ENHANCING NATURE-BASED SOLUTIONS IN MOMBASA

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ACRONYMS & ABBREVIATIONS

CBA: Cost-Benefit Analysis
CBO: Community-Based Organization
CIDP: County Integrated Development Plan
GHG: Greenhouse Gas Emissions
GIS: Geographic Information Systems
KFS: Kenya Forest Service
KWS: Kenya Wildlife Service
KMFRI: Kenya Marine Fisheries and Research Institute
KSH: Kenyan Shilling

KUSP: Kenya Urban Support Program
KWS: Kenya Wildlife Service
MDTF: Multi-Donor Trust Fund
NBS: Nature-Based Solutions
NYU: New York University
RPL: Recycled Plastic Lumber
SDG: Sustainable Development Goal
UNEP: The United Nations Environment Programme
WBG: World Bank Group

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This report was prepared for the World Bank Group (WBG), the County Government of Mombasa, and other relevant Kenya stakeholders to support their efforts to address the restoration and reintegration of mangrove forests within Mombasa County with a particular focus on Nature-Based Solutions (NBS).

The team was asked to:

1. Review enabling frameworks and legislation on environment protection, rehabilitation, and restoration

2. Document current NBS initiatives within Kenya and Mombasa County in accordance with current climate policy, and spatial plans.

3. Engage with county government and non-state actors involved in rehabilitation and restoration activities.

4. Develop a report outlining the challenges, gaps, and opportunities in meeting the stated goals and to provide recommendations to implement activities outlined in the County Integrated Development Plan (CIDP) and other plans and initiatives to meet these goals.

This work was conducted by a team of graduate students from New York University (NYU) under the guidance of WBG staff. The team started with a thorough review of relevant background literature (Kenya-specific and beyond). This was followed by field visits to both Nairobi and Mombasa to do mangrove surveying and to conduct interviews of various stakeholders at the government and community level, as well as with university researchers and representatives of development partners. The team prepared a preliminary comprehensive field report on the results of their work and developed initial recommendations that were presented to both the Mombasa county government and WBG staff.

The current report provides an overall situational analysis of Mombasa's mangrove forests, and it identifies key institutional and technical challenges to restoration, such as sedimentation, illegal wood harvesting, land use changes/challenges, rapid urbanization, erosion, and natural disaster risks. The work emphasizes the importance of mangroves, as they are a natural solution for increased coastal protection, biodiversity diversification, and local livelihood generation.

Based on the information collected and analyzed, the report offers and provides a rationale for selected recommendations on the following:

1. Increasing livelihood diversification through scaling up community-based organization activity

2. Enhancing solid waste management capacity

3. Developing sufficient data innovation technologies and a mangrove restoration index; and

4. Integrating land and sea spatial planning initiatives

The report concludes with a discussion of the relevant timeline for each of the recommendations with a focus on opportunities for near-term. It also suggests some areas for potential expansion of current initiatives.

This report proposes NBS to scale up sustainable and resilient mangrove restoration initiatives in Mombasa. Nature-based solutions are action items that effectively address societal challenges such as climate change, human health, food and water security, and disaster risk reduction. Such actions can benefit biodiversity and improve human well-being, particularly through protecting, sustainably managing, or restoring natural ecosystems. Notable studies emphasize the role of mangrove restoration in enhancing coastal resilience by acting as natural buffers against storm surges and providing habitats for diverse marine life.[1]

1 Ashrafuzzaman, M. "Mangrove Is the Facto Nature-Based Solutions to Tackle the Climate Change Around the Globe." In Handbook of Nature-Based Solutions to Mitigation and Adaptation to Climate Change, pp. 1-24. Cham: Springer International Publishing, 2023.
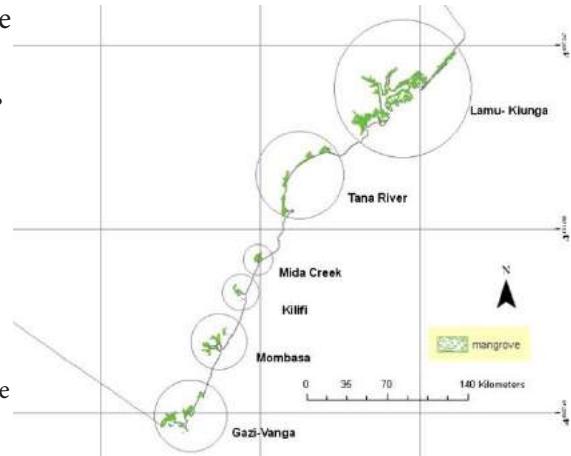
Figure 2: Kenya Mangrove Diagram
Source: Kirui et al. 2013

2.1 IMPACTS & EFFICACY OF NATURE-BASED SOLUTIONS

NBS are an instrument for addressing numerous contemporary crises, including rising global temperatures and the coronavirus pandemic, which have increased the strain on economies in both developed and developing countries.[2] This perspective underscores the multifaceted values of NBS, not only in ecological or environmental terms but also in bolstering worldwide economies. Incorporating NBS into environmental and urban planning is increasingly recognized as a transformative approach for addressing some of the most pressing challenges. From the escalating threats of climate change to the unforeseen impacts of global health crisis, NBS offer a path to resilience and sustainability that benefits both society and the environment.

NBS provide positive environmental impacts for climate change, biodiversity conservation, and soil preservation. Through processes such as carbon sequestration and storage, NBS such as reforestation and wetland restoration directly contribute to mitigating climate change. They also enhance the resilience of ecosystems

2 Croci , Edoardo, and Benedetta Lucchitta. 2021. Nature-Based Solutions for More Sustainable Cities – a Framework Approach for Planning and Evaluation. https://doi.org/10.1108/9781800436367.

and human communities to climate change impacts, such as sea-level rise, heat waves, and extreme weather events. NBS additionally support the conservation and restoration of ecosystems, contributing to the preservation of biodiversity.

NBS directly contribute to increased social and economic benefits such as improvement in livelihood and societal well-being, and job creation. NBS often support fisheries, agriculture, and forestry, which can contribute to food security and new revenue streams. Involving local communities in the planning and implementation of NBS projects can promote social inclusion, equity, and increased access to natural resources and benefits.

Within Mombasa the application of NBS could yield transformative impacts across environmental, economic, and social spheres. Mangroves not only fight against climate change but also protect shorelines from erosion and enhance fisheries' productivity, supporting the livelihoods of the coastal informal settlements. The integration of NBS into urban planning of Mombasa could mitigate the city's vulnerability to sea-level rise and storm surges, while also fostering sustainable tourism and local economic development.

2.2 CONTEXT OF MOMBASA, KENYA

In the context of increasing climate challenges in Mombasa, planting mangroves is a nature-based solution. Mangrove restoration addresses flooding issues caused by storm surges and coastal erosion. Mombasa is home to around 1,208,333 and the second largest county in Kenya, hosting the largest seaport in East Africa.[3] The port of Mombasa serves not only Kenya but other landlocked nations, as well as the northern region of Tanzania.

The county has a history of experiencing natural disasters brought on by extreme weather conditions, such as floods, which regularly result in significant damage and fatalities. The October 2006 floods affected 60,000 people in the city and the surrounding region. A 0.3-meter rise in sea level (based on recent climate change predictions) may also submerge around 17% of Mombasa's land, and a greater portion would become uninhabitable for agriculture due to salinity stress and water inundation.[4] Such disasters show flooding is one of the key adaptive issues that climate change brings to Mombasa. As a result, it is necessary to introduce enhancement of nature-based solutions for Mombasa to combat climate changes for adaptation and future development.

3 "Mombasa (County, Kenya) - Population Statistics, Charts, Map and Location." www.citypopulation.de/en/kenya/admin/coast/01__mombasa/.

4 Cynthia Brenda Awuor, Victor Ayo Orindi, and Andrew Ochieng Adwera. 2008. "Climate Change and Coastal Cities: The Case of Mombasa, Kenya." Environment and Urbanization20 (1): 231–42. https://doi.org/10.1177/0956247808089158.

2.3 MANGROVE COVERAGE: Mombasa, Kenya, & the World

According to the Global Mangrove Watch, the world restorable mangrove areas represent 5.56% of the total mangrove area.[5] The mean restoration potential score for the world is 68, whereas Kenya's potential score of 73 surpasses the world average standard. Kenya has greater potential for increased mangrove restoration efforts and is a key global asset for mangrove forests. There is both national and global value in the current successes and potential improvements for NBS initiatives in Kenya.

Mangrove ecosystems are a key component of the natural coastline. In the world, the area of mangrove habitat was 147,358.99 km² in 2020, which represents a linear coverage of 14.93% of the 2,139,308.93 km of the coastline.[6] The area of mangrove habitat in Kenya was 544.30 km² in 2020, which represents a linear coverage of 53.34% of the 1,504.03 km of the coastline.

In Kenya, mangrove forests include 61,271 hectares, accounting for roughly 3.0% of the country's total forest cover or less than 1.0% of its land area. Lamu County is home to about 59% of these forests. Kenya has nine different kinds of mangroves, the two most common being Rhizophora Mucronata, also known as Mkoko, and Ceriops Tagal, also known as Mkandaa. However, the rapidly changing environment poses major challenges to mangroves. From 1996 to 2020, the extent of mangroves in the world has decreased by 5,245.24 km². The extent of mangroves in Kenya has decreased by 5.61 km² in this period.[7]

5 "Global Mangrove Watch." www.globalmangrovewatch.org. https://www.globalmangrovewatch.org.

6 "Global Mangrove Watch." Www.globalmangrovewatch.org, www.globalmangrovewatch.org.

7 "Global Mangrove Watch." Www.globalmangrovewatch.org, www.globalmangrovewatch.org.
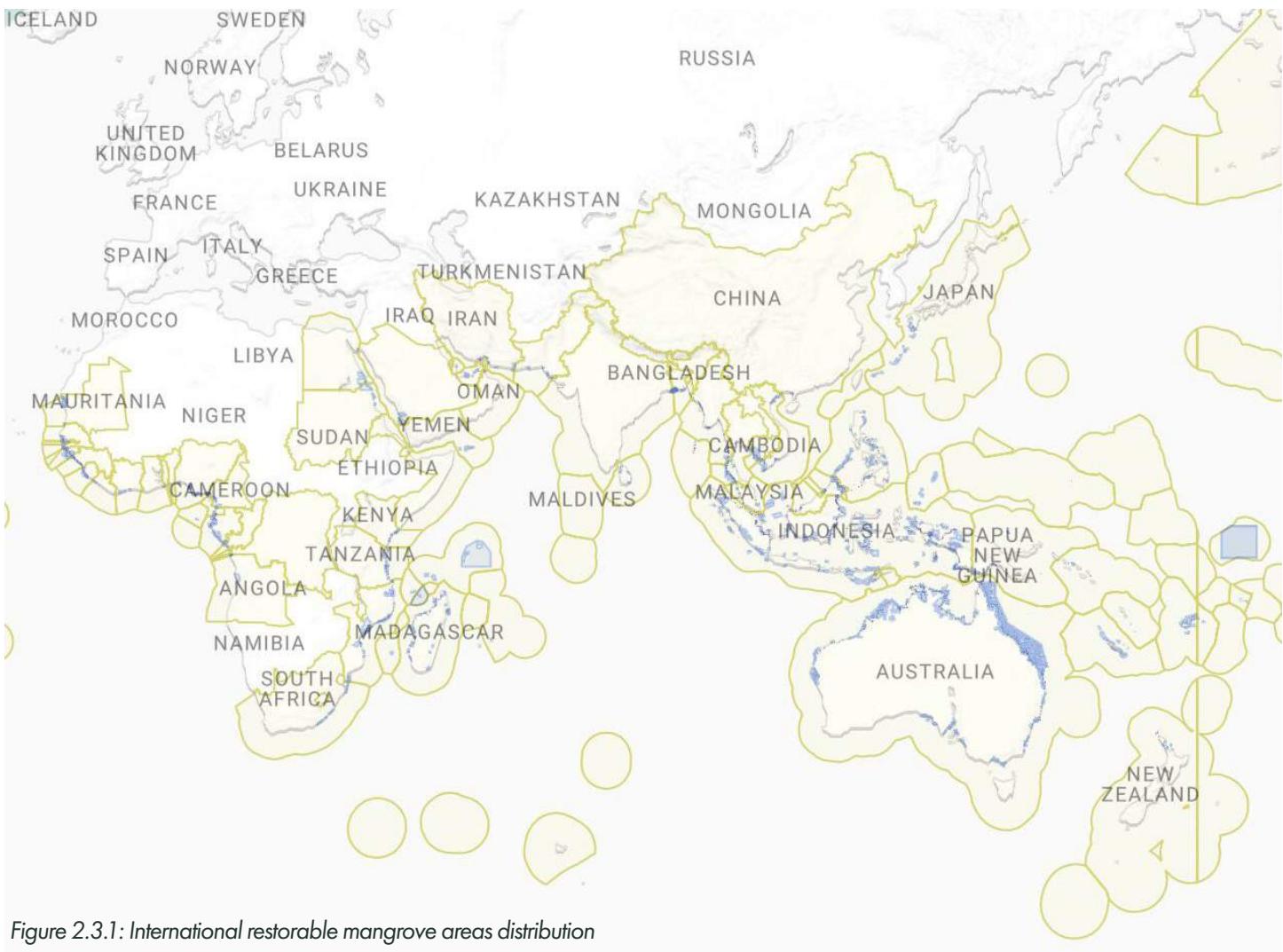
Figure 2.3.1: International restorable mangrove areas distribution

Mombasa is home to significant mangrove forests that cover approximately 3,700 hectares. These mangroves are predominantly found along the Mwache and Tudor creeks, see figure 02.[8] They serve as vital natural barriers against coastal erosion, natural habitats for marine life, and crucial carbon sinks.

Most mangrove areas have not been protected or restored to a self-sufficient capacity. Healthy mangrove forests are able to self-restore as the seedlings naturally replant themselves. In 2020, mangroves found in protected areas in Kenya represented only 19,784.00 ha out of a total 54,429.50 ha, which covers only 36.35%.
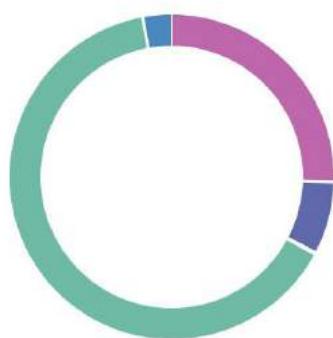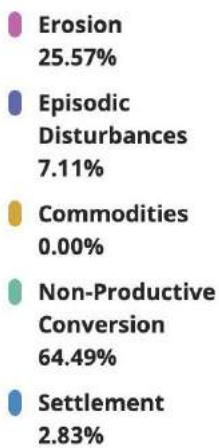
8 Bosire, J. O., J. J. Kaino, A. O. Olagoke, L. M. Mwihaki, G. M. Ogendi, J. G. Kairo, U. Berger, and D. Macharia. 2014. "Mangroves in Peril: Unprecedented Degradation Rates of Peri-Urban Mangroves in Kenya." Biogeosciences 11 (10): 2623–34. https://doi.org/10.5194/bg-11-2623-2014.

- Erosion 25.57%
- Episodic Disturbances 7.11%
- Commodities 0.00%
- Non-Productive Conversion 64.49%
- Settlement 2.83%

Figure 2.3.2: Drivers of mangrove loss in Kenya
Source: Global Mangrove Watch

Table 2.4 THREATS TO MANGROVE FORESTS IN MOMBASA

Threat	Primary Causes	Impacts	Exacerbating Conditions
Deforestation & Degradation	Rising population, poor governance, lack of understanding of mangrove value, high rates of poverty, lack of alternative livelihoods, insufficient management	Affects the sustainability of resources, coastline stability, and fisheries, leading to significant mangrove losses.	The deforestation and degradation of this environment pose major challenges. The total area of mangroves has reduced continually in Kenya since 1985. In 1985 there was an estimated 55,280 ha of mangrove. The Mwache and Tudor creeks have been identified as the most affected areas, with nearly 5,000 hectares of mangroves lost in the last 25 years. (Kirui et al. 2013) Mangroves in the Kilifi area have seen the highest rate of loss, with an overall loss of ~ 76% between 1985 and 2000. The large areas of mangroves in the Tana River and Lamu-Kiunga regions also showed higher rates of loss than other areas, with an overall reduction of 38% and 12% respectively.[9]
Wood Harvesting	Traditional reliance on mangrove wood for cooking and heating due to its high calorific value.	Deforestation, bare large areas and fragmented mangrove ecosystems.	The threat of wood harvesting necessitates the exploration of alternative building materials and energy sources. Traditionally, local communities relied on mangrove wood for cooking and heating, due to its high calorific value and availability. This practice left large swathes of land bare and the remaining mangrove ecosystems fragmented.[10]
Erosion & Sedimentation	This comes from encroaching development and certain farming practices.	Suffocate mangrove roots and alter water salinity, impacting the ecosystems' balance needed to thrive.	Another threat is erosion and sedimentation. In Mombasa, the Tanu River is a prime example where sedimentation has drastically changed the landscape.[11] As erosion continues unabated from developments and agricultural practices, the resilience of mangrove ecosystems is severely compromised.[12] This requires solving that boardwalks built on muddy soil regularly flood.
Land Use Changes	Urban expansion, agriculture, and salt mining convert mangrove areas into spaces for human activity.	The loss of mangrove cover and alters the ecological balance; affects biodiversity and ecosystem services that mangroves provide.	Land use changes in Mombasa are facing the challenge of monitoring and managing which is compounded by the vast land area that mangroves cover and the limited capacity for data collection and enforcement of conservation policies.
Environmental Disasters (Natural & Man-made)	Oil spills, El Niño events, and other ecological disturbances.	Long-term ecological impacts; exacerbate erosion and sedimentation.	Environmental disasters have left indelible marks on Mombasa's mangroves. The oil spills of 1998 and 2005, for instance, have had long-term ecological impacts, with many areas still struggling to recover.

9 Kirui, K.B., J.G. Kairo, J. Bosire, K.M. Viergever, S. Rudra, M. Huxham, and R.A. Briers. 2013. "Mapping of Mangrove Forest Land Cover Change along the Kenya Coastline Using Landsat Imagery." Ocean & Coastal Management 83 (October): 19–24. https://doi.org/10.1016/j.ocecoaman.2011.12.004.

10 Dahdouh-Guebas, F., C. Mathenge, J. G. Kairo, and N. Koedam. 2000. "Utilization of Mangrove Wood Products around Mida Creek (Kenya) amongst Subsistence and Commercial Users." Economic Botany 54 (4): 513–27. https://doi.org/10.1007/bf02866549.

11 Ballot, J., C. Hoyng, I. Kateman, M. Smits, and R. De Winter. 2006. "Coastal Erosion Project, Diani Beach, Kenya." Master Project Report.

12 Mwakumanya, Maarifa Ali, and Odhiambo Bdo. 2007. "Beach Morphological Dynamics: A Case Study of Nyali and Bamburi Beaches in Mombasa, Kenya." Journal of Coastal Research 232 (March): 374–79. https://doi.org/10.2112/04-0354.1.

As a devolved government, it is critical to understand the mandates and jurisdictions of the agencies and policies related to the enhancement of mangrove restoration. With a predominant subnational structure, the key to any engagement of nature-based solutions in Kenya is to equip and build capacity at the county level. The devolution outlined in the 2010 Constitution of Kenya places the county as the central jurisdiction in many areas including environmental and climate-related matters. The national government maintains a critical role in expertise and enforcement in affairs affecting nature-based solutions. Global or intergovernmental institutions tend to function in a capacity support role, often technical and/or financial. This section will address the global, national, and county legislation, policies, initiatives, guidelines and stakeholders relevant to the enhancement of nature-based solution initiatives for the restoration of mangrove forests in Mombasa County.

Table 3 Relevant Initiatives, Policies, Legislation, Stakeholders & Guidelines				
AREA OF EXPERTISE	NATURE-BASED SOLUTIONS	BLUE ECONOMY	DEVELOPMENT PLANNING	MANGROVES
GLOBAL LEVEL (A.3.1)	Global Facility for Disaster Reduction and Recovery (GDFRR)	PROBLUE (World Bank Group), GoBlue (UN-Habitat, UN Environment Programme)		United Nations Environment Programme Mangrove Forest Change Report, Global Mangrove Watch by the Global Mangrove Alliance
NATIONAL LEVEL (A.3.2)	National Environment Management Authority (High-Impact Projects), National Climate Change Action Plan	Kenya Marine And Fisheries Research Institute (KMFRI)	Kenya National Adaptation Plan 2015-2030, Kenya Urban Program, Climate Change Act	National Mangrove Ecosystem Plan (KMFRI, NEMA)
SUBNATIONAL LEVEL (A.3.3)	County Climate Action Plan, University of Nairobi Institute for Climate Change and Adaptation	County Government of Mombasa, Kenya Wildlife Service (Mombasa County Office)	2021-2031 Mombasa County Spatial Plan Draft, County Integrated Development Plan 2023-2028	Community-Based Organizations (Bidii Creek Conservancy, Brain Youth Group), Kenya Forest Service

Stakeholders (Organizations, Institutions, & Actors): Community-Based Organizations (Bidii Creek Conservancy, Brain Youth Group), University of Nairobi Institute for Climate Change and Adaptation, Kenya Marine And Fisheries Research Institute (KMFRI), National Environment Management Authority, County Government of Mombasa, Kenya Wildlife Service, Kenya Forest Service
Policies/Plans: 2021-2031 Mombasa County Spatial Plan Draft, County Integrated Development Plan 2023-2028, National Mangrove Ecosystem Plan, National Climate Change Action Plan, County Climate Action Plan, Kenya National Adaptation Plan 2015-2030
Guidelines: Global Facility for Disaster Reduction and Recovery (GDFRR), United Nations Environment Programme Mangrove Forest Change Report, Global Mangrove Watch by the Global Mangrove Alliance
Legislation: Climate Change Act
Initiatives: GoBlue (UN-Habitat, UN Environment Programme), PROBLUE (World Bank Group), Kenya Urban Program

The table above organizes all relevant entities based on operational level (global, national, subnational) and expertise area (nature-based solutions, Blue Economy, development planning, and mangroves). Refer to Appendix A for Overview and Supplemental Information of Initiatives, Policies, Frameworks, Stakeholders and Guidelines.

GLOBAL

The area of mangrove habitat in **the world** was **147,358.99 km²** in **2020**, this represents a linear coverage of **14.93%** of the **2,139,308.93 km** of the coastline.

- **Coastline coverage in 2020**
  319,338.96 km
- **Non mangroves**
  1,819,969.96 km
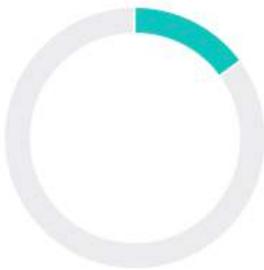
Mangroves found in protected areas in **the world** in 2020 represented **6,128,720.38 ha** out of a total **14,735,899.10 ha**.

- 0% - 20%
- 20% - 40%
- 40% - 60%
- 60% - 80%
- 80% - 100%

41.59 %
Mangrove protected

The extent of mangroves in **the world** has **decreased** by **5,245.24 km²** between **1996** and **2020**.

| Net change   Gain   Loss

km²

0
1500
3000
4500
6000

1996   2008   2010   2016   2018   2020
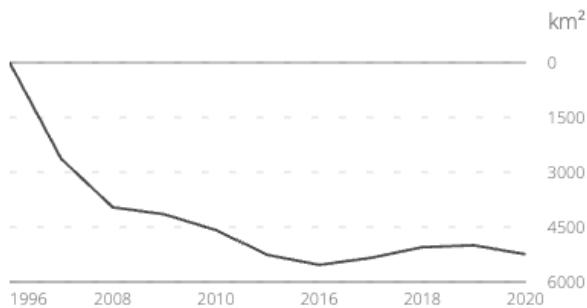
The mean restoration potential score for **the world** is **68**

0-20   20-40   40-60   60-80   80-100

KENYA

The area of mangrove habitat in **Kenya** was **544.30 km²** in **2020**, this represents a linear coverage of **53.34%** of the **1,504.03 km** of the coastline.

- **Coastline coverage in 2020**
  802.28 km
- **Non mangroves**
  701.75 km
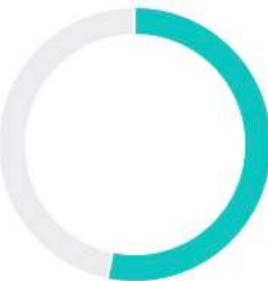
Mangroves found in protected areas in **Kenya** in 2020 represented **19,784.00 ha** out of a total **54,429.50 ha**.

- 0% - 20%
- 20% - 40%
- 40% - 60%
- 60% - 80%
- 80% - 100%

36.35 %
Mangrove protected

The extent of mangroves in **Kenya** has **decreased** by **5.61 km²** between **1996** and **2020**.

| Net change   Gain   Loss

km²

0
3
6
9
12

1996   2008   2010   2016   2018   2020
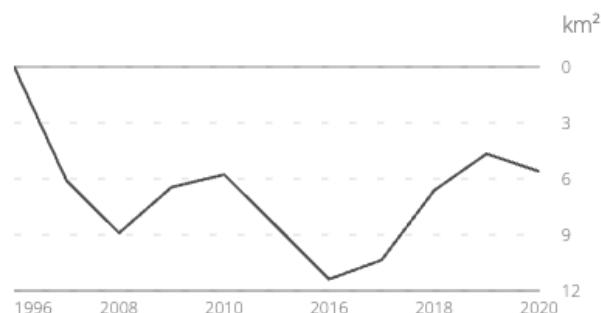
The mean restoration potential score for **Kenya** is **73**

0-20   20-40   40-60   60-80   80-100

Figure 3: Comparison between Global and Kenyan Mangrove Data
Source: Global Mangrove Watch. Accessed April 28, 2024. https://www.globalmangrovewatch.org/.

In January 2024, the NYU capstone team visited Kenya to explore NBS for mangrove restoration. Our methodology involved direct interactions with diverse stakeholders, including government officials, universities, and CBOs. Those agencies and organizations offered various perspectives of implementing NBS for mangrove restoration. From the University of Nairobi's Institute for Climate Change and Adaptation, the NYU capstone team gained insights into the importance of integrating cultural contexts and community participation in environmental projects. The World Bank and UN-Habitat provided an understanding of the financial and logistical complexities involved in managing large-scale ecological projects. Through engagement with CBOs like Bidii Creek Conservancy, the capstone team saw firsthand the efforts being made at the grassroots level and the challenges these groups face.

Throughout our field visit to Mombasa, the team identified three primary challenges hindering the effective implementation of NBS for mangrove restoration. First, policy gaps became evident through our discussions. Current environmental protection and mangrove restoration policies are insufficiently comprehensive or aligned, posing barriers to the initiation and progression of NBS projects. Second, financial challenges were a recurring theme across all stakeholders, with difficulty securing stable and adequate funding for restoration. This issue is particularly acute for local organizations, which often depend on erratic funding streams that complicate long-term planning and execution. Third, the lack of coordination among stakeholders — governmental agencies, non-governmental organizations, and community groups — emerged as a critical obstacle. This coordination deficit frequently results in disjointed efforts and inefficiencies, undermining the collective impact of restoration projects.

4.1 CHALLENGES OF LIVELIHOOD DIVERSIFICATION

In Mombasa, the transition towards diversified livelihoods is essential yet fraught with challenges, deeply rooted in both environmental degradation and the socio-economic fabric of the community.

Mangrove Depletion
The Mombasa County Government has noticed a large decrease in mangroves because of illegal cutting and city expansion. Mangroves protect the coast and are essential for fish populations that local communities depend on, mainly for consumption. The loss of mangroves is a major concern. Locals fish in these areas for species like mud crabs, snappers, and mullets, which are essential for food and financial resources. One of the main issues is the illegal cutting of mangroves, driven by reliance on mangroves for firewood. Stopping this illegal activity requires providing alternatives for energy, sustainable ways to meet their basic needs without harming the environment.

Challenges for Community-Based Organizations
Bidii Creek Conservancy is at the forefront of mangrove restoration in the Jomvu Kuu sub-county. Despite planting three million trees, the conservancy grapples with physical access challenges, due to poor road conditions and flooded areas, and insufficient funding which limits efforts to scale their impact. Engaging the youth is particularly challenging, with many seeking immediate results. Brain Youth Group in Junda Kisauni is making strides in mangrove restoration, beekeeping, and fisheries. However, they consume most of what they produce due to limited production capacity, deriving from a lack of technical know-how and resources. This underscores the need for training and resources to help groups like the Brain Youth Group increase productivity and move from subsistence to market-oriented production, making conservation efforts financially sustainable.

Exploring Alternative Energy and Infrastructure

Mombasa County Government's energy initiative investigates solar cooking and tidewater energy conversion and offers insight into potential sustainable alternative energy resources. Solar cooking uses solar energy to concentrate sunlight to cook food, offering clean and renewable energy. Tidewater energy aims to harness the kinetic energy from tidal movements to generate electricity, presenting a promising solution to power generation and mitigating flood impacts in coastal areas. However, the shift towards such alternatives is laden with implementation challenges, including the need for investment in technology, skills training, and market development for these new services and products. The transition requires not only the identification of sustainable alternatives but also significant support in capacity building, physical infrastructure development, and policy support to ensure these are accessible and beneficial to the community. Addressing these needs is crucial for securing the ecological future of Mombasa's mangroves and the economic resilience of its communities.

Inadequate Solid Waste Management Capacity

The Mombasa County Government officials also pointed out that Mombasa generates approximately a hundred tons of waste daily. The current infrastructure can only manage about sixty percent of this volume. This capacity shortfall means a significant portion of waste is in illegal dumping sites or polluting water bodies. As Mombasa County Government representatives outlined, waste is a dire threat to the urban environment and the mangroves, which are essential for coastal defense and biodiversity. The ineffective collection and recycling of plastic exacerbate the pollution in the ocean, harming marine life and the ecological balance. Addressing this challenge calls for improving waste management infrastructure and services to handle plastic waste more effectively. A general lack of awareness about sustainable waste management exacerbates the situation, highlighting the need for comprehensive community education and engagement programs. Mombasa County Government Officials also identified the rapid urbanization and population growth in Mombasa as primary factors straining the waste management system. This urban expansion overwhelms the capacity for waste management.

Photos of NYU team, World Bank Group and Mombasa County Government field visits to Bidii Creek Conservancy and Roka Bags Africa in Mombasa, Kenya on January 16th, 2024.

4.2 CHALLENGES OF DATA COORDINATION & CAPACITY

The data collected on mangroves by various agencies and organizations could be used more efficiently, improving mangrove restoration efforts. This inefficiency in data use leads to several issues in coordinating and enhancing these efforts. Without shared and accessible data, restoration projects often operate in isolation. For example, KMFRI gathers essential data on mangrove conditions, but this information doesn't always reach other organizations, especially CBOs. If this data were more available, CBOs and other groups could better align their restoration work to avoid duplication and ensure a more strategic approach.

Accessing critical GIS data is essential for understanding mangrove distribution and health. A wetland specialist's difficulty in accessing this GIS data presents challenges to planning and executing targeted restoration projects. Without comprehensive GIS data, identifying priority areas for restoration and tracking progress becomes challenging. Furthermore, the gap in data sharing impacts the training and capacity building of CBOs. These organizations are the grassroots of mangrove restoration but may lack up-to-date knowledge on best practices.

Based on the above findings, the NYU capstone team believes that mangrove restoration in Mombasa could be significantly improved by maximizing existing data. Ensuring data is shared effectively among all stakeholders would lead to more coordinated restoration efforts.

Inefficient Data Collaboration
The Mombasa disaster management teams, CBOs like Baus Taka Enterprise, educational institutions, and NGOs all point to inefficient data collaboration as a critical issue. This deficiency in real-time data compromises disaster preparedness and response, leading to heightened vulnerability during natural disasters. The lack of accessible information also stifles community engagement in sustainability efforts, weakening collective action. Policy-makers are also hindered by this issue because the decisions may be made without a clear understanding of the city's needs, potentially misdirecting resources and efforts away from critical issues.

4.3 URBANIZATION PRESSURES

Mangrove Depletion and Urban Expansion
Discussions with stakeholders from the Mombasa County Government, environmental NGOs, and CBOs revealed the impact of urbanization as a challenge to mangrove restoration. These discussions highlighted the tension between the growing population and the preservation of vital mangrove ecosystems. Urban development, driven by the need for housing, roads, and other infrastructure, is creeping into areas home to mangroves. This is problematic because mangroves serve as critical buffers against coastal erosion and are essential for biodiversity and local livelihoods. Stakeholders emphasized the importance of integrating environmental considerations into urban planning processes. The current approach to urban expansion, which often overlooks the ecological value of mangroves, directly threatens these ecosystems and, by extension, the communities that depend on them. The feedback from various groups in Mombasa emphasizes the importance of urban planning in the success of mangrove restoration initiatives. It points to the necessity for a more holistic approach to planning that considers the long-term ecological and social benefits of mangroves, ensuring that the city's growth does not come at the expense of its natural defenses and biodiversity.

Erosion and Sedimentation
The Mombasa County Government and KMFRI discussed erosion as a significant factor causing mangrove depletion. A significant observation at Bidii Creek illustrated the effects of urban expansion on mangrove health. During heavy rains, soil from these developed or developing areas wash down into the mangroves, depositing sediments that can suffocate and kill the mangrove trees. KMFRI discussed the impacts of this sedimentation on mangroves, emphasizing that the health and regenerative capacity of mangrove forests are severely compromised by the influx of sediment from eroded upland areas. Erosion is exacerbated by human activities associated with urban development, such as construction and land clearing. Without addressing the underlying causes of erosion and sedimentation, efforts to restore and protect mangroves in Mombasa will face ongoing challenges.

Photos of NYU team, World Bank Group and Mombasa County Government field visits to Brain Youth Group, Kenya Marine and Fisheries Research Institute, Baus Taka Enterprise, County Government of Mombasa, Kenya Wildlife Service and Bidii Creek Conservancy in Mombasa, Kenya (left to right). Visits were conducted between January 16th and 18th, 2024.

Recommendation One

Mombasa currently faces increased mangrove depletion and struggles to diversify economic development. The depletion impacts the local ecosystem and community viability. The following recommendation addresses these challenges by strengthening current CBO initiatives, introducing viable alternatives to mangrove cutting, and building up the communities to implement ecotourism efforts gradually. CBOs are trusted and well-connected within the community, with a solid understanding of local issues and mangrove ecosystems. Their involvement is crucial for promoting sustainable practices and preparing a future of ecotourism, which provides economic opportunity for Mombasa.

Our strategy revolves around three core objectives:
1. Facilitating a transition for communities reliant on mangrove resources to embrace alternative, sustainable livelihoods.
2. Empowering CBOs to expand their influence and effectiveness in environmental conservation while playing a pivotal role in community development and generating employment opportunities, especially for low-income groups.
3. Launching the development of ecotourism initiatives that safeguard the mangroves and stimulate local economic prosperity.

Achieving those goals will protect mangrove regions for future generations and protect ecotourism prospects. This approach brings dual benefits: conserving the unique mangrove ecosystems of Mombasa and fostering economic growth for its communities, thus laying a foundation for a sustainable and thriving future.

5.1 SUPPORTING INFORMAL SETTLEMENT RESIDENTS DEPENDENT ON MANGROVES

In Mombasa, supporting informal settlement residents who rely on mangroves for their livelihood is a complex challenge due to the vast areas these ecosystems cover. Efforts to reach these residents involve deploying search teams in vehicles and stationing personnel in mangrove areas to engage with those harvesting mangrove wood, primarily for cooking fuel due to the lack of available power. The majority of these residents depend on mangroves for a living. This situation highlights the need for interventions that provide viable options beyond mangrove cutting. Tailoring support to these individuals is crucial, with strategies focusing on aid, education, and creating sustainable employment opportunities rather than enforcement. Offering skill development programs, employment opportunities through CBOs, and education funded by stakeholders can provide individuals with increased livelihood diversification opportunities. Generating job opportunities, particularly in ecotourism following successful mangrove restoration, emerges as a pivotal strategy. Ecotourism promises to bolster the local economy and significantly reduce the need for illegal mangrove harvesting by providing alternative sources of income.

To address the energy needs of residents without access to power, distributing free solar cookers that concentrate sunlight to cook food and offering clean, renewable energy could be a solution, eliminating the

dependency on mangrove wood for cooking. This distribution should accompany education on the ecological impact of mangrove deforestation and introduce residents to CBOs for sustainable employment opportunities. The focus should lean on alternatives and education to prevent mangrove cutting. This approach aims to ensure Mombasa's residents become self-sufficient, moving away from the practice of mangrove cutting. Prioritizing preventing unauthorized deforestation is essential for making ecotourism and other sustainable practices viable, ultimately safeguarding the region's natural resources and enhancing community livelihoods through alternative means.

The pottery initiative of Bidii Creek represents one of the many opportunities to scale up existing livelihood diversification projects.

5.2 SCALING UP CURRENT CBO INITIATIVES

CBOs in Mombasa, which focus on productivity and eco-friendly initiatives, face the challenge of limited market access. This issue restricts CBO revenue generation capabilities and their capacity to offer employment opportunities. Developing a strategy to access new online and local markets can create additional jobs, thus enhancing the economic stability of low-income communities.

5.2.1 Collaborative E-commerce Platform

The launch of "Kenya's Green Marketplace" is a strategic move by Mombasa's CBOs to promote their eco-friendly and artisan products nationwide. This e-commerce initiative aligns with Kenya's digital evolution, providing a platform for sustainable living and conservation advocacy. By increasing product visibility and enabling direct sales, this platform is not merely a commercial venture but a catalyst for community engagement and economic development.

Strategy Implementation Timeline
1.   E-commerce Integration: The immediate task is

selecting and setting up the e-commerce platform, followed by uploading product listings and launching the site with a focus on user-friendly design and storytelling.
2.   Local Marketplaces and Events: Planning for these events starts three months in advance, with execution beginning in the fourth month, incorporating product sales and sustainability workshops.
3.   Marketing Strategy Development: This runs concurrently with e-commerce setup, promoting the online store and upcoming events, and adjusting strategies based on community feedback and analytics.

Monitoring and Evaluation
Critical metrics for success include monthly sales growth, customer feedback, vendor participation numbers, event attendance, and the effectiveness of marketing campaigns. Active community engagement in planning and execution with a feedback loop for continuous improvement, ensures the initiatives resonate with values and goals, contributing to the community's resilience and well-being.

5.2.2 Strengthening CBOs Through SSD

The "Skills for Sustainability & Development" (SSD) strategy is a transformative initiative designed to empower CBOs in Mombasa, Kenya. In a world where environmental degradation and social inequities pose significant challenges, the role of CBOs in spearheading sustainable development and conservation efforts becomes increasingly critical. The SSD strategy addresses two fundamental areas: enhancing the project execution capabilities of CBOs in environmental and community development and creating meaningful employment opportunities for individuals from low-income backgrounds. This comprehensive approach aims to equip CBO personnel and community members with essential skills in project management, financial literacy, and eco-friendly practices, ensuring their initiatives' long-term success and impact.

Table 5.2.2 Core Training Components of the SSD Strategy
1. Project Management Training: • A Path to Enhanced Efficiency   • Equip CBO staff and volunteers with skills to handle complex projects using Agile and Scrum methods.   • Aim for more effective project management, development of skilled project managers, and improved project outcomes in environmental and community initiatives.   2. Financial Management Workshops: Building a Solid Financial Foundation   • Provide comprehensive training on budget creation, financial tracking, grant writing, and financial reporting.   • Strengthen CBOs' financial health, enhance their planning for future needs, improve grant success, and build trust with funders through clear financial practices.   3. Sustainability Training: • Promoting Eco-friendly Practices   • Offer training on environmental stewardship and eco-friendly practices including conservation techniques, sustainable agriculture, and eco-product development.   Foster a shift towards sustainability, create job opportunities in environmental fields, and strengthen dedication to conservation and sustainable development.

5.2.3 Strengthening CBO Collaboration

The intricate challenges of environmental conservation and community development in Mombasa demand a multifaceted approach, drawing upon various resources and expertise. By cultivating robust partnerships with local businesses, government entities, educational institutions, and other NGOs, CBOs can significantly enhance their project impact. These collaborations are instrumental in facilitating knowledge exchange, pooling resources, and expanding CBO initiatives' influence and operational capacity. Crucially, they now also serve as a conduit for integrating low-income groups into meaningful employment and skill-building opportunities, fostering a more inclusive model of sustainable development.

Framework for Collaboration
The essence of fostering effective collaborations lies in a structured framework designed to identify, assess, and engage potential partners committed to promoting inclusive development. This framework prioritizes partnerships that create employment opportunities and enhance skill sets among marginalized groups, thereby supporting broader environmental sustainability objectives and community improvement.

Table 5.2.3 Criteria for Partner Selection
1. Inclusivity Track Record: Potential partners should have a demonstrable history of including low-income groups in their projects, whether through employment, skill development programs, or active community engagement.   2. Resource Commitment: A willingness to allocate specific resources towards inclusive actions is essential, ensuring that projects are designed to benefit marginalized groups directly.   3. Engagement and Feedback: Effective mechanisms for community engagement, allowing feedback from marginalized groups to inform project planning and implementation, are crucial.   4. Sustainability Commitment: A demonstrated dedication to environmental sustainability and creating sustainable opportunities for community members is necessary

5.2.4 CBO Support Request Form

The CBO Support request and Donor Support Forms serve as vital communication tools, ensuring that the specific needs of CBOs are articulated and matched with the right kind of support from potential donors and partners. The CBO Support Request Form is designed to capture the diversity of other organizations. By providing structured information about operational challenges, training needs, and anticipated impact, CBOs make it possible for donors and partners to understand where their support can have the most meaningful impact. This strategic communication aids in building partners aligned with an organization's goals and community needs.

This form facilitates a focused and efficient matching process, ensuring that your contributions directly address the critical areas for CBO development, ecotourism initiatives, and community empowerment.

See Appendix B for Section 5.2 Supplemental Information

Table 5.2.4 **Optimizing Strategic Alignment and Communication with CBOs through Form**
1. Enhanced Matching: By detailing the specific needs of CBOs and the corresponding support offerings from donors, CBOs can ensure a precise alignment that maximizes the effectiveness and impact of the support provided. 2. Streamlined Communication: These forms serve as standardized tools for communication, reducing complexities and saving time for both CBOs and donors. This clarity of CBO development's deficiencies is crucial during the intensive years of CBO development. 3. Focused Support: With a structured presentation of needs and offerings, resources can be channeled more strategically. This concentrated support is significant as CBOs navigate the challenges of scaling up, entering new markets, and integrating into ecotourism. 4. Dynamic Needs and Flexible Support: Recognizing the dynamic environment in which CBOs operate, the forms are designed to capture evolving needs and flexible support options. This adaptability is crucial in meeting the real-time requirements of CBOs and ensuring sustainable community development.

5.3 ECOTOURISM

5.3.1 Mangrove Restoration Monitoring

To operationalize the first section of the revised ecotourism plan, focusing on Dynamic and Adaptive strategies. These steps aim to ensure that the development of ecotourism activities is directly tied to the pace of mangrove restoration efforts led by CBOs and is designed in collaboration with these key stakeholders. The Dynamic and Adaptive ecotourism Development Plan is a strategic approach to ensure the sustainability and conservation of mangrove ecosystems in Mombasa while promoting ecotourism. This plan emphasizes the importance of mangrove restoration as a foundation for ecotourism activities, ensuring that these activities are introduced at a pace that the recovering ecosystems can sustain.

1. Mangrove Restoration Monitoring:
Establish dedicated teams comprising CBO members,

environmental experts, and volunteers to assess the health and biodiversity of mangrove ecosystems. Equip teams for accurate data collection to ensure ecotourism is sustainably introduced.

2. Data-Driven ecotourism Introduction:
Implement a robust real-time data collection system to monitor mangrove restoration progress. Use digital tools to ensure ecotourism activities begin in areas where ecosystems have sufficiently recovered, aligning with conservation goals.

3. Benchmark Setting for Ecotourism Readiness:
Collaborate with experts to set transparent, data-backed benchmarks based on ecological indicators like species diversity and ecosystem health. This ensures ecotourism activities support ecosystem recovery and are introduced sustainably.

5.3.2 The Role of CBOs in Ecotourism

Tailored training programs for CBO members are essential for preparing them for diverse roles within the ecotourism sector, such as tour guides, conservation educators, and eco-lodge operators. These training programs cover sustainable tourism practices, biodiversity, cultural heritage, and customer service to ensure that ecotourism experiences are both enriching and authentic. The goal is to develop a skilled cadre of CBO members who can engage tourists meaningfully, promoting environmental stewardship and cultural appreciation through their interactions. Establishing equitable revenue-sharing agreements is also crucial to ensure that a significant portion of ecotourism income is directed towards CBOs and community development initiatives. These models are designed to motivate CBOs to continuously enhance their ecotourism offerings while providing sustainable funding for their conservation and community projects. This approach involves creating transparent mechanisms for revenue distribution and ensuring that CBOs receive fair compensation, which supports their vital roles in conservation and community development.

Table 5.3.2 B
Collaborative Planning with Community-Based Organizations

1. Stakeholder Engagement in ecotourism Planning: Conduct workshops with CBOs, local government officials, ecotourism experts, and community leaders to develop a cohesive ecotourism strategy that aligns with environmental and community development goals. These workshops facilitate the creation of projects that boost local economies and promote ecological conservation.

2. Pilot ecotourism Projects: Identify and launch pilot ecotourism projects in areas meeting mangrove restoration benchmarks. These pilots serve as practical tests of ecotourism's ability to support environmental restoration, providing insights into the viability, community acceptance, and conservation effects of ecotourism, thus laying the foundation for scalable and sustainable initiatives.

Table 5.3.2 A
Further Actions for Sustainable Ecotourism Development

1. Community Engagement and Economic Benefits: Design ecotourism initiatives that create new economic opportunities for locals through training programs and local vendor platforms at ecotourism sites. This approach aligns economic development with conservation efforts, ensuring tangible benefits for residents.

2. Sustainability and Infrastructure: Ensure all ecotourism activities and infrastructure developments adhere to sustainability principles to minimize environmental impact and enhance conservation awareness among tourists. This includes careful planning of eco-friendly infrastructure and conducting environmental impact assessments.

3. Feasibility and Scaling: Assess the feasibility of ecotourism projects based on market demand and community readiness, supported by market research and feedback from pilot projects. This evaluation helps determine the scalability of initiatives, aligning them effectively with conservation goals and community needs.

Table 5.3.3
Ecotourism Activities & Services

1. Educational Tours and Workshops: Create training programs that mix scientific information and local knowledge for tour guides. Offer activities like guided tours and hands-on conservation projects to help visitors learn about the mangrove ecosystem. Promote these educational tours widely to attract visitors from around the world and increase appreciation for Mombasa's natural and cultural heritage.

2. Sustainable Tourism Infrastructure: Work with eco-friendly architects to build tourism structures that are good for the environment. Use renewable materials and follow sustainability practices in everyday operations to support conservation and enhance the ecotourism experience.

3. Community Involvement: Get the local community involved in ecotourism to ensure they benefit economically and participate actively in conservation. Provide community engagement workshops, job training, and support for local businesses to help community members gain from and contribute to ecotourism development.

5.3.4 Monitoring & Evaluation

To monitor and evaluate Mombasa's ecotourism initiatives effectively, a structured approach focuses on collecting actionable data through digital forms designed for ease of use by CBOs. The data collection emphasizing visitor metrics, conservation activities, and community impacts is crucial for informed decision-making. Training CBO members in inaccurate data reporting ensures reliability in tracking ecotourists' alignment with conservation and community goals. An adaptive management process, underpinned by regular data reviews and action planning sessions with stakeholders, facilitates continuous improvement of ecotourism strategies. This dynamic approach allows for the responsiveness of ecotourism operations to evolving environmental conditions and stakeholder needs, ensuring the initiatives contribute positively to Mombasa's conservation efforts and community well-being.

5.4 CONCLUSION

This plan aims to protect Mombasa's mangroves while boosting the local economy through ecotourism, with CBOs playing a pivotal role. It sets a clear path: offering alternative livelihoods to those dependent on mangrove cutting, empowering CBOs for better conservation and community work, and starting ecotourism that doesn't harm but helps the mangroves. By focusing on monitoring and evaluation, the plan ensures ecotourism grows in line with what the environment and community can handle. If executed well, this approach promises a sustainable future where conservation and community prosperity go hand in hand. This strategy's success hinges on the active participation and cooperation of everyone involved.

SOLID WASTE MANAGEMENT CAPACITY FOR PROTECTION 6

Recommendation Two

This recommendation addresses waste management as a necessity for mangrove restoration initiatives in Mombasa County. Within this portion, the linkages between waste management initiatives in the county and mangrove restoration will be analyzed to make tangible recommendations for scale-up opportunities.

In this report, the waste refers explicitly to solid waste, what RCRA defines as "solid waste" is any garbage or refuse, sludge from a wastewater treatment plant, water supply treatment plant, or air pollution control facility, and other discarded material generated by industrial, commercial, mining, and agricultural operations, as well as community activities.

The section focuses on wastewater and garbage disposal from community activities in daily life. Detailed examination of waste-related challenges provides a clearer understanding of the threats to mangrove restoration and highlights the urgency of integrating effective waste management strategies into conservation.

6.1 NECESSITY OF ADDRESSING WASTE CAPACITY

It is vital to identify the link between waste management and mangrove restoration. Waste management emerges as a pivotal concern in this battle, given that illegal dumping, and persistent flooding (particularly around informal settlements) are jeopardizing the mangroves' health. Understanding the impact of waste on mangroves is essential to the multifaceted approach needed for their restoration.

6.1.1 Illegal Dumping Impacts Mangroves

Mombasa's mangroves are particularly vulnerable around informal settlements, where illegal dumping and unsanctioned harvesting of mangrove wood are rampant. As a report from the UNEP supported, trash mounds in tidal channels can be harmful to the mangrove species since they inhabit near-shore

Figure 6.1.1: Adapted from "Does Plastic Waste Kill Mangroves? A Field Experiment to Assess the Impact of Macro Plastics on Mangrove Growth, Stress Response and Survival." 2021.

environments.[13] Rubbish can reduce tidal flushing and raise salinity levels. Animals that inhabit mangroves may perish from debris. Polluted mangroves can have a negative impact on the local economy.

In Mombasa, similar patterns of waste-induced degradation are evident. The city generates approximately 2200 tons of waste daily, of which only 65% is effectively collected, leaving a substantial amount to potentially end up in mangrove areas. This situation is exacerbated by illegal dumping practices, particularly near informal settlements, where mangrove forests collect improperly disposed waste.

This is especially true toward the seaward edge, where sediment and plastic debris accumulate, wave impacts are significant, and erosion is rapidly approaching. Coastal villagers either burn their plastic waste at home or dump it nearby, where it is washed away by rains. Mangroves around the coast, such as Mwache and Tudor creeks, then trap a large portion of the plastic that washes out to sea. Plastic is observably deposited in sediment ridges along the seaward edge of mangroves, where strut roots and aerodynamic masses create drag that greatly reduces the flow rate into the water. When heavy weather strikes, sediment ridges frequently move landward, burying mangrove root zones along the way as the piled material is frequently higher than the aerodynamic vegetation and fauna.[14]

Plastic pollution in mangroves of Vanga, Kenya, Source: UN News 2022

Adapted from "Does Plastic Waste Kill Mangroves? A Field Experiment to Assess the Impact of Macro Plastics on Mangrove Growth, Stress Response and Survival." 2021.

health.[15] The overloading leads to increased mortality rates during drought conditions and contributes to the massive deaths of mangroves in areas like Kilifi, Mwache, Port Reitz, Tudor, and Makupa creeks in Mombasa. In addition, in areas such as Kilifi, Makupa, Mwache, Tudor creeks, Port Reitz, and Vanga, this nutrient overload has led to greater mangrove mortality during periods of drought. The excess nutrients can lead to hypoxia conditions when they accumulate, effectively suffocating the mangroves and leading to significant die-offs.

13 "Coastal Crisis: Mangroves at Risk." 2017. UN Environment. November 3, 2017. https://www.unep.org/news-and-stories/story/coastal-crisis-mangroves-risk.
14 "Does Plastic Waste Kill Mangroves? A Field Experiment to Assess the Impact of Macro Plastics on Mangrove Growth, Stress Response and Survival." 2021. Science of the Total Environment 756 (February): 143826. https://doi.org/10.1016/j.scitotenv.2020.143826.

6.1.2 Nutrient Overload Cause of Drought Mortality in Mangroves

A less visible but equally devastating impact of poor waste management is the high nutrient content resulting from sewage disposal into water bodies adjacent to mangroves. The introduction of waste into mangroves contaminates the water and soil while introducing high levels of nutrients from sewage disposal. Nutrient overloading, as observed, is detrimental to mangrove

15 "Does Plastic Waste Kill Mangroves? A Field Experiment to Assess the Impact of Macro Plastics on Mangrove Growth, Stress Response and Survival." 2021. Science of the Total Environment 756 (February): 143826. https://doi.org/10.1016/j.scitotenv.2020.143826.

6.1.3 Sediment Displacement

Flooding, exacerbated by blocked drainage systems filled with improperly disposed waste, leads to further sediment displacement. This not only affects the water quality but also the physical landscape where mangroves grow, disrupting their natural habitat and making it difficult for young mangroves to establish and mature.

*Figure 6.1.3: Sedimentation & Debris in Mangroves*
Source: Adapted from "Does Plastic Waste Kill Mangroves? A Field Experiment to Assess the Impact of Macro Plastics on Mangrove Growth, Stress Response and Survival." 2021.

6.1.4 Inadequate Waste Capacity

While Mombasa has made steps in waste management, it is evident that waste is still an issue requiring improvement. As Mombasa endeavors to restore mangrove ecosystems, a critical yet often overlooked element emerges as the key to these efforts' success: effective waste management.

Mombasa's waste generation statistics paint a stark picture of the scale of this challenge. The county produces approximately 2,200 tons of waste daily, a substantial volume that tests the limits of its waste management infrastructure. Only 65% are collected and 13% of households can access county waste management services due to

mismanaged primary collection points.[16] Considering the county's efforts to implement robust waste policies, a significant gap in waste collection capabilities remains. This shortfall leaves a considerable amount of waste unmanaged, posing a direct threat to the mangrove ecosystems.

The county's ongoing struggle with illegal dumping, particularly near informal settlements and water bodies, exacerbates the vulnerability of mangroves to pollution and degradation. By reducing the volume of waste generated, Mombasa can alleviate the pressure on its waste management systems and protect its mangroves. The restoration and conservation of Mombasa's mangroves are inextricably linked to the county's ability to manage and reduce its waste.

Hands-on Guidelines: Capacity Building for Waste
The critical intersection between waste management and mangrove conservation in Mombasa demands a focused strategy, particularly in areas prone to environmental degradation and within informal settlements. In the field of waste management, Kenya has made achievements with current efforts that can be scaled up. Drawing on Kenya's successes in innovative waste management solutions, this section outlines a subset of recommendations aimed at bolstering waste management capabilities specifically within mangrove-rich areas of Mombasa County.

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16 Wekisa, Ezra, and Christine Majale. 2020. "Spatial Distribution of Waste Collection Points and Their Implications on Quality of Life in Mombasa County, Kenya." Journal of Urban Management 9 (2): 250–60. https://doi.org/10.1016/j.jum.2020.02.003.


Figure 6.1.4: Mombasa Concentration of Informal Collection
Source: Wekisa and Majale, 2020

6.2 BUILDING CAPACITY WITH SUCCESSFUL PROJECTS

6.2.1 Shimo La Tewa Waste Project

In an innovative effort to address environmental challenges and enhance marine ecosystem conservation, the Shimo La Tewa Wastewater Treatment Plant project stands as a testament to sustainable environmental management practices. Completed by the Kenya Marine and Fisheries Research Institute (KMFRI), this project aims to enhance the conservation of marine resources in Mtwapa Creek through the reduction of land-based sources of pollution from the Shimo la Tewa prison facility, using the constructed wetland. As the main approach, KMFRI constructed a Sh30 million wastewater treatment plant at the Shimo la Tewa prison in Mombasa.[17]

Using wetland plants, soil, and microorganisms to manipulate physical, chemical, and biological processes, KMFRI will employ engineered wetland technology to filter and purify wastewater like that of wetlands. Built wetlands are an affordable solution, and gravity will move the sewage. KMFRI claims that the plant will make it easier to treat jail trash, which is now dumped untreated into Mtwapa Creek. The population of Shimo

la Tewa Prison has grown to more than five thousand. There are roughly 1,000 inmates in the women's jail, 2,400 males in the maximum security prison, and 500 kids in the borstal boys' facility. Within the compound are the women's and senior staff quarters, the Shanzu court, the probation office, and other locations where some people are present. Every day, an estimated 400 cubic meters of garbage are created and dumped into Mtwapa Creek.

6.2.2 Evaluation of Project Scalability

To prove its effectiveness in replicating this project, this section provides a table that outlines key areas of assessment, including environmental impact, social implications, challenges faced, and opportunities for scalability and replication. To prove its effectiveness in replicating this project, this section provides a table that outlines key areas of assessment, including environmental impact, social implications, challenges faced, and opportunities for scalability and replication.

17 "Wastewater Treatment Plant to Be Built at Shimo La Tewa." The Star. https://www.the-star.co.ke/counties/coast/2021-05-27-wastewater-treatment-plant-to-be-built-at-shimo-la-tewa/.

TABLE 6.2.2 Evaluation Areas of Shimo La Tewa Case Study		
Criteria	**Evidence of Success**	**Potential for Replication**
Water Quality Improvement	Significant reduction in waterborne pollutants and improvement in water quality indicators.	Similar water treatment technologies can be adapted to other coastal or riverine environments.
Benefit for Restoring Mangroves	Restoration of mangrove ecosystems due to improved water quality and reduced pollution.	Techniques and practices proved to aid in mangrove recovery can be implemented in mangrove-rich areas facing similar threats.
Operational Efficiency	Efficient processing of 400 cubic meters of daily waste, overcoming previous operational inefficiencies.	Adoption of scalable waste treatment solutions that can be adjusted based on the community size and needs.
Scalability & Duplicability	Successful implementation within a high-risk area serves as a model for other regions.	Framework offers a blueprint in settings with similar environmental and social dynamics.

6.2.3 ACTION ITEMS AND NEXT STEPS			
Action Area	**Funding Focus**	**Involved Organizations**	**Time Phase**
Design & Engineering	Develop wastewater plant designs using engineered wetland technology, and source materials, and engage experts.	KMFRI, Bidii Creek Conservancy, University of Nairobi (for tech and assessment study)	0-6 Months
Budgeting & Resource Mobilization	Secure project funding, create a targeted budget plan, and mobilize resources.	Donors or partners (such as the World Bank), Mombasa County Government	3-9 Months
Construction & Implementation	Construct wastewater treatment facilities near Bidii, Tudor, and Mwache Creek, with community involvement.	KMFRI, Mombasa County Government, a task force for the project of construction, Bidii Creek Conservancy	9-21 Months
Monitoring & Evaluation	Track facility performance and environmental impact	Project Managers	Begin at 9th Month
Training & Outreach	Employ staff from nearby communities to manage and maintain equipment; develop training classes	Communities at Mombasa Island and Kilindini Harbor, KMFRI	Throughout Project
Further Expansion & Replication	Continue replication to other mangrove areas besides Bidii, Tudor, and Mwache Creek	Mombasa County Government, Project Steering Committee	2 years post

6.3 SCALING UP INNOVATIVE TECH MODELS

Another aspect of these recommendations involves scaling up the social business model of Baus Taka enterprise for waste collection. The expansion of Baus Taka's services, including broader app accessibility and enhanced cleanup operations, will make sustainable waste management solutions more accessible to Mombasa residents. This approach, modeled on the success of similar initiatives like the Clean Kenya and Hatua Nairobi apps, emphasizes economic viability, sustainability, and alignment with broader conservation objectives.

6.3.1 Integration with Baus Taka Enterprise

Addressing the waste collection challenge, Baus Taka has emerged as a pioneering initiative, leveraging digital technology to revolutionize the way waste is collected and managed in the county. This digital trash collection service represents a critical step forward in enhancing Mombasa's environmental sustainability and contributing to the broader goals of mangrove restoration and conservation. Baus Taka's service is built on the foundation of a user-friendly digital platform that simplifies the process of waste collection for residents

and businesses alike. Through an intuitive app, users can schedule waste pickup, manage their waste disposal needs, and contribute to the city's cleanliness and environmental health with unprecedented ease.

A key feature of Baus Taka's digital service expansion is the enhancement of mobile applications supported by its technology, namely Clean Kenya and Hatua Nairobi. These apps provide critical functionalities for waste segregation and reporting, enabling users to contribute valuable data on waste dumping and segregation practices. By harnessing the power of crowd-sourced information, Baus Taka, and its partner apps offer insightful data analytics that inform better waste management strategies and policies.

6.3.2 Steps and Improvement for Scaling Up: Community Training

This table proposes strategic enhancements to Baus Taka's waste management service, with a focus on education, technology, and community involvement. By expanding the accessibility and capabilities of their app, increasing authorized dump sites, and creating a comprehensive educational library, Baus Taka can significantly improve waste management practices in Mombasa. Collaborations with local CBOs will further deepen the community's commitment to conservation, directly benefiting mangrove restoration efforts. Tailoring waste collection efforts to directly benefit mangrove conservation, through targeted programs addressing specific pollutants, would reinforce the service's ecological impact. Finally, integrating incentives for users to adopt greener waste practices could transform community engagement from passive participation to active environmental stewardship.

TABLE 6.3.2 Areas to Scale Up Capacity for Solid Waste Management			
Improvement Areas	Actions	Involved Organizations	Timeline
Baus Taka's Digital Service & Application Training Class	Organize regular training sessions for new users	Baus Taka Team, Community Educators	Quarterly, Immediate Start
	Develop video tutorials and user guides for the application	IT Teams from Baus Taka & Mombasa County Government	Withing First Month of Each Quarter
Develop More Waste Collection Sites	Identify and set up additional authorized waste collection points in the county	Baus Taka, Mombasa Planning Department	Every 6 Months
	Collaborate with communities for space and permissions	CBOs such as Pwani Youth Network & Brain Youth Group	Initial Sites within 6 Months
Build Community Libraries for Environmental Education	Establish online and physical resources	Baus Taka	Within 1 Year
	Include multimedia resources, best practices, & case studies on mangroves	Education Specialists from the University of Nairobi	Content Updated Annually
Mobile Application Accessibility	Update mobile app	Baus Taka	New app version every 6 Months
	Conduct user experience research	Baus Taka	Ongoing user feedback
Community Engagement	Work with CBOs to facilitate community workshops	Baus Taka, CBOs such as Pwani Youth Network & Brain Youth Group	Monthly Workshops
	Implement an incentive system in the app for eco-friendly disposal and recycling	Baus Taka	Reward Program Launch within 6 Months
Waste Management Analytics	Integrate advanced data analytics for predictive waste generation	Baus Taka IT Department, Data Analysts	Analytics Integration within 1 Year
	Use analytics to inform targeted waste collection strategies	Environmental Data scientists (from county government or partners)	Data-driven Strategy Updates Annually

6.4 RECYCLED WASTE FOR MANGROVE INFRASTRUCTURE

6.4.1 Recycled Plastic Lumber

The last innovative follow-up recommendation includes utilizing recycled waste, particularly plastic, for constructing mangrove infrastructure such as boardwalks and access points. Kenya has existing experimental and pioneering projects that utilize recycled plastic for building boats. Supported by KUSP funding, a partnership between the Mombasa county government and Baus Taka could pioneer the introduction of recycled plastic lumber (RPL) in mangrove conservation efforts. This initiative, informed by a comprehensive risk assessment, draws inspiration from successful regional projects like the Pwani Youth Group's Plastic Recycling Program and Lamu County's FlipFlopi Project. RPL, produced from processed plastic waste, offers a durable, eco-friendly alternative to traditional construction materials. By repurposing collected plastic waste into RPL, Mombasa can pioneer a sustainable approach to infrastructure development in sensitive ecological areas such as mangroves.

6.4.2 Potential Next Steps

To make use of RPL in mangrove infrastructure, first, forge partnerships with local recycling facilities to ensure a steady supply of processed plastic waste for RPL production. Simultaneously, initiate capacity-building programs to equip local communities with the knowledge and skills necessary for participating in recycling and construction processes.
Next, in around 3 to 6 months, it is required to launch pilot projects to construct RPL boardwalks and access points in select mangrove locations. These projects will benchmark the material's durability, environmental impact, and community acceptance. Concurrently, conduct comprehensive feasibility studies to evaluate the technical and economic viability of scaling RPL infrastructure across mangrove conservation areas.

At the same time, it is beneficial to implement community-led RPL projects to foster a sense of ownership and responsibility towards mangrove conservation. Develop and deploy educational campaigns and materials to raise awareness about the importance of mangroves, the benefits of recycling, and the role of RPL in environmental conservation.
The final step is to establish a robust monitoring and evaluation framework to track the performance and impact of RPL infrastructure over time. Feedback from various stakeholders, including conservation experts, local communities, and eco-tourists, will inform ongoing improvements and adjustments. Based on the outcomes and lessons learned from initial projects, explore opportunities for replicating this model in other coastal regions facing similar environmental challenges.

Baus Taka Enterprise Plastic Recycling Bike. Photo taken during team field visit on January 18th, 2024.

Recycled Plastic Lumbar utilized for boat construction. Source: The FlipFlopi (https://www.theflipflopi.com)

6.5 OVERALL TIMELINE OF RECOMMENDATIONS

This table serves as an overarching guide to coordinate the various initiatives related to mangrove conservation and waste management in Mombasa. By segmenting the actions of scaling up the wastewater management system, improving the digital garbage collection, and utilizing recycled waste for mangrove infrastructure, Mombasa can prioritize immediate needs while setting the foundation for ongoing and sustainable improvements. Short-term actions focus on initiating projects and building momentum, while long-term actions are geared toward assessing outcomes, solidifying gains, and planning for broader applications. These future actions aim to build upon the established successes, scaling and replicating these models to have a broader impact on regional and potentially global conservation and sustainability efforts.

TABLE 6.5 Timeline of Recommendations for Solid Waste Management Capacity Building				
Time-frame		**Shimo La Tewa Replication**	**Baus Taka Service Improvement**	**RPL Utilization for Mangrove Infrastructure**
Short Term: Within 1 Year	0-3 Months	Targeting at Bidii, Tudor, and Mwache Creek: designing	Introduce more authorized dump sites.	Fund partnerships with recycling facilities: Pwani Youth Group
	3-6 Months	Budgeting and resource mobilization for plants.	App training classes and UI/UX improvements begin	Invest in and launch pilot RPL boardwalk projects in select locations. (Bidii creek)
	6-9 Months	Monitor construction progress and quality.	Develop a Library of resources for waste.	
	9-12 Months	Training for management system employees	Deploy an enhanced version of the Baus Taka app.	Engage communities in RPL projects and technique/skill training.
Mid-term: 3-5 Years		Operationalize treatment plants, initiate community education programs, and monitor impacts on mangrove systems.	Scale training outreach, integrate analytics, and solidify community-led waste initiatives.	Conduct feasibility studies for scalability, expand community-led projects, and establish a monitoring and evaluation framework.
Long-term: 5+ Years		Expansion of wastewater models to other regions	Leverage technology to drive city-wide adoption	Scale RPL infrastructure pilot project to other coastal areas

Recommendation Three

The following recommendation addresses the gaps in data between the local stakeholders, CBOs, and government agencies on mangroves in Mombasa County. There is a need to increase data sharing capacity within the county for a better understanding of what types of data are readily available, and where gaps need to be filled. This section explores the creation of a county wide data-sharing platform that will scale up data innovation capacities, provide employment opportunities for local community members, and build up the types of data available on mangrove

ecosystems. Following an exploration into how a data platform could be implemented, this recommendation provides the starting points necessary to create a mangrove restoration index that would be utilized by county officials. This index would provide a standard measurement system in which Mombasa county could compare results against, making for a more unified standard in terms of increasing data innovation capacity. Suggestions for different indicators, and which current models to base data gathering on will be explained within the confines of this index.

7.1 CURRENT MANGROVE DATA IN MOMBASA COUNTY

It is noted in the introductory remarks of this report that the NYU Capstone team noticed a plethora of data-gathering initiatives completed by stakeholders within Mombasa County. Mangroves are an integral part of both land and sea planning, providing a unique set of overlaps between different arms of the county government. The current stakeholders most directly involved in Mangrove restoration data collection are: Kenya Forest Service, Kenya Wildlife Service (KWS), Kenya Marine & Fisheries Research Institute (KMFRI), Mombasa County Government, both the Water Sanitation & Natural Resources and Environment/ Solid Waste Management departments. Within these respective stakeholders, there have been three types of data and surveying available.

1. Mangrove Degradation/Depletion Awareness
While Mangrove loss within the country has been monitored more closely in Lamu, home to the largest population of Mangroves in the country, Mombasa has mangrove forests in Tudor Creek and Mwache, providing the county with two larger significant

mangrove coverage zones. Within Tudor Creek, which extends about ten to fifteen kilometers depending on the season, about 1,651 hectares of Mangroves reside. Based on surveying, three main species reside in Tudor Creek, Rhizophora Mucronata Lamk., Sonneratia
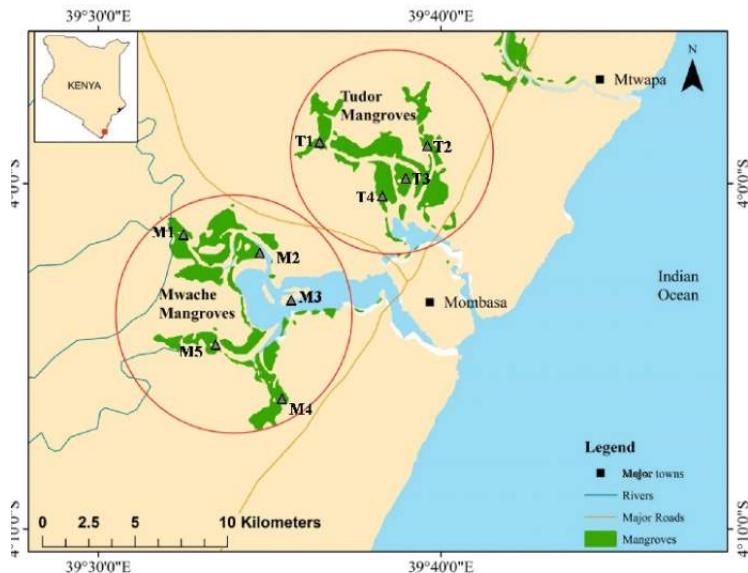
Figure 7.1.A : Mangrove Map of Mombasa County
Source: National Mangrove Ecosystem Management Plan, 2017
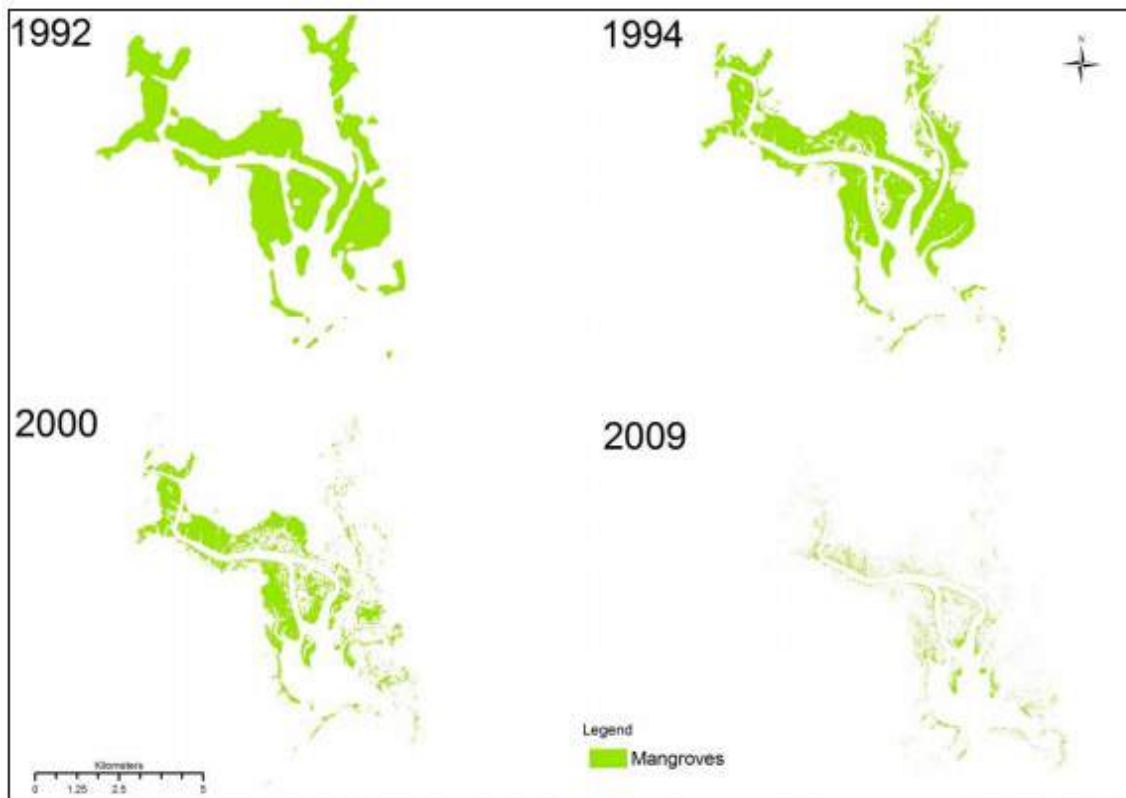
Figure 7.1.B : Mangrove Loss Since 1992, Source: National Mangrove Ecosystem Management Plan, 2017

Alba, and Avicennia Marine (Forsk) Vierh, with little species zonation along the creek. Within the Mwache Mangrove system there are approximately 1,500 hectares of mangroves, the dominant species being A.Marina, R. Mucronata, Ceriops Tagal, and S. Alba.[18]

Within both Tudor and Mwache zones, high levels of sedimentation during the wet season have directly contributed to sedimentation issues. Additionally, human consumption (ie: illegal harvesting and dumping) has increased the strain on these mangrove ecosystems. Tudor Creek, between the years of 1992 and 2009, lost 86.9% of its mangrove coverage while Mwache lost 45.4% during the same period. Respectively 5.1% and 2.7% annually during this period, much higher than the national average of .7% loss per annum. The KMFRI

study highlights the point that natural regenerative measures from the forest itself cannot compete with the current human pressures put on the ecosystem, specifically illegal wood extraction in Tudor Creek and Mwache areas.

KFS also has been monitoring the makeup of mangrove forests in Mombasa County as part of their 2017 National Mangrove Ecosystem Plan. In the report, KFS states that six percent of Mombasa County is covered by Mangrove forests, which puts the county on the lower end of total coverage. [19] Within this report it is mentioned that extracting wood from mangrove forests is one of the greatest human factors responsible for depletion. KFS states the most common use for mangrove wood is the creation of fishing

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18 Map of the study area showing the Mombasa Mangroves (Mwache and Tudor... | download scientific diagram. Accessed April 29, 2024. https://www.researchgate.net/figure/Map-of-the-study-area-showing-the-Mombasa-mangroves-Mwache-and-Tudor-creeks-M1-M2_fig1_262343830.

19 Olagoke, Adewole. "Mangroves in Peril: Unprecedented Degradation Rates of Peri-Urban Mangroves in Kenya." Academia. edu, November 9, 2021. https://www.academia.edu/5581055/ Mangroves_in_peril_unprecedented_degradation_rates_of_ peri_urban_mangroves_in_Kenya.

poles and firewood, making up about 70% of the wood requirement of local communities located near mangroves. However, it is to be noted that this data collection was done majorly through Lamu County within the last 12 years. KFS states that "...overall, there is limited data available for Mombasa County on pole removal from mangrove forests."[20]

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20 National Mangrove Ecosystem Management Plan. Accessed April 29, 2024.

2. Environmental Protection & Enforcement
KFS is the designated overseeing agency for mangroves in Mombasa County, and enforcement of protected areas falls under KFS mandates.

3. Effective Monitoring of Ecosystems & Wildlife
KWS does extensive monitoring of the areas within Mombasa's ocean territory to see the effects of human activities and climate change on the wildlife.

Table 2.2: Mangrove areas in the five counties along the Kenyan coast

County	Forested mangrove area (ha)	Percentage mangrove cover	Non-mangrove areas (water ways, salt pans, bare saline areas) (ha)
Lamu	37,350	61	61,836
Tana River	3,260	5	1,382
Kilifi	8,536	14	12,092
Mombasa	3,771	6	5,513
Kwale	8,354	14	7,205
Total	**61,271**		**80,823**

Table 4.1: Wood products extracted from mangrove forests in the last 12 years

County	No. of scores of poles											
	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Kwale	560	660	363	960	1029	704	478	387	456	472	478	454
Mombasa	-	-	-	-	-	-	-	-	-	-	-	103
Kilifi	120	150	184	98.4	111	152.5	135	122	91.5	96	100	95
Tana River	110	120	250	379	111	74	90	50	70	82	92	87
Lamu	4250	4200	3400	3660	3003.5	2284	3768	21577	72984	23224	96531	96103
TOTAL	**5040**	**5130**	**4197**	**5097**	**4255**	**3215**	**4471**	**22136**	**73601**	**23874**	**97201**	**96739**

(Source: KFS records)

Figure 7.2 : Mombasa County No. of Poles removed from Mangrove forests is non-existent in the KFS monitoring data, as shown above.
Source: National Mangrove Ecosystem Management Plan, 2017

7.2 DATA GAPS AND CHALLENGES

These areas of data monitoring have been completed by the different stakeholders mentioned, yet there still are fragmented portions of the system. Generalized data on mangrove depletion since 2009 has been estimated from the KMFRI monitoring report, and any reports since 2009 either have not been completed in the same capacity or have been shared only internally - as it is not possible to find such publications for public viewing.

While there is still a tangible and valid threat to the Tudor Creek and Mwache mangroves, as cited in the NYU Capstone Field report, there are limited data sources to confirm this currently. Only the 2017 KFS report (now seven years dated) publicizes the percentage of mangrove coverage in Mombasa County, but provides little in the way of depletion measurement since the KMFRI 2009 report. In terms of readily available GIS polygon data, there is limited mangrove data specific to Mombasa. Most of the available shapefiles are Lamu county centric, as the county has done more effective monitoring due to the scale of mangrove coverage in their region.

Another challenge is the individualism rooted within each data-collecting stakeholder. While KWS does extensive monitoring of wildlife status in mangrove regions, they internalize all these reports and have not shared this data with other relevant stakeholders. When interviewing KMFRI, mangrove experts also mentioned their current surveying reports have not been shared with the other local actors. KFS is currently the only stakeholder hiring members of the local community as enforcement officers for mangrove protection initiatives. While each stakeholder is doing extensive and incredibly helpful research, there is a gap in the way these reports are shared between the different agencies.

7.3 DATA INNOVATION PLATFORM FOR INSTITUTIONS AND COMMUNITY BASED ORGANIZATIONS

The aforementioned gaps in available data have provided the NYU Capstone team with the idea to create a formally managed online data-sharing platform, which can provide all relevant stakeholders involved in mangrove restoration initiatives with a unified central knowledge hub in which to gather data from. The goals for this initiative are two-pronged: provide a way for data-driven stakeholders (KMFRI, KWS, and KFS) with

the opportunity to share their findings while garnering more information on restoration initiatives, and to provide the CBOs currently doing mangrove restoration with a platform to upload their successes, projects, and volunteer initiatives. This data innovation platform is intended to be managed through the Mombasa County Government, allowing a local government agency to control the administrative aspects.
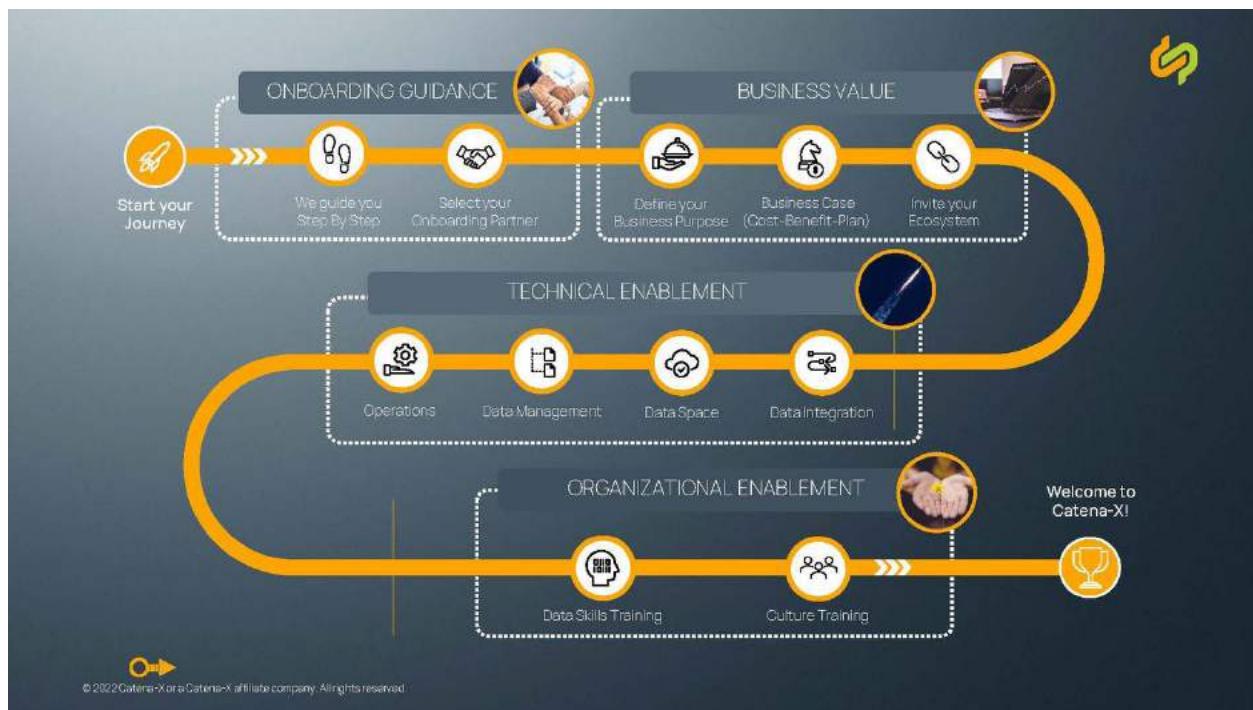

Figure 7.3.1: A general timeline of potential partnerships through Cetena-X

7.3.1 Potential Model for Blueprint

In terms of successful data innovation models, many US based consulting firms have created blueprints that WBG can assist the county government with implementing. Catena-X is a shared data platform for the automotive industry, designed to increase data sovereignty and interoperability between the 28 partners. While the initial exchange is between partners for a fee, the initial idea relates heavily to the intention for the Mombasa County government platform: increase data sharing capacity between relevant stakeholders to reduce unnecessary overlaps in data generation.

Catena-X offers a unique perspective to data sharing, where a potential partner has to go through a vetting process to get to the point of shared data aka "technical enablement". On-boarding is guided through staff who ensure that potential data partners create a purpose for wanting access to previously uploaded data, and create a comprehensive cost-benefit analysis as to why they should be granted access to the shared data platform,

and how the upload of any future data may benefit stakeholders. [21] The Mombasa county government has the potential to manage the uploading and collaboration of all relevant stakeholders. The timeline and action items the process are listed in Table 7.3.1.

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21 "Certification: Catena-X." Catena. Accessed April 28, 2024. https://catena-x.net/en/catena-x-introduce-implement/certification.

7.3.2 Privacy and Considerations

A shared data platform allows local actors to create partnerships in a value chain. This is the same in both private and public sector data innovation platforms. While private firms tend to have increased risks when it comes to data security - it should also be noted that the Mombasa County government works alongside WBG to determine necessary steps for protection mechanisms for uploaded data. While the

TABLE 7.3.1 DATA COLLABORATORS ACTION ITEMS		
Mombasa County Government	**World Bank Group**	**NEMA**
Begin to meet with stakeholders to get a baseline for which groups would be most willing to participate in the uploading of their data and current mangrove restoration initiatives. Act as a liaison between the community and the data-sharing platform.	Help finance the creation of the platform, meeting with website developers, software engineers, GIS mappers, and consultants. These connections are necessary first steps to enable the county government to manage the platform.	Review and approve the project as necessary.
Create new positions within the county government, [that can be filled by local community members either on a volunteer, part-time, or full-time employment level] IE: technology literacy trainers, local stakeholder liaison officers, data uploading progress officers, data community specialists, photographers, etc.	Collaborate with the county government to go over the development phases of the website/platform. Ensure that if there are any additional technology training or technological advancements needed in county offices, these are funded and provided.	
Begin the creation of the platform alongside the WBG.	Begin the creation of the platform alongside the county government.	
Take over the managerial process of the data platform. Begin to advertise uploading content to local stakeholders. Push for data to be shared between the local stakeholders.	Provide the county government with the necessary tools to advertise data sharing. IE: transportation to CBO sites, cameras to record advertisements, transport to/from CBO training on restoration initiatives.	
Act as a safeguard to the data platform. New CBOs and potential partners should apply through the county government to access shared data from stakeholders much like the Catena-X system. Once stakeholders are provided access/approved, they can have reign to upload or download shared data, or collaboration opportunities.	Continue to provide technical oversight until the county government can fully provide managerial and technological support to all involved stakeholders.	

intention is to eventually release all data for public use, there needs to be additional work done to ensure the privacy of citizens is protected and uplifted. This is especially relevant due to the proposed data innovation platform having a section for Mombasa CBOs to upload their training and community participation events.

7.4 MEASURING DATA SUCCESSES: A NEED FOR A MANGROVE-SPECIFIC INDEX

It is necessary to create a mangrove-specific index to properly measure the successes of the data sharing platform, increase surveying and monitoring initiatives, and CBO initiatives within Mombasa County. A set of four relevant indicators are proposed to capture the holistic health of the ecosystem. The targets and facilitators for each indicator is listed the actionable items below.

7.4.1 INDICATOR ONE:
Surveying of Modified & Natural Mangrove Related Ecosystems in Mombasa Measured Against National Mangrove Coverage

The intended reasoning for such an indicator is to understand which areas of Mombasa County mangroves are currently being modified by any sort of mangrove restoration initiative. It is necessary to establish a baseline where mangrove-related areas are being stimulated by CBO replanting initiatives, and which areas are natural and have not yet been addressed by replanting or protective organizations. The lack of updated mangrove coverage within the county has shown that there needs to be an immediate

Table 7.4.1 INDICATOR ONE: ACTION ITEMS TABLE			
Mombasa County Government	**KMFRI**	**KFS**	**WBG**
Oversee the creation of a surveying advisory committee between the county government, KMFRI, and KFS to begin designating surveying tasks VIA agreed upon charter.	Share all past and current mangrove surveying data extracted from Mombasa county with relevant stakeholders VIA upload to the recommended shared data platform.	Begin to compile a list of all Mombasa KFS employees trained in mangrove protection and monitoring initiatives.	Support the county government with the creation of an advisory committee, stepping in to fill managerial roles and provide necessary financing approvals.
Define the criteria for surveying data needed from KFS and KMFRI employees. Suggested criteria include drone images from above mangrove areas, measuring the quality of life of mangroves in surveying zones on a 1-5 scale, and how to count mangroves & geographic depletion.	Establish a team of Mangrove experts and GIS data researchers that will integrate gathered surveying data from KFS employees/volunteers on initial mangrove status.	Hire additional local community members and CBOs and begin a training regimen to establish targets for mangrove monitoring in the Tudor Creek and Mwache zones.	Act in an advisory role alongside any NEMA officials to ensure KFS training is being completed in a timely and efficient manner. Step in if there are financing or literacy gaps.
Publish reports every five years highlighting surveying and KMFRI data results and compare these to national averages for Kenya/other counties.	Take raw data gathered from KFS surveying and make spatial datasets for public domain usage. Upload to a shared data platform.	Surveyors assess matured mangrove trees, saplings, evidence of cut down trees, wildlife species present in the area, and erosion spots, in both natural and modified regions.	Provide surveying teams with the necessary tools to survey modified and natural mangrove ecosystem areas.

scale up of surveying initiatives. Local stakeholders should work together to scale up surveying initiatives, and reaffirm the mangrove mapping of both the Tudor Creek and Mwache zones every five years. This would give the local groups enough time to coordinate surveying methodologies, GIS mapping, and allow external researchers consistent timely data on which areas are being supported by replanting efforts. Comparing this county data to the national mangrove depletion average (which is much lower than Mombasa County) can be the indicator for successful restoration initiatives. The lower the depletion rate every 5 years, the more successful restoration initiatives are in Mombasa. The separation between both modified and natural mangrove-related zones provides local officials with a map of zones to prioritize for additional coverage.

7.4.2 INDICATOR TWO:
Percentage of Land and Sea Covered by Joint Spatial Plans in County

The intention of this indicator is to emphasize that mangroves are both a land and sea portion of the ecosystem. The need to integrate land and sea planning in Mombasa County will be explained in detail in this report's fourth recommendation. However, providing the mangrove performance index with integrated spatial planning initiatives will provide Mombasa County with a reliable method for measuring the progress of an integrated approach. Success can be indicated by an increase in the percentage of increased land/sea spatial

plans involving mangrove restoration initiatives. A complementary indicator could include the proportion of wildlife and marine regions protected under conservation efforts. This data would be easily accessible through KWS, which acts as the overseer of wildlife monitoring in the county. It is intended to be a semi-annual update of land and sea planning VIA county report, that the county establishes which mangrove regions are under protection by KFS/KWS, and to promote mangrove conservation as an agent for increased biodiversity.

7.4.3 INDICATOR THREE:
Percentage of Deteriorated Mangrove Regions Currently Under Restoration

Having a specific indicator solely for damaged mangroves under restoration is important because it differentiates between protected mangroves and restorative mangrove regions. Protected areas limit the ability of the local population to utilize the area for sustainable livelihood diversification; they are typically under protection through KWS and KFS. Areas currently under restoration through CBOs are typically areas where these protections are limited (either by the capacity to monitor or by regulations). Including an indicator that addresses the percentage of deteriorated mangrove regions will show the areas that are currently most distressed in terms of degradation, while also comparing that to the current restoration initiatives in the county. This can indicate which areas are consistently being addressed and which areas may need more restoration.

Table 7.4.2 INDICATOR TWO: ACTION ITEMS TABLE		
Mombasa County Government	**KMFRI**	**WBG**
Establish a timeline for semi-annual updated reports on percentages of land/sea integrated spatial planning for mangrove forests in the region.	Provide and upload internal wildlife monitoring data to the shared data platform, specifically from Mombasa National Park and reserve areas.	Initiate scale-up opportunities with large partners such as UN-Habitat, based in Nairobi but working on integrated land/sea planning initiatives. Begin conversations on partnerships between partners for data sharing on UN-Habitat-specific land and sea planning projects.
Initiate scale-up opportunities with large partners such as UN-Habitat, based in Nairobi but working on integrated land/sea planning initiatives. Begin conversations on partnerships between partners for data sharing on UN-Habitat-specific land and sea planning projects.	Initiate scale-up opportunities with large partners such as UN-Habitat, based in Nairobi but working on integrated land/sea planning initiatives. Begin conversations on partnerships between partners for data sharing on UN-Habitat-specific land and sea planning projects.	Work alongside the county government and UN-Habitat to define what regions to measure and how to define the integration of land and sea planning.

7.4.4 INDICATOR FOUR:

County Environmental Economic Accounts of Mangrove Ecosystem Services & GHG Emissions from Land Use Changes

This indicator provides economic context to mangrove restoration initiatives in the county. In tandem with monitoring GHG emissions from land use changes, (discussed further in recommendation four) it will provide probable measurements for success. This is an indicator that can be paired with a cost-benefit analysis of mangrove restoration; a better CBA ratio over the proposed reporting periods will show that mangrove restoration is a profitable expenditure for the region. This analysis can also build upon other recommendations in this report that target livelihood diversification for residents. Placing a positive, measurable economic value on the mangroves will provide the county government, and other larger stakeholders, the economic proof to scale up mangrove restoration initiatives. Reducing GHG emissions through increased mangrove restoration efforts will also provide potential stakeholders with incentives to scale up.

7.4.5 Timeline & Considerations

It is acknowledged that increasing data capacity in Mombasa County is not an easy task. There are many stakeholders involved, and their interests must be respected and uplifted while considering increased collaboration efforts. The NYU capstone team recommends that initial funding and consideration should primarily be focused on the immediate creation and management of the shared data innovation platform. This will bridge the current gaps between stakeholders' data knowledge and begin necessary collaboration initiatives to scale up CBO participation and knowledge sharing between government agencies.

Only after the creation and management of this platform, should the Mangrove index be created. While the NYU Capstone team has provided a potential set of indicators for this index, it is recommended to confirm successful indicators of mangrove restoration with environmental consultant teams. Indicator four offers critical starting points that place economic value on mangroves and mangrove services, but are not exhaustive and should be expanded upon to maximize success mechanisms. The indicators presented offer a preliminary start to further research.

Table 7.4.3 INDICATOR THREE: ACTION ITEMS TABLE		
Mombasa County Government	**KMFRI**	**WBG**
Act as a political/social liaison between KMFRI collecting surveying data on restoration initiatives, and the CBOs in the county currently acting as restoration partners. Begin to assign individuals at the county level.	Upload current datasets to the shared data platform to increase data accessibility for the county government. Begin to assess if there are surveying analyses needed to determine which areas are currently under restoration initiatives.	Conduct a needs analysis with KMFRI to determine if they need financial/operational assistance from WBG personnel and network to conduct a survey analysis of restoration areas in the county.
Begin to gather the report materials from KMFRI and assist as needed with local groups to answer: which areas are being protected under mandates, which are under community restoration, and which zones overlap in both protection and restoration methods. Additional areas to the county government to analyze include types of replanting methods and species replanted in restoration zones.	Begin the surveying of mangrove protection and restoration zones in the county. This includes partnering with both WBG and the county government to involve local stakeholders/CBOs in conducting restoration initiatives. This requires determining boundaries for restoration zones.	Provide tools and necessary assistance to KMFRI for surveying methods.
Begin to draft a report on the uploaded GIS data by KMFRI.	Analyze the collected data and begin implementing surveying data into GIS software.	Provide technical assistance to KMFRI with the tools necessary to create GIS analytical data that can be both interactive and easily comprehensible by consultant groups and local stakeholders.
Repeat this report every two years alongside KMFRI.	Repeat this analysis process every two years alongside the county government.	Continue to offer technical support as needed.

Recommendation Four

Rapid urbanization is a pressure experienced by cities across the globe. The population growth in cities is often a result of the relocation from rural regions to areas with more economic growth opportunities. The intent is to relocate and work in roles with higher or more consistent wages. While there are individual scenarios that achieve this mission, often the low-income rural residents are not able to attain consistent work and experience more extreme poverty in the cities. Due to the higher cost of living and the inability of the city to absorb the population influx, the lowest-income residents often reside in informal settlements without sufficient infrastructure and resources. As the dominant Kenyan port city, Mombasa is experiencing this phenomenon. In 2019, the population of Mombasa was approximately 1.2 million.[22] The latest projections from the Kenya National Bureau of Statistics predict a population growth of 1.42 million by 2027. Given the already strained resources, this steady growth will exacerbate the infrastructure and resource gaps. As the smallest county in Mombasa, in terms of land area, the increasing land use changes for residential development is a significant threat of urbanization.

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22 Department of Lands, Planning, Housing and Urban Renewal, Mombasa County Spatial Plan 2021-2031- Draft Plan § (2023).

The protection of mangrove forests in Mombasa is reliant on charting a path forward that integrates economic development with environmental restoration.

Land and sea planning is an integrative approach that considers the intricate relationships between ecosystems and incorporates collaborative environmental and spatial planning. In the case of mangrove forests in Mombasa, the development patterns and infrastructure capabilities have consequences on the mangrove forests. Of highest concern is the sediment, waste, and polluted waters generated by rapid urbanization that flow to the low elevation points of the county and prevent mangrove forest health. This integrative planning considers the holistic benefit of a healthy mangrove forest in Mombasa. A beneficial mangrove ecosystem sequesters carbon, cleans water flowing to the ocean, and therefore protects the reef, and generates high-value honey and marine life for livelihoods. Therefore, mangrove forest protection is critical and beneficial for the longevity of growth in Mombasa.

1. Target collaboration & NBS in the CIDP.
2. Address immediate and long-term erosion causes.
3. Define economic asset of mangrove ecosystem.

Mikindani Area of Mombasa, Source: Google Maps Aerial Image, 2024

8.1 COLLABORATION AND NBS INITIATIVES IN THE COUNTY INTEGRATED DEVELOPMENT PLANS

The CIDP is a county-led and implemented development plan running on a five-year cycle. Mombasa County has completed the latest CIDP, the third plan following the implementation of the CIDP since 2013. The process of the CIDP is not yet a national standard, a handful of counties do not yet implement a CIDP. The values outlined in the Mombasa CIDP include patriotism, professionalism, integrity, human dignity, good governance, and diversity. The tenants support the vision, "To see Mombasa County as a vibrant modern regional commercial hub with a high standard of living for its residents."[23] The plan is generated through the County Government of Mombasa including the Chief Officers and Directors of the departments. Civil Society Organizations provide community input in a week-long session. In the third installment, technical and financial support was given by UNICEF.

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23 County Government of Mombasa, Third County Integrated Development Plan (2023-2027) § (2023), page ii.

8.1.1 Creation of an Environmental Sector

The previous CIDP is analyzed according to the individual sectors as seen Figure 8.1.1. Based on the current sectors, there is no clear focus on the protection and restoration of environmental resources and assets. The first step is the creation of a CIDP sector targeting initiatives for climate change and environmental conservation and restoration. The creation of a new sector allows for measurable funding to be allocated to sector-specific projects. From there, outcome success can be measured and projects can be implemented in concert with other sectoral goals. The CIDP operates as the basis for all budgeting in the county, therefore it is critical that a sector be devoted to environmental conservation and climate change. Adequate funding and capacity building are difficult to support at the county level if it is not explicitly in the CIDP. The SPI number in the table indicates a percentage success

Figure 8.1, Source: County Government of Mombasa, Third County Integrated Development Plan (2023-2027) § (2023), page 251.
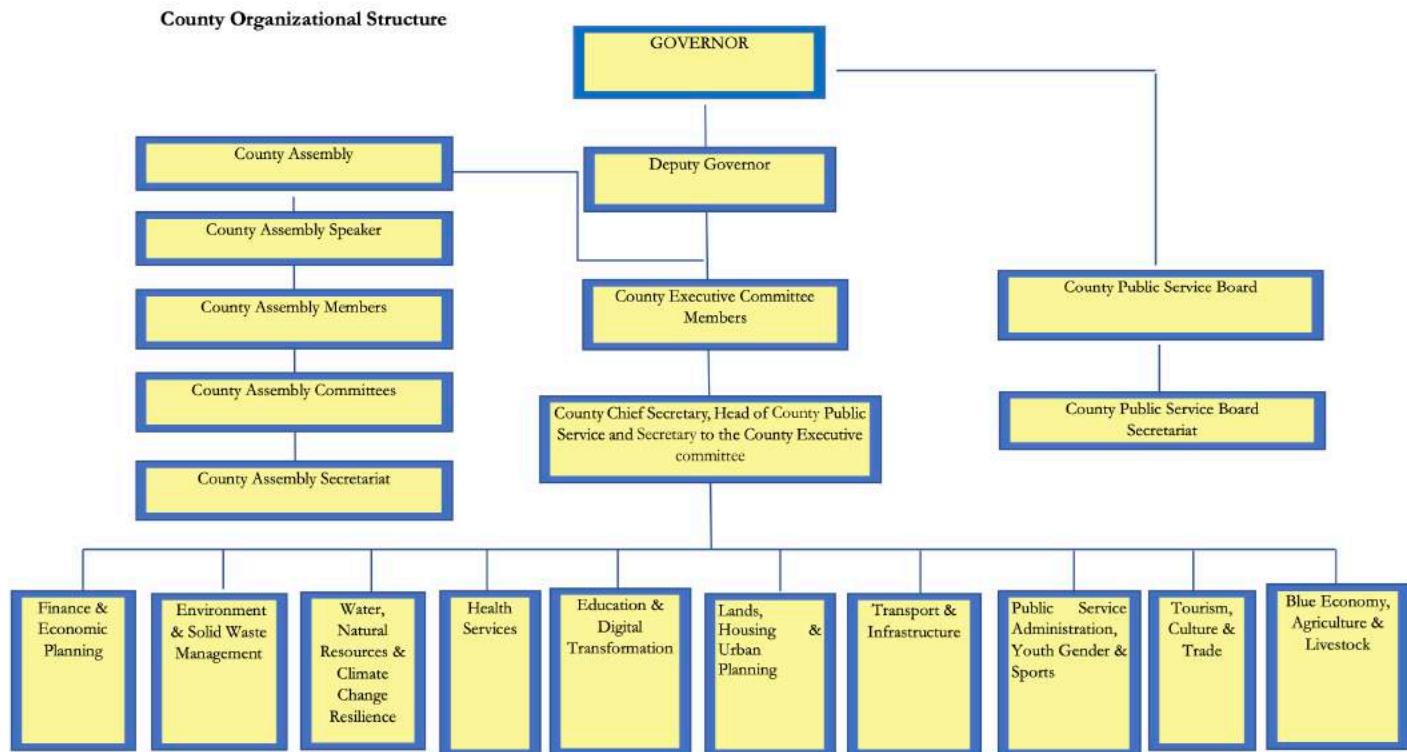
rate of achievement for each sector. Sectors four, six, and eleven are some of the sectors most impacted by rapid urbanization. These three sectors have the lowest program-based component SPI indicators, indicating lower success in the development priorities in the last five-year CIDP cycle. Sector Four practices included a refurbished land registry (50% complete), partially developed county spatial plan (80% complete), and GIS land and zoning plans (70% complete). The CIDP stated "there is a need to put in place housing, land policy and regulations. In addition, the lack of titles leads to loss of county revenue (in terms of ground rent and rates)" as a key lesson learned for sector four.[24]

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24 County Government of Mombasa, Third County Integrated Development Plan (2023-2027) § (2023), page 39.

Table 17: Schedule Performance Index (SPI)

S/No.	Sector	Programme-based Component, SPI	Flagship Projects, SPI
1.	Finance and Economic Planning	0.726984127	0.5
2.	Trade, Tourism and Investment	0.53112963	0.4
3.	Devolution and Public Service Administration	1.641026263	0.452777778
4.	Land, Planning, Housing and Urban Renewal	0.5	0.692076923
5.	Water, Sanitation and Natural Resources	0.729775659	0.204305556
6.	Energy, Environment and Waste Management	0.515273649	0.623809524
7.	Agriculture, Fisheries, Livestock and Cooperatives	1.225076113	0.43703125
8.	Health Services	1.243201963	0.652222222
9.	Education	0.735592582	1.017261905
10.	Youth, Gender, Sports and Cultural Affairs	0.882821748	0.127272727
11.	Transport, Infrastructure and Public Works	0.493174804	0.423904219
12.	ICT	0.668019621	0.544005102
	Total	0.82433968	0.510388934

Figure 8.1.1: Performance Indicators from Mombasa CIDP
Source: County Government of Mombasa, Third County Integrated Development Plan (2023-2027) § (2023). , page 27.

8.1.2 Integrate Land And Sea Planning

Mangroves forests are listed in the Natural Resource Assessment Table as relevant to all dependent sectors. The dependent sectors stand outside of the key sectors of the CIDP. The implementation of NBS for mangroves or other program areas becomes difficult without one sector devoted to the financial budgeting, planning and monitoring of these initiatives. Key relevant sectors include the Blue Economy, Agriculture & Livestock Sector and the Water, Natural Resources and Climate Change Resilience Sector. Mangroves sit between terrestrial and marine ecosystems. A planning approach that merges marine planning, land planning and climate resilience is critical for mangrove ecosystem restoration. To enhance NBS across Mombasa, the CIDP must ensure those initiatives are clearly defined in a sector where other objectives will not overshadow these initiatives. The argument could be made that NBS can be relevant to all sectors and therefore should not be given a stand-alone sector. However, a sector devoted to nature-based solutions and climate change would most effectively advocate for and implement these initiatives. Mangrove-related performance indicators fall under the natural resources and climate change resilience sector however, these indicators are not related to NBS. A sector devoted to these types of projects incentivize NBS capacity building and streamlines collaboration between Community-Based Organizations and the county on relevant programming. From here, the NBS and climate resilience sector can be responsible for collaborating with other sectors to spearhead NBS projects relevant to their sector. In Mombasa, this sector can specifically ensure collaboration between land and sea planning initiatives to generate a more integrated process.

Table 8.1 ROLE OF AN ENVIRONMENTAL CONSERVATION, CLIMATE RESILIENCE & NBS SECTOR			
Potential Programs	**CBO Collaborators**	**County Collaborators**	**National Collaborators**
• Nature-Based Solutions • Climate Emissions • Carbon Capture and Credits • Environmental Conservation and Restoration • Eco-Tourism • Marine Planning • Land and Sea Planning	• Environmental Community Based Organizations • Local data gatherers and enforcement personnel • Environmental School Programs • Nature Dependent Livelihood Individuals	• Mombasa Water and Natural Resources Sector • Mombasa Blue Economy, Agriculture & Livestock • Neighboring County Governments • Upstream County Governments	• National Environmental Management Authority • Kenya Marine and Fisheries Research Institute • Kenya Wildlife Service • Kenya Forest Service • National Climate Change Action Plan

8.1.3 Horizontal Collaboration of CIDPs

The CIDP is analyzed in terms of linkages with global and national development frameworks. This process ensures the CIDP supports and stays in line with Kenya Vision 2030 and 4th Medium-Term Plan, UN 2030 Agenda and the Sustainable Development Goals; Africa's Agenda 2063; Paris Agreement on Climate Change, 2015; EAC Vision 2050; ICPD25 Kenya Commitments; and Sendai Framework for Disaster Risk Reduction 2015 – 2030. While this is an effective task to ensure goal alignment, the CIDP does not have a robust process of ensuring horizontal alignment with other county governments. The other county governments are outlined as stakeholders with a target to collaborate on political and socioeconomic development. To absorb overwhelming population growth, collaboration with neighboring counties will be required. Kwale County, to the south of Mombasa, and Kilifi County, to the north, are the two critical partners to collaborate with through the County Integrated Development Plans (CIDP). There is no specific target for environmental and climate resilience collaboration. A sector dedicated to nature-based solutions and climate change would be able to spearhead the critical ecosystem collaboration that is required. The activities of dumping waste in upstream counties or disturbing soils in neighboring counties are a few examples of small but impactful areas of collaboration. Nature-based projects that address climate resilience are not impacted only by the activities within the county. Projects that work for coastal resilience and marine ecosystem health require collaboration across all Kenyan counties. The benefits of these projects will be experienced by all Kenyans. A sector dedicated to the collaboration of NBS and climate resilience will ensure financing and monitoring can be effective.
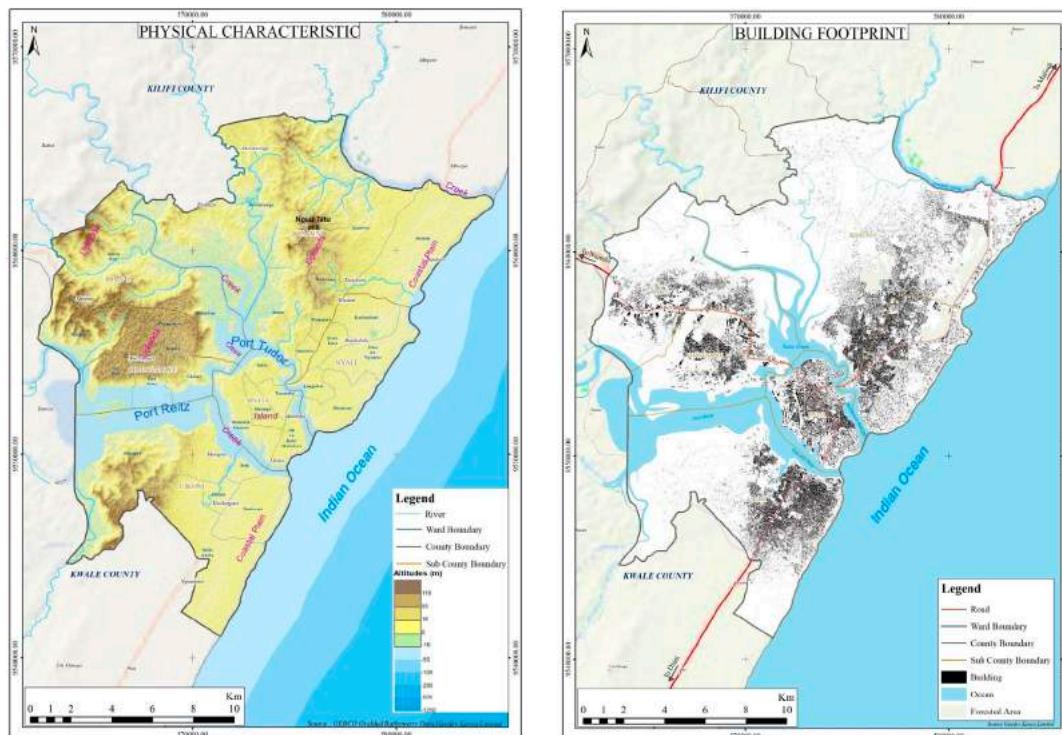

Figure 8.1.3: A comparison of the built-up areas (in black on the right) and the upland geology (in brown on the left) shows the strained land resources available for safe and secure residential development.
*Source: Department of Lands, Planning, Housing and Urban Renewal, Mombasa County Spatial Plan 2021-2031-Draft Plan, page 36 & 78.*

8.1.4 Long Term Spatial Planning

The Integrated Strategic Urban Development Plan encompasses the long-term vision of growth and development for a twenty-year cycle. This spatial plan lays guidelines for all land use development. Spatial planning is a relatively new role of the Mombasa County Government; the development of a county zoning plan is underway. NBS are evidently dependent on geographic forces, land uses and adjacencies become critical for these projects. A county sector dedicated to NBS and climate change resilience can ensure these projects are advocated for and protected in the spatial plan. Climate change and nature-based solutions are long-term projects, they are not implemented quickly and often the benefits are not seen for decades from inception.

The spatial plan is one of the longer-term visioning and development plans at the county level. It is imperative that NBS are considered and planned for in this process. The five-year timeline of the CIDP must still include these efforts to ensure appropriate budgeting. The financing will not be effectively utilized unless these efforts are considered in the long run. This also provides a clear tool for collaboration with counties in the long term.

The spatial plan can highlight areas of concern for NBS and operate as a tool to monitor these initiatives over a ten or twenty-year cycle. This provides more accurate insight into the success of the projects and creates a land use plan

that considers and protects NBS. The spatial plan is particularly effective for mapping the current ecosystems and connecting the development vision to the protection and restoration of those environments.

Figure 8.1.4: Land Cover Change over time
Source: Department of Lands, Planning, Housing and Urban Renewal, Mombasa County Spatial Plan 2021-2031- Draft Plan, page 24.
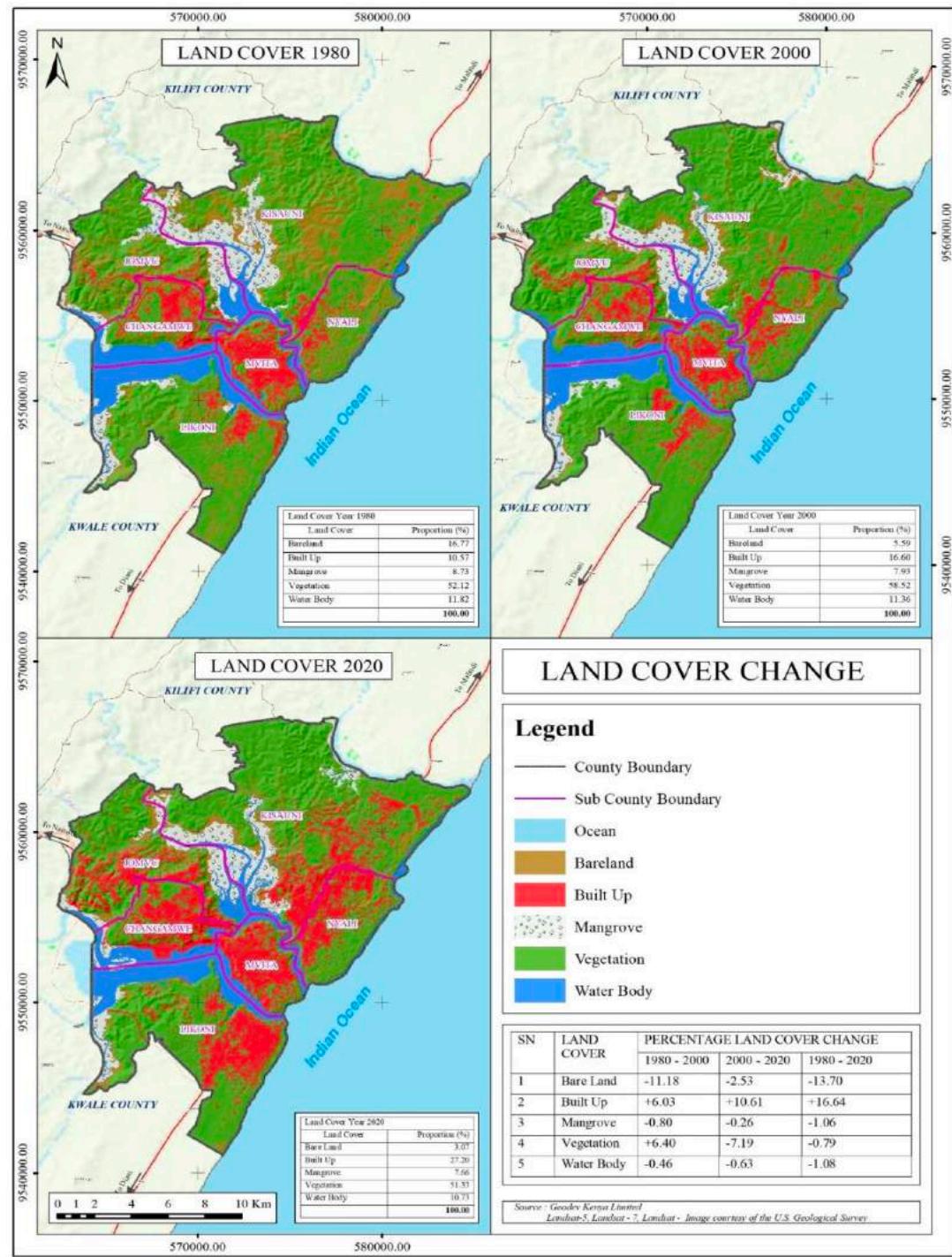
8.2 PREVENTING UPLAND EROSION: THE DEVELOPMENT OF BUFFER ZONES

Rapid Urbanization strains land availability and resources. This has historically and will continue to push development into low-elevation mangrove areas. This is already visible as more of the informal settlements develop down the hillside into the basin of the mangrove forests. These areas are already prone to natural flooding, putting residents at risk. While mangroves are often understood to protect shorelines from coastal erosion, the ecosystem itself must also be protected from inland erosion. The development disturbs land along the edge of the mangrove forests, creating increased erosion into the mangroves. Mangroves rely on certain soils to grow properly and these soils become overrun by the silt from the higher elevation areas. Erosion from encroaching development has destroyed trees and grasses at the edge of high-elevation areas. This pushes sediments to low-elevation mangrove areas that kill mangrove species and prevent or hinder replanting.

Therefore, erosion protection is critical to mangrove restoration. A study on the impact of the sediments on the mangroves in Mombasa is currently underway at KMFRI. The KMFRI team is working on a five-year study to explore sedimentation impacts of the mangrove forests, identifying areas with mangrove loss due to sedimentation and species of mangroves that thrive in each type of soil. Mangrove species are varied and can thrive in different types of sedimentation. There are several areas, referred to as dead zones, where upland sediments have washed into the mangrove forest. These sediments have killed the preexisting mangroves and prevent restoration efforts from being successful. To protect the mangrove restoration efforts, the erosion from development must be addressed and new species of mangroves or grasses must be planted in already damaged regions.

8.2.1 Near-Term Erosion Infrastructure

Erosion is a pressuring issue exacerbated by the recent El Nino rain events. Climate change patterns point to increased and more extreme precipitation events in the region. Erosion must be addressed in the near-term under the current circumstances of encroaching development. Erosion filter socks are low-tech, immediate solutions to protect mangrove forests from sedimentation. These socks are widely produced and can

Homes have been built along the slopes leading down to the mangrove forests. The most dramatic example is pictured here showing a new home built immediately against the mangrove boundary. The mangroves can be seen in the background. The barren area between the mangroves and the home is a barren area where mangroves could be restored. The home is also is a floodplain and will experience consistent extreme flooding.
Source: Photo by NYU team member, Emma Clark

be acquired quickly. They provide a low-cost solution to the current erosion threat. Below are the steps to implement filter socks.

1. KMFRI and Mombasa County collaborate to identify areas of erosion into the mangrove forests, ranking the regions from low to high risk.
2. Upon acquisition of filter socks, they are installed in the high-risk locations with the assistance of KMFRI, Mombasa County and local CBOs. This is an opportunity to educate and train CBO and community members on the benefits, installation, and monitoring of filter socks and erosion.
3. Filter socks are then monitored and data is collected to evaluate the success of implementation, new regions of implementation, regions requiring replacements, and any lessons learned.

8.2.2 Planning & Planting a Buffer Zone

To protect mangrove forests from sedimentation, a long-term solution limiting encroaching development is necessary. The continued population growth of Mombasa makes this a multifaceted issue. The development of a buffer zone is a clear guideline that can be outlined by the Mombasa Spatial Plan and the Mombasa Zoning Code. The buffer zone is a strip of land at the upland region along the edge of the mangrove forests. The zone will be a width determined by KMFRI to be sufficient for the protection of mangroves from erosion. The zone will be a region, defined by the Spatial Plan and Zoning Code, where development is not permissible. The region will be utilized for plantings that support erosion control and sedimentation capture.

Silt socks placed on a hillside to prevent erosion downstream. Source: "Erosion Control." Fossil Rock Services, October 25, 2019. https://fossilrockservices.com/erosion-control/.

Severe erosion of the upland areas at the edge of the mangrove forest, observed on the field visit to Bidii Creek Conservancy. Source: Photo by NYU team member, Manning He

Table 8.2.2 BUFFER ZONE COLLABORATION & ENFORCEMENT			
Identification	**Protection**	**Restoration**	**Enforcement**
KMFRI will provide data and technical support to Mombasa County to identify the width of buffer zones throughout the county. The local CBOs engaged in mangrove initiatives will be consulted to provide first-hand input & observations regarding erosion.	The extents and regions of the buffer zone will be communicated to Mombasa County Spatial Planning and Zoning Code teams. The extents of the buffer zone will be designated in both spatial plans and zoning code. It will be defined as a region with no disruption by human activity.	KMFRI will provide technical support of appropriate plantings to be implemented in the buffer zone. Mombasa County will collaborate with CBOs to begin planting in these regions. There will be regions of the buffer zone already developed. Efforts must begin to assess potential relocations.	Mombasa County, KFS, and CBOs will collaborate to build capacity for enforcement of the buffer zone to ensure no human activities are damaging the area. Data will be collected to communicate the success of the zones and appropriate next steps to combat sedimentation.

8.2.3 Introduction of Salt Marshes

There are regions of the Mombasa mangrove forests that have been heavily impacted by dead zones. Based on accounts from CBOs engaged in restoration, those areas are no longer viable for mangroves and restoration efforts have not been successful. The data and findings presented in the sedimentation study by KMFRI can be combined with the observations from the CBOs to identify each dead zone as either viable for a different mangrove species or no longer viable for mangroves. In the regions identified for mangroves, KMFRI can instruct CBOs on new methods and identify species to implement. The CBOs can lead the restoration efforts and provide insight on the success of each species. The areas identified as no longer viable for mangroves or areas where new species implementation fails can be utilized for fish pond farming structures or salt marshes. Brain Youth Group has developed two fish farming ponds in the dead zone adjacent to the mangrove forests. Along with mangrove restoration and bee-keeping, this organization farms milk fish for consumption. This is a model that can be scaled-up for the group to produce a surplus they can sell or in other regions for other groups to follow this model.

Mangroves provide an asset in their carbon capture. Where mangroves are no longer viable, salt marshes can often thrive in those sediments and provide high carbon sequestration rates. Projects underway in the western regions of the Indian Sundarbans have proven grasses to be an effective tool to restore mangrove regions impacted by sedimentation.[25] The grasses help increase soil nutrients and reduce salinity thus creating sediments more viable for mangroves. KMFRI and KFS can collaborate to introduce grasses to the dead zones of the mangrove forests. CBOs continue to play a critical role and can be trained to restore and protect this new ecosystem. Gathering, collecting and sharing data is also a critical piece to understanding the effectiveness of the initiative and the timeline at which mangroves could be reintroduced. The grasses have high carbon sequestration capabilities and can provide carbon credit funding opportunities.

25 Tandon, Aditi. "Grasses Spur Mangroves to Grow in an Erosion-Riddled Sundarbans Patch." Mongabay, April 28, 2022. https://india.mongabay.com/2022/03/grasses-spur-mangroves-to-grow-in-an-erosion-riddled-sundarbans-patch/.

Figure 8.2.2: Diagram of Mikindani and Jomvu shorelines shows desired buffer zone region (brown) and the dead zones (green) that could potentially be restored with proper protection from sedimentation.

Source: Google Earth Image 2024, Diagram by team member

8.3 DEVELOPMENT PRESSURES: ECONOMIC VALUATION OF MANGROVE ECOSYSTEMS

Erosion and collaboration can be addressed to better respond to the urbanization of Mombasa. However, development pressures remain and will likely increase. As stated in the Mombasa County Spatial Plan Draft, there is a need to identify areas that can absorb residential growth. This includes regions south of the county for new development and some regions where an increase in density is viable. It is critical to include mangrove protections, the long-term NBS and climate resilience initiatives in the spatial planning to ensure development does not hinder those efforts. There have been several residential and transportation projects completed over the last five years in Mombasa that have negatively impacted crucial ecosystems in the county. The review and permitting process is the jurisdiction of the county, however, it is hard to accurately assess projects when the value of the ecosystem is not captured and included in a cost-benefit analysis of a project.

8.3.1 Mangroves as an Economic Asset

It is difficult to put a monetary value on the benefits of ecosystems. The increased well-being, cleaner air, and improved quality of life are hard to quantify. However, in the case of the mangrove forests, carbon capture is an easier asset to value. Per KMFRI data, the mangroves in Mombasa have a value of ~269,000 KSH per hectare per year. This is a critical financial asset for the county and the people of Mombasa. When a development project is proposed, the impacts and costs to mangroves must be momentarily valued and included in the project analysis. KMFRI has played a role in community organizations sale of carbon credits to generate financial inputs, utilized for community resources and development.

A similar approach can be taken at the larger county scale. There is an opportunity for the county to begin measuring carbon capture and sell the credits to generate revenue sources for county development. The current CIDP states an expected resource gap of 121,492,000 Ksh for the 2023-2027 development plan cycle. The greatest carbon asset in Mombasa is the mangrove forests. With the current state of the mangroves, the budget deficit can be covered over the five years with a massive surplus of revenue. That revenue can be utilized to finance further NBS or climate resilience. The surplus also provides the opportunity to build waste management capacity and infrastructure improvements.
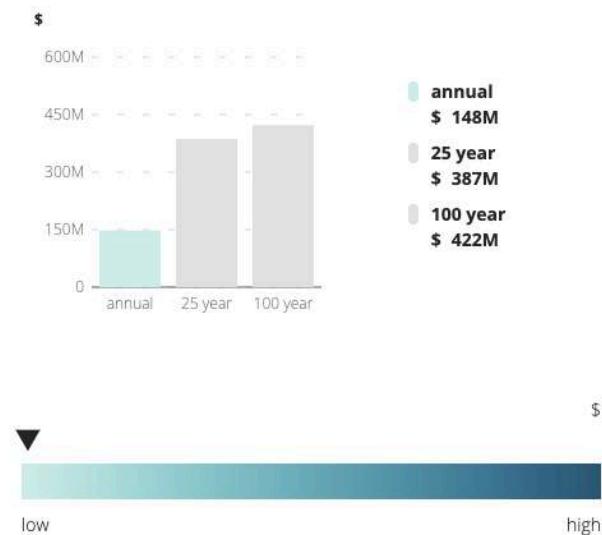

Figure 8.3.1: Mangrove ecosystems are a dynamic economic asset. All elements of the potential economic loss must be considered in development proposals.
Source: Global Mangrove Watch

8.3.1 Economic Valuation of Mangrove Forests in Mombasa (per hectare per year)				
Ecosystem Catagory	Coverage (ha)	Carbon Sequestration Value	Shoreline Protection Value	Total Value
Current Healthy Mangroves	1,921	1,721,237Ksh	1,663,720Ksh	450,059,180Ksh
Current Degraded Mangroves	1,850	1,657,621Ksh	1,602,234Ksh	433,425,030Ksh
Current Total Mangroves	3,771	3,378,837Ksh	3,265,820Ksh	883,484,210Ksh
Loss Since 1985	8,799	7,883,925Ksh	7,620,068Ksh	2,061,463,156Ksh
Approx. Bare Areas	2,500	2,240,021Ksh	2,165,134Ksh	585,709,500Ksh

Table 8.3.1 Data Source: National Mangrove Ecosystem Management Plan, 2017

| TABLE 8.3.2 DEVELOPMENT PROJECT COST-BENEFIT ANALYSIS CONSIDERATIONS	
Step One - Map Impact to Mangrove Forests	Consider all potential impacts to mangrove forests: Amount of Disrupted Sediments that could Erode, Construction Waste or Runoff, Future Waste Generated by Occupants, Hectares converted from pervious surfaces/natural ground-cover to impervious surfaces & increase in storm water
Step Two - Factor in Costs of Project based on Impact	Factor in Potential and Realized Costs to Project: • Carbon Sequestration Value Lost per hectare of threatened mangrove forest per year • Shoreline Protection Value Lost per hectare of threatened mangrove forest per year • Livelihood Value Lost per hectare of threatened mangrove forest per year • Cost of Increased Infrastructure Use or Needs (Stormwater, Waste, Potable Water, etc) • Cost of Increased use of transportation infrastructure and emissions from new commuters • Carbon Emissions cost of building and building use over assumed life cycle
Step Three - Run Project Cost-Benefit Analysis	Run Cost-Benefit Analysis of project, utilizing appropriate time horizon to account for climate consequences. Climate costs from increased storm or disaster events are increasing and therefore the costs factored into the analysis must increase over time. The analysis also needs to be run a minimum of 10-15 years into the future to ensure compounding costs listed in step two are accurately considered.

8.4 TIMELINE
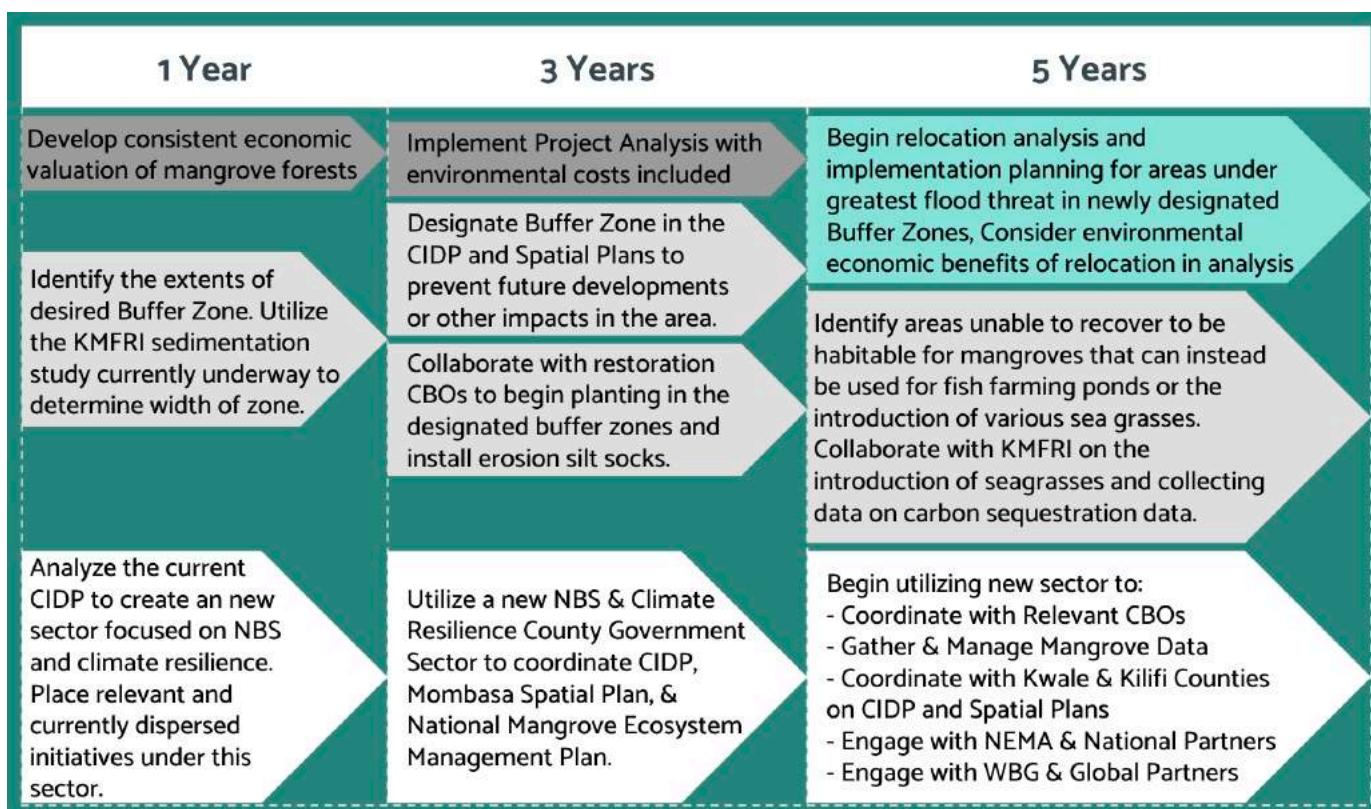
Figure 8.4 : Timeline of Implementation for Integrative Planning Recommendations

Conclusion

Mangrove restoration efforts and NBS initiatives are moving to the forefront of climate resilience policies globally. Kenya is one of the countries with an abundance of mangrove forests. The necessity to protect and restore these ecosystems is widely recognized. The field work in Kenya revealed a deep understanding that environmental restoration and economic development can go hand in hand. This is evident considering the vast economic resource the mangroves provide, both directly and indirectly. All levels are engaged with the issues of NBS and mangrove restoration, from CBOs to national authorities and global partners. There is a breadth of knowledge and variety of funding opportunities between the various stakeholders. The focus areas outlined in the report target these resources of knowledge and seek to diversify financing. The intent of each recommendation is a collaborative and multi-disciplined approach targeting concurrent economic and environmental development.

Photo by NYU team member, Manning He

TABLE 8 OPPORTUNITIES FOR NEAR-TERM ACTION			
Livelihood Diversification	**Waste Management**	**Data Innovation**	**Integrative Planning**
• Spread the forms among CBOs to gather essential data on needs and align resources. • Launch a Basic Email Marketing Campaign by sending simple, regular email updates to keep the community informed and engaged. • Host an introductory online session on digital skills or eco-friendly practices to engage community members promptly. • Send concise surveys to assess the community's interest and requirements for solar cookers, facilitating targeted support and training.	• Initiate Shimo La Tewa replication by designing targeted interventions at Bidii, Tudor, and Mwache Creek and mobilizing resources for the plants. • Improve the Baus Taka Service by introducing more authorized dump sites and enhancing the user interface and experience through app training classes. • Develop partnerships with recycling facilities, notably with Pwani Youth Group, to support RPL utilization in mangrove infrastructure. • Launch pilot RPL boardwalk projects in strategic locations, including Bidii Creek, to advance infrastructure development.	• The Mombasa county government can meet wetlands specialist Doug McFarlane and the World Bank team to discuss the current gaps in wetlands datasets for Kenya researchers. • The Mombasa County government can review NEMA's Wetlands Restoration Strategy with wetlands specialists/ researchers gaps in mind, noting what actions are possible at the current status quo. • The Mombasa County government and WB team can set up meeting times with KMFRI, KWS, and KFS separately to inquire about current data gathered on mangrove restoration or conservation. • The World Bank team can review the proposed Mangrove ecosystem index and decide areas to include, revise, or expand upon in continued research.	• Meet with County Government of Mombasa Sectors relevant to NBS initiatives or mangrove restoration to begin discussing opportunities to develop NBS projects and begin allocating specific funding • Halt further development along the low-lying boundaries of the mangrove forests. • Distribute erosion silt socks along regions of severe erosion. • Begin internal education and knowledge initiatives regarding the economic assets that mangroves provide and protect. Begin with governments, CBOs, developers, and other community members immediately engaged in the mangrove ecosystem. • Collaborate with KMFRI and the County Government of Mombasa to begin selling carbon credits for the existing mangroves. Apply this funding towards further initiatives outlined in the report.

APPENDIX A: ANALYSIS OF CONTEXT
Initiatives, Policies, Legislation, Stakeholders & Guidelines

A.3.1 GLOBAL LEVEL

A.3.1.1 GFDRR

Globally, NBS initiatives remain a relatively new area for policy development. One of the more specific Nature-Based Solution guides is the 2023 Report Assessing the Benefits and Costs of Nature-Based Solutions for Climate Resilience: A Guideline for Project Developers. The report was published by the Global Facility for Disaster Reduction and Recovery (GFDRR) administered by The World Bank. One of the hurdles to NBS projects is the accurate valuation of the benefits and costs of a project. As defined by the report, NBS is centered on building climate resilience through strategies that reduce the risk and enhance ecosystems. Funding for these projects is increasing globally, however, this funding is not keeping pace with the surmounting climate threats. In comparison to a non-NBS climate resilience project, NBS projects must value the benefit of the enhanced ecosystem. In terms of a mangrove restoration project, the carbon stock and biodiversity gains must be economically valued to be considered in a cost-benefit analysis of a project. This valuation of ecosystem assets is not yet normative and the incorrect valuation can disincentivize the implementation of NBS. The GFDRR report supports NBS implementation, providing a method to value and analyze NBS projects.

A.3.1.2 UNEP Mangrove Forest Change

The UN Environment Programme Report from 2023 is the latest global report on mangrove forests specifically. The report is structured around three recommendations:
1. Harmonize mangrove knowledge between global and local scales.
2. Utilize integrative thinking to understand the socio economic reliance on mangrove forests.
3. Recognize the need for a multi-action response.

While mangrove forest loss has stabilized globally following a 3.4% decrease since 1996, data is not sufficient at the local and national levels to understand the holistic health of mangrove forests. Stabilization globally is significant, but the previous forest degradation has created an increasing extinction risk for 44% of mangrove-related species and a loss of 139 mega-tonnes of carbon stocks. In Africa, the mangrove loss between 1996 and 2020 is 2.2%. This has resulted in measurable mangrove biodiversity loss in Kenya. One of the critical consequences is the loss of income for small-scale fisheries due to the loss of fish biodiversity. From a carbon perspective, Africa has a net loss of 16.7 mega-tonnes of carbon stock between 1996 and 2020. Globally, land use changes have resulted in an 82% loss in carbon stocks. This is particularly critical as one of Mombasa's key pressures to the mangrove forests is land use changes as a result of population growth. This report helps illustrate the local socio economic consequences of the mangrove forest health.

A.3.1.3 Global Mangrove Alliance

The Global Mangrove Watch, powered by the Global Mangrove Alliance is solidified as the standard for data regarding the mangrove ecosystems. The dataset reports on mangrove health including distribution and change, and restoration and conservation of forests. The dataset also includes metrics of climate and policy related to the carbon sequestration value of mangroves forests. The data is broken down by country, however, data at the local level is not well captured and included in this global dataset. Data collection and coordination remains a clear necessity to the enhancement of mangrove restoration globally and at the local levels. As observed in Mombasa, it is the vast cover of mangroves and their unique shoreline ecosystem that requires a thorough and multi-stakeholder approach to collecting

and sharing data. The Global Mangrove Watch is not able to provide the nuanced local-level data necessary to mangrove restoration. A few of these may include income lost to decreasing fish biodiversity, coral reef decline from lessened water filtration to ocean, and decreased air quality due to deforestation. Data that can connect the mangrove ecosystem health to these socio economic outputs is critical to understanding the highest and best use of mangrove restoration initiatives.

A.3.1.4 PROBLUE

The term blue economy is utilized in development strategies throughout the globe. As defined by the World Bank, the blue economy is the sustainable utilization of ocean resources including tourism, maritime transport, fisheries, and renewable energy for economic growth. This includes efforts to improve ocean ecosystem health as it is impacted by climate change and waste management to protect the vital resources. In support of these efforts, PROBLUE is the multi-donor trust fund that targets sustainable and integrated development of marine and coastal resources. PROBLUE targets four areas: management of sustainable fisheries and aquaculture, addressing ocean pollution, sustainable economic development of oceanic sectors, and building government capacity to manage marine resources. Marine resources are stated to include "promoting the use of nature-based solutions such as mangroves to boost coastal resilience." As the blue economy concept of economic development becomes normative, the mangroves remain a relatively recent area of focus for PROBLUE initiatives. The valuation of mangroves as an economic asset has highlighted the necessity of countries to consider the restoration of these ecosystems as an economic development tool at the national and local levels.

A.3.1.5 GoBlue

In Kenya, the Blue Economy Strategy functions as a partnership between the European Union and Government of Kenya focused on coastal urban centers. The governor for each of these counties,

including Mombasa, act as stakeholder members of the initiative. The strategy is divided into three program areas focused on growth, security and the environment.

1. Go Blue Growth targets increased sustainable economic growth through job creation in fisheries and other industries.
2. Go Blue Security aims to increase governance capacity as it relates to maritime activities.
3. Go Blue Environment targets conservation and sustainable development, namely in the policy and planning contexts.

Each strategy area has specific key performance indicators. Those related to nature based climate solutions are under Go Blue Environment, including the restoration and protection of coastal environments. Go Blue has several implementing partners. UN-Habitat and UNEP operate as the expert partners for innovative land-sea planning and management. The initiatives under Go Blue began in January 2021 and target completion in January 2024. Go Blue highlights a new interest area, integrated efforts between land planning and sea planning initiatives. This is critical for Mombasa, a county that encompasses the delicate adjacency between land and sea ecosystems. Land planning has operated as the dominant force in spatial planning efforts. With the introduction of sea planning as a necessity to protect and utilize the value of sea ecosystems; planning for coastal regions can become integrated by understanding the impact land planning results can have on the marine ecosystems downstream. In Mombasa, the mangrove ecosystems sit between the land and the sea. Initiatives in these forests can be best protected and implemented through the integration of land and sea planning.

A.3.2 NATIONAL LEVEL

A.3.2.1 National Adaptation Plan

Kenya's National Adaptation Plan 2015-2030 addresses the challenges posed by climate change given the country's reliance on natural resources. The plan's primary goal is to enhance climate resilience in line with Kenya 2030 goals of a prosperous nation with higher quality of life. Key elements of this plan include;

National Circumstances: NAP recognizes Kenya's current vulnerability to climate change and emphasizes the need for a coordinated approach to address these challenges. This is in alignment with Africa's priority response to climate change in the 15th African Ministerial Conference on the Environment.

Coordination of Adaptation Actions: NAP presents the current coordination arrangements for climate change adaptation managed by the National Climate Change Secretariat within the ministry of Environment and Natural Resources. NAP synthesizes all roles and responsibilities of ministries in mainstreaming climate change into various economic sectors.

Climate Hazard and Vulnerability Analysis: NAP highlights floods, sea-level rise, and droughts as major climate hazards throughout the country. Sea-Level rise is a major threat to Kenya's coastal region, posing a threat to Mangroves and coral reefs. Higher sea levels can lead to the inundation of low-lying areas, salination of freshwater resources, and increased coastal erosion that threatens housing, infrastructure, and livelihood in coastal areas.

The overall vision of the NAP is to enhance climate resilience towards the attainment of Kenya Vision 2030 by focusing on strong economic growth, resilient ecosystems, and sustainable livelihoods for Kenyans. Integration of national and county-level planning is essential to this vision, promoting synergies between mitigation and adaptation actions.

A.3.2.2 Kenya Urban Support Program

The primary goal is to leverage urbanization for national modernization, focusing on effective urban planning and management. Core objectives include delivering urban integrated development plans, ensuring effective development control, and providing infrastructure investment frameworks. The six key components are; urban space and shape, urban economies and livelihoods, urban infrastructure and service delivery, building climate resilience, governance institutions and finance, and urban policy development.

The program supports county governments in their mandate of establishing, delegating functions to, and financing urban boards. It emphasizes strengthening systems and capacities for urban planning, development control, urban management, and financing climate-resilient infrastructure. At the national level, the program focuses on urban development policies, capacity building, and program management. Subnationally, it incentivizes urban development capacity building and investments through performance grants. Overall, KUP is a comprehensive effort to modernize and improve urban areas in Kenya through a combination of strategic planning, capacity building, infrastructure development, and a focus on inclusivity and resilience.

A.3.2.3 NEMA

The National Environment Management Authority (NEMA) mandate focuses on sustainable management of the environment in the country. NEMA supervises and coordinates other agencies on all matters related to the environment. With the decentralized structure NEMA retains authority over projects designated as "high-impact", such as projects crossing through multiple countries. "Low-impact" projects are the jurisdiction of the county level These include waste management, water and air quality, or regulations that address specific areas. NEMA operates in all 47 counties and has operational offices within all counties.

NEMA has the following three NBS projects underway: Green New Growth and Employment Program, National Resources Management Program, Urban Environmental Planning. NBS projects are classified as low-impact projects and are implemented by the county office.

NEMA Programs :

Green New Growth and Employment Program: This program was designed to integrate environmental sustainability in Kenya's economic growth. It involved working with businesses to adopt eco-friendly practices and creating jobs in the green sector. The primary difficulty faced was in persuading traditional industries to adopt new, environmentally friendly technologies and practices, which often required significant initial investment and a change in long-standing operational procedures.

National Natural Resource Management Program: Focused on sustainable management of natural resources, this program included initiatives like community tree planting and promoting sustainable agriculture. One major challenge was ensuring consistent and effective community engagement across diverse regions, each with its own specific environmental concerns and socio-economic conditions.

Urban Environmental Planning: In response to rapid urbanization, NEMA worked on integrating sustainable practices into urban planning. This included initiatives for green spaces and sustainable waste management in urban development. A significant difficulty was balancing rapid urban development with environmental sustainability, especially in fast-growing cities where immediate economic growth was often prioritized.

A.3.2.4 National Mangrove Ecosystem Management Plan & KMFRI

The Kenya Marine and Fisheries Research Institute is a national research institution. KMFRI often plays a scientific or technical role, while other government agencies are mandated to manage and protect the mangrove forests. The institute is focused on coastal and marine ecosystems including mangrove forests, seagrasses and salt marshes. These three ecosystems are found along the Kenyan coast and provide a critical asset in the sequestration of carbon. This is both an environmental and financial asset.

KMFRI closely collaborated with NEMA in the development of the National Mangroves Ecosystem Management Plan, mostly notably presenting the historical loss of mangroves beginning in 1992. The data collected by KMFRI and presented in the report concludes a mangrove deforestation rate higher than the global deforestation. KMFRI has leveraged their knowledge of carbon capture through mangrove forests with the development of a carbon credits program. These projects include the Mikoko Project, the world's first blue carbon project and generating eighteen thousand USD per year, and the Vanga Blue Forest Project, preventing fifteen thousand tonnes of carbon emissions. The revenues generated from the sale of carbon credits is utilized for community projects, voted on and managed by the community organization. KMFRI takes the role of management of sale of the carbon credits, leveraging community participation for the utilization of funds.

The value of mangroves goods and services in Kenya is valued at 85.8 million USD per year and provides a unique funding source for community projects from education to health to infrastructure.

A.3.2.5 Climate Change Act

The Kenya Climate Change Act, becoming law in 2016, establishes the Climate Change Council. The act implements several climate change roles and responsibilities as well as integrating climate actions into existing public and private contexts. A key role is established in a Climate Change Directorate, naming a clear entity to spearhead climate change plans and operate as a key collaborator. Because NBS impacts and consequences do not stay within the boundaries of a county, the Climate Change Directorate can play a critical role in collaborating between counties.

Crucially, the act address financing climate actions including the regulation of carbon markets and the Climate Change Fund. National emphasis and provisioning of funding towards climate mitigation efforts is key for the implementation of NBS and other resilience projects. The regulation of the carbon market is being utilized by KMFRI. Through the act and the national climate change officials, Mombasa County Government, CBOs and other entities can capitalize on the opportunity to trade the carbon sequestered in mangroves. This is critical to creating an NBS program that can, at a minimum, be self-funded. This act creates clear national priorities for climate change actions.

A.3.3 SUBNATIONAL LEVEL

A.3.3.1 Mombasa County Spatial Plan

The 2021-2031 Mombasa County Spatial Plan Draft outlines the current status of Mombasa's mangrove forests covering 3,711 hectares and consisting of two main species. The draft plan stresses the intent of community engagement in efforts around mangrove restoration and protection. The plan targets the upscaling of initiatives through local government and larger community engagement, to-date these initiatives have been led by local groups. In the current county spatial structure, mangrove forests occupy the more inland or western areas of the bay. The majority of the mangrove areas are bordered by residential zones. The eastern portion of the bay is bordered by residential zones without mangrove forests along the coastlines. The land cover from 1980-2020 shows an increase of 16% in built-up land cover and a decrease of 1% land cover by mangroves.

The increase in land cover has been predominantly residential and pushing against or into regions previously covered in mangrove forests or other vegetation. These are also the areas of Mombasa most at risk to climate change water threats due to the low elevation, high levels of groundwater, and high rainfall rates. The ownership of this land is predominantly private. While it may appear that there are limited land use pressures, almost half of the built up land area is considered available land due to the low density or dispersed nature of residential development predominantly in the informal settlement regions. The Spatial Plan has indicated much of this land as opportunities for housing redevelopment. Much of the land bordering the current mangrove forests has been identified for agriculture redevelopment. Apart from residential, the largest commercial land use along the bay is industrial development and port activities. This acts as the economic hub for Mombasa.

The 2021-2031 Mombasa County Spatial Plan Draft targets housing, infrastructure and other development concurrently with coastal ecosystem restoration and protection. There is an opportunity to both increase development with minimal impact to mangroves and ocean resources while integrating it with community development. Similar to initiatives outlined in Go Blue, mangrove projects can be utilized to protect ocean resources and enhance communities through engagement with native environments. The development of mangrove restoration is critical to the economic development of Mombasa and the spatial plan provides a joint pathway towards this development.

A.3.3.2 County Climate Action Plan

The implementation of the County's Climate Action Plan (CAP) hinges upon robust climate governance structures to empower stakeholders across all levels of the County's work. The National Adaptation Plan of Kenya for 2015-2030, which builds upon the foundations laid out by the National Climate Change Action Plan and National Climate Change Response Strategy, provides a comprehensive overview of the national institutional arrangements designed to drive climate action. The National Climate Change Council (NCCC), chaired by the President and with the Cabinet Secretary for Climate Affairs supported by the Climate Change Directorate, bears the responsibility of mainstreaming climate change functions within both national and county governments. Furthermore, the NCCC holds authority over the approval and supervision of the NCCAP.

At the county level, Mombasa undertakes the mainstreaming of climate change actions, interventions, and duties into its County Integrated Development Plans (CIDPs) as stipulated by Article 125 of the Public Finance Management Act (2012) in the Constitution of Kenya (2010). This strategic alignment ensures that both socio-economic development and climate action priorities are addressed at the local level. Mombasa's current CIDP focuses on the period 2023-2028, which is covered by the third Medium Term Plan and is directly aligned with the NCCAP. Following devolution, the County has faced major hurdles in developing capacity to deliver services and track implementation, therefore the latest CIDP aims to efficiently align stakeholders' needs to the available resources.

However, the climate change crisis is of not only county but also national, regional, and global significance. As such, the need to collaborate with the National Government, other County Governments, development partners, private sector entities, academia, NGOs, UN agencies, and other stakeholders is imperative. Leveraging the knowledge, expertise, and financial contributions of these partners is integral to achieving the County's climate change objectives. To this end, Mombasa's CIDP states that the County will seek to strengthen existing partnerships and establish new linkages. Furthermore, the County aims to create an environment conducive for public-private partnerships to enhance the design and execution of climate change initiatives. Through these concerted efforts, Mombasa County envisions a future that is clean, green, and resilient to the challenges posed by climate changes.

A.3.3.4 Community-Based Organizations

Community-Based Organizations play the most critical role in engagement and implementation of mangrove restoration in Mombasa. The CBOs are the best resource to provide knowledge of current conditions in the mangrove forests due to their proximity. They also hold a breadth of historical knowledge regarding the degradation of the mangroves over time and the proven restoration practices. Beyond a depth of knowledge, the CBOs also provide critical capacity to monitor the forest. Any initiative to enhance nature-based solutions for mangrove restoration is reliant on real-time information on the success of restoration tactics and human activities negatively impacting the mission. The mangrove forests cover vast areas of land in Mombasa and current government capacities cannot adequately monitor the whole region. The CBOs are a critical resource in real-time reporting. Several CBOs are centered around conservation and restoration in Mombasa. These organizations are critical to enforcement, protection, and education. They are the first-line of defense against activities harming the ecosystem. They lead ongoing restoration initiatives throughout their local area. Finally, these organizations educate and engage their communities on the mangrove forests. Other CBOs play a similar role but focus waste management capacities and livelihood generation. These CBOs are critical to protecting the mangroves from threats external to the ecosystem and engage with the restoration CBOs.

APPENDIX B: RECOMMENDATION ONE

B.5.2 SUPPLEMENTAL INFORMATION

B.5.2.1 Collaborative E-commerce Platform

Platform Development and Management: Establishing the Online Marketplace
Creating "Kenya's Green Marketplace" necessitates a partnership between technology experts and CBO representatives. This collaboration aims to construct a platform that is not only user-friendly but also accessible to a diverse Kenyan audience, including those in remote areas. The platform will feature roles such as site administrators, customer service representatives, and product listing managers, prioritizing the employment and training of low-income individuals to enhance their digital competencies to highlight the unique stories behind each product.

Content Creation and Digital Marketing: Building the Brand
Success in the digital marketplace hinges on compelling content and strategic marketing. Engaging descriptions, high-quality photographs, and stories about the conservation efforts behind the products are essential. Specialized training programs in content creation, photography, and online marketing will be established, focusing on equipping low-income community members with valuable, marketable skills, thus opening up new employment avenues within the digital marketplace are the critical components of the plan.

Logistics and Distribution Coordination: Ensuring Smooth Operations
A seamless logistical operation is vital for transporting CBO products to customers across Kenya. This sector presents another opportunity for job creation within the e-commerce ecosystem. Specialized training in inventory management, order processing, packaging, and delivery coordination will be offered to individuals from low-income backgrounds, building a workforce

that supports the marketplace's operational needs and gains essential skills for personal development.

Support Needs for Sustainability: Securing Long-term Viability
"Kenya's Green Marketplace" sustainability relies on financial investment for development and operational costs, partnerships for digital skills and logistics management training, and access to necessary equipment like computers and cameras for content creation. This support is crucial for maintaining high-quality product presentations and efficient platform operations.

Engaging Marketing and Promotion: Storytelling for Conservation

Enhancing Visibility Through Community Markets
The "Community Markets for Conservation" strategy introduces monthly market events that serve dual purposes: showcasing CBO eco-friendly products and educating the community on sustainability practices. More than commercial hubs, these markets are gatherings where people can connect over shared conservation values, learn from sustainability workshops, and support local creativity and entrepreneurship.

Creating Employment Through Market Organization
Organizing these community markets generates numerous employment opportunities, particularly for low-income groups. Positions in event planning, logistics, vendor management, and customer service are crucial for the smooth execution of each market. Specialized training in these areas prepares individuals to effectively contribute to the CBOs' mission, fostering awareness about conservation and sustainability. Supporting the Strategy for Wider Impact
The success of the "Community Markets for Conservation" strategy depends on a supportive

ecosystem. Collaborations with local businesses for marketing and sponsorship, assistance from municipal authorities for event logistics, and creating a fund to support low-income vendors are essential. These efforts aim to make the markets accessible and inclusive, ensuring they become a staple feature of Mombasa's approach to sustainable development.

B.5.2.2 Strengthening CBOs Through SSD

Upgrading Project Management Methodologies
Project management serves as the backbone of any successful initiative undertaken by CBOs. Traditional methods often need to be revised to address the dynamic challenges presented by environmental and community projects. The SSD strategy aims to tailor methodologies for the unique needs of these projects to enhance flexibility, collaboration, and efficiency in project execution. This strategy component seeks to streamline processes and ensure that projects remain adaptable to changing circumstances, improving their effectiveness.

Enhancing Financial Management Competencies
Financial sustainability is paramount for the continuous operation and growth of CBOs. The SSD strategy incorporates targeted financial management workshops designed to strengthen the financial acumen of CBO personnel. These workshops cover various financial management aspects, including budgeting, financial planning, grant management, and comprehensive financial reporting. By enhancing these skills, CBOs can secure their financial stability, enabling them to undertake more ambitious projects and extend their impact within the community.

Fostering Sustainable Practices
The SSD strategy's heart lies in strongly emphasizing environmental stewardship and promoting sustainable practices. Training programs focused on eco-friendly practices are introduced to encourage CBOs to integrate sustainable solutions into their projects. This initiative amplifies the environmental impact of their work and aligns CBOs with global sustainability goals, fostering a culture of conservation and responsible resource management within the community.

Creating Employment Opportunities
A significant characteristic of the SSD strategy is its focus on job creation, particularly for individuals from low-income segments of the community. By providing training in project management, financial management, and sustainability, the strategy opens up new employment avenues, thereby contributing to the economic empowerment of community members. This approach not only aids in individuals' personal and professional development but also enhances the operational capacity of CBOs, creating a virtuous cycle of growth and development.

Impact and Transformation
Implementing the SSD strategy in Mombasa represents a comprehensive effort to enhance the capabilities of CBOs, ensuring their initiatives are impactful, sustainable, and aligned with the broader goals of environmental conservation and community development. By focusing on developing project management, financial management, and eco-friendly practices, the strategy fosters a holistic approach to tackling the challenges faced by communities in Mombasa.

Through targeted training and capacity-building initiatives, the SSD strategy aims to create a ripple effect of positive change, contributing to the economic empowerment of individuals, the operational efficiency of CBOs, and the community's overall well-being. The anticipated impact includes more effective and adaptable project execution, improved financial stability for CBOs, increased employment opportunities for marginalized individuals, and a significant enhancement in environmental stewardship and sustainable practices within the community.

B.5.2.3 Strengthening CBO Collaboration

Defining Collaborative Roles
Community Engagement Coordinators ensure that projects are designed with input from all community segments, especially marginalized groups. Inclusion Specialists are tasked with integrating inclusive practices throughout CBO operations and within partnerships, emphasizing the creation of opportunities for marginalized individuals.

Training and Support Mechanisms

Specific training modules targeted at CBO staff are critical for collaborations to be fruitful. These modules should focus on strategies for involving marginalized groups in project planning and execution, ensuring their voices guide development processes. Establishing networking platforms for CBOs and potential partners also prioritizes inclusivity and sustainable development discussions. Allocating grants and financial resources to support these early stages of partnership formation and training development is fundamental to laying a solid foundation for successful, inclusive projects.

Expected Outcomes

By adhering to this structured approach, partnerships are expected to enhance the impact of environmental and community development and significantly contribute to the economic empowerment of marginalized groups. Such collaborations ensure a more equitable distribution of project benefits, providing substantial support in employment, skill development, and active participation for marginalized communities.

Project Design and Policy Advocacy with Inclusivity

Designing projects with inclusivity at their core ensures that initiatives are deeply connected to community needs, providing direct benefits to marginalized groups. This includes setting clear inclusivity goals, engaging low-income groups in planning, and matching their skills with project requirements. Furthermore, advocating for policies that promote inclusivity and sustainable development is essential. Establishing dedicated roles within CBOs, such as policy advocates, focuses efforts on influencing policy in favor of sustainable community development and the inclusion of marginalized communities.

Implementation Considerations

For collaborations to succeed, they must be built on shared objectives, effective communication, and mutual respect. Continuous engagement, inclusive decision making, and joint capacity building efforts are essential. Regular monitoring and adaptive strategies based on evaluations, community feedback, and external conditions ensure initiatives remain impactful. Advocacy efforts, leveraging strategic planning and community mobilization, enhance the influence of CBOs and their partners, advocating for policies that support sustainability and equitable development.

B.5.2.4 CBO Support Request Forms

Support Request Form For CBO	
Operational Enhancement and Expansion Needs	**Additional Notes**
Financial Support Needs: ☐ Infrastructure Development (Detail needs for eco-tourism, community centers, etc.: _____) ☐ Operational Costs (Specify recurring costs like rent, utilities, salaries: _____) ☐ Project Funding (List projects and specify funding needs: _____)	
Training and Capacity Building: ☐ Project Management (Specify methodologies like Agile, Scrum: _____) ☐ Financial Planning and Management (Detail areas like budgeting, grants management: _____) ☐ Digital Marketing (Specify areas like SEO, and social media strategies: _____) ☐ Eco-friendly Practices (Detail required training like conservation techniques, sustainable farming: _____) ☐ Inclusivity and Community Engagement (Specify training needs: _____)	
Technology and Infrastructure: ☐ IT and Communication (Specify needs for computers, software, internet	

access: _____) ☐ Field Equipment (Detail types required, e.g., water testing kits, drones: _____) ☐ Eco-Tourism Infrastructure (Specify sustainable infrastructure needs: _____)	
Market Expansion and Collaboration: ☐ Market Research (Identify target areas for eco-tourism, product sales: _____) ☐ Scalability Assessments (Evaluate capacity for operational scaling: _____) ☐ Partnership Development (List potential collaboration areas with local businesses, and NGOs: _____)	

Job Creation and Inclusivity:
Immediate Job Opportunities (Detail jobs to be created short-term: _____)   Training for Low-Income Groups (Specify areas and types of training programs: _____)   Long-Term Employment Strategy (Describe the approach to sustainable job creation: _____)   Others:

Anticipated Impact and Timeline
Describe expected outcomes in the specified timelines.   Immediate (0-6 months):   _____   Short-term (6-12 months):   _____   Long-term (1-3 years):   _____

Donor Support Form	
Areas of Interest for Support	**Comment**
☐ Eco-Tourism Development and Integration ☐ Sustainable Community Projects and Job Creation ☐ Capacity Building in Project Management, Financial Planning, Digital Marketing ☐ Technology and Infrastructure for Sustainable Operations	
Types of Support Offered	
Financial Contributions: ☐ Seed Funding (Specify areas: _____) ☐ Operational Support (Detail preferred support type: _____)	
In-Kind Support: ☐ Technology Equipment (List items: _____) ☐ Training Programs (Specify areas: _____) ☐ Materials for Eco-Tourism Infrastructure (Detail types: _____)	
Collaboration and Partnership Opportunities: ☐ Project Co-Development (Specify interest areas: _____) ☐ Expertise Sharing (Detail expertise areas: _____) ☐ Resource Sharing (Specify resources: _____)	
Implementation and Engagement Preferences	
☐ Direct Engagement with CBOs ☐ Engagement through Partner Organizations (Detail preferences: _____) ☐ Specific Project Support (Specify projects: _____)	
Additional Comments	

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