats that deliver cash up front and could include performance-based components would allow risk sharing and faster delivery.

A key constraint for commercial funding of ecosystem solutions is the lack of clear metrics and parameters for investment. Progress made over the last year include increased

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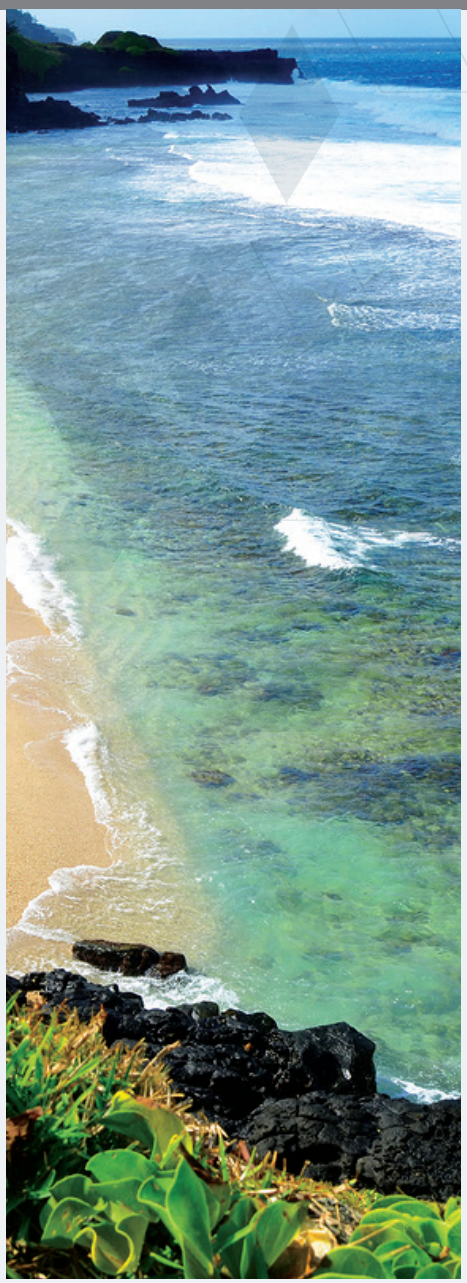


Blue natural capital approaches can be a logical component of an effort for greater private sector funding for coastal ecosystems.

engagement of the insurance industry around the concept of ocean risk and the development of a blue natural capital approach. Private sector funding will benefit not only from tools such as the proposed oceans supplement to the natural capital protocol but also from clear regulatory frameworks.

Without adequate ecosystem financing we will not be able to slow, let alone reverse the ongoing loss and degradation of coastal habitats. Public sector sources and in particular climate finance for adaptation, including through blended finance led by multilateral development banks will play a relevant and relatively cost-effective role in delivering some funding for coastal landscapes and ecosystems but this will be insufficient.

Supporting local livelihoods and a just transition will be key to get the required buy-in, scale and dynamics to offer sustainable ecosystem financing mechanisms. Nature-based solutions, in particular for adaptation finance towards resilient coastal infrastructure are likely to be of increasing importance. Engineering challenges and local capacity building need to be addressed adequately yet such infrastructure, including utilities, transport and coastal protection is most easily accessible to large-scale debt finance.

Marine habitats such as mangroves, tidal salt marshes and seagrasses are relevant carbon sinks and further opportunities exist to update the blue carbon accounting based on further science such as by adding macro algae and deep-water seagrasses and addressing carbon cycling to more accurately estimate carbon offsets in blue carbon ecosystems.

Adaptation finance area is emerging as potentially a robust source of funding for coastal ecosystems. The climate finance space is rapidly developing and starting to offer formats for water and landscape funding. How the forthcoming EU taxonomy on sustainable adaption finance will apply to blue ecosystem finance will be an important determinant of the ability to scale coastal habitat finance.

Blue natural capital approaches can be a logical component of an effort for greater private sector funding for coastal ecosystems. Blue natural capital assets will be seen as significantly more valuable under any scenario in which asset managers and governments realize the scale of the stranded assets problem in more traditional sectors. ◆

Torsten Thiele is a Visiting Fellow in the Institute of Global Affairs at the London School of Economics. His research areas are ocean governance and blue finance. Founder of the Global Ocean Trust and Senior Research Associate at IASS, Torsten Thiele had a long career in infrastructure finance in the City of London, where he was Head of Telecom Project Finance for Investec Bank plc till 2013. He holds graduate degrees in economics and in law from Bonn University, an MPhil from the University of Cambridge and an MPA from the Harvard Kennedy School. He returned to Harvard University as a 2014 Advanced Leadership Fellow. Torsten Thiele is also active on a number of advisory boards, including DOSI and EU ocean projects SOPHIE and iAtlantic.

How Financing Climate-Smart Development is Key to Island Survival?

Angelique Pouponneau

Co-Founder of SIDS Youth AIMS Hub; CEO of Seychelles' Conservation and Climate Adaptation Trust

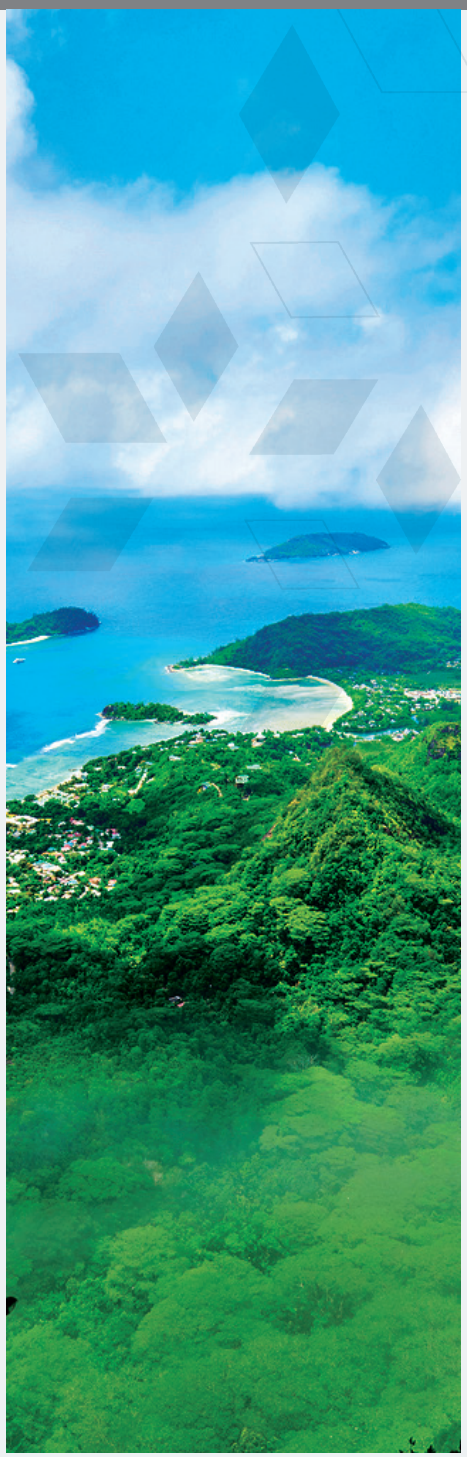
Small island developing States (SIDS) often describe themselves as the sentinels of the ocean. Their interests and desire to protect the marine environment stems from our very reliance on the health of the ocean for our survival. The ocean, and its ecosystem, provide citizens with their main source of protein. In my own home country of Seychelles, the reliance can be depicted with the comparison between the global average consumption of fish per capita at 22.3 kg annually to the country's average consumption of 67 kg of fish per capita annually. Furthermore, the marine environment is the foundation of the economy of SIDS, as tourism and fisheries remain pivotal to the generation of income and sustaining livelihoods. While strides towards sustainability remains central to the vision for development, the threat of climate change continues to undermine such efforts.

Collectively, 44 SIDS emit 1% of greenhouse gases, yet have the most to lose due to the impacts of climate change. The biggest threat is an existential one, with many low-lying islands threatened with extinction due to the rise of sea level. Some islands may not disappear but they will become uninhabitable and be thrust into poverty as the impacts of climate change invades marine ecosystems with rising temperatures and acidification. The Special Report on the cryosphere and Ocean indicates that coral reefs will not survive as temperatures reach beyond 2 degrees Celsius, which will result in a collapse of food systems for local communities and the collapse of the two pillars of our economy. In 1997-98, during the episode of El Niño there was a clear

movement of pelagic fish out of the EEZ of Seychelles to cooler latitudes, resulting in vessels landing their catch in alternative ports, leaving the largest tuna canning factory in the Indian Ocean short of fish to process, and leading to a significant loss in revenue. It is expected that such occurrences will become frequent until they become the norm. Despite, its negligible contribution to emissions, the urgent need to adapt to these impacts are every day considerations, while unequal disbursement between mitigation and adaptation continues at the international level.

As SIDS face these impacts, national budget allocations towards addressing these effects increase while access to public funds for adaptation dwindle. This reality is compounded by the fact that in 2017, the Seychelles has graduated to a "high income" country, further reducing its access to international public funds and concessionary financing. This "high income" classification is based solely on the high GDP that Seychelles shows while ignoring the fact that this is skewed by the very small population (i.e. 95,000) and the high inequality that the GNI indicates. It cannot be ignored that expenditure towards infrastructure to adapt to climate change is a greater burden for each citizen because of the small population. Regardless of attempts by the Government of Seychelles to call for a "resilience/vulnerability index" to underline the vulnerabilities of SIDS as it relates to climate change, this has fallen on deaf ears internationally. The situation is exacerbated as Seychelles is no longer ODA eligible and expects that public funds will no longer be channeled to it. With few developing countries reaching this categorization, the transition has been abrupt with news that there will be significant reduction of funds channeled from the UN institutions and agencies. Questions have emerged as to why such institutions, which are grounded in following the 2030 SDG agenda and ensuring that "no one is left behind" opts for a non-inclusive development for the most vulnerable communities, as SIDS are. While marginal changes may lead to graduation, its results are drastic and SIDS often find themselves unprepared for this transition. With the threat of climate change, the occurrence of countries slipping back into previous income statuses will happen even more frequently, but in more dire circumstances.

However, the Seychelles has refused to sit idly and is attempting to pave a new path to cope with its new realities by making innovative financing or blended capital as a means to address this lack of access to public funds. The Seychelles has engaged in two



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financial instruments, i.e. the debt-for-nature swap whereby a USD $21.6 million debt-buy back was facilitated between the Government of Seychelles and its creditors at the Paris Club with a loan and grant from The Nature Conservancy. The second, is a sovereign blue bond whereby three U.S.-based private investors have invested in a bond worth USD $15 million with the intent that the proceeds will be used towards the transition to sustainable fisheries.

One of the managers of the proceeds of these blended capital instruments is the Seychelles' Conservation and Climate Adaptation Trust (SeyCCAT). SeyCCAT is an independent public-private trust fund with the mandate of disbursing USD $ 750,000 annually towards ocean conservation and climate adaptation projects. It is evident that the priorities of the Seychelles (and why funds are required) are inevitably linked to the ocean and climate. So far, the funds have been channeled toward local communities to collect data and pilot management measures and citizens' education on climate change. Additionally, Seychelles is still able to access funds from multilateral funds such as the Green Climate Fund (GCF) and the Adaptation Fund (AF), which is why it continues to advocate for the replenishment of such funds.

It is increasingly clear that the tipping points are fast approaching and SIDS are likely to be left behind with the real possibility of the extinction of islands as rising temperatures and the acidification of the ocean undermine the very thing that SIDS depend on – the ocean. It is clear that the few options that remain open to SIDS are engaging in public-private partnerships, leveraging public funds to attract private capital to address its most pressing issue. However, this comes with challenges as private investors seek greater clarity on their financial returns on such investments, measurable and clear impact based on existing baselines, which are often lacking in such areas such as climate change and the ocean. As this area grows, investor confidence will increase but will it be in time to save these islands? To ensure the resilience and longevity of SIDS it is required that both public and private commitment will warrant that no one is left behind. ◆

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Angelique Pouponneau is a lawyer by profession and co-founded a non-governmental organisation, the SIDS Youth AIMS Hub - Seychelles which focuses on climate change and sustainable development at grassroots levels. She recently completed an LLM in Environmental Law where her research focused on the necessary legal framework for oceans to be able to act as a solution to climate change. She is currently the Chief Executive Officer of the Seychelles' Conservation and Climate Adaptation Trust.

Central and Southern Africa:
High-Stakes Decisions under Climate Uncertainty

Declan Conway

Professorial Research Fellow, Grantham Research Institute on Climate Change and the Environment, London School of Economics and Political Science

Rapid development in parts of central and southern Africa is occurring within a context of high exposure and vulnerability to climate change but with relatively low capacity for adaptation. Major infrastructural investments with 5–40 year lifetimes are being planned and implemented in the region – many without being informed by climate information. Ensuring this infrastructure is viable in a changing climate is essential, yet decision-makers face significant challenges in assessing how climate change affects investment decisions.

An international research project led by the Grantham Research Institute at LSE has been working over the past four years to address critical knowledge gaps in the understanding of central and southern Africa's climate and to effectively communicate climate information to decision-makers – crucial for enabling climate-resilient development in this highly vulnerable region. The research has generated important advances in understanding the complex processes that influence variability and extreme events in the climate system[1]. This enables evaluation of the credibility of the modelled future climate, in contrast to more dated approaches which simply average the results of climate models.

The project, named UMFULA (meaning 'river' in Zulu and standing for Uncertainty Reduction in Models for Understanding Development Applications) has focused on rainfall as the most important challenge for climate models and a crucial variable for major decisions that affect the water–energy–food sectors. The researchers undertook detailed work on the management of water in Malawi and Tanzania, in a context of

increasing demand for agricultural production and hydropower under a changing climate. Research focused on the Lake Malawi Shire River Basin, where outflows from Lake Malawi into the Shire River are critical for hydropower and irrigation, and also for biodiversity; and on the Rufiji River Basin, a significant source of water for drinking, irrigation, livestock and hydropower in Tanzania.

UMFULA has advanced the potential for climate models to capture the key features that drive the climate in central and southern Africa. For example, the researchers have improved insights into the El Niño Southern Oscillation, the single biggest influence on large-scale rainfall variability in southern Africa. They show how a strong Pacific Ocean El Niño event affects regional circulation patterns, and that human-caused warming has increased the risk of severe drought.

In terms of adaptation and climate-resilient planning, a significant finding from the project is the importance of understanding the likely future characteristics of climate risk that infrastructure will be exposed to. However, given uncertainty over how the climate will change in future, approaches must be strongly informed by local considerations and be robust to that uncertainty: that is, options need to work reasonably well across a range of uncertain future climate (and other) conditions. This approach allows researchers to inform decisions being made now, without having to wait for possible reductions in uncertainty.

The UMFULA team investigated the implications of a range of potential outcomes, to enable decision-makers to determine priorities while factoring in the uncertainties in the climate projections. In both UMFULA's case studies in Malawi and Tanzania, decisions in the water–energy–food nexus involve large investments, long life-times and irreversibility. Development plans have to incorporate trade-offs between irrigation, hydropower and agricultural intensification and the impacts on ecosystem services (such as natural flood defences and ecological reserves), among other considerations. UMFULA's aim was to provide the evidence base for this decision-making. For example, the region contains a number of major dams and more are planned, including one that when complete will be among the largest in Africa. The project's results show that adaptive rules for dam operation will be needed to deal with greater variability in reservoir inflows, and that improved coordination of decisions across water–energy–food sectors will be required to achieve development goals sustainably.

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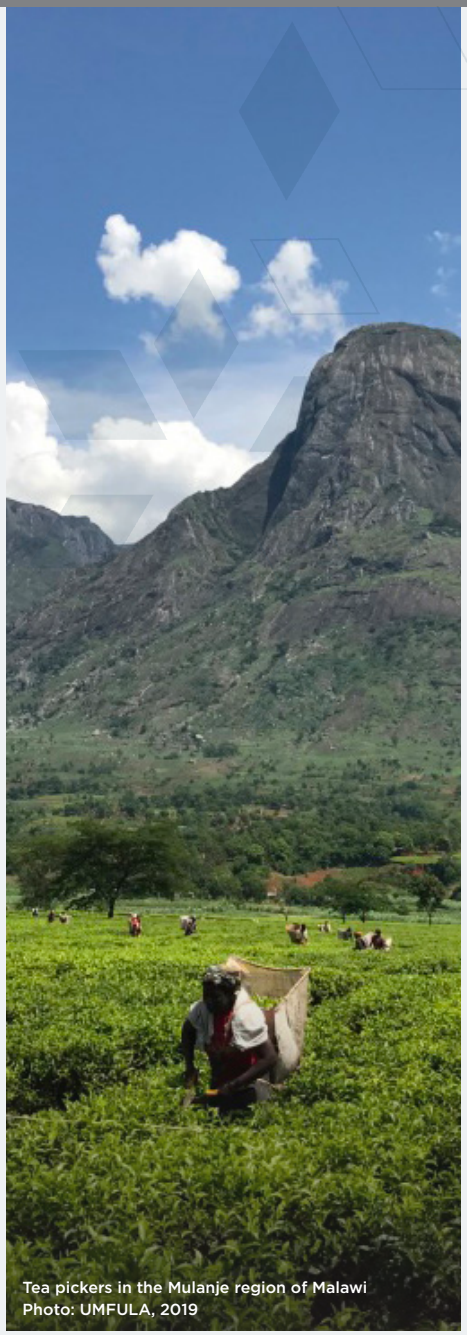

Tea pickers in the Mulanje region of Malawi
Photo: UMFULA, 2019

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UMFULA also embraced a process of co-production of knowledge by researchers and wider stakeholders, to help build capacity to factor climate risks into long-term planning. Researchers have gained a better understanding of real-world decision-making in which climate change is one of many important factors. For example, the tea sector is important to Malawi's employment and economy – and is highly reliant on the right rainfall and temperature conditions. UMFULA has worked with large tea estates and smallholder farmers to tailor future climate projections, analysing changes for a set of metrics that could specifically affect tea yield and quality. Co-producing this information between UMFULA researchers and stakeholders in the tea sector has enabled the growers to identify appropriate ways to adapt their industry to reduce climate risk.

Of course, political influences, policy processes and local perspectives affect decision-making processes at all levels. UMFULA's analysis of Malawi, Tanzania and Zambia shows that change in political leadership, frequent cabinet reshuffles, shifts in ministerial mandates and rotation of high-level civil servants have led to a focus on short-term planning that links with electoral cycles, rather than on the necessary long-term building of resilience strategies and climate adaptation investments.

The climate is already changing – with major consequences for ecosystems and society. Adaptation strategies are needed to manage current impacts and will be increasingly vital as the world continues to warm. But adaptation is complex and societies are only at the start of a learning process that will continue for decades. In UMFULA the aim has been to contribute to this process by developing capacity to understand climate risks and to collaboratively design ways for their incorporation into long-term planning in Malawi, Tanzania and more widely in central and southern Africa. ◆

1.See UMFULA (2019) The current and future climate of central and southern Africa: What we have learnt and what it means for decision-making in Malawi and Tanzania, Cape Town: Future Climate For Africa, https://futureclimateafrica.org/resource/key-messages-from-the-umfula-project/

Declan Conway is a Professorial Research Fellow at the Grantham Research Institute on Climate Change and the Environment at the London School of Economics and Political Science, where he leads the sustainable development research theme. Declan's research cuts across water, climate and society, with a strong focus on adaptation and international development.

Responding to the Urgency of Ocean Risk

Karen Sack
President & CEO, Ocean Unite

Chip Cunliffe
Sustainable Development Director, AXA XL

Nathanial Matthews
Director of Programs, Global Resilience Partnership

United Nations Secretary General António Guterres remarked earlier this year: "... I have visited many communities affected by extreme weather events and other natural hazards. From the South Pacific to Mozambique to the Caribbean and beyond, I have seen the devastating and life-changing impact of the climate emergency on vulnerable communities. Disasters inflict horrendous suffering and can wipe out decades of development gains in an instant. In the coming decade, the world will invest trillions of dollars in new housing, schools, hospitals and other infrastructure. Climate resilience and disaster risk reduction must be central to this investment." But in building that resilience and allocating those investments, the ocean is often forgotten as an investible solution to mitigate risk.

The ocean is changing faster than at any time in human history, creating increased uncertainty and risks for billions of people. Global heating from CO2 emissions is warming the ocean and making it more acidic, causing sea levels to rise, intensifying storms and damaging marine ecosystems which provide essential services from resilience to food security and climate regulation.

The recent IPCC Special Report on the Ocean and Cryosphere in a Changing Climate provided fresh evidence on the speed and extent of the changes occurring in the ocean. The report warns that ocean heating and acidification are increasing at a steady rate, and highlights a wide range of associated impacts on the world's coastal areas, which are home

to 40% of the world's population – more than 600 million of whom (around 10 per cent of the world's population) live in areas that are less than 10 metres above sea level.

Ocean changes pose threats to the lives and livelihoods of millions of people, most of them in the poorest and most vulnerable communities in the Global South and in Small Island Developing States (SIDS). Their economic, social, cultural and political security, traditional ways of life, access to food and nutrition, and health all stand to be significantly affected.

It is increasingly clear that the changes to our ocean come with huge financial costs attached. Analysis by the UN Office for Disaster Risk Reduction points to a rise of 151% in direct economic losses from climate-related disasters over the last 20 years. In the last 10 years alone, insurers have paid out some $300 billion following storm damage to coastal regions, and the costs to governments and taxpayers have been far higher. It's now estimated that by 2050, the global community will face annual costs of $1 trillion as a result of the combined effects of rising sea levels and extreme weather events on our coastlines.

The mounting evidence of the environmental, human and economic costs of ocean changes demand urgent and meaningful action to address ocean risk. And yet, our global response has not, so far, matched the scale and complexity of the challenge.

But things are changing. Following a call for action by the UN last year, a paradigm shift in addressing ocean risk is under way, with the launch of a new multi-sector initiative, the Ocean Risk and Resilience Action Alliance (ORRAA), at the UN Secretary General's Climate Action Summit in September.

Founded by leading insurer AXA, ocean conservation non-profit Ocean Unite and the Global Resilience Partnership, ORRAA is supported by the Government of Canada and has a diverse and growing set of members, observers and partners.

It is designed to foster crucial collaboration between governments, financial institutions, the insurance industry, environmental organisations and other stakeholders to create innovative finance solutions that build resilience to ocean risk in the regions that need it the most. Its multi-stakeholder engagement will enable key actors to work together on critical solutions.

This starts with developing finance products that invest in resilient natural capital. It's impossible to overstate the importance of healthy reefs,

mangroves, seagrass beds, saltmarshes, wetlands and other marine ecosystems to coastal protection in countries that often lack the resources to finance relief and recovery efforts. Ensuring that these ecosystems are protected, managed and regenerated requires new approaches that unleash cost-effective investment.

Research by the Nature Conservancy estimates that mangroves, for example, reduce annual flooding for more than 18 million people worldwide. They are also known to sequester between five to 10 times the amount of carbon from the atmosphere as a terrestrial forest and are nurseries for multiple species. A healthy reef can reduce incoming wave energy by up to 97 percent, whilst a one metre loss of coral reef height, on the other hand, can double the damage done to the shoreline from an extreme weather event.

It has also been estimated that the median cost of building a tropical breakwater is about 15 times greater than the cost of restoring a coral reef, so incentivising investment mechanisms that safeguard these natural shields makes sense whichever way you look at it.

The Ocean Risk and Resilience Action Alliance's work is based on three interconnected pillars.

First, it will focus on developing innovative, risk-adjusted and scalable products that change the risk perceptions of investing in coastal natural capital. These include nature-based insurance, risk pools, sustainability incentives, carbon credit initiatives, green/blue bonds, resilience bonds and debt restructuring. It also promotes investments in people through micro-finance and micro-insurance products that incentivise sustainable practices that will pay off in the long term. After piloting a number of small-scale projects in specific coastal areas, ORRAA will expand and replicate those across wider regions.

Second, the Alliance will advance and integrate the global narrative on the critical importance of ocean resilience within the climate agenda, informing and advancing ocean risk policy amongst governments and the private sector, and increasing public understanding.

Finally, key to the adoption of these new finance instruments and influencing policy outcomes is understanding the science that underpins ocean-derived risks and deepening the understanding of workable solutions. This is why another priority for the Alliance is to accelerate the research and data collection needed to better analyse, model and manage ocean risk.

In collaboration with several partners, AXA is leading the development of an Ocean Risk Index to develop potential scenario analyses of the implications of sea level rise and habitat degredation on fiscal policy.

In addition, through a partnership with the world-renowned Stockholm Resilience Centre, ORRAA, will begin by curating a synthesis report on the impacts of ocean risk on women and girls in vulnerable regions. Additionally, SRC will deliver a cornerstone report on the impacts of ocean risk on SIDS and Least Developed Countries to describe the potential for building adaptive capacity within these communities, and the funding modalities and reporting mechanisms needed to ensure maximum positive impact.

Understanding and building engagement around ocean risk as a function of the hazards, exposure and vulnerabilities of communities, cities, countries and regions , is more critical than ever. By bringing sectors together, collaborating, generating knowledge and leveraging public funds to significantly scale private investment, we can regenerate and revitalise nature for the benefit of ecosystems and society for future generations. ◆

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Nature-Based Flood Resilience:
Reaping the Triple Dividend from Adaptation

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The actions taken to overcome poverty and manage climate change will determine what the future will look like. Natural capital – the world's stock of natural assets – and the ecosystem services it provides to make human life possible, are hugely important to climate change adaptation and to sustainable development more widely. This has long been recognised but the approach still lacks financing and the pace of translating natural capital's potential into policy and business models remains slow.

Yet smart climate change adaptation – with natural capital playing a key role – could realise a triple dividend: avoiding and reducing the losses and damages from climate change impacts; stimulating entrepreneurship and economic activity; and generating sustainable development co-benefits.

The integrated management of flood risk is one context where natural capital could take centre stage. On the coast, natural capital solutions include maintaining or establishing oyster reefs or mangrove forests to dissipate wave energy, buffering against high tides and storm surges and reducing coastal erosion. Inland, methods include cleaning up waste from riverbanks and estuaries to support drainage and prevent channel obstruction, and making space for the natural flow of river systems rather than restricting them to ever narrower artificial channels.

Nature-based solutions offer many advantages over 'hard' engineered measures such as seawalls: healthy ecosystems can regenerate, do not need energy supply and do not lose their performance capacity over time

(unless they are harmed). They also help to maintain biodiversity and reduce pollution, contribute to positive mental health and provide spaces for tourism and leisure.

The Zurich Flood Resilience Alliance (ZFRA) has been working with more than 100 communities across 13 countries to help strengthen resilience to floods. An important area of interest for the Alliance is determining how natural capital – as well as human, financial, social and physical capital – can be a part of resilience-building strategies. Building climate resilience and adaptive capacity is not simply a question of strengthening or upgrading homes and infrastructure: it is also about ensuring the necessary human, social, physical, natural and financial systems are in place to address climate impacts when they occur. Climate change cuts across all of these systems, which in turn are complex and interrelated, and trying to tackle adaptation focusing on only one system is likely to fail. Funding for preventative adaptation and resilience needs to match what is currently being spent on relief efforts and repairs after a disaster – as this ex-ante approach will leverage much greater returns in the long run.

ZFRA has developed a holistic approach to resilience, designed to enable local decision-makers and those most at risk to identify how their own resilience can be strengthened. Within this, natural capital is recognised as offering significant benefits but there are challenges in trying to strengthen its role.

One challenge surrounds trust. It is more difficult to convey how increased natural water storage, mangrove forests or improved river biodiversity, for example, could be as effective as a physical construction such as a levée. Timelines come into play here too: hard engineering will have a clear, immediately visible impact, whereas natural capital solutions will take more time to provide a quantifiable effect.

In promoting immediate investment in natural capital solutions, and other types of adaptation and resilience measures, we need better messaging to drive home the urgency.

It is also more difficult to 'sell' natural capital methods that are relatively new and may lack rigorous analysis of their results – new approaches may be needed to better understand what constitutes their costs and benefits.

In promoting immediate investment in natural capital solutions, and other types of adaptation and resilience measures, we need better messaging to drive home the urgency: the world cannot afford to spend decades waiting for solutions to develop, mature and be mainstreamed. The benefits of acting now far outweigh the costs of waiting and addressing climate impacts after the fact; that the cost of doing nothing is not zero must be much better acknowledged if we are to assess current and future costs more accurately. Experts like ZFRA need to find ways to convince those developing investment vehicles to act quickly. For example, the market for 'blue bonds' – funds dedicated to ocean-friendly projects – needs to mature in the next two to three years if it is to have an impact before it is too late to make lasting improvements to the health of the oceans.

Politically, we need to stop accepting that the external costs – among them the negative and unequally distributed effects of climate change – of current investments are often borne by the weakest and most vulnerable in society. This makes these investments seem economically more viable than they really are, to the detriment of greener and bluer investments. And we need to better assess and quantify the long-term benefits of non-traditional, 'softer' approaches that yield benefits that are difficult to monetise; this again twists decision-making at the expense of the oceans and coastal regions and the economies that depend on them.

Additionally, looking at a system in its entirety will help identify crossover opportunities between climate change mitigation and adaptation. For example, a mangrove reforestation project has carbon sequestration benefits – and thus could get carbon credits to generate cash flow to make the project investable – but would also have storm surge protection potential. Viewing these benefits holistically can help advance blue finance.

Ultimately, we need better quantification of the additional benefits of a natural capital approach to climate change adaptation and resilience and to move away from a classical cost–benefit analysis that is rooted in physical infrastructure only. ◆

Looking at a system in its entirety will help identify crossover opportunities between climate change mitigation and adaptation.

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Decarbonisation Risks in Shipping: Implications for Insurance Underwriters

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Limiting the impacts of climate change requires significant decarbonisation efforts across countries, sectors and stakeholders. Collaboration and engagement are necessary to meet the concomitant challenges, as the example of insurance and shipping shows.

Vivid Economics and experts from the Grantham Research Institute have recently examined the effects of decarbonisation on the global economy up to 2030 and drawn out its implications for insurance markets. This article summarises the expected effects on activity patterns and risk profiles for the shipping sector, and sets out an agenda for insurance markets to help facilitate decarbonisation.

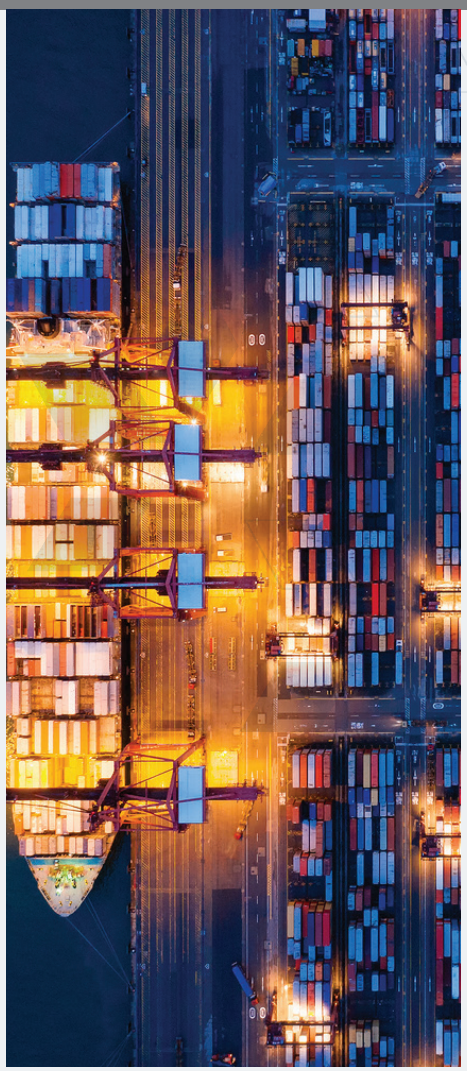
Global efforts to decarbonise economies will act as a headwind to growth in the shipping sector but are unlikely to cause an about-turn in the next decade. In a scenario where the global average temperature increase is kept to 2°C above pre-industrial levels, Vivid Economics' Net Zero Toolkit predicts a slight fall in revenues in 2030 in the sector, compared with a reference scenario in which countries fulfil their current Nationally Determined Contributions to the Paris Agreement. But in the absence of viable alternatives to container shipping, and with growing demand for global trade, we expect the sector to continue to grow even in more ambitious decarbonisation scenarios: in a 'beyond 2°C' scenario (where warming is limited to well below 2°C), global volumes are expected to more than triple up to 2060.

However, as a conduit of global economic activity, regional and sectoral patterns of shipping will be profoundly affected by the zero-carbon transition. Some significant routes are expected to decline precipitously: for example, a third of maritime trade currently comprises fossil fuels, but global consumption of coal and oil would fall by 55 and 21 per cent respectively over the period to 2030 under a 'beyond 2°C' scenario, according to the International Energy Agency. On the other hand, very rapid growth is expected for cargoes such as biomass, renewables equipment and lithium, all of which present distinct risks for transporters. This will impact the geographical mix of shipping revenues, with the United States acting as a key supply source of wood pellets for Europe and global lithium reserves concentrated in Latin America.

In the absence of breakthrough technologies, the sector will likely need to rely on incremental efficiency measures up to 2030. Shipping is not directly included in the Paris Agreement: the challenge to reduce global emissions is set instead by the International Maritime Organization (IMO), the UN agency with responsibility for the safety and security of shipping and the prevention of pollution by ships. In April 2018 the IMO set an ambition to reduce total annual greenhouse gas emissions from shipping by a minimum of 50 per cent by 2050 compared with 2008. Under current activity projections this target would require zero-emissions vessels to be operational by 2030. It is not clear what technology zero-emissions vessels could employ, but to achieve decarbonisation by increasing efficiency a mix of technical measures will likely be required, including the use of lighter materials, propulsion devices such as wind turbines, reducing speeds and ship size, and optimising ship–port interfaces to reduce emissions throughout the shipping process.

A barrier to progress on decarbonisation within the sector relates to the functioning of the IMO. Developing regulatory standards for the sector will involve complex negotiations between the organisation's 174 member nations. Past experience – for example with the IMO's 2020 sulphur cap regulation – suggests this could be a protracted process.

All of these trends – shifts in revenue sources, changing technology and



Very rapid growth is expected for cargoes such as biomass, renewables equipment and lithium, all of which present distinct risks for transporters, and which will impact the geographical mix of shipping revenues.

Challenges relate to uncertainty around the future mix of regulations and technologies, as well as possible asset-stranding and sudden shifts in risks resulting from the transition towards new routes and cargoes.

uncertain future regulation – could have far-reaching effects on the risks of doing business in the sector. Insurers therefore have an important role in supporting the zero-carbon transition: through both making the most of opportunities and rising to challenges that the transition presents.

Opportunities for insurers include growth in premium income associated with increasing insurable values of vessels as they adopt low-emissions technologies and as the set of insured risks, including risks on compliance with new regulations, broadens. There is also a potential role for insurers to facilitate investment in low-carbon technologies by supporting more effective risk-sharing between vessel owners and charterers. Collaboration between insurers and risk managers is to be encouraged for its potential to support the transition, in particular through developing common risk management standards for insurance contracts and new risk-sharing mechanisms to underpin investment.

Challenges relate to uncertainty around the future mix of regulations and technologies, as well as possible asset-stranding and sudden shifts in risks resulting from the transition towards new routes and cargoes. Proactivity is required to meet these challenges – both in anticipating changes in risk profiles and in advocating the adoption of efficient regulatory standards.

In sum, the decarbonisation efforts that are necessary to limit climate change are expected to cause a radical rebalancing of global economic activity over the coming decade. The shipping sector, which conveys 90 per cent of world trade, can adapt to the transition by serving new markets, adopting new technologies and complying with its own new decarbonisation regulations. Given the resultant impact on risks across the sector, active engagement by insurance underwriters will be an important ingredient of a successful transition. ◆

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Solving A Chinese Puzzle in Global Governance

Zhongying Pang

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While the US, the world's largest economy, withdrew from the 2015 Paris Agreement in 2017 under the Donald Trump administration, China, the second largest economy, has been taking the lead in forging and fulfilling the Agreement.

China's commitment and compliance in global climate governance is just part of China's systemic liberal global/foreign policy. Under the leadership of President XI Jinping, unlike Trump's USA, China has been taking a pro-global governance attitude and action: China not only defends the existing globalization, but seeks a "new globalization" represented by the largest ever "Belt and Road Initiative" (BRI) in global development, particularly in the development of global infrastructure networks. In 2017 and 2019, China organized two BRI summits in Beijing to drive globalization in a new direction amid serious "de-globalization" symbolized by the Donald Trump's "America First" anti-globalism foreign policy and UK's leave from the European Union (Brexit).

The core doctrine of China's liberal global policy is self-entitled "A Community of Shared Future for Mankind" (Ren Lei Ming, Yun Gong, Tong Ti), which was formally presented at the 18th and 19th National Congresses of the ruling Communist Party's Political Reports in 2012 and 2018. The doctrine was legally written into the Constitution of the People's Republic of China in March 2018.

Currently, there is an unprecedented global puzzle emerging from China, as the USA is ending the liberal order represented by the United Nations and International Economic (finance and trade) Organizations as well as UN-

organized global governance processes like the UNFCCC, while China, labeled in the West as "illiberal", conducts a liberal foreign/global policy. This is not a story of the globally fashionable "illiberal China in a liberal order", but how the ironically "illiberal" China helps save the existing liberal order.

On April 23rd, 2019, in the port city of Qingdao, with the heads of foreign naval delegations at the commemoration of the 70th anniversary of the founding of the Chinese People's Liberation Army(PLA) Navy, President Xi Jinping called for concerted efforts to safeguard maritime peace for a Shared Maritime/Marine Future: "The blue planet humans inhabit is not divided into islands by the oceans, but is connected by the oceans to form a community with a shared future, where people of all countries share weal and woe". Since then, China has been doing much to seek a policy of "A Maritime/Marine Community with a Shared Future".

China has been taking great action to build the future, including the 21st Century Maritime Silk Road, which is a key part of the BRI, and since 2012 has organized the China Marine Economy Expo (CMEE). Recently, Shenzhen, China's leading innovative city, held the expo in October 2019 with President Xi Jinping's strong message: towards "a Shared Marine Future" by developing a first class "blue economy"—a sustainable marine resources-based economy.

At home, China has been pursuing a nation powered by seas and oceans (Hai Yang Qiang Guo, HYQG). The HYQG is well known indispensable part of China's nationalist renaissance ambition.

The goal of the HYQG includes not only traditional sea power, but also a highly developed marine economy. China looks at marine areas as a new source of national power and a new driving force to boost China's economic transformation from heavily dependent on continental resources to marine resources. So far, since the beginning of this century, the growth of China's marine economy has been achievable as the nation is already a large marine economy.

It is clear that if China's marine economy is systemically decisive in its whole economic system, it will significantly contribute to the ocean's already serious problems, particularly global ocean warming. In an important national forum on the "Shared Marine Future" at the Ocean University of China (OUC) in Qingdao. Professor Wu Lixin, director of the Qingdao National Laboratory for Marine Science and Technology (QNLM), warned of a vicious circle-climate change affects oceans and ocean warming affects climate. He believes China's effective

It is clear that if China's marine economy is systemically decisive in its whole economic system, it will significantly contribute to the ocean's already serious problems, particularly global ocean warming.

This document highlights how China contributes to global climate governance by abiding by the UN climate rules, moving towards a "Shared Future". It is not enough: China's marine aspect of climate policy is lacking.

and active role in preventing global ocean warming is a must.

Wu's remarks show China's leading marine scientists have realized the danger of global ocean warming.

China's paradox is that in a time of global climate change, it is untimely to be a leading maritime nation.

How does China solve its contradiction between being a leader in global climate governance, and nationalist requests for an advanced marine economy?

China needs to strike a balance between its maritime ambition and its international liberal commitment: towards a "Shared Marine Future".

Before the 2019 UN Climate Action in New York, China issued its "Position and Action" document in Beijing: "China has always attached great importance to addressing climate change. Upholding a national strategy of attaching equal importance to mitigation and adaptation, China has regarded addressing climate change as a great opportunity to achieve high-quality economic development and promote ecological progress. China will continue, as always, to firmly implement the Paris Agreement, fully honor its commitments, promote the establishment of an equitable, rational, and win-win global climate governance mechanism, and work with others to build a community with a shared future for mankind." At the UN Climate Action Summit, China was a co-leader in advocating the "Nature Based Solutions" (NBS).

This document highlights how China contributes to global climate governance by abiding by the UN climate rules, moving towards a "Shared Future". It is not enough: China's marine aspect of climate policy is lacking. In other words, China needs to make specific policies and practices in order to solve the conflict between the rapid development of a marine economy and the prevention of ocean climate change. This lies in forging a "Shared Marine Future".

Before President Xi Jinping's 2019 "Shared Marine Future" advocacy in Qingdao, China joined the United Nations Ocean Conference in 2017 for "partnering for the implementation of Sustainable Development Goal 14" - "Blue Partnership". China's academic and media have also paid attention to the Intergovernmental Panel on Climate Change (IPCC) Special Report on the Ocean and Cryosphere in a Changing Climate (2019). No doubt, as the marine policies grow in prominence in the development agenda at various levels in China, China needs to do double governance work: governing China's marine economy according to ongoing global climate governance, and truly practicing its liberal policy to promote the world's Shared Marine Future." ◆

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The Case for Agile Regional Ocean Sustainability Banks

Nishan Degnarain
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The health of our ocean is the single biggest driver of climate change on the planet. The transition to a low-carbon, more sustainable economy, is estimated at over $2 trillion[1]. This is four times larger than the 1933 New Deal to avoid the Great Depression ($650 billion in today's prices) and over ten times larger than the Marshall Plan for European Recovery after WW2 ($150 billion in today's prices). Such a transition represents the single biggest economic opportunity over the next decade, and if designed and executed well, can harness the power of new technologies, create new economic sectors, stimulate the economies of many low-income countries, creating millions of new jobs and ensuring technology transfer to the Global South. Our current sustainability investment efforts are fragmented, piecemeal and focused on traditional sectors that will lead to incremental solutions, relative to the challenges our planet faces. Government and Philanthropic Investments into the ocean represent only $5 billion a year, relative to the $200 billion a year needed over the next decade. This paper calls on the creation of new financial instruments that will turbo-charge investment into revenue-generating high potential new growth sectors of the economy, which will not just address the crisis facing our oceans, but restore planetary health.

Planetary Tipping Points

Look at any chart of human impact on the oceans since the 1950s in every ocean basin, and you will see near-exponential curves[2], whether these be for the growth of industrial fisheries, growth of coastal tourism, collapse

of fish stocks, collapse of coral reefs, destruction of mangroves, loss of polar ice, spread of invasive species, and increasing endangerment and extinction of species.

This has placed the world on the brink of various tipping points which will impact the most vulnerable populations around the world. The changes to the physics, chemistry and biology of our ocean systems are compounded by the socio-economic challenges of high unemployment and declining opportunities in the traditional maritime sector. These pressures are mounting and are likely to come to a head in the next decade in many parts of the world, as more fisheries collapse, tourism sites decline, and our oceans become more barren.

Incremental solutions based on current technologies are not sufficient to restore a healthy ocean ecosystem. Such interventions will be overtaken within a decade, by both a changing ocean environment, as well as new technological advances. Government and Philanthropic interventions are important, but not sufficient alone to address the challenge our ocean faces. Harnessing the resources of the private sector and global finance community will be crucial.

A Fourth Industrial Revolution

We are on the brink of a Fourth Industrial Revolution in modern times – a period where technological advancement is so rapid, that it fundamentally alters our economic systems for almost a century. New digital platforms, new energy systems, Artificial Intelligence, Autonomous Robotic Systems, 3D printing, Synthetic Biology could transform our economies into new fast-growth trajectories.

How can we harness the power of the Fourth Industrial Revolution, as a force for good, ensuring the right safeguards are in place?

Acupuncture points and systemic solutions

At first glance, the challenges for such a transition appear almost insurmountable. Estimates are that the transition will cost an estimated $2 trillion over the next decade. The scale of transition to move our economy from our current production systems, transportation, energy production, land and ocean use will be the single biggest transition we have seen in modern times.

The suite of solutions we need call for a global approach across multiple sectors, and requires both the de-industrialisation of OECD countries, as well as new development paths for fast growing economies. It calls for a new consumption model for the emerging middle classes of China, India, South East Asia, Africa, Latin America, that looks radically different from the middle-class consumption pattern

of Western Economies (four times lower ecological footprint per capita).

This means de-risking some solutions, both through financial investments as well as policy innovation. In consumer packaging, we have seen how policies against plastics has stimulated the growth of alternative new biodegradable materials and greater recycling solutions to emerge in response. Similarly, statements and policies in favour of electric vehicles have now ensured all major car divisions around the world have some form of Electric Vehicle capability that are likely to come online in the next few years.

We now need to take a bolder approach, if we are going to mobilise the full potential of the private sector.

A Bold and Holistic Ocean Finance approach

1. Build a Sustainable Ocean Economy

Governments should explore ways to encourage Fourth Industrial Revolution technologies into their maritime economies. Potential ideas include building new Ocean investment asset classes and indices (ESG), build Capacity Building Centres and Training Academies in each country to develop a 'high-skilled' ocean economy talent base, making procurement processes easier for new technologies to be adopted in existing Public and large Private Sector Enterprises. This will help address existing sectors and ensure greater transparency of operations. At the same time, we need to encourage new sectors that currently do not exist, but can restore ocean health. For example, we may need to encourage a large-scale coral-growing industry or algae carbon sequestration, in the same way that the Space Race was seen as solely in the Government domain until 2004 when California-based X-Prize[3] launched the growth of the private space industry.

2. Create new Ocean Financial Instruments

To support such investments, there is a need to develop new public and private financing tools for ocean activities. This includes developing Investment Frameworks for Long Term Institutional Investors, Governments and private investors (such as new ESG indicators), building Investment Pools around different Ocean Asset Classes, develop new financing tools (e.g., credit guarantees). Potential ideas include 'Blue Bonds, or Debt for Nature Swaps,' the World Bank's 'Plastics Investment Pool,' identifying Ocean Infrastructure priorities to set an investment agenda, Belt and Road Blue Investment Principles. Such approaches need to take into account nature-based solutions, that could often ensure a greater Return on Investment.

3. Develop Blue Risk Instruments

There is a need to develop new financial risk tools to assess the risk of various ocean investments. For example, through insurance and financial risk leaders, develop new ocean risk tools to guide financing, building new ocean risk metrics, develop new ocean risk technologies to de-risk ocean investments (operationally and financially). Potential ideas include building an 'ARC of Oceans[4],' a G20 FSB-Taskforce on Climate Disclosure, that has stronger emphasis on the oceans.

Regional Ocean Sustainability Banks

Each ocean basin has their own particular challenges (e.g., extinction risk of various species, loss of land, emergence of Seabed Mining, changing oceanic currents). The challenges in our ocean are sufficiently different from land, requiring different skillsets to understand, make scientific recommendations as well as investment decisions, particularly around hybrid-finance mechanisms with the private sector and explore sectors that have never needed to exist before (e.g., to prevent species extinction, prevent coral degradation, explore nature based solutions around carbon sequestration and coastal protection).

Having Regional Ocean Sustainability Banks that can channel public and private capital into projects to transform economies into more sustainable blue economies will be crucial. These must have strong scientific advisory bodies to ensure solutions being developed are fully sustainable, and to ensure best practice is being shared globally. Guiding investments of $200 billion a year will require hybrid capital approach with credible investment partners.

Having Regional Ocean Sustainability Banks that can channel public and private capital into projects to transform economies into more sustainable blue economies will be crucial.

A strong area to start could be with China. China has the potential to be a global leader in this area, as the Belt and Road Initiative covers over a quarter of the world's EEZs. A Blue Belt and Road, with Blue Investment Principles could be developed.

In words of Jacques Cousteau, "The sea, the great unifier, is man's only hope. Now, as never before, the old phrase has a literal meaning: we are all in the same boat." The warning signs are all around. Now is the time for bold leadership. ◆

1 *Global Center on Adaptation 2019 Report: https://gca.org/global-commission-on-adaptation/adapt-our-world*
2 *The Great Acceleration: An Environmental History of the Anthropocene since 1945 by J. R. McNeill and Peter Engelke (2014)*
3 *Diamandis, P. and Kotler, S. (2012), "Abundance: The Future is Better Than You Think"*
4 *ARC (Africa Risk Capacity) is a new public-private sovereign risk agency of the AU to build African countries' capacity to manage Natural Disasters*

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