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ADVOCACY REPORT ON SUSTAINABLE MANGROVE HABITAT MANAGEMENT

AND THE IMPACT OF LOCAL POLLUTION ON THE MANGROVE ECOSYSTEMS OF MATOLA AND INHACA

CLIMA DE MUDANÇAS

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Estudos e Advocacia Ambiental

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TITLE

SUSTAINABLE MANAGEMENT OF MANGROVE HABITATS AND THE IMPACT OF LOCAL POLLUTION ON THE MANGROVE ECOSYSTEM IN THE AREAS OF MATOLA AND INHACA

PUBLISHED BY

Istituto Cooperazione Economica Internazionale (ICEI), within the framework of the projects MangAction: Preservação e Valorização do Património Ambiental para o Desenvolvimento Sustentável e Resiliente na Baía de Maputo (AID: 012432.01.0) and *Clima de Mudanças: Caminho para a criação e reforço de uma geração ambientalmente consciente em Moçambique.*

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TABLE OF CONTENTS

FIGURES INDEX

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TABLE INDEX

List of Scientific Names, Acronyms, and Abbreviations

A. marina – Avicennia marina

B. gymnorhiza – Bruguiera gymnorhiza

C. tagal – Ceriops tagal

R. mucronata – Rhizophora mucronata

RS – Regeneration Stage

m – meters

cm – centimeters

AICS -Italian Agency for Development Cooperation

ICEI - Istituto Cooperazione Economica Internazionale

EBMI – Estação de Biologia Maritima de Inhaca

PNAM – Parque Nacional de Maputo

WW-GVC – WeWorld-GVC

CTV – Centro Terra Viva

ICEI

CNV – Conselho Nacional de Voluntariado de Moçambique

CSOs – Civil Society OrganizationsOSC s -

1. Introduction

The degradation of mangrove ecosystems in Mozambique has intensified due to factors such as deforestation for firewood and construction materials, pollution from solid waste, and the disorderly occupation of coastal areas. This situation not only jeopardizes the biodiversity and essential ecosystem services provided by mangroves but also threatens food security and the living conditions of the communities that depend on these ecosystems.

This advocacy document aims to raise awareness among public authorities and Civil Society Organizations (CSOs) about the urgent need to implement effective management and oversight measures for mangrove areas. Based on the results of the case study **Sustainable Management and Restoration of Mangrove Habitats,** conducted in the communities of Matola and Inhaca Island under the project **MangAction: Preservation and Enhancement of Environmental Heritage for Sustainable and Resilient Development in Maputo Bay**, co-financed by the Italian Agency for Development Cooperation (AICS), this document presents concrete evidence of the impacts of degradation and outlines viable solutions for the preservation of these essential ecosystems.

The research showed that, although some mangrove areas remain well conserved—particularly on Inhaca Island, due to the protection provided by the Maputo National Park— many others are under significant pressure. In Matola, for example, the mangroves have been severely affected by the deposition of solid waste, unplanned urban expansion, and the lack of proper natural resource management.

Considering the population growth in coastal areas and the absence of effective regulation, it is imperative that policymakers, community leaders, and civil society organizations collaborate to implement sustainable strategies to mitigate environmental impacts. Investment in solid waste management, environmental education, and strengthened monitoring can contribute to the conservation of mangroves, ensuring food security, local economic development, and climate resilience for coastal communities in Mozambique.

The project **Climate of Change: Pathway to Building and Strengthening an Environmentally Aware Generation in Mozambique,** led by WeWorld-GVC (WW-GVC) and coordinated by nstitute for International Economic Cooperation (ICEI), Terra Viva Center (CTV), and the - National Volunteer Council (CNV), aims to consolidate good environmental governance in Mozambique, particularly in the provinces of Cabo Delgado, Nampula, Zambézia, and Maputo.

This document will be shared during various project activities aimed at strengthening civil society and fostering active youth participation in environmental protection.

2. Contex

Mangroves are coastal ecosystems consisting of trees and shrubs adapted to waterlogged, saline or brackish soils, typically characterized by low-oxygen conditions. Adapted to highly saline and anoxic environments, mangroves possess respiratory roots and salt-excreting leaves, with water in these ecosystems being brackish and subject to salinity variations due to tidal cycles. (Duke, 1992).

Regarded as coastal pillars, mangroves play a vital role in erosion protection by acting as natural barriers that reduce the impact of waves, storms, and cyclones. Their roots stabilize the soil and protect surrounding areas (Kathiresan, 2001). Moreover, mangroves are biodiversity-rich habitats, crucial for numerous marine species, such as fish, crustaceans, and mollusks, which rely on these ecosystems for reproduction, growth, and feeding. (Macnae, 1968; Duke, 2017).

Mangroves filter pollutants and sediments from water, enhancing environmental quality and supporting the health of aquatic ecosystems. They also play a key role in carbon sequestration, helping mitigate the effects of climate change. (Carvalho & Jardim, 2017).

Beyond their ecological significance, mangroves hold substantial socio-economic value, being vital for fishing, mariculture, and eco-tourism activities. Many coastal communities depend directly on mangroves for their livelihoods, through fishing, shellfish gathering, and other natural products. These ecosystems also play a key role in protecting against natural disasters, acting as a "natural shield" against phenomena such as tsunamis and hurricanes (Macnae, 1968; Duke, 2017; Nicolau et al., 2017).

Despite their importance, mangroves are among the most threatened ecosystems globally, with a 35% decline over the past five decades, primarily due to human activities such as logging, unsustainable fishing practices, urbanization, and pollution (Donato et al., 2011; Goldberg et al., 2020).

Africa contains approximately 20% of the world's mangrove forests, with Mozambique accounting for about 2.3% of that area, housing the second-largest mangrove expanse on the continent, covering 12% of Africa's total mangrove area (FAO, 2007; Simard et al., 2019).

In Mozambique, mangroves are primarily found in the provinces of Nampula and Cabo Delgado (north), Zambézia and Sofala (central), and Inhambane and Maputo (south) (Barbosa et al., 2001). The most common species include Avicennia marina, Bruguiera gymnorrhiza, and Rhizophora mucronata, with the first being the most widely distributed (MITADER, 2015; Bosire et al., 2016).

In the southern part of the country, regions such as Morrumbene, Inhambane Bay, Maputo Bay, and Inhaca Island are renowned for their well-developed mangrove forests (MITADER, 2015). Maputo Bay, in particular, is fed by five major rivers and is characterized by a great diversity of mangrove species (Paula et al., 2014).

Mangrove forests extend along the coast from south to north. While some formations are found in the south, they are more abundant in the central region and

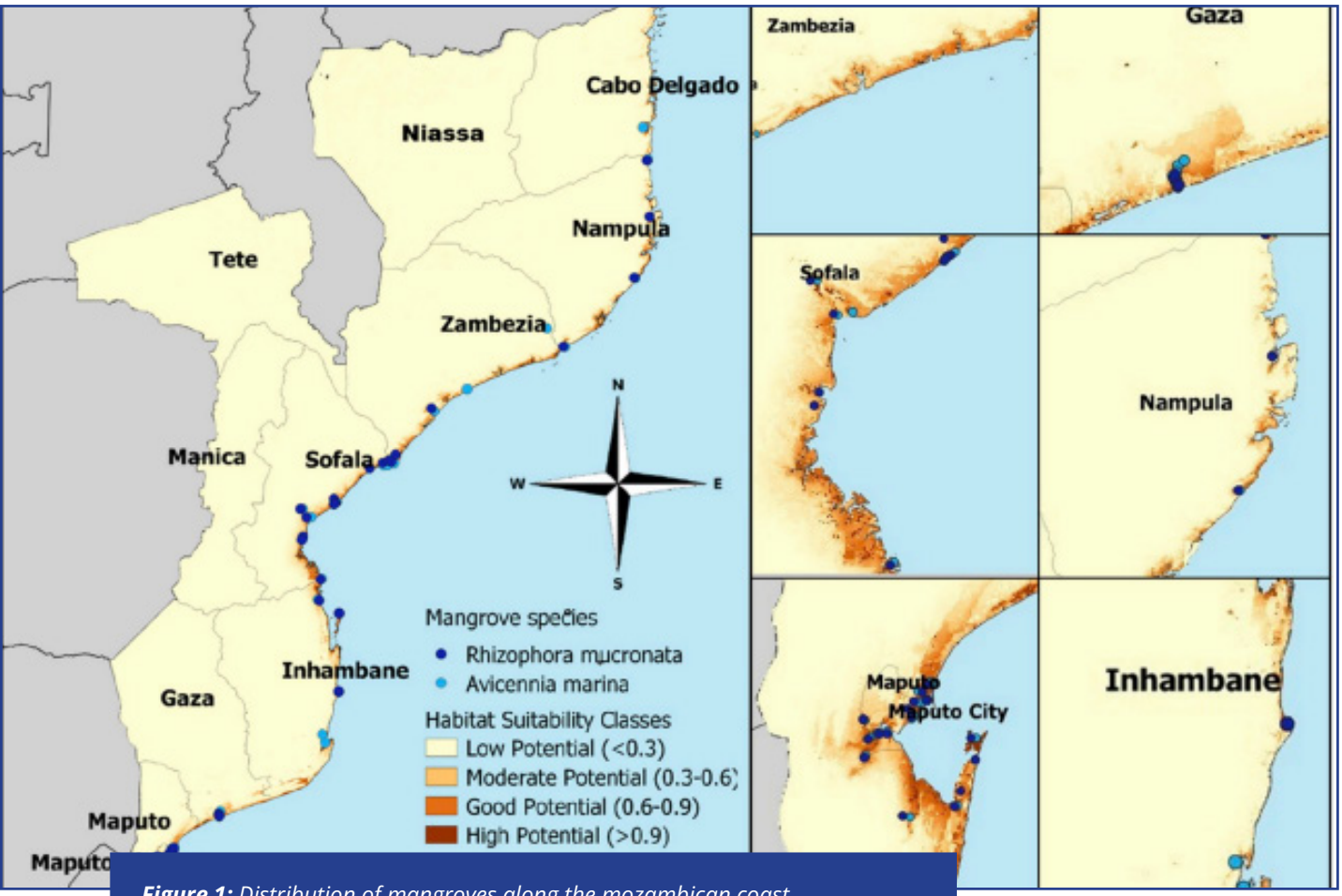


Figure 1: *Distribution of mangroves along the mozambican coast*

increasingly scattered in the north. Most of these forests are riparian, developing at river mouths (estuaries) and influenced by tidal cycles.

However, due to their socioeconomic importance, the mangrove forests of Mozambique, especially those located near major cities like Maputo, are experiencing significant degradation due to logging and urban growth (MITADER, 2015; Bosire et al., 2016). Monitoring mangrove areas, such as Maputo Bay, can provide crucial information on their current state and the impacts of anthropogenic activities (Carvalho & Jardim, 2017; Nicolau et al., 2017).

3. Objectives

"The purpose of this document is to provide legal and environmental technical support to promote the sustainable management of mangroves and the proper administration of solid waste in coastal communities, aiming to:

a. Raise awareness and guide public authorities, businesses, civil society organizations, and local communities on the importance of mangrove conservation.
b. Analyze existing legislation, highlighting the rights and duties related to environmental protection and solid waste management.
c. Recommend legal and administrative solutions, suggesting public policies, regulatory instruments, and actions that ensure environmental sustainability and the well-being of coastal populations.

d. Strengthen environmental governance, encouraging social participation and compliance with laws to prevent environmental damage and promote sustainable development.

4. Challenges

The study had already anticipated controversial results regarding both the survey findings and the actual observations, particularly in Matola. The mangrove area in Matola city has faced significant anthropogenic pressure due to population growth, leading to increased dumping of solid waste. This is further compounded by widespread beliefs in the community, such as the idea that: 'the resource was given by God and, therefore, it cannot be depleted.'

Although the survey results indicated that most people denied dumping solid waste in the mangrove or cutting it down, the reality on the ground was very different. This discrepancy was expected given the significant population growth in these neighborhoods. For example, in Língamo, families are living within the mangrove area, which has led to the indiscriminate cutting of mangrove trees for housing construction. Riparian areas are also being used as dumping grounds for solid waste and other materials.

5. Case Study Results

The study found poor regeneration in the region's mangroves, with very few saplings present, indicating a struggle in the ecosystem's natural recovery process. Solid waste was observed being discarded within the mangrove, along with garbage dumps located very close to these areas, particularly in the Língamo community in Matola. These pollution conditions negatively affect soil quality and the overall health of the ecosystem, further hindering mangrove regeneration.

An important observation was the conversion of mangrove areas into residential areas, both through tree cutting for resources and the allocation of land for housing. This is especially evident in the – Escola de Pesca community and Língamo communities in Matola, where urbanization has encroached on natural ecosystems.

These observations contrast with the information gathered from the Matola community survey (Fishing School and Língamo). During data collection, most of the population (60%) claimed not to engage in mangrove cutting, yet a majority (82%) admitted that waste dumping occurs in these areas (Table 1). This suggests a gap between the community's perceptions and the reality on the ground regarding mangrove cutting. After analyzing both the illegal waste dumping and the

environmental impact of tree cutting, it is clear that both actions have been excessive and are significantly contributing to the worsening environmental degradation in the area.

Table 1: Survey results on solid waste deposition and mangrove cutting in Matola

Area	Question	Answer (Yes/No)	Question	Answer (Yes/No)
Matola	Is waste dumped in the mangrove?	Yes – 82%	Is mangrove cutting done?	Yes – 40%
		No – 18%		No – 40%

The discrepancy may stem from a lack of awareness about the environmental impacts of these practices or from informal activities that are not recognized or acknowledged by the communities, such as illegal land occupation and improper waste disposal. To address this, environmental education initiatives and the strengthening of community-based natural resource management should be implemented, encouraging active participation from the population in the protection and restoration of mangroves.

The study found that, in a general sense, the mangrove on Inhaca Island is in good

Figure 2: *Healthy mangrove ecosystem in Inhaca, Ribwene neighborhood - A and Nhaquene - B.*

conditions, especially the portion in the Nhaquene neighborhood (Figure 2), which stands out for

Figure 4: *Natural death/degradation of mangroves, Nhaquene neighborhood*

being relatively well-preserved compared to other areas in the region. However, some areas were found to be under pressure, mainly due to waste disposal (Figure 3) and the natural death of trees (Figure 4), indicating environmental impacts even in largely intact areas.

According to the survey data, the population categorically denied the practice

of waste disposal in the mangrove area (Table 2). This leads us to consider that i) there may be a lack of perception or awareness among the community about the impact of waste on the health of the ecosystem, or ii) solid waste may arrive at mangrove areas through ocean currents, creating a significant waste management problem, particularly on an island with limited access to large urban centers.

Table 2: Survey results on solid waste deposition and mangrove cutting in Inhaca

Area	Question	Answer (Yes/No)	Question	Answer (Yes/No)
Inhaca	Is waste disposed of in the mangro-ve?	Yes – 40%	Is mangrove cutting done?	Yes – 0%
		No – 60%		No – 100%

Both in Ribwene and Nhaquene, the mangrove remains in good condition, considering the transect sampling conducted in these two neighborhoods. However,

inadequate waste management in Ribwene may be one of the factors contributing to the progressive deterioration of certain sections of the ecosystem, despite the environmental awareness that, in theory, the community claims to have. Again, this reflects a significant discrepancy between what is reported (in the survey) and what is directly observed, suggesting that the actual waste disposal practices may not be fully recognized by the population or that there are cultural habits that still need to be addressed through environmental education and improvements in waste management..

i. Fauna Composition in Polluted and

Figure 5: *Species (Uca annulipes and Cerithidea decolata) observed in the unpolished area of the mangrove at the fishing school, Matola.*

Figure 6: *Presence of reeds and macrophytes in the polluted area of Lingamo, Matola.*

Unpolluted Areas

In the sampled areas of the mangrove forest near Língamo and the Fishing School, two species of crabs, *Uca annulipes and Cerithidea decolata (Tódwé),* were found in the

Figure 7: *Cerithidea decolata species showing excessive mortality in the polluted mangrove areas, Inhaca, Ribwene.*

unpolluted transects, indicating a relatively healthy ecosystem (Figure 5). However, in the most polluted areas, the visible fauna was limited to reeds and macrophytes (Figure 6), pointing to a negative impact on local biodiversity from contamination. Reeds and macrophytes are known indicators of pollution.

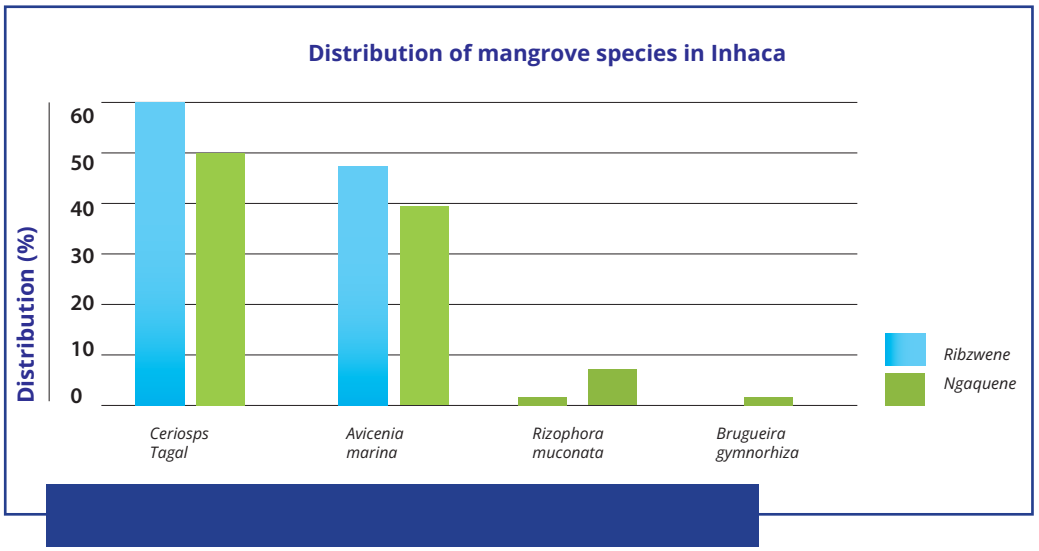
Figure 8: *Mangrove species found in the four sampling areas: A. marina, B. gymnorhiza, R. micronata, C. tagal*

In the mangrove forest of Ribwene neighborhood, the same two species of crabs were observed. However, in the polluted areas, the death of Cerithidea decolata (Tódwé) was noted, with only U. annulipes present, indicating a more severe impact of pollution on local marine fauna (Figure 7).

In the mangrove forest of the Ribwene neighborhood, the same two species of crabs were observed. However, in the polluted areas, Cerithidea decolata (Tódwé)

Figure 9: *Mangrove species found in the four sampling areas: A. marina, B. gymnorhiza, R. micronata, C. tagal*

was found dead, with only U. annulipes remaining, suggesting a more severe impact of pollution on the local marine fauna (Figure 7)..



ii. Regeneration

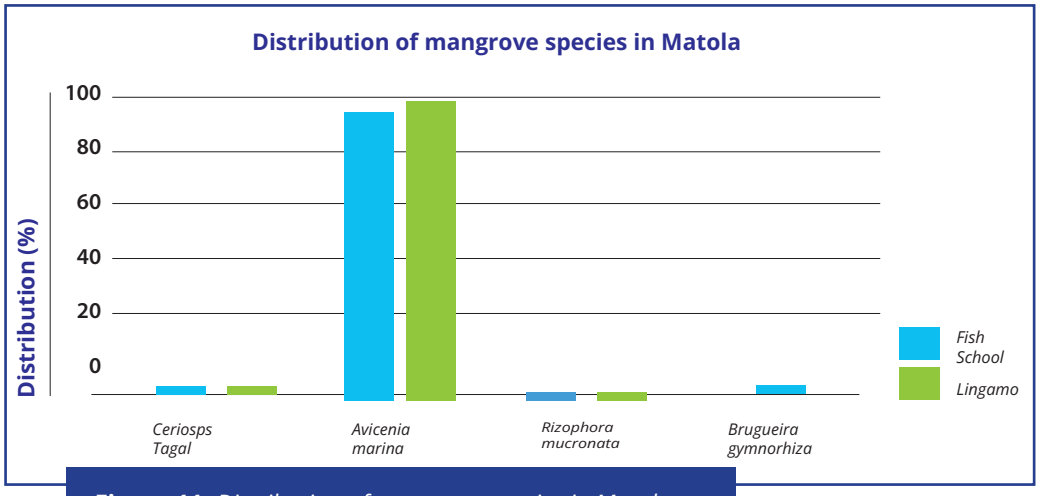


Figure 11: *Distribution of mangrove species in Matola*

Regarding the natural regeneration of the mangrove, A. marina, C. tagal, R. mucronata, and B. gymnorhiza (Figure 9) were the species that contributed to mangrove regeneration.

A. marina was the species found in the greatest abundance across all four study sites. In Nhaquene and Ribwene, the species with the highest seedling density was C. tagal (Figure 10).

Figure 10: *Distribution of mangrove species in Inhaca*

The specific composition of seedlings at each site was different. In Língamo and the

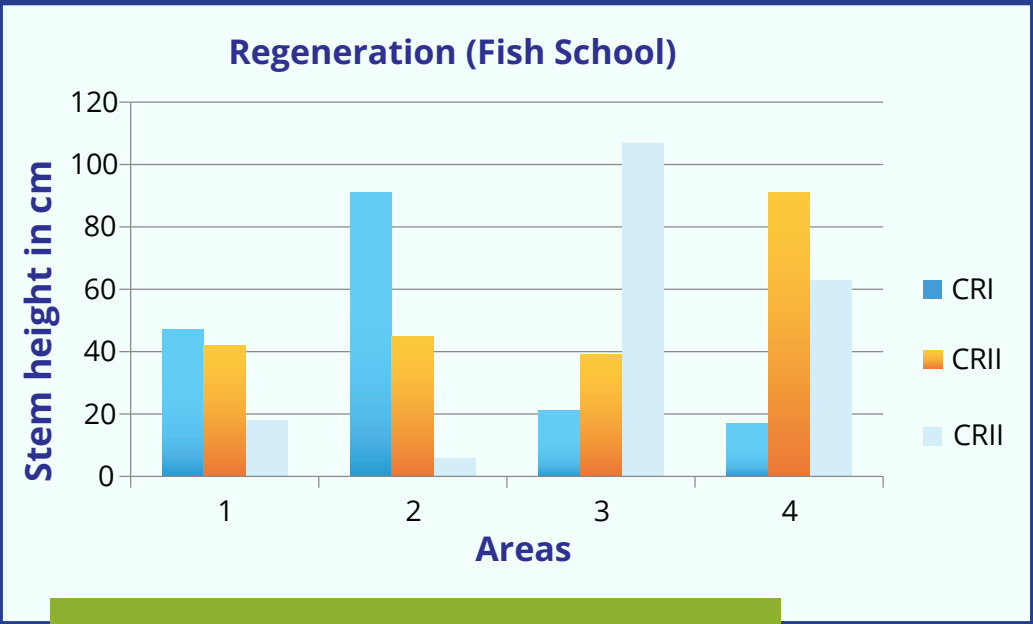


Figure 12: *Mangrove regeneration stage in the Fishing School community*

Fishing School, A. marina was found in high abundance compared to the species C. tagal, R. mucronata, and B. gymnorhiza (Figure 11).

In the neighborhoods of Nhaquene and Ribwene, three species of seedlings were found: A. marina in all stages of regeneration; R. mucronata in stages I and II; and C. tagal in all stages

When comparing regeneration stages by species, differences were observed only for A. marina in stages CR I and CR II. Polluted sites showed low regeneration rates, likely due to the presence of solid waste, which alters the soil composition and makes seedling germination more difficult.

iii. Matola

The graph of regeneration stages of the mangrove in Fishing School shows variations across the four sampling transects (Figure 12). Each transect shows a distinct distribution of seedlings and young plants, reflecting the health and regeneration process of the mangrove ecosystem.

In the first area, there is a predominance of Stage CR I (less than 40 cm in height), followed by Stage II (between 40 cm and 1.5 m), and finally Stage III (height between 1.5 m and 3 m). This pattern indicates a mangrove area with good regeneration, with a significant presence of seedlings and young plants, suggesting a healthy and recovering ecosystem.

In the second area, a peak is observed in CR I, followed by a considerable proportion of CR II, and a small number of CR III plants. This suggests that regeneration is good in the early stages, but with some limitation in the regeneration of more mature plants.

In the third area the peak is observed in CR III, indicating that the area is more degraded, with a predominance of plants (between 1.5 and 3 meters tall). CR II appears in smaller proportions, and CR I is the least represented, suggesting that regeneration is in a more advanced stage of degradation. It is worth noting that

waste deposition in this transect may be negatively impacting the regeneration process, possibly hindering plant growth.

Finally, in the fourth area the peak is in CR II, followed by CR III and, in smaller amounts, CR I. This indicates that the area is at an intermediate stage of regeneration, with signs of recovery. Regeneration appears to be limited by degradation and the presence of waste.

Area 3, with waste deposition, shows a negative impact on mangrove regeneration, while the second transect reflects a healthier regeneration area.

The graph of the regeneration stages of the mangrove in Língamo (Figure 13) illustrates the distribution of the different regeneration stages across the four sampling transects. The first transect presents all three regeneration stages: I, II, and III, indicating variation in vegetation density and health across the sampled area. Regeneration Stage I is represented by denser and healthier vegetation, while Stages II and III reflect areas with limited regeneration and signs of degradation.

In the other three areas Stages II and III predominated, suggesting areas with sparse vegetation and significant degradation. This points to a slower regeneration process, possibly due to the high levels of solid waste deposition in the mangrove ecosystem.

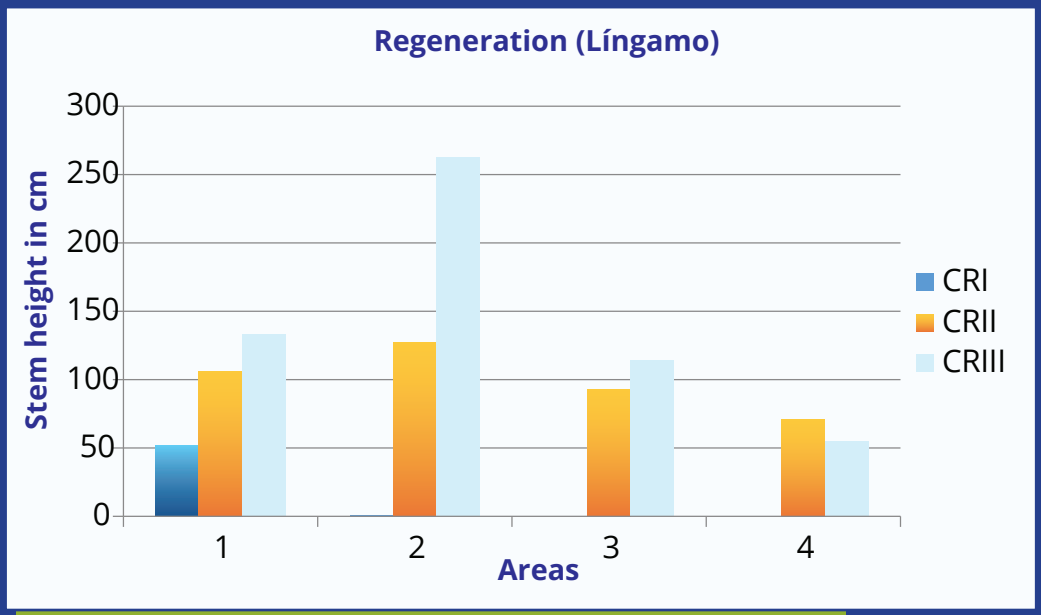


Figure 13: *Mangrove regeneration stage in the Língamo community*

These results indicate that, while the first transect reflects a relatively healthier mangrove ecosystem, the other areas are in more advanced stages of degradation, with little regeneration or recovery of species. This degradation may be linked to the wear and tear of the ecological environment.

However, in the second area the peak is observed in Stage III, suggesting that this area is at a more advanced stage of degradation. During the sampling, a noticeable absence of fauna and excessive domestic waste presence were observed, which may indicate a high level of toxicity in the region, further compromising the regeneration

process and the health of the ecosystem.Inhaca

iv. Inhaca

The regeneration stages graph for the mangrove in Ribwene shows the distribution of different stages across the four sampling transects, with significant variations between them (Figure 14).

In the first area there's a sharp peak in Stage III, indicating an area with mature vegetation and substantial regeneration. Stage I is also well-represented, suggesting

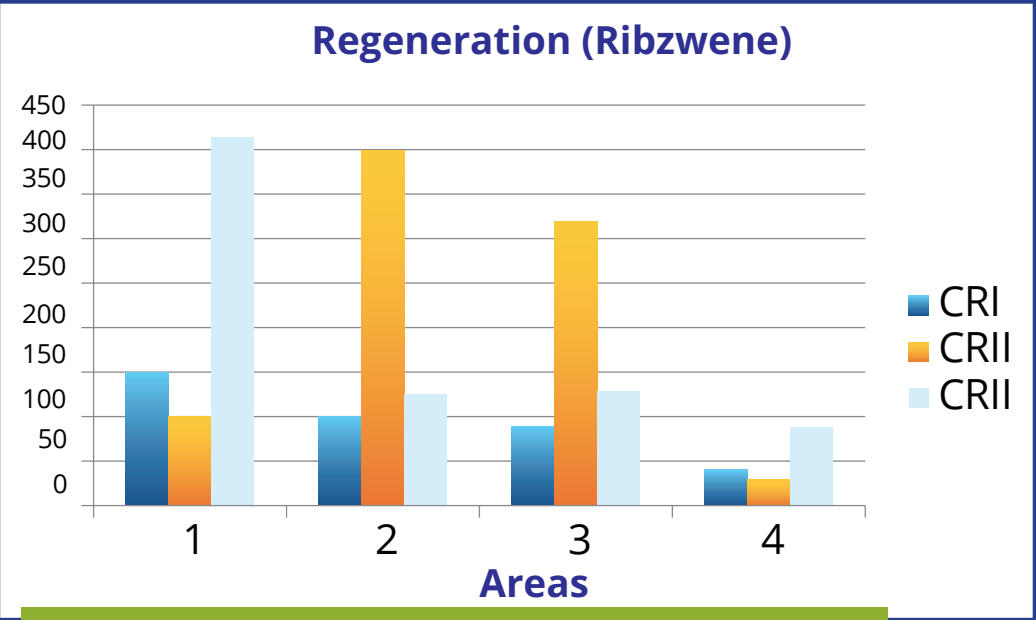


Figure 14: *Mangrove regeneration stage in the Ribwene community*

healthy regeneration, while Stage II is the least prominent, indicating vegetation at an intermediate growth and recovery stage.

In the second area, the peak is in Stage II, followed by a limited presence of Stage III and, lastly, Stage I. This suggests that the area is in an intermediate regeneration stage, with some parts already regenerating but other, more degraded sections. Waste deposition was observed in this transect, which may be hindering the regeneration process and negatively affecting the vegetation.

In the third area, Stage II is most prominent, followed by a moderate amount of Stage I and a smaller presence of Stage III. This distribution also points to an intermediate regeneration stage, with some areas containing young vegetation, but others showing signs of degradation. The waste in this transect could also be slowing down regeneration, preventing plant growth.

In the fourth area, there's little vegetation, with Stage III dominating, followed by Stage I, and Stage II in smaller amounts. This suggests a highly degraded area, with minimal visible regeneration and mostly older, deteriorated vegetation. Boats were also seen in this area, which could negatively impact the mangrove by compacting the soil and removing vegetation, further contributing to the ecosystem's decline.

These results indicate that while the first area shows a healthier regeneration process, the other transects display clear signs of degradation, with waste and boat impacts hindering regeneration and disturbing the balance of the mangrove ecosystem in Ribwene.

The graph of the regeneration stages of the mangrove in Nhaquene illustrates the distribution of the different regeneration stages across the four sampling transects, with a predominant pattern in Stage III across all transects (Figure 15).

In the first area, a very high peak in Stage III is observed, indicating an area with predominantly mature vegetation and significant regeneration. Stage II is also well represented, suggesting considerable regeneration in intermediate stages, while Stage I appears in smaller quantities, reflecting some areas of early-stage regeneration, but still growing.

In the second area the peak is once again in Stage III, followed by a moderate amount of Stage II and, in smaller quantities, Stage I. This suggests that, although some areas are in advanced stages of regeneration, other parts of the transect are still in the process of regeneration, with limited young vegetation represented by Stage I.

In the third area, the peak is in Stage III, but with a considerable amount of Stage I, suggesting a more dynamic and healthy regeneration, with areas of young and growing vegetation. Stage II appears in smaller proportion, indicating some areas in intermediate regeneration stages, but still recovering.

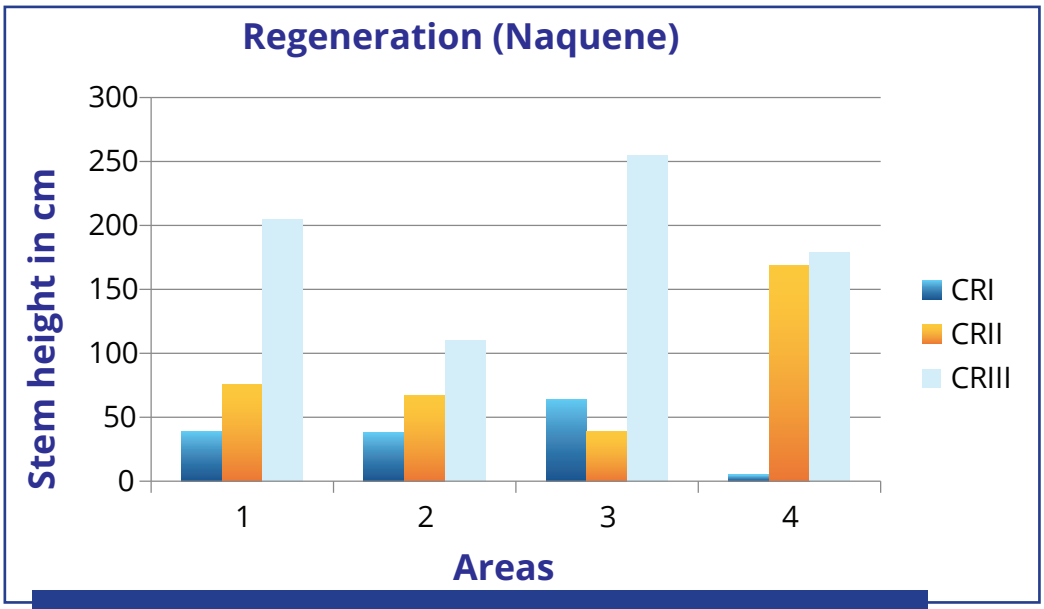


Figure 15: *Mangrove regeneration stage in the Nhaquene community*

v. Sustainable management of mangroves and solid waste

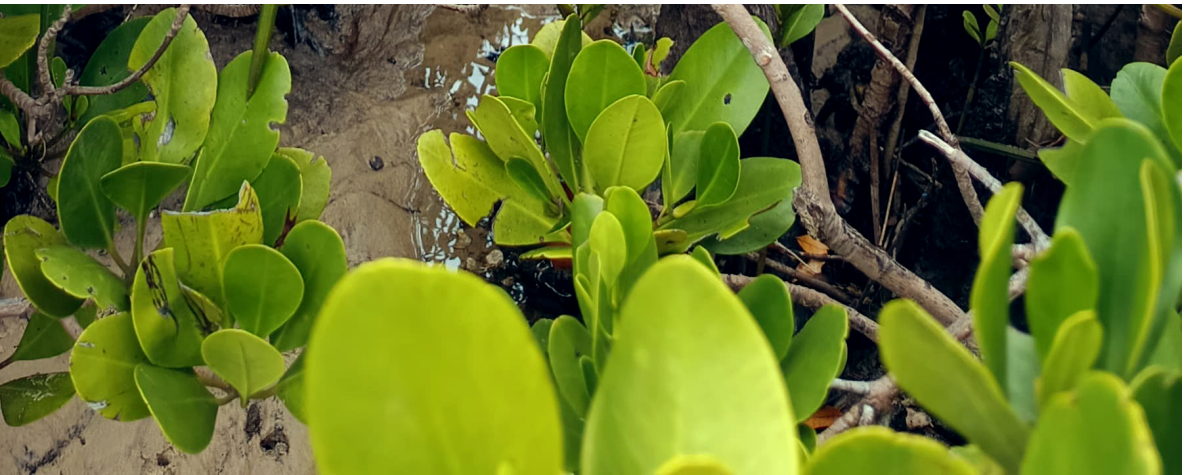
The results of the surveys conducted in Matola (Fishing School and Língamo) and Inhaca (Ribwene and Nhaquene), based on a sample of 50 residents per area and 25 per community, show that the majority of respondents fall within the age range of 36-50 years, both in Matola (42%) and Inhaca (36%). In Matola, the majority of the participants were female, with 27 women, while in Inhaca, the majority were male, with 33 men.

Six hundred and six percent of participants in both districts have direct access to the mangrove, as they live in areas adjacent to the mangrove. Ninety-six percent of respondents stated that the mangrove is a source of food for families, while a small number of respondents in Inhaca stated that the mangrove is also used for materials for housing improvement or firewood. In Inhaca, the primary food provided by the mangrove is crab, while in Matola, it is fish.

When asked about the availability of resources in the mangrove ecosystem throughout the year (Table 3), 90% in Matola and 70% in Inhaca believe that there is a scarcity of resources in the mangrove ecosystem, and most attribute this phenomenon to a lack of attention to mangrove conservation, associating it with frequent cutting (especially in Matola), solid waste deposition (in both areas), and other factors.

Table 3: Survey results about the availability of resources in the mangrove

Availability of Resources in the Mangrove



Location|Area	Sex	Scarcity over the Year	New Species	Seasonal
Matola	Male	30%	0	4%
	Female	60%	0	0
Inhaca	Male	40%	4%	8%
	Female	30%	2%	10%

Regarding mangrove preservation practices (Table 4), 78% of participants in Matola believe that the community protects the mangrove, with 58% attributing this to its role as a nursery for various species and a source of food. In contrast, 12% think the community does not conserve the mangrove. On Inhaca Island, 86% of participants believe the community preserves the mangrove, with the majority (38%) citing the ecosystem's importance as the reason for protection..

Table 4: Survey results about community preservation practices for the mangrove.

Community preserves the mangrove							
Areas	**No, because they don't care about conservation**	**No, because they need food for their family**	**No, because they need material for building houses**	**Yes, because of its importance as a nursery and food source**	**Yes, because of its importance to the ecosystem**	**Yes, because there is monitoring**	**Yes, because of its importance in local traditions**
Matola	4%	6%	2%	58%	8%	12%	0%
Inhaca	2%	6%	2%	24%	38%	22%	2%

Regarding the protective measures for the mangrove ecosystem (Table 5), in Inhaca, 42% of participants consider that the prohibition of mangrove cutting is essential for its preservation; while in Matola, 36% consider reforestation activities and the prohibition of deforestation to be effective measures, with 30% adding the need for also monitoring fishing activities.

Table 5: Results of the community survey regarding measures to protect the mangrove ecosystem.

Medidas de proteção dos mangais	
Matola	**Responses (%**
Deforestation prohibition	12%
Deforestation prohibition + Fishing monitoring	8%
Reforestation + Deforestation prohibition	36%
Reforestation + Deforestation prohibition + Fishing monitoring	30%
Reforestation + Deforestation prohibition + Fishing monitoring	**Responses (%**
Inhaca	
Fishing monitoring	12%
Deforestation prohibition	42%

Deforestation prohibition + Fishing monitoring	22%

Reforestation + Fishing monitoring	4%
Reforestation + Deforestation prohibition	4%
Reforestation + Deforestation prohibition + Fishing monitoring	12%

Regarding decision-making in mangrove management (Table 6), the Matola community (84%) states that decisions have been made in meetings where the community has a voice. In Inhaca, 60% of respondents believe that decisions are made by government entities, while 20% believe that decisions are made in meetings where the community also has a say. This finding may be related to the fact that the marine area of Inhaca belongs to the Parque Nacional de Maputo and the fact that Inhaca is part of the Área de Protecção Ambiental de Maputo. Both areas have a series of regulations that must be followed and respected by the communities, compared to the communities of Matola.

Table 6: Survey results on community decisions regarding mangrove management

Decisions regarding mangrove management				
Areas	**Decisions are made by government entities**	**In meetings where the community has a voice**	**Private sector**	**Don't know**
Matola	4%	42%	4%	8%
Inhaca	60%	20%	12%	6%

Regarding the challenges faced in mangrove management, the Matola community believes that the pressure from urban growth and pollution from solid waste have been the main factors impacting mangroves. The Inhaca community, on the other hand, observes that urban growth pressure has also been a critical factor for the sustainable management of the mangrove.

When questioned about the management of solid waste in the communities (Table 7), in Inhaca, 55% of participants stated that they deposited waste in the mangrove because it was the closest location, both for domestic and marine waste. This was followed by 15% who stated that the tides eventually carry the waste away. In Matola, 97% of people responded that solid waste was placed in the mangrove due to a lack of appropriate disposal sites, with most waste being domestic.

Table 7: Survey results on community reasons for solid waste deposition in mangroves

Reasons for Disposing of Solid Waste in the Mangrove			
Areas	**Lack of appropriate disposal sites**	**Closest location to the community**	**Waste is carried away by the tide and the area stays clean**
Matola	80%	2%	0%
Inhaca	6%	22%	6%

Considering that the impact of solid waste on the natural regeneration of mangroves

was assessed, the community's perception regarding the amount of solid waste in the mangroves was also sought (Table 8). In Inhaca, 54% of respondents believe that the amount of waste has decreased, compared to 40% who believe it has remained the same, and 4% who believe it has increased. In Matola, 46% of respondents believe that the amount of solid waste in the mangroves has increased, 28% believe it has remained constant, and 20% did not know how to answer.

Survey results on solid waste in the mangrove ecosystem

Solid Waste in the Mangrove				
Area	**Increased**	**Decreased**	**Remained constant**	**Don't know**
Matola	46%	6%	28%	20%
Inhaca	4%	54%	40%	2%

Although both communities dispose of solid waste in the mangrove, when asked if this waste impacts the proper development of the mangrove and the entire ecosystem, 96% of respondents in Inhaca answered "yes," while 52% answered "yes" in Matola. On the other hand, 100% of respondents in Inhaca acknowledge that the mangrove is a crucial ecosystem, mainly for: i) its superior species diversity, ii) the promotion of sustainable tourism, and iii) enhanced coastal protection. In Matola, only one person said they did not recognize any benefits from the mangrove, while the majority highlighted its importance for i) greater species diversity and ii) increased coastal protection.

6. Political and practical recommendations

a. Policy recommendations

Sustainable mangrove management and solid waste disposal by coastal communities are critical for environmental conservation, public health, and the sustainable development of coastal areas. Protecting these vital ecosystems (mangroves) and implementing effective waste management policies require a robust legal framework and coordinated action between the public and private sectors.

- **National Environmental Policy (Resolution No. 5/95, August 3):** This policy outlines the objectives for ecosystem protection and biodiversity conservation, which includes mangroves.
- **Environmental Law (Law No. 20/97, October 1): T**his law provides the legal foundation for environmental management and the conservation of natural resources, including mangroves.
- **Land Law (Law No. 19/97): T**his law defines areas designated for total and partial protection in Mozambique, with mangroves being included in these categories.
- **Forests and Wildlife Law (Law No. 10/99, July 7):** This law establishes principles and norms for the protection, conservation, and sustainable use of forest and wildlife resources, which also applies to mangroves.
- **Decree No. 12/2002 of June 6:** This decree regulates Law No. 10/99 regarding the protection, conservation, and sustainable management of forest and wildlife resources.
- **Mangrove Management Strategy: T**he Mozambican institutional framework designates mangrove management responsibilities to various entities at different levels, involving stakeholders as stipulated in national legislation.
- **Biodiversity Conservation Law (Law No. 5/2017):** This law establishes the legal framework for biodiversity conservation, including the protection of sensitive ecosystems like mangroves

These laws and policies aim to ensure the protection of mangroves, acknowledging their importance for biodiversity, coastal protection, and the livelihoods of local communities. However, some of these laws need to be updated to reflect the current challenges faced by coastal areas. The following are policy recommendations that should be adapted to the contemporary realities of coastal communities.

- **Strengthening environmental legislation and regulation – Review and stricter enforcement of existing laws:** Current laws related to mangrove protection and solid waste management should be reviewed to ensure they meet today's needs, with strict monitoring to ensure compliance.

Updating environmental laws should address new challenges, such as increased urbanization and growing coastal pollution.

- **Creation of more specific legislation** – Encourage the creation of local laws that: specifically address mangroves and coastal communities, adapting general regulations to local realities and promoting sustainable environmental management. Specific laws on solid waste management should be implemented to strengthen enforcement and protect these ecosystems.

- **Implementation of integrated solid waste management plans – Develop municipal solid waste management plans:** Create waste management plans that include selective collection, recycling, and composting, with a special focus on coastal areas and mangroves.

These plans must be adapted to local specificities, taking into account the diversity of communities and the environmental impacts associated with waste in coastal ecosystems

- **Strengthening enforcement and penalties –** Urgent improvement of environmental monitoring in Matola and Inhaca: Strengthen environmental monitoring across the coastal zone, including mangrove ecosystems, to prevent illegal activities such as land encroachment, waste dumping, and exploitation.

- **Implementation of strict penalties –** Enforce severe penalties for: violations of environmental laws, such as illegal mangrove cutting, improper waste disposal, and illegal land occupation. These penalties should be applied swiftly and effectively, with clear accountability mechanisms for offenders in both Matola and Inhaca.

- **Education and awareness in coastal communities –** Develop educational and awareness programs: Implement environmental education initiatives in schools and communities, highlighting the importance of mangrove conservation and proper waste management.

- **Promotion of cleanup campaigns and community engagement –** Organize periodic beach and mangrove cleanup campaigns in both Matola and Inhaca, engaging local communities, NGOs, and other stakeholders. These campaigns can be an effective way to raise public awareness and foster a shared responsibility for waste management.

- **Practical implementation of waste collection and treatment systems –** Invest in the necessary infrastructure for waste management, such as selective collection points, sanitary landfills, and treatment systems, particularly in isolated or growing communities, to prevent improper waste disposal in mangroves and along the coast.

- **Fostering partnerships and joint actions – Encourage partnerships between the public and private sectors:** Facilitate collaboration between governments, municipalities, private companies, and NGOs to implement mangrove preservation and restoration projects.

- **Strengthening environmental education –** Develop targeted environmental education programs for communities living near mangroves to raise awareness about the impacts of pollution and ecosystem degradation. These programs

should emphasize the importance of mangroves for biodiversity, coastal protection, and local economies.

- **Improvement of sanitation infrastructure –** To reduce pollution's impact on mangroves, invest in building adequate sanitation infrastructure, establishing accessible solid waste collection points, and enabling local authorities to collect and treat waste effectively.
- **Integrated land-use management –** Mangrove management should be incorporated into land-use planning, with public policies that prevent unchecked urban expansion and promote sustainable urban planning, minimizing the impact of urban growth on natural ecosystems. This requires coordination between various government bodies and local communities.
- **Continuous monitoring and research –** Implement a continuous monitoring system for mangroves, conducting periodic studies and research to assess the conservation status of ecosystems and identify degradation factors. Additionally, communities should be actively involved to ensure their participation in decisions regarding natural resource management.
- **Strengthening local governance –** Mangrove management should adopt a collaborative approach between local authorities, NGOs, and communities. Establishing local mangrove management committees or strengthening existing bodies, such as the Community Fisheries Council (CCP) in Inhaca, can be an effective way to promote active community participation and ensure sustainable decisions that reflect the interests of all stakeholders.
- **Enhancing the skills and knowledge of CCPs and CGRNs –** Provide training to Community Fisheries Councils (CCPs) and Community Natural Resource Management Committees (CGRNs) to enhance their capacity to act and gain recognition within their communities. These bodies should be encouraged to adopt sustainable mangrove management practices, such as prohibiting illegal tree cutting, promoting reforestation of degraded areas, and identifying suitable locations for waste disposal.

b. Practical recom

The **MangAction** Project, implemented by ICEI, which works with the communities of Matola (Língamo, Fishing School, Malhampsene, and Mussumbuluco) and the Island of Inhaca, in coordination with government institutions, conducted training for committees and communities with the goal of strengthening knowledge on natural resource management, sustainable mangrove management, and practical techniques for producing mangrove seedlings and restoring mangrove areas.

After the initial training on sustainable mangrove management provided to the communities of Matola, community-specific Action Plans were developed based on the realities faced in each coastal community of Matola, promoting actions to ensure the sustainable use and conservation of forest and wildlife resources within the mangrove ecosystem. ICEI has been supporting these communities by distributing equipment and providing knowledge to facilitate the committees' work in executing their action plans, raising awareness of the communities about sustainable management and the conservation of mangrove resources.

7. Call to action

We urgently appeal to the Government, environmental organizations, community structures, and all citizens to mobilize for the defense of mangroves and the

It is time to act!

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sustainable management of solid waste in coastal communities. The protection of these ecosystems is vital for food security, climate resilience, and the sustainability of the populations that depend on them.

It is imperative to adopt and implement effective public policies that integrate mangrove conservation with responsible waste management, ensuring environmental integrity and the well-being of local communities. Concrete and immediate actions are needed to halt the degradation of mangroves, reduce pollution, and restore affected areas, ensuring a balance between conservation and sustainable development.

Joint and coordinated action from all actors is essential to prevent the irreversible loss of biodiversity, strengthen the local economy, and mitigate the impacts of climate change. Mangroves are one of the most effective ecosystems in carbon capture and storage, playing a crucial role in climate regulation and coastal protection.

The future of mangroves and coastal communities in Mozambique depends on the decisions made today. Only through collective commitment and responsible environmental governance can we ensure a positive legacy for future generations. It is time to act!

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