Kenya
Mangrove Restoration: Investment Brief

Climate Adaptation Market Opportunities
Infrastructure, Energy and Manufacturing

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GLOBAL CENTER ON ADAPTATION

ABOUT THE GLOBAL CENTER ON ADAPTATION

The Global Center on Adaptation (GCA) is an international organisation, hosted by the Netherlands, which works as a solutions broker to accelerate action and support for adaptation solutions from the international to the local, in partnership with the public and private sector, to ensure we learn from each other and work together for a climate resilient future.

ABOUT AFRICA ADAPTATION ACCELERATION PROGRAM

GCA is providing technical assistance under the Africa Adaptation Acceleration Program (AAAP), a joint initiative launched by the GCA and the African Development Bank in 2021.

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CONTEXT

This investment brief is part of a regional analysis undertaken by the Global Center on Adaptation, developed in close coordination with partners including CGAP and GCA's downstream financial institution partners under the Africa Adaptation Acceleration Program, in collaboration with the consulting firm Pegasys. The analysis identifies and operationalizes climate adaptation investment opportunities in infrastructure, energy, and manufacturing across Tanzania, Kenya, Zambia, and the Democratic Republic of Congo. Building on these results, the present brief aims to provide a decision-support resource for commercial banks, microfinance institutions, and other lenders seeking to assess and integrate climate-related risks and opportunities within their infrastructure, energy, and manufacturing portfolios.

Across energy, manufacturing and infrastructure, climate variability is increasingly translating into material credit risk. Erratic rainfall, rising temperatures, flooding, and more frequent extreme events disrupt energy generation and distribution, impair manufacturing operations, and reduce the reliability and service life of physical infrastructure. These impacts weaken borrower revenues and asset values, with direct implications for both clients and lenders, including deteriorating portfolio performance, elevated non-performing loan ratios, and increased volatility in infrastructure and corporate lending

The analytical framework underpinning this investment brief series reframes climate adaptation as a risk-adjusted investment opportunity. It identifies discrete, technology-driven interventions across value chains and assesses their bankability through market sizing, borrower segmentation, and business model analysis. Each brief is structured to align with financial sector requirements, including compatibility with existing lending instruments (e.g. asset finance, value chain finance) and applicability across borrower archetypes such as utilities, project developers, construction firms, and industrial SMEs.

The investment brief series, focused on Climate Adaptation Market Opportunities in Energy, Manufacturing and Infrastructure, aims to support financial institutions in systematically integrating adaptation into core lending operations, with a view to strengthening client and portfolio resilience while capturing emerging market opportunities.

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Kenya's coastline is under mounting financial pressure. Without adaptation, in Mombasa, Kenya's largest coastal city and East Africa's biggest seaport, as much as $4.8 billion worth of coastal assets could be exposed to flooding and inundation by 2050.

For Kenya's commercial banks, this is not an climate change concern at the margins - it is a balance sheet issue. Conservative estimates suggest that **USD 3–6 billion of existing bank lending** is exposed to coastal physical climate risk across real estate, tourism, manufacturing, SMEs, and infrastructure. As these risks intensify, so too do the pressures on collateral values, non-performing loans, provisioning, and capital adequacy.

This brief makes the case that mangrove restoration – a cost-effective and proven coastal adaptation tool – creates **direct and material commercial opportunities for Kenya's banks**. These opportunities are organised across **two horizons:** actions banks can take now to generate revenue and build capability; and a larger, longer-term opportunity to protect existing balance sheets by working with clients to reduce coastal climate risk and developing specific lending products.

> **Target Audience of the Investment Brief**
>
> This brief is designed for commercial banks - specifically sustainability teams, risk and credit officers, and new business units. It outlines how mangrove restoration can directly reduce expected credit losses and create new revenue opportunities across lending and advisory services.
>
> While banks are the core audience, the analysis is also relevant to other private sector organisations with coastal exposure, such as real estate developers, tourism operators, and infrastructure owners.

The Physical Risk to Bank Portfolios

Coastal flooding and sea-level rise generate correlated credit risk across multiple borrower categories simultaneously – amplifying potential losses within bank portfolios rather than affecting isolated borrowers. Mombasa alone could face flood depths of up to **1.8 metres by 2050** for a 1-in-100-year event, with associated damages of **USD $570 million affecting approximately 1.8 million people**. These impacts fall directly on sectors that constitute material portions of Kenyan bank loan books:

Coastal real estate: Coastal properties are projected to lose 5–10% of market value globally over the next decade without protective measures, weakening collateral and increasing default risk.

Manufacturing and industry: Expected annual losses in coastal economic zones around Mombasa could rise by 30–50% by 2040, affecting cash flows and creditworthiness.

Tourism and hospitality: Revenue volatility in unprotected coastal areas is projected to increase by up to 20%, elevating SME lending risk.

Infrastructure: Ports, roads, utilities, and transport assets face a growing physical climate risk, with implications for infrastructure finance and PPP-linked exposures.

Mangroves as Natural Risk Mitigation Infrastructure

Mangrove restoration is not a 'nature add-on' – it is a proven risk-reduction solution with measurable, asset-level financial impacts. Globally, mangroves avert over **US $65 billion in flood damages** and protect more than **15 million people** annually. Studies demonstrate wave-height reductions of 15–60% and significant decreases in expected annual losses for nearby coastal assets. In Kenya, the flood protection

value of mangroves has been estimated at **USD $238–311 per hectare per year** in areas such as the Tana Delta (Karanja & Saito, 2017) – a direct financial return on natural infrastructure that reduces borrower default probabilities, stabilises collateral values, and lowers insurance costs for assets already on bank balance sheets.

Unlike hard engineering, mangroves attenuate storm surge and wave energy across entire coastal zones, protecting **multiple borrowers simultaneously** and across loan-relevant time horizons. Beyond risk reduction, healthy mangrove ecosystems underpin Kenya's blue economy – supporting fisheries productivity, ecotourism, community livelihoods, and emerging carbon revenues – all of which translate into more stable borrower cash flows and stronger repayment capacity.

The Commercial Opportunity for Banks: Two Horizons

This brief identifies seven specific opportunities for commercial banks to engage. These are structured across two distinct time horizons, reflecting differences in complexity, market readiness, and commercial scale.

HORIZON 1 — Engage Now

Lending to carbon project developers: Working capital, bridge finance, and term loans to mangrove carbon developers with contracted offtake and identifiable revenue streams.

Business loans to mangrove-aligned enterprises: SME and enterprise lending — potentially on preferential terms — to fisheries, aquaculture, and ecotourism businesses whose cash flows and assets depend on healthy mangrove ecosystems. Targeting 5–10% of the existing ~USD 5.6bn MSME loan book toward this segment implies a USD 280–560 million portfolio opportunity.

Arrangement and custodial fee services: Fee income from structuring, arranging, and administering transactions that support Mangrove Restoration. Initially this could include basic custodial functions like trust fund management and move towards blue bond structuring and facilitating parametric insurance flows — without deploying balance sheet capital. These offerings could then be expanded into Horizon 2 as Banks experience develops and the market matures and more complex transaction structuring is required, for instance through supporting debt-for-nature swaps or securitisation of carbon revenues.

HORIZON 2 — Build Toward

De-risking existing client portfolios: The largest single opportunity. By integrating mangrove presence into credit assessments — collateral valuation, tenor decisions, and risk-based pricing — banks can protect the estimated USD 3–6 billion of existing lending exposed to coastal climate risk. This is a defensive, balance-sheet-level opportunity that does not require new products or client relationships.

Infrastructure and project finance: Incorporating mangrove restoration into project due diligence and physical climate risk assessments for coastal infrastructure. Broad proxies suggest USD 60–150 million of existing coastal infrastructure finance may be in areas where mangroves can materially reduce physical risk.

Supply chain finance: Trade and working capital finance to buyers, aggregators, and processors sourcing from mangrove-dependent value chains. Addressable opportunity estimated at USD 5–12.5 million in the near term.

Municipal and county-level financing: Supporting county-level coastal protection and resilience programmes where mangrove restoration is integrated with broader infrastructure investment, subject to appropriate guarantee and on-lending structures.

Why Act Now

Horizon 1 opportunities require no new products, no fundamental changes to credit frameworks, and no major organisational restructuring. They can be pursued today with limited complexity, allowing banks to generate revenue, build institutional knowledge of mangrove-aligned lending, and establish track record in Kenya's blue economy. Critically, they allow banks to begin **aligning with emerging climate disclosure requirements** - including CBK's Climate Risk Guidance and the Taskforce on Nature Based Financial Disclosure - pre-empting possible moves towards mandatory obligations.

Horizon 2 represents the more significant commercial prize. An estimated **USD 3–6 billion of the Kenyan banking system's coastal loan book** is exposed to physical climate risk that will intensify over the coming decade. Even small improvements in loss severity, collateral preservation, or borrower resilience can materially reduce expected credit losses, provisioning requirements, and capital charges. The banks that invest now in understanding and managing coastal physical risk — and in building relationships with clients, DFIs, and restoration partners — will be better placed to protect their portfolios and capture the commercial upside as Kenya's blue economy matures.

> **The investment case for banks is dual-sided**
>
> **Defensive:** Mangroves protect the estimated USD 3–6 billion of existing coastal lending from accelerating physical climate risk, reducing expected credit losses, provisioning pressure, and capital charges.
>
> **Offensive:** Seven specific lending and fee-based opportunities — spanning carbon finance, SMEs lending, infrastructure, and custodial services — offer a credible and growing commercial pipeline for banks willing to engage early.

Enabling Conditions and Next Steps

Realising these opportunities requires **banks to build specific capabilities**: the ability to screen coastal portfolios for physical climate risk using available spatial tools; the ability to quantify how hazard exposure translates into credit-relevant financial impact; and the ability to engage clients constructively around coastal risk and mitigation options.

These capabilities do not require large upfront investment. Banks can begin by **overlaying existing client and collateral registers against publicly available hazard maps**, and by using the CBK's Climate Risk Guidance as a framework for integrating physical risk into credit processes. The TNFD LEAP framework - backed in Kenya by the Kenya Bankers Association provides additional structured guidance for assessing how nature and climate-related risks translate into financial exposure.

Partnerships will be equally important. Blended finance facilities - including the Blue Natural Capital Financing Facility, the Blue Carbon Accelerator Fund, and Proparco's Climate & Nature Risk-Sharing Facilities - can provide guarantees, first-loss protection, and technical assistance that can help make Horizon 1 transactions commercially viable and reduce the learning cost for banks entering this market.

Full analysis of each opportunity, market sizing, risk considerations, and a detailed implementation pathway are set out in the sections that follow.

1. The Adaptation Challenge

Kenya's coastline is increasingly exposed to severe and frequent flooding, with economic losses projected to rise sharply under climate change. Current analyses estimate that, in Mombasa, Kenya's largest coastal city and East Africa's biggest seaport, as much as $4.8 billion worth of coastal assets could be exposed to flooding and inundation by 2050 without adaptation (Stimson, 2021). These hazards directly threaten Kenya's productive economy - housing, tourism, manufacturing zones, coastal agriculture, fisheries, and transport.

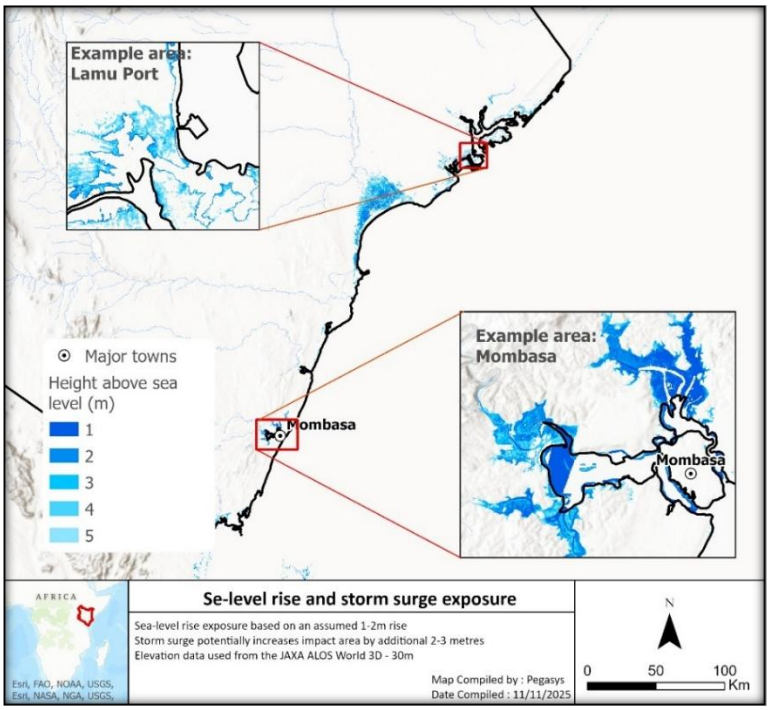

Figure 1: Sea level rise and storm surge exposure zones for the coastline of Kenya

Mombasa, one of Kenya's main financial and economic hubs, could experience flood depths of up to 1.8m by 2050 for 1-100 years return period, as evidenced by the Coastal Risk Index tool. This corresponds to total flood damages of USD $570 million, impacting approximately 1.8 million people.

Figure 2: Projected Flood Depths in 2050 in Mombasa for 1-100 years return period (Source: Coastal Risk Index Tool)

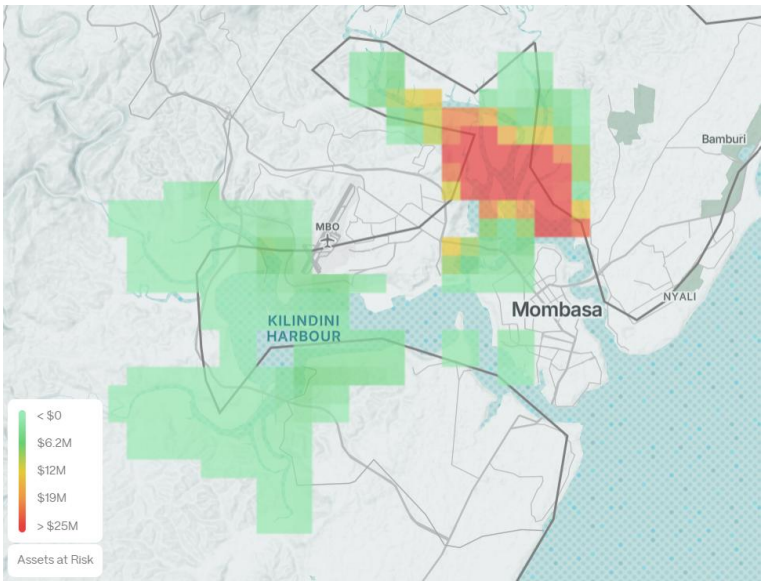

Figure 3: Projected Flood Damages in 2050 in Mombasa for 1-100 years return period (Source: Coastal Risk Index Tool)

For financial institutions, this translates into higher credit risk, declining collateral values, rising non-performing loans, and increased insurance costs.

Coastal flooding and sea-level rise cause direct physical damage to buildings, roads, utilities, and productive land - inundating properties, corroding foundations, disrupting power and water supply, and rendering assets temporarily or permanently unusable. In Kenya's coastal counties, this physical damage is concentrated in economically active zones: the port and industrial estates of Mombasa, the tourism corridors of Kilifi and Kwale, and the densely populated low-lying settlements that line the coastline. As these assets are damaged or destroyed, their economic value deteriorates — and with it, the financial position of the businesses and households that own or depend on them. For financial institutions, this translates into higher credit risk, declining collateral values, rising non-performing loans, and increased insurance costs. The impacts fall directly on core sectors that constitute material portions of Kenyan commercial banks' loan books:

- **Households & mortgages:** Properties in low-lying coastal areas are projected to lose 5–10% of market value globally over the next decade without protective measures, increasing mortgage default risk and weakening collateral coverage ratios. Coastal exposure models for Mombasa show hundreds of thousands of people and billions of USD in assets are already at risk from sea-level rise and extreme water levels - suggesting material collateral risk for coastal properties and mortgage portfolios (Brown, Kebede, & Nicholls, 2011).
- **Manufacturing & industrial borrowers:** Flooding disrupts production, damages equipment and inventory, and causes supply-chain delays. In the coastal economic zones around Mombasa, expected annual losses could rise by 30–50% by 2040, directly affecting borrowers' cash flow and creditworthiness (Nying'uro, Kimutai, Mwangi, & Khaemba, 2024).
- **Tourism & coastal SMEs:** Resorts, hotels, and tourism-dependent SMEs face heightened business-interruption risk, with studies projecting up to 20% increases in revenue volatility in unprotected coastal areas, elevating SME lending risk and portfolio instability.
- **Coastal infrastructure:** with ports, railways, toll-roads, telecommunications infrastructure being amongst some of the high value infrastructure at risk and where mangroves can provide measurable risk-reduction up to ~5–10 km inland.

Because these exposures are geographically concentrated, coastal flooding creates correlated risk across multiple borrowers and asset classes simultaneously, amplifying potential losses within bank portfolios rather than affecting isolated borrowers. In short, coastal flooding is a material and accelerating financial risk to banks' loan books.

Adaptation solutions are needed to protect coastal assets. These can take the form of hard engineering 'grey' infrastructure such as sea walls, surge barriers, and levees, or 'green' infrastructure such as restored mangroves, salt marshes, and living shorelines that absorb wave energy and reduce inundation. Green infrastructure such as mangrove restoration can be considered as a natural risk mitigation infrastructure class, comparable to engineered grey solutions with measurable impacts on expected losses.

Mangrove restoration is one of the few adaptation interventions with demonstrated, asset-level risk reduction benefits at scale. Mangroves are forests of trees and shrubs growing along coastlines in tropical areas, creating natural buffers that dissipate wave energy and reduce peak height of coastal flooding. Unlike hard infrastructure, mangroves attenuate storm surge and wave energy across entire coastal zones, reducing expected losses for multiple borrowers simultaneously and protecting collateral values over loan-relevant time horizons.

Globally, mangroves avert over US $65 billion in flood damages and protect over 15 million people each year (Menendez, Losada, Torres-Ortega, Narayan, & Beck, 2020). Studies show wave-height reductions in the range of 15–60% and measurable decreases in expected annual loss for nearby coastal assets (McIvor, Moller, Spencer, & Spalding, 2012). In Kenya, these protective functions help stabilise coastal property values, reduce borrower default probabilities, and improve the resilience of industrial and tourism assets[1] (Hamza, Esteves, & Cvitanovic, 2022). Beyond risk reduction, mangroves contribute to Kenya's blue economy, generating co-benefits in fisheries productivity, carbon revenues, ecotourism, and community livelihoods, reinforcing long-term economic stability in regions where banks maintain substantial exposure.

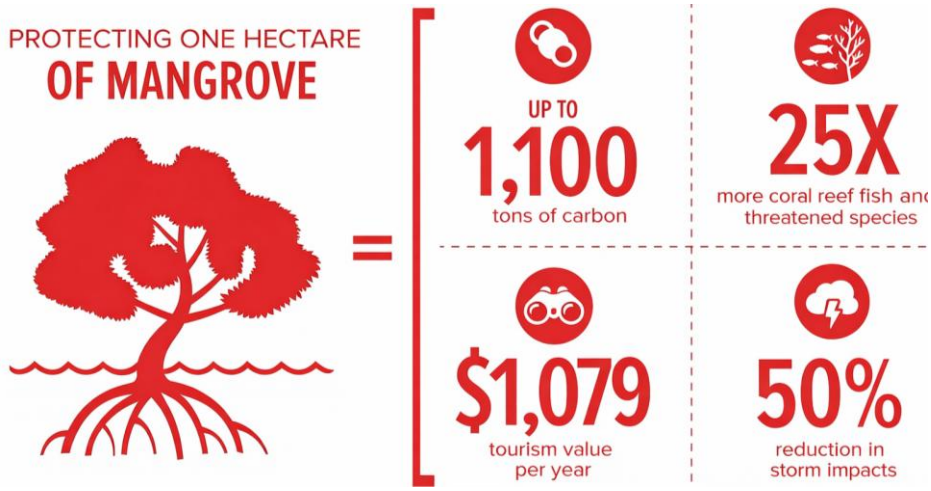

Figure 4: Example benefits of Mangrove protection (Source: Conservation International)

However, scaling mangrove restoration is complex. Flood protection is a classic collective-action challenge. Its benefits are widely distributed, while restoration costs fall on specific communities, landholders or businesses. As a result, Kenya's mangrove landscapes remain structurally under-funded, despite clear economic benefits. Unlocking their full adaptation value requires coordinated public, concessional, and private capital, alongside mechanisms for monetising resilience benefits.

This brief identifies the scale of the investment need and where commercial banks can directly participate in and benefit from enhancements to Kenya's coastal resilience via mangrove restoration. It finds that Banks can play a catalytic role by financing clients, projects, and place-based investments aligned with mangrove restoration, strengthening the resilience of their own loan portfolio while positioning themselves at the forefront of Kenya's emerging blue-economy opportunity.

[1] This study found that combined mangroves and corals prevent higher coastal hazard exposure across ~ 35% of Kenya's coastline, and that loss of these ecosystems would increase the proportion of coastline at higher exposure from 16% to 41%.

2. The Investment Need in Kenya

Restoring mangroves in Kenya will require significant capital. An initial estimate, based on the data outlined in the section below and collated as part of this assignment suggests that directionally **USD 280 million** would be needed to bring degraded mangrove ecosystems in Kenya back to good ecological, functional condition and provide coastal protection benefits.

Kenya's total mangrove extent is over **61,000 hectares** along the coast (Lamu, Kilifi, Kwale, Tana River, Mombasa) (Chisika & Yeom, 2023). However, not all these mangroves are degraded, and restoration efforts should be focused on mangroves in need of restoration.

The **Global Tool for Nature-based Solutions**[2] estimates a potential 28,000 hectares of mangrove restoration potential. **Therefore, for the purpose of this brief, we assume an indicative restoration target *of* 28,000 hectares** [3]of mangroves that can be restored to good ecological condition. Spatial information on the location of the mangrove restoration opportunity is found in the Appendix.

Mangrove restoration costs vary by site conditions, hydrology, community involvement, and methodology. A range observed in restoration literature and project data is **USD 8,000/hectare for establishment and planting** (Mongabay, 2025) and USD **2,000/hectare for ongoing management and monitoring** (25% of upfront restoration costs); resulting in a cost of USD **10,000/hectare across the full project lifecycle**[4].

USD 280 million (28,000 hectares x USD 10,000/hectare) therefore represent the indicative restoration investment required to bring degraded mangrove ecosystems in Kenya back to good ecological, functional condition and provide coastal protection benefits.

Total Kenyan mangrove area (Hectares)	Total restoration potential (Hectares)	Total restoration cost (USD/hectare)	Total Investment Need (USD)
61,000	28,000	USD 10,000	280,000,000

Investing in mangrove restoration in East Africa **generates substantial economic and financial returns that often far exceed the initial costs**. Costing and impact data for mangrove restoration in East Africa consistently show compelling *economic* returns through avoided damages and ecosystem service gains. For example, the Global Tool on NbS projects that a 140-ha restoration in Kilifi County yields USD 219,082 in avoided damage benefits, with a benefit-cost ratio (BCR) of 1.63 when considering just coastal protection outcomes, *not financial returns* (i.e., not including revenues from sale of carbon credits or increased revenues from enterprises that benefit from restored mangroves). Globally, and when factoring financial benefits, mangrove restoration projects deliver higher returns: meta-analyses find benefit-cost ratios ranging roughly from 6.8 to 10.5 based on avoided damages and ecosystem services over time, underscoring strong cost-effectiveness of restoration investments at scale (Sue, Friess, & Gasparatos, 2021).

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[2] The Global Centre for Adaptation (GCA), in partnership with the University of Oxford, developed advanced analytical tools (The Global Tools on NbS) that can identify and map opportunities for NbS projects supporting infrastructure resilience, supported by UK International Development with funds from the UK government. These tools provide a common set of metrics that capture and quantify (with sufficient robustness) the benefits of NbS for infrastructure resilience alongside broader outcomes, such as carbon and biodiversity. These analytics enable investors and governments to identify and prioritise investments in NbS where they can deliver a viable financial return and measurable social benefits.

[3] Wetlands International has identified 23,000 hectares of degraded mangroves that can be restored to good ecological condition in Kenya (Wetlands International, 2025); a number broadly aligned with Global Tool on NbS results.

[4] Costing data from the Global Tool on NbS estimate a total restoration cost of USD 94 million for 28,000 hectares, or USD 3,357 per hectare. While these estimates are based on projections in Kenya, some unit costs appear unusually low (as low as USD 90 per hectare), whereas others (around USD 10,000 per hectare) are more consistent with, and broadly confirm, cost assumptions observed in international best practice used for this brief.

However, there is a gap between the total restoration costs for resilience (the broad need for coastal protection) and the size of the market from the perspective of commercial finance– knowing that early stages of mangrove restoration initiatives are typically not funded by commercial banks, but rather by NGOs, DFIs and MDBs as the following section articulates. Commercial banks operate where benefits accrue to identifiable borrowers, or where risks can be reduced through structure, partnerships, or policy support.

The following sections articulate the market context for mangrove restoration, explaining how these schemes are typically structured and the participants involved and where the different opportunities lie for commercial banks.

3. Market Context and Opportunities for Commercial Banks

Typical Structure of a Mangrove Restoration Scheme

Mangrove restoration projects are typically anchored by NGOs or community trusts, supported by technical partners, and aligned with national policy frameworks. This model is reflective of the nature of mangrove restoration as a collective-action asset: with benefits widely distributed across communities and industries, while costs and implementation responsibilities fall on specific actors. To make these projects viable structures are needed that combine or apportion concessional finance, community delivery, benefit-sharing mechanisms, and long-term governance frameworks in clearly understood models. This section provides a high level description of how such schemes currently operate.

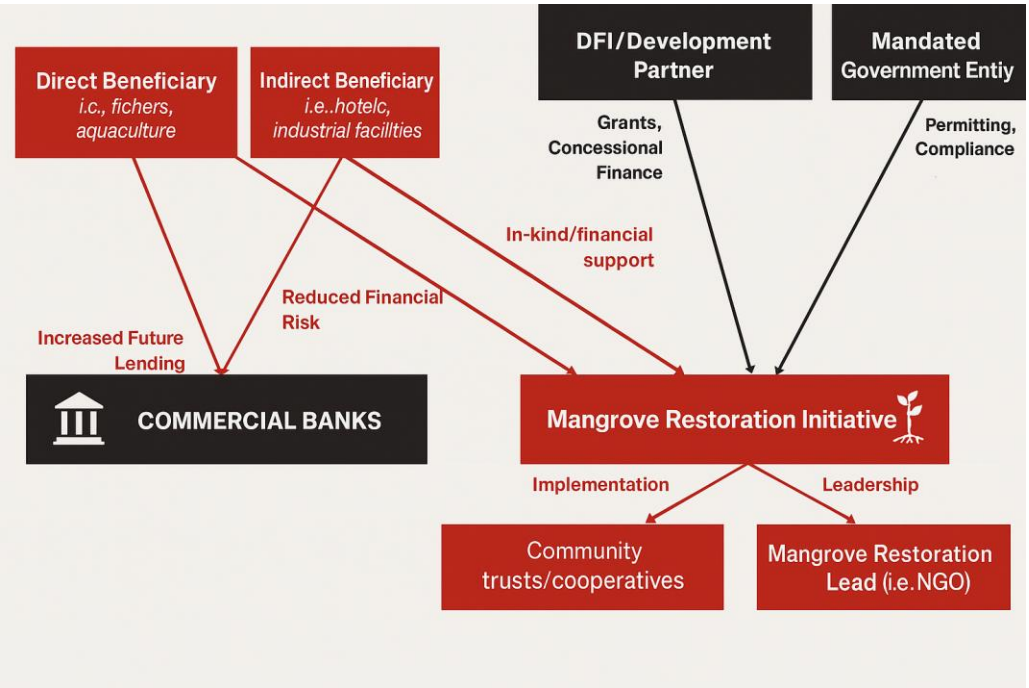

Figure 5: Stylised Structure of a Mangrove Restoration Initiative

1. Funders

Mangrove restoration typically begins with grant or concessional funding, which covers early-stage costs such as community mobilization, baseline assessments, nursery development, and governance setup. This initial funding is often provided by NGOs, bilateral donors, or multilateral institutions such as UNEP, the Global Environment Facility, or the European Union. These actors play a catalytic role, absorbing ecological and operational risk while building the foundation for future monetization.

As projects mature, they may start to generate revenue from the sale of carbon credits, through certification schemes like Plan Vivo, which verify ecosystem services and enable access to carbon markets. In parallel, opportunities for private-sector involvement grows, particularly in segments where mangrove health supports real-asset performance such as tourism and aquaculture.

In Kenya, the Lamu Blue Carbon Project, supported by the European Union and implemented with the Government of Kenya, exemplifies this model. It began with donor funding to restore 4,000 hectares and secured Plan Vivo certification to monetize carbon benefits.

This structure is also aligned with international best practice: the World Bank's Blue Economy for Resilient Africa and UNEP-FI's Investing in Nature both emphasize layered capital stacks and outcome-based financing as critical enablers for nature-based solutions. In Indonesia (World Bank, 2022) and the Philippines (Wetlands International, 2025), large-scale mangrove restoration has similarly relied on multilateral and philanthropic funding to establish governance and ecological baselines before opportunities for aquaculture and eco-tourism ventures emerge.

2. Implementers

Implementation **is often community-led**, with local groups responsible for planting, monitoring, and stewardship. At the outset, communities are typically involved in preparing sites and organizing nurseries, ensuring that seedlings are available for planting. They then carry out the planting itself, often through collective efforts that reinforce local ownership. Over time, these groups move into **stewardship roles**, maintaining the restored areas, enforcing local rules to prevent degradation, and integrating restoration into everyday livelihoods. **Monitoring is also part of their role,** with communities tracking progress and working alongside NGOs or research partners to ensure that outcomes are credible. Governance structures, such as community trusts or cooperatives, provide a framework for benefit-sharing and accountability, embedding restoration within local institutions.

This model reflects the IUCN's emphasis on **inclusive governance and local capacity**, and aligns with Wetlands International's Community-Based Ecological Mangrove Restoration (CBEMR) approach, which has been successfully applied in Kenya's Tana Delta and Lamu regions (Wetlands International, 2025). It also reflects the IUCN Global Standard for Nature-based Solutions (IUCN, 2020), which stresses the importance of inclusive governance and local implementation capacity. It also aligns with the Mangrove Breakthrough's Roadmap, which calls for scalable delivery models rooted in community ownership.

Alongside communities, **technical partners** (typically NGOs, universities, or research institutes) provide expertise in site selection, hydrological assessments, species matching, and monitoring design. Their role is crucial in bridging local knowledge with scientific rigor.

For instance, in the **Vanga Blue Forest project**, community members manage patrols and sustainable harvesting, supported by external technical teams for carbon quantification; and the Youth Pawa initiative in Mombasa mobilizes youth volunteers for planting and maintenance, demonstrating how restoration can be embedded in local social structures.

Additionally, **county and national authorities provide permitting, zoning, and compliance oversight.** They also align restoration projects with coastal development plans and national strategies. In Kenya, county governments in Mombasa, Lamu, and Kwale play a critical role in integrating mangrove restoration into broader coastal management frameworks, while national agencies such as the Kenya Forest Service and the State Department of Fisheries provide regulatory legitimacy.

3. Beneficiaries and value distribution

Mangrove restoration projects in Kenya generate a set of benefits that extend from the immediate livelihoods of coastal communities to the broader resilience of national and regional economies. Understanding this structure requires a clear distinction between **direct beneficiaries**, who experience immediate and tangible gains from restored ecosystems, and **indirect beneficiaries**, who benefit through reduced risk exposure, stabilized asset values, and enhanced economic resilience.

Direct beneficiaries are primarily local communities and small enterprises whose livelihoods are closely tied to coastal ecosystems. Fishers and aquaculture operators benefit from healthier nursery habitats, improved water quality, and increased fish stocks, which directly enhance productivity and income. Artisanal fisheries, which provide food security and employment for thousands of households along Kenya's coast, are particularly dependent on mangrove ecosystems. Restoration also supports small-scale aquaculture ventures, such as silvo-fisheries and regenerative shrimp farming, which integrate mangroves into production systems to reduce disease risk and improve yields. Beyond fisheries, communities gain diversified income streams through activities such as beekeeping, agroforestry, and ecotourism. Restored mangrove sites attract visitors, creating opportunities for guided tours, cultural experiences, and micro-enterprises.

Indirect beneficiaries include sectors and institutions whose exposure to coastal flooding and erosion is reduced by the protective functions of mangroves. Tourism operators, particularly resorts and hotels in Mombasa and Lamu, benefit from stabilized shorelines and reduced storm damage, which lowers business interruption costs and protects asset values. Industrial facilities located in coastal economic zones gain resilience against production downtime and supply-chain disruption, improving their creditworthiness and reducing insurance premiums. Public infrastructure such as schools, health centers, and transport hubs also benefit from reduced flood risk, safeguarding essential services and lowering the fiscal burden on local governments. At a macro level, county and national governments benefit from stabilized tax bases and reduced disaster-response expenditures, reinforcing the economic case for restoration.

The value distribution mechanisms embedded in these projects are closely linked to the types of carbon markets they access. In Kenya, community-led mangrove initiatives such as Mikoko Pamoja and Lamu Blue Carbon operate primarily within the voluntary carbon market, where credits are sold to companies and individuals seeking to offset emissions. While discussions around Internationally Transferred Mitigation Outcomes (ITMOs) under Article 6 of the Paris Agreement are ongoing, current Kenyan mangrove projects remain focused on voluntary markets rather than regulated compliance markets.

Revenues generated through these voluntary carbon markets can then be reinvested into community development projects, including clean water provision, education facilities, and healthcare services, as demonstrated by Mikoko Pamoja. This model shows how restoration delivers tangible social dividends while sustaining ecological outcomes. At the same time, integrating income-generating activities such as agroforestry and beekeeping ensures households see immediate financial returns, reducing reliance on carbon revenues alone and diversifying resilience. Together, these mechanisms strengthen both community welfare and long-term stewardship of restored mangrove ecosystems.

4. Ensuring long-term sustainability through governance, MRV and policy alignment

Projects typically involve mandated public entities such as the Kenya Forest Service or the State Department of Fisheries, which provide oversight, legitimacy and coordination. County governments play a critical role in permitting, zoning, and coastal planning, requiring harmonization between national directives and local development strategies. Many projects also establish community trust models to manage benefit-sharing and ensure compliance, as seen in Mikoko Pamoja and Vanga.

A key reference point is the National Mangrove Ecosystem Management Plan (2017–2027), which establishes a dedicated governance framework including a Directorate, a National Mangrove Management Committee, Heads of Conservancy, and County-level Coordinators. This plan provides a structured mechanism for aligning restoration projects with national priorities and ensuring accountability across multiple levels of government.

Long-term success also depends on alignment with broader policy frameworks. Mangrove restoration must be aligned with Kenya's blue economy strategy, Nationally Determined Contributions (NDCs), National Biodiversity Strategies and Action Plans (NBSAPs) as well as county-level coastal development strategies. This alignment provides legitimacy, coordination, and long-term policy support, making projects more attractive to investors and ensuring they contribute to national climate and development goals.

Credible Monitoring, Reporting, and Verification (MRV) systems are essential for both certification and adaptive management. Kenya's National Mangrove Ecosystem Management Plan includes outcome-oriented matrices to track success, while newer projects like Papariko integrate drone-based degradation assessment, eDNA biodiversity monitoring, and digital MRV platforms - combining indigenous knowledge with cutting-edge science. These approaches reflect emerging global standards, such as those promoted by TNC's Coastal Risk & Resilience Framework and the Mangrove Breakthrough's MRV guidance.

The Opportunity for Commercial Banks

Mangrove restoration in Kenya is increasingly identified not just as an ecological imperative, but as an investment opportunity (Kenya Forest Service, 2025) (Kenya Bankers Association, 2025).

For commercial banks, the opportunity does not lie in financing the upfront costs of mangrove restoration, which are typically borne by donors, NGOs, and concessional programs[5]. However, commercial banks can play an important role. **They can realize commercial opportunities in seven areas today, including by de-risking their existing loan portfolios**. At the same time they can build capability and position to benefit from a pipeline of new lending opportunities in the future. In this way, mangrove restoration becomes both a defensive strategy to safeguard collateral and an offensive strategy to build competitive advantage and expand lending into Kenya's emerging blue economy.

These seven opportunities for commercial banks are identified in Figure 6 below. The nature of each opportunity and the value for banks is then discussed in the following section alongside efforts to establish the indicative scale of the commercial opportunity, based on available information and suitable proxies[6].

Figure 6: Summary of Opportunities for Commercial Banks

1. Lending to carbon project developers

Commercial banks can lend to carbon project developers restoring mangroves and generating verified carbon credits for sale on voluntary carbon markets. While donors and concessional capital typically fund early restoration activities, carbon developers increasingly operate as professional project sponsors with contracted offtake[7] and hard-currency revenues.

Banks can provide working capital, bridge finance, or term loans to support project development, monitoring, verification, and scale-up. Banks can lend directly to project developers on a corporate finance

[5] Although there may be opportunities to provide trade finance to contractors and companies involved in the establishment and set-up of mangroves.

[6] Given the nature of the sector, its maturity and the lack of data in some instances, these should be treated as indicative estimates not precise market sizes.

[7] In the form of commitments to purchase carbon credits. For example; the Mikoko Pamoja mangrove carbon credit project in Gazi Bay, one of the earliest blue-carbon initiatives in the world sold credits on the voluntary carbon market that were *purchased by Apple (12,000 credits reported as being sold). Verra Registry, 2025.*

/ balance sheet lending basis, or on a project finance basis with lending to a specific special purpose vehicles tied to cash-flow generated by that project, although discussions with market participants suggest the latter is likely to play a modest role in the near-term[8]. For banks, this represents a familiar form of project or corporate lending, generating interest income while building exposure to a growing asset class aligned with global decarbonisation commitments. Precedents for commercial bank lending to carbon developers do exist in the market, and while limited are accelerating. For example, in 2023, ABN AMRO provided a carbon-backed working capital loan to Vlinder, a mangrove restoration developer operating in Kenya (Quantum Commodity Intelligence, 2024).

Market scale | Globally, voluntary carbon markets transact ~USD 2–3 billion annually, with nature-based solutions accounting for roughly 40–50% of issued credits. Blue carbon credits from mangroves trade at a premium relative to many terrestrial offsets due to high carbon density, durability, and adaptation co-benefits.

East Africa is already a recognised hub for nature-based carbon projects. Kenya's voluntary carbon market features more than 70 projects and has issued over 40 million carbon credits across sectors (Eastern Africa Alliance on Carbon Markets and Climate Finance, 2023). While volumes of credits from mangrove restoration are currently understood to be modest at ~10,000 tCo2e[9] a year and revenues unlikely to be substantial based on prevailing voluntary carbon credit prices.

However, credit issuances from the existing Mikoko Pamoja and Lamu Blue Carbon Projects serve as examples of a growing blue carbon market niche in Kenya which has the potential to become material if traded volumes and prices escalate towards 2030/2050. Organisations consulted as part of this study suggested that in the future, the emerging biodiversity credits market may also present supplementary revenue opportunities from mangroves, as will activation of Internationally Transferred Mitigation Outcomes (ITMO's). These are essentially carbon credits, that can be transferred between countries and have been recently activated under Article 6 of the Paris Convention[10]. For both these reasons its plausible that traded volumes of credits as well as prices will increase, creating greater opportunities for banks.

Risks to be managed | A key constraint on bank lending to carbon project developers is the difficulty of hedging exposure to voluntary carbon market (VCM) price volatility and credit delivery risk — risks that fall outside the standard toolkit of commercial lenders. This is where development finance institutions (DFIs) and donors can play a catalytic role, for example through first-loss protection (FLPs), partial credit guarantees, or political risk insurance that make the residual risk profile acceptable to commercial banks. Insurance products specifically designed for VCM exposure are also emerging as a complementary risk mitigation tool, though the market remains nascent.

2. Business loans to mangrove-aligned enterprises[11]

Mangrove restoration underpins the productivity and resilience of coastal SMEs operating in fisheries, aquaculture, eco-tourism, and related blue economy sectors. Banks can provide standard enterprise and SME loans to these existing businesses. This could include preferential terms linked to mangrove-positive

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[8] Based on the limited revenues currently estimated from projects listed on public registries vs. the cost and complexity of establishing Special Purpose Vehicles. Also supported by Tripathy, Aneil (2024). *MCSC Corporate Climate Finance Primer*. MIT Climate and Sustainability Consortium. Published May 2024. Available from the MIT DSpace repository.

[9] Project analysis, based on Verra Registry Issuances and implied $ revenues from average Voluntary Credits prices. Please see appendix for further detail.

[10] Article 6 of the Paris Agreement allows countries to trade verified carbon emission reductions (ITMOs) to help meet climate targets, under strict accounting rules to avoid double counting. Global traded volumes are expected to be modest in the near term (millions of tonnes per year), with longer-term scenarios suggesting up to ~1–2 $GtCO_2e$ annually by the 2030s, implying a potential market value in the tens of billions of dollars at prices of ~$20–40/t.

[11] While there is no established international definition of 'Mangrove Aligned Enterprises' there are parameters that can be applied in a robust way, in alignment with the work of the Taskforce on Nature Related Financial Disclosures (TNFD) and Blue Economy definitions used by the likes of the World Bank. These can include the extent to which enterprises: Operate within a defined coastal/mangrove influence zone (e.g. ≤5 km from mangrove belt or dependent fishing area), Derive a material portion of their revenue (>30–40%) from activities directly supported by mangrove ecosystems, Participate and 'do-no-harm' to recognised mangrove management or restoration schemes, Relies on assets protected by mangroves (landing sites, ponds, lodges, cold storage, jetties).

practices. This would allow banks to play an important role in supporting access to credit without developing new asset classes or products but by recognising the role of healthy ecosystems in stabilising cash flows and asset values for existing or emerging clients. This approach is well-established in analogous sectors: Rabobank has structured sustainability-linked loans for aquaculture companies in Chile and Australia in which interest margins are tied to measurable environmental KPIs such as ASC certification and antibiotic reduction targets (Rabobank, 2022).

Mangroves add real, measurable value to fish production. 30–80% of tropical commercial fish species depend on mangroves at some stage of their lifecycle. As such they support the primary productivity that underpins coastal fisheries and their revenues. In Kwale County, research estimated that mangrove-associated fisheries contribute about US $198 per hectare per year in fisheries production value (after fishing costs) (Hassan, Mwangi, & Kairgo, 2017). Mangroves also act as natural breakwaters. For fisheries this results in fewer damaged boats, nets, and landing sites each year. This delivers a direct cost-saving, not an abstract climate benefit for fisheries. It can also translate into more fishable days per year due to calmer near-shore conditions.

Market scale | The global blue economy is estimated at USD 3–6 trillion annually, supporting more than 350 million jobs, with coastal SMEs forming the majority of enterprises. In Kenya, coastal activities contribute an estimated 5–10% of GDP (World Bank, 2019) when tourism, fisheries, ports, and coastal services are combined and may reflect a material portion of total Kenyan SME credit[12]. It has been estimated that marine fisheries and coastal ecosystem's share — part of the broader blue economy — is over KSh 440 billion (~US $4.4 billion) in annual economic value.

Establishing the exact boundaries of this market, in terms of the lending opportunity for banks is challenging. However, analysis suggests it is material. Kenyan commercial banks currently hold ~USD 5.6 billion in outstanding MSME loans[13]. If banks deliberately target 5–10% of existing MSME lending toward mangrove-aligned / coastal blue economy enterprises it would imply a USD 280–560 million loan portfolio.

Increasing effort is being made internationally to stimulate and respond to demand in this sector. Examples of existing approaches to bank lending to the sector include the Blue Finance Facility, launched with participation from BNP Paribas, which is a USD 35 million impact loan facility to support reef-positive and blue economy businesses around marine protected areas. This offers loans to enterprises such as responsible ecotourism, community aquaculture, sustainable fisheries, and blue carbon projects. The work of Rabobank, highlighted above as well as BNP Paribas biodiversity-linked loans that highlight growing appetite to link loan performance to wider environmental benefits.

3. Supply chain finance for mangrove-dependent goods

Banks can also provide trade finance and supply chain finance to buyers, aggregators, and processors sourcing goods from mangrove-dependent ecosystems, including fish, shellfish, honey, and eco-products. By supporting working capital needs across the value chain, banks benefit from offering short-tenor loans while indirectly supporting mangrove conservation through more stable and traceable sourcing relationships when accompanied by strong frameworks to ensure the integrity of sourcing approaches such as MSC, ASC, GSSI-benchmarked standards, Fairtrade, or IFC Performance Standard 6-aligned due diligence.

From a banking perspective, this opportunity is characterised by short tenors, rapid turnover, and relatively low unit margins, making it familiar but potentially operationally intensive. The most bankable entry point is likely to be lending against contracted offtake and established buyers—such as seafood processors, exporters, hotels, or retailers—who aggregate supply from multiple coastal producers. In these cases, mangrove dependence is an underlying driver of supply stability and quality rather than the direct credit exposure.

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[12] In many emerging markets, coastal SMEs represent 20–40% of local SME credit demand, concentrated in food production, processing, hospitality, and logistics.

[13] As of December 2024, Kenyan commercial banks held approximately USD 5.6 billion in outstanding MSME loans, based on Central Bank of Kenya data (KES 784.4 billion). Converted at ~KES 140/USD. Used as an indicative proxy for existing SME credit exposure, not a measure of new or incremental lending demand.

However, market participants interviewed for this study note that this supply chain finance, while interesting is likely to be modest in absolute balance-sheet terms for most commercial banks. Several structural factors constrain scale in Kenya including the realities that:

- Primary producers are fragmented and typically operate below minimum bankable ticket sizes.
- Value chains are seasonal and exposed to price volatility, increasing monitoring costs.
- Supply chain finance volumes tend to recycle quickly, limiting outstanding exposure even where transaction flows are large.

As a result, supply chain finance linked to mangrove-dependent goods is unlikely to represent a major growth opportunity for banks. Instead, its commercial logic lies in portfolio optimisation and client relationship deepening.

Market scale | Global seafood trade exceeds USD 150 billion annually, with sustainability and traceability requirements increasingly shaping buyer behaviour. In East Africa, these value chains already depend heavily on finance—often informal, short-term, and high-cost—creating theoretical space for banks to substitute with structured products.

In practice, the addressable opportunity for commercial banks is a narrow slice of this total trade value for the reasons flagged above (ticket size, tenor etc) and are concentrated among a limited number of processors, exporters, and large buyers capable of meeting bank credit standards. A bottom-up assessment focused on bankable counterparties suggests that outstanding supply chain finance exposure linked to mangrove-dependent value chains in Kenya is likely in the range of USD 5–12.5 million across the commercial banking system today (see appendix for more information). For commercial banks, the opportunity is therefore best understood as incremental.

4. Integration into infrastructure and project finance

For commercial banks financing coastal infrastructure — including ports, processing facilities, tourism assets, and logistics hubs — the integration of mangroves as natural infrastructure can affect project bankability by reducing physical climate risk and enhancing long-term cash-flow stability. Mangroves act as living coastal buffers, attenuating wave energy and reducing flood exposure.

For lenders, this can translate into lower expected damage costs, improved insurance terms, and more resilient project cash flows, strengthening risk-adjusted returns without expanding debt capacity or altering core project economics. Studies show that mangroves can reduce wave energy by 60–70% over relatively short distances, often at lower lifecycle cost than purely engineered coastal defences. For Kenyan banks financing public or private coastal infrastructure, integrating mangrove restoration into project design and financing can therefore have a clear business case and should be considered as part of physical climate risk assessment and project due diligence.

Market scale | Coastal flooding causes tens of billions of dollars in losses globally each year, and climate-resilient infrastructure investment needs are estimated at USD 3–4 trillion annually. Globally, mangroves create significant flood protection value — one modelling exercise found some 20-km coastal stretches, often near urban infrastructure, benefit from over USD 250 million in annual flood protection value due to mangroves (Menendez, Losada, Torres-Ortega, Narayan, & Beck, 2020). In the Kenyan context, mangroves in the Tana Delta and along the coast have been shown to significantly buffer coastal flooding, with net flood protection values of USD 238–311 per hectare per year, illustrating that natural coastline habitats can contribute materially to risk reduction for nearby infrastructure assets (Joseph & Saito, 2017).

In Kenya, broad market proxies suggest it's possible that USD 60–150 million of existing coastal infrastructure finance provided by commercial banks is currently exposed in areas where mangroves can materially reduce physical climate risk[14].

[14] These are indicative estimates based on Central Bank of Kenya sectoral credit data; and standard African bank portfolio splits and the assumption that coastal counties account for ~10–15% of GDP and a similar share of infrastructure assets. It is assumed that mangroves provide material protection to 20-30% of those assets. For more details please see the appendix.

Lenders are also increasingly required to assess and disclose physical climate risk on long-tenor assets such as infrastructure through emerging disclosure standards, including IFRS S1 and S2. Incorporating nature-based risk mitigation into project finance frameworks can therefore support both credit risk management and regulatory alignment.

5. Municipal or county-level financing

Commercial banks can potentially support coastal protection and resilience programmes at the county or municipal level, where mangrove restoration is integrated alongside traditional grey infrastructure such as seawalls, drainage, and flood control systems. In the Kenyan context, direct sub-national borrowing capacity is constrained, and commercial lending is therefore most viable where appropriate national government guarantees, on-lending arrangements, or ring-fenced repayment mechanisms are in place.

While public-sector borrowers rely primarily on fiscal allocations, donor funding, and concessional finance, commercial banks can potentially play a complementary role. This is particularly relevant where mangrove restoration contributes to long-term fiscal resilience by reducing damage to public assets, lowering maintenance costs for coastal infrastructure, and protecting revenue-generating assets such as ports, roads, tourism facilities, and public utilities.

For banks, such transactions can offer sovereign- or quasi-sovereign risk exposures, typically with shorter tenors and defined use of proceeds, rather than open-ended balance-sheet risk. When appropriately structured, these facilities can support local adaptation priorities while remaining consistent with banks' public-sector and infrastructure lending frameworks.

Market scale | Globally, sub-national governments are responsible for an estimated 60–70% of climate adaptation spending, yet receive a disproportionately small share of climate finance flows. In Kenya, coastal counties play a central role in land-use planning, flood management, and maintenance of public infrastructure, but face persistent financing gaps for resilience investments.

Analysis suggests that USD 30–60 million per year of county-level expenditure in Kenya's coastal counties is directed toward infrastructure and climate-relevant activities. These could, in principle, include mangrove restoration as part of broader coastal resilience programmes[15]. While not all of this expenditure is suitable for commercial lending, it provides a reference point for the scale of public-sector coastal investment to which commercial banks may provide complementary financing when appropriate guarantees, on-lending structures, or blended finance arrangements are in place.

While the commercial lending opportunity at county level maybe be limited in volume, it represents a potential future strategic entry point for banks with established clients.

6. De-risking existing clients assets

The lending portfolios of Kenyan Commercial Banks are exposed to coastal flooding risk. Household, small enterprise and corporate lending in sectors such as manufacturing, real estate, health and agriculture are all vulnerable to rising sea levels, storm surges and salt-water intrusion. Without adaptation to these risks, coastal asset values can decline, non-performing loans rise, and insurance costs escalate.

Unlike the preceding opportunities, which generate incremental new lending volumes, the primary commercial significance of mangrove restoration lies in its ability to protect *existing* bank balance sheets — potentially across billions of dollars of exposed coastal assets.

The chart below illustrates the concentration of aggregate commercial bank lending in sectors exposed to coastal climate risk in Kenya, alongside the segments where mangrove restoration can materially reduce physical risk. For banks, the relevance of mangroves is not environmental, but financial: as natural coastal buffers, healthy mangrove systems attenuate wave energy, reduce flood depth and frequency, and stabilise shorelines, thereby lowering the severity and correlation of losses across coastal loan books.

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[15] Total county budgets for FY 2024/25 was 602bn KES according to the Office of the Controller of Budget equivalent to USD 4.5bn. Coastal counties (Mombasa, Kilifi, Kwale, Lamu, Tana River) account for ~10–12% of total county budgets and according to the Office of the Controller of Budget ~36% of county budgets allocated to development expenditure. Of this 20–30% of development expenditure can be estimated to be linked to infrastructure, flood management, land use, and coastal protection. This implies an envelope of between $30-60m within which selectively structured commercial financing may play a complementary role.

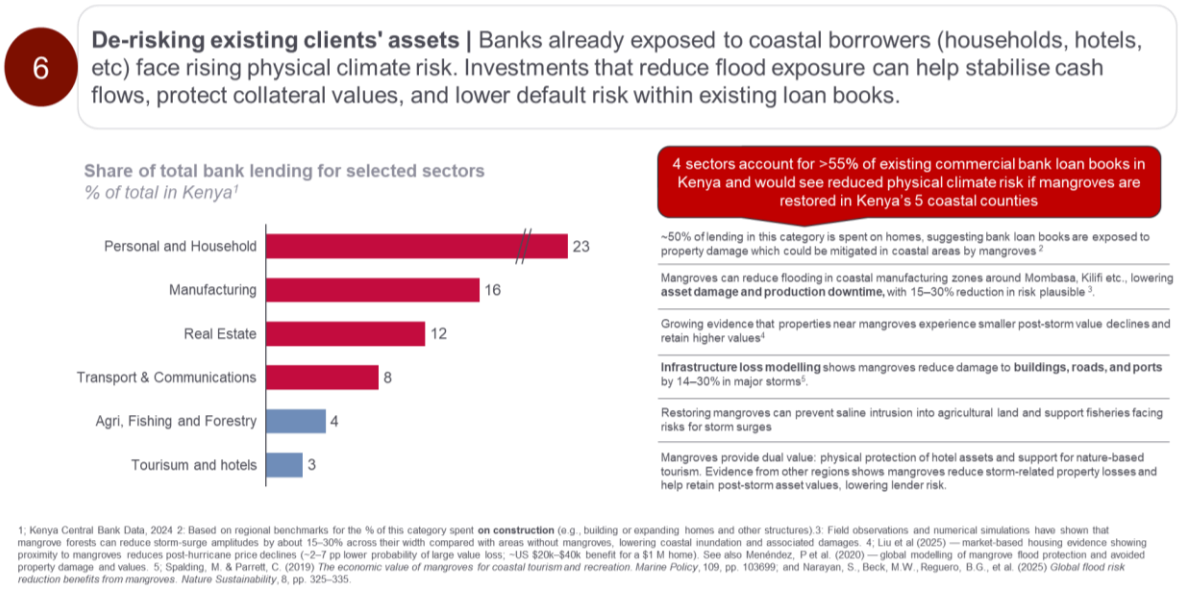

Figure 7: Sectors in which banks can materially de-risk existing lending books

Empirical evidence shows that mangroves can reduce wave energy by approximately 20–60%, significantly lowering flood impacts and averting substantial expected annual damages along the East African coast. For lenders, these biophysical effects translate into more stable borrower revenues, lower probability of default during extreme events, improved collateral recovery values, and reduced insurance premiums. In this sense, mangrove-positive interventions function as a form of *natural risk mitigation infrastructure*, helping to protect the long-term value of assets already financed by the banking system.

- Industrial borrowers: Industrial and manufacturing borrowers: Coastal processing and manufacturing facilities are highly sensitive to flooding-related downtime and supply-chain disruption. Mangrove-stabilised shorelines reduce operational interruptions and asset damage, supporting revenue continuity and creditworthiness (UNEP, 2024).
- Tourism and hospitality assets: Hotels and resorts in locations such as Mombasa and Lamu face increasing erosion and storm damage, which undermines both cash flows and property values. Mangrove buffers reduce business interruption risk and physical damage, improving debt service capacity and protecting collateral underpinning term loans and mortgages (Blue Life Hub, 2025). (Joseph & Saito, 2017).
- Infrastructure and public facilities: Infrastructure, public facilities, and PPP-linked exposures: Schools, health centres, transport assets, and utilities in low-lying coastal areas benefit from reduced flood exposure when mangroves are restored. This lowers default risk on public-private partnerships, contractor balance sheets, and county-linked financing structures to which commercial banks are exposed (Wetlands International, 2025).

Market scale | The commercial significance of mangrove restoration lies in protecting existing bank assets rather than generating new loan volumes. Conservative proxies suggest that USD 3–6 billion of Kenyan commercial bank lending is exposed to coastal physical climate risk today across real estate, tourism, manufacturing, SMEs, and infrastructure[16]. Even small improvements in loss severity, collateral preservation, or business interruption risk can materially affect expected credit losses, provisioning, and capital adequacy. As regulators increasingly require banks to quantify and manage physical climate risk at portfolio level, mangrove restoration functions as a form of natural risk mitigation infrastructure underpinning the resilience of a substantial share of the banking system's existing balance sheet.

[16] This estimate is derived by applying conservative sectoral and geographic exposure filters to the Kenyan banking system's total loan book. Starting from total gross loans of approximately USD 30–35 billion based on CBK data, and estimated 35% is concentrated in sectors sensitive to coastal physical climate risk. Applying a further 25–40% geographic exposure factor for coastal counties yields an estimated USD 3–6 billion of lending exposed to coastal flooding, erosion, and storm surge risk. This excludes broader macroeconomic spillovers and represents a cautious estimate.

At the portfolio level, mangrove restoration also reduces the risk of correlated losses during extreme weather events - an issue of growing concern for regulators and supervisors. The Network for Greening the Financial System (NGFS) and UNEP-FI emphasise that integrating physical climate risk into credit assessment and stress testing is now a prerequisite for resilient banking systems (UNEP, 2024). Recognising mangrove systems as part of the coastal risk mitigation landscape enables banks to better manage sectoral concentration, regional exposure, and climate stress scenarios.

Importantly, this does not imply that commercial banks directly finance mangrove restoration. Rather, banks benefit by lending into environments where physical risk is being reduced, whether through public, donor, or blended-finance interventions. By factoring the presence (or absence) of mangrove buffers into credit assessments—through collateral valuation, tenor decisions, or risk-based pricing—Kenyan banks can a) price their lending to reflect costal climate risks accurately and b) work with their existing borrowers to proactively identify opportunities to support mangrove restoration as a means to reduce this risk.

7. Arrangement and custodial fee-based services

In addition to balance-sheet lending, commercial banks can generate fee-based income by providing arrangement, advisory, custody, and trustee services linked to mangrove-related financing structures and broader blue economy transactions. These activities do not rely on banks deploying significant capital, but instead leverage capabilities in transaction structuring, fiduciary services, and cash management.

In the near term, fee income from these activities is likely to be measured in hundreds of thousands rather than millions of dollars per bank, reflecting the bespoke nature of current transactions. That said, the strategic value of these services can exceed their direct fee contribution. Acting in fiduciary or arranging roles allows banks to:

- Gain early visibility on emerging blue economy transactions
- Build institutional relationships with DFIs, donors, counties, and project sponsors
- Position themselves as trusted financial intermediaries as markets formalise and create optionality for future lending, trade finance, and capital markets mandates

Relevant use cases include:

Parametric insurance | Parametric insurance can complement mangrove restoration by providing rapid, trigger-based payouts for coastal flood events while restoration investments help reduce underlying physical risk over time. Banks will not typically offer insurance they can act as escrow, payout, and transaction agents, managing premium collection, trigger-based payouts, and cash flows between insurers, reinsurers, donors, and beneficiaries.

Debt-for-nature swaps | Debt-for-nature swaps can support mangrove restoration by creating dedicated, ring-fenced funding for conservation through the restructuring of existing public debt. While such arrangements are bespoke and require particular expertise to negotiate and structure banks can serve as local custodians and paying agents, holding conservation trust accounts and administering earmarked debt service and environmental expenditure flows.

Blue bond issuance | Banks participate as co-arrangers, trustees, and custodians, supporting bond structuring, issuance, settlement, and ongoing covenant and cash-flow administration.

Collateral or cash-flow administrator for ring-fenced revenue streams linked to carbon credits, resilience payments, or ecosystem service revenues | these could include acting for community based organizations involved in the delivery of carbon credits schemes as Trusts or businesses.

Long term market development opportunities

In the longer term, as the result of mangrove restoration banks can realize opportunities to finance future economic growth. Beyond risk reduction, mangrove restoration creates new lending opportunities by stimulating economic activity in coastal regions. Healthy mangrove ecosystems underpin Kenya's emerging blue economy, generating revenue streams across fisheries, aquaculture, eco-tourism, and community enterprises. For banks, this means a growing pipeline of borrowers whose resilience and productivity are directly tied to restored landscapes.

- Eco-tourism: Projects in Kenya have demonstrated how restored mangrove sites attract visitors, enabling SMEs to offer guided tours, hospitality services, and cultural experiences. Banks can finance expansions, upgrades, and working capital for these businesses.
- Fisheries and aquaculture: Mangroves improve water quality and nursery habitats, boosting artisanal fisheries and enabling regenerative aquaculture models. Projects can integrate silvo-fisheries and sustainable aquaculture, creating clear revenue pathways for debt financing.
- Beekeeping and agroforestry: Diversified livelihoods linked to mangrove ecosystems, such as honey production and agroforestry, provide microfinance opportunities. These activities are low-ticket but high-uptake, especially when paired with fintech-enabled credit scoring.

4. Implementation and Scaling Pathway

To realise the opportunities associated with mangrove restoration commercial banks can take action across two horizons. **One focussed on engaging now** to generate revenues by lending and providing services to existing mangrove aligned enterprises and carbon project developers. These are comparably lower complexity opportunities for banks and would allow them to build market insight and capability.

The second horizon focuses on working with existing bank clients to map and mitigate coastal climate risk. This would protect banks own balance sheets and build towards new lending opportunities associated with supply chain, infrastructure and municipal finance offerings for mangrove projects as these nascent markets evolve. These opportunities are likely to emerge over a longer time period and involve both greater levels of complexity and require commercial banks to build greater expertise.

The logic for pursuing this approach is summarised in the figure and section below. A set of practical next steps for Banks to take to build capacity, partnerships and take action is also provided.

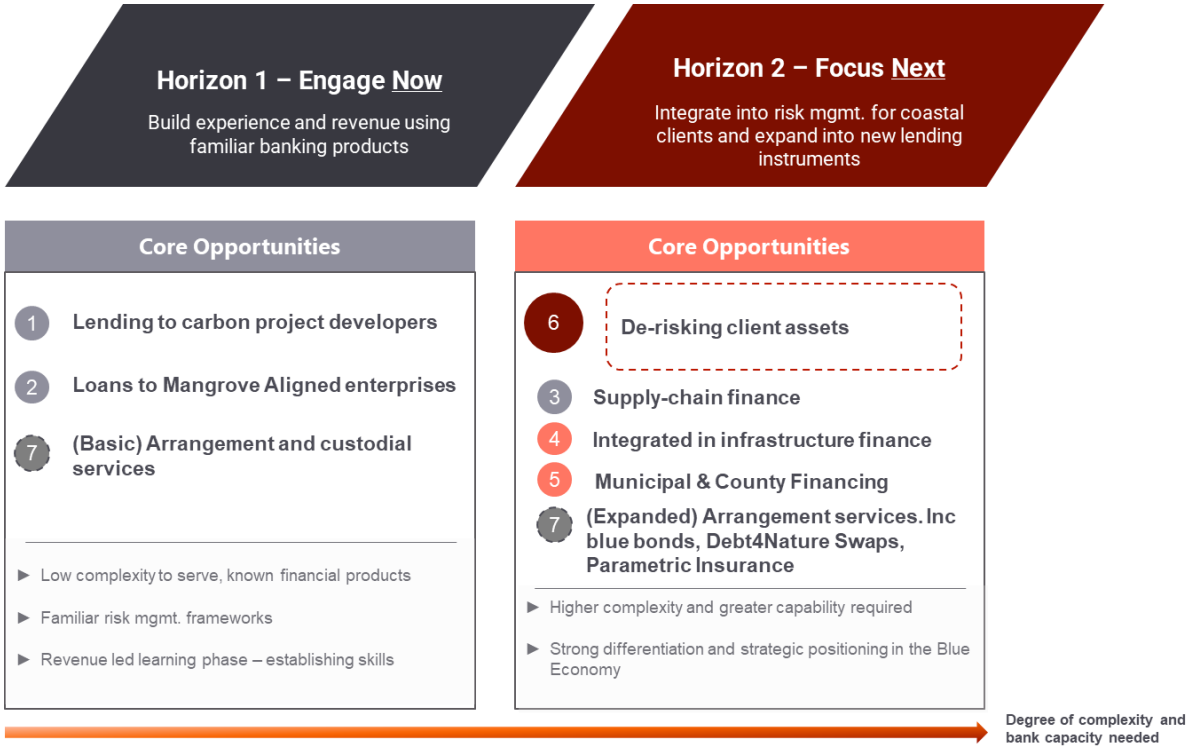

Figure 8: Scaling pathway for commercial banks to engage in Mangrove Restoration

Engage NOW to support transactions with clear revenue streams as a means to build capability and track record. To deliver this the **focus** should be on:

- **Selectively engaging with carbon markets**, including lending to carbon project developers with identifiable cash flows and developing insight into project level and market risks[17].
- **Expand lending to mangrove aligned enterprises, coastal and blue economy value chains**, where short-tenor lending supports working capital and growth.

[17] Including project delivery risk and carbon price risk.

- Act as a provider of basic arrangement and custodial services associated with mangrove restoration, such as custodial, trustee, and escrow services for community organisations and companies involved in delivering mangrove restoration.

This can be enabled by exploring partnerships and co-lending opportunities with specialist funds and facilities that provide blended finance, guarantees, and technical assistance that reduce risk and accelerate learning. These could include the Blue Natural Capital Financing Facility, The Blue Carbon Accelerator Fund, The Blue Guarantee Company and Proparco's Climate & Nature Risk-Sharing Facilities.

Banks can also explore opportunities to manage carbon project risk through accessing insurance for non-delivery of credits (both for under-issuance vs forecast and reversal risk) which are offered by organisations such as Howdens and Marsh and providers of carbon price risk floors and demand aggregation[18].

Why now? These transactions allow banks to build understanding of mangrove linked opportunities and establish their internal capabilities. At the same time they can build lending track record and fees and align climate risk management with emerging climate disclosure and risk management expectations, which demand clear identification of physical climate risk and quantification of the credit and financial value at risk. All this without requiring major changes to core credit frameworks, allowing it to be done with limited organisational complexity and friction.

Focus NEXT on | realising the major opportunity to protect bank balance sheets by working with existing clients to identify their coastal climate risks and reduce them. Here mangroves can function like off-balance-sheet risk-mitigation infrastructure, improving the risk-adjusted performance of existing loan books. As understanding and expertise grows banks can also explore more complex lending opportunities such as Supply Chain Finance, Infrastructure and Municipal finance opportunities linked to mangroves restoration.

Why focus here? | Client-level risk mitigation represents the largest opportunity for commercial banks because it protects and enhances the value of existing loan books, rather than relying on the creation of new products or client relationships. Banks already have material exposure to coastal borrowers across housing, tourism, SMEs, manufacturing, and infrastructure. Improving the resilience of these clients directly reduces expected credit losses, stabilises collateral values, and supports long-term client relationships - making this both a risk management priority and a core commercial opportunity.

While Supply Chain Finance, Infrastructure and Municipal lending associated with mangrove restoration can, and should also be pursued the market as new revenue opportunities - the scale of the opportunity to protect and limit risk is significantly larger.

[18] Organisations can include Respira and Symbiosis Coalition that support revenue and demand certainty respectively.

What are the practical steps Banks can take?

Banks should focus on building their ability to support clients with Physical Climate Risk and Opportunity Management for their Coastal Portfolios. Doing so requires moving from high-level awareness of climate risks to spatially explicit, client-level risk identification, and developing a clear view on options for reducing those risks by supporting mangrove restoration and evaluating the business case associated with it.

Delivering this requires:

1) Screening coastal portfolios | This can help produce a prioritised list of borrowers and collateral assets facing material physical climate hazards - flooding, storm surge, or salinity - so that subsequent effort is focused where risk is most material.

   Banks can begin this process by utilising spatial risk identification tools such as: GCA's Global Risk Index (GRI) Risk Viewer which provides free, high-resolution hazard mapping as well as the WWF Water Risk Filter and the World Bank's Country Climate and Development Report (CCDR) for Kenya. Banks can also seek expert technical support from Kenya Marine and Fisheries Research Institute as well as Pwani University and Technical University of Mombasa for marine science and the University of Nairobi and private service providers to conduct asset-level modelling for more complex portfolios.

   This step does not require new data systems - it can begin with the bank's existing client and collateral registers overlaid against publicly available hazard maps.

2) Quantifying value at risk | Hazard exposure matters most to banks if it translates into financial impact. Banks should work with relationship managers to translate physical risks into credit-relevant metrics: likely impacts on borrower revenues under stress scenarios, potential collateral value impairment, and changes to debt service capacity.

   The CBK Guidance on Climate-Related Risk Management provides a framework for integrating physical climate risks into existing credit risk processes and scenario analysis. For most banks, a useful starting point is a simple materiality assessment for the highest-exposure segments — coastal agriculture, hospitality, fisheries, and coastal SMEs — before moving to full portfolio-level modelling. Complementing this, the Taskforce on Nature-related Financial Disclosures (TNFD) LEAP framework (Locate, Evaluate, Assess, Prepare) offers a structured approach to assessing how nature and climate-related risks translate into financial exposure.

   Importantly, the TNFD has strong institutional backing in Kenya: the Kenya Bankers Association served as a co-convener of the TNFD Consultation Group and formally launched the framework in the Kenyan market in 2023 alongside WWF and KEPSA, committing through its Sustainable Finance Initiative to encourage voluntary adoption across the sector. Adopting this approach early would support commercial banks should broader regulatory adoption become mandatory.

3) Prioritising high-risk clients and engaging with them | Bank clients who face material coastal risk will need to be informed. Early engagement serves two purposes: it gives banks better data on how clients are managing risk (which improves credit assessment), and it positions the bank as a constructive partner rather than a reactive creditor when risks materialise.

   Relationship managers need to be equipped to have conversations that clearly articulate the nature, magnitude and degree of certainty attached to those coastal climate risks. This is not necessarily a core competency of existing relationship managers. The Global Centre on Adaptation's climate finance masterclass provides accessible introductory materials for client-facing staff to help them up-skill and communicate effectively.

4) Assessing risk mitigation options | This will require banks to work with partners to establish a suite of technical risk mitigation options. For example establishing the appropriate:

   - Nature based solutions, which may include mangrove restoration but extend to dune rehabilitation and wetland restoration
   - Asset-level resilience measures, including flood-proofing of buildings, elevation of critical equipment, drainage improvements, and salinity-resilient infrastructure for industrial and agricultural assets.
   - Risk transfer mechanisms, including parametric insurance products linked to storm surge, rainfall, or flooding thresholds, which can provide rapid liquidity following climate shocks.

5) Building the business case for action | For each risk mitigation option, banks should be able to articulate the financial logic: how a resilience investment changes expected credit loss, protects collateral value, or improves debt service stability under stress. This is the step that converts risk management from a compliance exercise into a commercial proposition — both internally (making the case to credit committees) and externally (making the case to clients).

Suggested entry point: A practical first step for most banks might be to conduct a pilot covering a defined coastal sub-portfolio - for example, hospitality and tourism lending in Mombasa or Kilifi, or aquaculture and fisheries clients in a single county. A pilot of this kind could produce a hazard-mapped exposure register, a set of client engagement conversations, and two or three worked examples of risk mitigation options and their financial logic - all within three to six months and without significant systems investment. The outputs would provide the evidence base for scaling across the broader coastal portfolio.

RESOURCES

This brief directly builds on the following technical reports:

- GCA (2026), Rapid Climate Risk Assessment and Adaptation Investment Opportunities Mapping in Infrastructure, Energy and Manufacturing, Tanzania Country Report. Developed in cooperation with partners including CGAP, and consulting firm: Pegasys.

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APPENDIX

ANNEX 1. DEFINING THE BIOPHYSICAL AND SPATIAL POTENTIAL FOR MANGROVE RESTORATION IN KENYA

GCA's Global Tool on NbS can support identification of the mangrove restoration opportunity in Kenya. The tool identifies areas aligned with other spatial priority sites identified by national and international research endeavours (Wetlands International, 2025) (Kenya Forest Service, 2025). These include the following:

- Lamu and Tana Delta: major clusters of degraded mangroves interacting with tidal dynamics and community land use.
- Kwale and Kilifi: significant pockets where human pressures (e.g., unsustainable harvesting and land conversion) have reduced ecosystem condition.
- Mombasa peri-urban fringes: comparatively smaller but high-impact degraded stands.

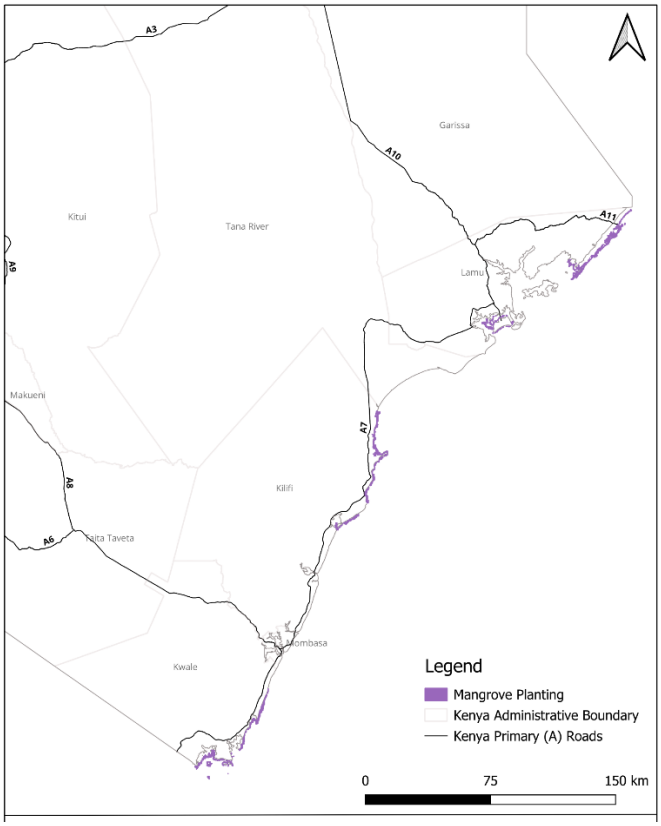

Figure 9: Global Tool on NbS Mangrove Restoration Areas

ANNEX 2. TOTAL MANGROVE RESTORATION COST ESTIMATES

Mangrove restoration costs vary by site conditions, hydrology, community involvement, and the restoration methodology employed. A range observed in restoration literature and project data suggests:

- Establishment & planting: USD 8,000 per hectare (Mongabay, 2025). (includes community engagement, seedlings, planting activities, site preparation)
- Ongoing management and monitoring: It is common in nature-based restoration budgets to allocate 20–30% of upfront restoration costs over the first 10 years for monitoring, protection, community stewardship, and MRV work.

Assumptions made by the team: The team assume that 25% of initial costs are allocated for early ongoing management, with these costs distributed evenly on an annual basis over a 10-year period. This allowed the team to calculate the Total Restoration Cost (Capital + Operating Costs)

Restoration capital cost (one-off): 28,000 ha × USD 8,000/ha = USD 224 million.

Ongoing management & monitoring (10-year window): 28,000 ha × (USD 8,000 × 25%) = 28,000 × USD 2,000 = USD 56 million

This implies a total restoration cost estimate of USD 280 million.

ANNEX 3. MANGROVE CARBON CREDIT VOLUMES AND REVENUE ESTIMATES

This appendix provides indicative estimates of the current and potential future scale of mangrove-related carbon credit issuance in Kenya, together with illustrative revenue implications based on prevailing voluntary carbon market prices. The analysis is intended to inform discussions on commercial relevance by providing an informed sense of project revenues and the implied debt that could be serviced, as such it provides plausible parameters rather than precise market sizing for commercial banks.

Estimated volumes of mangrove carbon credits

The team started by establishing current credit issuance (c. 2024–25). This appears to is driven by a small number of community-led Plan Vivo projects, with one larger Verra-registered project entering the pipeline. Aggregate issuance remains small in absolute terms.

Table A1. Estimated annual issuance of mangrove carbon credits in Kenya

Project / Category	Estimated annual issuance (tCO_2e/year)	Basis of estimate	Key sources
Mikoko Pamoja (Plan Vivo)	~3,000	Published project design and reporting	UN-REDD; Plan Vivo project documentation
Vanga Blue Forest (Plan Vivo)	~4,000–5,000	Cumulative PVCs issued to date annualised	Plan Vivo Registry
Papariko Blue Carbon (Verra)	~0–2,000 (early stage)	Recently registered; limited verified issuance so far	Verra registry; FSD Africa / project materials
Total – current (best estimate)	**~10,000**	Rounded central estimate	Synthesis of above

Forward-looking (2030) stress-test. Scaling is constrained by land tenure, community agreements, MRV costs, and time-to-first-issuance. Using a conservative assumption about the plausible yield of ~15–25 tCO_2e/ha/year (using a central ~20) and estimates of total plausible hectares of mangrove restoration potential the team can derive some basic ranges of annual carbon credit outputs in the future:

- **Low case (slow pipeline expansion):** ~50,000–70,000 tCO_2e/year
- **Central case (projects execute as planned):** ~150,000–160,000 tCO_2e/year
- **High but plausible case:** ~300,000–310,000 tCO_2e/year

With respect to $ revenues we can assume that credits from Mangroves typically price above generic nature-based credits. Based on the assumptions below in table A2 the implied revenue is:

- **Current** (based on ~10,000 tCO_2e/year): ~USD 80k–150k/year (central ~USD 100k)
- **2030 central case** (~150,000 tCO_2e/year): ~USD 1.2–2.3m/year (central ~USD 1.5m)

Table A2. Average voluntary market price assumptions (USD/tCO_2e)

Price case	USD/tCO_2e	Rationale	Indicative sources
Low	8	Conservative prices for Plan Vivo / community forestry credits	Ecosystem Marketplace (VCM price summaries); Plan Vivo market reports
Midpoint (central)	10	Selected mid-point	Selected mid-point
High	15	Premium blue-carbon transactions; not representative of market average	Select bilateral transactions reported in VCM analyses. Comparison with ClearBlueMarket Analysis. https://www.regreener.earth/blog/carbon-credit-prices-today-trends-and-forecasts-for-2026

1. Supply chain finance, commercial and market size parameters

To establish indicative parameters for the scale of the supply chain finance (SCF) opportunity associated with mangrove-dependent value chains, the consulting team applied a conservative, bottom-up sizing approach focused on establishing the number of plausible bankable counterparties.

Step 1: System-wide outstanding SCF exposure

The teams analysis assumed a limited number of coastal enterprises that could realistically utilise SCF, based on the scale of their operations and the currently limited penetration of SCF among Kenyan enterprises. For the purposes of analysis, we assumed that 10–25 processors, exporters, or large buyers could actively deploy SCF facilities at any given time. An average SCF facility size of USD 500,000 was applied as a conservative midpoint, reflecting a lower-mid-market SCF facility size that is economical for banks while remaining accessible for coastal firms. This yields an estimated USD 5.0–12.5 million in total system-wide outstanding SCF exposure.

Step 2: Allocation across active banks

Although approximately 10–12 Kenyan banks offer trade finance services based on desktop research, supply chain finance activity is concentrated among a smaller subset. Based on market practice and sector focus, it is assumed that 3–5 banks would actively deploy SCF into mangrove-dependent coastal value chains at any given time.

Resulting per-bank exposure | Dividing total system-wide exposure across active banks yields the following indicative range per bank:

- Low case: USD 5.0m ÷ 5 banks = **USD 1.0m per bank**
- High case: USD 12.5m ÷ 3 banks ≈ **USD 4.2m per bank**

2. Infrastructure finance estimates

To help contextualise the scale of the market opportunity for commercial banks the consulting team have provided broad indicative estimates of the level of Kenyan commercial bank exposure to infrastructure assets where mangrove restoration could materially reduce physical climate risk and improve long-term asset resilience. These should be treated carefully and as efforts to establish boundaries only and not a substitute for bottom-up analysis.

Underlying assumptions/data utilised

Step	Parameter	Data point / assumption	Result	Source
1	Kenya infrastructure investment need	~USD **4bn per year** infrastructure financing gap	Reference envelope	World Bank
2	Bank-financed share of infrastructure	Commercial banks typically finance a **minority share** of	Qualitative filter and phase IEM	World Bank PPP diagnostics database

		infrastructure via loans, PPPs, and project finance	project phase 1 analysis	
3	Estimated bank infrastructure exposure (stock)	Infrastructure, construction, transport & utilities typically **15–25%** of large African bank loan books	USD **3–5bn** system-wide (derived)	CBK sectoral credit reporting; African banking benchmarks
4	Coastal-relevant infrastructure	Coastal counties represent ~**10–15%** of GDP and infrastructure assets	USD **300–500m**	Kenya National Bureau of Statistics (KNBS)
5	Assets where mangroves are material	Flood-exposed, long-tenor coastal assets (~**20–30%** of coastal infrastructure)	USD **60–150m**	Derived using Menéndez et al. flood-risk relevance

Indicative headline result: USD 60–150 million of existing Kenyan bank infrastructure exposure sits in assets where mangrove restoration could materially reduce physical climate risk and improve long-term asset resilience. Please note: This is risk-mitigation on existing exposures, not incremental lending volume.

3. Estimating Commercial Bank Lending Exposure to Coastal Physical Climate Risk in Kenya

To provide an indication of the parameters of the opportunity the team conducted a transparent, proxy-based analysis to estimating the stock of Kenyan commercial bank lending that is plausibly exposed to coastal physical climate risk (flooding, storm surge, erosion, saltwater intrusion). The objective here was not precision, but to establish an order-of-magnitude estimate, sufficient to inform the brief with a clear logic that could be challenged, enhanced and updated should that be necessary, outside of this assignment. The estimate is based on publicly available banking sector data, sectoral credit allocation, and conservative geographic exposure assumptions.

Readers should remember that this is not a lending market; it is a balance-sheet protection issue affecting a material share of the Kenyan banking system's existing loan book. It also does obviously not look at the costs and economic viability associated with acting to manage and mitigate these risks using mangrove restoration.

Step #	Parameter	Data point / assumption	Calculation and principal sources	Range or mid-point taken
1	Total commercial bank loan book	Total loans outstanding in Kenyan commercial banking system	CBK-reported gross loans ≈ USD 30–35bn. Central Bank of Kenya (2023) *Bank Supervision Annual Report*.	Midpoint: **USD 32bn**
2	Identify climate-exposed sectors	Sectors materially sensitive to coastal flooding and storm surge (real estate, tourism, manufacturing, trade, transport, infrastructure, coastal SMEs)	CBK sectoral credit data indicates these sectors account for ~35–45% of lending. Central Bank of Kenya (2023) *Monthly Economic Review*.	Conservative assumption: **35%**
3	Sectoral exposure subtotal	Apply sectoral filter to total loan book	USD 32bn × 35%	**USD 11.2bn**

4	Geographic exposure filter (direct)	Estimate share of sectoral lending located in, or directly dependent on, coastal counties (Mombasa, Kilifi, Kwale, Lamu, Tana River)	Apply conservative range of **25–40%** Coastal counties' economic contribution supported by review of Kenya National Bureau of Statistics (KNBS)	USD 2.8–4.5bn
5	Indirect coastal dependence (optional uplift)	Capture borrowers economically dependent on coastal infrastructure (ports, tourism supply chains, logistics) but not physically located on coast	Modest uplift of **10–20%.** This could be removed if a more conservative estimate is desirable, as tracking dependence is challenging.	USD ~3.1–5.4bn
6	Rounded estimate	We have used a range to reflect uncertainty and avoid a sense of false precision	Rounded range	**USD 3–6bn**

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