Neufin

Carbon Sector Spotlight

Blue Carbon

Project Development Opportunities in India

About Neufin

Neufin is a technology platform for businesses to simplify access to green financing. Our mission is to become the platform that powers the world's transition to zero emissions. We aim to address the USD 0 trillion/year gap in climate finance globally through innovative delivery of financial products across key stressed geographies - India, Southeast Asia (SEA), Middle East & Africa (MEA). Neufin has extensive experience working on the voluntary carbon market. Our products range across the carbon value chain - simplifying the carbon offset generation process, providing market access for the sale of offsets, pricing strategies, market intelligence as well as legal-commercial advisory. We help businesses retain the maximum value for their carbon assets.

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About the report

The blue carbon ecosystem offers us immense mitigation potential. The sector remains largely untapped due to regulatory, economic, and scientific complexities. India particularly, is home to a vast expanse of distressed mangrove ecosystems that underscore the need to accelerate conservation and restoration efforts. However, the policy and regulatory landscape is in a nascent phase and needs to evolve rapidly. To add to the complexity, blue carbon projects often require a large investment corpus. The investment gap is reinforced by the risk potential inherent to projects in ecologically sensitive zones. Coastal ecosystems are prone to impact from climate-related physical in the form of natural calamities such as flooding, which can cause considerable damage to the project site, and consequently, investments made into building projects in such a region. In a sector where action is time-sensitive and adequate funding is in short supply, carbon markets emerge as a viable pathway to bridge this financing gap.

This report provides a comprehensive overview of the blue carbon ecosystem. It provides project developers and investors a guide for making decisions regarding developing and investing in financial and human resource-intensive projects such as those in the blue carbon ecosystem. In the first half of the report, we dissect the fundamentals and explore the investment outlook and potential for blue carbon projects. We then adopt an India-focused lens and dive into the policy and regulatory apparatus governing the ecosystem, as well as the complexities that project developers and investors must be well-acquainted with before investing organisational resources.

The second half of the report acts as a stepwise guide to understanding the processes involved in developing a blue carbon project in the VCM. This includes understanding the carbon market at two levels; market demand, and project logistics. The report covers a range of considerations to be made to ensure adequate economic and environmental return on investment for both project developers and investors. These considerations include understanding the project development life cycle, selection criteria for a project site, as well as the demand and supply for carbon credits emerging from blue carbon projects.

The reader must note blue carbon projects are complex in comparison to other carbon projects. Coastal regulations and policies are an undertaking of both, central and state governments, and hence the compliance framework may vary from region to region. This report also provides the reader with an India focused overview. Neufin can undertake a regional analysis upon request.

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Glossary

APWD: Avoiding Planned Wetland Degradation

AUWD: Avoiding Unlanned Wetland Degradation

BCE: Blue Carbon Ecosystem

CIW: Conservation of Intact Wetlands

CRZ: Coastal Regulation Zone

CVCA: Critical Vulnerable Coastal Areas

EIA: Environment Impact Assessment

ESA: Ecologically Sensitive Area

FY: Financial Year

GHG: Greenhouse Gas(es)

gtCO2e: gigatonnes of carbon dioxide equivalent

HTL: High Tide Line

ICVCM: Integrity Council for Voluntary Carbon Market

IFC: International Finance Corporation

IPCC: Intergovernmental Panel on Climate Change

ISFR: Indian State of Forests Report

LEK: Local Ecological Knowledge

LTL: Low Tide Line

MISHTI: Mangrove Initiative for Shoreline Habitats and Tangible Income

NDC: Nationally Determined Contributions

NBS: Nature Based Solution

NGO: Non-Governmental Organisations

NWCP: National Wetlands Conservation Program

PDD: Project Design Document

RWE: Restoring Wetland Ecosystems

SDG: Sustainable Development Goals

TEK: Traditional Ecological Knowledge

UNFCCC: United Nations Framework Convention on Climate Change

UT: Union Territory

VCM: Voluntary Carbon Market

VCMI: Voluntary Carbon Market Integrity Initiative

VCS: Verified Carbon Standard

WRC: Wetlands Conservation and Restoration

Introduction

Blue carbon has increasingly attracted more attention in recent years due to its significant role in mitigating climate change. As the world grapples with the urgent need to reduce greenhouse gas emissions, Blue Carbon Ecosystems (BCE), such as mangroves, seagrasses, and salt marshes, have emerged as powerful allies. These coastal and marine habitats sequester and store carbon dioxide at remarkable rates, offering a nature-based solution to offset carbon emissions. Beyond carbon sequestration, they also provide coastal protection, support biodiversity, sustain fisheries, and bolster the resilience of coastal communities in the face of climate-related challenges. Incorporating blue carbon into climate discussions and conservation efforts can significantly accelerate action towards achieving carbon neutrality and building climate resilience, making it an extremely important component of global climate change strategy.

What is blue carbon?

Blue Carbon refers to the carbon stored in coastal and marine ecosystems, specifically in vegetation and sediments of these environments. Unlike traditional carbon sequestration in terrestrial forests, blue carbon is unique because it occurs in coastal and aquatic environments. Seagrasses, mangroves, and salt marshes situated along coastlines function as carbon stores and serve as what is known as a carbon reservoir. These coastal ecosystems, despite being considerably smaller in scale compared to Earth's forests, have the capacity to sequester carbon at a significantly higher rate and can continue to do so for millions of years. Most of the carbon absorbed by these environments is stored beneath the surface. Remarkably, the carbon contained within coastal soil often dates back thousands of years.

When these systems suffer damage, an extensive quantity of carbon is released back into the atmosphere, where it subsequently contributes to climate change. Thus, safeguarding and rejuvenating coastal habitats represents an effective strategy to mitigate climate change.

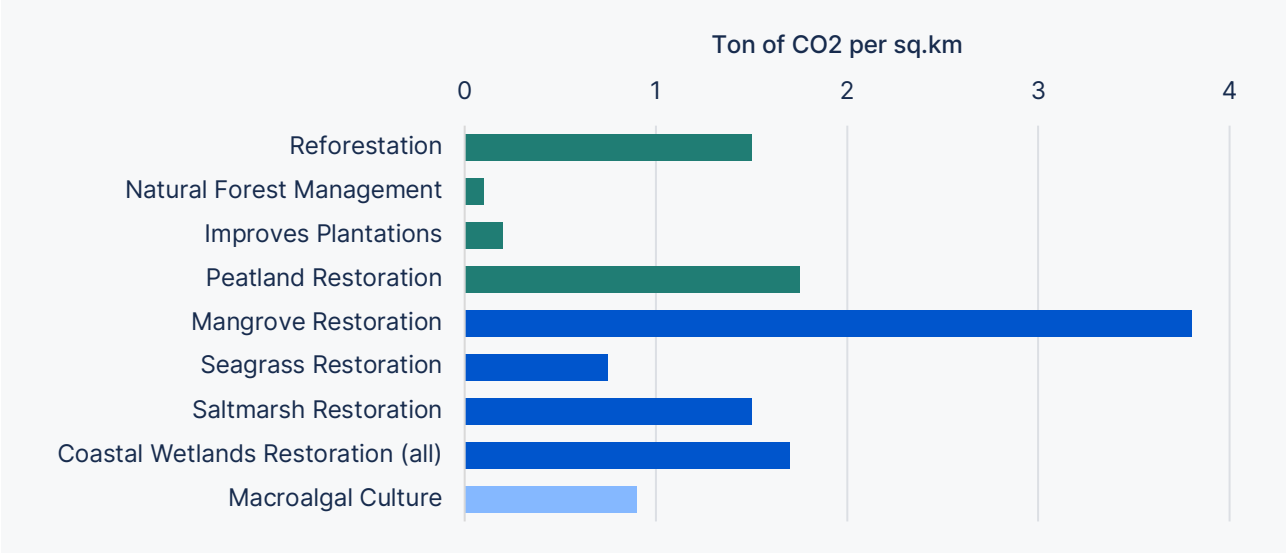

Figure 1: Mitigation Potential per Unit Area of Restoring Land-based and Marine Ecosystems
Source: The Ocean as a Solution to Climate Change, World Resources Institute

According to an analysis carried out by the Ocean Panel and the World Resources Institute, although the mitigation potential of restoring green ecosystems, notably forests, is greater in total, the mitigation potential of blue ecosystems per unit area is very high, as visible in the figure above.

Types of blue carbon ecosystems

Blue carbon ecosystems encompass a variety of coastal and marine habitats that are highly effective at sequestering and storing carbon. The main types of blue carbon ecosystems include:

Mangroves

Mangroves, a unique group of salt-tolerant trees, thrive in intertidal zones of tropical and subtropical regions across the globe. Covering approximately 14.8 million hectares, with 5.4 million hectares protected, these ecosystems are concentrated primarily in Indonesia, Brazil, Nigeria, and Mexico [International Finance Corporation, 2023]. Mangroves are remarkable for their ability to tolerate saltwater and secrete excess salt through their leaves. They serve as vital carbon sinks, storing up to 6.4 gigatons of carbon and sequestering over 24 million metric tons of CO_2 annually — making them crucial contributors to climate change mitigation [IFC, 2023].

Despite their ecological importance, mangroves have faced significant challenges. Since 1980, deforestation has led to the loss of 20-35% of mangrove forests, primarily due to activities like agriculture, aquaculture, and coastal development. Deforestation hotspots are prominent in South America and Southeast Asia, where shrimp farming has been a major driver of mangrove conversion, resulting in the emission of an estimated 317 million metric tons of CO_2 equivalent between 2000 and 2012. While deforestation rates have somewhat decreased in recent years, ongoing mangrove conversion still releases nearly 14,000 metric tons of CO_2 per year [IFC, 2023].

Salt marshes

Salt marshes, formed by mineral sediments and organic material accumulation, play a crucial role in coastal ecosystems. They are mainly found outside the tropics, with significant coverage in the United States, Canada, Europe, Australia, and emerging markets like Argentina, Mexico, and Russia. These marshes are vital for filtering pollutants, improving water quality, and serving as critical habitats for marine species, essential for healthy fisheries.

Globally, salt marshes cover an estimated 5.5 million hectares and have an average annual carbon sequestration rate of 6 to 8 metric tons of CO_2 equivalent per hectare. The loss of salt marshes is occurring at rates of 1 to 2 per cent annually, resulting in estimated emissions ranging from 0.02 to 0.24 gigatons of CO_2 equivalent per year [IFC, 2023]. In industrialised countries, salt marshes often suffer from severe degradation due to levee construction, infrastructure development, and agricultural use, disrupting their connection to the sea and altering their natural functions.

Seagrass meadows

Seagrasses are crucial underwater flowering plants with deep roots, growing up to four meters in length. These coastal ecosystems are vital for a multitude of reasons, including supporting food security, combating climate change through carbon storage, enhancing biodiversity, purifying water, and protecting coastlines. Despite covering just 0.2 per cent of the seafloor, seagrasses have the remarkable ability to store up to twice as much carbon per hectare as terrestrial forests, contributing to burying 10 per cent of all carbon annually in the ocean. Some estimates suggest that the world's

seagrass meadows, spanning 946 locations, could potentially store up to 8.4 gigatons of CO_2 equivalent [IFC, 2023].

Despite their ecological significance, seagrasses are among the most threatened and least conserved marine ecosystems. Only 26 per cent of recorded seagrass meadows are in protected areas, and it's estimated that 29 per cent of these ecosystems have been lost, with an annual loss rate of 1.5 per cent. The degradation of seagrass ecosystems also contributes to emissions of 0.05 to 0.33 gigatons of CO_2 equivalent per year [IFC, 2023]. Seagrasses face various threats, including nutrient and sediment runoff, boating activities, land reclamation, dredge-and-fill projects, and harmful fishing practices.

How does blue carbon benefit the environment?

Blue carbon can play a vital role in mitigating climate change, protecting coastlines, preserving biodiversity, improving water quality, and sustaining both ecosystems and human livelihoods. Some of the ways in which blue carbon projects can benefit their environment are:

Carbon sequestration: Blue Carbon ecosystems capture and store significant amounts of carbon dioxide (CO2) from the atmosphere.

Biodiversity support: Blue Carbon habitats provide essential breeding and feeding grounds for various marine species, including fish, crabs, and shrimp.

Coastal protection: They act as natural buffers against coastal erosion and storm surges by reducing the impact of sea-level rise and extreme weather events.

Water quality improvement: Seagrass meadows filter pollutants, trap sediment, and improve water quality in coastal areas, enhancing the overall health of coastal ecosystems.

Support to coastal economies: Well-preserved coastal areas with healthy blue carbon ecosystems can attract tourists interested in water sports and activities.

Additional revenue source through carbon markets: Some blue carbon projects involve carbon trading and payments for ecosystem services, providing an additional income source for coastal economies.

Figure 2: Potential benefits of blue carbon projects

Blue carbon ecosystems are strong contenders for conservation financing because they have suffered considerable historical losses and remain threatened globally. The loss of habitat has historically been a major source of carbon emissions and will continue to be so in the future. For example, if the ongoing loss of mangroves persists, it is estimated that nearly 3400 gtCO2e could be released by 2100, including foregone soil carbon sequestration. These ecosystems also have the potential to further reduce emissions through restoration efforts. While net carbon sequestration depends on the age of the restoration, restored ecosystems can rapidly sequester carbon and reduce methane emissions by reintroducing tidal exchange. The potential for carbon gains is substantial, given that at least 800,000 ha are suitable for mangrove restoration worldwide, and similar opportunities exist for the restoration of other BCEs [Macreadie et al, 2021]. When avoided emissions and restoration are combined, the potential for carbon additionality is substantial. On a global scale, conserving all BCEs could prevent emissions of 141–466 gtCO2e annually, and their large-scale restoration could draw down an additional 621–1064 gtCO2e annually [Daneil et al., 2022]. Together, these carbon benefits equate to approximately 3% of global carbon emissions. The total value of blue carbon wealth generated through carbon sequestration has been estimated at over USD 190 billion per year [Griscom et al., 2017].

Mitigation Option		**Mitigation Potential (GtCO2e/year)**	
		2030	**2050**
Conservation Potential mitigation from halting loss and degradation of ecosystems	Mangroves	0.018 – 0.040	0.009 – 0.037
	Saltmarshes	0.001 – 0.003	0 – 0.002
	Seagrasses	0.003 – 0.034	0.003 – 0.034
Restoration Potential mitigation from restoring and rehabilitating ecosystems and organisms	Mangroves	0.004– 0.026	0.028 – 0.172
	Saltmarshes	0.001 – 0.002	0.004 – 0.015
	Seagrasses	0.001 – 0.004	0.007 - 0.025

Table 1: Mitigation Potential from Blue Carbon Ecosystems, 2030 and 2050
Adapted from: Oceans as a solution to climate change, World Resources Institute

As established above, conservation and restoration of these coastal systems can help mitigate billions of tons of CO2e, inching the planet closer to its climate mitigation goals. While the mitigation potential of conservation activities may appear less in contrast with that of restoration activities, neither can be ignored. However, we must gradually shift our focus from conservation to restoration to tap into the carbon sequestration potential of the coastal ecosystems.

Blue carbon ecosystems and carbon markets

As established in the previous section, restoration and conservation of blue carbon ecosystems is steadily gaining prominence as a key nature-based solution. Despite this, the implementation of blue carbon projects is challenging. Some of these hurdles are shared below:

- **Lack of Awareness:** Many people, including policymakers and potential investors, are not fully aware of the role coastal and marine ecosystems play in carbon sequestration. This lack of awareness has led to insufficient attention and funding for blue carbon initiatives.
- **Complex Ecosystems:** Coastal and marine ecosystems are intricate and dynamic, making them more challenging to manage and restore compared to other carbon offset projects. This complexity can deter potential project developers.
- **Funding Constraints:** Blue carbon projects often require substantial financial resources for research, restoration, and long-term monitoring. Limited funding options can hinder their development.
- **Regulatory Hurdles:** In some regions, regulatory or legal apparatus may be complex or lacking and thus, may hinder the implementation of blue carbon projects, which can discourage potential investors.

Active participation of key stakeholders, particularly the commercial sector, in Payments for Ecosystem Services (PES), is crucial for the success of mangrove blue carbon projects. Commercial decisions about blue carbon preservation and restoration opportunities are currently blocked by gaps in understanding the potential climate mitigation benefits and financial returns on investment for with these projects at a national, regional, and global scale. To make an informed decision, it is crucial that stakeholders understand the scientific and financial potential that blue carbon projects hold.

The potential of Blue Carbon Projects – an investment perspective

Private sector financing can play a vital role in supporting a range of conservation efforts aimed at coastal ecosystems and in ensuring the effective and efficient attainment of NDCs. The burgeoning market for blue carbon credits is one such avenue for financing, and can help overcome several challenges by providing financial incentives and a structured framework for blue carbon projects:

- **Financial Incentives:** Carbon markets offer a source of revenue for blue carbon projects through the sale of carbon credits. This financial incentive can make these projects more economically viable and attractive to investors.

- **Emission Reduction Benefits:** Blue carbon projects help reduce overall greenhouse gas emissions by capturing and storing carbon, contributing to climate goals. This aligns with the objectives of carbon markets, which aim to incentivise emission reductions.
- **Increased Awareness:** By incorporating blue carbon into carbon markets, there is a higher likelihood of raising awareness about the importance of coastal and marine ecosystems for carbon sequestration, leading to increased support and investment.
- **Standardisation and Verification:** Carbon markets often require projects to adhere to standardised protocols and undergo rigorous verification processes. This can enhance the credibility and accountability of blue carbon initiatives.

Blue carbon has garnered special attention from businesses seeking to compensate for emissions that cannot be reduced through decarbonisation and efficiency improvements in production. At present, nature-based solutions (NbS), which are primarily centered on terrestrial carbon, receive a minimal share of global climate funding, despite their capacity to significantly contribute to reducing carbon levels by 2030. Nevertheless, there is an expectation of a rapid increase in funding, especially since corporate entities are increasingly committing to achieving net-zero emissions targets. Blue carbon has attracted interest because it is viewed as an NbS offering additional benefits that align with organisations' corporate social responsibility (CSR) mandates.

Despite the corporate sector interest and a substantial number of scientific studies focusing on BCE, only a limited number of blue carbon projects are generating and selling carbon credits at present. Consequently, the significant demand for blue carbon credits from the corporate sector remains untapped. Blue carbon offsets remain highly specialised for now but are expected to become mainstream once specific obstacles preventing their growth are addressed.

Blue carbon currently represents a relatively small portion of the carbon market, but its potential within the voluntary carbon market is substantial. According to a 2021 study, approximately 20% of the world's mangrove area, totalling around 2.6 million hectares, could potentially qualify for blue carbon credits related to avoiding deforestation, generating USD 1.1 billion annually [Zeng et al., 2021]. The table below presents the findings from the same study, where it highlights the regional estimates of the extent, climate mitigation potential, and return on investment (based on net present value) of financially viable mangrove blue carbon.

Region	Extent (ha)	Climate mitigation potential (tCO2e / year)	Net Present Value (million USD)
Global	1,054,900 (±78,000)	26,164,000 (±4,664,000)	1,188.89 (±241.2)
Americas	58,800 (±17,800)	1,871,000 (±718,000)	47.75 (±21.72)
Africa	240,500 (±14,900)	3,940,000 (±597,000)	211.32 (±35)
Asia	703,600 (±42,600)	19,153,000 (±3,183,000)	874.47 (±175.03)
Oceania	51,900 (±2,700)	1,199,000 (±156,000)	55.35 (±8.83)

Table 2: Regional estimates of the extent, climate mitigation potential, and return on investment (based on net present value) of financially viable mangrove blue carbon. Adapted from: Global potential and limits of mangrove blue carbon for climate change mitigation

The higher rates of habitat loss observed in ecosystems like seagrasses suggest even greater potential for other BCEs. A 2019 market survey has shown that 51% of asset managers see investment opportunities in blue carbon, driven by regulatory requirements and corporate social responsibility mandates [Vanderklift et al., 2019]. Major banks have highlighted the need for an USD 11.1 billion investment in global mangrove restoration to achieve carbon sequestration goals [Earth Security, 2020], which has also piqued the interest of accounting firms and asset managers [KPMG, 2021].

The commercial interest in blue carbon has grown to the point where investors are actively seeking and funding blue carbon opportunities. A prominent bank recently announced the launch of two natural capital funds that aim to raise a combined investment capital of up to USD billion, with a particular focus on blue carbon ecosystems [HSBC, 2020].

Carbon project developers are collaborating with investors and other stakeholders to establish frameworks that facilitate the development of blue carbon projects such as the Blue Carbon Facility [Mirova, 2021]. Similarly, initiatives like the Blue Natural Capital Financing Facility and the Blue Carbon Accelerator Fund have been created to foster collaboration among stakeholders, including financiers, technology providers, and academia [IUCN, 2021]. The World Economic Forum has initiated the Blue Carbon Challenge, aimed at identifying and supporting potential blue carbon projects through financing, training, and education [Gardeiner, B and Bell, V., 2021]. In February 2022, during the global One Ocean Summit, French President Emmanuel Macron announced the establishment of the Global Blue Carbon Coalition, bringing together governments, intergovernmental organisations, international NGOs, and banking and insurance partners to scale up blue carbon projects [Conservation International, 2022]. These examples illustrate that various structures and partnerships are now being established to facilitate the development of blue carbon projects. This is a positive signal that the commercial sector is increasingly ready to leverage and invest in blue carbon opportunities over the next 2-3 years.

The Indian context

India's commitment to achieving its 2070 net-zero target requires a comprehensive exploration of all possible strategies that can help the country decarbonise. In this context, nature-based solutions such as blue carbon ecosystems, including mangroves, tidal and salt marshes, and seagrasses, have the potential to play a critical role in carbon sequestration. However, India's 'Long-Term Low-Carbon Development Strategy' document, which it has submitted to the United Nations Framework Convention on Climate Change (UNFCCC), does not adequately emphasise this opportunity [Thakur, P. and Jena, L., 2022]. The absence of a clear plan for restoring and maintaining blue carbon storage assets could become a significant source of carbon emissions in the future.

Status of Blue Carbon in India

India has a wealth of wetland ecosystems distributed in different geographical regions. Most of the wetlands in India are directly or indirectly linked with major river systems such as the Ganges, Cauvery, Krishna, Godavari and Tapti. The country has a total of 757,060 wetlands, of which 188,470 are inland wetlands and 13,033 are coastal wetlands [Bassi et al., 2014]. Coastal wetlands occupy an estimated 4,140,116 hectares and are largely dominated by mangrove vegetation. About 80% of the mangroves are distributed in the Sunderbans of West Bengal, Gujarat, and the Andaman and Nicobar Islands, with the rest being spread across the coastal states of Odisha, Andhra Pradesh, Tamil Nadu, Karnataka, Kerala, Goa, and Maharashtra.

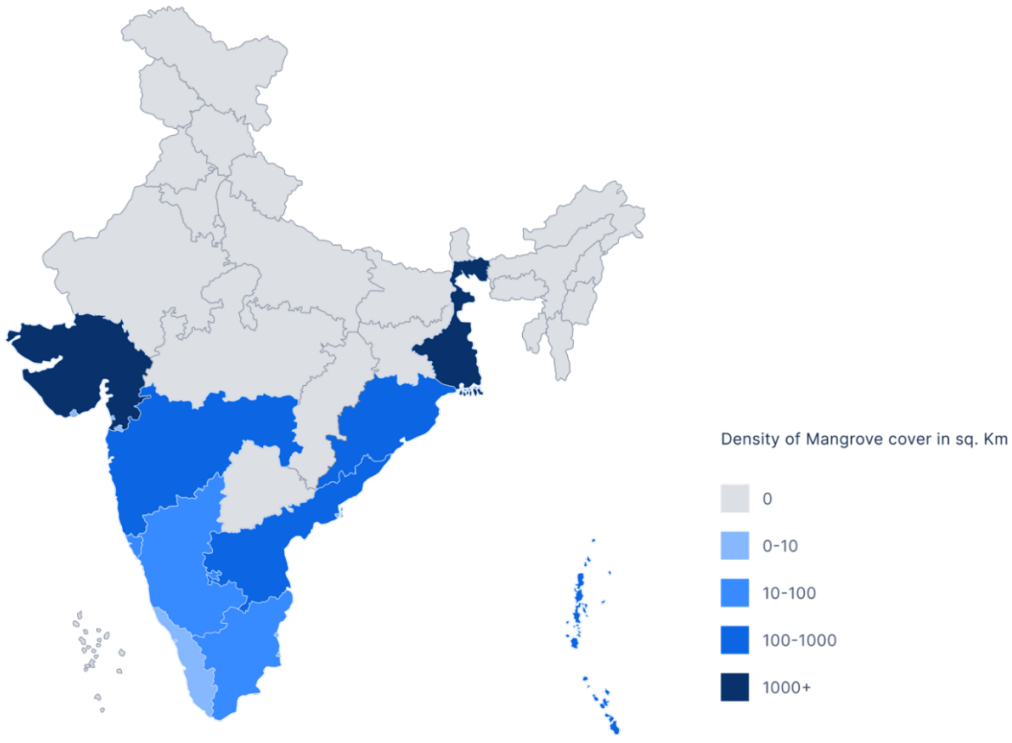

Figure 2: Mangrove cover in India
Source: ISFR 2021

Mangrove cover in India

According to the 2021 India State of Forest Report (ISFR-2021) [Ministry of Environment, Forest, and Climate Change, 2022], India has about 3% of the total mangrove cover in South Asia, and the country's mangrove cover has increased by 54 square km (1.10%) as compared to the previous 2019 assessment. West Bengal has 42.45% of India's mangrove cover, followed by Gujarat 23.66% and Andaman & Nicobar Islands 12.39%. While the cover has increased [The Mangrove Alliance, 2022], mangroves, however, are under threat. India's mangroves along the Bengal coastline, already at risk due to climate change, sea level rise and land use changes, are beginning to fast erode according to new research [Mondal, B. and Saha, AK., 2018]. Mangroves show conspicuous tone and texture on the satellite images. According to a study conducted by The Energy Resources Institute (TERI), the trend in sequestration potential of mangroves in India over the years is positive, as can be seen in the image below.

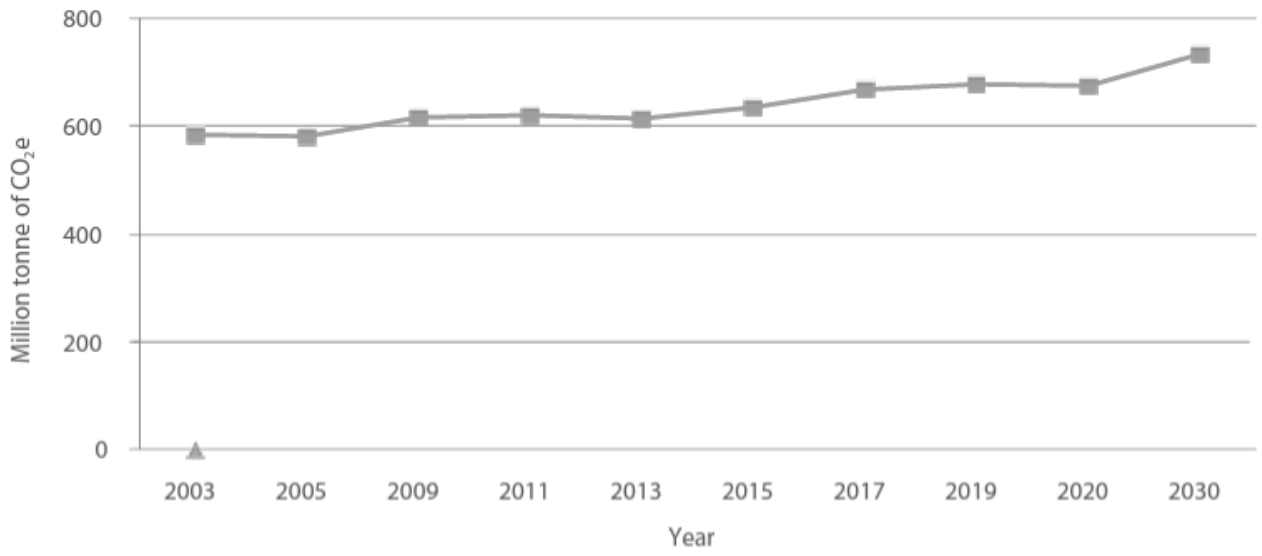

Figure 3: Sequestration potential for mangroves in India
Source: Scope and potential of coastal ecosystems towards mitigating climate change

In the ISFR-2021 assessment, the mangrove cover has been categorised into Very Dense (canopy density of 70% and above), Moderately Dense (canopy density of 40% and more but less than 70%) and Open categories (canopy density of 10% and more but less than 40%) [Ministry of Environment, Forest, and Climate Change, 2022]. The assessment [Ministry of Environment, Forest, and Climate Change, 2022] shows that mangrove cover in the country is 4,992 sq km, which is 0.15% of the country's total geographical area. Very Dense mangrove comprises 1,475 sq km (29.55 %) of the mangrove cover; Moderately Dense mangrove is 1,481 sq km (29.67 %) while Open mangroves constitute an area of 2,036 sq km (40.78 %). There has been a net increase of 17 sq km in the mangrove cover of the country as compared to the 2019 assessment.

The States that show significant gain in mangrove cover are Odisha (8 sq km) and Maharashtra (4 sq km). The reason for the increase in mangrove cover in Odisha is mainly due to the natural regeneration, plantation activities in suitable land such as the banks of the rivers near estuaries and on intertidal mudflats associated with areas that are inundated by seawater on a daily cycle. The increase in mangrove cover has been observed in the districts of Kendrapara, Jagatsinghpur and Balasore in Odisha. In Maharashtra, the increase in mangrove cover is mainly due to natural regeneration. The increase has also been observed in the South 24 Parganas district of West Bengal. The State/UT-wise

extent of mangrove cover in the three canopy density classes along with the change in comparison to the 2019 assessment is presented in the table below:

	State / UT	**Very Dense Mangrove** (in sq. km)	**Moderately Dense Mangrove** (in sq. km)	**Open Mangrove** (in sq. Km)	**Total** (in sq. Km)	**Change with respect to ISFR 2019**
1	Andhra Pradesh	0	213	192	405	1
2	Goa	0	21	6	27	1
3	Gujarat	0	169	1,006	1,175	-2
4	Karnataka	0	2	11	13	3
5	Kerala	0	5	4	9	0
6	Maharashtra	0	90	234	324	4
7	Odisha	81	84	84	259	8
8	Tamil Nadu	1	27	17	45	0
9	West Bengal	994	692	428	2,114	2
10	A&N Islands	399	168	49	616	0
11	D&NH and Daman & Diu	0	0	3	3	0
12	Puducherry	0	0	2	2	0
13	**Total**	**1,475**	**1,481**	**2,036**	**4,992**	**17**

Table 3: Mangrove Cover Assessment (2021)
Source: ISFR 2021

Barriers to developing blue carbon projects in India

Despite the environmental benefit of restoring and conserving BCE being well studied and mounting investor interest in the space, the market for blue carbon credits remains relatively untapped. This is because a host of factors come together to create a complex environment for the development of blue carbon projects. Economic, scientific, and political challenges coupled with the systemic complexity of the carbon market create an intimidating ecosystem for stakeholders across the spectrum. This section addresses the various challenges and proposes broad solutions.

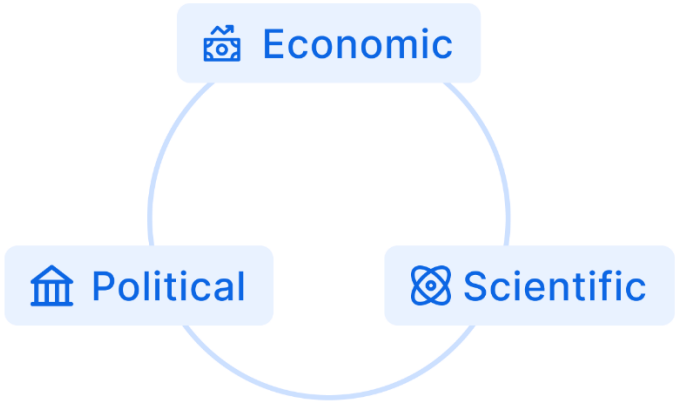

Figure 4: Barriers to developing carbon projects in India

Economic Barriers

Sustainable and Long-Term Financing

Blue carbon projects often require sustained funding over an extended period. The long-term financial commitment required for monitoring, maintenance, and conservation activities can be challenging to secure, especially when considering the economic uncertainties over time. Mangrove restoration projects that align with ethical and ecological principles cannot be completed in just two to three years; instead, they require an extended timeframe, spanning two to three decades. In order to obtain carbon accreditation, it's imperative to adhere to a 20 to 30-year timescale.

Investors typically prefer substantial projects with brief completion timelines as they are easier to oversee and more cost effective. Most blue carbon projects often involve smaller-scale endeavours, spanning hundreds of hectares rather than thousands, primarily due to decentralised ownership or control [Beeston, M. and Vermilye, J., 2020]. The process of restoring or expanding these project sites is a lengthy one, requiring 20 to 30 years to reach maturity.

Solution: For any sustainable solution, it is essential to transition towards a commercially viable business model. The constant need for securing extended funding consumes both time and resources that could be more effectively allocated elsewhere. Short-term financial support has, at times, incentivised the use of misleading metrics for gauging success, such as the annual count of planted seedlings. Furthermore, long-term monitoring of seedling survival, which often falls beyond the immediate project scope, may not receive due attention, potentially resulting in unreported seedling mortalities of up to 100%. It's noteworthy that no recognised carbon standard regards mass planting as a valid method for restoration.

To reconcile the disconnect between investor expectations and the actual realities of blue carbon projects, it is imperative to incorporate this extended timeline and the associated costs into the projected returns. To address the current challenges of time delays and high expenses in assessing carbon sequestration, there is potential for innovative monitoring techniques that offer more frequent assessments over extended periods at minimal costs. Enhanced comprehension and monitoring play a pivotal role in making well-informed evaluations and mitigating disparities in expectations.

Economic Valuation Challenges

Assigning a clear economic value to the carbon sequestration and other ecosystem services provided by blue carbon ecosystems can be complex. This can hinder the development of market-based mechanisms to generate revenue, such as carbon credits or Payments for Ecosystem Services (PES).

The current revenue generated per hectare from carbon credits in mangrove ecosystems is not competitive when compared to income from aquaculture or alternative land uses. Despite the notably high rates of carbon sequestration and storage within mangroves, the issue lies in the prioritisation of short-term gains over the considerably larger benefits achievable in the long run. The pricing of carbon credits, which is often based on monoculture forestry projects, fails to account for the added value associated with mangroves and other blue carbon initiatives. It also overlooks the broader economic worth of the services provided by mangrove ecosystems. Blue Carbon projects, however, offer supplementary advantages, that have already been discussed in the introduction.

Solution: There is a requirement for a distinct pricing system and market specifically tailored for blue carbon. This system would encompass the intrinsic worth of blue carbon ecosystems in relation to fisheries, food security, biodiversity, and other factors. It could also be designed to enable the layering of Payments for Ecosystem Services (PES). As an example, a novel "credit" founded on the coastal protection capabilities of undisturbed mangroves could potentially be introduced into the market within the coming years. This fresh pricing framework would come with its unique identity or branding, akin to the concept of Fair Trade, and it would be reinforced by a robust system of regulations to ensure the credibility of project outcomes.

Market Volatility for Carbon Credits

Blue carbon projects may rely on revenue from the sale of carbon credits. The volatile nature of carbon markets can impact the economic viability of these projects, as fluctuating credit prices may affect revenue projections and investment returns.

Solution: Anticipating that a distinct pricing mechanism for blue carbon would remain unaffected by the immediate influences of the larger carbon market is not practical. It is worth exploring the possibility of linking blue carbon pricing to predefined timeframes, similar to the concept of bonds and other time-based financial instruments. Consequently, blue carbon agreements could guarantee a fixed value for a specified duration.

Scientific Barriers

Lack of access to scientific knowledge

The research required to support coastal carbon initiatives has made substantial progress. Recent peer-reviewed scientific papers are fairly well disseminated within a limited circle of mangrove experts and conservation biologists. However, disseminating these findings to a broader audience is often inadequate. Local stakeholders' capacity to discover, access, comprehend, and apply this research is restricted, given that it is frequently concealed behind technological or language barriers. Their ability relies on stakeholder access to training and guidance from scientists. This presents a noteworthy obstacle to local management of blue carbon projects and sustains a dependency on external expertise rather than fostering local capacity development.

Solution: Field projects require guidance for making well-informed decisions. This process begins with an evaluation of the current ecosystem, followed by the identification of key issues to address and opportunities for enhancement. While some aspects can be addressed using general templates and guides, a more specialised tool becomes necessary when dealing with technical intricacies. According to a gap analysis based on primary research conducted in 2020 [Beeston, M. and Vermilye, J., 2020], there is potential to develop a decision tree model that encompasses the various factors that must be taken into account, such as tidal patterns, native species, sediment transport, and more. Such models could consolidate information from the wealth of existing research papers and guide into a practical field-ready format that requires less scientific expertise than is currently demanded. The delivery format for this resource should be carefully considered, covering online and offline access, digital and hard copy versions, and multiple languages, all while remaining openly accessible and free of charge.

Complexity of Proof

Accreditation standards necessitate precise quantification of carbon reserves, predictive models for assessing carbon capture under natural conditions versus the best and worst-case scenarios, and the capability for continuous monitoring. This entails a substantial workload and a requirement for competent personnel who might need to be hired. Furthermore, evaluations of methane and nitrous oxide emissions are obligatory. However, obtaining direct measurements of these greenhouse gases on-site is typically neither technically feasible nor economically viable for blue carbon projects. Consequently, accepted default values are employed as substitutes for accurate site-specific data.

Solution: There is a widespread consensus that the ecological principles underpinning mangrove restoration are firmly established. Best practices, often involving the restoration of site hydrology to facilitate natural recovery with limited planting [Lewis et al., 2019], are generally acknowledged methodologies. Detailed techniques for field-based carbon measurement are comprehensively outlined in the "Coastal Blue Carbon" manual by the Blue Carbon Initiative, while guidelines for project development and management are well-documented by Jane Glavan in 2013 [Galavan, 2013] and Crooks et al. in 2014 [Crooks et al. 2014].

When applied appropriately, these methods are widely recognised as valid by accreditation bodies. However, we have yet to identify a comprehensive resource that integrates guidelines for the biophysical management, sustainable development, and community engagement aspects with the necessary steps for accreditation into a coherent methodology tailored specifically for blue carbon projects. The provision of highly detailed technical guidance is challenging due to significant geographic variations in coastal system ecology, but there is a feasible opportunity to create a simplified model for project implementation.

Accreditation also mandates the modelling of projected methane and nitrogen oxide emissions or storage. Several universities and research institutions are working towards enhancing the availability of precise measurements of methane and nitrogen oxide fluxes. These measurements can serve as supporting evidence to refine the models used by blue carbon projects. It is evident that a more coordinated and well-funded endeavour is required to generate region-specific data, which should be recognised as a research priority.

Controlling for uncertainties

The process of natural regeneration may involve the management of ecosystem stressors that originate upstream, beyond the project's defined boundaries. In the context of mangroves, high-profile mass planting initiatives that garner attention but suffer from inadequate monitoring and significant failure rates have the unfortunate effect of redirecting resources away from more deserving projects.

Solution: Projects need to adopt a comprehensive perspective and account for the repercussions of elements that are beyond their immediate jurisdiction. For instance, the pollution from agricultural runoff may have detrimental effects on downstream ecosystems. Addressing this issue entails involving upstream farmers to identify feasible and agreeable solutions. The unintended outcomes of repetitively planting seedlings in pursuit of short-term economic gains can be effectively mitigated through the integration of the solutions outlined in this report. However, just as projects that fail to meet viability criteria should be assessed, all proposals should also undergo testing to ensure they do not introduce additional unintended consequences.

Political Barriers

Land tenure rights

As part of their 2020 study, Beeston and Vermilye interviewed the project staff involved in developing mangrove projects in south-east Asia. 100% of the interviewees stated that identifying who has the land tenure rights was a major issue. For instance, in areas where disused aquaculture ponds are located within former mangrove habitats, there is a theoretical potential for restoration and blue carbon projects. Although the land may have reverted to local communities, disputes over ownership, leaseholds, or usage rights are frequent, and identifying absent landowners can be complex. Dealing with land tenure matters is not insurmountable, but it can pose a costly, time-consuming, and intricate obstacle to project implementation. In one study conducted in Indonesia, for instance, two sites initially deemed to have 100% and 81% of the surveyed area suitable for restoration were ultimately reduced to a mere 2.5% and 0.4% of feasible restorable area once socio-political factors were considered [Brown et al, 2020]. In contrast, mangroves in Kenya are officially owned by the nation, and the Mikoko Pamoja project illustrated that management rights and carbon ownership can be granted to legally registered local cooperatives.

Solution: In the Indian context, the solution remains fluid for now. Since there is no national strategy to resolve issues, such as overlapping regulatory boundaries and unclear land rights, including defining where responsibility for coastal governance lies – project developers and investors are liable to gain clarity on the following matters, especially since the answers will vary from state-to-state:

- Who owns the land-use rights of coastal mangroves; is it national, regional, local or private?
- Who has the responsibility for policy, management and enforcement; is it the forestry department, marine department, or another agency?
- Who can earn carbon credit offset against the project – landowner or the project developer?

Fragmented governance

Perhaps the most challenging aspect of developing a blue carbon project India is the fact that multiple governmental control different aspects of blue carbon ecosystems. Project developers find themselves trying to navigate the rules and regulations set by multiple legislations, policies, and programs – often implemented by different authorities. Furthermore, mangrove systems may be regarded as either marine or terrestrial, or neither, or both, and are therefore subject to overlapping legislations. With policies existing at the state and central level in India, the chances of getting lost in the complex web of systems and bureaucratic processes are high.

Solution: While the responsibility to untie the knotted systems, and build long-term solutions lies with the government, project developers and investors must do their own due diligence. Thus, instead of a solution the next section of the report provides a comprehensive list of legislations and policies that govern blue carbon ecosystems in India

Indian policy and regulatory landscape

The growing recognition of the significance of coastal ecosystems in addressing and combating climate change is evident in the national commitments outlined in the Nationally Determined Contributions (NDCs). These NDCs serve as the primary policy and action plans at the national level for implementing the Paris Agreement among its 195 signatory nations. Out of these signatories, 28 countries have incorporated mentions of coastal wetlands in their strategies to mitigate climate change impacts. Additionally, 59 countries have included considerations for coastal ecosystems and coastal regions in their adaptation approaches. Furthermore, these nations have made specific references in their NDCs to at least one type of blue carbon ecosystem, such as seagrass beds, salt marshes, and mangrove forests. India, however, does not have a comprehensive blue carbon program. The 'Long-Term Low-Carbon Development Strategy' document submitted by India to the United Nations Framework Convention on Climate Change (UNFCCC) also does not focus on blue carbon as an opportunity to meet its climate commitments.

Instead, there are numerous policies and regulations that have been established to ensure that projects set up close to the coastline align with the coastal laws, rules, and regulations of the country. They encompass various aspects, including guaranteeing the safety of coastal areas (including disaster management), preserving biodiversity, planning for marine spatial use, bolstering livelihoods, conserving water resources, and managing waste, among other things. In this section, we capture relevant rules and policies, both at the union and the state level. This means a web of frameworks to navigate to ensure that blue carbon projects are in accordance with all legal and policy mandates.

Regulations and Policies Governing Coastal Ecosystems

Wetlands, ecosystems located at the interface of land and water, play a crucial role in securing human well-being and sustaining biological diversity. The Ramsar Convention is an intergovernmental treaty that provides the framework for national action and international cooperation for the conservation and wise use of wetlands and their resources. India ratified the Convention in 1982. As a fulfilment of its commitments to the Convention, India designated 75 wetlands to the list of Wetlands of International Importance of the Ramsar Convention.

With India's coastal wetlands being predominantly covered by mangroves, the regulatory and policy landscape primarily focuses on protecting and expanding the mangrove ecosystem compared to other blue carbon projects such as seagrass and saltmarshes. While projects developing seagrass and saltmarshes are also required to abide by relevant notifications, the ropes are tightened when it comes to mangrove projects as they fall under the list of Ecologically Sensitive Regions. As established above, investment in such projects must come after ensuring that the project is in line with the various state and central government regulations.

The following subsections discuss the Indian regulations and policies that may impact the offtake and success of the project:

- Wetlands (Conservation and Management) Rules, 2017
- Coastal Regulation Zone Notification, 2011 under the Environment Protection Act, 1986
- National Coastal Mission Program
- Mangrove Initiative for Shoreline Habitats and Tangible Incomes (MISHTI)
- National Wetland Conservation Programme (NWCP)

Wetlands (Conservation and Management) Rules, 2017

The Wetlands (Conservation and Management) Rules, 2017, are a set of regulations formulated to protect and manage wetland ecosystems in the country. These rules were enacted under the provisions of the Environment (Protection) Act, 1986

The rules define wetlands broadly to include areas such as lakes, rivers, ponds, marshes, swamps, and any other area that holds water, whether natural or artificial. They establish a process for identifying and cataloguing wetlands at the state and national levels. State Wetland Authorities are responsible for preparing and updating lists of wetlands within their jurisdiction. The 2017 rules also provide guidelines on the following:

Protection and Conservation: The rules lay down provisions for the protection and conservation of wetlands. States are required to take measures to ensure that wetlands are not drained, reclaimed, or used for non-wetland purposes.

Regulation of Activities: The rules prohibit certain activities within wetlands or within a specific distance from the boundary of wetlands, which may have an adverse impact on their ecological character. These activities include reclamation, setting up of industries, construction, and disposal of waste.

Prior Approval: Prior approval from the State Wetland Authority is required for any activity or project within a wetland or its buffer zone that is likely to have an adverse impact on the wetland's ecological character.

Management Plans: The rules emphasise the development of wetland management plans by State Governments and Union Territory Administrations for the conservation and sustainable management of wetlands.

Pollution Control: They also address issues related to water quality and pollution control within and around wetlands.

Violations of these rules can result in penalties, which may include fines and imprisonment. Since the rules clearly highlight the role of State Wetland Authorities in gaining prior approval for a project and also mandate the establishment of state-wise management plans, it is important that project developers and investors maintain caution and ensure that necessary permits have been secured through state authorities.

Coastal Regulation Zone Notification, 2011 under the Environment Protection Act, 1986

Considering the nature of the impact they may have on the surrounding ecosystem, mangrove ecosystems in India are legally protected by the **Coastal Regulation Zone Notification, 2011 under the Environment Protection Act, of 1986** [Department of Environment, Forests and Wildlife, MoEFCC, 2016]. In India, the Coastal Regulation Zone (CRZ) Rules govern human and industrial activity close to the coastline, in order to protect the fragile ecosystems near the sea. They restrict certain activities — such as large constructions, setting up of new industries, storage or disposal of hazardous material, mining, reclamation and bunding — within a certain distance from the coastline. CRZ rules were issued with three specific objectives:

- Ensure livelihood security for fisher communities and other local communities living in coastal areas
- Conserve and protect coastal stretches, their unique environment and their marine area
- Promote development in a sustainable manner based on scientific principles taking into account the dangers of natural hazards in the coastal areas, sea level rise due to global warming

According to the CRZ, the landward stretch of 500 m from the High Tide Line as the Coastal Regulation Zone, divided into four classes and imposed restrictions on activities and processes in this zone. CRZ-I includes ecologically sensitive areas, CRZ II includes the built-up areas (towns and cities), relatively undeveloped areas especially rural areas came under CRZ III and islands came under CRZ IV.

Mangroves fall under CRZ-I – this means projects require special clearances and a robust monitoring and assessment process to ensure no harm is caused to the local ecology, community, and livelihood. While the CRZ Rules are made by the Union Environment Ministry, implementation is ensured by state governments through their Coastal Zone Management Authorities. This creates a double layer of compliance for projects to prevent disbandment or cancellation.

However, some of the standardised rules applicable apply to all ecosystems under CRZ-I. To ensure that the project is in accordance with the notification issued in 2011, investors must secure proof that before setting up a project in CRZ-I, the following clearances have been obtained by the developer:

- Rapid Environment Impact Assessment (EIA) Report;
- Disaster Management Report and Risk Management Report;
- CRZ map indicating HTL and LTL demarcated;
- No Objection Certificate from the concerned Pollution Control Boards;
- The clearance accorded to the projects shall be valid for a period of five years.

Furthermore, under the provisions of the Act, no new construction is permitted in CRZ-I except:

- Projects relating to the Department of Atomic Energy;
- Construction of trans-harbour sea link and roads without affecting the tidal flow of water, between the Low Tide Line (LTL) and High Tide Line (HTL) etc.

While guidelines to designate an area as an Ecologically Sensitive Area (ESA) have been in existence, albeit on broad terms leaving open-ended decision-making to the State Government, thus providing

them with opportunities to adopt diversified criteria. However, under the CRZ 2011 notification, some ESAs were given Special Dispensations. As a result, the Sunderbans, Gulf of Khambat and Gulf of Kutch, Malvan, Achra-Ratnagiri in Maharashtra, Karwar and Coondapur in Karnataka, Vembanad in Kerala, Bhaitarkanika in Orissa, Coringa in East Godavari and Krishna in Andhra Pradesh were declared as **Critical Vulnerable Coastal Areas (CVCA)**. The CVCAs have been specified as the ecologically or environmentally sensitive areas located on the coasts that are vulnerable to human intervention or any other causes. Following the notifications, integrated management plans were prepared for each of these areas in consultation with the local communities. Any investment in projects being hosted in CVCAs should come after closely verifying that the project is in compliance with the listed CVCA's specific management plan.

Besides compliance and regulatory mandates, the union government is actively working to build a supportive policy framework that promotes mitigation efforts to protect mangrove ecosystems at large. These policies provide support in terms of financing and capacity building. Since developing in ecologically fragile regions requires developers to engage closely with the government, investors may find it useful to ensure that the implementation parties are aware of these policies. Projects that actively make use of the available policy infrastructure are likely to be more credible, with less likelihood of failure. Some of the relevant programs and policies are:

National Coastal Mission Program

In its bid to protect mangroves and coral reefs, the central government has laid out the 'Conservation and Management of Mangroves and Coral Reefs', under the National Coastal Mission Programme [Press Information Bureau, 2022]. Under this scheme, the Government extend assistance to Coastal State/UTs for the implementation of action plans including survey and demarcation, alternation and supplementary livelihood, protection measures and education and awareness activities. For example, with assistance from the program Government of Maharashtra has – 1) formed a dedicated Mangrove Cell for mangrove conservation, and 2) created a Mangrove and Marine Biodiversity Conservation Foundation for mangrove and marine conservation, research and livelihood activities. The mangrove cell combines the latest scientific knowledge and capacity-building platforms for local communities to advance restoration and conservation practices.

Project developers can work with such institutions established by the state government, as they can help ensure smoother execution in sensitive regions. Support from such specialised cells can also help build rapport with the community and guide action that is socially and ecologically responsible.

Mangrove Initiative for Shoreline Habitats and Tangible Incomes (MISHTI)

In line with global efforts to conserve and restore mangroves, India began the implementation of the Mangrove Initiative for Shoreline Habitats and Tangible Incomes (MISHTI) [Press Information Bureau, 2023]. Green growth was featured as a key priority in Union Budget 2023-24 with a focused allocation for augmenting mangrove vegetation as important carbon reservoirs. The scheme is planned to be implemented for a period of five years from 2023-2024 to 2027-2028. Currently, there is approximately 5000 sq km of area under mangroves and through the MISHTI program an additional area of 540 sq km is proposed to be covered across 9 States and 4 Union Territories.

This comprehensive initiative aims to explore mangrove development areas across 11 states and 2 union territories over five years, starting from FY 2023-24. Through a Public Private Partnership program, MISHTI focuses on the conservation and restoration of mangroves along India's coastline, sharing best practices for plantation, conservation, management, and resource mobilisation. Under the scheme, the government provides financial assistance to local communities for carrying out mangrove plantation activities. Additionally, awareness campaigns are conducted to educate people about the significance of mangroves and their role in environmental protection. The plantation activities are carried out in collaboration with local communities and NGOs to ensure sustainability and community ownership of the initiative. The Centre will cover 80% of the project cost, while state governments will contribute the remaining 20%.

Project developers have the opportunity to benefit immensely from the government's support under this scheme. Not only would projects registered under the scheme receive financial and capacity-building support from the government, but may also see faster-moving timelines in terms of bureaucratic processes.

National Wetland Conservation Programme (NWCP)

The National Wetlands Conservation Programme (NWCP) [Conservation and Survey Division, MoEFCC, 2009] is a Centrally Sponsored Scheme initiated by the Ministry of Environment, Forests & Climate Change (MoEFCC). Its primary objective is to halt the ongoing deterioration of the country's wetlands and promote their responsible utilisation to benefit local communities while simultaneously conserving biodiversity. The extent of central assistance provided through this program hinges on the submission of proposals by state governments, adherence to prescribed standards, and the availability of budgetary resources.

As of February 2022, India boasts the largest collection of wetlands and Ramsar sites in South Asia, comprising 49 sites encompassing a total area of 10,93,636 hectares. Wetlands stand out as some of the most biologically diverse ecosystems worldwide. They provide crucial support to a diverse array of plant and animal species while serving as vital buffers against floods and storms.

The management of wetlands falls under the purview of state governments and Union Territory administrations due to their ownership of the land resources. The Ministry has allocated 115 wetlands across 24 States and 2 Union Territories for conservation and administration within the framework of the program. Additionally, the NWCP offers state governments guidance and extends financial and technical support. The criteria employed to recognise wetlands of national significance within the NWCP mirror those established by the Ramsar Convention on Wetlands. The central government assumes the overarching role of coordinating wetland conservation initiatives.

This means that while the power to make macro-level strategic decisions rests in the hands of the central government, micro configurations around the technicalities of initiatives and projects are managed by the state government. Investors must assess if the project aligns with guidelines at both levels to avoid any risk of the project being disallowed. Project implementation teams that have gone through capacity-building sessions held by the regional government are more likely to be privy to the rules and ensure compliance.

Developing a blue carbon project in carbon markets

The project development process for a blue carbon project remains the same as any other project in the voluntary carbon markets. Besides following the multi-step process that needs to be followed to get a project to the credit issuance stage, numerous other considerations need to be made. The following section encapsulates the range of considerations to be made before investing in or developing a blue carbon project.

Project Due Diligence

Eligibility Assessment

Projects need to effectively generate carbon credits to be economically viable. There are scenarios wherein registering a project with a carbon certification standard may not be the most economically viable decision. This is especially evident when the resources required for issuing and marketing carbon credits exceed the revenue generated from their sale. Consequently, project developers must clearly understand their project's alignment with an existing certification standard and methodology.

For instance, as per Verra, a major carbon standard, eligible Wetlands Restoration and Conservation (WRC) activities are those that increase net GHG removals by restoring wetland ecosystems or that reduce GHG emissions by rewetting or avoiding the degradation of wetlands. As per the standard a project qualifies only if the area meets an internationally accepted definition of wetland, such as from the IPCC, Ramsar Convention on Wetlands, those established by law or national policy, or those with broad agreement in the peer-reviewed scientific literature for specific countries or types of wetlands.

Under Verra, activities that generate net reductions of GHG emissions from wetlands are eligible as WRC projects, and activities that actively lower the water table depth in wetlands are not eligible. Eligible WRC activities include:

- **Restoring Wetland Ecosystems (RWE):** This category includes activities that reduce GHG emissions or increase carbon sequestration in a degraded wetland through restoration activities. Such activities include enhancing, creating and/or managing hydrological conditions, sediment supply, salinity characteristics, water quality and/or native plant communities. For these requirements, restoration activities are those that result in the re-establishment of ecological processes, functions, and biotic and/or abiotic linkages that lead to persistent, resilient systems integrated within the landscape.
- **Conservation of Intact Wetlands (CIW):** This category includes activities that reduce GHG emissions by avoiding degradation and/or the conversion of wetlands that are intact or partially altered while still maintaining their natural functions, including hydrological conditions, sediment supply, salinity characteristics, water quality and/or native plant communities. Wetland degradation

or conversion can be planned (designated and sanctioned) or unplanned (unsanctioned). Planned and unplanned degradation or conversion of wetlands can therefore encompass a wide variety of activities such as those listed under REDD while adding a wetland component.

Activities covered under the CIW project category are those that are designed to stop or reduce planned or unplanned degradation or conversion in the project area to other land uses.

The following CIW activities are eligible:

- **Avoiding Planned Wetland Degradation (APWD):** This activity reduces GHG emissions by avoiding degradation of wetlands, or further degradation in partially drained wetlands that are legally authorised and documented for conversion.
- **Avoiding Unplanned Wetland Degradation (AUWD):** This activity reduces GHG emissions by avoiding unplanned degradation of wetlands, or by avoiding further degradation in partially degraded wetlands.

Once the project type is deemed viable, project developers and investors should evaluate the resources needed in terms of both time and finances to navigate each stage of the process. Furthermore, estimating the potential income from selling carbon credits and evaluating the associated risks, including double counting, emission reduction ownership, and market dynamics is crucial.

Certain project types commonly encountered in carbon markets may necessitate only a brief evaluation to determine eligibility or ineligibility. This is due to the availability of information from existing projects that can simplify the assessment process. Conversely, complex projects, particularly those tied to natural ecosystems, demand a more comprehensive evaluation due to their numerous variables that can influence a methodology's eligibility or the quantification of emission reductions. To conduct a comprehensive due diligence report for a Blue Carbon Ecosystem (BCE) project, access to key information is indispensable. This includes:

Background Information and Technology

- Conducting a feasibility study for the project.
- Familiarity with industry-standard practices relevant to the proposed project activity.
- Estimating the projected project lifespan.
- Conducting a financial analysis, including cost and revenue projections.
- Providing technical details for common alternative scenarios.
- Establishing a project timeline, covering the feasibility study, design, financial closing, commissioning, and other phases.
- Outlining the monitoring, reporting, and verification process, if applicable.

Identifying Potential Obstacles

- Compiling a list of barriers and challenges encountered during the project's development, encompassing financial, legal, administrative, technological, and other dimensions.
- Assessing the permanence of carbon sequestration within the project's context.

Legal Considerations

- Evaluating the current regulatory framework related to the proposed project.
- Clarifying the ownership status of sequestered emissions.

Based on the information at hand and the desired level of confidence, project proponents should continue the project due diligence to ascertain whether their project qualifies for an established carbon certification standard.

Associated financials

The expenses associated with the development of carbon assets are frequently underestimated. To ensure that the proceeds from carbon credit sales at least offset these expenses, it is crucial to incorporate these costs into the overall project development budget. Various budget components to consider include:

Consultant fees: Many organisations lack the technical expertise to conduct the entire carbon certification process independently. It is common practice to engage third-party consultants for tasks such as drafting the Project Design Document (PDD), conducting environmental and social impact assessments, and providing support during validation audits, monitoring, and verification audits. Depending on the project's complexity, fees for PDD development can range from €15,000 to €50,000, while validation and verification support may cost between €5,000 and €10,000 each. Monitoring assistance can range from €5,000 to €20,000 [IUCN, 2014].

Auditing costs: Audits, including the pre-registration validation and post-emission reduction verification, can range from €10,000 to €30,000, depending on the project's complexity. Verification audits need to occur regularly or whenever the project proponent intends to issue carbon credits.

Certification standard fees: Each carbon certification standard has a pre-defined fee structure for processing and managing project applications and registrations. These fees typically apply at the time of registration and issuance. For instance, the fee structure for the Verra Registry consists of several components. Firstly, there is a USD 500 account opening fee for each account, payable in full upon approval. Additionally, an annual account maintenance fee of USD 500 is assessed, with payment due both at the time of account approval and subsequently in January of each year. For those requesting pipeline listings, there is a fee of USD 1,000, payable at the time of the request. Finally, project registration requests incur a review fee of USD 2,500, which must be paid at the time of submission [Verra, 2023].

Transaction costs or fees: The expenses related to marketing, negotiating, contracting, and delivering a project's carbon credits can vary significantly based on factors like the type of organisation involved (e.g., public authority, small project developer, or private buyer), the nature of the transaction (e.g., forward selling for multiple years versus spot selling for a single transaction), and the sales channel (e.g., direct marketing, retailers, online platforms). The total costs from the initial assessment to the first delivery of carbon credits may range from €50,000 to €150,000, excluding any potential expenses associated with developing a new methodology [IUCN, 2014].

Furthermore, to ensure that the project adheres to desired quality standards, investors must prioritise projects adhering to ICVCM (Integrity Council for Voluntary Carbon Market) and VCMI (Verified Carbon Standard for the Blue Carbon Project) guidelines in blue carbon initiatives for several compelling reasons. Firstly, these guidelines ensure robust scientific methodologies and accurate measurement of carbon sequestration, mitigating the risks associated with uncertain environmental impact assessments. Secondly, adherence to these standards enhances project credibility and transparency, instilling investor confidence and facilitating sustainable financial support. Thirdly, by aligning with globally recognized frameworks, projects can navigate regulatory landscapes more effectively, reducing legal and reputational risks. Ultimately, investing in projects that follow ICVCM and VCMI guidelines not only supports environmentally responsible practices but also positions investors strategically in a burgeoning market, fostering long-term financial viability.

Demand-supply of blue carbon credits (Global)

The prices of carbon credits are contingent on multiple factors such as project location and vintage (the year in which a credit was issued). One of the primary drivers of price fluctuations is the delicate balance between supply and demand. Carbon credit prices can surge when demand outpaces supply, often due to increased corporate commitments to carbon neutrality and sustainability goals. Conversely, oversupply, caused by an abundance of eligible projects, can lead to price depressions.

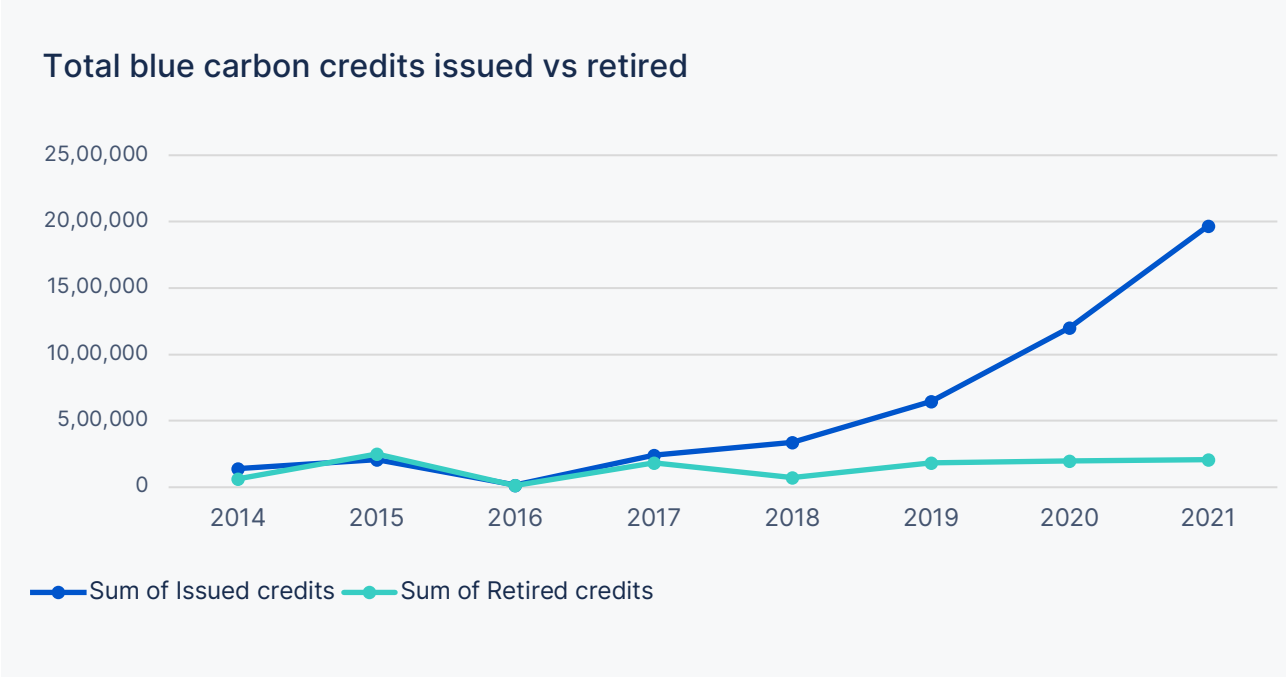

Figure 5: Sum of blue carbon credits issued vs. retired

The graph illustrating the number of issuances and retirements for different vintages displays a distinct trend: retirements seem to follow historical patterns, remaining steady over time. There has been a noticeable surge in the supply, especially among more recent vintages from existing registered projects. This rise in credit supply can be mainly attributed to two key factors:

- Since 2015, Delta Blue Carbon – the largest blue carbon project to date – has issued a large number of credits for a blue carbon project. Rooted in 350,000 hectares of Tidal Wetlands on the coast of the Sindh region of Pakistan, this project accounts for more than 66% of all Blue Carbon credits in circulation. The emission removals throughout the life of the project are estimated to be 142,050,139 tCO2e.
- Delta Blue Carbon credits are perceived to be "high-quality" credits globally by buyers – indicating that although prices have fallen for most project types in the VCM over the last year, blue carbon credits continue to trade at a premium.

The success of Delta Blue Carbon has incentivised project developers to commission new blue carbon projects – Verra has 9 additional projects that are on track to issuing blue carbon credits globally. Blue carbon projects, if executed well, generate high quality credits that meet the quality standards of increasingly quality-conscious buyers. As buyers become increasingly intentional in the quality of credits they purchase, blue carbon credits will continue to command a premium in coming years.

The flow of credits from upcoming project issuances does not diminish the space for new blue carbon projects to be set up on two accounts – the anecdotal evidence for demand remains strong, and so does the environmental potential of such projects. According to Plan Vivo, a carbon standard with registered blue carbon projects, its Kenyan projects are oversubscribed, with credit sales pre-booked ahead of release [The Economist, 2022]. Its CEO, Keith Bohannon, stresses that demand continues to outweigh supply, with heavy ocean polluters such as shipping companies seeking high-quality blue carbon credits [The Economist, 2022].

Price Trends

Latest transaction data suggests that blue carbon credits continue to sell at a premium, trading at an average of USD 19 per credit in 2022 and USD 8 per credit in 2023 (47% increase). Looking at the data, we may extrapolate that as quality starts to play an outsized role in determining the price of a credit, buyers move towards proven projects/project types with proven low risk of reputational harm.

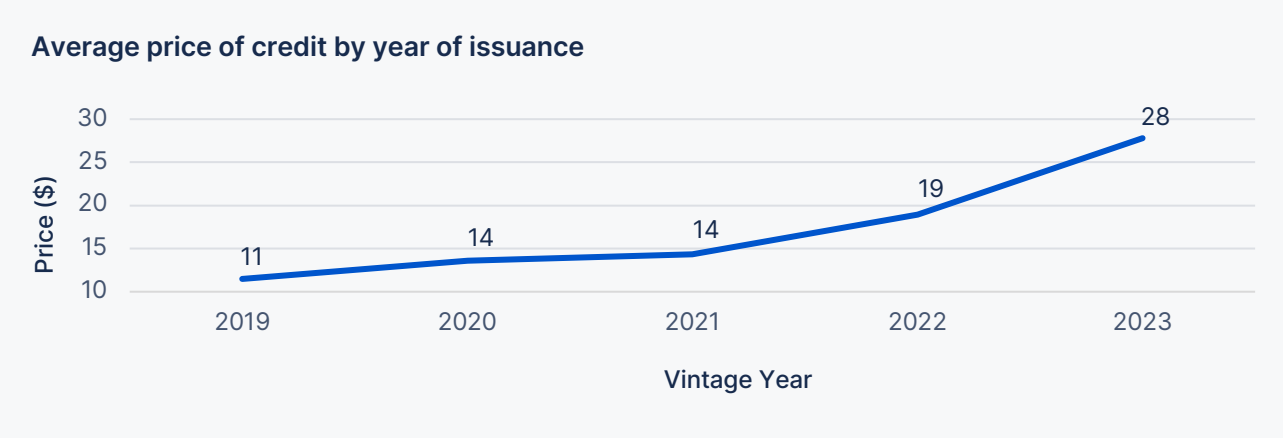

Figure 6: Average price of credit by year of issuance

The relationship between market demand and supply in the VCM is at the core of carbon credit price volatility. The market's responsiveness to shifts in corporate commitments, consumer preferences, regulatory environments, project quality, and broader economic conditions makes it a dynamic and evolving space where prices fluctuate in response to these ever-changing factors.

Factors affecting price

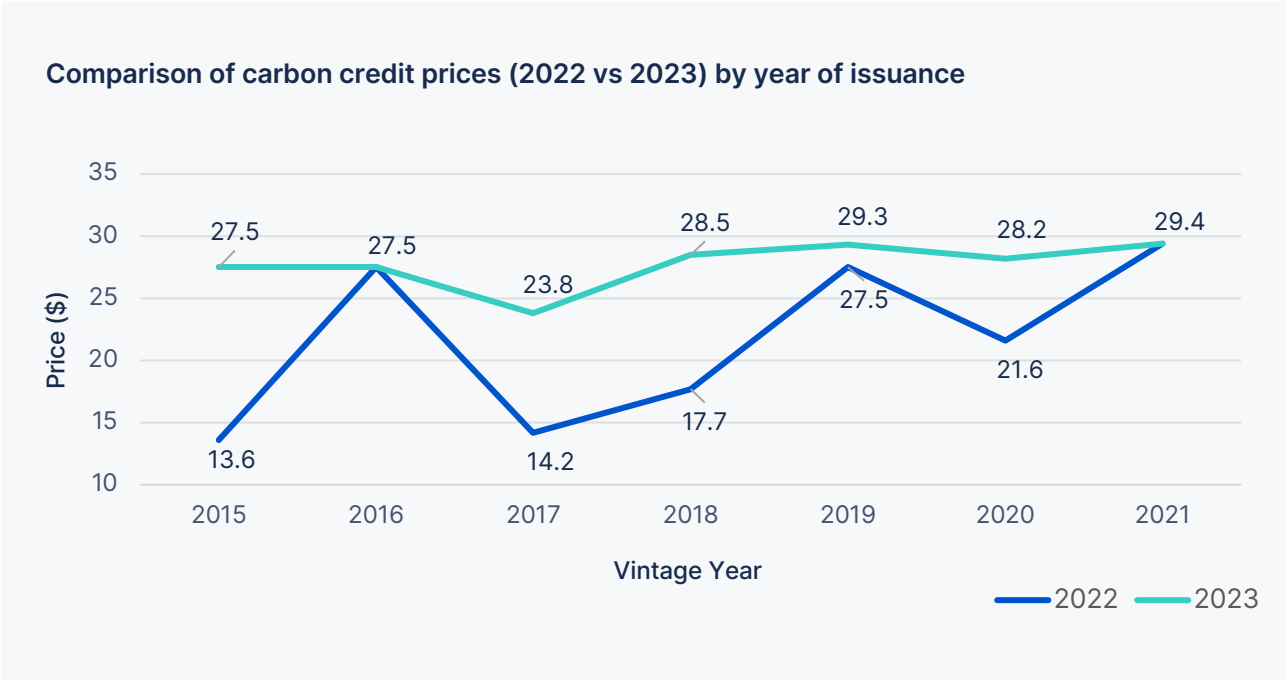

Figure 7: Comparison of carbon credit prices (2022 vs 2023) by year of issuance

The graphs above compare the prices of blue carbon credits by Vintage in 2022 vs 2023 (price of the same credit sold in 2022 vs 2023).

It may be interesting to note that in 2022, the vintage year had an impact on the buyers' decision of purchasing the credits – for example, the 2018 vintage was priced almost 35% lower than the 2019 vintage. However, in 2023, trends suggest that buyers are foregoing the vintage so long as they are able to purchase and retire blue carbon credits – indicating towards the perceived quality of blue carbon projects.

Site selection and assessment

Site selection and assessment are crucial steps in blue carbon project development and are essential components of the project ideation and design phase. Poor site selection is often mentioned as a cause for restoration failure, and must be done carefully for the following reasons:

Ecosystem suitability: Different coastal and marine ecosystems, such as mangroves, seagrasses, and salt marshes, vary in their ability to sequester and store carbon. Selecting a site with the right type of ecosystem is essential to maximise carbon sequestration potential. For example, mangroves are generally more efficient at carbon sequestration than salt marshes.

Carbon storage capacity: The carbon storage capacity of blue carbon ecosystems can vary significantly based on factors like the size and health of the ecosystem. Choosing a site with a high capacity for carbon storage can result in more significant climate benefits.

Coastal vulnerability: The vulnerability of a coastal area to factors like sea-level rise, storms, and erosion is crucial. Vulnerable areas may not be suitable for long-term carbon storage projects, as they could result in carbon release if the ecosystem is degraded or lost.

Regulatory and policy considerations: Different regions and countries may have specific regulations and policies governing the protection and restoration of blue carbon ecosystems. Site selection should take these into account to ensure compliance and facilitate project permitting.

Community and stakeholder engagement: Engaging with local communities and stakeholders is essential in blue carbon projects. The site should be selected in a way that minimises negative impacts on local livelihoods and maximises community support.

Monitoring and management: Easy access to the site and the ability to monitor and manage the ecosystem are critical. Remote or difficult-to-reach locations may pose challenges in terms of ongoing maintenance and data collection.

Carbon Accounting and Reporting: Accurate measurement and reporting of carbon sequestration are essential for blue carbon projects. Choosing a site with clear boundaries and well-defined carbon pools simplifies the accounting process.

Cost-effectiveness: Site selection can significantly impact project costs. Choosing a site that is logistically feasible and cost-effective is important for project sustainability. The process of gaining approvals can also be cost-intensive, particularly for ecologically sensitive areas.

Site selection requires a holistic assessment of ecological, environmental, social, and economic factors to ensure the project's success in sequestering carbon, conserving ecosystems, and benefiting local communities while aligning with regulatory frameworks.

By answering the questions below, project developers and investors can verify if a potential project site is suitable or not:

- Does the site offer enough carbon sequestration potential? Does the size of the coastal ecosystem and the growth rate of vegetation offer enough carbon storage capacity?
- Can geographic characteristics such as proximity to urban areas, accessibility, and vulnerability to climate change impacts like sea-level rise and storms impact the potential project sites?
- Is the project economically viable based on cost estimations for restoration or conservation activities and the potential revenue from carbon credit sales?
- Is there an adequate opportunity for the project to have co-benefits such as habitat restoration, biodiversity conservation, shoreline protection, and improved water quality, to add to the appeal of the project?
- Will the project developer be able to meet the legal, regulatory, and certification requirements for the project to proceed? This may include permitting, land tenure considerations, and compliance with relevant standards.

Several research institutions, multilateral bodies, and private organisations have been adding to the growing repository of knowledge that equips project developers to understand the scientific, social, and project execution-related nuances better. The ecosystem map puts together various standards, initiatives, and guidance avenues that can help deliver quality projects, that can then deliver high quality blue carbon credits in the voluntary carbon market.

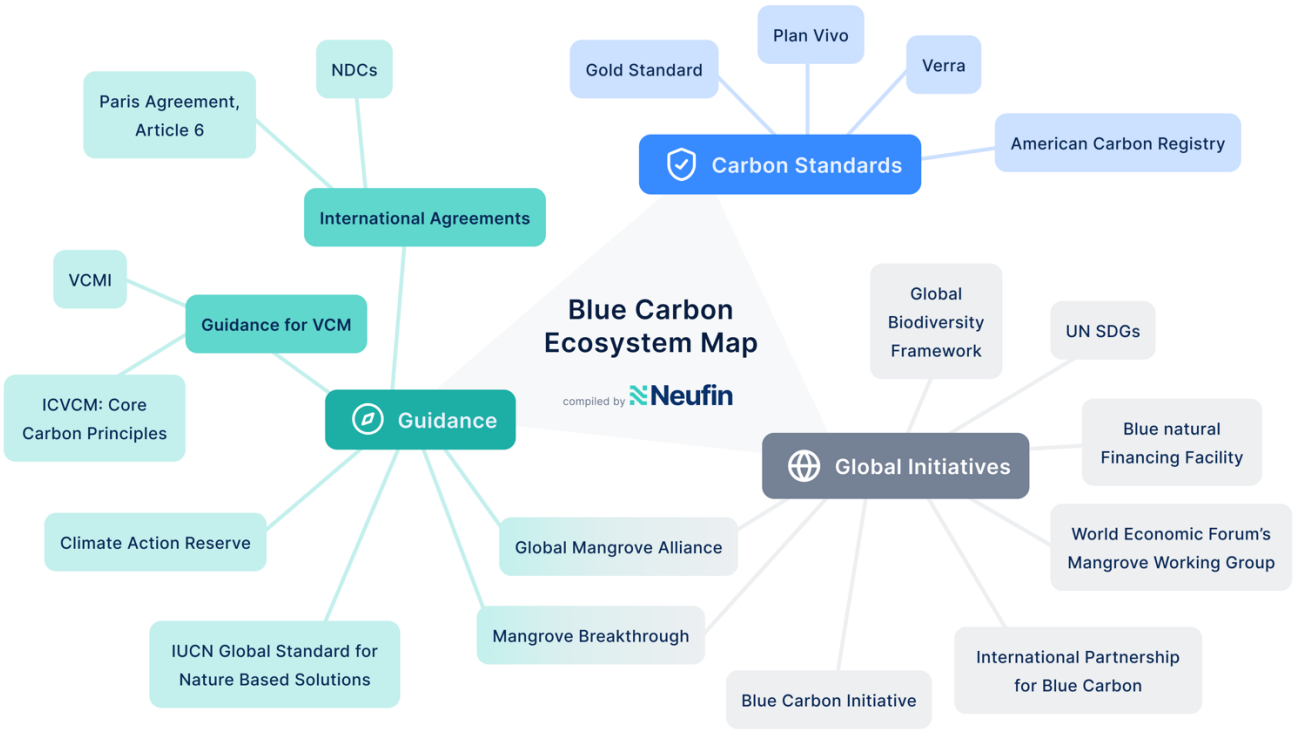

Figure 8: Ecosystem map for Blue Carbon

You can get in touch with Neufin by writing to carbon@neufin.co and get access to insights on other factors that influence the prices of carbon credits, and the price trends in the voluntary carbon market.

Best practices

Climate projects are often prone to risks and externalities that may hinder the successful execution of activities. It is important to cushion the project from risk by identifying possible causes for failure and learning from mistakes made by similar projects in the past. Blue carbon projects, in particular, are expensive to execute and require technical expertise. Restoring mangroves, for example, is a transformative nature-based method of mitigating climate change and increasing coastal resilience. Healthy mangrove ecosystems capture and store carbon at much higher rates than most terrestrial forests and act as natural infrastructure that provides vital protection from storms, coastal flooding, and erosion. Simultaneously, mangroves can boost economic resilience by increasing access to sustainable livelihoods and food sources.

Despite their importance, investments in ambitious mangrove restoration projects have been slow. Investors are concerned that many mangrove restoration efforts fail, yet such failures are preventable so long as implementation parties follow the following best practices:

Making use of local ecological knowledge

Having a broader and more detailed understanding of the local conditions and history of a particular site can greatly improve the successful implementation of blue carbon projects. For many areas, however, there are huge data gaps, including information on past conditions, local human uses, the fauna and flora, and physical and hydrological settings. To fill knowledge gaps, scientists often rely on estimates from large-scale, low-resolution datasets, but such information rarely captures the local context. Collecting local data can be challenging, costly, and time-consuming. Nevertheless, locals can provide a critical route to addressing data deficiencies and knowledge gaps.

Local ecological knowledge (LEK) is a broad term encompassing the information any local people have on animals, plants, and the environment with which they are familiar. This broad definition includes but extends beyond, traditional ecological knowledge (TEK), which is often multi-generational and rooted in a cultural framework. LEK can provide information on the organisms present, the interactions between humans and the environment, and changes in the ecosystem through space and time.

Work with the government

As established above, implementing blue carbon projects requires immense technical expertise. Governments, both at the state level recognise this fact and also understand the importance of promoting the sector due to its positive environmental impact. Thus, working closely with the governments by attending capacity building and training programs, and ensuring compliance can help project developers prevent failure. Overall, project execution and investment decisions must be made after close assessments to ensure a return on investment in terms of environmental and social impact. Working in synergy with governments, NGOs, and community-based organisations can significantly improve the chances of success.

Account for climate-related physical risks

Despite the planning, the project climate may see unpredicted changes. Coastal ecosystems are sensitive to environmental shifts. In the past, mangrove restoration projects have been hampered due to the increasing salinity of water, changing the adaptability of certain mangrove species in the area. Natural disasters such as hailstorms and cyclones also threaten newly planted mangroves in some plantation sites. These anthropogenic and natural factors have been noted in existing projects, to account for which many mangroves had to be replanted. Project financials must thus account for such climate-related risks and make provisions accordingly.

Seek scientific expertise

Whether large-scale or small, most projects are hindered by weaknesses in conception and execution. Local NGOs and communities often head small-scale efforts without the technical expertise to design restoration projects effectively. Governments usually conduct large-scale restoration efforts but are largely focused on reducing costs and maximising project area.

Many projects are conceived without addressing the underlying causes of loss, resulting in failure to sustain any initial gains in mangrove coverage. Other projects fail due to techniques which are at odds with the established science – like planting the wrong species, or in the wrong areas. Typically, restoration has focused on planting single species, often selecting fast-growing species, or easily planted seedlings that may not be suited to local conditions. While effective mangrove restoration approaches have been developed and implemented, this capacity and knowledge is still not broadly available. Failed restoration efforts represent lost opportunities to re-establish the many benefits that mangroves provide, but they also represent a tremendous waste of resources and undermine confidence in the restorability of mangroves.

Develop robust implementation and monitoring plans

It is important that before investing in any blue carbon process, the implementing party is put under thorough scrutiny for their technical expertise in the field, and the ability to carry out the project in compliance with domestic and regional policies while being socially responsible.

Investors can cushion themselves against shocks by ensuring that the project developers have an end-to-end approach targeting three key stages:

- **Pre-implementation:** setting objectives for restoration e.g., carbon sequestration, coastal protection
- **Implementation:** utilising best practices that account for specific local conditions, while addressing the objectives
- **Post-implementation:** monitoring, evaluation, and learning from conducted activities

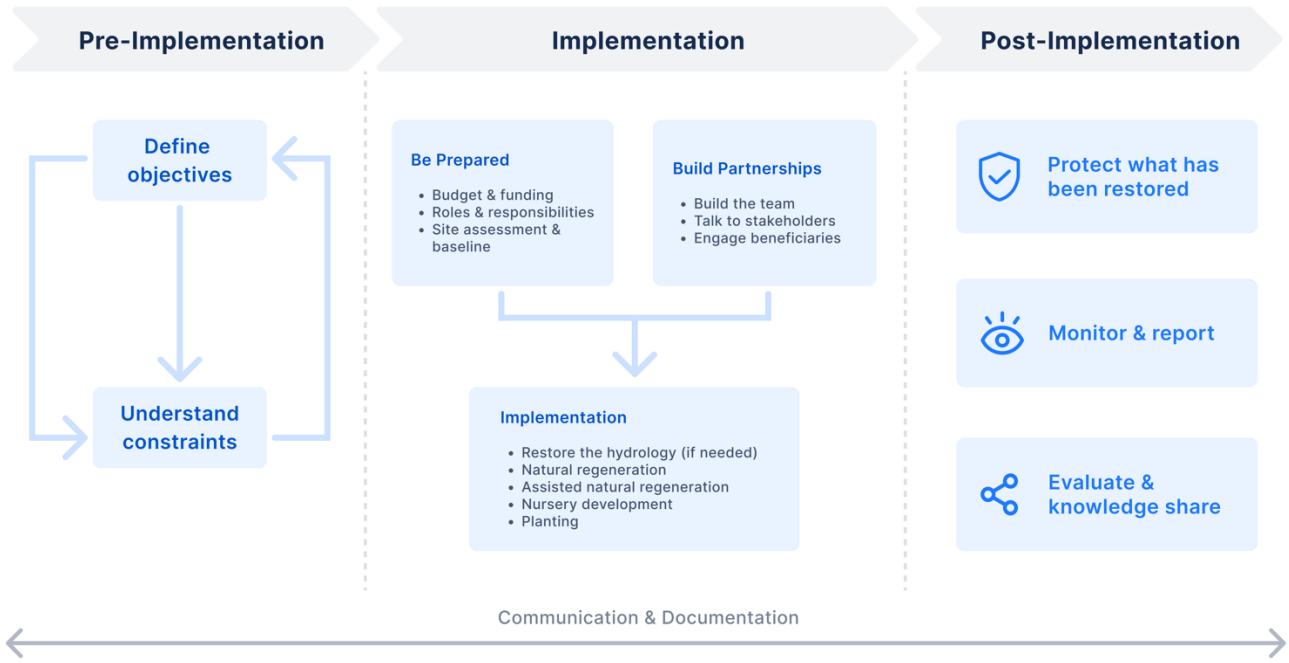

Figure 6: Components of implementation plans for blue carbon projects

Leverage technology in the monitoring and verification process

The current most precise method for estimating forest biomass relies on labour and time-consuming field measurements, making it impractical for use in extensive geographic areas. Remote sensing technologies offer a viable alternative, allowing the observation and recording of land surface features across large regions using airborne or satellite sensors. These technologies are considered more efficient and cost-effective for large-scale biomass estimation due to their ability to collect extensive data, cover wide spatial areas, and generate digital outputs.

The combination of remote sensing and geographical information system (GIS) techniques has also been employed for estimating biomass and carbon stocks in mangrove ecosystems. However, to enhance the accuracy of aboveground biomass estimates, it is advisable to integrate remote sensing methods with field measurements during the monitoring and verification process. The advantage of the remote sensing approach is its ability to reduce the labour-intensive data collection phase, saving time and costs, particularly in vast areas.

As established in previous sections, conserving and restoring coastal ecosystems can have a host of benefits for the environment. A carefully planned and well-implemented blue carbon project can help attain several of the SDGs, that have spillover benefits on the community and the local ecosystem. Some of the SDGs such projects can help achieve are:

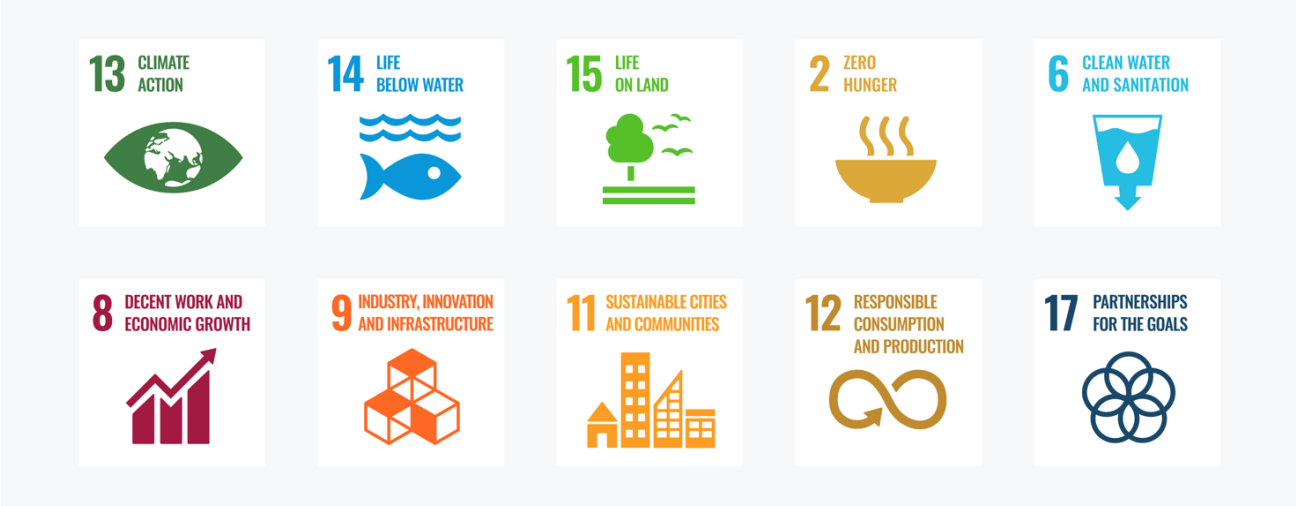

Figure 7: Scope for SDG attainment through a blue carbon project

Blue carbon projects have the potential to advance multiple Sustainable Development Goals by addressing climate change, conserving biodiversity, supporting livelihoods, reducing inequalities, and promoting sustainable and resilient communities. Their integrated approach to environmental and social sustainability makes them valuable tools for achieving a more sustainable and equitable future.

Blue Carbon: An Investor checklist

Environmental Safeguards

- Does the project make provisions for conservation and restoration activities?
- What is the expected percentage in hectares and carbon volume?
- What are the interventions to make that happen?
- Is restoration a planned component of the project?
- Will the project developer be able to follow the best practices for ecological restoration?
- How does this project define successful restoration? How does it measure progress and success?

Co-benefits and empowering local communities:

- How will different communities participate in project design, governance, and management?
- What are the respective roles of the various stakeholder groups, especially Indigenous Peoples and local communities, women, and other marginalised groups?
- What systems are in place to ensure the decision-making processes are fair, participatory, and transparent?
- What respective roles did the various stakeholders have in defining the benefit-sharing structure?
- At what point in the project development was the benefit-sharing structure defined and what kinds of agreements are in place to formalise the structure?

- How would it be monitored and governed going forward?
- Who has visibility into the benefit-sharing structure, project costs, and financial flows?

Local policy and regulations

- How does the current policy, legal, and governance environment support the successful development of this project?
- To what extent do multiple government agencies have overlapping or adjacent jurisdiction at the project site and how will this be managed?
- Has the project engaged the support of local resource agencies? Are their respective roles and benefits well understood and defined within the project plan?
- How does the government support land tenure for local communities and Indigenous Peoples? Do policies exist to define who owns land and carbon rights?
- What are the policy, legal, and/ or governance risks? How is the project developer actively addressing these risks?

Project planning and potential

- Has the project developer done a blue carbon project feasibility study to determine feasibility against recognised methodologies?
- How will the project design and measurement, reporting, and verification approach account for the dynamic and highly connected nature of blue carbon ecosystems
- What are the project's expected impacts on carbon, biodiversity, and livelihood?
- Which accepted standards and methodologies are used to quantify impact and how are they applied?
- How does local and Indigenous knowledge shape the project plans?
- What is the original cause for ecosystem degradation (e.g., conversion for other land uses or altered water flow) and what measures are being taken to remove this specific threat to ecosystem recovery and to ensure biophysical conditions are appropriate for recovery?

Key Takeaways

1

Blue carbon can play a vital role in mitigating climate change, protecting coastlines, preserving biodiversity, improving water quality, and sustaining both ecosystems and human livelihoods. Restoration and conservation activities will both play a critical role in reaping the full environmental potential of blue carbon ecosystems.

2

Despite the environmental benefit of restoring and conserving BCE being well studied and mounting investor interest in the space, the market for blue carbon credits remains relatively untapped. Economic, scientific, and political challenges coupled with the systemic complexity of the carbon market create an intimidating ecosystem for stakeholders across the spectrum.

Economic Barriers

- Investors prefer substantial projects with brief completion timelines as they are easier to oversee and more cost-effective. Extended timeline typical to projects in the BCE and the associated costs must be incorporated into the projected returns.
- Assigning a clear economic value to carbon sequestration and other ecosystem services provided by blue carbon ecosystems can be complex. A distinct pricing system and market specifically tailored for blue carbon is needed.
- The volatile nature of carbon markets can impact the economic viability of these projects, as fluctuating credit prices may affect revenue projections and investment returns. The possibility of linking blue carbon pricing to predefined timeframes must be explored

Scientific Barriers

- Local stakeholders' capacity is restricted, given that research is frequently concealed behind technological or language barriers. However, there is potential to develop a decision tree model that could consolidate information and guide into a practical field-ready format.
- Accreditation standards necessitate precise quantification of carbon reserves. In the short term, this can be resolved by following the accounting best practices established in literature. But a more coordinated and well-funded endeavour is required to generate region-specific data.
- Projects in BCE are susceptible to unpredictable climate-related risks. Projects need to adopt a comprehensive perspective and account for the repercussions of elements that are beyond their immediate jurisdiction.

Political Barriers

Identifying who owns the land tenor rights is a critical issue that must be resolved before beginning work on a blue carbon project. Project developers and investors must seek clarity on the following matters, especially since the answers will vary from state-to-state: Who owns the land-use rights of coastal mangroves? Who has the responsibility for policy, management and enforcement Who can earn carbon credit offset against the project?

3

Private sector financing can play a vital role in supporting a range of conservation efforts aimed at coastal ecosystems and in ensuring the effective and efficient attainment of NDCs. Blue carbon currently represents a relatively small portion of the carbon market, but its potential within the voluntary carbon market is substantial. Recent years have seen the emergence of new projects, but not enough to meet market demand for the high-quality credits that emerge from blue carbon projects. Demand far exceeds supply and will continue to do so in the coming years.

4

The most challenging aspect of developing a blue carbon project India is the fact that multiple governmental control different aspects of blue carbon ecosystems. While the responsibility to untie the knotted systems, and build long-term solutions lies with the government, project developers and investors must do their own due diligence. To helps with this, the report provides a comprehensive list of legislations and policies that govern blue carbon ecosystems in India.

5

The project development process for a blue carbon project remains the same as any other project in the voluntary carbon markets. Besides following the multi-step process that needs to be followed to get a project to the credit issuance stage, some other considerations need to be made including:

- Checking if the project is eligible for the carbon market
- Understanding the associated financials in executing the project
- Understanding past trends for the demand and supply of blue carbon credits in the VCM
- Understanding how to select a project site

6

It is important to cushion the project from risk by identifying possible causes for failure and learning from mistakes made by similar projects in the past. Some general principles that must guide project design are:

- Making use of local ecological knowledge
- Work in tandem with the government
- Account for climate related physical risks
- Seek scientific expertise
- Develop robust monitoring and implementation plans
- Leverage technology in the monitoring and implementation process

Annexures

Blue Carbon Projects under Plan Vivo

Project ID	Title of the project	Status	Country	Estimated Annual Carbon Credits
PV_2020_026	Vanga Blue Forest	Registered	Kenya	5,019
PV_2020_023	Tahiry Honko Community Mangrove Project	Registered	Madagascar	1,443
PV_2014_012	Mikoko Pajoma Mangrove Conservation for Community Benefit	Registered	Kenya	2,500

Blue Carbon Projects under VERRA-VCS

Project ID	Title of the project	Status	Country	Estimated Annual Carbon Credits
4539	Community-Based Mangrove Conservation and Restoration in Sierra Leone	Under development	Sierra Leone	258,000
4136	Wetlands Along the Yangtze River and Dongting Lake Restoration Project in Junshan	Under validation	China	9,774
3818	Blue Carbon Mitigation through Community-Based Mangrove Restoration	Under validation	Myanmar	259,130
3773	Mindanao Forests for People and Sustainable Livelihoods (MinFor)	Under development	Philippines	1,608,286
3730	Climate Action in Myanmar through a Community-based Mangrove Restoration	Under validation	Myanmar	91,861

3365	Developing a Voluntary Carbon market project for the Sundarban Tiger Reserve in India	Under development	India	57,587
3360	Developing climate resilience of the coastal communities of Sunderbans through Mangrove Afforestation	On Hold	India	44,578
3361	Participatory Mangrove Afforestation & Restoration on the west coast of India	Registration requested	India	11,536
3357	Climate Resilient & Community Driven Mangrove Afforestation Programme	On Hold	Sri Lanka	73,240
3294	Muskitia Pâsa Klîn Nâka sa	Registration and verification approval requested	Honduras	38,058
3230	Abu Ali Island Mangrove Planting Project - Eastern Province Saudi Arabia	Registration and verification approval requested	Saudi Arabia	1,627
3226	Padang Tikar Landscape	Under validation	Indonesia	590,557
3223	CONSERVATION AND RESTORATION OF THE MANGROVE ECOSYSTEM IN THE GAMBIA THROUGH THE REDD+ MECHANISM	Under development	Gambia	300,000
3057	Tlawan kiwi nak chuchit Blue Carbon Mangrove Conservation Project, Conserving Coastal Ecosystems in Veracruz to Support Life	Under development	Mexico	65,946
2976	Uh lu'umil Zazil-ha Blue Carbon Mangrove Conservation Project, Conserving Coastal Ecosystems in Quintana Roo to Support Life	Under development	Mexico	1,718
2974	Aztlan Blue Carbon Mangrove CONSERVATION project - Conserving the Marismas NACIONALES of Nayarit	Under development	Mexico	323,590

2975	U' Balam'moo A'kalché ó Blue Carbon Mangrove Conservation Project, Conserving Coastal Ecosystems in Campeche to Support Life	Under development	Mexico	667,276
2842	Restoring Mangroves in Mexico's Blue Carbon Ecosystems	Under development	Mexico	868,302
2834	Mangrove Restoration Project with Sine Saloum and Casamance communities, Senegal	Registration requested	Senegal	95,470
2500	BONOS DEL JAGUAR AZUL	Under development	Mexico	48,518
2459	NAYA REDD+	Registration and verification approval requested	Colombia	350,000
2403	Riau Ecosystem Restoration Carbon Project	Registered	Indonesia	6,870,411
2360	Virginia Coast Reserve Seagrass Restoration Project	Under development	United States	1,349
2088	Mangrove Restoration and Sustainable Development in Myanmar	Registration requested	Myanmar	403,831
2250	Delta Blue Carbon – 1	Registered	Pakistan	2,407,629
1899	Sumatra Merang Peatland Project (SMPP)	Registered	Indonesia	1,338,569
1764	Reforestation and Restoration of degraded mangrove lands, sustainable livelihood and community development in Myanmar	Registered	Myanmar	184,006
1477	Katingan Peatland Restoration and Conservation Project	Registered	Indonesia	7,451,846

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