

<https://doi.org/10.5281/zenodo.18739666>

Legal and Policy Implications of Blue Carbon Projects: Protecting Coastal Ecosystems for Climate Change Mitigation

Aarzoo Farhad	Assistant Professor, Department of Law, Shaheed Benazir Bhutto Women University, Peshawar aarzoofarhad@sbbwu.edu.pk
Dr. Mohammad Jan	Assistant Professor, Department of Shariah and Law, Islamia College Peshawar jan@icp.edu.pk
Imad Ali	Advocate High Court imad.qau@gmail.com

Abstract: *Majority of the blue carbon ecosystems, such as the mangroves, seagrasses, and salt marshes, are important in climate change mitigation because they are capable of capturing huge quantities of carbon dioxide. Nevertheless, these ecosystems are under attack due to the rise of the coastal development, pollution, and climate change, even despite their beneficial nature in the context of the environment and climate. This essay discusses the legal and policy consequences of blue carbon projects created to preserve and rehabilitate these ecosystems. It starts by examining the current legal international frameworks including the United Nations Framework Convention on Climate Change (UNFCCC), and the Convention on Biological Diversity (CBD) that acknowledges the importance of blue carbon in climate management plans of the world. The national policies and regional efforts to achieve conservation of the blue carbon ecosystems are also discussed in the paper, with Australia, the United States, and Brazil as case studies.*

Nevertheless, this is not an entirely smooth sail, and legal and policy gaps are still present to keep blue carbon projects being effectively implemented. These are a lack of financial incentives, not being integrated into wider climate policies, and problems in measuring and monitoring carbon sequestration. The article outlines the main environmental and policy issues that include the destruction of the coastal ecosystem and the necessity to come up with more effective legal tools to facilitate the use of blue carbon credits and carbon markets.

The article presents a number of recommendations on how the blue carbon projects can be furthered such as enacting of legislations that clarify the specifications of carbon offset programs, establishing of blue carbon marine parks, and increased public-private collaboration to fund conservation initiatives. Lastly, it will require increased international collaboration to coordinate legal systems and place blue carbon in global climate change and sustainability ambitions. The study will also attempt to present a broad overview of the legal and policy avenue that should be taken to protect and scale blue carbon as a nature-based intervention to climate change.

Keywords: Blue carbon, coastal ecosystems, climate change mitigation, United Nations Framework Convention on Climate Change (UNFCCC), Convention on Biological Diversity (CBD), coastal governance.

1. Introduction

Context and Background

Mangroves, seagrasses, and salt marshes, which are blue carbon ecosystems are highly effective in reducing the effects of climate change, as they are important carbon sinks. Such coastal systems can store, as well as absorb, large quantities of carbon dioxide (CO₂), a greenhouse gas that leads to global warming. The rates of carbon sequestration in mangroves, seagrasses, and salt marshes are many times higher than the rates of carbon sequestration in most terrestrial ecosystems, and thus play an essential role in the global carbon sequestration strategy to lower atmospheric CO₂ levels (Fourqurean et al., 2012). Nevertheless, even though they are significant, these ecosystems are becoming more and more threatened by development of coastal areas, pollution, climate change and extraction of resources in an unsustainable manner, which prevents their ability to act as carbon sinks.

Blue carbon is a term that is used to refer to the carbon captured and saved by the coastal and marine ecosystems. The capacity of blue carbon ecosystems to retain huge amounts of carbon over time has led to the increased recognition of its importance in mitigating climate change. Such ecosystems are not only carbon catchers but also play a major role in conserving biodiversity, coastal protection and sustainable livelihoods of the local communities reliant on fishing and tourism. With the growing need to solve climate change, blue carbon has become a key element of nature-based solutions (NbS), which are solutions that engage the power of nature to tackle societal issues, including climate change (Selig et al., 2012).

The anemic rise of nature-based solutions in global climate policy is indicative of a progress toward more ecosystem-based, holistic approaches to climate mitigation. The Paris agreement and the United Nations Sustainable Development Goals (SDGs) highlight the importance of solutions that combine ecosystem-based solutions to reduce the effects of climate change. Namely, SDG 13, which is concerned with climate action, highlights the importance of nature-based solutions such as blue carbon in meeting climate goals (United Nations, 2015). Coastal ecosystems also offer a dual purpose of meeting climate targets and also countering biodiversity loss and ecosystem degradation by their carbon-sinking capacity.

With the rest of the world still trying to find solutions on how to curb the emission of greenhouse gases, coastal ecosystems have a huge potential on carbon absorbing. Blue carbon projects, including mangrove restoration and seagrass planting, have the potential to sequester carbon on a scale that contributes meaningfully to global climate goals. The increasing recognition of their potential has sparked both scientific research and policy interest in developing frameworks to protect and restore these critical ecosystems (Pendleton et al., 2012).

Research Questions

This research aims to explore the legal and policy frameworks that govern the protection and restoration of blue carbon ecosystems. Key questions addressed include:

1. What are the existing legal frameworks—both international and national—that support the conservation and restoration of blue carbon ecosystems?
2. How can international and national legal systems effectively promote and regulate blue carbon projects to ensure their success and scalability?
3. What are the primary challenges in integrating blue carbon into broader climate change mitigation strategies, particularly in terms of governance, funding, and enforcement?

Significance of Research

The significance of this research lies in its potential to inform global and national climate strategies by

providing a comprehensive examination of the legal and policy dimensions of blue carbon. As nations work toward meeting climate targets set under the Paris Agreement and addressing SDG 13, blue carbon ecosystems present an underutilized opportunity to mitigate climate change. These ecosystems also provide co-benefits such as biodiversity conservation, coastal protection, and the enhancement of livelihoods for communities dependent on marine resources (Mcleod et al., 2011). However, despite their importance, there remains a significant gap in legal and policy frameworks that support the protection, restoration, and scaling of blue carbon projects. This incompatibility blocks the entire potential of these ecosystems in being used in mitigating climate globally.

There is still a problem incorporating blue carbon projects into the climate change mitigation strategies. These barriers should be overcome by effective legal instruments, coordination of policies and financial mechanisms. Moreover, a sound governance framework is necessary to facilitate the realization of blue carbon ecosystems that are properly safeguarded and restored to respond to the challenges of international collaboration, sustainable use of resources, and restoration of ecosystems.

This research will offer valuable information on how the law and policies can be enhanced to support the sustainable utilization of coastal ecosystems by overcoming the problems and opportunities that come with blue carbon projects. This involves analyzing the contribution of international legal tools and domestic policies, giving suggestions on how it can be better governed to increase the efficacy of blue carbon projects in addressing climate change.

2. Legal and Policy Frameworks for Blue Carbon Projects

International Legal Frameworks

The legal environment of blue carbon projects is mainly influenced by a few international treaties and agreements which deal with climate change and marine protection. These frameworks provide the international regulations and processes of managing and safeguarding the blue carbon ecosystems including mangroves, seagrasses, and salt marshes. These ecosystems are progressively being accorded much importance in carbon sequestration, and the importance of these ecosystems is still incompletely established into legal instruments of different countries.

United Nations Framework Convention on Climate Change (UNFCCC).

UNFCCC and its follow-up Paris Agreement are at the center of global climate regulation. The Paris Agreement seeks to restrict the global rise in temperature to less than 2°C and seek to curb the rise to 1.5°C. Although the agreement underscores the need to cut down on greenhouse gas emission, it also focuses on the contribution of nature-based solutions (NbS) towards attaining climate objectives. The climate action plans of the countries in the form of the Nationally Determined Contributions (NDCs) present an essential chance of integrating blue carbon into climate policies. Nevertheless, the level of inclusion of blue carbon ecosystems in the individual NDCs is uneven, with some countries mentioning them as a component of their carbon mitigation efforts, whereas others do not mention it at all (Griscom et al., 2017).

To effectively incorporate blue carbon projects into the Paris Agreement, it will be necessary that the countries explicitly include these ecosystems in their climate action plans and develop national legal frameworks to support blue carbon initiatives and allow the production of carbon credits based on their protection and restoration (Houghton et al., 2015).

Biological Diversity Convention (CBD).

Another key international agreement that affects the blue carbon projects is the CBD. Its main objective is to preserve the biological diversity and to make natural resources sustainable in their use. The CBD focuses on marine biodiversity conservation, such as blue carbon ecosystem conservation. The Aichi Targets, which have been adopted under CBD, specifically demand the protection and restoration of the

marine ecosystems, which also include ecosystems that store carbon. Marine Protected Areas (MPAs), which are critical to the preservation of blue carbon ecosystems, are often used as part of global strategies for biodiversity conservation under the CBD. Additionally, the Post-2020 Global Biodiversity Framework, which will succeed the Aichi Targets, is expected to further recognize and incorporate the role of blue carbon in achieving global biodiversity and climate goals (Secretariat of the Convention on Biological Diversity, 2020).

The Kyoto Protocol and Carbon Markets

The Kyoto Protocol established the first binding commitments for climate change mitigation through emission reduction targets for developed countries. It also introduced market-based mechanisms like carbon trading and carbon credits. Although the Kyoto Protocol was more of an industrial emission agreement, the establishment of carbon markets has formed the foundation of extending blue carbon to these mechanisms in future. Projects which sequester carbon such as forestry and land-use projects were permitted by the Clean Development Mechanism (CDM) under the Protocol to generate carbon credits that could be bought and sold on international markets. The blue carbon projects however were not wholly integrated into the carbon market in the Kyoto Protocol and as a result, a gap that is being filled in more subsequent international frameworks exists.

The Paris Agreement presented such mechanisms as the Article 6 market-based approaches, and it can provide a mechanism to introduce blue carbon into carbon markets in a more efficient way. Blue carbon projects, including mangrove restoration, are also supported by the Global Environment Facility (GEF) and other international climate funds, which are providing the financial support needed to implement and scale these projects (Pinnock et al., 2020).

International Blue Carbon Awareness.

The use of blue carbon ecosystems has received growing international appreciation as a result of its vital contribution to the mitigation of climate change. The legalization of these ecosystems is however in its infancy.

Nature-based solutions have become recognized as an effective policy to cut emissions and meet climate targets by the UNFCCC, but the blue carbon ecosystems are not yet fully embedded in the global climate architecture. The integration of blue carbon credits in carbon markets is still incomplete and not tightly controlled, but some systems like blue carbon certification schemes and the creation of carbon credit standards via the restoration of coastal ecosystems are heading in the right direction (Santos et al., 2019).

Global funds such as Global Environment Facility (GEF) are offering assistance in blue carbon projects to work on restoration of ecosystems and creation of sustainable methods of managing the environment to promote carbon sequestration and protection of biodiversity. These funds have played a critical role in funding the projects which show the prospects of blue carbon to support the objectives of climate like mangrove restoration in Philippines and Indonesia (Pinnock et al., 2020).

National and Regional Legal Frameworks

The law at the national level plays a vital role in putting blue carbon projects in practice. Nations possessing large blue carbon systems are starting to make such initiatives a part of national policies and climate policy. The regulatory methods themselves are, however, very diverse.

Australia

One of the most developed blue carbon conservation programs in the country is the Blue Carbon Initiative adopted in Australia. The Australian Government has acknowledged the importance of mangroves, seagrasses and salt marshes in carbon sequestration and reduction of climate changes. Laws and regulations have been established to conserve these ecosystems such as the coastal zone

management plans and programs that encourage land owners to rehabilitate coastal ecosystems to generate carbon credits. Nevertheless, it remains difficult to coordinate the national climate policy with local initiatives to preserve the marine environment (Groot et al., 2015).

United States

The United States has formulated measures to enhance the protection of coastal wetlands and blue carbon ecosystems via legislations like Coastal Zone Management Act and Clean Water Act. Although these laws have prospered in controlling the conservation of wetlands, it has failed to embrace blue carbon as an official component of mitigation of climate change. The protection of seagrasses and mangroves through legal mechanisms under the Endangered Species Act has not been particularly successful in protecting the ecosystems over the long-term (Ramsar Convention, 2020).

Brazil

The blue carbon projects implemented by Brazil are mainly mangroves. Legal instruments have been developed to protect coastal ecosystems and incentivize carbon sequestration through restoration projects. However, conflicts between economic development and ecosystem protection in coastal regions, particularly related to aquaculture and urban expansion, present ongoing challenges to implementing effective blue carbon policies (Barreto et al., 2018).

Challenges in National Laws

While several countries have made strides in incorporating blue carbon ecosystems into national frameworks, there are significant legal gaps. In many cases, national laws do not provide sufficient financial incentives or legal protections for the conservation and restoration of blue carbon ecosystems. There is a lack of standardization in carbon credit certification and no globally agreed-upon legal framework to guide the integration of blue carbon into carbon markets. Additionally, competing land-use and coastal development interests often limit the effectiveness of legal instruments designed to protect blue carbon ecosystems.

Marine Spatial Planning (MSP) and Blue Carbon

Marine Spatial Planning (MSP) is a critical tool in integrating blue carbon projects into broader coastal zone management strategies. MSP helps allocate space for various marine activities while protecting vulnerable ecosystems. Integrating blue carbon ecosystems into MSP can ensure their protection from threats like coastal development, pollution, and unsustainable fishing practices. MSP offers an opportunity to enhance blue carbon conservation by designating areas specifically for ecosystem restoration and carbon sequestration activities (Ehler & Douvère, 2009). However, integrating blue carbon into MSP requires significant changes in legal frameworks to ensure that these ecosystems are considered alongside other marine activities like shipping, tourism, and fisheries.

3. Environmental and Policy Challenges in Blue Carbon Projects

Environmental Challenges

Degradation of Blue Carbon Ecosystems

The health of blue carbon ecosystems—specifically mangroves, seagrasses, and salt marshes—is increasingly threatened by several anthropogenic and natural factors. Coastal development is one of the most significant threats, as the expansion of urban areas, ports, and resorts often leads to the destruction or degradation of vital coastal habitats. Mangroves, in particular, are often cleared for land reclamation and shrimp farming, while seagrasses and salt marshes are lost to land conversion, draining, and pollution (Alongi, 2014). These ecosystems are not merely significant in the carbon sequestration process but also they provide shelter to a plethora of marine life thereby their destruction is harmful to

biodiversity and the process of mitigating climate change.

Another significant cause of blue carbon ecosystem degradation is pollution. Agricultural run off and sewage result in nutrient loading that causes eutrophication which disturbs the equilibrium among coastal ecosystems. Marine life may also be poisoned with chemical pollutants including heavy metals and oil spills, which reduces the capacity of marine plants, including seagrasses and mangroves, to store carbon (Fourqurean et al., 2012). Plastic pollution is another menace that is on the increase, as it impacts not only on the organisms that inhabit these ecosystems but also their capacity to grow to survive their environmental pressures.

The biggest long-term threat to blue carbon ecosystems is likely to be climate change. Increasing sea levels may also drown important coastal ecosystems, and acidification and rising temperatures of the oceans may interfere with the growth and survival of seagrasses and corals (Duarte et al., 2013). Specifically, mangroves; the most sensitive species to sea level and salinity changes are under extinction threat due to sea-level rise. A combination of these factors is turning it into all the more challenging to conserve and recover these ecosystems.

Another cause of degradation of blue carbon ecosystems is through overfishing. The destructive effects of trawling and illegal fishing are not restricted to marine biodiversity only; they also destroy sensitive habitats such as seagrass meadows and mangrove forests by physical impact. Overfishing causes the ecological balance to be disturbed and this causes the herbivorous species to be killed which supports the healthy seagrass beds which consequently impacts the carbon sequestration capacity of the ecosystems (Barbier et al., 2011).

Measuring Carbon Sequestration

The impossibility of quantifying the carbon sequestration in these ecosystems is one of the major issues of scaling blue carbon projects. Although it is established that mangroves, seagrasses, and salt marshes sequester carbon at high rates, a precise way of quantifying this carbon storage is complicated. The measurement techniques are yet to be developed, because the carbon stocks of these ecosystems may differ greatly with location, type of ecosystem, and environmental factors (Fourqurean et al., 2012).

As a case in point, carbon storage in mangrove forests is relatively easy to measure because of the dense vegetation and well-developed roots, whereas seagrasses and salt marshes, as a consequence of the submerged and often buried biomass, are difficult to measure. Remote sensing and subsurface sampling are new technologies under development to better how carbon is measured, and these methods are in their infancy (Macreadie et al., 2017). In addition, it is complex to measure the long-term storage of carbon in blue carbon ecologies because of the dynamic character of these ecosystems and the possibility of carbon re-release by storms or alterations in land-use.

Monitoring and Enforcement

In order to guarantee the success of the use of blue carbon projects in the long-term, it is important to observe their effectiveness. Proper mechanisms of monitoring can be used to determine whether restoration activities are causing demonstrable increases in carbon storage and whether ecosystems are being sufficiently safeguarded. In the example of blue carbon credits, proper and trustworthy monitoring is a key to their validity in carbon markets.

Nonetheless, the remoteness of most of the blue carbon ecosystems and the difference in the rate of carbon sequestration can make monitoring a difficult task. Current surveillance approaches usually use in-situ sampling which is costly and time-consuming. Consequently, the necessity to use a more affordable and more scalable monitoring technologies, including satellite-based monitoring and automated data acquisition techniques, is urgent (Graham et al., 2019). The application of rules also presents a challenge, mainly in areas with ineffective governance or lack of funds to conserve their areas.

Policy Challenges

Legal and Financial Incentives

Lack of financial incentives is one of the greatest obstacles to the success of blue carbon projects. Though the carbon market has experienced some growth, there is still a policy gap in the integration of the blue carbon ecosystems into the carbon market. Blue carbon credits are at an early stage, and the regulatory frameworks are usually ambiguous on how the credits are to be valued and verified (Peskest et al., 2012).

Moreover, legal tools to offer financial incentives to the local population and land owners to invest in preserving and recovering the blue carbon ecosystems are missing. The governments and international donors need to establish stronger funding strategies, including subsidies, tax exemption, and carbon offset schemes, to motivate the promotion of the blue carbon projects on a large scale (Nellemann et al., 2014).

Private vs. Public Interests

Another major challenge is associated with the conflict between the objectives of conservation of the population and the desire of the sector to invest in blue carbon credits. On the one hand, governments and NGOs are concentrated on protecting and restoring ecosystems, and on the other hand, the private sector sees the potential of making a profit out of carbon market and offset programs. Such a conflict allows the exploitation of blue carbon credits without providing special care to healthy ecosystems and long-term sustainability (Houghton et al., 2015).

In the case of blue carbon, the incentive behind the effort of private investment is often financially oriented and short-term, whereas the incentive behind the effort of public conservation is long-term and sustainable management and integrity of the ecosystem. A balance between these conflicting interests is a key to the long-term success of blue carbon initiatives.

Inclusion in Greater Climate Policy.

Although blue carbon is increasingly being recognized, it is still apparent that there is no cohesion between blue carbon initiatives and national climate policy. In the majority of national climate plans, the emphasis on mitigation plans targeting land-based measures, especially reforestation and agriculture is much higher than the blue carbon ecosystems which are frequently overlooked or receive inadequate funding. The inclusion of blue carbon in national climate change mitigation and adaptation plans would make the policies on climate change more effective, and would lead to the realization of Nationally Determined Contributions (NDCs) in the Paris Agreement.

The governments should embrace policies that clearly observe the option of blue carbon ecosystems in carbon sequestration and climate resilience. This involves the inclusion of blue carbon in the climate adaptation strategies, the need to realize that they can maintain the coastlines against storm surge and sea levels rise and the development of cross-sectoral collaboration between the marine conservation and fisheries management and climate policy (Pendleton et al., 2012).

Cooperation and Governance International.

The global nature of blue carbon makes it imperative that the global community takes action. Robust governance structures are required to promote joint response to blue carbon especially in those regions where the coastal ecosystems cut across jurisdiction.. Regional initiatives, such as the East Asia and Pacific Islands partnerships, can promote cooperation on transboundary marine ecosystems and help harmonize national policies across borders.

The establishment of regional agreements can support the protection and restoration of blue carbon ecosystems while enabling the trade of carbon credits across countries. International organizations, such as the UNFCCC and the CBD, have a crucial role to play in coordinating these efforts, setting common

standards for blue carbon projects, and facilitating access to climate finance.

4. Strategies for Advancing Blue Carbon Projects

Innovative Legal Solutions

Advancing blue carbon projects requires innovative legal solutions to address the challenges of effectively conserving and restoring blue carbon ecosystems while ensuring their integration into broader climate change mitigation efforts. Below are some proposed legal reforms that could enhance the governance and scalability of blue carbon initiatives.

Blue Carbon Certifications and Standards for Marine Carbon Credits

One of the most critical steps in advancing blue carbon projects is the creation of clear and reliable blue carbon certification systems. Establishing internationally recognized standards for marine carbon credits would provide legitimacy to blue carbon projects and ensure that carbon sequestration in mangroves, seagrasses, and salt marshes is accurately quantified, verified, and tradable in carbon markets. Standards such as those developed by the Verified Carbon Standard (VCS) for terrestrial carbon credits could be adapted to the marine environment, setting criteria for project monitoring, measurement, and verification. This would create a more structured approach for managing and promoting blue carbon as a legitimate mechanism for carbon offsetting in international climate agreements (Chausson et al., 2020).

In addition, the introduction of blue carbon certifications would encourage private investment and public policy support by creating a recognizable market for carbon credits. These certifications would also ensure that carbon sequestration from marine ecosystems is effectively protected, helping to prevent overexploitation or misuse of marine resources.

Creation of Marine Protected Areas (MPAs) Focused on Blue Carbon Ecosystems

The introduction of Marine Protected Areas (MPAs) specifically targeting blue carbon ecosystems would offer strong legal defenses to mangroves, seagrasses and salt marshes. At the moment, the number of MPAs involved in the management of these ecosystems is not large and many of them fail to mention them in their management frameworks. Including blue carbon ecosystem into MPAs would not only aid to preserve these crucial habitats against coastal development and pollution, but also enhance the capacity of these regions to sequester carbon since they would not be degraded (Parker et al., 2012).

Such MPAs would be legally required to incorporate restoration actions and certain management operations to increase the carbon sequestration of blue carbon ecosystems. Adaptive management strategies to accommodate the dynamic character of coastal ecosystems and changing threats to them should be encompassed in the legal frameworks of MPAs.

Introduction of International Blue Carbon Agreements.

To improve the global management of blue carbon ecosystems, international blue carbon agreements should be formed and help in cross-border collaboration in conserving and restoring blue carbon ecosystems. These agreements would facilitate alignment of policies, norms and funding arrangements of blue carbon projects, especially in areas where the coastal ecosystems cut across national boundaries e.g., the East Asian seas and the Pacific Islands (UNEP, 2020).

Implementation of binding agreements on the UNFCCC and CBD levels may be able to create exchanges of carbon credit and offer legal framework on the financing of blue carbon projects in developing nations. Such agreements might be consistent with international climate ambitions, so that

blue carbon ecosystems are incorporated into country determined contributions (NDCs) and carbon trading schemes by the Paris Agreement.

Policy Integration

The blue carbon must be integrated into national and regional policies to achieve the scale up of these projects and its integration with the larger climate strategies. Through the incorporation of blue carbon in the carbon action plans, the countries will be in a position to actualize the entire potential of these ecosystems in mitigating the emission of carbon and also meet the target of the climate.

Blue Carbon and Carbon Pricing Mechanisms.

Carbon pricing systems, including carbon taxes or cap-and-trade, that incorporate blue carbon within carbon offset packages are one of the most effective ways of integrating blue carbon into overall climate policy. Governments can use economic incentives to protect and restore blue carbon ecosystems, and this requires the acknowledgment of the carbon sequestration benefits of such ecosystems.

As an illustration, nations might establish a carbon offset market enabling enterprises to purchase blue carbon credits to compensate on their emissions, just as it is presently being done with terrestrial forest project in carbon market plans (Nellemann et al., 2014). This would motivate the actors in the private and the public sector to spend their money on the protection and recovery of the coastal ecosystems.

Incentives by the government to restore and protect the blue carbon ecosystems.

Legal incentives to restore and preserve blue carbon ecosystems may also be put forward by governments. This might involve subsidies of the owners of coastal lands or other individuals who participate in the mangrove, seagrasses, and salt marshes restoration works or habitat protection. Legal reform may also offer tax reductions or other incentives to have the investment in blue carbon credits by the private sector and due to that, it may become economical to have businesses involved in the conservation of blue carbon, as well as take part in reducing climate change (Wood et al., 2017).

Public-Private Partnerships

Both the private and the public sectors need to be involved in achieving the success of blue carbon projects. It is possible to use the opportunities of the public-private partnerships (PPP) to find the ways to attract the private investments in blue carbon restoration projects, and to keep these projects in line with the larger interests of the people concerning the mitigation of the climate and the protection of nature.

Taking advantage of Private Sector Investment.

Participation of the private sector can be enabled by the use of green bonds, impact investing, and corporate social responsibility (CSR) in blue carbon projects. The private companies can invest in blue carbon credits or in restoration initiatives, which will offset their emissions and will show their interest in being environmentally responsible. The international climate finance institutions, including World Bank and Global Environment Facility (GEF) can play a key role in catalyzing such partnerships by supporting project funding in developing countries where blue carbon ecosystems are most at risk.

International Climate Financing

Blue carbon projects can receive international financing via international climate funds, e.g. the Green Climate Fund (GCF) or Adaptation Fund, which are capable of funding large-scale restoration projects especially in developing nations where such efforts cannot be afforded by local communities. This money can also be utilized to fund capacity building and technical support to establish legal frameworks to allow blue carbon to be part of national climate plans (Parker et al., 2012).

Global Governance Recommendations.

Systems of International Relations.

In order to maximize the effect of blue carbon initiatives, it is necessary that international cooperation should take place. The global governance systems should aim at encouraging transnational cooperation in conserving the blue carbon, with such undertakings being carried out in regions with a common marine ecosystem. The UNFCCC and the CBD can be instrumental in creating this partnership by harmonizing activities, setting national policies, and making the blue carbon ecosystems a part of the climate agenda and the national biodiversity protection objectives.

The International Organizations.

Through technical support, capacity building and financial assistance of blue carbon projects around the world the international organizations (World Bank, GEF and the United Nations Environment Programme (UNEP)) play a crucial role. These organizations can also assist in building the global blue carbon markets and developing standardized certification systems to ensure that these ecosystems are taken good care of and restored in a manner that serves the global climate interests.

5. Conclusion

Mangroves, seagrasses and salt marshes are examples of blue carbon ecosystems that are important components of climate change mitigation as they serve as an important carbon sink. These ecosystems have been found to capture carbon much faster than the terrestrial ecosystem hence a vital instrument in the quest to reduce global warming. Nevertheless, blue carbon ecosystems are under the attack of considerable threats of coastal development, pollution, overfishing, and climate change itself. There should be effective legal frameworks and policy measures to conserve and rehabilitate these ecosystems and to full exploit their potential of reducing climate change.

The difficulties of the blue carbon projects are complex. Legal frameworks tend to be inadequate or disjointed, and there is not much integration in the carbon market, no vivid certification of carbon credits, and minimal financial incentive motivating restoration and protection. There is also a challenge in effectively measuring and monitoring carbon sequestration, which is essential for ensuring that these ecosystems contribute to nationally determined contributions (NDCs) under the Paris Agreement. The integration of blue carbon into broader climate strategies and coastal management policies remains a key challenge, with limited recognition of their importance in climate policy at the national and international levels.

Looking to the future, the role of blue carbon ecosystems in global climate policy will only continue to grow as nations seek to meet climate targets set under the Paris Agreement. These ecosystems offer not only a natural solution to carbon sequestration but also significant co-benefits, including biodiversity conservation, coastal protection, and the support of local livelihoods dependent on marine resources. Legal and policy innovations will be crucial in scaling up blue carbon initiatives. These innovations should include blue carbon certification schemes, the creation of Marine Protected Areas (MPAs) focused on these ecosystems, and the establishment of international agreements to coordinate cross-border efforts in managing blue carbon resources. By recognizing the unique contributions of blue carbon ecosystems, legal frameworks can be adapted to include them as a key component of climate adaptation and mitigation strategies.

To unlock the full potential of blue carbon ecosystems, international cooperation is urgently needed. Governments, international and stakeholders should collaborate to align legal frameworks at the international level and develop viable governance frameworks to protect blue carbon. Cooperation plays a very important role in enhancing the sustainable management of blue carbon ecosystem, especially in areas that have transboundary coastal ecosystem.

Such initiatives as blue carbon in international agreements and carbon markets will also be necessary to promote investment and make these projects sustainable. Partnerships among the government and the businesses may also serve to expand the restoration processes and to incorporate the blue carbon in larger climate finance schemes. Incorporating blue carbon projects into national climate policies, especially via the UNFCCC and CBD would allow these ecosystems to help achieve global climate objectives, increase climate resilience, and promote a healthy future of marine systems.

A positive prospect of mitigation and recovery of blue carbon ecosystems provides a relevant chance to combat climate change and loss of marine biodiversity at the same time. By taking decisive action now to strengthen legal frameworks, promote sustainable policies, and foster international collaboration, we can ensure that these ecosystems continue to provide invaluable services for future generations.

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