

International Conservation, Protection, and Sustainable Management of Blue Carbon Ecosystems: An Overlooked Tool in Climate Change Mitigation and Adaptation

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I. INTRODUCTION

As the world is painfully aware, climate change is the most pressing existential crisis of our time. While our use of fossil fuels is a major contributor to this crisis, they have also been an undeniably useful resource across the globe, and our detrimental reliance on them runs deep. They warm homes, power cities, preserve food, transport people and goods, and create resilient and cost-effective materials when refined into plastics and synthetic fibers. Unfortunately, the extraction, processing, and burning of fossil fuels emits greenhouse gases that trap the sun's heat and raise average global temperatures. This increases the frequency and severity of extreme weather events like the unusually severe and frequent hurricanes and wildfires we already see today.²

To worsen matters, humanity continues to destroy ecosystems which remove carbon from the atmosphere when healthy, choosing to prioritize rapid industrial and terrestrial development instead. During photosynthesis, plants in coastal wetlands extract carbon dioxide from the air and water, a process which eventually locks carbon into the soil as those plants die and decompose.³ However when coastal ecosystems are destroyed or degraded, these carbon stores are released into the atmosphere as three potent greenhouse gases: carbon dioxide, methane, and nitrous oxide.⁴ Globally, the destruction of coastal ecosystems adds an estimated 450 million metric tons of greenhouse gases to the atmosphere each year.⁵ In addition, approximately one-third of all anthropogenic carbon emissions to date have arisen from *solely* those terrestrial ecosystems destroyed and replaced by livestock farms, not to mention those ecosystems destroyed for other uses.⁶ Thus, the destruction of ecosystems for industrial development not only cuts off their carbon-storing potential but also directly contributes to climate change by releasing the carbon they already had stored. Climate change may be the greatest existential threat humans have faced, and we must use every possible means to combat it. Natural carbon stores could play an indispensable role in this effort, yet some of the most powerful carbon-sequestering ecosystems—coastal habitats known as “blue carbon”—are also some of the most gravely threatened.⁷

² *What Is Climate Change?*, UNITED NATIONS: CLIMATE ACTION, <https://www.un.org/en/climatechange/what-is-climate-change#:~:text=Climate%20change%20refers%20to%20long,like%20coal%2C%20oil%20and%20gas> (last visited Apr. 24, 2023).

³ *Coastal 'Blue Carbon': An Important Tool for Combating Climate Change*, THE PEW CHARITABLE TRUSTS, (Sept. 20, 2021) <https://www.pewtrusts.org/en/research-and-analysis/issue-briefs/2021/09/coastal-blue-carbon-an-important-tool-for-combating-climate-change>.

⁴ *Id.*

⁵ *Id.*

⁶ Michael Eisen & Patrick Brown, *Rapid global phaseout of animal agriculture has the potential to stabilize greenhouse gas levels for 30 years and offset 68 percent of CO₂ emissions this century*, PLOS CLIMATE, Feb. 1, 2022, <https://journals.plos.org/climate/article?id=10.1371/journal.pclm.0000010>.

⁷ THE PEW CHARITABLE TRUSTS, *supra* note 2.

This paper will argue that blue carbon ecosystems can be most effectively utilized to combat climate change by synchronizing their conservation and management through an international framework. To reach this conclusion, this paper will first describe in depth what blue carbon ecosystems are, how they can be used as a tool against climate change, and the many additional non-climate related benefits they provide. Then, it will investigate the current state of blue carbon globally, identifying and evaluating blue carbon's role in international climate change law while focusing on the United Nations Framework Convention on Climate Change and related instruments. In doing so, it will assess whether there is an avenue for the effective international coordination of blue carbon conservation and sustainable management under current treaties. Finally, this paper will argue that the international community should urgently prioritize blue carbon as a climate mitigation and adaptation tool, analyzing different pathways to this goal and considering whether an entirely new treaty would be more fit to address this crucial resource.

II. WHAT IS BLUE CARBON?

The term blue carbon refers to certain coastal, marine, and estuarine ecosystems which have great capacity to store carbon. These include mangroves, tidal and salt marshes, and seagrass meadows.⁸ About 83% of the Earth's carbon cycle is circulated through its oceans, and while blue carbon coastal ecosystems cover merely 2% of all ocean area, they account for approximately 50% of the total carbon that is sequestered in ocean sediments.⁹ Indeed, these highly productive ecosystems sequester carbon at a rate two to four times faster than mature tropical forests.¹⁰ Blue carbon ecosystems also offer numerous benefits other than carbon storage. They provide habitat for marine species, support fish stocks, increase food security, sustain livelihoods in coastal communities, filter water that flows into oceans and reef systems, and protect coastlines from erosion and storm surges which is intensified by climate change.¹¹

However, despite these many important functions, blue carbon ecosystems remain "some of the most threatened ecosystems on Earth."¹² Due to mangrove forest exploitation, urban and industrial coastal development, pollution, and pressures from agriculture and aquaculture, blue carbon ecosystems are being

⁸ *Blue Carbon*, UNESCO: INTERNATIONAL OCEANOGRAPHIC COMMISSION, <https://www.ioc.unesco.org/en/blue-carbon> (last visited Sep. 12, 2024).

⁹ *Critical Storage*, THE BLUE CARBON INITIATIVE, <https://www.thebluecarboninitiative.org/> (last visited Apr. 24, 2023).

¹⁰ BRIAN C. MURRAY ET AL., DUKE UNIV., NICHOLAS INST. FOR ENV'T POL'Y SOLS., GREEN PAYMENTS FOR BLUE CARBON ECONOMIC INCENTIVES FOR PROTECTING THREATENED COASTAL HABITATS, at 6 (2011), <https://nicholasinstitute.duke.edu/sites/default/files/publications/blue-carbon-report-paper.pdf>.

¹¹ UNESCO: INTERNATIONAL OCEANOGRAPHIC COMMISSION, *supra* note 7.

¹² *Id.*

degraded or destroyed at four times the rate of tropical forests.¹³ Annually, the coastal extent of these ecosystems is estimated to decline by 0.5% to 3%, depending on the ecosystem's type.¹⁴ Destruction of blue carbon ecosystems both eliminates their potential as effective carbon sinks and exacerbates climate change.¹⁵

When an ecosystem's biomass decays, its high carbon content is released back into the atmosphere in the form of potent greenhouse gases.¹⁶ The United Nations Educational, Scientific, and Cultural Organization International Oceanographic Commission ("IOC-UNESCO") states that "ongoing carbon losses from blue carbon ecosystems are estimated to account for up to 19% of emissions from global deforestation."¹⁷ Thus, the importance of conservation and effective management of blue carbon is twofold: to maximize the carbon-capturing capacity and other benefits these incredible ecosystems provide, and to prevent their already stored carbon from re-entering the atmosphere.

III. THE STATE OF BLUE CARBON MANAGEMENT AND RESTORATION TODAY

While blue carbon is a compelling natural carbon sequestration method, its effective utilization requires us to overcome barriers related to gaps in scientific understanding, technology, management approaches, and financial capability.¹⁸ Global scientific discourse is still investigating several aspects of these ecosystems and their carbon storage potential, asking questions including: what factors affect the rate of carbon storage in soil and sediment; how does climate change impact carbon accumulation; to what extent do disturbances affect sedimentary carbon stores; and how can the net flux of greenhouse gases between blue carbon ecosystems and the atmosphere be estimated?¹⁹ It is also still unclear which management practices best promote long-term blue carbon sequestration.²⁰ The preservation techniques attempted thus far have involved little quantification of carbon benefits beyond a few years.²¹ Further, management and restoration

¹³ *Id.*

¹⁴ *Id.*

¹⁵ *Id.*

¹⁶ THE PEW CHARITABLE TRUSTS, *supra* note 2.

¹⁷ UNESCO: INTERNATIONAL OCEANOGRAPHIC COMMISSION, *supra* note 7.

¹⁸ Peter A. Macreadie et al., *The future of Blue Carbon science*, NATURE COMM'NS., Sep. 5, 2019, at 8-9, <https://www.nature.com/articles/s41467-019-11693-w.pdf>.

¹⁹ *See id.* at 2-7.

²⁰ *Id.* at 7-8.

²¹ *Id.* at 8.

approaches vary so widely²² that it is difficult to define what constitutes “success” for such projects.²³

These knowledge gaps prevent the accurate valuation of climate benefits, which poses a substantial obstacle to investment in these ecosystems by private entities, governments, and communities. One study found that most mangrove rehabilitation and restoration projects fail due to a “lack of community involvement, appropriate governance structures, and alignment of [the] objectives and goals of external agents . . . and local stakeholders.”²⁴ Without an accurate understanding of what tangible benefits they may gain, how their projects can be executed effectively, and what outcomes should be considered successful, these parties often lack proper incentives to collaborate toward a common goal. Similarly, governments may struggle to create appropriate regulatory structures for blue carbon because of the lack of sufficient information. Furthermore, there is a risk that the recent spike in interest in blue carbon²⁵ will dissipate before a deeper scientific understanding of the quantifiable benefits of blue carbon ecosystems can be reached.

The international community has also taken note of the challenges these knowledge gaps pose. In fact, the *Ocean and Climate Change Dialogue to consider how to strengthen adaptation and mitigation action* at the 26th Conference of the Parties (“COP 26”) under the United Nations Framework Convention on Climate Change (“UNFCCC” or “the Convention”) specifically noted blue carbon as an important nature-based solution to climate change. The UNFCCC’s Subsidiary Body for Scientific and Technological Advice stated in its report from the Dialogue that, “[while] critical gaps remain in scientific observation and research on areas like blue carbon . . . [these] gaps and opportunities on adaptation and mitigation could be identified under the UNFCCC process and could help drive the United Nations Decade of Ocean Science for Sustainable Development.”²⁶ Thus, despite the challenges of blue carbon, there is a dedicated international community working to bridge knowledge gaps and

²² See Aaron M. Ellison et al., *Mangrove Rehabilitation and Restoration as Experimental Adaptive Management*, FRONTIERS IN MARINE SCI., May 15, 2020, at 1, <https://www.frontiersin.org/articles/10.3389/fmars.2020.00327/full> (Discussing varying management approaches, including native species restoration versus planned design with emphasis on functionality taking advantage of non-native species and especially for effectiveness in a rapidly changing environment).

²³ Robert J. Orth et al., *Restoration of seagrass habitat leads to rapid recovery of coastal ecosystem services*, SCI. ADVANCES, Oct. 7, 2020, at 1, <https://www.science.org/doi/pdf/10.1126/sciadv.abc6434>.

²⁴ Ellison et al., *supra* note 21, at 3.

²⁵ Yiwen Zeng et al., *Global potential and limits of mangrove blue carbon for climate change mitigation*, 31 CURRENT BIOLOGY 1737, 1737 (2021), <https://www.sciencedirect.com/science/article/pii/S0960982221001354/pdf>.

²⁶ Informal Summary Report by the Chair of the UNFCCC Subsidiary Body for Scientific and Technological Advice, *Ocean and climate change dialogue to consider how to strengthen adaptation and mitigation action*, at 21 (Apr. 29, 2021), https://unfccc.int/sites/default/files/resource/SBSTA_Ocean_Dialogue_SummaryReport.pdf.

preserve the potential of these ecosystems as viable climate change mitigation tools.

Scientific and policy-based research is being conducted across the world by Non-Governmental Organizations (“NGOs”), national governments, intergovernmental organizations, and private entities, including several blue carbon-specific international institutions. One such institution, the International Blue Carbon Institute, was founded at COP 27 by Conservation International and Amazon, just one year after concerns about blue carbon were noted at COP 26.²⁷ This institution’s mission is to support blue carbon projects in Southeast Asia and the Pacific Islands, showcasing international collaboration between a private entity, an NGO, and an intergovernmental organization.²⁸

Conservation International, alongside the United Nations Environment Programme (“UNEP”), IOC-UNESCO, the Global Environmental Facility (“GEF”), GRID-Arendal, and the International Union for Conservation of Nature, collectively drive much of the work on blue carbon in the international arena. These organizations, in various combinations, have created and continue to support the Blue Carbon Initiative, the International Partnership for Blue Carbon, the GEF Blue Forests Project, and the Policy Framework for Blue Carbon Ecosystems. These organization’s focuses include furthering scientific research on blue carbon, developing policy mechanisms to incorporate blue carbon into international climate policy, and increasing knowledge sharing on blue carbon between governments, researchers, and NGOs.²⁹ Blue carbon projects at the national level are also an important part of the global effort to increase understanding of blue carbon, and some have achieved long-term success.³⁰ However, we still have a lot to learn. The more research that is performed, the more that scientists and policymakers can learn from and build upon the successes and failures of one another. Indeed, research is so increasingly collaborative that it has led various studies to conclude that adaptive management, or learning from

²⁷ Press Release, Conservation International, *Amazon and Conservation International Establish International Blue Carbon Institute* (Nov. 14, 2022), <https://www.conservation.org/press-releases/2022/11/16/amazon-and-conservation-international-establish-international-blue-carbon-institute>.

²⁸ *Id.*

²⁹ See *About Blue Carbon*, <https://www.thebluecarboninitiative.org/about-blue-carbon> (last visited Apr. 24, 2023); see also *Australia acts to create the International Partnership for Blue Carbon to fight climate change*, <https://www.unesco.org/en#:~:text=Founding%20members%20of%20the%20International,Program%20%3B%20the%20Pacific>; see also *About the GEF Blue Forests Project*, <https://gefblueforests.org/about/> (last visited Apr. 24, 2023); see also *Library, POL’Y FRAMEWORK FOR BLUE CARBON ECOSYSTEMS*, <https://www.bluecarbonpolicy.org/library> (last visited Apr. 24, 2023); see also *Policy Calendar, POL’Y FRAMEWORK FOR BLUE CARBON ECOSYSTEMS*, <https://www.bluecarbonpolicy.org/policy-calendar> (last visited Apr. 24, 2023).

³⁰ See, e.g., Orth et al., *supra* note 22; see also, e.g., Ryan J. Rezek et al., *Long-term performance of seagrass restoration projects in Florida, USA*, SCI. REP.’S, Oct. 29, 2019, <https://www.nature.com/articles/s41598-019-51856-9>.

the processes and past experiences of others, is an advantageous restoration approach.³¹

Regardless of the outcomes of future research and despite our current knowledge gaps, “we now have the fundamental knowledge to justify the inclusion of [blue carbon] protection, restoration, and creation in [climate] mitigation mechanisms.”³² Thus, to best synchronize our efforts to protect blue carbon and preserve its many benefits, we must organize its management at the international level. The next section of this paper will evaluate the current roles of blue carbon under existing international climate change instruments to assess policy pathways to the desired outcome. In doing so, it will investigate the existing framework, evaluate its benefits and drawbacks, and identify areas in need of further development.

IV. BLUE CARBON AND INTERNATIONAL CLIMATE CHANGE LAW

The UNFCCC is the leading source of international law regarding climate change. Its various protocols, agreements, and programs provide ample opportunity to integrate blue carbon into international climate mitigation and adaptation strategies. Despite the UNFCCC’s potential in this arena, this discussion would not be complete without inquiring into whether the existing framework is enough to protect and restore blue carbon to the extent needed to fully realize the benefits of these ecosystems, or whether further development of international environmental law, possibly including a new independent blue carbon treaty, is necessary.

A. *The United Nations Framework Convention on Climate Change*

1. General Framework

The UNFCCC is the international community’s greatest organized response to the threat of climate change, with “near-universal membership” by 198 countries.³³ Opened for signature in 1992, it created a foundation for a continued and changing international response to climate change, which has produced the Kyoto Protocol, the Paris Agreement, and various other climate-related programs and mechanisms.³⁴ Its overarching goal is to “stabiliz[e] greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous

³¹ Ellison et al., *supra* note 21, at 4-5; see Orth et al., *supra* note 22, at 3.

³² Macreadie et al., *supra* note 17, at 9.

³³ *What is the United Nations Framework Convention on Climate Change?*, UNFCCC, <https://unfccc.int/process-and-meetings/what-is-the-united-nations-framework-convention-on-climate-change> (last visited Apr. 24, 2023).

³⁴ See DAVID HUNTER, JAMES SALZMAN & DURWOOD ZAELEKE, *INTERNATIONAL ENVIRONMENTAL LAW AND POLICY* 651 (6th ed. 2022).

anthropogenic interference with the climate system.”³⁵ The Convention realizes this goal by placing certain commitments on four groups of country parties, separated according to their “common but differentiated responsibilities and respective capabilities.”³⁶ These grouped commitments are foundational for subsequent instruments under the framework.

All parties to the Convention are subject to the general requirements of Article 4.1, which include the following: developing national inventories of anthropogenic greenhouse gas emissions and removals by sinks; developing climate change mitigation programs and incorporating climate considerations into national policy where feasible; facilitating the sharing of knowledge, research, and technology; and cooperating in preparing adaptation measures.³⁷

All industrialized countries are categorized as Annex I parties, subject to additional commitments under Article 4.2, whereby they are charged to “tak[e] the lead” in reducing greenhouse gas emissions.³⁸ Notably, Annex I parties must adopt and regularly communicate detailed information on national policies limiting anthropogenic greenhouse gas emissions and protecting and enhancing carbon sinks, aiming to return to pre-1990 emissions levels.³⁹

Excluding industrialized countries from the former Soviet bloc, which were undergoing economic transition at the time of the UNFCCC’s ratification, all other industrialized countries are also categorized as Annex II parties.⁴⁰ These parties have the most extensive commitments of any group. On top of the general requirements imposed upon all parties and those imposed upon Annex I parties, Annex II parties are also required to provide financial resources to developing countries to cover the costs of implementation and communication regarding their climate mitigation commitments. They must also assist in the implementation of adaptation measures for developing countries that are particularly vulnerable to adverse effects of climate change.⁴¹

Crucial to the UNFCCC’s role as “an institutional architecture for the progressive development of the [climate] regime”⁴² is the establishment of the Conference of the Parties (COP) as the “supreme body of [the] Convention.”⁴³ The COP meets once a year and is charged with keeping the implementation of the UNFCCC under regular review and making decisions as necessary to maintain its effectiveness.⁴⁴ In addition to a long list of enumerated powers to this effect,

³⁵ United Nations Framework Convention on Climate Change art. 2, May 9, 1992, S. TREATY DOC. No. 102-38, 1771 U.N.T.S. 107.

³⁶ *Id.* at art. 4(1).

³⁷ *Id.* at art. 4(1)(a)-(j).

³⁸ *Id.* at art. 4(2)(a)-(b).

³⁹ *Id.*

⁴⁰ HUNTER ET AL., *supra* note 33.

⁴¹ United Nations Framework Convention on Climate Change, *supra* note 34, at art. 4(3)-(4).

⁴² HUNTER ET AL., *supra* note 33.

⁴³ United Nations Framework Convention on Climate Change, *supra* note 34, at art. 7(2).

⁴⁴ *Id.* at art. 7(2), (4).

the COP is given broad discretion to “exercise such other functions as are required for the achievement of the objective of the Convention.”⁴⁵ It is this grant of discretion, paired with the UNFCCC’s overall trend toward flexibility, which has allowed the promulgation of two crucial developments within this framework: the Kyoto Protocol and the Paris Agreement.

2. The Kyoto Protocol

At the first COP in 1995, country parties were required to “review the adequacy” of the developed countries’ commitments, and it was clear to many by this point that stabilizing atmospheric greenhouse gas concentrations at a safe level, as per the goal set out in Article 2 of the UNFCCC, would not be possible by simply freezing emissions at the 1990 level.⁴⁶ Thus, after two years of negotiations for intensified commitments, the Kyoto Protocol (“the Protocol”) was ratified in 1997.⁴⁷

The Kyoto Protocol, in contrast to the Paris Agreement, imposed steep greenhouse gas emissions reduction targets onto individual countries to be met within a five-year initial commitment period from 2008-2012.⁴⁸ A second commitment period was originally intended to follow, but it was rendered largely ineffective because several major emitters withdrew or declined to participate in the second period.⁴⁹ Nevertheless, the Kyoto Protocol established some important climate mechanisms still in operation that may benefit blue carbon. Discussion of the Protocol provides a useful contrast to aid in understanding the later Paris Agreement’s framework.

To make its reduction targets and timetables feasible, the Kyoto Protocol adopted a “cap-and-trade” approach.⁵⁰ Under this system, country parties could meet their emissions reduction targets by engaging in a combination of direct emissions reductions and participation in different “flexibility mechanisms” under the general umbrella of emissions trading.⁵¹ The most pertinent mechanisms to this paper’s discussion are the trading of emissions reduction credits generated through Land-Use, Land-Use Change, and Forestry (LULUCF) activities, and the Clean Development Mechanism.

Under the LULUCF mechanism, country parties could generate emissions reduction units by sequestering carbon via forest management (including

⁴⁵ *Id.* at art. 7(2)(m).

⁴⁶ HUNTER ET AL., *supra* note 33, at 653.

⁴⁷ *Id.* at 654.

⁴⁸ Kyoto Protocol to the United Nations Framework Convention on Climate Change art. 3, Dec. 10, 1997, 2303 U.N.T.S. 162; HUNTER ET AL., *supra* note 33, at 654.

⁴⁹ *See* HUNTER ET AL., *supra* note 33, at 658.

⁵⁰ HUNTER ET AL., *supra* note 33, at 655. *See also Emissions Trading*, <https://unfccc.int/process/the-kyoto-protocol/mechanisms/emissions-trading> (last visited Apr. 24, 2023) (discussing the cap and trade approach implemented by the Kyoto Protocol).

⁵¹ HUNTER ET AL., *supra* note 33, at 655. *See also Emissions Trading*, *supra* note 49.

afforestation and reforestation), cropland and grazing land management, and revegetation.⁵² Emissions reduction units generated through LULUCF could either be retained for the generating party's use in meeting their reduction target or sold from one Annex I party to another to count toward the purchaser's reduction target.⁵³ LULUCF activities are still available under the Paris Agreement.

The Clean Development Mechanism involves transferring emissions reduction credits from a non-Annex I (developing) country to an Annex I (developed) country.⁵⁴ Under this mechanism, an Annex I country could fund an emissions-reducing project within a non-Annex I country and, after certifying the emissions reductions, apply those credits to their own emissions reduction target.⁵⁵ Eligible activities include renewable energy projects, energy efficiency efforts, and afforestation and reforestation under LULUCF.⁵⁶

Although these two mechanisms no longer operate quite as intended now that the Kyoto Protocol is essentially defunct, they have been partially incorporated into Article 5 of the Paris Agreement. These mechanisms also contributed to the development of the REDD+ (Reducing Emissions from Deforestation, Degradation, and Enhanced Conservation of Forests) program, which is still in operation today.

3. REDD+

REDD+ is a mechanism created by a package of seven fairly technical COP decisions that set out the steps a country may take to carry out forestry projects within their borders that qualify for "results-based payments."⁵⁷ REDD+ covers a multitude of activities aimed at protecting and enhancing the carbon storage of forests, as well as minimizing carbon emissions from deforestation and forest degradation.⁵⁸ Originally, the purpose of REDD+ was to create a mechanism that ensured forestry projects could generate accurate and verifiable emissions reduction credits such that they could be "recognized by the climate regime as appropriate for trading in a global carbon market."⁵⁹

⁵² See Kyoto Protocol, *supra* note 47, at arts. 3, 6; United Nations Framework Convention on Climate Change Conference of the Parties 6 Decision 5/CP.6, at 7-11 (July 24, 2001); *Emissions Trading*, *supra* note 49.

⁵³ United Nations Framework Convention on Climate Change Conference of the Parties 6 Decision 5/CP.6, *supra* note 51, at 7.

⁵⁴ See Kyoto Protocol, *supra* note 47, at art. 12.

⁵⁵ HUNTER ET AL., *supra* note 33, at 655; see United Nations Framework Convention on Climate Change Conference of the Parties 6 Decision 5/CP.6, *supra* note 51, at 8-10.

⁵⁶ United Nations Framework Convention on Climate Change Conference of the Parties 6 Decision 5/CP.6, *supra* note 51, at 9.

⁵⁷ HUNTER ET AL., *supra* note 33, at 1185.

⁵⁸ *Id.*

⁵⁹ HUNTER ET AL., *supra* note 33, at 1185; see *What is REDD+?*, <https://unfccc.int/topics/land-use/workstreams/redd/what-is-redd> (last visited Apr. 24, 2023).

Despite the recent increase in voluntary carbon market participation⁶⁰ and widespread use of carbon markets in domestic policy, it remains unclear how much demand will be available for credits generated by REDD+ forest-based activities “in the absence of a global carbon market formed by mandatory global caps on emissions.”⁶¹ Regardless, REDD+ activities may still be incorporated into Internationally Transferred Mitigation Outcomes under the Paris Agreement.

Outside of a global carbon market, REDD+ may still have the potential to benefit the blue carbon conservation and forests. Countries must attain a “REDD-Ready” designation before they are eligible to produce verified REDD+ carbon credits. In other words, they must follow the UNFCCC’s required steps to demonstrate that their forestry projects provide real carbon offsets.⁶² These requirements include the creation of a national action plan that identifies and prioritizes forests to be managed and the establishment of a safeguard information system that tracks the implementation of environmental and social safeguards for designated forests.⁶³ In addition, since these requirements pose a higher burden on countries with fewer resources, numerous funding streams created both by the UN and NGOs have mobilized substantial financial aid to assist nations in developing these programs and becoming REDD-Ready.⁶⁴

Although mangroves are the only forest ecosystem categorized as blue carbon, they would still benefit from inclusion in REDD+’s regulatory framework and from the continued availability of REDD+ funding. Management, conservation, and regulation of mangrove forests is often costly and scientifically complex. Thus, the availability of external funding to assist nations in establishing effective mangrove management and monitoring regimes is crucial, especially for developing countries. Further, depending on how that funding is allocated, it may be used as an incentive to increase community involvement, which is a key factor in the success or failure of mangrove rehabilitation efforts.⁶⁵ Funding allocated in this manner not only enhances carbon benefits for the globe, but also provides ecosystem services (including those that aid in climate adaptation, e.g. storm protection) and financial support for the immediate community.⁶⁶

While the REDD+ program is currently more limited than originally intended, mangroves provide such valuable services that any opportunity to increase mangrove protection in a world threatened by climate change must be seized upon. Thus, REDD+ support and funding for mangroves must be prioritized as much as it is for terrestrial forests. Support must come from all angles, including

⁶⁰ Chris Webb, *The vital role of voluntary carbon markets* (Nov. 1, 2022), <https://www.hsbc.com/insight/topics/the-vital-role-of-voluntary-carbon-markets>.

⁶¹ HUNTER ET AL., *supra* note 33, at 694-95, 1186.

⁶² *Id.* at 1185.

⁶³ *Id.*

⁶⁴ *See id.* at 1185-86.

⁶⁵ Ellison et al., *supra* note 21, at 3.

⁶⁶ UNESCO: INTERNATIONAL OCEANOGRAPHIC COMMISSION, *supra* note 7.

from developed countries, the UN, relevant UN sub-programmes such as the UNEP and IOC-UNESCO, NGOs, and private entities. Further, nations must be urged to incorporate mangrove forests into their REDD+ strategies and national policy through regulation, informational campaigns, and any other means available.

4. The Paris Agreement

The Paris Agreement (“the Agreement”) grew out of an international realization that the Kyoto Protocol’s style of binding commitments did not necessarily induce compliance, as sanctions on non-compliant parties proved ineffective even with a formal enforcement mechanism.⁶⁷ Further, the international community was coming to find that countries would more readily commit to deeper emissions reductions when those commitments were voluntary and non-binding.⁶⁸ These two findings led to the creation of the Paris Agreement’s unique format: binding in form and procedure, but not in substance.⁶⁹

At the core of the Agreement are several shared goals that recall the basic framework of the UNFCCC: “stabilize greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system”; differentiate requirements based on national capabilities and respective responsibilities; and include adaptation commitments alongside mitigation.⁷⁰ The Paris Agreement built upon this framework, calling for the following:

Holding the global average temperature to well below 2°C above pre-industrial levels . . . [i]ncreasing the ability to adapt to the adverse impacts of climate change . . . [and m]aking finance flows consistent with a pathway towards low greenhouse gas emissions . . . in the light of different national circumstances.⁷¹

To achieve these objectives, the Paris Agreement employs a “bottom-up approach,” by which country parties are required to “prepare, communicate and maintain successive national determined contributions” (NDCs) that must account for the nation’s total anthropogenic carbon emissions and total removals by sinks.⁷² Each party’s NDC is required to “reflect [the party’s] highest possible ambition, reflecting its common but differentiated responsibilities and respective capabilities”⁷³ As such, developed country parties are required to “tak[e] the

⁶⁷ HUNTER ET AL., *supra* note 33, at 662.

⁶⁸ *Id.*

⁶⁹ *Id.*

⁷⁰ United Nations Framework Convention on Climate Change, *supra* note 34, at arts. 2, 4.

⁷¹ Paris Agreement to the United Nations Framework Convention on Climate Change art. 2, Dec. 12, 2015, T.I.A.S. No. 16-1104, 3156 U.N.T.S. 54113.

⁷² HUNTER ET AL., *supra* note 33 at 663; Paris Agreement, *supra* note 70, at art. 4.

⁷³ Paris Agreement, *supra* note 70, at art. 4.

lead by undertaking economy-wide absolute emission reduction targets,” while developing country parties “should continue enhancing their mitigation efforts, and are encouraged to move over time towards economy-wide emission reduction or limitation targets”⁷⁴

Parties must communicate updated NDCs every 5 years, and each successive NDC must “represent a progression beyond the Party’s then current [NDC].”⁷⁵ Finally, “to promote effective implementation,” the Paris Agreement established an Enhanced Transparency Framework (ETF), which involves regular national reporting and international review to “provide a clear understanding of climate change action in light of the objective of the Convention.”⁷⁶ The information generated through the ETF is then reviewed at the “global stock-take,” initiated at COP 28 in 2023 and set to repeat every five years thereafter, in order to inform parties on updating and enhancing their actions, support, and cooperation for international climate action.⁷⁷

This procedural framework is the only portion of the Paris Agreement that is binding upon country parties. Although NDCs are “harmonized to some extent by agreed substantive guidelines and strengthened by common rules for transparency, monitoring, review, and verification,” the content of a party’s NDC and the methods it chooses to achieve the goals set out therein are all entirely at the individual nation’s discretion.⁷⁸ It is this “bottom-up approach” that drew such significant global participation, including the globe’s largest emitters, whose prior absence frustrated the purpose of the Kyoto Protocol.⁷⁹

Despite the Paris Agreement’s effective replacement of the Kyoto Protocol, Article 5 of the Agreement encourages country parties to utilize pre-existing frameworks to reduce emissions through nature-based solutions, such as sustainable management of forests, conservation, and prevention of deforestation and forest degradation.⁸⁰ Thus, some of the programs and mechanisms established under the Protocol which may benefit blue carbon still operate under the Paris Agreement, including REDD+, LULUCF, and the Internationally Transferred Mitigation Outcomes mechanism.

a. LULUCF under The Paris Agreement

LULUCF projects have been widely included in country parties’ NDCs as sinks to account for carbon removals. In fact, 90% of the “second generation” of NDCs, which were updated from the initial round submitted at the Paris Agreement’s

⁷⁴ *Id.*

⁷⁵ *Id.*

⁷⁶ *Id.* at art. 13.

⁷⁷ *Id.* at art. 14.

⁷⁸ HUNTER ET AL., *supra* note 33, at 666.

⁷⁹ *Id.* at 663; *see id.* at 658.

⁸⁰ Paris Agreement, *supra* note 70, at art. 5.

inception, included LULUCF activities.⁸¹ Of those projects, 52% involved afforestation, reforestation, and revegetation, 31% involved sustainable forest management, and 37% involved “cross-cutting options” such as expanding national protection of wetlands.⁸² Although mangroves and tidal wetlands are necessarily encompassed within LULUCF, it is unclear whether non-terrestrial or marine activities, such as seagrass restoration and management, would qualify as land-use or land-use change projects under the mechanism.

In addition, despite its widespread use, “only about 20[%] of all NDCs include quantifiable targets for [the LULUCF] sector . . . [and] less than half of those . . . includ[e] greenhouse gas-based targets . . . or metric tons of carbon dioxide equivalent.”⁸³ From this statistic, it is clear that some nations need additional support in developing carbon accounting and verification methodologies to realize the full potential of LULUCF and blue carbon. REDD+ and its corresponding funds do provide a robust carbon accounting system for LULUCF forests, but reliance on REDD+ exclusively would leave behind many blue carbon ecosystems, including tidal wetlands and seagrass meadows.

LULUCF climate mitigation solutions are important, allowing nations to capitalize on their unique ecological situations in their NDCs, especially concerning blue carbon and its high rate of carbon sequestration. The great potential of these projects, combined with the even greater danger posed by climate change, warrants increased funding and resources directed toward the development of an accessible carbon accounting system for *all* LULUCF activities, beyond just forests.⁸⁴ These resources must come from every angle, including from the UN and its relevant sub-entities, developed countries, NGOs, and private entities where feasible. In addition, LULUCF regulations should be modified to explicitly include carbon-storing marine ecosystem projects within the definition of “land-use,” to ensure their inclusion in country parties’ NDCs. Finally, these developments should be heavily publicized so that it is easier for country parties, especially developing countries, to learn about and access any new resources and carbon accounting mechanisms.

⁸¹ UN-REDD Programme Secretariat, *UN-REDD Programme Info Brief: Linking Redd+, The Paris Agreement, Nationally Determined Contributions And The Sustainable Development Goals: Realizing The Potential Of Forests For NDC Enhancement And Implementation 2* (Mar. 2, 2022), <https://www.un-redd.org/sites/default/files/2022-03/NDC%20Final.pdf>.

⁸² *Id.*

⁸³ *Id.* at 2.

⁸⁴ Paris Agreement, *supra* note 70, at art. 9 (“[d]eveloped country Parties shall provide financial resources to assist developing country Parties with respect to both mitigation and adaptation in continuation of their existing obligations under the Convention”); Paris Agreement, *supra* note 70, at art. 10, (“[a] technology framework is hereby established to provide overarching guidance to . . . facilitating enhanced action on technology development and transfer . . . Support, including financial support, shall be provided to developing country Parties for the implementation of this Article . . .”); Paris Agreement, *supra* note 70, at art. 11, (“Developed country Parties should enhance support for capacity-building actions in developing country Parties”).

b. Internationally Transferred Mitigation Outcomes

Article 6.2 of the Paris Agreement sets out a program similar to the Kyoto Protocol's emissions trading system, by which country parties may achieve their NDCs by implementing collaborative projects as Internationally Transferred Mitigation Outcomes (ITMOs).⁸⁵ Under this system, one country may invest in an emissions reduction or carbon removal project in another "host" country.⁸⁶ Then, once the carbon offsets produced by the project are verified,⁸⁷ the funding country may count those offsets toward its own NDC emissions reduction goals.⁸⁸ In addition, Article 6 grants great flexibility in how country parties may decide to design and implement their projects, and since subsequently published regulations have only briefly touched on procedural and accounting matters, cooperating countries retain this broad discretion regarding the structure of their projects.⁸⁹

Given the flexibility that Article 6 grants to parties cooperating under an ITMO, blue carbon may be incorporated into such a project in a variety of ways. One option for country parties is to use existing programs and mechanisms such as REDD+ and LULUCF, as they are encouraged under Article 5. Considering the funding streams and other support that these mechanisms can provide, both REDD+ and LULUCF may provide more standardized pathways to the successful implementation of a project. Indeed, the nature of the ITMO program as a quasi-carbon trading mechanism may revitalize some of REDD+'s potential by providing a pre-existing stock of forest-based carbon credits ready for use by countries cooperating under an ITMO.

However, although LULUCF provides an established pathway for work on mangroves and tidal wetlands, it is somewhat ambiguous regarding whether marine activities, such as seagrass revegetation, qualify as land-use projects. REDD+, of course, focuses solely on forests. Moreover, the text of the Paris Agreement that addresses nature-based mitigation seems to focus on terrestrial forests rather than blue carbon ecosystems.⁹⁰ The ITMO mechanism provides a sorely needed second option by which country parties can utilize blue carbon,

⁸⁵ Paris Agreement, *supra* note 70, at art. 6(2); HUNTER ET AL., *supra* note 33, at 700.

⁸⁶ See Paris Agreement, *supra* note 70, at art. 6; see also United Nations Framework Convention on Climate Change Conference of the Parties 26 Decision 2/CMA.3, at 15 (Mar. 8, 2022).

⁸⁷ See Paris Agreement, *supra* note 70, at art. 6(4) (describing ITMO carbon offset project verification as "essentially replicat[ing] the Clean Development Mechanism").

⁸⁸ Paris Agreement, *supra* note 70, at art. 6(2); HUNTER ET AL., *supra* note 33, at 700.

⁸⁹ See Paris Agreement, *supra* note 70, at art. 6.

⁹⁰ Paris Agreement, *supra* note 70, at art. 5, ("[p]arties are encouraged to take action to implement and support, including through results-based payments, the existing framework as set out in related guidance and decisions already agreed under the Convention for: policy approaches and positive incentives for activities relating to reducing emissions from *deforestation and forest degradation*, and the role of conservation, *sustainable management of forests* and enhancement of *forest carbon stocks* in developing countries; and alternative policy approaches, such as joint mitigation and adaptation approaches for the integral and sustainable management of *forests*" [emphasis added]).

allowing them to design and carry out their own unique projects as they see fit so long as they conduct accurate carbon accounting and verification.

In this way, ITMOs empower cooperating country parties to utilize all types of blue carbon ecosystems to their fullest potential, as opposed to LULUCF and REDD+. Moreover, the great degree of flexibility the ITMO mechanism provides to cooperating countries is ideal for blue carbon projects which necessarily entail constant change, often performing best under adaptive management approaches.⁹¹

The only drawback to individually curated blue carbon ITMOs is the lack of resources in comparison to pre-existing programs. This is one obstacle in the path of an otherwise ideal pathway to incorporating blue carbon into the international climate change framework. However, this obstacle may be mitigated if countries with high emissions and financial resources frequently seek ITMO arrangements to ease the burden of the steep reductions they must make under the Paris Agreement's 2°C goal. This is also the perfect stage for blue carbon initiatives and other NGOs to step in and provide additional resources.

However, ITMOs are only piecemeal solutions. Considering the climate risks entailed by the continued destruction of blue carbon in the absence of protective measures, the international community needs to do more. Therefore, increased funding and availability of additional resources directed toward blue carbon conservation and restoration projects should be strongly prioritized, especially for unique projects under the flexible ITMO mechanism. Overall success relies on a wide array of finance flows and resource sharing from as many sources as possible, including the UN, relevant sub-entities like the UNEP and IOC-UNESCO, developed countries, NGOs, and private entities where feasible.⁹² Lastly, awareness of the need for such resources must be raised at every possible juncture, especially by the UN through its related public campaigns (e.g. the Decade of Ocean Science for Sustainable Development) and its soft law instruments (e.g. the Sustainable Development Goals).

B. Sufficiency of the UNFCCC's Framework for Blue Carbon

The existing climate change mitigation regime provided by the UNFCCC may supply the framework needed to synchronize the management of blue carbon on an international level. It is true that portions of the UNFCCC lack in their ability to enact widespread protection, restoration, and sustainable management of blue carbon ecosystems. However, it is also true that filling these gaps could transform the UNFCCC into the exact type of framework needed to realize the full extent of blue carbon's climate benefits.

In addition, it may be more effective to seek out resources for blue carbon protection and restoration under the auspices of UNFCCC, as opposed to outside of it, due to the widespread reach and influence of the Convention and the UN as

⁹¹ Ellison et al., *supra* note 21, at 4.

⁹² Paris Agreement, *supra* note 70, at art. 9-11; *see infra* note 83.

an institution. Moreover, the UNFCCC has already utilized and assisted blue carbon ecosystems by facilitating their incorporation into at least 28 country parties' NDCs and 59 country parties' adaptation strategies.⁹³ The international community now has the opportunity to improve upon the existing UNFCCC system by expanding the role of blue carbon within it.

V. CONCLUSION: ASSESSING THE NEED FOR A BLUE CARBON TREATY

Additional improvements to the UNFCCC may be all that is necessary to cement the role of blue carbon as a valued international climate mitigation tool. However, given that the UNFCCC is not currently prioritizing blue carbon conservation to the extent necessary, it is pertinent to assess whether the international community ought to pursue an additional treaty with the sole purpose of protecting blue carbon. This paper ultimately finds that a new blue carbon treaty would be unnecessary and, given the progressive nature of climate change, potentially a waste of time. So long as sufficient resources are secured and regulations are introduced to increase blue carbon incorporation into LULUCF, REDD+, ITMOs, and NDCs, the UNFCCC's framework may be able to adequately protect and rehabilitate blue carbon. Furthermore, with near-universal membership,⁹⁴ international attention is already focused on the UNFCCC as the premier international mechanism combatting climate change. This status gives it significant political weight and the ability to tap into resources from all reaches of the globe. The UNFCCC's framework may not be perfect, but it is already here, and climate change is too.

At this juncture, it is not known whether the full scope of blue carbon's benefits can be realized under the UNFCCC in enough time to have a meaningful impact on global warming. However, treatymaking is a mercilessly slow process and climate change worsens by the day. Time is of the essence, and if blue carbon is to have any role in keeping global temperatures at a safe level, the international community must at least *try* to incorporate it more extensively into the existing framework. In addition, there are a few non-climate sources of international law undiscussed by this paper, such as the Ramsar Convention on Wetlands and the Rio Convention on Biological Diversity, which already focus on ecosystem conservation. These active treaties could provide additional protections to blue carbon ecosystems where the UNFCCC falls short, and could therefore be important subjects of future research.⁹⁵ Thus, it could be a risky waste of time to

⁹³ PHAM THU THUY & LE THI THANH THUY, CIFOR, INFOBRIEF: INCORPORATING BLUE CARBON INTO NATIONALLY DETERMINED CONTRIBUTIONS: CURRENT STATUS, OPPORTUNITIES AND CHALLENGES OF 13 ASIA-PACIFIC COUNTRIES 1 (2019), https://www.cifor.org/publications/pdf_files/infobrief/7554-infobrief.pdf.

⁹⁴ UNFCCC, *supra* note 32.

⁹⁵ See *generally* Convention on Biological Diversity, June 5, 1992, 1760 U.N.T.S. 79; Ramsar Convention on Wetlands of International Importance Especially as Waterfowl Habitat, Dec. 21, 1975, T.I.A.S. No. 11084, 996 U.N.T.S. 245.

draft an entirely new blue carbon treaty for the unlikely outcome that it would be more effective than existing international law. Instead, the international community should capitalize on the potential of the UNFCCC and related international instruments to protect, restore, and realize the full range of benefits of blue carbon ecosystems.