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Blue Carbon in International Law:

Understanding challenges and opportunities for delivering multiple benefits while protecting coastal ecosystems

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Abbreviations

1 Introduction

The impacts of climate change, as well as over-fishing activities, loss of marine biological diversity, and the degradation of marine ecosystems became more apparent in the 1990s.[1] Since then, severe droughts, floodings, increases in sea level rise and consequent submersion of coastal areas, and even the COVID-19 pandemic have shown the signs of an ill planet.

Along with terrestrial or dryland forests, blue carbon ecosystems (BCE) – which encompass mangrove forests, saltmarshes, and seagrass meadows, – have been deeply degraded. In this sense, it is estimated that a large percentage of these ecosystems is already lost. At current rates, and if this continues, an even larger extent could be lost in the next years.[2] Losses are attributed mostly to anthropogenic causes – particularly as a result of coastal developments (such as aquaculture and port activities), pollution, erosion from land-based sectors (such as agriculture and tourism), offshore activities, and, incidentally, the effects of climate change itself.[3,4] According to the last IPCC report, climate-related risks and long-term impacts are multiple times higher than seen in the past, and likely to escalate with each global warming increase.[5] Some changes are already unavoidable and irreversible. The rise in sea levels, for instance, is set to last for centuries to millennia.[6] This reality, added to a low financial flow to support adaptation and mitigation goals,[7] makes prioritizing actions to preserve blue carbon, which can deliver multiple benefits, even more relevant.

Generally, efforts to reduce greenhouse gas (GHG) emissions and enhance sinks, including conservation, restoration, and sustainably managing ecosystems, are referred to as mitigation[8] efforts. Over the years, society has adopted many approaches to dealing with coastal ecosystems. Many have ignored (or continue to ignore) the threat of climate change to continue business as usual (BAU); some seemed to consider carbon markets an 'omnipotent' solution that would permit capitalists to continue their search for profits while mitigating the risks of

[1] UN, "Report of the Secretary-General: Oceans and the Law of the Sea", GAOR/A/72/70 (2017): 3.

[2] The Blue Carbon Initiative. "About Blue Carbon." Accessed March 29, 2023. https://www.thebluecarboninitiative.org/about-blue-carbon.

[3] Paul G. Harris, 1st ed., *Routledge Handbook of Marine Governance and Global Environmental Change*. (London: Routledge, 2022). doi:10.4324/9781315149745, 124.

[4] Nicholas J. Murray et al., "High-resolution Mapping of Losses and Gains of Earth's Tidal Wetlands," Science 376, no. 6594 (2022): 744-49, 3.

[5] IPCC, 2023: Summary for policymakers, Lee, Hoesung, Katherine Calvin, Dipak Dasgupta… Noureddine Yassaa, In: Synthesis Report of the IPCC Sixth Assessment Report, AR6SYR, 2023, https://www.ipcc.ch/report/sixth-assessment-report-cycle/,15.

[6] IPCC, "Summary for policymakers", 19.

[7] Ibid, 19, 20 and 35.

[8] UNFCCC, "Introduction to Mitigation", Accessed April 30, 2023. https://unfccc.int/topics/introduction-to-mitigation

climate change; and yet others have referred to pairing benefits (or valuing projects that deliver co-benefits) as a way to foster resilience in climate action.

Moreover, 'blue' carbon credits, which are generated by conserving, restoring, or sustainably managing BCEs can be more attractive to buyers (such as corporations, governments, or individuals) due to the various benefits delivered by preserving these ecosystems, which often exceed those of their terrestrial peers.[9] Attractiveness is given by different reasons, including, e.g., companies needs´ to support their corporate social responsibility (CSR) strategies, to reduce the risk of environmental impacts due to their investments, and even due to concerns with wider community or biodiversity benefits.[10]

However, searching for carbon credits of projects that deliver 'co-benefits' is not simple, as the field is permeated with uncertainties. Uncertainties involve the implementation and maintenance of a blue carbon project that effectively mitigates GHG emissions, the possibility of projects to generate co-benefits, and whether co-benefits can be designed, measured, and delivered within these projects. The research question that this paper attempts to answer, therefore, is: ***Whether projects to conserve, restore or sustainably manage BCEs can be paired with or are able to deliver benefits beyond GHG emissions reductions, and what is the current knowledge (including main challenges) regarding blue carbon (and co-benefits itself) impairing the design and effective delivery of co-benefits.***

From a legal lens, the paper analyses the possibility of co-benefits in protecting blue carbon ecosystems, with a focus on how researchers and policymakers conceptualized and contextualized the idea of co-benefits (i.e., benefits beyond GHG sequestration and storage) in developing climate mitigation strategies, in especial blue carbon projects. The research is specially tailored to the context of projects that intend (or make use) of carbon markets. Incidentally, as these can be inserted into wider policy and regulatory strategies, it extends to them.

One of the objectives is to identify how the 'co-benefits' discourse has been applied, as well as remaining critics of these approaches within the current international law framework. Another is attempting to identify the best approaches and mistakes made by researchers, policymakers, and 'practitioners' of blue carbon preservation when dealing with coastal projects that have used or envisaged "co-benefits". The intent is not to exhaust possibilities but to

[9] Daniel A. Friess et al., "Capitalizing on the Global Financial Interest in Blue Carbon", ed. Suborna Barua, PLOS Climate 1, no. 8 (15 August 2022): e0000061, doi:10.1371/journal.pclm.0000061, 3.

[10] Mathew A Vanderklift, et al., "Constraints and Opportunities for Market-based Finance for the Restoration and Protection of Blue Carbon Ecosystems." Marine Policy 107 (2019): 103429, https://doi.org/10.1016/j.marpol.2019.02.001, 3-4.

provide a legal assessment of the use of co-benefits in expanding blue carbon protection and how they fit into wider international goals.

Primarily, the methodology used in this research is a thorough analysis of existing academic literature, case studies, and policy papers about (or relating to) BCEs and climate policies. The academic literature review is based on a systematic search and analysis of relevant scholarly books, articles, and reports, as well as international instruments such as treaties and resolutions from international bodies. Secondary sources, such as policy papers and websites, were consulted where relevant. The case analysis involves examining discretionary selected case studies to identify narratives, gaps, and successful implementations of climate mitigation strategies or projects that considered co-benefits.

Chapter 2 gives an overview of the main concepts in this paper; Chapter 3 describes how BCEs fit into international law; Chapter 4 presents the main co-benefits linked to BCEs projects, as well as the understandings in literature and policies on the matter; Chapter 5 presents a brief overview of main legal and general challenges in implementing a blue carbon project itself; chapter 6 set out examples of developing countries approaches in contextualizing and conceptualizing co-benefits; and chapter 7 offers a summary on the current knowledge gap regarding co-benefits and the concluding remarks for this paper.

2 Clarifications and context

2.1 Blue carbon ecosystems (BCEs)

The term blue carbon refers to carbon captured and stored by marine and coastal ecosystems, often including all fluxes and stores that are biologically driven and responsive to management.[11] In concept, BCEs refer to coastal and marine ecosystems, specifically to mangroves forests, tidal marshes, and seagrass ecosystems,[12] which are often at the centre of restoration, conservation, and sustainable management activities, and therefore considered "actionable" ecosystems.[13,14] At the same time, in literature BCEs can also refer to other components,

[11] Peter I. Macreadie, et al., "Operationalizing Marketable Blue Carbon." One Earth 5, no. 5 (May 2022): 485–92, doi:10.1016/j.oneear.2022.04.005, 486.

[12]Intergovernmental Oceanographic Commission (IOC) UNESCO, "Blue carbon", Accessed March 29, 2023. https://ioc.unesco.org/our-work/blue-carbon

[13] Mathew A. Vanderklift et al., "A Guide to International Climate Mitigation Policy and Finance Frameworks Relevant to the Protection and Restoration of Blue Carbon Ecosystems", *Frontiers in Marine Science* 9 (7 July 2022): 872064, doi:10.3389/fmars.2022.872064, 14.

[14]Catherine E. Lovelock and Carlos M. Duarte, "Dimensions of Blue Carbon and Emerging Perspectives", Biology Letters 15, no. 3 (March 2019): 20180781, doi:10.1098/rsbl.2018.0781, 2.

such as, e.g., macroalgae or seaweeds, phytoplankton, fish, coral reefs, or bivalves. [15] These ecosystems are primarily not included in blue carbon activities that could sell carbon due to a lack of GHG mitigation potentials or due to related gaps in scientific knowledge[16] and methodologies to define their GHG mitigation potentials.[17]

The three actionable ecosystems contribute both to mitigation and adaptation to climate change due to several traits. First, BCEs can sequester and store significant amounts of carbon in their biomass and underlying soils and, if degraded or lost, can release carbon into the atmosphere.[18,19] Comparatively, BCEs also store two to four times more carbon than terrestrial forests,[20] and five times more than similar areas of rainforests.[21] Second, conserving and restoring wetlands can provide numerous benefits against climate change such as flood and coastal erosion protection, water quality improvement – through filtering of water pollution –, and local livelihoods support by providing fish, construction materials, fuel, offering ecotourism opportunities, or even have spiritual values for communities.[22,23,24]

Due to this knowledge, and aware that protecting, managing, and restoring vegetated ecosystems on land and in the ocean can help reduce net emissions of GHGs and thus limit global warming[25], conserving, restoring, and sustainably managing BCEs became part of the growing concept of nature-based solution (NbS).[26,27] Under the IUCN Global Standard, NbS

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[15] Nianzhi Jiao et al., "Blue carbon on the rise: challenges and opportunities", *National Science Review: Oxford*, 2018, Vol. 5, No. 4, 465.

[16] Lovelock and Duarte, "Dimensions of Blue Carbon and Emerging Perspectives", 1.

[17]Cf: Emily Pidgeon et al., "Blue Carbon: Integrating Ocean Ecosystems in Global Climate Action report" , https://bluecarbonpartnership.org/wp-content/uploads/2021/10/blue-carbon-integrating-ocean-ecosystems-october-2021a.pdf, 2-3.

[18] IPCC, Weyer, N. M., et al. (2019). "Annex I: glossary," in IPCC Special Report on the Ocean and Cryosphere in a Changing Climate, eds H.-O. Pörtner, D. C. Roberts, V. Masson-Delmotte, P. Zhai, M. Tignor, E. Poloczanska, et al. Intergovernmental Panel on Climate Change (IPCC), 13.

[19] Marrakech Partnership for Global Climate Action, "Outcome document Action Event: Blue Carbon Implementation Lab", COP27. Accessed April 2, 2023, https://unfccc.int/sites/default/files/resource/MPGCA_COP27_IL_Blue_Carbon_OD_3011.pdf.

[20] IOC UNESCO, "Blue carbon", Accessed February 24, 2023, https://ioc.unesco.org/our-work/blue-carbon.

[21] Moritz von Unger, Femke H. Tonneijck and Cinthia Soto, "Voluntary Carbon Markets for Wetland Conservation and Restoration" (Wetlands International, 2022), 6.

[22] Friess et al., "Capitalizing on the Global Financial Interest in Blue Carbon", 1.

[23] Marrakech Partnership for Global Climate Action, "Outcome document Action Event: Blue Carbon Implementation Lab", https://unfccc.int/sites/default/files/resource/MPGCA_COP27_IL_Blue_Carbon_OD_3011.pdf

[24] Adam P. Hejnowicz et al., "Harnessing the Climate Mitigation, Conservation and Poverty Alleviation Potential of Seagrasses: Prospects for Developing Blue Carbon Initiatives and Payment for Ecosystem Service Programmes', *Frontiers in Marine Science* 2 (9 June 2015), doi:10.3389/fmars.2015.00032, 5.

[25] Vanderklift et al., "A Guide to International Climate Mitigation Policy and Finance Frameworks Relevant to the Protection and Restoration of Blue Carbon Ecosystems", 2.

[26] Josefin Thorslund et al., "Wetlands as Large-Scale Nature-Based Solutions: Status and Challenges for Research, Engineering and Management", *Ecological Engineering* 108 (November 2017): 489–97, doi:10.1016/j.ecoleng.2017.07.012, 1.

[27] Emmanuelle Cohen-Shacham, et al., "Nature-based Solutions to address global societal challenges" (Gland, Switzerland: IUCN, 2016). ISBN: 978-2-8317-1812-5, http://dx.doi.org/10.2305/IUCN.CH.2016.13.en, 2

are defined as "actions to protect, sustainably manage and restore natural and modified ecosystems in ways that address societal challenges effectively and adaptively, to provide both human well-being and biodiversity benefits."[28] In other words, NbS are meant to "harness the power of nature to boost natural ecosystems, biodiversity, and human well-being to address major societal issues, including climate change."[29]

Finally, BCEs usually occupy interconnected areas or land-to-sea transition zones.[30] Legally, it means that various governance arrangements can exist; [31] for instance, mangroves can be owned by states or private parties and seagrasses can be found beyond exclusive economic zones (EEZ),[32] which makes controlling these areas to preserve them even more challenging.

2.2 Co-benefits

As part of projects that conserve, restore, or sustainably manage ecosystems, but also from wider climate debates, co-benefits do not have one single definition. Rather, they are conceptualized and contextualized in many ways, by literature, practitioners of coastal conservation, experts, and policymakers.

In the context of climate mitigation policies, strategies, and projects, the term 'co-benefit' often refers to benefits beyond the mitigation of GHG emissions. In this broader scenario, co-benefits or "side benefits" can include improving energy access, community development, biodiversity conservation, or improved community health. Often, they are also used as incentives for developing countries to participate in carbon offsetting programs and are fostered through promises of, e.g., poverty reduction, local development, or technology transfer benefits.[33]

For blue carbon specifically, the co-benefits narrative usually involves the consideration of multiple benefits that can be secured by protecting BCEs, including ecosystem services

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[28] IUCN, "Guidance for using the IUCN Global Standard for Nature-based Solutions", (1st ed), https://portals.iucn.org/library/sites/library/files/documents/2020-021-En.pdf , 1.

[29] WWF, "Working with nature to tackle societal challenges and benefit people, nature and climate", Accessed April 4, 2023, https://wwf.panda.org/discover/our_focus/climate_and_energy_practice/what_we_do/nature_based_solutions_for_climate/.

[30] Rachel R. Carlson et al., "Synergistic Benefits of Conserving Land-Sea Ecosystems", *Global Ecology and Conservation* 28 (August 2021): e01684, doi:10.1016/j.gecco.2021.e01684, 1.

[31] Surrallés, Alexandre, and Hélène Artaud. *The Sea Within*. IWGIA, 2018, 143-144.

[32] Macreadie et. al, "Operationalizing marketable blue carbon", 486-487.

[33] Kamilla Karhunmaa, "Opening up Storylines of Co-Benefits in Voluntary Carbon Markets: An Analysis of Household Energy Technology Projects in Developing Countries", *Energy Research & Social Science* 14 (April 2016): 71–79, doi:10.1016/j.erss.2016.01.011, 71.

such as improving water quality, providing habitat for coastal fisheries and biodiversity,[34] as well as providing positive community impacts,[35] and, generally, socio-economic benefits.[36] To exemplify, co-benefits can also be described as the "provision of coastal defense to safeguard people and property, support of global economies through enhanced fisheries and tourism activities, improvement of surrounding aesthetics, creation of 'green' jobs, and generally increasing the resilience of natural ecosystems to environmental disturbances."[37]

On another approach, academic literature and policy papers seem to employ the word "co-benefit" to describe a situation where one benefit is the main focus while the others are seen as direct 'consequences' or 'additions' to the first, without any hierarchy between them.[38] To illustrate, protecting mangroves to mitigate GHG emissions ('main' benefit) can lead to the 'consequent' co-benefit of increasing biodiversity conservation in the area, and both of them have equal value.

Further, international policies sometimes use the term (co-benefit) when referring to synergies between activities that mitigate GHG emissions and those which promote adaptation to climate change. For example, mitigation measures such as reducing GHG emissions with forest preservation, afforestation, and reforestation activities can be described as having adaptation co-benefits, especially in the case of mangrove forests which can protect coastlines (e.g., from erosion and sea level rises).[39] Another example: mitigating GHG emissions by restoring wetlands overexploited or depleted by fisheries activities can support co-benefits for adaptation by increasing blue carbon areas' resilience to future (and sustainable) aquaculture practices. Notably, the last example is justified because healthy BCEs can be "less sensitive to threats" –

[34] Valerie Hagger, Nathan J. Waltham, and Catherine E. Lovelock, "Opportunities for Coastal Wetland Restoration for Blue Carbon with Co-Benefits for Biodiversity, Coastal Fisheries, and Water Quality", *Ecosystem Services* 55 (June 2022): 101423, doi:10.1016/j.ecoser.2022.101423., 2.

[35] Harris, *Routledge Handbook of Marine Governance and Global Environmental Change*, 127.

[36] Mikael Karlsson, Eva Alfredsson & Nils Westling (2020), "Climate policy co-benefits: a review", Climate Policy, 20:3, 292-316, DOI: 10.1080/14693062.2020.1724070, p. 301

[37] Su Yin Chee et al., "Enhancing Uptake of Nature-Based Solutions for Informing Coastal Sustainable Development Policy and Planning: A Malaysia Case Study", *Frontiers in Ecology and Evolution* 9 (28 September 2021): 708507, doi:10.3389/fevo.2021.708507, 2.

[38] E.g., see: Md Mizanur Rahman et al., "Co-Benefits of Protecting Mangroves for Biodiversity Conservation and Carbon Storage", *Nature Communications* 12, no. 1 (23 June 2021): 3875, doi:10.1038/s41467-021-24207-4, 7 ; Hagger, Waltham, and Lovelock, "Opportunities for Coastal Wetland Restoration for Blue Carbon with Co-Benefits for Biodiversity, Coastal Fisheries, and Water Quality"; and Harris, *Routledge Handbook of Marine Governance and Global Environmental Change*, 127.

[39] Cf. UNFCCC Secretariat, "NDCs under the Paris Agreement, Synthesis Report by the secretariat", 2022, 37-36.

including perturbations created by socio-economic contexts, such as land conversions and degradations (e.g., due tourism) – and "better able to recover from loss" or degradation.[40]

In this paper, the word co-benefit will refer to benefits beyond GHG emission reductions, particularly (but not strictly) to those capable of providing benefits to humans. This includes, e.g., livelihoods diversification, improvement of water quality, biodiversity benefits, and so on. Incidentally, it will also touch upon wider benefits, such as those with socio-economic impacts (e.g., poverty alleviation).

Mostly, the paper considers co-benefits in the context of projects that seek to conserve, restore, or sustainably manage BCEs and that are capable to generate carbon credits. To illustrate or enlighten arguments, however, it will also consider scenarios beyond these projects, when climate policies and strategies are similarly applied.

2.3 Blue carbon projects

The term "blue carbon project" in this paper will refer to projects which aim to use the climate change mitigation value of BCEs to support their conservation, sustainable management, and/or restoration.[41] They are resourceful initiatives to be adopted by countries, entities (private or public), local communities, and other actors in the improvement of global climate resilience, as well as to support many other sustainable development objectives. Projects can also make use of market mechanisms (especially carbon markets) to achieve climate efficiency goals and overall, represent remarkable tools to support international legal frameworks, as demonstrated further.

3 Blue carbon in international law: current framework

3.1 Policies and the legal system

Blue carbon projects are usually developed in the context of local or national policies and regulations but can also be part of larger international frameworks. That is not just due to often being developed by agents at multiple levels – i.e., international, national, regional, and/or

[40] T. E. Angela L. Quiros et al., "Blue Carbon Ecosystem Services Through a Vulnerability Lens: Opportunities to Reduce Social Vulnerability in Fishing Communities", *Frontiers in Marine Science* 8 (3 August 2021): 671753, doi:10.3389/fmars.2021.671753., 3, 9 and 14.

[41] I.e., defined similarly to AGEDI (Abu Dhabi Global Environmental Data Initiative),"Building Blue Carbon Projects - An Introductory Guide", (AGEDI/EAD, 2014). Produced by GRID-Arendal, A Centre Collaborating with UNEP, Norway, https://oceanfdn.org/sites/default/files/ADGEI%20Building%20Blue%20Carbon%20Projects%20-%20An%20Introductory%20Guide-ilovepdf-compressed-ilovepdf-compressed.pdf , 1.

local – but to the extent they contribute to commitments set by diverse international instruments.[42]

In this sense, the main agreements shaping the climate regime have provisions for the protection of carbon sinks and reservoirs, as well as larger mitigation and adaptation measures relating to preserving BCEs. For instance, the United Nations Framework Convention on Climate Change (UNFCCC, 1992), encourages countries to develop national (or regional) programs for mitigating or adapting to climate change, particularly through promoting sustainable management, and cooperation in the conservation and enhancement of sinks and reservoirs of GHG, including biomass, forests (which includes mangrove forests) as well as coastal and marine ecosystems (article 4). Additionally, the Paris Agreement (2015) recognizes the importance of ensuring the integrity of all ecosystems, including oceans (preamble); encourages parties to conserve and enhance sinks and reservoirs of GHG, with a focus on achieving a net zero emissions scenario by 2050 (article 5); encourages parties to enhance adaptative capacity including through the protection of ecosystems (article 7); as well as recognize the necessity to minimize, avert and address losses and damages by leveraging international cooperation to support the resilience of communities and ecosystems to the effects of climate change (article 8). Precursor to the Paris Agreement, the Kyoto Protocol (1997), had also defended the protection and enhancement of GHG sinks and reservoirs, as well as international cooperation between parties to enhance the effectiveness of its goals (article 2).

Further, the Convention on Biological Diversity (CBD, 1992) recommends parties to establish protected areas for specific conservation objectives, as well as promote environmentally sound and sustainable development in adjacent areas (article 8). Likewise, the Ramsar Convention on Wetlands (1975) of international importance determines parties to promote the conservation of wetlands and waterfowl (article 4) and the Sendai Framework for Disaster Risk Reduction (2015) identifies four priority areas for action (including strengthening disaster risk governance, resilience and enhancing preparedness to address climate change impacts), all of which conserving, restoring and sustainably managing BCEs could address too.

Moreover, the 2030 Agenda for Sustainable Development has several goals (SDGs) which can also be achieved – directly or indirectly – by protecting BCEs. In this sense, connections can be made particularly between goals such as reducing poverty (SDG 1), increasing food security (SDG 2), promoting gender equality (SDG 5), increasing supply and purification

[42] Bodansky, Daniel, Jutta Brunnée, and Lavanya Rajamani. *International Climate Change Law*. Oxford: Oxford University Press, 2017, 6-7.

of water (SDG 6), combating climate change (SDG 13), conserving life below water (SDG 14), and protecting life on land (SDG 15).[43]

Last year, nature-based solutions (NbS), – which do not have a definition under the CBD, the UNFCCC, or any other international climate change instrument, – were also included in the new Global Biodiversity Framework (GBF) or Kunming-Montreal Global Biodiversity Framework[44] and recognized by the United Nations Environment Assembly (UNEA) as having an important role in the global response to climate change.[45]

In this sense, the UNEA resolution (2022) agreed on the necessity of consensus upon a concept for NbS, in light of potential misuse of the term. The concept was then set out in line with IUCN's Global Standard definition (exposed in Chapter 2). UNEA also recognized that NbS play an essential role in achieving SDGs, including by "addressing major social, economic and environmental challenges, such as biodiversity loss, climate change, land degradation, desertification, food security, disaster risks, urban development, water availability, poverty eradication, inequality, and unemployment, as well as social development, sustainable economic development, human health and a broad range of ecosystem services."[46]

Recent developments also include the Sharm el-Sheikh Implementation Plan (decisions 1/CMA. 4 and 1/CP.27), adopted at UNFCCC's COP27, which encourages parties to consider NbS in their adaptation and mitigation plans while ensuring relevant social and environmental safeguards, and reinforces the important role of local communities, indigenous peoples, as well as the civil society in addressing and responding to climate change.[47]

In the context of climate change, all these recognitions make NbS, including blue carbon projects, gain even more importance and momentum. Regarding the GBF, coastal NbS figures in both targets 8 and 11, which refer to minimizing the impact of climate change on biodiversity and increasing its resilience (through mitigation, adaptation, and disaster risk reduction actions), as well as restoring, maintaining, and enhancing nature's contributions to people, including ecosystem functions and services, by using NbS and/or ecosystem-based

[43]UN, "Transforming Our World: The 2030 Agenda For Sustainable Development", https://sustainabledevelopment.un.org/content/documents/21252030%20Agenda%20for%20Sustainable%20Development%20web.pdf

[44]Kunming-Montreal Global Biodiversity Framework, Released December 22, 2022, at CBD/COP/15/L25, https://www.cbd.int/article/cop15-final-text-kunming-montreal-gbf-221222.

[45] UNEA, UN Environment Assembly 5 (UNEA 5.2) Resolutions, 2022, https://www.unep.org/resources/resolutions-treaties-and-decisions/UN-Environment-Assembly-5-2

[46] Ibid.

[47] UNFCCC, *Decisions taken at the Sharm El-Sheikh Climate Change Conference*, 2022, Accessed April 22, 2023, https://unfccc.int/cop27/auv

approaches.[48] These targets also increase the importance of coastal NbS in achieving multiple benefits, including climate, biodiversity, community, and ecosystem benefits.

On another take, blue carbon projects can be inserted into wider coastal zone management toolkits, to fulfill both national and international goals. In particular, toolkits include Marine Protected Areas (MPAs), Other Effective Conservation Measures (OECMs), Integrated Coastal Zone Management (ICZM), and Ecosystem-based Management (EBM), including Marine Spatial Planning (MSP).[49] For example, MPAs and OECMs are mentioned by the GBF as means to achieve target 3 of reducing threats to biodiversity. This target prescribes countries to ensure and enable that by 2030 at least 30 percent of coastal and marine areas are effectively conserved and managed through well-connected and equitably governed systems of protected areas (such as MPAs) and OECMs.[50] A blue carbon project in this sense, can be developed to fit into all these toolkits.

3.2 Legal processes and mechanisms

Since the UNFCCC, multiple processes and mechanisms to tackle climate change have been developed.[51] Relevant to blue carbon, Nationally Determined Contributions (NDCs), REDD+ (Reducing emissions from deforestation and forest degradation, as well as sustainably managing forests and enhancing forest carbon stocks), as well as adaptation-related processes stood out[52] and, within those, diverse mechanisms to facilitate international cooperation were developed.

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[48] Kunming-Montreal Global Biodiversity Framework, 2022.

[49] For definitions of these conservation tools please see: Jon Day et al. (eds.). "Guidelines for applying the IUCN protected area management categories to marine protected areas". Second edition. (Gland. Switzerland: IUCN:2019) 2 ; IUCN-WCPA Task Force on OECMs, "Recognising and reporting other effective area-based conservation measures". (Gland, Switzerland: IUCN: 2019), 3 and CBD, "Protected areas and other effective area-based conservation measures (Decision 14/8)", 2018, https://www.cbd.int/ doc/decisions/cop-14/cop-14-dec-08-en.pdf ; European Commission, "Towards a European Integrated Coastal Zone Management (ICZM) Strategy. General Principles and Policy Options: EU Demonstration Programme on Integrated Management in Coastal Zones 1997-1999", (Luxembourg, European Communities; 1999), 32; TNC, "What is Ecosystem-Based Management (EBM)?", Accessed April 2, 2023, https://marineplanning.org/overview/tnc_approach/what-is-ebm/ ; Charles Ehler and Fanny Douvere. "Marine Spatial Planning: a step-by-step approach toward ecosystem-based management." (Intergovernmental Oceanographic Commission and Man and the Biosphere Programme. IOC Manual and Guides No. 53, ICAM Dossier No. 6. Paris: UNESCO: 2009 (English)), 18.

[50] Kunming-Montreal Global Biodiversity Framework, 2022.

[51] Daniel Bodansky, and Lavanya Rajamani, "The Evolution and Governance Architecture of the United Nations Climate Change Regime," Global Climate Policy : Actors, Concepts, and Enduring Challenges. Eds. U. Luterbacher and D. F. Sprinz (Cambridge, MA: The MIT Press), 13–66.

[52] Justine Bell-James, "'Blue Carbon' and the Need to Integrate Mitigation, Adaptation, and Conservation Goals within the International Climate Law Framework", in Craik, Neil. "Global Environmental Change and Innovation in International Law.", https://doi.org/10.1017/9781108526081.006, (Cambridge University Press: 2018), 83.

3.2.1 NDCs

NDCs describe voluntary commitments made by parties to the Paris Agreement and submitted to the UNFCCC Secretariat. In their commitments, to be made every five years, countries are encouraged to submit their pledges to reduce GHG emissions (mitigation), as well as demonstrate intentions to reduce climate change vulnerability (adaptation). The commitments should be made to reflect 'progression' and with a vision of 'highest possible ambition', while concomitantly respecting the principle of common but differentiated responsibilities and respective capabilities (CBDR-RC) and respective capabilities in light of different national circumstances.[53]

Including blue carbon in NDCs, through commitments such as protecting seagrass beds to safeguard fishing grounds, planting mangroves to improve flooding defense, or rewetting coastal floodplains to combat erosion can facilitate the implementation of mitigation and adaptation actions within countries.[54] Notably, in current global NDC targets, some countries have indeed included measures that directly or indirectly account BCEs, including measures such as protecting and restoring wetlands/ coastal areas[55] (e.g., Indonesia and Bangladesh).[56]

Moreover, with climate litigation on the rise, a failure to pursue NDCs' objectives can be an opportunity to involve judiciaries in demanding climate actions from States. In this sense, judges can compel countries in implementing policy prescriptions when detailed climate legislations are absent, as well as can fill enforcement gaps in climate law.[57] As national (or nationally recognized) court decisions can be made force of the law – i.e., transforming non-binding international commitments (NDCs) into binding rules for States, – NDCs represent an unlocked potential to accelerate climate ambition, including the protection of BCEs.

Nevertheless, blue carbon in NDCs has also faced criticism due to a lack of structure and detail of commitments, which can hinder implementation of these goals.[58]

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[53] Cf. article 4, Paris Agreement.

[54] Moritz von Unger et al., "Blue NbS in NDCs. A booklet for successful implementation", (GIZ 2020), 11.

[55] UNFCCC Secretariat, "NDCs under the Paris Agreement, Synthesis Report by the secretariat", 2022.

[56] UNFCCC, "NDC Registry", Accessed April 24, 2023, https://unfccc.int/NDCREG ; Cf. Indonesia NDC (submitted in 23/09/2022), 12 and Bangladesh NDC (submitted in 26/08/2021), 10.

[57] Joana Setzer and Lisa Benjamin, "Climate Change Litigation in the Global South: Filling in Gaps", (AJIL unbound, Vol.114, 2020), doi: https://doi.org/10.1017/aju.2020.6, 1-2.

[58] von Unger et al., "Blue NbS in NDCs. A booklet for successful implementation", 13.

3.2.2 REDD+

On the blue carbon lane, mangrove forests are usually the only actionable BCE to be part of REDD+ strategies,[59] meaning that mangrove projects can use its policy mechanisms, methodologies, and finance to support their activities.

REDD+ was first developed as a policy approach to generate financial incentives for developing countries to participate in climate change policies through the management of forests.[60] After several COP discussions,[61] methodological and financing guidance for REDD+ activities were also provided through the Warsaw Framework for REDD+ (WFR)[62] , and eventually, REDD+ was recognized at treaty level, under the Paris Agreement (article 5). At the same time, domestic legal frameworks set the rules for the implementation of international REDD+ policies.[63]

Lastly, under UNFCCC, coastal wetlands are also included within the land-use, land-use change, and forestry (LULUCF) sector, consolidated into agriculture, forestry, and other land use (AFOLU) in 2006 to include agriculture in scope.[64]

3.2.3 Adaptation

Another avenue for realizing blue carbon projects is by focusing on their adaptation services,[65] which are not just given importance through the Paris Agreement but recognized as part of UNFCCC's objective (article 2).

In this sense, through National Adaptation Programmes of Action (NAPAs) set out under the Marrakech Accords, least-developed countries (LDCs) can establish their national adaptation priorities and target the financial support of developed countries, including by getting access to a special climate change fund created for their aid.[66] Similarly, through National Adaptation Plans (NAPs) established under the Cancun Adaptation framework, developing

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[59] Vanderklift et al., "A Guide to International Climate Mitigation Policy and Finance Frameworks Relevant to the Protection and Restoration of Blue Carbon Ecosystems", 4.

[60] Justine Bell-James, "'Blue Carbon' and the Need to Integrate Mitigation, Adaptation, and Conservation Goals within the International Climate Law Framework", 91.

[61] Ibid, 89-92.

[62] UNFCCC, "What is REDD+?", Accessed February 16, 2023, https://unfccc.int/topics/land-use/workstreams/redd/what-is-redd#:~:text=The%20framework%20is%20commonly%20referred,the%20implementation%20of%20REDD%2B%20activities.

[63] Louisa Denier, et al., *The Little Book of Legal Frameworks for REDD+*, (Global Canopy Programme: Oxford, 2014)

[64] Vanderklift et al., "A Guide to International Climate Mitigation Policy and Finance Frameworks Relevant to the Protection and Restoration of Blue Carbon Ecosystems", 5.

[65] Justine Bell-James, "'Blue Carbon' and the Need to Integrate Mitigation, Adaptation, and Conservation Goals within the International Climate Law Framework", 98.

[66] Ibid, 98.

countries can determine their medium to long-term adaptation needs.[67] Including blue carbon in NAPs or NAPAs follows the same logic as including it in NDCs, in the sense that it does signal developing countries' intent to promote blue carbon sustainability, define needs for blue carbon protection and enable international cooperation.

3.2.4 Finance mechanisms and actors

An important aspect of blue carbon strategies involves financial support. Currently, international law offers a series of instruments, such as bilateral agreements, and international and regional schemes, that can support inflows of foreign investment to blue carbon protection, as well as institutions to facilitate cooperation between countries.[68]

In terms of financial actors, blue carbon investor types vary, and includes private sector actors (e.g., multinational corporations, investment funds, or philanthropic donors). To date, finance for coastal and marine conservation – including BCEs – is typically provided by philanthropies and public-sector grants (which may also include money received from the private sector).[69,70] Intermediary financiers can also facilitate investment in protecting BCEs. Examples of international institutions include the World Bank, the Global Environment Facility (GEF),[71] and the Green Climate Fund (GCF),[72] which can receive and disburse public or private money for environmental purposes.

Numerous financial models can also be used for blue carbon investment such as grants, including blue carbon in the corporate social responsibility (CSR) strategies of companies, or even through establishing a system of payments for ecosystem services (PES) to support coastal preservation.[73] A prominent mechanism also involves carbon markets and specifically by allowing a project to sell carbon credits (also understood as offsets).[74]

Carbon offsets, – comprehended as emission reductions of CO^2 or GHG made to compensate for offset emissions released elsewhere, – can be used to support projects' longevity (in the short- or long-term), including projects relating to the LULUCF (land-use, land-use

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[67] Ibid, 98-99.

[68] Harris, *Routledge Handbook of Marine Governance and Global Environmental Change*, 54.

[69] Ibid, 124-126.

[70] Melissa Bos, Robert L. Pressey, and Natalie Stoeckl, "Marine Conservation Finance: The Need for and Scope of an Emerging Field", *Ocean & Coastal Management* 114 (September 2015): 116–28, doi:10.1016/j.ocecoaman.2015.06.021, 118.

[71] See: UNFCCC, Global Environment Facility, Accessed February 16, 2023, .https://unfccc.int/process-and-meetings/bodies/funds-and-financial-entities/global-environment-facility#:~:text=The%20Global%20Environment%20Facility%20(GEF,contained%20in%20decision%2012%2FCP.

[72] See: UNFCCC, Green Climate Fund, Accessed February 16, 2023, https://www.greenclimate.fund/about/governance#:~:text=GCF%20is%20a%20main%20operating,on%20Climate%20Change%20(UNFCCC).

[73] Harris, *Routledge Handbook of Marine Governance and Global Environmental Change*, 126.

[74] Ibid, 127.

change, and forestry) sector and REDD+.[75,76] This is done by permitting project owners to use carbon credits in funding or mitigating the costs of a BCE intervention, as well as by providing additional income for communities,[77,78] which usually are the caretakers of blue carbon projects.

In principle, blue carbon credits can be sold both through compliance and voluntary carbon markets. Historically, however, compliance markets have not accepted blue carbon offsets,[79] and blue carbon projects have benefited mostly from sales through voluntary markets.[80,81,82]

Conceptually, compliance (also known as regulated) markets describe those created under any international, national, and/or regional policy or regulatory requirements, while voluntary carbon markets (national or international) function for carbon credit sales made on a voluntary basis.[83] Under UNFCCC, crediting mechanisms include the Clean Development Mechanism (CDM), the Joint Implementation Mechanism (JI) – both established under the Kyoto Protocol – and the mechanism established under article 6 of the Paris Agreement (particularly through the generation of carbon units called Internationally Transferred Mitigation Outcomes (ITMOs)).[84] Lastly, REDD+ frameworks can also allow carbon credits sales.[85]

Despite all these possibilities, however, and to frustrate the growing interest of investors 'blue' carbon credits,[86,87] very few blue carbon projects are certified to sell these credits.[88] In

[75] Wen-Hsien Tsai, "Carbon Emission Reduction—Carbon Tax, Carbon Trading, and Carbon Offset", 2020, p.4

[76] Emission reductions are usually measured in CO2tonnes (each credit is equivalent to one metric tonne of CO2 CO2 equivalent (tCO2 e).

[77] Wylie, Lindsay, Ariana E. Sutton-Grier, and Amber Moore. "Keys to Successful Blue Carbon Projects: Lessons Learned from Global Case Studies." Marine Policy 65 (2016): 76-84.

[78] C.C Pricillia, Patria, and Herdiansyah. "Social Consideration for Blue Carbon Management.

[79] Read Porter, Cody Katter, and Cory Lee, "Legal Issues Affecting Blue Carbon Projects on Publicly-Owned Coastal Wetlands" (2020). Sea Grant Law Fellow Publications. 96. https://docs.rwu.edu/law_ma_seagrant/966, 6.

[80] Ibid,1.

[81] C.C Pricillia, Patria, and Herdiansyah. "Social Consideration for Blue Carbon Management, 3.

[82] Harris, *Routledge Handbook of Marine Governance and Global Environmental Change*, 127.

[83] UNDP, "What are carbon markets and why are they important?", Updated May 18, 2022, https://climatepromise.undp.org/news-and-stories/what-are-carbon-markets-and-why-are-they-important,

[84] Michael A Mehling, "Compliance, Implementation, and Effectiveness", Market Mechanisms, Oxford Public International Law, Part VIII Chapter 53, (http://opil.ouplaw.com). (c) Oxford University Press, 2022, pp.1-16, 7.

[85] Christina Voigt, Research *Handbook on REDD and International Law*. Research Handbooks in Climate Law. Cheltenham, England: Edward Elgar Publishing, 2016, 92-93.

[86] Macreadie et al., "Operationalizing Marketable Blue Carbon", 487.

[87] Friess et al., "Capitalizing on the Global Financial Interest in Blue Carbon", 3.

[88] World Ocean Initiative, "Are blue carbon markets becoming mainstream?", Posted April 12, 2022, ttps://impact.economist.com/ocean/ocean-health/are-blue-carbon-markets-becoming-mainstream

addition, a "financial shortfall"[89] or "gap" [90] to fund these interventions seems to exist, preventing worldwide investment to protect blue carbon habitats.

3.3 Access to carbon markets

3.3.1 GHG offset principles

Procedurally, carbon credit transactions can also rely on the work of independent carbon crediting institutions/programs,[91] which have their own requirements in certifying projects to sell carbon. In this sense, common offset principles (or criteria) to be demonstrated by project developers, includes *additionality, minimal leakage, and permanence*. The first means that the project must demonstrate that the emission reductions by preserving BCEs would not have happened without the incentive of carbon offsets; the second means that the project should not be the reason for the migration of GHG releases to another area (also known as displacement); and the last seeks to minimize the risk that GHG emissions will occur after the project has sold its carbon credits.[92,93]

Other criteria can also exist such as, e.g., a requirement for developers to demonstrate unambiguous project ownership (which entails demonstrating that the only party able to legitimately claim carbon offsets from the project is the one registering it).[94] Although they may seem harsh, these criteria are important. Notably, due to various problems with carbon credits integrity (which includes greenwashing, [95] for instance)[96] harshness is justified. For example, while the Kyoto Protocol have been a pioneer in launching international carbon crediting mechanisms, it was also exposed to critics of failing to fulfill its envisioned objective, by allowing

[89] Harris, *Routledge Handbook of Marine Governance and Global Environmental Change*, 58 and 123.

[90] United Nations Environment Programme (UNEP), "State of Finance for Nature. Time to act: Doubling investment by 2025 and eliminating nature-negative finance flows." (Nairobi: 2022) https:// wedocs.unep.org/20.500.11822/41333, 26.

[91] Carbon crediting entities and programs include, among others: European Union Emissions Trading System (EU ETS); California Cap-and-Trade Program; Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA); Verified Carbon Standard (VCS); Plan Vivo; Gold Standard; Climate, Community & Biodiversity Standards (CCBS); American Carbon Registry (ACR); Clean Development Mechanism (CDM); Joint Implementation (JI); and Climate Action Reserve (CAR).

[92] Grimsditch, Gabriel. "Options for Blue Carbon within the International Climate Change Framework" *Sustainable Development Law & Policy* 11, no. 2 (2011): 22, 238.

[93] von Unger, Tonneijck and Soto, "Voluntary Carbon Markets for Wetland Conservation and Restoration".

[94]Porter, Katter, and Lee, "Legal Issues Affecting Blue Carbon Projects on Publicly-Owned Coastal Wetlands", 3.

[95] Greenwashing can be defined as, e.g., "the intersection of two firm behaviors: poor environmental performance and positive communication about environmental performance". Cf. Magali A. Delmas and Vanessa Cuerel Burbano, "The Drivers of Greenwashing", *California Management Review* 54, no. 1 (October 2011): 64–87, doi:10.1525/cmr.2011.54.1.64, 65.

[96] von Unger, Tonneijck and Soto, "Voluntary Carbon Markets for Wetland Conservation and Restoration, 22-23.

migration of emissions from "caped" or regulated countries to "uncapped" or unregulated countries (mostly developing ones) and thus signifying no real offsetting outcomes.[97,98,99,100]

Finally, while an analysis of all carbon credits criteria is not necessarily in the scope of this research (and many fall beyond legal comprehension), it is worth noting that some carbon crediting mechanisms have requirements for benefits beyond GHG mitigation to be pursued or, at least, to be considered. For instance, Plan Vivo requires projects developers to "enable communities to plan and take control of their resources in a sustainable way that promotes rural livelihoods and other environmental and social co-benefits"[101]; and the Gold Standard provides for project developers to inform social and environmental impacts deriving from projects registered under the methodology for land use and forest activities.[102]

3.4 Risks of project-based approaches

Currently, most of the actions to protect BCEs (and in particular restorations) seem developed at project-based levels rather than considering the management of whole ecosystems. In part, this is (possibly) justified by the fragmentation of REDD+ and climate policies – to which BCEs preservation is also rooted, – and that makes the preservation of ecosystems rely upon different governance frameworks, rules, and standards.[103]

In contrast, jurisdictional programs, which are larger efforts to mitigate GHG emissions across ecosystems, reaching *jurisdictional scales*, could be better approaches. Jurisdictional approaches are often developed within a subnational entity or grouping of entities but can also exist at 'entire' country levels, and are enabled by policies or regulations.[104,105]

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[97] Gbenga. Ibikunle and Gregoriou, Andros, 1st ed., *Carbon markets: microstructure, pricing and policy*, 2018 2018., 1-243., 17.

[98] Amanda M Rosen, "The Wrong Solution at the Right Time: The Failure of the Kyoto Protocol on Climate Change, Politics & policy" (Statesboro, Ga.: 2015), Vol.43 (1), 30-58.

[99] Anton Hartl, "The effects of the Kyoto Protocol on the carbon trade balance", (Review of World Economics :2019) 155:539–574 https://doi.org/10.1007/s10290-019-00350-5 , 1-540.

[100]Oscar Reyes and Gilbertson, Tamra, "Beyond Carbon Markets", Accessed February 22, 2023, https://www.un.org/en/chronicle/article/beyond-carbon-markets.

[101] Plan Vivo, "Eligibility Criteria", Accessed April 10, 2023, https://www.planvivo.org/Pages/FAQs/Category/eligibility-criteria.

[102] Gold Standard, "Land-Use & Forests Activity Requirements", Posted April 20, 2020. https://globalgoals.goldstandard.org/203-ar-luf-activity-requirements/.

[103] Voigt, Christina. *Research Handbook on REDD and International Law*, 63-65 and 83.

[104] Greg Fishbein, and Lee, Donna. "Early Lessons from Jurisdictional REDD+ and Low Emissions Development Programs", (Rep. Arlington: 2015), 10.

[105] In strategies to implement REDD+ projects, a distinction is made between "jurisdictional", "nested" and "project" scales. Jurisdictional refers to REDD+ developed through a governance level covering an administrative area for which public authorities can take decisions, such as national or federal level or subnational states; nested implies coordinated and harmonized

Compared to jurisdictional, project-based approaches, formed within pluralist systems, can have negative social and environmental implications such as allowing "biodiversity leakage" (i.e. avoided deforestation in areas with low levels of biodiversity leading to increased deforestation in other areas with high levels of biodiversity) or "land-grabbing" – due to restricting access to productive lands by virtue of preserving BCEs, – which leads to the displacement of local communities.[106] In other words, projects can be arguably more susceptible to social risks and leakage (which may include carbon leakage too, as different rules may apply to different locations and permit activities releasing GHG to migrate elsewhere).

At the same time, expanding blue carbon conservation into larger geographical spaces is challenging. For instance, research regarding the mitigation potentials of all blue carbon areas is mostly unavailable, and so, gathering larger 'plots' for interventions may require even more efforts, including capital, to close knowledge gaps.[107] Moreover, building jurisdictional approaches seems challenging even for terrestrial forests,[108] which have a comparative advantage when it comes to the level of case experience in initiatives to conserve, restore, and manage ecosystems.

On another approach, carbon credits resulting from jurisdictional approaches (particularly under REDD+) have been historically not allowed in compliance carbon markets and not transacted on voluntary markets,[109] which may have dictated a tendency around project-based blue carbon interventions too, especially when those projects envisaged to sell carbon credits.

At the same time, while a clear path to jurisdictional approaches seems on the making, blue carbon projects can be developed and further "nested" into larger programs, as these become available (i.e., implemented in a coordinated and harmonized manner as to permit further integration at governance levels).[110] In other words, and as literature pointed out in the occasion of discussing biodiversity benefits, in the absence of place-based research to back up

implementations of REDD+ programs and activities at multiple accounting scales and governance levels within a country; and at 'projects' level, it refers to site-specific REDD+ activities. See: Beatriz Granziera; Hamrick, Kelley and Comstock, Maggie, "Eligibility Requirements for REDD+ Standards and Financing",7.

[106] Voigt, Christina. *Research Handbook on REDD and International Law*, 83.

[107] Jen Howard, Hoyt, S., Isensee, K., Pidgeon, E., Telszewski, M. (eds.) "Coastal Blue Carbon: Methods for assessing carbon stocks and emissions factors in mangroves, tidal salt marshes, and seagrass meadows". Conservation International, Intergovernmental Oceanographic Commission of UNESCO, International Union for Conservation of Nature. (Arlington, Virginia, USA: 2014), 21.

[108] Cf., Fishbein, and Lee, "Early Lessons from Jurisdictional REDD+ and Low Emissions Development Programs", 25.

[109] Granziera, Hamrick and Comstock, "Eligibility Requirements for REDD+ Standards and Financing", 6.

[110] Ibid, 7.

interventions – or in this case availability of a jurisdictional pipeline to protect BCEs, – pilot projects can maximize learning and facilitate the achievement of benefits.[111]

In this sense, pilot projects can facilitate the understanding of stakeholders' needs and interests; be adaptive to ecological, social, and governance perspectives; and be geographically designed to account for local ecological, and socio-economic conditions.[112]

4 Benefits beyond GHG mitigation

This section intends to answer whether (or if) blue carbon conservation, restoration, and sustainable management projects can deliver benefits beyond GHG mitigation (co-benefits) and what is the current understanding of the matter. Although split into sub-topics for an easy overview, these benefits can exist concomitantly.

4.1 Preserving biodiversity

Although not always targeting areas capable to provide biodiversity benefits, carbon-focused strategies can achieve these goals too.[113] In this sense, BCEs can provide habitat for wildlife and migratory species, such as marine turtles and birds,[114] as well as improve water and soil protection and provide microclimate benefits, or pollination services, which benefit not only humans but other species. Hence, the idea of connecting "scapes" for multifunctional purposes, such as addressing biodiversity in climate strategies is currently growing.[115]

However, effective biodiversity benefits are hard to measure and therefore blue carbon projects may find it challenging to demonstrate these. A parallel can be made, for instance, between biodiversity offset critics and carbon offset projects which claim co-benefits of biodiversity conservation.

Biodiversity offsets are generally understood as "mechanisms intended to balance development and environmental goals by compensating for residual impacts of projects after appropriate steps have been taken to first avoid and minimize impacts."[116] They aim to achieve no

[111] Stefan Gelcich et al., "Achieving Biodiversity Benefits with Offsets: Research Gaps, Challenges, and Needs", *Ambio* 46, no. 2 (March 2017): 184–89, doi:10.1007/s13280-016-0810-9, 187-188.

[112] Ibid, 187 and 188.

[113] Vierros, Marjo, 2017, "Communities and blue carbon: the role of traditional management systems in providing benefits for carbon storage, biodiversity conservation and livelihoods", Climatic change, 2017, Vol.140 (1), p.89-100, 92.

[114] Barbier et al., "The value of estuarine and coastal ecosystem services". Ecol Monogr 81:169–193 and Pendleton et al., "Estimating Global "Blue Carbon" Emissions from conversion and degradation of vegetated coastal ecosystems". (PLoS ONE 7(9):1–7: 2012), quoted in Vierros, "Communities and blue carbon: the role of traditional management systems in providing benefits for carbon storage, biodiversity conservation and livelihoods", 90.

[115] Pörtner et al., "Overcoming the Coupled Climate and Biodiversity Crises and Their Societal Impacts", 3.

[116] Stefan Gelcich, et al., "Achieving biodiversity benefits with offsets: Research gaps, challenges, and needs", 184.

biodiversity net loss and preferably net gains for biodiversity conservation.[117] In this sense, biodiversity conservation is the main target and not a co-benefit in projects principally aimed at mitigating GHG emissions.

The main criticism of biodiversity offsets is that there is a lack of research to back up locally-based policies and programs, especially research on non-ecological factors such as socioeconomic and local governance aspects, which ultimately contribute to the success or not in achieving biodiversity benefits.[118] When a blue carbon offset project claims to have or be in pursuit of biodiversity co-benefits, these socio-economic and governance challenges will also exist, impairing the verifiability of actual and positive biodiversity impacts.

The research gap is also twofold. On one hand, empirical research on biodiversity offsets is scarce compared to carbon offsets. On the other, the peer-reviewed research field is currently dominated by US-based research. In fact, literature shows that over 90% of all research has occurred in developed countries, and at least 98% of researchers were shown affiliated to developed countries. [119] In contrast, most biodiversity offset policies and programs are occurring in middle- or low-income countries. The problem can be obvious, especially considering that "place-based research" (or specific geographic scoping) is needed for the successful designing and implementation of biodiversity offset programs,[120]as well as to generate effective biodiversity benefits.

On another approach, limiting climate change while safeguarding biodiversity depends on balancing concomitant human interests (e.g., food production). In this sense, authors have also proposed the identification of strongest win-win solutions at regional and local levels and avoiding those that can have negative effects (effects such as, e.g., food production pressures threatening biodiversity elsewhere) in order to balance human interests. [121]

4.2 Securing water quality and sustainable livelihoods

Healthy BCEs were shown to contribute to water quality, fisheries, and aquaculture production, as well as agriculture. The first is due to their capacity to filtrate water sediments, including pollution, and the second is because healthy BCEs provide important nurseries to fish and marine invertebrates, such as shrimp or mussels, which can be sustainably exploited

[117] Ibid, 184.
[118] Ibid, 184 and 187.
[119] Ibid, 184-187.
[120] Ibid, 184-187.
[121] Ibid, 4.

by coastal communities. [122,123,124,125] Even beyond eventual project boundaries, in adjacent areas, these co-benefits can eventually be delivered. They are also particularly important to local communities and have been demonstrated in numerous blue carbon projects around the world.[126]

Moreover, livelihoods opportunities and water benefits as a consequence of a blue carbon project can be a two-way road, as incorporating the promotion of livelihoods those strategies can increase communities' support to ecosystem conservation and restoration practices,[127] possibly increase carbon credits payments into the project (as voluntary carbon credit buyers pay more for projects with environmental, social and economic co-benefits[128]) and be a key to a successful blue carbon project.[129]

However, the extent to which they can be valued within a project may also depend on measuring these co-benefits, including understanding patterns of delivery (e.g., "identifying and linking fishing grounds to coastal seascapes is often challenging due to the lack of reliable data on spatial patterns of fishing effort and the habitat use patterns of fished species"[130]). Thus, more research is needed to identify and weigh ecosystem services (such as water quality or fisheries benefits) and verify how these benefits derive from specific blue carbon projects.[131] Stakeholders consultations, in this sense, could be an option. Likewise, carefully designing a project to deliver co-benefits and measuring its performance would be recommended.

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[122] Cisneros-Montemayor, et al., "Agreements and benefits in emerging ocean sectors: Are we moving towards an equitable Blue Economy?", (Elsevier Ltd.: 2022), https://doi.org/10.1016/j.ocecoaman.2022.106097, 2 and 6.

[123] Barbier et al., "The value of estuarine and coastal ecosystem services" and Pendleton et al., "Estimating Global "Blue Carbon" Emissions from conversion and degradation of vegetated coastal ecosystems", quoted in Vierros, "Communities and blue carbon: the role of traditional management systems in providing benefits for carbon storage, biodiversity conservation and livelihoods", 90.

[124] H.-O. Pörtner et al., "Overcoming the Coupled Climate and Biodiversity Crises and Their Societal Impacts", *Science* 380, no. 6642 (21 April 2023): eabl4881, doi:10.1126/science.abl4881, 3.

[125] Hejnowicz et al., "Harnessing the Climate Mitigation, Conservation and Poverty Alleviation Potential of Seagrasses: Prospects for Developing Blue Carbon Initiatives and Payment for Ecosystem Service Programmes", 5.

[126] Cf, C.C Pricillia, Patria, and Herdiansyah. "Social Consideration for Blue Carbon Management, 3 and Wylie, Sutton-Grier, and Moore. "Keys to Successful Blue Carbon Projects: Lessons Learned from Global Case Studies.".

[127] Ibid, 3.

[128] Hagger, Waltham, and Lovelock, "Opportunities for Coastal Wetland Restoration for Blue Carbon with Co-Benefits for Biodiversity, Coastal Fisheries, and Water Quality", 8.

[129] Wylie, Sutton-Grier, and Moore. "Keys to Successful Blue Carbon Projects: Lessons Learned from Global Case Studies.",78-79.

[130] Simon J. Pittman et al., "Rapid site selection to prioritize coastal seascapes for Nature-Based Solutions with multiple benefits", *Frontiers in Marine Science* 9 (29 April 2022): 832480, doi:10.3389/fmars.2022.832480, 9.

[131] Cf., Hagger, Waltham, and Lovelock, "Opportunities for Coastal Wetland Restoration for Blue Carbon with Co-Benefits for Biodiversity, Coastal Fisheries, and Water Quality", 8.

4.3 Generating income and other social benefits

Blue carbon projects have also resulted in additional income for local communities, through both carbon financing (carbon credit profits)[132] and other practices. In this sense, blue carbon projects can indirectly contribute to generating income and other social benefits when paired with activities such as ecotourism, [133,134] education, research, or jobs.[135,136,137,138]

Practices to generate income beyond carbon credits are sometimes referred to as payment for ecosystem services (PES) and include, e.g., tourism fees for marine protected areas (MPAs) and community conservation agreements, in which local communities receive funds or other economic incentives – such as capital investments for infrastructure, or access to social services – in exchange for conserving and stewarding blue carbon areas.[139]

On argument basis, global capitalism also indicates that private actors are more likely to engage in preserving ecosystems when monetary benefits are involved and so, the pairing of coastal protection strategies with financial benefits may be a valid idea. An example of this logic is found in Vietnam, where a project has achieved both conservation and monetary goals. Designed to conserve mangroves in a certain area, specific conservation and reforestation rules were imposed to shrimp farmers in a certain project area. In return, farmers would profit from organic shrimps certified and sold at premium prices (i.e., higher prices). Ultimately, the shrimp certification mechanism was estimated to generate higher profits than those of carbon credits sales within project boundaries[140] and therefore encouraged farmers to adhere.

Further, as the implementation of GHG emission reduction projects is usually limited by capital, carbon payments, and other compensation mechanisms can also be used to provide a source of finance for projects.[141]

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[132] C.C Pricillia, Patria, and Herdiansyah. "Social Consideration for Blue Carbon Management, 3.

[133] Grorud-Colvert et al, "The MPA Guide: A framework to achieve global goals for the ocean", Science 373, 1215 (2021), https://doi.org/10.1126/science.abf0861 , 8.

[134] Macreadie et. al, "Operationalizing marketable blue carbon", 487.

[135] Cisneros-Montemayor, et al., "Agreements and benefits in emerging ocean sectors: Are we moving towards an equitable Blue Economy?", 2 and 6.

[136] Wylie, Sutton-Grier, and Moore. "Keys to Successful Blue Carbon Projects: Lessons Learned from Global Case Studies.",78-79.

[137] Pörtner et al., "Overcoming the Coupled Climate and Biodiversity Crises and Their Societal Impacts", 3.

[138] Chee et al., "Enhancing Uptake of Nature-Based Solutions for Informing Coastal Sustainable Development Policy and Planning: A Malaysia Case Study", 2.

[139] Bos, Pressey, and Stoeckl, "Marine Conservation Finance: The Need for and Scope of an Emerging Field", *Ocean & Coastal Management* 114 (September 2015): 116–28, doi:10.1016/j.ocecoaman.2015.06.021,119.

[140] Wylie, Sutton-Grier, and Moore. "Keys to Successful Blue Carbon Projects: Lessons Learned from Global Case Studies.",78-79.

[141] Mercedes Bustamante, et al., "Co-benefits, Trade-offs, Barriers and Policies for Greenhouse Gas Mitigation in the Agriculture, Forestry and Other Land Use (AFOLU) Sector." *Global Change Biology 20*, no. 10 (2014): 3270-290, 3275.

At the same time, carbon credits alone are not enough to provide income and support blue carbon projects in the short and medium terms[142] and therefore do not provide overpowering incentives for protecting ecosystems in detriment to normal economic activities. Likewise, other financial mechanisms (such as PES) are not necessarily comprehended or properly designed within jurisdictions,[143] and these need preliminary addressing to facilitate payment flows into projects.

In attempt to increase the overall finance flow into blue carbon projects, literature is also recommending the practice of "bundling" or "stacking" ecosystem services and payments (including carbon payments) as a way to ensure the durability of projects.[144, 145, 146] Simply put, it means to combine carbon credits revenue with other sources of revenue.[147] Favouring sites that can provide multiple benefits (e.g., biodiversity protection plus GHG mitigation) to increase the amount of payments going into the project is also an option. Nevertheless, the idea may still require robust metrics and verification tools to support claims for co-benefits[148] and consequently facilitate the payment for those in a blue carbon project primarily developed to mitigate GHG.

4.4 Enforcing tenure and sustainable use rights

AFOLU projects developed in territories occupied by IPCLs and other social groups can contribute to clarifying and securing land tenure and land-use rights against incursions and use of lands by other actors.[149] Consequently, projects that reduce GHG emissions by sustainably managing, conserving, or restoring mangrove forests have similar potential. Arguably, the idea also applies to projects that involve salt marshes and seagrass areas, in the sense that marine tenure and use rights could similarly be clarified and enforced in benefit of relevant stakeholders.

At the same time, implementing a blue carbon project alone, away from wider regulatory, policy, and governance contexts will not be enough to guarantee enforcement of tenure and use

[142] Macreadie et. al, "Operationalizing marketable blue carbon", 488.

[143] Ibid, 488.

[144] Friess, et al., "Capitalizing on the global financial interest in blue carbon", 10.

[145] Hagger, Waltham, and Lovelock, "Opportunities for Coastal Wetland Restoration for Blue Carbon with Co-Benefits for Biodiversity, Coastal Fisheries, and Water Quality", 2.

[146] Macreadie et. al, "Operationalizing marketable blue carbon", 488.

[147] Ibid, 488-489.

[148] Ibid, 488.

[149] Bustamante, et al., "Co-benefits, Trade-offs, Barriers and Policies for Greenhouse Gas Mitigation in the Agriculture, Forestry and Other Land Use (AFOLU) Sector.", 3272.

rights benefits. In essence, variables such as *robust regulations and/or policies* over land tenure and use rights, as well as the *level of law enforcement* will directly determine whether local communities will benefit from enforced tenure and use rights.[150]To illustrate, if land tenure and user rights over blue carbon areas are already clarified by laws and enforced by local authorities, stakeholder communities will have legitimate access to land and related resources (e.g., food or water), and a blue carbon project would only *strengthen existing rights*. Conversely, if they are not, and even in the presence of a generally sound project, these rights can be disputed. In other words, the securing of tenure and use rights as a co-benefit from a blue carbon project also depends on the level of structure in terms of regulations, policies, and law enforcement found within the host country.

Regarding land tenure arrangements, more research is needed to understand how their forms (e.g., state ownership, individual ownership, or community rights) under different locations and circumstances lead to negative or positive effects and what are the enabling conditions to promote multiple benefits.[151] Likewise, when problems are identified, political will (assisted by the international community or not) should attempt to fix gaps.

The same logic is valid when blue carbon areas are subject to marine tenure arrangements or marine use rights (e.g., fishing and aquaculture rights), meaning that site-specific contexts, governance aspects, laws, and policies will determine if securing marine tenure or rights is possible. In this sense, coastal wetlands were historically "communal territories, inhabited, managed into multiple use systems, governed by access and use rights and controlled by local customs",[152] i.e., various tenure and use rights arrangements can exist on countries' coasts and difficult the enforcement of tenure and use rights. Additionally, practices such as unreported fishing and usage, as well as "shady access agreements" on the coasts have difficulted securing marine tenure and use rights for years; on many occasions, coastal areas were also seen as "wastelands,"[153] which exemplifies the indifferent treatment given by humanity in regards to preserving blue carbon.

Hence, if local communities are to benefit from tenure and use rights enforcement as a consequence of a project to protect BCEs, these arrangements need to be *a priori* understood within jurisdictions and *a posteriori* respected or improved (including with regards to the treatment given by countries and other actors in dealing with international waters).

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[150] Ibid, 3272.

[151] Ibid, 3272.

[152] Surrallés and Artaud. *The Sea Within*, 143-144.

[153] Ibid, 143-144.

4.5 Alleviating or reducing poverty

Blue carbon interventions can also be paired with promises of poverty alleviation, although the connection is not necessarily easy to make. Perhaps as most blue carbon projects developed in the world are small,[154] their impacts on reducing poverty cannot be easily determined. In addition, tackling poverty, which is a problem with multiple causes, requires holistic approaches that go beyond protecting blue carbon areas.

In this sense, poverty can be linked to economic *inequalities* encompassing gender, wealth, income, and consumption, as well as access to labor, education, or healthcare.[155] Other *social and political rights* – such as the right to live under a just and non-corrupt government or to live free from violence – can also directly impact levels of poverty.[156] In addition, marginalization is part of a cycle, where the absence of a right can contribute to the denial of others, [157] and so addressing one may require fixing others. For example, the absence of women's civil rights to own land in rural areas could lead to a lack of opportunities in exploring the livelihoods found therein and consequently result in limited access to income and poverty.

On another approach, sustainable development policies are increasingly focusing on the idea of achieving simultaneous goals (social, cultural, environmental, and economic) by supporting specific activities. These goals can (arguably) lead to poverty alleviation. In the marine sector, the idea is sometimes referred to as "blue growth" [158] or "blue economy"[159] and relates to achieving multiple goals by supporting marine-based activities (such as, e.g., aquaculture, tourism, etc). Likewise, AFOLU measures linked to food production (e.g., agroforestry, sustainable agricultural production) was noted as a way to increase food access and availability at local levels, and thus contributing to food security,[160] which is often part of solutions to tackling poverty.

Pairing blue carbon restoration, conservation, and sustainable management activities with the implementation of sustainable livelihoods could be considered part solutions to

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[154] Friess, et al., "Capitalizing on the global financial interest in blue carbon", 1.

[155] Horner, Rory, and David Hulme. "From International to Global Development: New Geographies of 21st Century Development." Development and Change 50, no. 2 (2019): 347-78., 363 and 365.

[156] Savitri Goonesekere, Civil and Political Rights and Poverty Eradication, 53 and 64.

[157] UN, "Land and Human Rights: Standards and Applications", HR/PUB/15/5/Add.1, (United Nations: 2015), 10-11.

[158] Amanda R. Lindsay et al., "Evaluating Sustainable Development Policies in Rural Coastal Economies", *Proceedings of the National Academy of Sciences* 117, no. 52 (29 December 2020): 33170–76, doi:10.1073/pnas.2017835117, 33170.

[159] Cisneros-Montemayor, et al., "Agreements and benefits in emerging ocean sectors: Are we moving towards an equitable Blue Economy?", 3.

[160] Bustamante, et al., "Co-benefits, Trade-offs, Barriers and Policies for Greenhouse Gas Mitigation in the Agriculture, Forestry and Other Land Use (AFOLU) Sector.", 3271 and 3275.

alleviate/reduce poverty. However, as literature shows, even when policies are developed to achieve both conservation goals and poverty reduction/ alleviation there is limited evidence that the latter can be effectively delivered, especially in rural economies.[161]

Similarly, restoring BCEs, for example, may not lead to direct poverty mitigation benefits. Therefore, considering other variables may be interesting. For example, proper spatial planning (i.e., promotion of sustainable development by balancing competing human interests), has been suggested to optimize poverty reduction co-benefits in restoration of ecosystems.[162] Likewise, ensuring that benefits, including carbon credits, will be shared with all stakeholders (including small-scale landowners and users), rather than concentrated in the hands of certain social groups, can prevent increases in marginalization levels.[163] Hence, adequate benefit sharing will play a part in the level of poverty alleviation that could be achieved.

Arguably, there is no doubt that protecting wetland ecosystems can contribute to alleviating poverty in the long run, particularly due to the potential of promoting adaptation to climate change by increasing local resilience in benefit of communities. In other words, although conserving, restoring, and sustainably managing BCEs may not result in tackling such a holistic challenge alone, they certainly contribute,[164] especially when coupled with diversification of livelihoods, income from blue carbon credits, or, generally, the provision of coastal benefits distributed in a fair and equitable manner.

Lastly, it is important to consider that project scale in terms of geographical size and stakeholders involved may also affect the delivery of poverty alleviation/reduction co-benefits.

4.6 Promoting equity

For socially marginalized groups, protecting ecosystems can be a twofold solution. On one side, vulnerable groups, including indigenous peoples and local communities (IPCLs), women, and children, have important roles in stewarding natural ecosystems, not just through direct activities such as planting trees but also by contributing with local/traditional knowledge and experiences.[165] On the other side, protecting these ecosystems can (potentially) reduce

[161] Lindsay, et al, "Evaluating sustainable development policies in rural coastal economies", 33171.

[162] Pörtner et al., "Overcoming the Coupled Climate and Biodiversity Crises and Their Societal Impacts", 3.

[163] Bustamante et al, "Co-benefits, trade-offs, barriers and policies for greenhouse gas mitigation in the agriculture, forestry and other land use (AFOLU) sector" 3275.

[164] Hejnowicz et al., "Harnessing the Climate Mitigation, Conservation and Poverty Alleviation Potential of Seagrasses: Prospects for Developing Blue Carbon Initiatives and Payment for Ecosystem Service Programmes", 5.

[165] Vierros, "Communities and blue carbon: the role of traditional management systems in providing benefits for carbon storage, biodiversity conservation and livelihoods", 92.

inequity levels, both in terms of inter- and intragenerational equity (i.e., concerning people across different generations or within the same generation, respectively).

Previous experiences from global climate policy fields demonstrated that top-down approaches[166] often resulted in "social and economic disruption and hardship".[167] Added to the importance of IPCLs, women and children's roles in stewarding natural ecosystems, it is then not a surprise that most of the guidance on the management of forests and BCEs, in policy papers and literature, emphasize the need to include them in decision making.[168]

Lessons from past REDD, integrated coastal management, and MPAs also show that the success of interventions is closely linked to the participation of IPCLs, other user groups, and stakeholders in management and planning processes.[169] In other words, conservation and sustainable management of ecosystems are more effective when "undertaken by those whose daily lives depend on the resource in question, and who have the most to gain or lose from the decisions made."[170] Likewise, rather than relying solely upon scientific knowledge passed on to communities from scientists, the consideration for local communities' knowledge, by building participation and capacity through education, training, and cultural empowerment can help reduce inequities.[171]

In this sense, equity can be promoted when GHG mitigation interventions are designed in a way to distribute socioeconomic benefits, responsibilities, promote fair access to finance mechanisms, and technology, as well as promote decision-making in a participatory manner, similar to the recommendations in GHG mitigation interventions concerning the AFOLU sector[172] (sector which also includes coastal wetlands).

In summary, respecting local communities' knowledge and experiences, as well as securing participation in decision-making and promoting adequate sharing of benefits and responsibilities can enable equity benefits for both future and present generations as legacy of a

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[166] Ie., when decision-making is formed at the highest level of governments and imposed to its subjects.

[167] Ibid, 93.

[168] E.g., Carolina Contreras and Thomas,Sebastian, "The role of local knowledge in the governance of blue carbon", (Journal of the Indian Ocean Region: 2019), 15:2, 213-234, DOI: 10.1080/19480881.2019.1610546 ; Michael Lockwood et al., "Governance Principles for Natural Resource Management, Society and Natural Resources", (2010) 23:10, 986-1001, DOI: 10.1080/08941920802178214 ; and FCPF Guidance Note on Benefit Sharing for ER Programs, "Note on Benefit Sharing for Emission Reductions Programs Under the Forest Carbon Partnership Facility and BioCarbon Fund Initiative for Sustainable Forest Landscapes", July 2019, Version 2.

[169] Vierros, "Communities and blue carbon: the role of traditional management systems in providing benefits for carbon storage, biodiversity conservation and livelihoods", 92-93.

[170] Ibid, 95.

[171] Ibid, 96.

[172] Bustamante, et al., "Co-benefits, Trade-offs, Barriers and Policies for Greenhouse Gas Mitigation in the Agriculture, Forestry and Other Land Use (AFOLU) Sector.", 3275.

blue carbon project. Remarks made on the occasion of assessing potential poverty alleviation/reduction co-benefits, however, will possibly apply, i.e., inequity is a holistic problem and specific interventions that protect BCEs may not completely solve it; plus, the scale of interventions can interfere with the level of 'equity benefits' that can be delivered.

4.7 Enhancing coastal resilience

BCEs can be natural solutions against coastal waves, flooding, and erosion. In this sense, "mangroves and saltmarshes stabilize coastlines by trapping sediment with their root systems and by reducing wave height and velocity with their dense vegetation" and seagrasses help "stabilize sediment and regulates water currents that contribute to coastal erosion".[173] Therefore, healthy BCEs can be considered "natural infrastructure" and be part of wider solutions for disaster risk reduction, especially to enhance coastal resilience to climate change effects in benefit of people living at the coasts.[174]

However, few studies have quantified the value of these ecosystems for coastal resilience matters, especially in terms of costs to build and maintain these natural infrastructures and expected benefits (i.e., the level of coastal resilience that could be achieved by using BCEs to mitigate the effects of extreme events such as storms and high waves for example). Planning coastal protection benefits by using BCEs can be more challenging because coastal protection benefits will also vary according to other factors (such as ecological and storm-specific factors).[175]

Consequently, available data to investigate the possible delivery of coastal resilience co-benefits as a consequence of a blue carbon project – or to facilitate the inclusion of these co-benefits in projects' design and implementation – is relatively missing.

4.8 Other benefits

Well beyond the benefits exemplified in the previous sections, protecting coastal wetlands can result in numerous other benefits. For example, non-material benefits, such as blue

[173] Suzanne Ozment; Ellison,Gretchen; and Jongman,Brenden. "Nature-Based Solutions for Disaster Risk Management: Booklet" (English). (Washington, D.C.: World Bank Group: 2022), 6.

[174] Ariana E Sutton-Grier, Kateryna Wowk, and Holly Bamford. "Future of Our Coasts: The Potential for Natural and Hybrid Infrastructure to Enhance the Resilience of Our Coastal Communities, Economies and Ecosystems." *Environmental Science & Policy* 51 (2015): 137-48, 140-142.

[175] Ibid, 140-142.

carbon being relevant for cultural identity, recreation, or valued for spiritual purposes[176,177] and even contributing to human health (due to BCEs capacity to improve soil, air, and water quality, which is also important for human health)[178] can be generated through protecting BCEs. Directly measuring and quantifying these benefits from specific blue carbon projects, however, is also challenging.

Finally, as the blue carbon field evolves, so does the possibility of discovering new benefits beyond GHG mitigation. Hence, benefits delineated in this chapter 4 may not be exhaustive.

5 Challenges of blue carbon projects

Before assessing the possibility to deliver of multiple benefits, developing a blue carbon project that mitigates GHG can already be demanding, especially in terms of measuring GHG benefits and bypassing legal hurdles within jurisdictions. Arguably, these challenges can also disturb or prevent the delivery of co-benefits.

5.1 Measuring mitigation benefits

To ensure effective mitigation of GHG emissions as consequence of a project, it is generally necessary to establish a baseline for emissions in the absence of the intervention. For blue carbon, baselines (or reference levels) are equally important.[179,180] In simple words, it is necessary to determine what is the scenario of emissions at a certain moment in time to know how much GHG emissions the project can mitigate in the future. Ultimately, blue carbon strategies have borrowed methods from terrestrial ecosystems, which usually involve quantifying "the amount of carbon sequestered as a result of protecting a BCE against ongoing loss from anthropogenic threats."[181]

Under the UNFCCC regime, there are two actions countries can take to facilitate the setting of baselines. One is to submit national inventories of GHG emissions and removals (in

[176] Pörtner, et al, "Overcoming the coupled climate and biodiversity crises and their societal impacts", 3.

[177] Barbier et al., "The value of estuarine and coastal ecosystem services" and Pendleton et al., "Estimating Global "Blue Carbon" Emissions from conversion and degradation of vegetated coastal ecosystems", quoted in Vierros, "Communities and blue carbon: the role of traditional management systems in providing benefits for carbon storage, biodiversity conservation and livelihoods", 90.

[178] Bustamante, et al., "Co-benefits, trade-offs, barriers and policies for greenhouse gas mitigation in the agriculture, forestry and other land use (AFOLU) sector", 3275.

[179] AGEDI, "Building Blue Carbon Projects - An Introductory Guide", 70.

[180] Howard, et al. (eds.), "Coastal Blue Carbon: Methods for assessing carbon stocks and emissions factors in mangroves, tidal salt marshes, and seagrass meadows", 110.

[181] J. Jack O'Connor, Benedikt J. Fest, Michael Sievers, Stephen E. Swearer, 2019, "Impacts of land management practices on blue carbon stocks and greenhouse gas fluxes in coastal ecosystems— A meta-analysis", DOI: 10.1111/gcb.14946 , 1355.

particular carbon emissions) to the Climate Change Secretariat[182], which is the UN entity tasked with supporting the global response to the threat of climate change.[183] The other is to communicate their emission reduction targets through NDCs.[184]

Although seemingly informative, providing information on intended commitments (NDCs), combined with the disclosure of national GHG inventories information can be a tool for the realization of blue carbon projects. For example, by incorporating blue carbon into countries' GHG emissions inventories, partners seeking to conserve or restore BCEs can provide authoritative data on carbon-storing capacity of their coastal projects and potentially profit from future awarded emissions credits.[185] It can also provide incentives for preserving or restoring blue carbon areas,[186] as relying on transparency mechanisms build trust among actors engaged in these activities. Providing information on GHG inventories and NDCs can also set the parameter for calculating baselines in sustainability projects, as well as enable international cooperation.

In REDD+, setting up baselines has led to the development of the forest reference emission levels and/or reference levels (RELs/RLs). The RELs/RLs are benchmarks used to measure, report and verify (MRV) the performance of REDD+ activities in terms of emission reductions and removals.[187, 188] REL usually measures the *gross* emission levels, while RLs refer to *net* emissions *and removals* in a set period of time; REL is used as a baseline for emission reductions from *deforestation and forest degradation*, while RLs is used to demonstrate baseline for emission reductions and carbon stock enhancement *from conservation, sustainable forest management and enhancement of carbon stocks.*[189]

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[182] Cf. articles 4 and 12, UNFCCC

[183] UNFCCC, 'What is the purpose of the secretariat?', accessed in 26 February 2023, https://unfccc.int/about-us/about-the-secretariat

[184] Article 4.8, Paris Agreement., combined with UN, Decision 1/CP.21: Adoption of the Paris Agreement, paragraph 31, p.5-6.

[185] NOAA's Office for Coastal Management, 'Digital Coast Program Gets "Blue Carbon' Added to U.S. Emissions Inventory", last modified 22 February 2023, https://coast.noaa.gov/states/stories/digital-coast-program-gets-blue-carbon.html

[186] Vanderklift et al., "A Guide to International Climate Mitigation Policy and Finance Frameworks Relevant to the Protection and Restoration of Blue Carbon Ecosystems", 4.

[187] Denier, et al., *The Little Book of Legal Frameworks for REDD+*, 107.

[188] RELs/RLs set the baseline of country emissions (in tonnes CO_2/year). Cf. Decision 12/CP.17, Guidance on Systems for Providing Information on how Safeguards are Addressed and Respected and Modalities relating to Forest Reference Emission Levels and Forest Reference Levels as referred to in Decision 1/CP.16, UN Doc. FCCC/CP/2011/9/Add.2, 15 March 2012, at paras. 7–15; Decision 14/CP.19, at para. 4; and Decision 13/CP.19, in Voigt, Christina. *Research Handbook on REDD and International Law*, 36.

[189] Denier, et al., *The Little Book of Legal Frameworks for REDD+*, 107.

The development of RELs/RLs should also be done in accordance with the country's definition of "forest" used in a country's GHG inventory.[190] In this sense, RELs/RLs show if a country has achieved real emission reductions and thus, are a prerequisite for receiving results-based finance through REDD+ policies.[191] In other words, particularly for mangrove areas,[192] but broadly for coastal wetlands, if included in a country's concept of forests, these ecosystems can benefit from REDD+ policies (including benefitting from financing opportunities, which include opportunities to sell carbon credits). Once a credible baseline has been established, the emissions reductions or removals from a BCE project can be calculated by measuring the actual emissions from the project and comparing them to the estimated emissions under the baseline scenario (colloquially referred to as business-as-usual scenario).[193]

On another approach, if a country does not possess robust GHG inventories and NDC targets, it may be trickier to establish credible baselines for BCE projects. The alternative is to borrow ideas from dealing with terrestrial forests and to rely on historical data, or expert analysis.[194] The real problem, however, lies in measuring carbon stocks and estimating emission reduction potentials of BCEs. Unlike terrestrial forests, which have clearer methodologies for such,[195] the complex and dynamic nature of BCEs, make it difficult to measure and estimate sequestration and storage potentials.[196,197] In short, this happens because wetlands are affected by numerous variables such as soil types, vegetation compositions, precipitation (or fluctuation in water levels), salinity, etc.[198]

At the same time, there is a problem of lack of data, knowledge, and methodologies to calculate emission reduction potentials. [199,200] Knowledge gaps, for instance, include fields such

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[190] Denier, et al., *The Little Book of Legal Frameworks for REDD+*, 107.

[191] Ibid, 107.

[192] Vanderklift et al., "A Guide to International Climate Mitigation Policy and Finance Frameworks Relevant to the Protection and Restoration of Blue Carbon Ecosystems", 4.

[193]Cf., Michael Gillenwater, "What is a baseline?", Posted March 14, 2022, https://ghginstitute.org/2022/03/14/what-is-a-baseline/

[194] Voigt, Christina. *Research Handbook on REDD and International Law*, 39.

[195] Cf., Denier, et al., *The Little Book of Legal Frameworks for REDD+*, 93-104.

[196] O'Connor et al., "Impacts of Land Management Practices on Blue Carbon Stocks and Greenhouse Gas Fluxes in Coastal Ecosystems—A Meta-analysis", 1355.

[197] Christine Bertram et al., "The Blue Carbon Wealth of Nations", *Nature Climate Change* 11, no. 8 (August 2021): 704–9, doi:10.1038/s41558-021-01089-4., 704 and 708.

[198] 2013 Supplement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories: Wetlands. Methodology Report – October 1, 2013. https://www.ipcc.ch/publication/2013-supplement-to-the-2006-ipcc-guidelines-for-national-greenhouse-gas-inventories-wetlands/, 24.

[199] Macreadie et al., "Operationalizing Marketable Blue Carbon", 487.

[200] O'Connor et al., "Impacts of Land Management Practices on Blue Carbon Stocks and Greenhouse Gas Fluxes in Coastal Ecosystems—A Meta-analysis", 1355.

as mapping geographical extents of BCEs (especially large seagrass areas), measuring sequestration and storage potentials of particular areas, etc.[201]

In an attempt to reduce the methodologies gap, the IPCC has also released its 2013 Supplement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories: Wetlands (or Wetlands Supplement) which provides a set of tools and methodologies to be used by countries in filling gaps of information and science in their emissions accounting regarding coastal wetlands.[202] The use of the Supplement is also encouraged by the Paris Rulebook (instrument designed to facilitate the implementation of the Paris Agreement).[203] Despite the effort, however, only a few countries seem to refer to the 2013 Wetlands Supplement guidance in the last round of NDCs,[204] making global use of the guidelines uncertain.

5.2 A short overview of legal hurdles

As research pointed out, the "development of blue carbon offset projects is inherently site-specific, occurring in the context of a particular ecosystem, array of cultural uses, project partners, and suite of laws and regulations."[205] Hence, relevant legal standards and authority will differ substantially according to location,[206] and affect projects at host country levels.

Providing legal guidance for all possible situations is neither feasible nor the focus of this academic study. Rather, an overview of the main legal hurdles (as well as incidental challenges) is made, for the purpose of understanding how those can affect a blue carbon project, as well as possibly prevent the achievement of multiple benefits altogether. Challenges were divided into sub-chapters, although they may appear in literature and other sources on an intertwined basis, in the sense that most of them aggravate or interact with each other.

5.2.1 Regulations and policies inefficiencies

Since many blue carbon actionable areas are under jurisdictional boundaries of States, – especially mangrove forests and salt marshes – interventions can be impaired by eventual

[201] Howard, et al., "Coastal Blue Carbon: Methods for assessing carbon stocks and emissions factors in mangroves, tidal salt marshes, and seagrass meadows", 21.

[202] 2013 Wetlands Supplement to the 2006 IPCC Guidelines for National GHG Inventories.

[203] CMA 1-3: Rules, modalities and procedures for the transparency framework for action and support referred to in Article 13 of the Paris Agreement, https://unfccc.int/sites/default/files/resource/cp24_auv_transparency.pdf, 7.

[204] UNFCCC Secretariat, "NDCs under the Paris Agreement",18.

[205] Porter, Katter, and Lee, "Legal Issues Affecting Blue Carbon Projects on Publicly-Owned Coastal Wetlands".

[206] Ibid.

inefficient legal frameworks and regulations of host countries. These inefficiencies can take various forms.

First, an absence of legal protection to these ecosystems can be a challenge to conservation more broadly. For example, in Malaysia, although some mangrove forests are protected by law as reserves, others can fall into a "legislative gap" regarding their conservation and management,[207] which impairs comprehensive protection.

Second, some economic sectors may not be completely regulated both within and beyond jurisdictions and indirectly impact the levels of conservation of blue carbon areas. For instance, there are currently few, if any, global policy frameworks and environmental assessment procedures to effectively comprehend and control the environmental risks of maritime development across jurisdictions and oceans,[208] which could allow industrial and overfishing activities, for example, to threaten a BCEs conservation project.

Another faulty situation can occur when a country possesses regulations or policies to preserve BCEs from unsustainable practices, but for some reason, those are not respected. For example, a study showed that, although guidelines and regulations enforce sustainable aquaculture practices in mangrove forests in Indonesia, social limitations – such as a lack of farmers' knowledge about these regulations – prevent these to be completely effective.[209]

5.2.2 Lack of capacity or coordination among actors

Another problem in implementing a blue carbon project can be an absence of capacity or coordination among host countries' agencies and jurisdictional levels of government.

In this sense, overlapping competencies of institutions responsible for the management of coastal ecosystems can lead to obstacles in conserving wetlands and coastal areas. For example, the diverse agencies mandated to execute Integrated Coastal Zone Management (ICZM) plans in Malaysia,[210] the existence of diverse jurisdictions and administrative bodies with coastal responsibilities in Australia[211] or the numerous agencies mandated to oversee blue

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[207] Chee et al., "Enhancing Uptake of Nature-Based Solutions for Informing Coastal Sustainable Development Policy and Planning: A Malaysia Case Study", 12.

[208] Nathan J. Bennett et al., "Towards a Sustainable and Equitable Blue Economy", *Nature Sustainability* 2, no. 11 (14 October 2019): 991–93, doi:10.1038/s41893-019-0404-1, 2.

[209] Kevin Muhamad Lukman, Yuta Uchiyama, and Ryo Kohsaka, "Sustainable Aquaculture to Ensure Coexistence: Perceptions of Aquaculture Farmers in East Kalimantan, Indonesia", *Ocean & Coastal Management* 213 (November 2021): 105839, doi:10.1016/j.ocecoaman.2021.105839., 3-4.

[210] Chee et al., "Enhancing Uptake of Nature-Based Solutions for Informing Coastal Sustainable Development Policy and Planning: A Malaysia Case Study", 12.

[211] Beverley Clarke et al., "Enhancing the Knowledge–Governance Interface: Coasts, Climate and Collaboration", *Ocean & Coastal Management* 86 (December 2013): 88–99, doi:10.1016/j.ocecoaman.2013.02.009., 89.

carbon areas in Sierra Leone [212] could subject an intervention site to competing claims and thus difficult the protection of BCEs. Competing claims would exist, e.g., if one agency granted a license for restoration activities while the other gives out licenses for agriculture practices over the same blue carbon area; arguably, both claims would be legitimately founded. When it comes to lack of coordination among government agencies and sectors, overlapping mandates, and inconsistent policies and regulations, country examples are actually numerous (e.g., Cambodia, Papua New Guinea, Sri Lanka, and Vietnam).[213]

Finally, and especially in developing countries, causes can involve weak and fragmented institutions, incomplete legal foundations, or limited political will.[214] Countries may also lack resources, technology, infrastructure, and monitoring facilities to support effective engagement in conservation matters. Likewise, technical, economic, and human resources limitations may difficult the enforcement of the laws. In addition, initiatives developed by centralized ministries and departments may not be replicable in provinces and remote areas,[215]– areas that may be even more affected by climate vulnerabilities (such as high waves).

5.2.3 Politics and governance issues

From a human rights perspective, corruption and lack of transparency in decision-making and implementation of laws, policies, and programs undermine the rule of law.[216] In the scenario of access to coastal lands and resources, the implementation and long-term endurance of a project will also be affected by social vulnerabilities[217] such as e.g., corruption, inequalities, and poverty.

In this sense, good governance of coastal resources, including mangrove forests, seagrass meadow areas, and salt marshes should be sought by policymakers and are desirable conditions for blue carbon project developers. Of course, as the concept of 'good governance' is a rather political term, "used to describe a subjective evaluation of the functioning of the government of a particular country",[218] it may not be easy to determine if a country has good governance. It is true, however, that political (and social) unrest may disrupt strategies to

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[212] Zebedee F. Njisuh and Sainge, Moses Nsanyi. "A preliminary assessment of Ecosystem services in the Sherbro River estuary, southern Sierra Leone" (2022), 23 and 25.

[213] Pham T.T. and Le Thi T.T., *Incorporating Blue Carbon into Nationally Determined Contributions: Current Status, Opportunities and Challenges of 13 Asia-Pacific Countries* (Center for International Forestry Research (CIFOR), 2019), doi:10.17528/cifor/007554, 6.

[214] Joana Setzer and Lisa Benjamin, "Climate Change Litigation in the Global South: Filling in Gaps", *AJIL Unbound* 114 (2020): 56–60, doi:10.1017/aju.2020.6, .4.

[215] Ibid,4.

[216] UN, "Land and Human Rights: Standards and Applications", 16.

[217] William A. Galston, "The Enduring Vulnerability of Liberal Democracy." *Journal of Democracy* 31, no. 3 (2020): 8-24.

[218] Curtis Francis Doebbler, *Dictionary of public international law*. Lanham, Maryland: Rowman & Littlefield. (2018), 265.

effectively manage blue carbon. This is the case, for example, of wetlands in Ethiopia, particularly in the Nile river basin, in which political and social disputes arising from the exploitation of water resources, [219] added to a lack of specific policies for effective wetlands management, difficult the conservation of BCEs.[220]

On a note, political-based problems affect not only blue carbon but the wider context of climate policies. Idiosyncrasies of political leaders, for instance, can also influence government positioning towards protecting other ecosystems, such as seen during Trump's and Bolsonaro's presidential mandates (USA and Brazil respectively),[221] and directly affect the fight against climate change.

5.2.4 Land tenure and use rights uncertainties

To implement a blue carbon project, and especially to carry out activities in accord with the requirements of carbon markets, the legal title to the project site, as well as related land use rights, may need to be defined.[222,223]

In this sense, literature has broadly discussed the need to clarify land tenure situations before implementing any blue carbon project, especially to exclude (or attempt to exclude) social conflicts,[224] which could jeopardize the effective protection of BCEs. Defining tenure, however, is a complicated task, especially in coastal wetland areas.[225,226,227] In detail, from a governance and legal perspective, coastal vegetated ecosystems are often contested spaces – e.g., mangroves can have boundaries between private and state-owned lands, and seagrasses

[219] Jewaro, Awol Kedir, and İbrahim Diler. "The State of Water Management in Ethiopia: Problems and Solution Approaches." *Acta Aquatica Turcica* 17, no. 4 (2021): 555-67, https://doi.org/10.22392/actaquatr.915819.

[220] Lisa-Maria Rebelo and McCartney, Matthew P, "Wetlands of the Nile Basin Distribution, functions and contribution to livelihoods", In Awulachew, Seleshi Bekele; Smakhtin, Vladimir; Molden, David; Peden D. (Eds.). *The Nile River Basin: water, agriculture, governance and livelihoods*. Abingdon, UK: Routledge – Earthscan, 222-226.

[221] Hanna-Mari Ahonen et al., "Governance of Fragmented Compliance and Voluntary Carbon Markets Under the Paris Agreement", *Politics and Governance* 10, no. 1 (23 February 2022), doi:10.17645/pag.v10i1.4759, 236.

[222] Vanderklift et al., "Constraints and Opportunities for Market-based Finance for the Restoration and Protection of Blue Carbon Ecosystems", 3-4.

[223] Porter, Katter, and Lee, "Legal Issues Affecting Blue Carbon Projects on Publicly-Owned Coastal Wetlands",11.

[224] C.C Pricillia, Patria, and Herdiansyah. "Social Consideration for Blue Carbon Management, 4, with reference to Lovelock and Duarte, "Dimensions of Blue Carbon and Emerging Perspectives", 1–5 ; Howard J et al., "The potential to integrate blue carbon into MPA design and management". *Aquat. Conserv. Mar. Freshw. Ecosyst.* 27, May, 2017, 100–115 ; Contreras C and Thomas S, "The role of local knowledge in the governance of blue carbon" J. *Indian Ocean Reg.* 15, 2 , 213–234 ; and Moraes O, "Blue carbon in area-based coastal and marine management schemes–a review". J. *Indian Ocean Reg.* 15 (2019), 2, 193–212.

[225] Macreadie et al., "Operationalizing Marketable Blue Carbon", 487.

[226] Porter, Katter, and Lee, "Legal Issues Affecting Blue Carbon Projects on Publicly-Owned Coastal Wetlands", 11

[227] Justine Bell-James, "Overcoming legal barriers to coastal wetland restoration: lessons from Australia's Blue Carbon methodology", Restoration Ecology, 7.

can exist beyond exclusive economic zones (EEZ) or in countries where national and state laws conflict.[228]

Land tenure governance is also dependent on several national, local, and contextual factors, with systems often built through "multiple layers of laws, rules, customs, traditions, perceptions and regulations, which sometimes overlap and/or contradict each other."[229] Formal ownership or land titles (statutory laws) may not always exist. In fact, other land tenure forms, including, e.g., rental, occupation, indigenous tenure, seasonal use (such as grazing land by pastoralists), or permitted use and extraction of resources (such as firewood or water) can co-exist.[230] In Guyana, for instance, there are three legal tenure systems (i.e., public lands, indigenous people lands, and private freehold), which have complicated mangrove forests management in the past.[231]

Moreover, in a blue carbon offset project, other ownership rights – such as the right to sell carbon – may need assuring. Carbon rights will demonstrate the ability of project owner to claim ownership of mitigation efforts.[232,233] In some countries, however, these rights are not sufficiently defined by law (e.g., Cambodia[234]).

Lastly, unclear or inexistent tenure and use rights can also contribute to various obstacles in protecting BCEs. For instance, a link has been made between overexploitation or unsustainable utilization of wetland resources and unclear property rights over aquatic resources.[235]

5.3 Other incidental hurdles (non-legal) and considerations

5.3.1 Finance, science, and empirical knowledge uncertainties

Coastal NbS projects usually require significant investment to analyze feasibility of possible revenue streams without the guarantee of success, conditions that can repel private investment.[236] In other words, blue carbon projects are often impaired by the uncertainty of risks compared to returns.[237] Common understandings over coastal NbS needs, objectives, and

[228] Macreadie et al., "Operationalizing Marketable Blue Carbon", 487.

[229] UN, "Land and Human Rights: Standards and Applications", 10.

[230] Ibid, 11.

[231] Linda Johnson-Bhola, "Effects of Rural Land Tenure System on Mangroves Management in Corentyne, Guyana", 8.

[232] Porter, Katter, and Lee, "Legal Issues Affecting Blue Carbon Projects on Publicly-Owned Coastal Wetlands", 23 and 28.

[233] AGEDI, "Building Blue Carbon Projects - An Introductory Guide", 49.

[234] Yeang, Donal, Kirtiman Sherchan, and Joe Heffernan, "Policy Brief: Carbon Rights and Benefit Sharing in Cambodia", 2014, p.7.

[235] Mesfin Gebrehiwot. Local ecological knowledge and wetland management in the Ethiopian Rift Valley (2020) GeoJournal 87: p 215–229 https://doi.org/10.1007/s10708-020-10250-z , 220

[236] Eselin, M; Schep, Stijn; Duinmeijer, Chris and Van Pul, Joris (2022), "Market Study, Financing Nature Based Solutions for Coastal Protection: A practical review of blended finance approaches with carbon credits from blue carbon sources", (Netherlands, 2022), 26.

[237] Macreadie et. al, "Operationalizing marketable blue carbon," 487.

the co-benefits these solutions provide, for instance, are lacking[238] – and so, parties (e.g., governments, conservation organizations, and investors) may find it dubious to deploy money and resources on uncertain grounds.

In addition, and as mentioned in sub-chapter 5.1, scientific data, methodologies, and empirical knowledge to build conservation, restoration, and sustainable management activities which can generate real GHG mitigation benefits is often lacking. [239,240]

5.3.2 Social critics

In developing and operating blue carbon projects, local community engagement can be more important than finance in blue carbon projects, as it builds social resilience and preserves cultural values while promoting blue carbon protection.[241] Conversely, blue carbon protection is impaired by the historical marginalization of groups – such as women and indigenous peoples, – which are consistently identified as closest to activities that preserve and sustainably manage forests and coastal ecosystems but get fewer opportunities to participate in decision-making.[242,243,244]

Women's access to land, for instance, by holding property titles or securing tenure rights, is restricted in many countries. Discrimination, in this sense, can take both *de jure* (formal) or *de facto* (substantive) forms, the first happening when the state's constitutions, laws, and official policies discriminate, and the latter based on historical and persistent prejudice.[245] Even further, poor rural women, are among the most marginalized,[246] and many of them (may) live in coastal areas.

Indigenous people suffer from similar discriminations, as well as possess similar historical importance as custodians of BCEs.[247] Their land tenure rights, however, are not always

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[238] Eselin, Stijn; Duinmeijer, and Van Pul (2022), "Market Study, Financing Nature Based Solutions for Coastal Protection: A practical review of blended finance approaches with carbon credits from blue carbon sources", 3.

[239] Macreadie et al., "Operationalizing Marketable Blue Carbon", 487.

[240] O'Connor et al., "Impacts of Land Management Practices on Blue Carbon Stocks and Greenhouse Gas Fluxes in Coastal Ecosystems—A Meta-analysis", 1355.

[241] Vanderklift et al., "Constraints and Opportunities for Market-based Finance for the Restoration and Protection of Blue Carbon Ecosystems", 4.

[242] CI, "High-Quality Blue Carbon Principles and Guidance", Accessed April 5, 2023, https://climatechampions.unfccc.int/wp-content/uploads/2022/11/HQBC-PG_FINAL_11.8.2022.pdf , 16.

[243] Sarah Gammage, "Gender and Equity in Policies and Programs to Foster Climate Mitigation and Adaptation in Latin America", 2021, expert paper prepared for UN Women Expert Group Meeting, https://www.unwomen.org/sites/default/files/Headquarters/Attachments/Sections/CSW/66/EGM/Expert%20Papers/Sarah%20GAMMAGE_CSW66%20Expert%20Paper.pdf pp. 1-27, 2-7.

[244]Client Earth, "How can the law help save the world's forests?", Posted in January 1st 2023, https://www.clientearth.org/latest/latest-updates/opinions/how-the-law-can-save-the-world-s-forests/.

[245] UN, "Land and Human Rights: Standards and Applications", 10-12.

[246] Ibid, 10.

[247] Ibid, 14.

recognized. Even when they are, violations for the profit of third parties often exist, and customary sustainable practices of indigenous peoples and local communities (IPLCs) are traded for third parties' activities that cause economic (and social) hardship,[248] as well as impair blue carbon preservation.

Further, as past policy experiences illustrate, top-down approaches to preserve BCEs areas (c.f., MPAs), have not been as effective when enforced without the complete and effective involvement of IPLCs.[249] Consequently, future blue carbon sustainability is highly dependent on new (bottom-up) strategies that include IPLCs, as well as their knowledge, in blue carbon management processes.[250]

6 Co-benefits: selected approaches from developing countries

In this section, developing countries' approaches in attempting to implement projects/strategies which envisioned benefits beyond carbon are analyzed. Countries were selected at discretion, based on relevance to the research question. Nevertheless, as the 'co-benefits' idea is not only discussed in blue carbon policies but in the wider climate policy spectrum, similar scenarios were considered for argumentation.

6.1 Kenya

Mikoko Pamoja is a mangrove reforestation and restoration project implemented in Gazy Bay, Kenya. Primarily developed with the help of a non-profit organization, the project has been the first community-led blue carbon project in the world. [251]

Still during the project design, a Payments for Ecosystems Services (PES) agreement was celebrated between the local community and the Plan Vivo crediting mechanism, in the hopes of using carbon credits sales through the voluntary market to finance rehabilitation and protection of mangroves. [252,253] The project was also developed with local government support, as well as robust scientific data (c.f., significant amount of research on mangroves and carbon

[248] Vierros, "Communities and blue carbon: the role of traditional management systems in providing benefits for carbon storage, biodiversity conservation and livelihoods", 92 and 93.

[249] Vanderklift et al., "Constraints and Opportunities for Market-based Finance for the Restoration and Protection of Blue Carbon Ecosystems", 4.

[250] Vierros, "Communities and blue carbon: the role of traditional management systems in providing benefits for carbon storage, biodiversity conservation and livelihoods", 92 and 93.

[251] Cf., ACES, "Mikoko Pamoja: The world's first community-led blue carbon project", Accessed March 30, 2023, https://aces-org.co.uk/our-projects/mikoko-pamoja-2/

[252] Wylie, Sutton-Grier, and Moore. "Keys to Successful Blue Carbon Projects: Lessons Learned from Global Case Studies.", 79.

[253] AGEDI, "Building Blue Carbon Projects - An Introductory Guide", 56.

sequestration in the region had been published).[254] Through the project, several benefits – including GHG mitigation and beyond – were achieved. In this sense, carbon profits have been used to incentivize or finance activities such as beekeeping, ecotourism, school constructions, purchase of books, installation of water pumps, and even stimulated the cultivation of terrestrial wood as an alternative to using the more valuable trees (i.e., mangroves).[255]

Moreover, the overall success of the intervention was attributed particularly to the engagement of the local community, which had directly participated and supported the project activities, as well as the combination of government support, available data, and finance.[256]

In this sense, by involving several layers of civil society (government, scientists, investors, and local communities), Mikoko Pamoja has demonstrated that co-benefits related to GHG emissions reduction projects can be achieved through a *holistic approach*, one that takes into consideration bottom-up strategies and effective stakeholders' engagement, as well as government active support.

6.2 Cambodia

Considered a least developing country (LDC), Cambodia was the host to many climate change projects and processes, as well as an example of a governance system funded and strongly influenced by donors (i.e., countries financing mitigation interventions within Cambodia), which counted with government support.[257]

Narratives such as mainstreaming plans to address climate change into the national and sectoral development strategies, focusing on synergies between climate change adaptation and mitigation, as well as the possibility to capitalize on those became more common with the development of the Cambodia Climate Change Strategic Plan (CCCSP/2014–2023). This reflected directly on REDD+ approaches and the use of carbon markets (notably the CDM), as well as other intergovernmental climate initiatives, often relying on the idea of "co-benefits" or multiple benefits these mechanisms could bring, including poverty alleviation and development. [258]

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[254] Wylie, Sutton-Grier, and Moore. "Keys to Successful Blue Carbon Projects: Lessons Learned from Global Case Studies.", 79.

[255] Ibid, 79.

[256] Ibid, 79.

[257] Mira Käkönen et al., "Rendering Climate Change Governable in the Least-Developed Countries: Policy Narratives and Expert Technologies in Cambodia", *Forum for Development Studies* 41, no. 3 (2 September 2014): 351–76, doi:10.1080/08039410.2014.962599, 360 and 371.

[258] Käkönen et al., "Rendering Climate Change Governable in the Least-Developed Countries: Policy Narratives and Expert Technologies in Cambodia", 356 and 361.

Nevertheless, with Cambodia being heavily dependent on international aid and with developed countries eventually showing less support to the Kyoto Protocol (and thus leading to carbon price decreases) the goal of achieving multiple benefits through policy programs and specific projects mostly failed.[259] Ultimately, the main failure was that the talk about integration and multiple objectives (i.e., adaptation, mitigation plus social development) created more problems than they could solve, especially as it ignored trade-offs between sustainability goals, costs of implementing these goals, and interests – particularly economic interests – of key stakeholders (including vulnerable groups and local communities).[260]

Cambodia's case shows that although integration, mainstreaming, and meeting multiple objectives are valid and important considerations for climate change strategies and projects, different actors (including direct beneficiaries and stakeholders) voices should be considered during policy-making dialogues which often happens exclusively between donors and governments. In this sense, transformative and informed policy-making choices would be more effective if multi-level discussions, involving not only representatives of governments and donor actors, but also key stakeholders – such as local communities, scientists, and NGOs – were implemented, and especially to understand how and if benefits beyond climate mitigation can result from carbon projects or programs. Likewise, co-benefits should be effectively planned and account for possible trade-offs, interests of key stakeholders and, if possible, external circumstances such as the real opportunities to sell carbon at fair prices.

For blue carbon projects, these principles certainly apply, in the sense that direct beneficiaries and key stakeholders should participate in the development of a blue carbon project and the design of co-benefits. Discussions should also consider the main challenges in developing blue carbon strategies, including those relating to policies and regulations, capacity building, coordination among actors, land tenure and use rights, the necessary finance flows, trade-offs between conservation goals and other interests, and so on.

7 Concluding remarks

The protection of blue carbon ecosystems, in particular mangrove forests, salt-marshes, and seagrass meadows has increasingly attracted the attention of the international community, especially due to the higher GHG storage and sequestration capacities in comparison to terrestrial ecosystems, but also due to the potential to achieve many other benefits.

[259] Ibid, 360-367.

[260] Ibid, 367 and 371.

Co-benefits can increase the overall value of a project, both in the scenario of carbon credits transactions and beyond. However, developing projects that conserve, restore, or sustainably manage blue carbon areas, as well as seeking to include co-benefits in blue carbon projects can be challenging.

Recently recognized under the United Nations system within nature-based solutions (NbS) to address climate change, protecting blue carbon ecosystems through conservation, sustainable management, and restorations generate not only GHG mitigation benefits but also a range of co-benefits. These involve enhancing water quality, enabling the development of sustainable livelihoods, preserving biodiversity, enforcing tenure and use rights, alleviating (or reducing) poverty, promoting equity, improving coastal resilience, providing income, as well as other eventual social benefits such as creation of jobs, promotion of research, recreation, human health, among others.

At the same time, uncertainties in assessing co-benefits, as well as global challenges in pursuing conservation, restoration, and sustainable management activities may exist, and disrupt the ability of projects to deliver both GHG mitigation benefits and co-benefits.

In this sense, blue carbon preservation is already a field that requires extensive legal attention, especially to navigate legal and other inefficiencies found within host countries, – inefficiencies that are deep-rooted in the historical unprotective treatment given by societies to coastal wetlands and ecosystems. Therefore, co-benefits cannot be seen as 'set-in-stone' or obvious benefits of a blue carbon project or strategy and neither designed carelessly as to avoid dealing with the main problems when implementing blue carbon projects. In fact, there is no way to generate co-benefits if a blue carbon project itself is not developed in a legally sound manner, according to countries' realities in terms of laws, policies, responsibilities of government agencies and blue carbon stakeholders, as well as considering multidisciplinary challenges, from social realities to availability of financial mechanisms, research and beyond.

Further, and as shown throughout this paper, there is a considerable knowledge gap when it comes to assessing, quantifying, and ensuring benefits beyond GHG mitigation, especially co-benefits related to a project that conserves, restore or sustainably manage BCEs. Knowledge gaps encompass particularly the assessment and valuation of ecosystem services provided by protecting wetlands and coastal areas, how to engineer projects to generate co-benefits, and the necessity to consider numerous variables from governance to legal, financial, environmental, and social realities. For the generation of co-benefits paired with GHG mitigation strategies more broadly, additional final points need to be made.

First, in the academic field and policymaking, most of the ideas around the "co-benefits" from projects that mitigate GHG are not necessarily settled. In this sense, and despite the many published and peer-reviewed studies about the additional benefits of climate policies and projects, most of the academic literature conceptualizes and contextualizes co-benefits differently.[261] Hence, inconsistencies between them and generalizations may exist.

Second, policymakers do not seem to adopt consistent paths to allow benefits beyond climate mitigation to be achieved in their decision-making processes. In part, the lack of context and concepts from academic literature can be a reason for the difficulty of policymakers in adopting certain paths. Properly identifying and measuring these co-benefits in literature, therefore, could increase support for climate action and provide a better understanding of the real impact of climate policies.[262]

Third, on the difficulty of assessing (and securing) co-benefits from climate mitigation policies or projects, an underlying cause may be that measuring concatenated nature and human systems after (or before) implementing policies and projects is complex, involving the evaluation of multiple socio-economic, political, and natural contexts. Comparatively, numeric measurements, – such as those employed in GHG emissions accounting– may not be suiting to quantify many of the co-benefits exemplified in Chapter 4 (e.g., enforcement of sustainable use rights). In this sense, some co-benefits require more nuanced methods of measurement such as community consultations (e.g., biodiversity benefits), or depend on wider socioeconomic and qualitative assessments of variables within jurisdictions (e.g., measuring poverty and inequality requires assessing levels of access to education, basic infrastructure, health, and security levels[263]).

Some suggestions to tackle the lack of measurement of co-benefits could be to identify realistic win-win strategies that facilitate synergies between preserving blue carbon and relevant trade-offs, including interests of affected parties such as local communities and public actors, by undertaking stakeholders' consultations or wide in-country assessments, as well as to promote local monitoring programs and research intended to clarify the matter of co-benefits. Clarification in this sense should consider proper conceptualization and measurement of each potential co-benefit, tailored to the reality of specific locations and communities.

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[261] Mikael Karlsson, Eva Alfredsson, and Nils Westling, "Climate Policy Co-Benefits: A Review", *Climate Policy* 20, no. 3 (15 March 2020): 292–316, doi:10.1080/14693062.2020.1724070, 293 and 304.

[262] Ibid, 293.

[263] World Bank, "Piecing together the poverty puzzle", (Washington, DC: World Bank. License: Creative Commons Attribution CC BY 3.0 IGO: 2018) doi: 10.1596/978-1-4648-1330-6, 91-94.

The development of guidelines and methodologies to measure these co-benefits – by carbon crediting mechanisms or others – can also be a suggestion to assess the extent of possible co-benefits in blue carbon offset projects. In this sense, as guiding principles and methodologies could, for example, facilitate the implementation and design of biodiversity offset programs,[264] so could they measure biodiversity benefits from blue carbon projects.

Ultimately, approaches such as one-size-fits-all solutions or unrealistic promises of benefits achieving, without due care in planning, assessment, and mitigation of risks may not be recommended. In the scenario of developing a particular blue carbon project where no guidance in relation to co-benefits seems to exist, the recommendation could be to assess similar cases, discover how project developers have incorporated the idea of delivering multiple benefits into project designs, and identify if those co-benefits can be enabled in future blue carbon conservations, sustainable management, or restorations. In other words, the planning for co-benefits in addition to GHG mitigation benefits could be done through experimentation and critical thinking.

Finally, the same principles making international law a field requiring dialogues among states, state-empowered entities, and non-state actors,[265] apply to the development of blue carbon interventions with multiple benefits, i.e., cooperation between multiple actors, including non-state actors, can facilitate knowledge exchanges to implement blue carbon projects and, nonetheless, for enabling the delivery of benefits beyond GHG mitigation.

[264] Stefan Gelcich et al., "Achieving Biodiversity Benefits with Offsets: Research Gaps, Challenges, and Needs", 184-189, p. 185

[265] Evans, Malcolm D. *International Law*. Fifth ed. Oxford: Oxford University Press, 2018, 89.

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