Reach Alliance

A Virtuous Cycle

Mangrove Conservation and Blue Carbon Initiatives in Coastal Kenya

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The Reach Alliance was created in 2015 by the University of Toronto's Munk School of Global Affairs & Public Policy, in partnership with Mastercard's Center for Inclusive Growth. Our global university network now includes: Ashesi University, the University of Cape Town, Tecnológico de Monterrey, Singapore Management University, University College London, University of Melbourne, University of Oxford, and University of Toronto.

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Cover photo: Fishing boats in Vanga

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Executive Summary

Kenya is an emerging leader in innovative and sustainable blue carbon initiatives aimed at mitigating the effects of climate change on coastal marine ecosystems. In 2012, coastal villages in Gazi Bay implemented the world's first voluntary mangrove carbon credit project called Mikoko Pamoja. Seven years later, in 2019, three coastal villages further south along the coast in Vanga introduced a much larger mangrove carbon credit initiative called Vanga Blue Forest Project. Mangrove trees are an especially effective carbon sink, storing up to ten times more carbon than terrestrial forests do. By conserving their mangrove forests, the two community-led projects have not only reduced their carbon emissions but have also sold carbon credits to international companies and other organizations to help them achieve their carbon-reduction goals. Mikoko Pamoja and Vanga Blue Forest offer important insights into how remote coastal villages can introduce effective mangrove conservation and restoration strategies that can sustainably manage their coastal ecosystems, replenish marine life, introduce alternative livelihood opportunities, and support local economic development. They demonstrate what we call a virtuous cycle of conservation, carbon financing, and local economic development in otherwise hard-to-reach and neglected village communities.

Figure 1. Mangroves on the southeastern coast of Kenya near Jimbo village

Kenya's Mangroves in the Context of Climate Change

Climate change is a global existential threat that poses multidimensional challenges that include undermining global food supplies, the degradation of climate ecosystems, and exacerbating social and economic inequalities, all of which ultimately endanger human health. Nations worldwide are working to mitigate climate change by transitioning to sustainable systems and practices that reduce greenhouse gas (i.e., carbon dioxide) emissions. Addressing climate change requires multisector collaboration and efforts. It goes beyond relying solely on top-down policy, intergovernmental agreements, and the efforts of nongovernmental organizations (NGOs). The private sector and markets have a significant role to play in not only reducing their carbon footprint but also in financing and supporting projects that mitigate climate change.

It is especially important to address climate change in the global south where the poorest populations — who have contributed the least to the environment's degradation — most acutely feel its effects. Coastal villages in Kenya rely on local natural resources for their livelihoods, chief among them their surrounding mangrove forests. But coastal regions are at a particularly high risk of climate-related food insecurity, habitat loss, and severe weather events that harm their quality of life.

More than 2.5 million Kenyans live in coastal communities, home to some of the world's most lush mangrove forests. Villagers rely on these mangrove forests for flood protection, timber, firewood, and as breeding grounds for marine life that support their local fishing industries. However, unsustainable resource use, such as illegal logging, and environmental pressure from increasing global temperatures have devastated these ecosystems in Kenya and worldwide. Kenya's mangrove forests have been degraded by 50 per cent over the past 50 years. This has contributed to increased flooding and coastal erosion, growing food insecurity (due to loss of breeding area for fish), and rising poverty. The climate crisis is endemic in Kenya. Dependence on, as well as exploitation of, coastal natural resources causes a vicious cycle, accelerated by climate change.

We identify a virtuous cycle that can potentially counteract the vicious cycle of climate change: a cycle that preserves rather than degrades the eco-system, reduces carbon emissions permanently, and enables sustainable community development. We highlight how hard-to-reach coastal communities in Kenya are sustainably managing their mangrove forests to generate

income for local development through the sale of carbon credits.

Mangrove forests are uniquely effective in reducing greenhouse gas emissions by storing up to ten times the carbon that terrestrial forests do. In other words, mangroves have a disproportionately large impact when it comes to mitigating the effects of climate change. The additional carbon stored by preserving forests can be sold as carbon credits, which are traded on the global market to reduce carbon footprints. Until recently, carbon credit initiatives did not centrally involve the communities that border these important natural resources. Two initiatives in Kenya have led the way in experimenting with and transforming mangrove carbon credits — often referred to as "blue carbon."

In 2012, coastal villagers, international scientists, community organizations, as well as the government of Kenya spearheaded a new blue carbon credit model when they launched the Mikoko Pamoja (MP) project. Community co-creation, rather than top-down implementation, was central to the project. Community members worked with scientists and forest rangers to prevent mangrove degradation, storing carbon that would have otherwise been emitted into the atmosphere. In doing so, they generated and sold carbon credits in global markets. Income from those sales was then invested by villagers in local development projects.

In other words, the villages in the MP initiative capitalized on their conservation and reforestation efforts, turning their work to mitigate climate change into important revenues for them to invest. They benefitted from what we refer to as the virtuous cycle of mangrove conservation: carbon financing through the sale of carbon credits and community development.

The success of MP provided the blueprint to implement a larger, more ambitious blue carbon initiative near the border between Kenya and Tanzania, called the Vanga Blue Forest (VBF) project. VBF was launched in 2019 and is three times the size of MP's site. It supports over 8,700 people from three villages, compared to 5,400 living across two villages in the MP site. To date, the MP and VBF projects have generated nearly USD 200,000 for the villages involved in the two blue carbon initiatives.

The promise of carbon financing (i.e., the sale of carbon credits) has incentivized the communities to conserve their mangrove forests, which in turn has generated income for local development projects, such as access to clean water, investments in education, and other infrastructure priorities. Mangrove forests are not only a critical way to reduce greenhouse gas emissions but, if managed as a community-led blue carbon credit project, they can also provide multiple benefits to the communities and their surrounding environmental ecosystems.

In this report we show how a small-scale, multistakeholder project, supported with buy-in from the local communities, technical experts, and the government, can be a model for sustainable, long-term, and community-driven development.

Hard to Reach

Typically, when we think of reaching the hard to reach, we are thinking of those who are socially, politically, economically, and geographically marginalized. We conceive of "reach" as delivering development interventions — from food security to education programming to financial literacy to medical care, and so on — to hard-to-reach or hardly reached people and their communities. The concept of reaching the hardest to reach or the hardly reached is particularly compelling when one considers the imperative of "leaving no one behind," as the United Nations Sustainable Development Goals agenda compels the global development community to do.

Logistical optimization, the proliferation of accessible technology platforms, developing mobile delivery systems, and increasing cultural competencies (among other solutions), involve getting things from one place to another, while overcoming obstacles and barriers along the way. We tend to think of "reach" as getting important things from point A to point B. To be sure, reaching the hard to reach — and the research featured in the many case studies conducted by the Reach Alliance — focuses on delivering things efficiently and inclusively in different settings around the world.

But what happens when the benefits of development are immovable? What does reaching the hard to reach entail when the benefits of development, such as those generated from climate resilience, are not delivered from one place to another, but rather, realized in situ, in the hardest-to-reach places?

Blue carbon initiatives in Kenya such as Mikoko Pamoja (MP) and Vanga Blue Forest (VBF) are illustrative cases in which the benefits of development are generated in, rather than delivered to, remote coastal villages. These are geographically and socioeconomically difficult-to-reach communities. They have been neglected and are susceptible to economic downturns, public policy failures, and other trappings of poverty. Remote coastal villages in Kenya are especially vulnerable to the effects of climate change such as coastal erosion, marine life degradation, and the negative impact on their economic livelihood, even though such communities have contributed the least to climate change.

The solutions these villages have developed to address climate change and drive local development, however, are not imported or delivered from afar. They have not been copied or replicated. Rather, the solutions have been invented, adapted, and maintained by these remote fishing communities.

Here we highlight examples of development and climate resilience in hard-to-reach places where solutions are developed by people who live there. The technical knowledge required to support MP and VBF may have come from elsewhere, but the design, implementation, and sustainability of the blue carbon projects are developed and maintained locally. Lasting and effective solutions do not necessarily have to be invented in "the centre" (nor by so-called experts), and from there delivered to society's margins. Coastal villages in Kenya have figured out a way to both ecologically and economically benefit from mangrove conservation. They have implemented intensely local solutions to a global challenge.

MP and VBF demonstrate that sustainable solutions can emerge from the margins, and that the world would do well to consider how to emulate and replicate such solutions elsewhere.

The Blue Economy in Kenya

Oceans and forests are essential natural resources. They absorb greenhouse gas (GHG) emissions, such as carbon dioxide, and convert them into carbon and oxygen. While oxygen is released back into the air, carbon is stored in these ecosystems, acting as so-called carbon sinks. This process cleans our air and stores carbon that otherwise rapidly warms the Earth's atmosphere and leads to climate change.

Mangrove forests are an especially important coastal ecosystem and carbon sink. They are uniquely effective in mitigating climate change because they permanently capture up to ten times more carbon than terrestrial forests. They also offer other critically important ecological, social, and economic benefits. These co-benefits include ecological regeneration, poverty alleviation, and stimulation of local economic activity. These wide-reaching benefits make mangroves effective tools for promoting

sustainable development. They play a vital role in the "blue economy," which includes economic activity that leverages the sustainable management of oceans and coastal ecosystems.

Not surprisingly, blue carbon projects have grown exponentially in recent years. Kenya's Mikoko Pamoja (MP) mangrove carbon credit initiative was the world's first local mangrove carbon credit initiative. The Vanga Blue Forest (VBF) project in 2019 increased the project size fivefold. Both MP and VBF integrate three features or "pillars" that feed into each other. The first pillar is local mangrove conservation and restoration. The second is innovative carbon credit financing, which generates immediate financial capital for local development. The third pillar is meaningful community co-creation, contributing to what we refer to as "local ownership" of the blue carbon project.

Together, the three pillars have a synergistic effect: local communities manage their mangrove forests to increase carbon capture; the carbon that is stored (i.e., not emitted) is assigned an economic value, and then sold as carbon credits to organizations and businesses seeking to offset their own carbon emissions. The financial returns are then invested by the community in development projects locally. The three pillars support a virtuous cycle — they address climate change, generate resources for local communities, and ensure community participation in allocating resources to prioritize local needs.

Mangrove Forests and Conservation

Despite their immense ecological, social, and economic significance, mangroves constitute only 0.4 per cent of the world's forest cover. They account for an estimated 2 to 10 per cent of total carbon sequestered and stored by the Earth's forests. Globally, their total area spans around 15 million hectares.

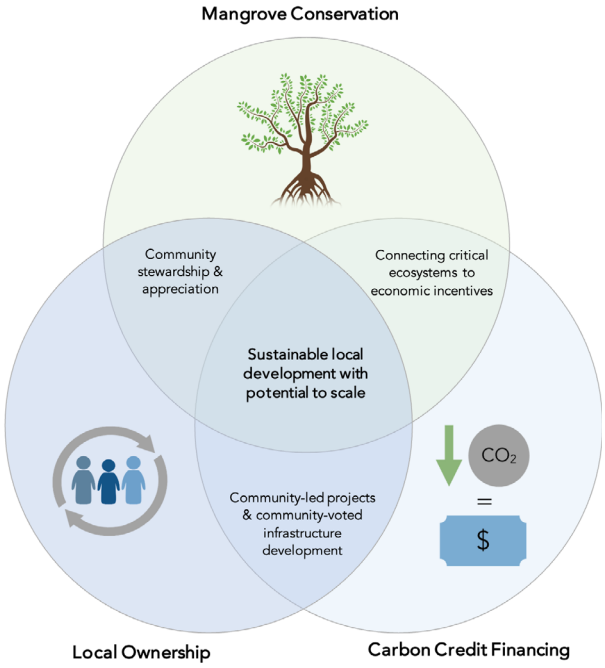

Figure 2. Three pillar framework: mangrove conservation, carbon credit financing, and local ownership

Mangroves occupy the transitional zone between land and sea, often partially submerged in water. They have unique characteristics that make them highly effective carbon sinks. Unlike terrestrial forests, mangroves have roots that can extend over a metre above the ground, creating an intricate root meshwork. As the mangroves use absorbed carbon to grow and shed roots, the discarded roots become trapped in this meshwork, accumulating carbon in the soil. This process, known as root turnover, permanently sequesters carbon. Permanent storage, as we discuss later, is essential to blue carbon projects.

Mangroves' root meshwork also serves as a natural defence against the destructive impacts of climate change. It traps sediment and acts as a natural coastal barrier, mitigating flooding and coastal erosion by absorbing and dissipating the energy of waves and tides. This protection is particularly crucial for safeguarding coastal communities against sea level rise and intensifying coastal storms.

Figure 3. Root meshwork in mangrove forest, Gazi

Finally, the root meshwork provides a secure refuge for marine life. Mangroves provide essential breeding grounds for fish, and thus play a pivotal role in sustaining the local ecosystem and supporting coastal livelihoods. Robust and regenerative fish populations have far-reaching downstream effects or co-benefits, such as improving food security, generating revenue for local communities, and enhancing climate change resilience. In short, preserving mangrove forests provides myriad co-benefits for humans and the environment.

Carbon Credit Financing and Markets

Voluntary carbon credit markets were created to accelerate the reduction of GHG emissions by employing economic incentives for conservation and reforestation. Carbon credit markets assign a monetary value to carbon removed or prevented from being released into the atmosphere, such as through sequestration by natural carbon sinks.

Carbon credits — each credit representing one ton of carbon — are sold by those who remove or sequester carbon and are purchased by organizations looking to offset their emissions. The concept of the global carbon credit market first emerged in the United Nations Framework Convention on Climate Change in 1992. The carbon credit market has evolved since then, notably through regulatory improvements through the 2015 Paris Agreement and yearly convenings of the Conference of the Parties.

Carbon credit projects include five principal stakeholders. *Project coordinators* design and oversee carbon credit projects, and offer sellable credits in the global marketplace. Project *validators* establish standard project features and implementation guidelines that developers must adhere to. *Third-party verifiers* assess and approve project plans and their implementation, including baseline measures and subsequent monitoring of the mangrove forests. The verification process occurs regularly, in intervals of (at most) every five years. *Buyers* are often companies and other organizations that purchase credits to offset their carbon emissions in order for them to reach their own carbon-reduction goals. Finally, *resellers* purchase credits from multiple projects and sell credit packages to buyers.

Industry standards outline four factors that influence the economic value (i.e., price) of a carbon credit. Through our discussions with carbon-credit resellers, we identified an additional fifth factor that can affect the price of carbon credits:

1. Emission reductions must be *real*. Emission reductions need to be accurately measured according to internationally agreed-upon scientific guidelines, such as those reflected in the Intergovernmental Panel on Climate Change (IPCC).
2. Credits must be *additional,* in that they represent carbon sequestered (or not released into the atmosphere) as a result of efforts beyond what project verifiers deem as "business as usual." In other words, the carbon stored must represent emissions that *would have occurred* had the project not been implemented. Conservation must be effective. An accurate baseline measure of emissions is thus required to demonstrate how the conservation project contributes to additional reductions.

3. Credits must be *verifiable* to inculcate market confidence. Assuring the credibility of carbon credits requires third parties to verify, monitor, and assess the project's design, management, and implementation.
4. Carbon credits must be *permanent*. Assuring permanence requires a long-term strategy, such as protecting and conserving the project area for a minimum of 20 years. Mangrove forests are especially important when it comes to permanence because they naturally store carbon deep into the soil, where it is less likely to be released in the near or medium terms.
5. In addition to removing carbon from the atmosphere, economically viable carbon credit projects can also result in *co-benefits*, such as ecological resilience, local economic development, socioeconomic equity, and increased food security, among others. Our research on Kenyan blue carbon projects confirms that the generation of such co-benefits is critical to ensuring the project's longer-term sustainability.

Community Participation, Local Ownership

Coastal communities have direct access to the mangroves and are directly affected by their degradation. Community members are the ultimate users, caretakers, and beneficiaries of their surrounding mangrove forests. Ensuring that social, economic, and ecological co-benefits accrue to local communities is especially important for these otherwise hard-to-reach communities in the global south. From an equity point of view, these communities have contributed the least to climate change, given their small carbon footprint, but they have nonetheless felt its most immediate effects.

We have found that meaningfully co-created blue carbon initiatives contribute to a sense of local ownership among communities. Local ownership ensures that projects are not only implemented correctly at the outset, but also vigilantly monitored and sustained over the long term.

Kenya's Community Forest Associations (CFAs) are a critical actor in Kenya's blue carbon initiatives. The CFAs are community-based organizations that enable local communities to participate in decision-making processes and the management of forest resources. They promote communities' active participation. Importantly, CFAs are a separate legal entity from the government and are financially independent of the government. Organizational separation reduces the possibility of corruption and in turn promises that the benefits of any blue carbon project are shared by the entire community. Further, CFA leadership is tenured, based on community-agreed-upon timelines, usually lasting less than two years. Rotating leadership promotes democratic principles, reduces corruption, and encourages ongoing community participation.

Organizationally, CFAs involve multiple user groups, such as those in charge of forest conservation, replanting, harvesting, and other activities like beekeeping. In the cases of MP and VBF, people who engage in generating mangrove credits are one user group.

The Participatory Forest Management Plan (PFMP) outlines the relationship between the CFA and other actors to ensure all stakeholders are clear about their commitments, rights, and their claims to benefits generated from forest use. With respect to the MP and VBF projects, for instance, the PFMPs codified how the community members are involved in co-designing and managing the projects. The PFMPs also stipulate that at least 60 per cent of project revenues generated from the sale of carbon credits goes toward community development. Once established, project revenues earned by communities can reach over 90 per cent of total revenue, as reported in Mikoko Pamoja's 2022 earnings statement.

THE IMPORTANCE OF A GOOD PLAN

In addition to the Participatory Forest Management Plan (PFMP) and community forestry associations (CFAs), both the Mikoko Pamoja and Vanga Blue Forest projects encourage community participation in their *project design document* (PDD). In both cases, the project developers and local communities involved with MP and VBF created the PDD to outline how the project interacts with CFAs and PFMPs. The PDD addresses all aspects of the project, including how it will involve and provide benefits to the community. The PDD follows the democratic ethos of the PFMP and CFAs, ensuring the project user group is determined through democratic elections and for a limited tenure. How revenues are allocated for community development is also determined through democratic voting.

Mikoko Pamoja (MP) and Vanga Blue Forest (VBF) Projects

Gazi Bay, home to the fishing villages Gazi and Makongeni, was an ideal place to implement the world's first mangrove carbon credit project. A two-hour drive south from Mombasa, along the coast, Gazi Bay is considered to be the world's most studied mangrove site because of nearby academic and government research institutions.

In 2001, Dr. Mark Huxham, a Scotland-based marine biologist and ecologist, began collaborating with the Kenya Marine and Fisheries Institute (KMFRI), a government research institution, to conduct in-depth research in the Gazi Bay mangrove forests. Their research looked to enhance the health of the Gazi mangrove forests and to bolster fish populations. However, the prospect of an increased fish yield in the distant future did not hold much appeal to the community, considering their immediate food insecurities and endemic poverty — the average household income in Gazi can be as low as USD 20 per month, about half of the World Bank's definition of the poverty line.

Village elders engaged in discussions with the KMFRI and international scientists, expressing their frustrations about providing scientists access to the mangrove forests with few benefits in return. To address these concerns, Dr. Huxham and KMFRI scientists proposed selling carbon credits generated by the villages to generate income for the local communities.

With admittedly little experience in the carbon credit market, Huxham and his colleagues established a nongovernmental organization (NGO) called the Association for Coastal Ecosystem Services (ACES). They were careful to develop a carbon credit project that aligned with the goals of the local Community Forest Association (CFA), its user groups, and in accordance with the Gazi Bay Participatory Forest Management Plan (PFMP). ACES partnered with Plan Vivo, a Scotland-based carbon validator known for its focus on sustainable development and rural improvement.

Soon after its 2012 launch, Mikoko Pamoja (MP) earned revenues for the villages for their efforts to conserve and reforest their mangrove forests. MP's success generated carbon credit sales and revenue, which the community then invested in local infrastructure improvements. Clean cookstoves were introduced in households, water pumps and wells were installed, and new schools were built.

On the southeastern tip of Kenya, another cluster of villages in Vanga began conservation work on their mangrove forests in 2004. When the Vanga, Kiwegu, and Jimbo villages learned of the success achieved by MP, they approached ACES

for assistance to launch their own blue carbon credit project. After two years of collaboration, the Vanga Blue Forest (VBF) project was established in 2019. MP and VBF projects have generated approximately USD 200,000 for local community development in the two areas.

ACES is the project coordinator for both projects, handling everything from administration and project management to the sale of carbon credits. KMFRI, meanwhile, provides technical support to the local communities. In addition to providing scientific expertise in mangrove forest management, KMFRI also supplies mangrove nurseries to the Gazi and Vanga CFAs to help them conserve and repopulate forests. Plan Vivo validates the carbon credits produced by the projects, while Epic Sustainability verifies them. To reduce "greenwashing," ACES strives to sell carbon credits to only those buyers committed to emission reduction plans.

Both MP and VBF employ a standard measurement methodology called a "baseline and additionality assessment" to calculate the number of credits that they can sell and the value of the carbon credits in the market. This assessment methodology involves four steps:

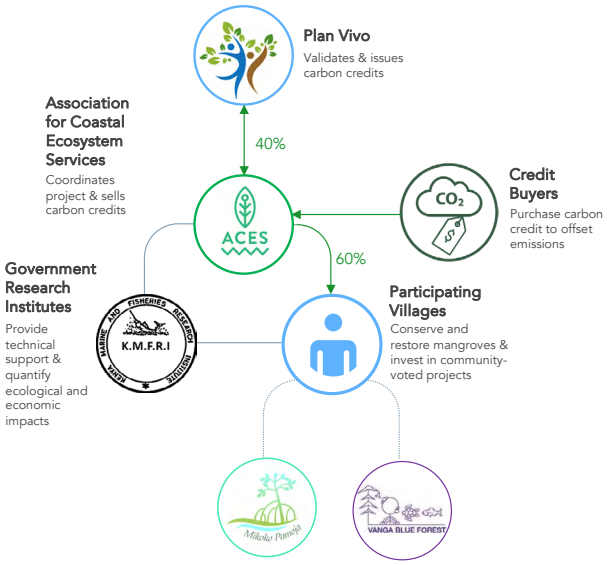

Figure 4. Project implementation and actor flow chart

baseline scenario determination, conservation strategy, verification, and impact assessment.

Baseline Scenario

The initial stage of any carbon credit project requires an accurate assessment of the baseline scenario. This first step entails a detailed baseline description of the project area in order to accurately estimate the volume of carbon emissions that would have occurred had the project not been implemented. It is critical to accurately determine the baseline scenario, since all carbon-credit valuations are based on this reference point.

Data used to conduct a holistic assessment of baseline conditions include historical ecological data (such as satellite imagery of forest canopy area and animal biodiversity), socioeconomic factors (such as community forest use and population growth), as well as government policies.

The 615-hectare mangrove forest of Gazi Bay shelters the villages of Gazi and Makongeni from the strong waves of the Indian Ocean. The rich biodiversity of the forest encompasses all nine of Kenya's mangrove species. *Sonneratia alba*, for example, is primarily found on exposed beaches in the bay, with bunches of thin roots protruding upwards from the sand. This particular species plays an important role in mitigating coastal and beach erosion, especially during the rainy seasons. Traditionally, wood from other mangrove species is used as building materials for homes and fishing boats, as well as for firewood fuel.

Eighty-seven percent of community members in these villages depend on mangroves for fuel and building materials. The rising population over the past several decades has increased demand for these resources. Between 1985 and 2010, satellite imaging data showed that the mangrove forest in the Gazi Bay region had shrunk by almost 1 per cent each year. The land-use pressures to exploit the forests combined with weak enforcement of existing harvesting laws contributed to the forest's rapid depletion.

Figure 5. Diversity of mangrove species at MP Gazi and VBF sites

Unregulated cutting negatively impacted fish stocks, affecting food security as well as the villagers' economic livelihoods.

The Vanga, Kiwegu, and Jimbo villages in Vanga Bay also experienced the challenges of mangrove degradation. Similar to Gazi, satellite imaging of the 450-hectare project area showed severe degradation between 1991 and 2016. Thirty percent of the working-age people in the Vanga Bay villages are unemployed, with the other 70 per cent primarily relying on fishing as a source of work. Flooding and storm surges eroded the coast, exacerbating forest degradation.

In short, prior to the 2000s, Kenya's coastal mangrove forests were disappearing at an alarming rate, and with them the primary livelihoods of villagers. For the proposed blue carbon projects to be effective, they needed to develop viable and effective conservation strategies and implementation plans.

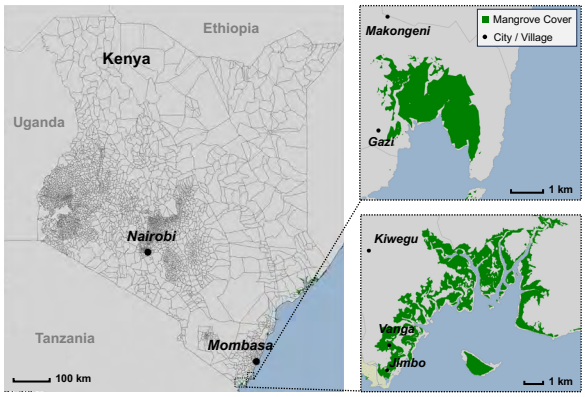

Figure 6. Mangrove coverage in Gazi Bay and Vanga region

Conservation Strategy

MP and VBF identified ways to mitigate mangrove forest degradation. For example, to reduce mangrove harvesting for fuel, they introduced fuel-efficient cookstoves as a more sustainable alternative. Fast-growing woodlots were introduced as an alternative source of wood and fuel. By growing and harvesting *Casuarina equisetifolia* trees, a fast-growing terrestrial species that sequesters much less carbon than mangrove trees, the village communities were able to reduce their carbon footprint.

Villagers also accelerated their mangrove forest regeneration efforts by establishing nurseries for mangrove seedlings and designated planting areas. In collaboration with researchers from KMFRI and international scientists, the Gazi and Vanga CFAs introduced innovative hydrological techniques to better support mangrove reforestation.

In terms of additional co-benefits, these partnerships enhanced local capacity building. Eventually, community members were able to contribute directly to forest management and monitoring, as well implement novel reforestation

and conservation techniques drawing on their Indigenous knowledge and traditional practices with the land.

Finally, alternative sources of income were developed for community members who had previously relied on mangrove trees for their livelihoods. Promoting eco-tourism, sustainable aquaculture practices, and the development of mangrove-based products (such as honey) has created alternative and additional sources of income for the local communities. In short, villagers are incentivized to conserve and sustainably manage their mangrove ecosystems for these important co-benefits.

Measurement and Verification

The MP and VBF projects have implemented 20-year strategies for reducing carbon emissions. To turn these conservation and reforestation commitments and practices into sellable carbon credits (i.e., assessed an economic value), however, they need to be measured and verified.

As we noted before, market-ready credits must demonstrate that the carbon stored or not emitted is both real and permanent. Accurate measurement is critical. Changes in forest health and growth are measured according to established international guidelines. Measurements occur several times annually and involve recording the trees' physical characteristics, such as tree height and trunk width. The data are then used to calculate how much carbon is stored in the trees and soil.

Measurements are collected by community members, with technical support from KMFRI scientists. Because of the community's involvement in measuring and monitoring mangrove forest health, they develop a deep sense of local ownership over the carbon credit projects. They are invested in the conservation and reforestation work.

MP and VBF are verified regularly. Third-party verification assures the market that the community has successfully implemented their mangrove conservation and reforestation plans. The verification process is comprehensive, including extensive reviews of planning documents at the outset, on-site visits to the forests, data analysis, and compliance assessments. Once the projects have been verified by Epic Sustainability, Plan Vivo validates the projects and approves the issue of carbon credits to sell on global carbon markets.

Global and Local Impacts

Based on baseline scenario measures, MP's 125-hectare project area would have decreased to 90 hectares over the next 20 years without any intervention. Meanwhile, VBF's 450-hectare forest project site would have decreased to 424 hectares in the same time frame had the degradation rate continued without any efforts to conserve the mangroves. The projected depletion of the MP and VBF mangrove project areas, in the absence of any conservation effort, would have emitted over 220,000 metric tonnes of greenhouse gases into the atmosphere.

To date, the MP and VBF conservation and reforestation interventions have significantly slowed the expected rate of degradation, safeguarding 34 hectares of mangrove forest that would have been harvested without local conservation interventions. Over the planned 20-year duration of the project, the cumulative carbon savings from the MP and VBF project areas are estimated to reach an impressive 170,000 metric tonnes of GHGs.

Biodiversity and the population of forest animals are being replenished as a result. Villagers we interviewed observed that once-depleted fish stocks had increased and revitalized the local fishing economy. Efforts to develop alternative sources of livelihood based on

sustainable conservation of the forests — such as beekeeping, seagrass harvesting, and ecotourism—have also become important sources of local economic development.

Through the sale of carbon credits, villagers in the MP and VBF projects are compensated for their efforts to conserve and reforest their mangroves — compensated for *their work and their efforts*. Through deliberative and democratic processes, the communities determine their local development priorities. In consultation with ACES, villagers prioritize development projects that they determine are best for the entire community. Unlike many other development-assistance projects, the MP and VBF initiatives are thus locally owned, and the resources generated from their efforts to conserve and mitigate climate change are theirs to invest.

Since 2012, MP has generated approximately USD 10,000 each year, which has been invested in several local development projects. For example, the funds have financed the installation of two freshwater wells and pumps in Gazi village and connected them to households and communal water collection points. Collecting water is no longer a five-hour daily task for women and children in the village, freeing up women's time for other income-generating activities and training programs, as well as increasing access to education for the children.

VBF, a much larger project site, has already generated around USD 120,000 of total revenue since its implementation in 2019. Approximately two-thirds of these funds, or about USD 80,000, have been allocated to the three villages participating in the project. We learned through our interviews that members have allocated these resources to various local development projects, including the construction of flood-resistant roads, the procurement of medical supplies, and modernized renovations to a science laboratory in the village school. Recently, Jimbo village celebrated its first-ever university-bound science scholarship student.

Factors for Success

The Mikoko Pamoja (MP) and Vanga Blue Forest (VBF) projects successfully established an innovative model of *conservation for development*. Project developers and community members implemented conservation strategies that were based on local effort and local knowledge and reflected local priorities. Credit valuation, the provision of important co-benefits, and market demand for MP and VBF carbon credits have steadily grown. Credit sales have generated resources for community infrastructure development, which has further bolstered community buy-in and conservation efforts.

Figure 7. Gazi community water pump and VBF science laboratory

Conservation efforts, the sale of carbon credits, and the reinvestment of those revenues into the villages represent the *virtuous cycle* we described earlier. Several factors account for MP and VBF's success.

Favourable Local Contexts for Carbon Credit Projects

A common theme in our discussions with informants from the scientific research community, government, and the villages was that conservation can be achieved only through the effective management of pressures on natural resources. Successful conservation thus requires careful consideration of the specific local socioeconomic context. Some economic activities may exacerbate deforestation, while others promote incentives that encourage community commitment to conservation.

The economies in Gazi and Vanga are primarily fishing dependent, which means that they rely on healthy mangrove forests as breeding grounds for fish. These economies were incentives to conserve the mangroves to increase the fish stocks and seagrass beds along the coast. Community efforts, in other words, boosted their traditional local economy.

Project Success Relied on Addressing Local Drivers of Forest Degradation

Identifying and addressing local factors of forest degradation are critical to developing an effective and sustainable conservation strategy. Conservation requires sustained deliberate action that reflects local context. During their planning phase, the MP and VBF project designers identified the local drivers of mangrove degradation and then developed specific conservation strategies tailored to address them. In a way, they developed a theory of change, which has informed the actions that communities have taken to mitigate degradation in their mangrove forests.

SOCIOECONOMIC CONTEXT SHAPES ATTITUDES TOWARD CONSERVATION

Local livelihoods are critical in influencing how communities engage with conservation. For instance, when the Kenyan government imposed a ban on mangrove logging in 2018, there was great pushback against it in areas where local economies rely heavily on mangrove harvesting. In contrast, the ban was more easily accommodated in Gazi Bay and Vanga because their economies rely on mangroves as long-term natural resource, rather than something to sell in the short term.

For example, community members in Gazi Bay and Vanga relied on mangroves as a source of wood for construction and fuel. To address this, the villages planted woodlots of fast-growing trees as an alternative source of wood. The community also introduced energy-efficient cookstoves that are lined with clay to maintain heat and burn wood more efficiently, thus reducing the amount of firewood fuel that they needed.

To supplement household incomes, the two projects have explored sustainable alternative livelihood opportunities, such as beekeeping for honey production and seaweed farming. The villages have also pursued other entrepreneurial initiatives, such as ecotourism. The Gazi Community Forest Association (CFA) built the Gazi Women's Mangrove Boardwalk for visitors to tour its forests and purchase crafts.

In addition to conserving the mangroves, both MP and VBF have also prioritized mangrove reforestation. With support from publicly funded research institutions, such as Kenya Marine and Fisheries Institute (KMFRI), villagers have

experimented with innovative planting techniques to improve mangrove seedling survival rates. To date, community members in Gazi Bay and Vanga, predominantly women, have planted thousands of new mangrove seedlings.

Local Ownership Bolsters Sustained and Long-Term Community Support

Thanks to extensive community participation in the design and implementation of the initiatives at the outset, and in sharing co-benefits, community members feel a strong sense of ownership over MP and VBF. Transparency and participatory decision making also promote a sense of local ownership. Project leaders publicly post the revenues and expenses from the carbon credit initiatives for villagers to see. In addition, mechanisms for continual community feedback ensure that local input establishes developmental priorities. Community members gather at regular meetings called *barazas* to vote on and prioritize projects in education, health, water, and conservation.

To ensure community participation, before any blue carbon project can commence, the villages must first establish its Community Forest Association (CFA), consent to its Participatory Forest Management Plan (PFMP), and co-design the Project Design Document (PDD). The CFA is a separate legal entity that is financially independent from the government. It is instrumental in fostering agreement between the local communities and the government on the rights and responsibilities in managing the use of government-owned mangrove forests. The PFMP establishes sustainable forest management plans that both the CFAs and blue carbon project developers adhere to. It also describes how co-benefits will be shared between the community and project developers, and how community members determine how local development priorities are identified.

CONSERVATION FOR DEVELOPMENT

The revenue generated from carbon credit sales has significantly improved villagers' quality of life. Community-voted fund allocation allows each community to prioritize its own needs. For instance, Gazi village prioritized clean water projects and Jimbo village built a science laboratory for the local school. Previously, students had to travel five kilometres to the neighbouring village to practise and conduct their science laboratory tests. Because of the long journey, attendance was low, which led to poor academic outcomes and thus no acceptance into postsecondary science programs.

During our fieldwork we visited the new lab that was equipped with sinks, benches, and Bunsen burners. Students' academic performance has significantly improved, and one student received a science scholarship to attend university — the first in the village.

Partnership with Government and Academic Research Institutions Helped Build Local Capacity

Long-standing partnerships with government and academic institutions have been essential to developing local capacity for sustainable mangrove forest management. Capacity building includes developing expertise in mangrove conservation, reforestation, measurement, data collecting, and forest monitoring.

In Gazi Bay and Vanga, KMFRI along with collaborating international scientists trained villagers to measure trunk diameter, collect soil samples, and nurture mangrove seedlings. Investing in capacity building and forestry education has ensured that community members are meaningfully engaged in mangrove conservation and, importantly, are self-sustaining over the long term.

Figure 8. VBF team shows replanting at salt flats and hydrological solutions

ROOTING EDUCATION IN THE LOCAL CONTEXT

In both projects, community leaders received training from government and academic partners in areas ranging from mangrove ecosystem management to carbon credit project implementation and communicated these complex topics to the community.

For instance, elders used storytelling to emphasize the benefits of conservation. They described how the marine life thrived and fish catches were abundant in previous decades thanks to a healthy mangrove ecosystem. Community leaders emphasized the importance of mangroves for human health by comparing life on the coast to life in big cities: "Look at the people in Nairobi — they don't breathe fresh air like us. Our mangroves provide us with good clean air, which keeps us healthy."

Training local villagers to perform technical activities also reduces the costs that would otherwise have to be incurred by hiring technicians and scientists to conduct these same activities. As a result, projects are managed more sustainably, community members are more empowered, and knowledge is transferred among community members. For example, a local CFA leader and project member demonstrated to us the various reforestation strategies they have employed in an abandoned salt flat. As a result of high soil salinity and limited freshwater, the area had become barren. He recounted how, through collaboration with KMFRI, community members have implemented innovative hydrological techniques to promote mangrove growth, such as building dikes and digging trenches as irrigation channels. The once-barren salt flat is now budding with mangrove seedlings.

Eager young members of the community discussed how they too want to learn how to develop these techniques to lead the village conservation efforts one day in the future.

Demand for Blue Carbon Credits Contributed to the Projects' Success

Blue carbon projects are generating considerable interest globally. Many NGOs are becoming involved in the development and implementation of blue economy initiatives. Governments, including Kenya's, have started to develop coastal ecosystem management strategies as part of their national plans for climate change mitigation. Private-sector businesses are beginning to integrate blue carbon initiatives into their own emissions-reduction strategies.

Demand for blue carbon projects, and for viable, legitimate carbon credits, is growing. Although the voluntary carbon credit market is still relatively new, worldwide it is expected that the

current market size of USD 5.5 billion will grow to potentially USD 50 billion by 2050.

Carbon credits from MP and VBF are in demand, not only because of their high credit quality (verified, validated), but also because of the many co-benefits they deliver to these coastal villages. We were told that credits are in such high demand that project developers are increasingly selective about whom they sell their credits to, and now work almost exclusively with buyers genuinely committed to sustainability and to reducing their carbon emissions. Demand for MP and VBF credits have reinforced the virtuous cycle of mangrove conservation, carbon credit sales, and revenues generated for local development.

Replicating for Scale

One of the overwhelming barriers to fully achieving the Sustainable Development Goals involves scaling up successful innovations to reach those who are the hardest to reach. Over the past several decades, development practitioners have experimented with different interventions to address inequality, poverty, food insecurity, universal access to healthcare, and climate change. Many of these solutions have been piloted or experimented with in very local settings but they need to be scaled up to have the global impact needed to achieve the SDGs.

We typically think of scaling up as a continually expanding implementation process by which the economies of scale produce more efficient and cost-effective solutions. The more people are reached, the more cost-effective the solutions become.

At the core of the scaling process is expansion through replication. Using the metaphor of markets or market share, for instance, the process of scaling up involves expanding markets through the extension of trade routes, the proliferation of retail outlets, and the development of more production sites. When we think of scaling up in healthcare, we tend to point to the replication of health services, the extension of healthcare services through the creation of more medical facilities, and the development and proliferation of low-cost healthcare interventions. In other words, scaling up typically involves the *scaling outward* of successful interventions, be they products or services.

Normally, we think of scaling as the process of expanding and replicating the reach of a successful intervention from the centre outward. This "radiant" model of scaling up has its limits, however. As we know from repeated failures to reach the hardest to reach, there comes a point when scaling ever further to the margins becomes inefficient, cost prohibitive, or logistically inviable. Scaling up by scaling out makes it difficult to reach communities that are the most marginalized.

Mikoko Pamoja (MP) and Vanga Blue Forest (VBF) are examples of successful climate-resilient development initiatives that were designed, adapted, and sustained *in the margins*. They originated not from the centre or the metaphoric metropole, but rather from intensely local initiatives in hard-to-reach coastal villages. With them in mind, how might we scale up and replicate successful interventions in hard-to-reach places? We offer four key insights into this process. Replicating for scale requires that local interventions be rooted, replicable, sustainable, and a source of diversified value to the communities.

First, the initiative must be *rooted* in the local community and reflect its specific circumstance and local context. As we've emphasized in this report, fostering a sense of community ownership whereby local villagers co-create the initiative, participate as partners in its implementation, and work as key stakeholders in the long-term sustainability of the project has been critical to the success of MP and VBF. Capacity building has also ensured that villagers are able to implement

and continually adapt their strategies to conserve their mangroves and generate income.

As the villages in Gazi and Vanga demonstrate, local context matters a great deal. They rooted the blue carbon initiative to address the social and economic needs of their communities. Rooting a blue carbon project in another context — such as in villages that depend much more on mangrove harvesting — requires different considerations and conservation strategies.

Second, the core characteristics of the blue carbon projects need to be *replicable* across different settings. In their contribution to the *Stanford Social Innovation Review*, Wong, Zlotkin, Ho, and Perumal contend that despite the need for local customization in implementing an intervention, scaling requires identifying what they call the "replicable efficiency core."[1] In other words, scaling through replication does not require that successful local interventions be replicated *in toto*, but rather replicating only the "core" mechanism.

In the cases of MP and VBF, the replicable efficiency core is what we have identified to be the *virtuous cycle* where local efforts to conserve their mangroves have generated carbon credit scales, which in turn have earned the villages income to invest in their local development priorities. The specific ways in which this virtuous cycle can be achieved will vary among different communities (e.g., different conservation strategies, different reforestation strategies, different ecological ecosystems, and so on), but at their core, each community must replicate the main features of mangrove conservation, the sale of carbon credits, and the investment into local development.

Third, replicated interventions, such as blue carbon initiatives, need to be *sustainable* over the long term. To successfully scale up development interventions, communities require the capacity to maintain the initiatives and must benefit from their sustained efforts. For interventions to be scaled up, they cannot be short-term solutions.

In the cases of MP and VBF, for instance, long-term sustainability of the blue carbon projects has been achieved through capacity-building partnerships between the villagers and scientific experts, such as those with the Kenya Marine and Fisheries Institute (KMFRI) and other environmental research institutes. That both initiatives are supported by local community forest associations and context-specific forest management plans also bodes well for their long-term sustainability. Finally, the revenues that have been generated from the sale of carbon credits — and importantly, the long-term viability of global carbon credit markets which are responsible for these revenues — ensures that local villagers remain committed to sustainably managing their mangrove forests and their marine ecosystem more generally.

The promise of replicating for scale requires not only that initiatives are locally rooted, replicable, and sustainable over the long term, but also that they continually *add more and diversified value* to the local communities. As we've shown, the generation and delivery of important co-benefits in the MP and VBF blue carbon initiatives — from improved fishing to carbon credit income — have incentivized local communities to maintain their commitment to mangrove conservation and reforestation. But what if more co-benefits could be generated and delivered to the villages? Specifically, how can we leverage the innovations critical for the success of blue carbon initiatives, such as the important roles played by the local community forest associations and other community-based organizations, to deliver other

1 Joseph Wong, Stanley Zlotkin, Carmen Ho, and Nandita Perumal, "Replicating Parts, Not the Whole, to Scale," *Stanford Social Innovation Review*, 7 August 2014.

kinds of value and benefits to these otherwise hard-to-reach communities?

For example, as we have seen in many parts of the world, leveraging mobile technology platforms to expand the benefits of financial inclusion, especially in remote rural communities (i.e., banking the previously unbanked), has created additional opportunities to promote and deliver other kinds of products and benefits, such as insurance, access to real-time market information, and the eased flow of remittances.

Figure 9. Research team meeting with local leadership of MP and VBF

The point is that by developing and implementing local solutions to critical challenges, such as we have seen in Gazi Bay and Vanga, remote coastal communities have also created new institutions and organizations, more expansive stakeholder networks, and increasingly professional leadership capacity among local villagers, all of which can be leveraged to do more and ultimately deliver more value to the villages.

Lessons Learned

Mikoko Pamoja (MP) and the Vanga Blue Forest (VBF) projects are ground-breaking case studies. They are among the first carbon credit projects, with the MP pilot being the first in the world, to leverage blue carbon conservation to generate resources for development in otherwise hard-to-reach communities. At the core of MP and VBF is a virtuous cycle in which community-led conservation efforts generate community co-benefits. These illustrative cases shed light on how conservation can be both sustainable and economically beneficial in communities with low income.

Aligning Incentives

Protecting and restoring environmental resources such as mangrove forests cannot be achieved simply by "putting up a fence." We cannot assume that people, especially people with few resources, will conserve and sustain their natural ecosystems out of an ethical commitment alone. Ongoing investment in sustainable practices requires incentives that are aligned with the needs, interests, and priorities of key stakeholders.

Leadership

Successful local carbon projects require more than just economic incentives and the promise of co-benefits; they need strong leadership as well, and specifically principled commitments among community leaders to mangrove conservation and to addressing climate change more generally. From the verifier, which is responsible for assessing and certifying carbon reduction strategies, to the local project coordinators overseeing the implementation of the project, effective and principled leadership ensures accountability throughout the value chain.

Local Participation

Blue carbon projects cannot adopt a one-size-fits-all approach. Success depends on local participation and engagement at every stage: from decision making and measurement to planning and voting on how funds are to be allocated to support local development priorities. Merely involving communities in superficial ways is not sufficient. These projects must be an integral part of the local identity, reflecting their specific contexts and the local threats to mangrove forests.

Long-term Planning

A long-term project plan is required for carbon reduction permanence to ensure the validity and value of the carbon credits. Long-term planning involves a comprehensive approach to conducting baseline assessments, the implementation of conservation and restoration strategies, and over time, generating returns from the sale of credits and the realization of other co-benefits. A long-term plan requires continual adaptation, innovation, and improvement in conservation and reforestation efforts.

Clarifying Governance and Policy Framework

The blue carbon credit market has rapidly evolved, threatening to outpace the development of appropriate and effective policies and regulatory frameworks that govern how carbon credits are produced and sold. Transparency

in how carbon credits are valued and priced is needed. Policies that determine how the global carbon credit market is monitored and regulated are required to prevent market failure.

The carbon market is still relatively new and has been described by many as the "wild west." Regulatory strengthening will help address the skepticism surrounding carbon credit markets, which was articulated recently in a 2023 *Guardian* article that exposed inconsistencies in the valuation of credits.[2] Standardizing a carbon market framework will need to rely on international collaboration, knowledge sharing, and multi-sectoral stakeholder engagement, including local community voices and perspectives.

Kenya, like many other countries experimenting in the blue economy, currently lacks a well-defined policy framework and specific guidelines tailored to blue carbon projects. A national blue carbon credit framework would clarify how to establish a CFA, design an effective PFMP, collect data, and collaborate with technical experts.

Looking Ahead

Ocean and coastal ecosystems are Earth's most biodiverse ecosystems. Alongside necessary emission reductions, blue carbon initiatives have the potential to sequester and store vast amounts of carbon and offer numerous co-benefits to communities of low income. They can support biodiversity and local economic development.

The blue carbon credit market is growing. The Africa Carbon Markets Project, for instance, was launched in 2022, portending a coordinated, Africa-wide effort to develop the carbon credit market on the continent. MP and VBF were hailed as key proofs of concept, showcasing the many benefits that carbon credit projects can potentially bring. The surge in the number of mangrove carbon credit projects, from just three in 2021 to over 40 receiving project approval in 2022, further demonstrates the increasing importance of these blue carbon initiatives.

Policy and regulatory frameworks must also evolve alongside the growing market. Transparency in credit evaluation has to be enforced to not only prevent market failure, but also ensure that these market-based mechanisms actually reduce greenhouse gas emissions.

For these reasons, Mikoko Pamoja and Vanga Blue Forest initiatives are critically important to the future of blue carbon solutions. They have successfully demonstrated that carbon credit projects are not only a way to meaningfully combat climate change in local settings, but are also a source of development and prosperity for otherwise poor, neglected, and hard-to-reach communities.

2 Patrick Greenfield, "Revealed: More than 90 per cent of Rainforest Carbon Offsets by Biggest Certifier Are Worthless, Analysis Shows," *The Guardian*, 18 January 2023.

Research Team

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Founded at the University of Toronto in 2015, with support from the Mastercard Center for Inclusive Growth, the Reach Alliance has since scaled to seven other leading universities around the world. As a student-led, faculty-mentored, research and leadership initiative, Reach's unique approach uncovers how and why certain programs are successful (or not) in getting to some of the world's hardest-to-reach populations. Research teams, comprised of top students and faculty from across disciplines, spend nine to twelve months investigating each case study. Once the data collection process is complete, teams write case reports that are published and disseminated across the Reach Alliance's diverse network of policymakers, practitioners, academics, and business leaders.

Inspired by the United Nations' call to eliminate global poverty by 2030 as part of a set of Sustainable Development Goals (SDGs), our mission is to pursue the full achievement of the SDGs by equipping and empowering the next generation of global leaders to create knowledge and inspire action on reaching the hardest to reach.

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