CLIMATE ACTION NETWORK TANZANIA

Think, Act & Transform

PROJECT BASELINE REPORT

Strengthening the Contribution of Local Actors for a Climate Resilient Society in Zanzibar (Phase I)

August 2025

Brot für die Welt

ACKNOWLEDGEMENT

This baseline survey was conducted in support of the concerted efforts of partners of Climate Action Network Tanzania (CAN Tanzania), including organisations, institutions, and individuals who deserve special mention and acknowledgement for their contributions and support of the activity.

Bread for the World (BftW), as CAN Tanzania's partner, is acknowledged for its financial support. We also recognise those who are involved in the development of the report.

We further appreciate the cooperation of the CAN Tanzania team, Zanzibar office, who were always available to provide support with planning, logistics, and other assistance, including facilitating the data collection stage.

Our sincere thanks to the contributions of Tumbatu Shehias leaders and officers, and household members who took part in the surveys, FGDs, and KIIs. Their participation and collaboration greatly facilitated the process of achieving a comprehensive understanding of the island environment, thereby enabling appropriate adaptation strategies.

EXECUTIVE SUMMARY

This research was conducted to understand baseline information in Tumbatu Island for a project titled "Strengthening the Contribution of Local Actors for a Climate Resilient Zanzibar." A quantitative approach was used targeting community members, extension officers, and representatives from non-governmental organisations and community society organisations, using questionnaires, focus group discussions, and key informant interviews. Household heads (N=40) and household members (N=261) were interviewed in Mtakuja village on the island to gather information on environmental degradation, conservation strategies, climate change adaptation, and resource governance. These were analysed to better inform future project activities on Tumbatu Island and to provide more targeted recommendations to policymakers. The results show that livelihood strategies differ among households and that income varies. The gender income differences were that men had a higher average income of 150,000 - 500,000.00 TZS, while women's income was below 150,000.00 TZS. Fishing, crop farming, and community services livelihood initiatives provided the most household income, followed by livestock keeping, horticulture, petty business, and wage employment. This demonstrates that both men and women remained in fisheries and crop farming livelihoods, although men dominated, whilst women largely exited fisheries, as men did. This underscores the need to enhance gender-sensitive adaptive management in coastal contexts. The results also show that the most climate shocks affecting livelihoods included drought, strong winds, and unpredictable rainfall. Further, the study reveals a vicious cycle of degradation. The dominant practice of open waste dumping and burning pollutes the land and water, while the alarming decrease in mangrove cover has stripped the island of its natural coastal defences. There is strong interest in practical initiatives like recycling, whereas others show significant resistance to beekeeping, mangrove-based aquaculture, and eco-tourism due to cultural barriers, lack of knowledge, and fear of negative social impacts. This underscores that effective intervention must not only address environmental symptoms but also engage deeply with the social, economic, and cultural realities of the island's residents. This study adds knowledge on coastal communities and climate change resilience and identifies factors that warrant further investigation in the islands of Unguja and Pemba, Zanzibar.

ABBREVIATIONS/ACRONYMS

BftW	Bread for the World
CAN Tanzania	Climate Action Network Tanzania
CSO	Community Society Organization
FGD	Focus group discussions
FGD	Focus Group Discussions
FHH	Female Household Head
HH	Household
IK	Indigenous Knowledge
IPCC	Intergovernmental Panel on Climate Change
IUCN	International Union for Conservation of Nature
KAP	Knowledge, Attitudes, and Practices
KBA	Key Biodiversity Area
KII	Key Informant Interviews
LGA	Local Government Authorities
MHH	Male Household Head
MS	Microsoft
NGOs	Non-Governmental Organizations
TMA	Tanzania Meteorological Authority
TUMCA	Tumbatu Marine Conservation Area
TZS	Tanzania Shillings
WEO	Ward Executive Officer
ZEMA	Zanzibar Environmental Management Authority

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CHAPTER 1

1 INTRODUCTION

1.1. Background Information

The Intergovernmental Panel on Climate Change (IPCC) 6th Assessment Report underscores the increasing intensity and frequency of climate change impacts, particularly in small island states like Zanzibar. Due to their low-lying nature, these islands face distinct challenges, including flooding, drought, resource scarcity, and land loss from sea-level rise and coastal erosion. These changes threaten biodiversity and livelihoods, particularly in the fishing, agriculture, and tourism sectors that underpin the economic foundations of many island communities.

In Zanzibar, approximately 87% of the economy, including small-scale farming, fisheries, and tourism, is highly vulnerable to environmental degradation and coastal erosion (Torre-Castro et al. 2022). This vulnerability is exacerbated by low adaptive capacity, limited access to information, and widespread poverty. Furthermore, inadequate coordination and fragmented efforts among state and non-state actors hinder the effective implementation of climate and environmental frameworks.

The local manifestations of climate change are severe. Unpredictable weather patterns have resulted in both droughts and intense rainfall, the latter causing floods that submerge homes and destroy crops. These extremes disrupt the agriculture and fishing sectors, which are vital to the local economy. Additionally, rising ocean temperatures have driven fish species into deeper waters, making them inaccessible to fishers using traditional wooden dhows.

Other impacts include inundation of farmland and housing due to sea-level rise and degradation of mangrove forests, which serve as critical buffers between the ocean and fertile land. Increased sea surface temperatures have also caused coral reef bleaching, further reducing fish catches and impairing household food security and economic stability. These compounding effects highlight the urgent need to strengthen adaptation measures and promote livelihood diversification.

Tumbatu Island, a small islet of Zanzibar's northern coast, exemplifies these challenges. It lies within the rich marine biodiversity of the Tumbatu Marine Conservation Area (TUMCA), which is dedicated to protecting marine life and promoting sustainable fishing. The island's ecosystems include some of Zanzibar's most significant mangroves, multi-species seagrass beds, coral reefs, and a terrestrial forest that supports an IUCN-vulnerable species. These habitats provide essential services, supporting local livelihoods through artisanal fishing and other resource-based activities. Crucially, mangroves act as a natural buffer against climate hazards such as sea-level rise, thereby

enhancing community resilience.

However, the Tumbatu Key Biodiversity Area faces serious conservation threats, including overfishing, destructive fishing practices, coastal sand mining, mangrove degradation, and overdependence on natural resources. These patterns of unsustainable use are driven by local knowledge, attitudes, and practices, coupled with an inadequate understanding of governance and conservation. Heavy reliance on coastal resources means conservation efforts often conflict with traditional livelihoods. Furthermore, limited economic options pressure communities to increase their exploitation of natural resources, while terrestrial forests are cleared for agriculture, biofuel, and development.

These challenges threaten to diminish fishing opportunities, increase vulnerability to sea-level rise, and cause land degradation. Addressing these interconnected issues requires a multifaceted strategy, including effective management, community engagement in decision-making, the promotion of sustainable practices, and the development of alternative livelihoods.

In response to long-standing climate challenges, the Climate Action Network (CAN) Tanzania is implementing the project "Strengthening the Contribution of Local Actors for a Climate Resilient Zanzibar." To ensure the smooth implementation of interventions, CAN Tanzania undertook a baseline study in Tumbatu. This study identifies critical social and environmental concerns in the Mtakuja, Gomani, and Uvivini Shehias. Based on its findings, the study recommends targeted interventions to support the community in developing sustainable strategies for livelihood diversification, environmental conservation, and enhanced climate resilience, ultimately contributing to a more sustainable and climate-resilient Zanzibar.

1.2. Problem Statement

Coastal communities in Tumbatu are increasingly presented with valuable opportunities to bolster their resilience against the profound challenges posed by escalating climate risks. The island's stunning geography, characterised by lush marine environments and vibrant ecosystems, underscores the critical need for innovative approaches to effectively combat climate variability and environmental pressures. As indicators of climate change—such as rising sea levels, shifting rainfall patterns, coastal erosion, and warming ocean temperatures—intensify, stakeholders have a pivotal opportunity to develop comprehensive strategies that protect vital resources, including fisheries productivity, shoreline integrity, freshwater availability, and the safety of coastal settlements.

The prevailing socioeconomic landscape on the island presents both challenges and opportunities.

With many livelihoods anchored in sensitive sectors, particularly artisanal fishing and small-scale resource harvesting, there is substantial potential for economic diversification to strengthen communities' resilience to climate shocks. By addressing critical infrastructure gaps, such as improving access to clean water, reliable sanitation, efficient transport systems, and sustainable energy sources, we can significantly enhance the overall resilience and quality of life for residents. Furthermore, a thorough examination of social inequalities, particularly those affecting women's access to resources and decision-making roles, can pave the way for a more equitable and inclusive approach to vulnerability reduction.

Harnessing the wealth of local ecological knowledge and the established coping practices within these communities offers a solid foundation for enhancing adaptive responses. Transitioning from largely informal and reactive strategies to more organized and proactive measures will empower communities to confront the escalating climate threats they face. Strengthening institutional coordination and cultivating robust localized climate planning mechanisms will be essential in aligning national and regional climate resilience policies with the distinct needs and aspirations of local communities.

Implementing targeted interventions to enhance local capacity, promote sustainable ecosystem management, and foster participatory governance is critical to ensuring that mounting climate impacts do not compromise livelihoods or exacerbate environmental degradation. This project is a strategic initiative to bridge the critical gap between policy commitments and on-the-ground realities at the community level, empowering local actors to lead adaptation efforts and strengthen socioecological systems for a sustainable, thriving future.

1.3. Rationale of the Study

A comprehensive baseline study is pivotal in laying the groundwork for effective climate-resilience initiatives in Tumbatu. This island, characterised by its vibrant ecosystems and cultural richness, grapples with significant exposure to climate hazards, a heavy reliance on climate-sensitive livelihoods, and limited infrastructure. Such conditions heighten its vulnerability to environmental shocks and socioeconomic stresses, making it essential to establish a thorough baseline to understand the intricate fabric of local conditions, vulnerabilities, capacities, and opportunities.

The baseline serves multiple critical functions. Firstly, it acts as an empirical reference point, enabling stakeholders to measure the progress and effectiveness of project interventions against tangible data. By meticulously documenting the current ecological state, diverse livelihood patterns, governance frameworks, and social dynamics, the project team can track changes over time and

evaluate whether interventions are fulfilling their intended goals. Moreover, the baseline intricately outlines the specific vulnerabilities, adaptive capacities, and pressing needs of households, communities, and institutional bodies. This detailed understanding ensures that project strategies are not only grounded in local realities but also culturally relevant and responsive to the genuine challenges faced by Tumbatu's residents.

Furthermore, the baseline facilitates informed decision-making for resource allocation, program design, and risk management. It highlights critical gaps in ecosystem health, institutional capacity, and social inclusion, guiding the development of targeted interventions to enhance ecological resilience and community adaptive capacity. By weaving together data on environmental conditions, socioeconomic status, governance structures, and gender dynamics, the baseline study champions an inclusive approach that empowers women, youth, and other marginalised groups to actively engage in climate adaptation efforts, thereby fostering a diverse and dynamic participatory environment.

Quantitatively documenting the current state of key resources, such as the extent of mangrove cover, coral health, and fish stock levels. The study pinpoints the most critical interventions for sustainable resource conservation and effective restoration. Furthermore, by assessing community Knowledge, Attitudes, and Practices (KAPs) and existing livelihood strategies, the study identifies the root causes of environmental pressure and viable opportunities for diversification. This evidence is essential for designing locally appropriate strategies, such as which sustainable fishing practices to promote and which alternative livelihoods (e.g., climate-resilient agriculture or ecotourism) offer the greatest potential to reduce dependence on degraded ecosystems.

Ultimately, the baseline study is more than a technical formality; it serves as a strategic compass guiding the project's design, implementation, monitoring, and evaluation. By providing invaluable insights, it ensures that interventions are not only effective and sustainable but also scalable, thus contributing to the long-term vision of establishing a climate-resilient society in Tumbatu. In this way, the baseline underpins all project activities, ensuring that each action is thoughtfully guided by precise, context-specific evidence and aligned with broader regional and national objectives for climate resilience. By providing a clear understanding of the starting point, the study empowers the project team and the community of Mtakuja, Gomani and Uvivini Shehias to make informed decisions, track their success in building resilience, and ultimately demonstrate the project's tangible contribution to a sustainable, climate-resilient Zanzibar.

1.4. Objectives

1.4.1. Objectives of the project

- Climate resilience in Chuini and Mtakuja communities enhanced
- The newly defined climate-related legal frameworks of Zanzibar (guidelines, regulations, laws, and strategies) support coordinated national adaptation efforts.

1.4.2. Objectives of the Baseline Study

The baseline study was designed to generate comprehensive, reliable data to inform the planning, implementation, and monitoring of the project's climate-resilience interventions in Tumbatu. By systematically documenting the current socioecological, economic, and institutional conditions, the study aims to clarify the local community's vulnerabilities, adaptive capacities, and priority needs. This evidence should empower project stakeholders to design interventions that are contextually relevant, targeted, and capable of delivering measurable impacts.

1.4.3. Specifically, the baseline study seeks to:

a) **Assessing Community Livelihoods and Socioeconomic Conditions:** the base documented household income sources, livelihood strategies, demographic profiles, social vulnerabilities, and gender dynamics to pinpoint groups most affected by climate variability and environmental changes. This information is instrumental in informing strategies for livelihood diversification and resilience-building, specifically addressing the needs of men, women, youth, and other marginalised groups.

b) **Evaluating Ecosystem Health and Resource Status:** The study assessed the condition of critical coastal and marine ecosystems, such as coral reefs, mangroves, and seagrass beds. This approach identifies areas of degradation, resource pressures, and potential for restoration to ensure that ecosystem-based adaptation interventions are evidence-driven and maximise both ecological and community benefits.

c) **Examining Institutional and Governance Structures:** the baseline analyses the capacity, functionality, and effectiveness of local governance institutions, community-based organisations, and formal agencies involved in climate adaptation and resource management. This study uncovers gaps and coordination challenges while identifying opportunities to enhance participatory governance and institutional support for local actors.

d) **Identifying Climate Risks and Adaptive Capacity:** The study documented local exposure to climate hazards, current coping mechanisms, and existing adaptive practices. Understanding the community's adaptive capacity and resilience strategies provided a solid

foundation for designing interventions that build upon existing knowledge, practices, and social networks.

e) **Establishing Baseline Indicators for Monitoring and Evaluation:** the study developed measurable indicators across social, environmental, economic, and institutional dimensions to track progress and outcomes throughout the project lifecycle. This will ensure our project can quantify improvements in resilience, livelihood sustainability, and ecosystem health.

Through these objectives, the baseline study creates a robust evidence base to inform strategic decision-making, optimise resource allocation, and ensure that all project activities are tailored to the specific challenges and opportunities present in Tumbatu. It serves as a vital reference point for monitoring changes, evaluating impacts, and scaling successful interventions, ultimately advancing the overarching goal of fostering a climate-resilient, sustainable island community.

CHAPTER 2

2 METHODOLOGY AND STUDY SITE

2.1. Description of the Study Area

2.1.1. Geographical Location of the Study Area

Tumbatu Figure 1 It is situated within the rich marine biodiversity zone of Tumbatu Marine Conservation Area (TUMCA). Legally established in 2014 under the Fisheries Act, CAP.279, R.E. 2023. TUMCA encompasses 162.9 km^2 and is designated as a key biodiversity area (KBA) in the region. Its boundaries extend from the high-water mark at Kendwa village (6° 44.4'S, 39° 17.3'E) to the beach of Nyanjale village (6° 02.0'S, 39° 11.7'E).

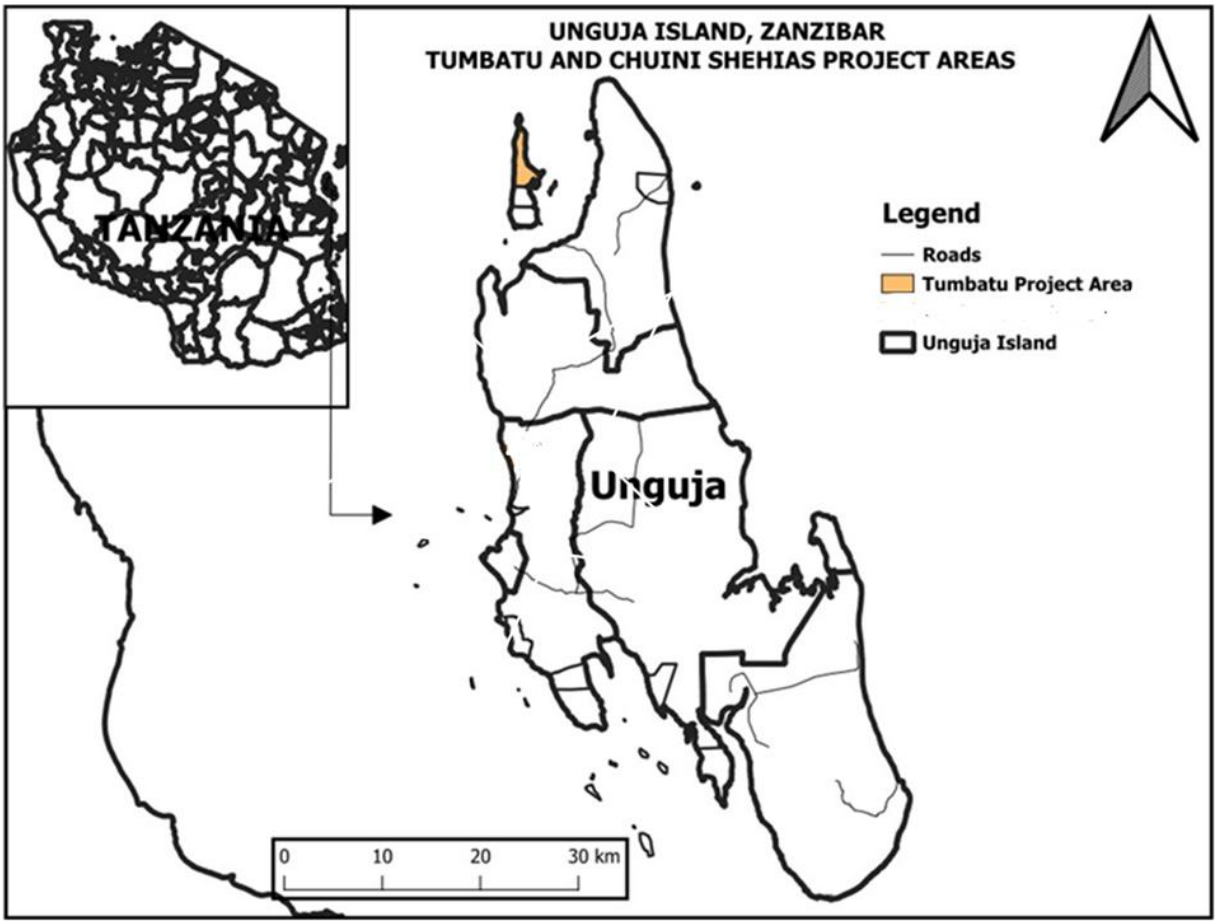

Figure 1. The Map of Zanzibar showing the study area, Tumbatu Island.

2.2. Methodological Approach

The baseline study conducted in Tumbatu embraced a proactive methodological approach characterised by participatory engagement, interdisciplinary collaboration, and a strong foundation in evidence-based research. By weaving together social, ecological, and institutional dimensions, the study sought to provide a rich, nuanced picture of the community's climate vulnerability and

adaptive capacity. Using a balanced mix of both qualitative and quantitative methods, the study ensured that the data gathered was not only robust but also reliable, ultimately fostering a deeper understanding of the intricate relationships at play in the face of climate challenges

2.2.1. Desk Review

An extensive, in-depth analysis of the existing literature, reports, policies, and spatial data on climate change, livelihoods, coastal ecosystems, and governance in Zanzibar has been conducted. This effort aims to create a robust contextual foundation for the forthcoming fieldwork. Among the key documents reviewed are detailed regional climate assessments that illuminate the local impacts of climate change, a comprehensive fisheries report that highlights the challenges facing the marine environment, and strategic development plans that outline the roadmap for sustainable growth. Together, these resources provide valuable insights into the intricate interplay of environmental and socio-economic factors affecting the region.

2.2.2. Household Questionnaires

Structured questionnaires were administered to a carefully selected representative sample of households, yielding rich quantitative data. The participants in the household survey (n=40) were from three shehia of Mtakuja, Uvivini, and Gomani. This process aimed to uncover detailed insights into various aspects of community life, including demographic characteristics, diverse livelihoods, sources of income, access to essential services, levels of climate awareness, and households' adaptive practices in response to environmental change.

2.2.3. Key Informant Interviews (KIIs)

In-depth conversations with local leaders, government officials, and civil society representatives were conducted to gather rich qualitative insights into governance structures, institutional capacity, the effectiveness of policy implementation, and community perceptions of climate risks. The KII (N=10; 3 female, 7 male) included the Tumbatu sub-district administrative secretary, the District fisheries officer, the Zanzibar Environmental Management Authority, the Tumbatu marine conservation manager, the councillor, and the shehia leaders. These dialogues not only highlighted existing frameworks but also identified potential avenues to enhance resilience and promote proactive strategies in the face of climate challenges.

2.2.4. Focus Group Discussions (FGDs)

Community Focus Group Discussions (FGDs) were thoughtfully organised to engage residents in a dialogue about their experiences and perspectives on various climate hazards. The FGDs (26, 15 females, 11 males) were conducted with local leaders (shehas) and community members. Topics

included environmental education, governance structures, and livelihood practices. Participants shared valuable insights into social dynamics, gender roles, and the rich tapestry of traditional ecological knowledge that informs their adaptive practices. These engaging discussions not only facilitated a deeper understanding of community resilience but also provided an essential platform for consensus-building, thereby validating and enriching the findings from household surveys.

2.2.5. Ecosystem Assessments

Comprehensive field-based ecological surveys were conducted to evaluate the health and status of key coastal ecosystems, including mangroves, coral reefs, and seagrass beds. Employing a range of sophisticated methods such as transect sampling and precise GPS mapping, the surveys provided detailed data on these environments. Additionally, participatory resource assessment sessions were conducted with local fishers, elders, and community members, who provided insights into resource types and uses, community engagement, historical conservation roles in managing shared resources, and livelihood diversification opportunities and challenges. Observations were validated through site visits to the affected areas. This collaborative approach not only deepened our understanding of the intricate dynamics within these ecosystems but also empowered the community to play an active role in conservation and sustainable management efforts.

2.2.6. Household Headship

In this study, a Female Household Head (FHH) was a household in which a female member was known by community members and other family members as the household head and the economically responsible member. In this study, we define a Female Household Head (FHH) as a household led by a female member who is recognised by both the community and family members as the primary leader and economic provider. This designation encompasses not only women who actively manage household finances but also those who, despite not making financial contributions, play significant roles in the household's well-being. The female head is pivotal in overseeing household income, ensuring that essential needs such as nutritious food and adequate healthcare are met for all family members.

On the other hand, a Male Household Head (MHH) is defined as a male who assumes responsibility for the household's economic support and decision-making. In this study, given the small sample size, we have combined FHHs and MHHs in our analysis. This approach allows us to gain deeper insights into the diverse dynamics of household leadership, irrespective of gender, and to appreciate the varied experiences and contributions of both female and male household heads. The FHHs also included adults who were present in households without financial contributions. The female head was responsible for household income, which supported the

family's necessities, including food and healthcare. A Male Household Head (MHH) was a household in which a male was economically responsible for other household members and decision-making. Due to the small sample size, the FHHs and MHHs were combined during analysis.

2.2.7. Institutional and Governance Analysis

The study thoroughly mapped the intricate landscape of both formal and informal governance structures, shedding light on the diverse roles, responsibilities, coordination mechanisms, and decision-making processes inherent within them. Through detailed document analysis and in-depth interviews, it skilfully revealed capacity gaps while also illuminating institutional strengths. Moreover, the research identified promising opportunities to foster participatory governance, thereby enabling more inclusive and collaborative decision-making.

2.2.8. Data Integration and Analysis

To ensure both reliability and validity, we systematically integrated diverse quantitative and qualitative data through triangulation. This multifaceted approach employed statistical analysis in SPSS and MS Excel, along with thematic coding, culminating in a richly detailed baseline report that played a crucial role in shaping our project planning, indicator development, and monitoring frameworks. The data were presented in tabular form, graphs, and pie charts to enhance visualisation and summarise the findings, thereby improving the understandability and interpretation of the concepts.

This comprehensive methodological framework allowed the baseline study to capture the intricate socioecological tapestry of Tumbatu, revealing the complexities and nuances of the local context. Furthermore, it provided actionable insights for strategic project interventions and actively incorporated the invaluable perspectives of local stakeholders at every stage of data collection and analysis, fostering collaboration and community engagement throughout the process.

2.2.9. Limitations of the study

a) Scope and Delimitation

The study is confined to a specific geographical area and a specific point in time. The findings are therefore a snapshot of conditions and may not be generalizable to other communities or to different seasons. The cross-sectional nature of the data means that it captures perceptions and situations at a single point in time, rather than long-term trends.

b) Reliance on Self-Reported Data

A significant portion of the data, particularly on socio-economic profiles, climate awareness, and livelihood practices, was collected through household surveys and interviews. This method is susceptible to biases such as recall bias (inaccurate recall of past events), social desirability bias (providing answers that respondents believe are socially acceptable), and intentional misrepresentation (e.g., underreporting income or overreporting environmentally friendly practices).

c) Sample Size and Representativeness

As a preliminary study, it may utilise a sample that, while carefully selected, may not fully represent the community's diversity. The views of certain subgroups (e.g., the most marginalised, female-headed households, or migrant workers) might be underrepresented as they were not adequately captured in the sampling frame.

CHAPTER 3

3 FINDINGS AND DISCUSSION

3.1. Household Status

In this study, we analysed data from 40 households, consisting of 34 male-headed households (MHH) and 6 female-headed households (FHH). Notably, 91% of the MHH were married, whereas 50% of the FHH were widows. This distribution highlights the varying demographic characteristics within these households, providing valuable insights for further research and analysis. (**Error! Reference source not found.**).

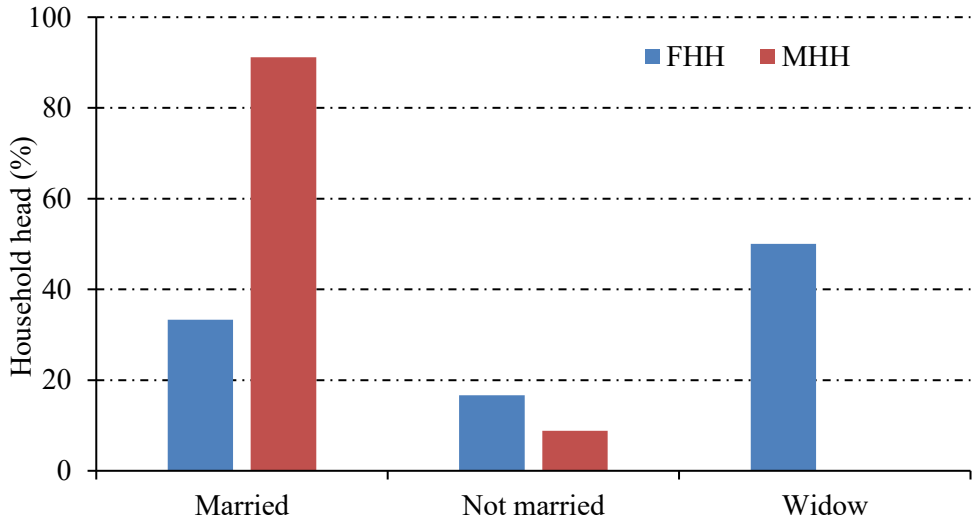

Figure 2. Household heads marital status at Tumbatu Island.

The composition of household members, categorised by leadership roles, reveals intriguing insights into family structures as depicted in the provided data. Notably, the dependency ratio in male-headed households (MHH) is slightly higher than in female-headed households (FHH), suggesting that adults in MHH often shoulder greater responsibility for children than their counterparts in FHH. Delving deeper into the analysis of household size by age group, it becomes clear that both FHH and MHH are predominantly composed of adults, with striking proportions of 75% in FHH and 64% in MHH, substantially exceeding the representation of children under 18 in these environments. Moreover, a striking disparity is observed among elderly residents: only 15% reside in FHH, whereas 85% reside in MHH.

These statistics not only underscore the varying dynamics of household composition influenced by leadership structures but also reveal the broader social implications of these trends, inviting further investigation into the unique challenges and advantages faced by different types of households.

Table 1. The composition of household members by household headship.

Composition	Female Household Head	Male Household Head
	Mean ± S.D.	Mean ± S.D.
Number of children < 18 years	2.50 ± 2.43	2.18 ± 2.21
Number of adults*	4.50 ± 1.87	4.26 ± 2.39
Total household members	7.00 ± 3.52	6.44 ± 2.74
**Dependency ratio	0.34 ± 0.47	0.36 ± 1.82

*Adult is the householder member over 18 years of age.

**Dependency ratio = number of children under 18 years of age/number of adults in household.

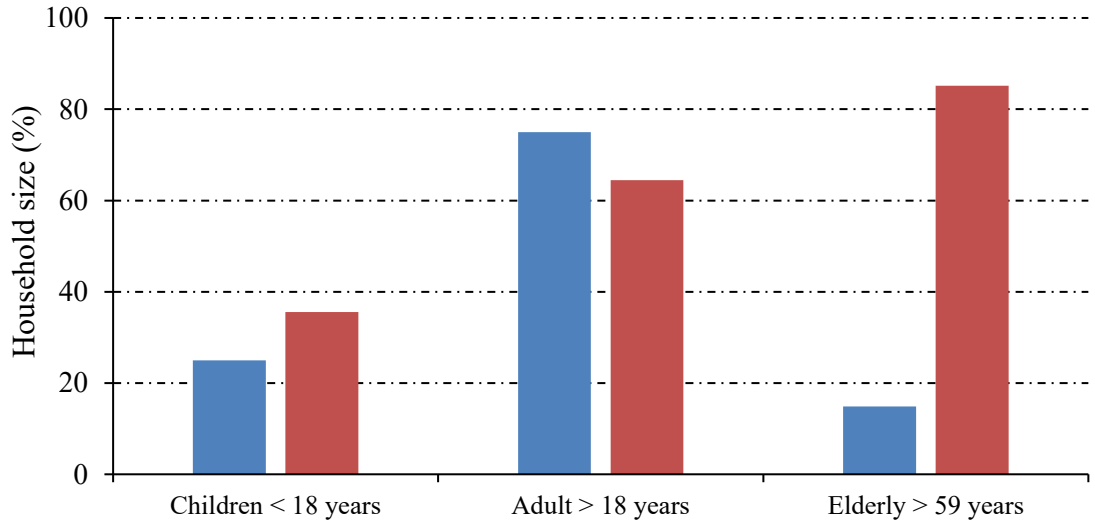

Figure 3. Per cent of household size by age group at Tumbatu Island

3.2. Demographic and Socio-economic Status

Table 1 provides a detailed overview of the respondents' socio-economic characteristics, revealing diverse demographics and living conditions. The sample was predominantly male (67%), with 33% female. This gender distribution sets the stage for understanding the societal dynamics at play. By age, the largest cohort comprised individuals aged 36–55 years (45% of the sample). This middle-aged group is crucial, as they are often responsible for both familial and economic responsibilities. Following this group were respondents aged over 55 years, who may possess valuable life experiences and insights.

Educational attainment in the sample exhibited several significant trends. A striking 60% of participants indicated that their highest level of formal education was primary school. Additionally,

25% were identified as illiterate, reflecting a pressing need for educational resources and support. Within this illiterate group, a marked gender disparity emerged, with 20% of men and 5% of women unable to read or write. In contrast, the remaining respondents had achieved secondary or tertiary education, highlighting areas for potential development and empowerment.

Examining employment patterns reveals that 85% of respondents were not affiliated with the formal labour sector, while only 10% reported full-time employment. This indicates a considerable percentage of the population may be engaged in informal work or other economic activities. Monthly income among the respondents exhibited significant variation. The majority earned between 150,000 and 500,000 Tanzanian Shillings (TZS), positioning them in a lower-income bracket. Only 12% reported a monthly income exceeding 500,000 TZS, suggesting economic constraints in this community. However, it is noteworthy that 70% of participants reported that their monthly earnings were sufficient to cover their household expenses. This indicates resilience and resourcefulness among respondents, as they navigate financial challenges while striving to meet their basic needs.

Table 2. Demographic and socio-economic characteristics of respondents at Tumbatu Island.

Characteristics	Description	Percentages (%)	
		Female	Male
Sex	Sex	32.5	67.5
Age	Youths 18-35	7.5	10
	Mature 36-55	20	25
	Over 55	5	32.5
Education	Primary education	25	35
	Secondary education	2.5	10
	Tertiary education	0	2.5
	Informal education	5	20
Marital status	Married	22.5	60
	Not married	2.5	7.5
	Widow	7.5	0
Employment status	Not employed	32.5	52.5
	Self employed	0	2.5
	Full-time employed	0	10
	Part-time employed	0	2.5
Monthly income	<TZS 150,000	25	17.5
	TZS 150,000 –500,000	7.5	37.5
	TZS 500,000–1,000,000	0	12.5
Income meets household expenses	Yes	12.5	17.5

	No	20	50

3.3. Climate Shocks and Livelihoods Activities

A significant number of respondents reported experiencing climate shocks that profoundly affect their livelihoods. They identified a combination of drought and strong winds (25%) as a leading challenge, followed by the unpredictability of rainfall alongside drought (approximately 18%). Strong winds alone also posed a notable threat, affecting 20% of the individuals surveyed. These climate-related disturbances primarily disrupt the effective planning and execution of daily income-generating activities, such as fishing and horticulture, with approximately 40% of respondents experiencing the consequences acutely.

Additionally, the destructive force of strong winds has resulted in severe structural damage, with 30% reporting the loss of roofs on their homes, leaving them vulnerable to further environmental stresses. Furthermore, 13% of respondents experienced significant crop losses, resulting in insufficient harvests and further economic insecurity. On a more positive note, 17% reported being unaffected by these climate shocks, suggesting pockets of resilience within the community. This feedback underscores the urgent need for more adaptive strategies and robust support systems to strengthen resilience to the growing challenges posed by climate variability.

Table 3. Climate shocks affecting community livelihoods at Tumbatu Island.

Characteristics	Description	Percentages (%)	
		Female	Male
Climate shocks which affect livelihoods	Drought and strong winds	7.5	17.5
	Drought and unpredictable rainfall	5	12.5
	Strong winds	5	15
	Strong winds and unpredictable rainfall	5	5
	Unpredictable rainfall	2.5	2.5
	Floods and unpredictable rainfall	2.5	2.5
	Sea level rise	2.5	2.5
	None	2.5	10

The livelihoods of residents on Tumbatu Island are predominantly based on three key activities: agriculture, fishing, and a range of supplementary endeavours, including small-scale businesses, wage employment, and community services. Among these, wild fisheries stand out, with approximately 68% of households relying on them as a significant source of sustenance and income. Meanwhile, 32% of households are engaged in agricultural pursuits, including crop farming, livestock rearing, and horticulture. A closer examination reveals fascinating differences in livelihood engagement between male and female respondents. Men predominate in the agricultural sector, with 42% of the workforce cultivating essential crops such as cowpeas, maize, and cassava.

Additionally, they engage in small-scale coconut and sweet potato cultivation, indicating their continued reliance on traditional farming methods. On the other hand, women play a critical role in their communities, largely contributing to wild fisheries (32%) and crop farming (26%). While women are involved in other livelihoods, only 15% participate in petty businesses and community services, indicating potential for further empowerment.

Community engagement appears to significantly influence livelihood choices, with an impressive 65% of men participating in community services and wage employment. This highlights the importance of community-oriented initiatives in providing stable income opportunities for men, while women continue to balance their roles in traditional and emerging economic activities. Sustainability is a vital focus among respondents engaged in fishing, where recommended fishing gear is essential not only for preserving fish stocks but also for optimising their earnings. The most frequently employed methods include basket and fish traps (40%), reflecting traditional practices, alongside hook-and-line fishing (28%) and octopus gleaning (20%), which highlight local knowledge and skills. In contrast, spear fishing remains a rare technique, utilised by only 2.5% of respondents, suggesting a preference for or greater accessibility to other fishing methods.

Overall, the livelihoods on Tumbatu Island comprise a diverse array of activities, shaped by local customs, gender roles, and sustainable practices, all of which contribute to the community's resilience and economic diversity.

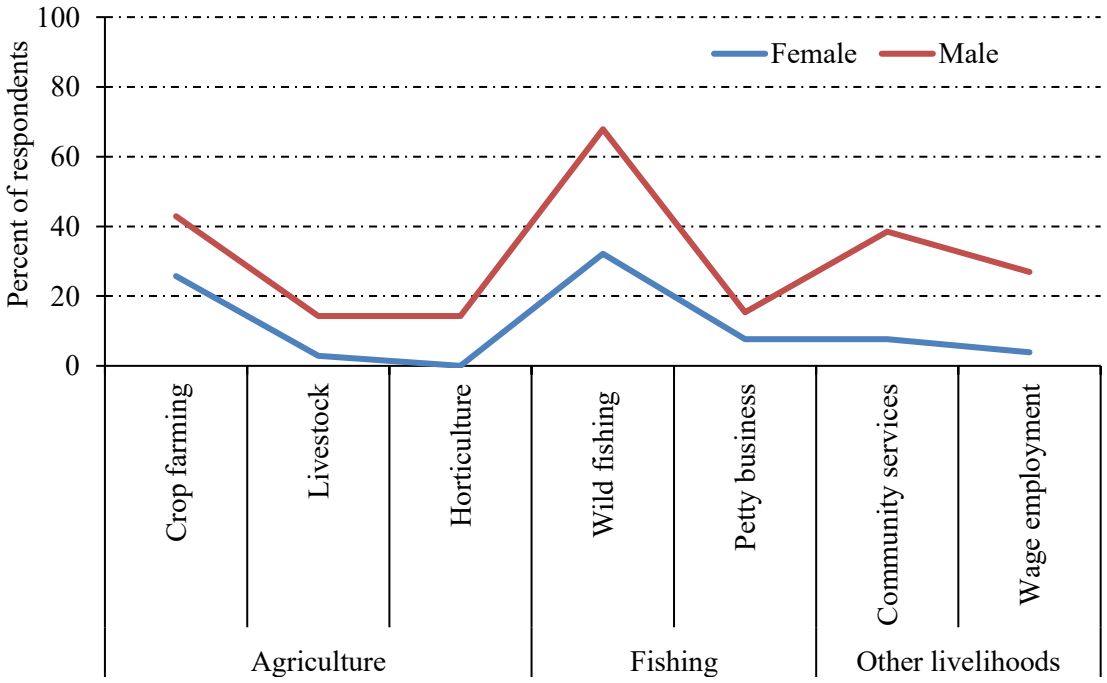

Figure 4. Percentage of respondents on livelihood practices

The report provides an overview of respondents' access to natural, social, and financial resources.

The findings indicate connections between gender and access to these resources, which may be influenced by climate change. This suggests an opportunity to further explore and implement targeted interventions to address these disparities.

Table 4. Description of respondents' access to resources at Tumbatu Island

Access to Resources	Descriptions	Percentages (%)	
		Female	Male
Natural resources	Easy to access and good	10	15
	Accessible with some challenges	10	30
	Not good	12.5	22.5
Social resources	Easy to access and good	20	20
	Accessible with some challenges	7.5	35
	Not good	5	12.5
Financial resources	Accessible with some challenges	0	17.5
	Not easily accessible	7.5	32.5
	Not interested	25	17.5

Research has consistently demonstrated that women are more susceptible to vulnerabilities within their communities compared to men, largely due to a notable lack of leadership opportunities and an inequitable distribution of resources. Various factors such as educational attainment, income levels, and access to resources significantly influence how vulnerability is perceived (Rana and Routray 2018; Sattar and Cheung 2019). For instance, women who rely on ecosystem services for their livelihoods are disproportionately affected when these ecosystems are degraded, leading to a marked decline in their income-generating capacity and overall production (Nyangoko et al., 2022). Consequently, women are particularly vulnerable to the degradation of natural resources, a situation exacerbated by their underrepresentation in decision-making roles and by their critical household responsibilities, particularly those related to ensuring food security for their families.

3.4. Environmental Degradation

The local environment currently faces a range of challenges, as evidenced by survey responses that identify critical areas requiring urgent attention. The study highlights four interrelated environmental issues affecting Tumbatu Island, each presenting distinct yet interconnected opportunities for positive change.

First, the rising tide of waste pollution is a pressing concern, threatening pristine waters and delicate habitats that sustain local biodiversity. Secondly, the striking reduction in essential mangrove cover diminishes the island's natural defences against coastal erosion and disrupts the vital ecosystems they support. Moreover, the island is experiencing moderate to high levels of coastal erosion, which is gradually eroding the shoreline and endangering both natural landscapes and human infrastructure. Lastly, the alarming deterioration of water quality poses significant risks to water

security, affecting community health and livelihoods.

Collectively, these pressing challenges paint a sobering picture of an ecosystem under strain, yet they also present a pivotal opportunity for collective action and restoration, allowing us to foster a more resilient and vibrant environment for future generations.

3.4.1. Increased Solid Waste Pollution

Waste pollution has surfaced as a critical environmental challenge that demands urgent and thoughtful intervention. Many community members have observed a troubling increase in solid waste levels, primarily attributable to unsustainable disposal practices. The prevalent methods include open dumping and burning, while recycling and sorting remain strikingly underutilised, indicating a clear opportunity for improvement. A comprehensive analysis of primary household waste disposal methods on Tumbatu Island unveils some striking trends. Open dumping has become the dominant practice among residents, with nearly 78% relying on it. In contrast, only a small fraction of the population burns their waste, underscoring the need for more effective waste management solutions.

One of the most significant environmental repercussions of this extensive open dumping is the direct impact on the island's coastline. Uncontrolled waste is frequently swept into the ocean, where it is transported by ocean currents and tidal action. This creates a troubling feedback loop, as waste is often redeposited on the island's pristine shores, further degrading the landscape's natural beauty. To mitigate this pressing issue, fostering community engagement in sustainable waste management practices, such as enhancing recycling efforts and implementing sorting systems, will be essential. By taking proactive steps to promote environmentally responsible behaviours, the community can break the cycle of pollution and work towards a healthier, cleaner environment for future generations.

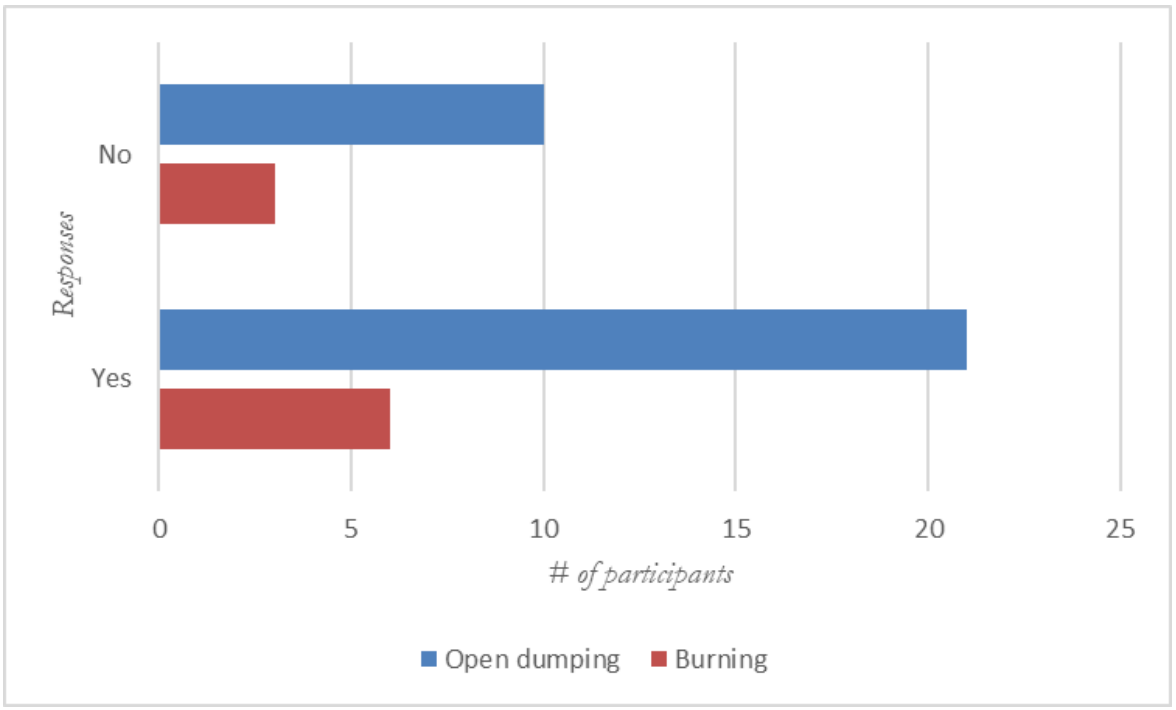

Figure 5. The open dumping vs burning for household waste disposal

The widespread reliance on environmentally harmful practices presents a significant opportunity to improve waste management. The practice of open dumping not only contaminates soil and water but also creates inviting habitats for disease-carrying vectors, posing a threat to public health. Simultaneously, open burning releases a cocktail of harmful toxins and particulate matter into the atmosphere, thereby compounding risks to public health and accelerating environmental degradation. Survey data clearly highlight the urgent need for innovative, sustainable waste management solutions. These could include comprehensive improvements to waste-management infrastructure and robust educational initiatives to address the pressing challenges posed by plastic waste. Implementing these strategies will be instrumental in transforming the current crisis into an opportunity for a healthier future.

Moreover, it is heartening to discover that respondents recognised household organic waste as a valuable resource for natural fertilisation. This practice is not only fundamental to enriching soil fertility but also transformative for agricultural productivity. By harnessing this organic material, we can bolster crop yields and promote sustainable agricultural practices. Through collective commitment to these eco-friendly initiatives, we can effectively address waste management challenges and foster a sustainable environment for future generations.

3.4.2. Decreased Mangrove Cover

The preservation of mangrove forests on Tumbatu Island presents an important environmental opportunity that the local community is eager to address. These remarkable coastal ecosystems,

characterised by their intricate root systems and vibrant biodiversity, play a crucial role in safeguarding both the environment and residents' livelihoods. The health of the mangroves is intricately woven into the daily lives of the community, who rely on these rich habitats for resources, protection from coastal erosion, and a thriving fishing industry. Recent observations have highlighted changes in mangrove cover, prompting a heightened sense of urgency and responsibility among local residents. The lush greenery that once dominated the shoreline is gradually giving way to areas of decline, prompting widespread reflection on the need for conservation.

A recent survey provides data on this pressing issue, revealing that approximately 85% of participants have observed a concerning decline in mangrove cover. This statistic not only underscores the gravity of the situation but also reflects a strong awareness and commitment within the community to address the challenge. With this collective understanding, Tumbatu Island is poised to undertake meaningful initiatives to restore and safeguard its mangrove ecosystems, ensuring that these natural treasures continue to thrive for generations to come.

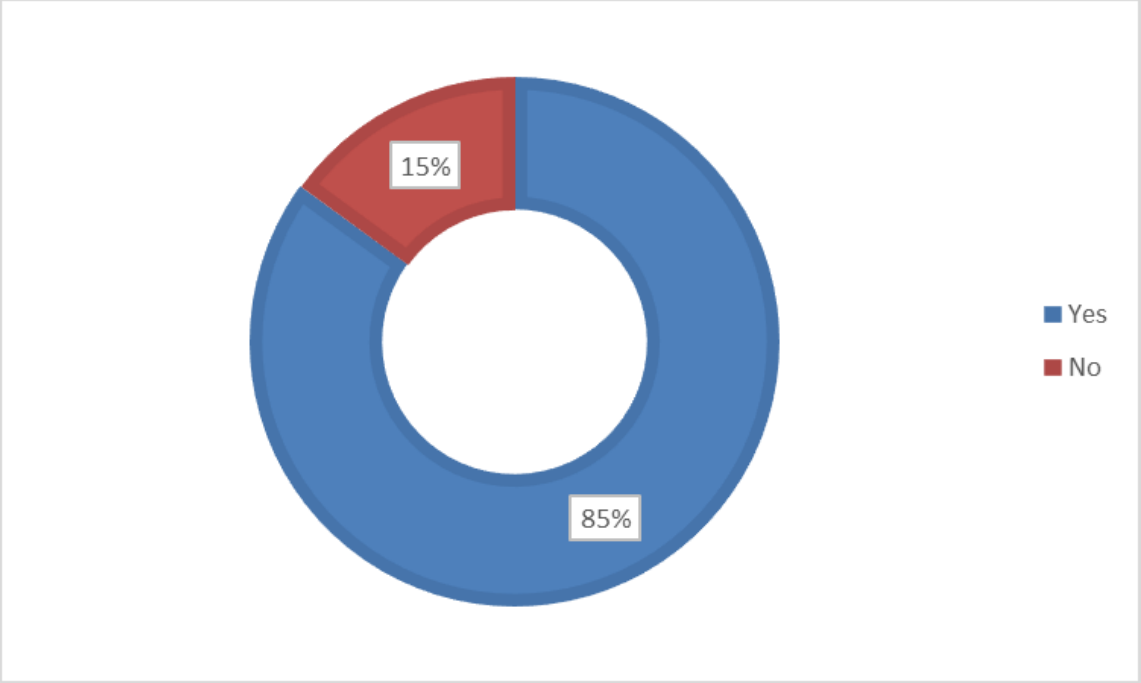

Figure 6. Decrease in mangrove cover on Tumbatu Island

This consensus underscores the pressing need to address the decline of vital natural resources, including mangrove ecosystems, which have historically provided a diverse array of essential ecosystem services. These remarkable services include protecting delicate coastlines from devastating storm surges and erosion, providing rich nursery habitats that nurture juvenile fish and sustain commercially important fisheries, and supplying sustainable materials for construction, fuel,

and other vital community needs. Acknowledging this decline not only emphasises the urgency of environmental stewardship but also reveals the intricate web of socio-economic implications that arise from it. Ecologically, the protection and restoration of mangroves are paramount for maintaining biodiversity, which in turn enhances the ecosystem's carbon sequestration capacity and plays a crucial role in combating climate change. Additionally, healthy mangrove forests serve as natural barriers, bolstering coastal defences against the increasing frequency of natural disasters.

Economically, revitalising these ecosystems can lead to thriving fisheries, empowering local communities, and boosting incomes associated with fishing. Furthermore, safeguarding mangroves ensures a sustainable supply of natural resources essential for traditional crafts and construction projects. It also has the potential to reduce future costs associated with coastal management and disaster recovery, thereby alleviating financial pressures on communities and local governments. By shifting our focus to the restoration and protection of mangrove cover, we can advance ecological integrity and economic resilience across the region, paving the way for a harmonious and sustainable future for all stakeholders.

3.4.3. High Severity Coastal Erosion

Coastal erosion on Tumbatu Island is closely linked to mangrove loss. The responses about the state of coastal erosion are presented in **Error! Reference source not found.**. The results show that community members rated the severity as moderate to high. The degradation of natural coastal buffers, such as mangroves, increases shoreline vulnerability to wave action, leading to the gradual loss of land. This poses a direct threat to infrastructure, housing, and the very land upon which community livelihoods depend.

Coastal erosion on Tumbatu Island is linked to the widespread loss of mangrove forests, especially *Rhizophora mucronata*. These vital ecosystems traditionally act as a natural barrier, absorbing wave energy and stabilising sediment with their dense root systems. However, their degradation has severely compromised this protective function, leaving the island's shoreline increasingly exposed and vulnerable to the relentless forces of the sea. This has initiated a cycle of gradual yet persistent land loss that threatens the community's very foundation.

The local community's perception of this environmental crisis is clearly documented in **Error! Reference source not found.**. The survey results indicate that most respondents reported coastal erosion as moderate to high in severity. This assessment is not merely anecdotal; it directly reflects the observable impacts on their daily lives and environment. The disappearance of the mangroves has directly led to more intense wave action, which now encroaches farther inland with each passing season.

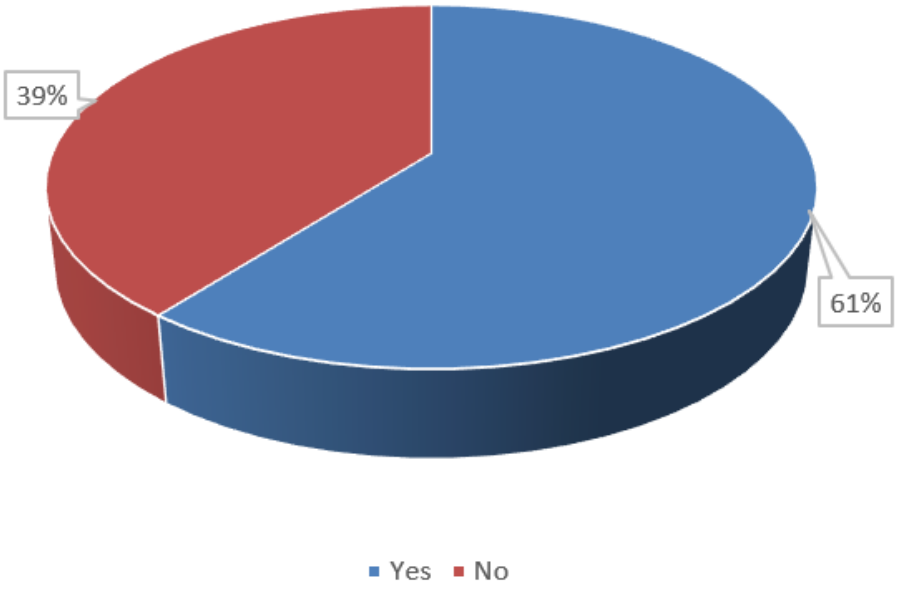

Figure 7. Moderate to high severity of the coastal erosion in Tumbatu Island

The persistent erosion of Tumbatu Island's coastline poses significant challenges that prompt the community to develop adaptive strategies to safeguard its infrastructure, housing, and the land that sustains its livelihoods. As the majestic shoreline gradually retreats, opportunities arise to fortify homes and public structures against the relentless forces of nature, while also exploring innovative methods to protect the island's lush agricultural lands and vital natural areas from the encroaching sea.

This pressing environmental issue, particularly the deforestation of vital mangrove ecosystems, can catalyse a collective call to action. It encourages residents to work together to preserve their safety, economic stability, and the rich cultural heritage that defines Tumbatu Island. By embracing sustainable practices, the community can not only confront these challenges head-on but also enhance its resilience, ensuring a harmonious coexistence with its breathtaking environment for generations to come.

3.4.4. Extreme Water Scarcity

Tumbatu Island is grappling with a range of environmental challenges, chief among them a critical water security crisis that severely impacts its residents' everyday lives. Many households face severe water scarcity, with reports indicating that some lack reliable access to safe drinking water for 3 to 8 months each year. This chronic shortage not only disrupts daily routines but also compels community members to dedicate significant time and effort to locating water for essential tasks such as drinking, cooking, and maintaining sanitation.

The islanders primarily depend on three water sources: free untreated water (47.37%), free treated water (28.95%), and water procured from private vendors (23.68%). While these sources provide some relief, they fall woefully short of meeting the community's needs. The public tap system, emblematic of the challenges faced, is often unpredictable and regularly out of service. As a result, residents increasingly rely on private vendors with access to larger, more efficient rainwater-harvesting facilities, enabling them to replenish their supplies more reliably than most households can.

This heavy reliance on purchased water places an undue financial burden on families already grappling with poverty, further exacerbating their vulnerability to environmental stresses like drought. Yet, within this pressing crisis lies an opportunity for innovative solutions that could significantly improve access to and security of water for the people of Tumbatu Island. By addressing these challenges head-on, the community can enhance its resilience and improve the overall quality of life for its residents.

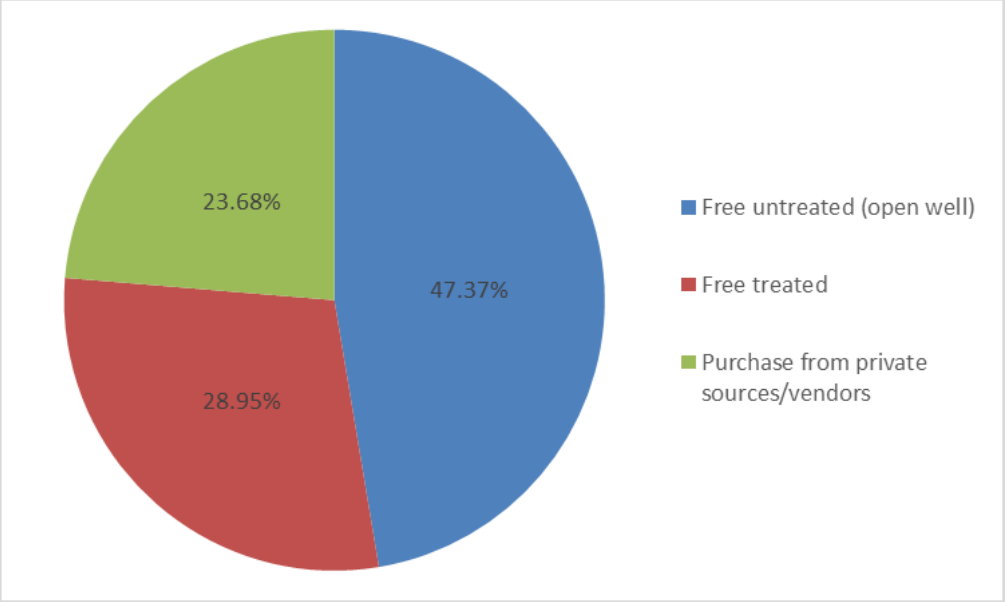

Figure 8. The water sources for the local community on Tumbatu Island.

This situation underscores the pressing need for innovative solutions to alleviate the financial burden on struggling households. By empowering these families to allocate their limited resources more effectively, we can help them prioritise essential needs such as nutritious meals, accessible healthcare, and quality education, thereby enriching their lives. Enhancing access to reliable, safe water sources not only strengthens community resilience but also significantly reduces reliance on costly purchased water and vulnerable open wells. During extended droughts, when well-water levels decline and the price of delivered water rises, turning the challenge of water insecurity into a pressing call for proactive community engagement can lay the groundwork for effective emergency

preparedness.

This approach fosters a culture of support and collaboration, ultimately leading to sustainable resource management that benefits both individuals and the community. By nurturing these connections, we can create a thriving environment in which everyone has the means to succeed, even in the face of adversity.

3.5. Existing Environmental Conservation Strategies

On Tumbatu Island, four key strategies for enhancing environmental conservation have been identified: leveraging beekeeping, developing mangrove-based aquaculture, promoting ecotourism, and implementing effective recycling initiatives. This report highlights respondents' level of interest in these important conservation measures.

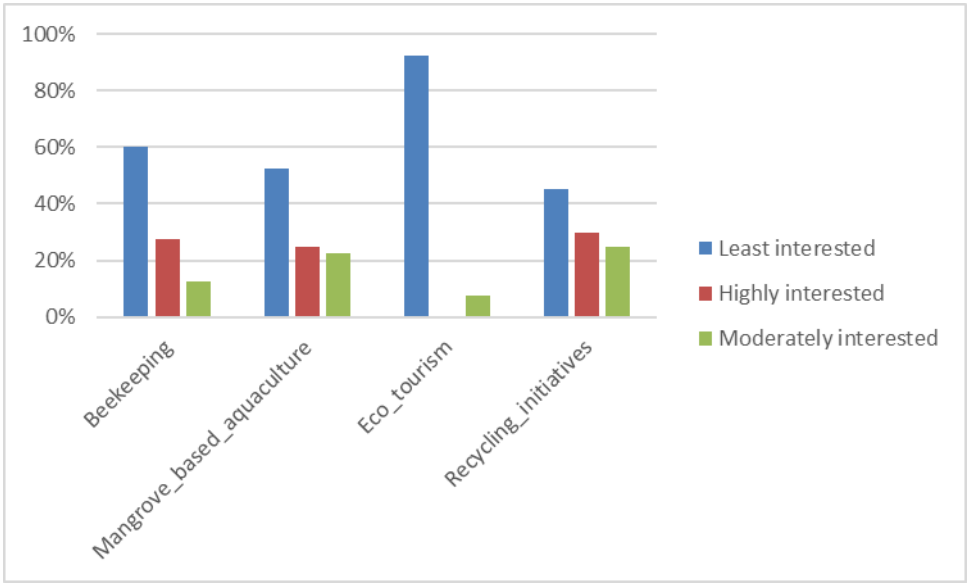

Figure 9. Level of interest in the existing environmental conservation strategies in Tumbatu Island.

3.5.1. Beekeeping Potential

The survey results indicate a significant opportunity to develop beekeeping in the lush, biodiverse mangrove forests, despite approximately 60% of respondents currently showing limited enthusiasm for this endeavour. This disinterest stems from a convergence of factors, including a widespread lack of knowledge and technical expertise, sociocultural norms that pigeonhole beekeeping as a male-oriented activity, often encapsulated in the phrase "It is for men," and a natural apprehension of bees. Additionally, many individuals prefer to pursue faster-growing income-generating activities, viewing beekeeping as a long-term commitment that yields rewards. In contrast, the current reliance on mangroves primarily for harvesting firewood and building materials underscores a pressing reality: many communities prioritise immediate survival needs over sustainable practices, even in the face of prohibitions against such resource exploitation.

However, there lies a glimmer of hope in the potential synergy between beekeeping and conservation efforts. Encouragingly, around 40% of respondents recognised that this harmonious integration could serve as a powerful catalyst for mangrove protection by creating direct economic benefits. As several respondents noted, strategically placing beehives can serve as a natural deterrent to tree-cutting, encouraging preservation through both the economic value they generate and the practical barriers they create. This scenario illustrates a promising pathway to foster sustainable livelihoods while championing the conservation of these vital ecosystems.

3.5.2. Mangrove-based Aquaculture System

Mangrove-based aquaculture emphasises a shift away from traditional, often destructive farming that clear-cuts mangroves. The core principle is integration, not replacement. Rather than removing mangroves to create ponds, the aquaculture system is designed to operate in harmony with the mangrove forest. The survey results indicate that the majority of respondents (approximately 52%) expressed the least interest in pursuing mangrove-based aquaculture. This prevalent disinterest appears to stem primarily from a self-reported lack of knowledge and technical skills required for this specific practice.

In contrast, a significant proportion of respondents (about 48%) acknowledged the potential environmental benefits of mangrove-based aquaculture. They recognised that, if implemented sustainably, it could enhance local marine biodiversity and alleviate anthropogenic pressure on other critical ecosystems surrounding Popo Island, such as coral reefs and seagrass meadows. This is particularly crucial as Popo Island has been identified as a potential breeding and nursery ground for a wide variety of marine species. The proximity of mangroves to these habitats makes their conservation and sustainable use a key factor in ensuring the overall health and resilience of the island's marine ecosystem.

3.5.3. Promoted Eco-tourism

The survey results indicate a significant trend: approximately 92.7% of respondents expressed limited enthusiasm for eco-tourism initiatives on Tumbatu Island. This prevailing sentiment creates opportunities for meaningful discussions about the underlying concerns and potential solutions to foster a thriving tourism sector. Many locals harbour fears that the introduction of eco-tourism could disrupt cherished social norms and imperil the island's rich cultural heritage and traditional values.

However, this context also presents a valuable opportunity to raise awareness of the myriad benefits that responsibly managed eco-tourism can provide, including economic diversification, job creation, and environmental conservation. Key areas ripe for enhancement include establishing

robust funding mechanisms for initial investments and ongoing operations, expanding access to training and skills development necessary to manage sustainable tourism enterprises, and strengthening enforcement mechanisms to ensure compliance with environmental and cultural protection regulations.

In addition, addressing governance complexities such as political interference and jurisdictional conflicts among governing bodies will be vital to establishing a stable, supportive environment for sustainable tourism initiatives. By addressing these challenges and harnessing the unique potential of Tumbatu Island, we can build a more sustainable and prosperous future for the community and its natural surroundings.

3.5.4. Recycling Initiatives

The Tumbatu island community has demonstrated a strong commitment to recycling, with 55% of survey participants reporting moderate to high interest. This enthusiasm stems from a blend of environmental stewardship and practical advantages. A key motivator for many households, particularly those with gardens or small farms, is the economic benefits of converting organic waste into compost or manure. This practice not only supports sustainable farming but also provides a free, nutrient-rich soil amendment, decreasing reliance on commercial fertilisers.

Despite strong community support for recycling initiatives, the rising volume of waste poses a challenge. This contrast between public intention and environmental outcome highlights the need for effective systems to translate goodwill into actionable strategies. To address this, it is essential to improve recycling and waste management infrastructure. The current lack of facilities for sorting, processing, and repurposing materials means that many recyclable items, unfortunately, end up in general waste or litter. By enhancing this infrastructure, we can better align community support with real environmental change, breaking the cycle in which increased consumption contributes to environmental degradation.

Additionally, the community has a clear understanding of the health risks associated with poor solid waste management. Concerns about disease-carrying pests, water contamination, and respiratory health risks from burning waste are prevalent. This knowledge reinforces the importance of establishing formalised recycling programs, as the community recognises the direct connection between public health and a clean environment. Ultimately, the community's interest in recycling reflects a strong desire for personal improvement and collective well-being, fostering a healthier and more sustainable future for everyone.

3.6. Climate Change Adaptation

3.6.1. Climate Shocks Facing Community Members in Tumbatu Island

The vibrant community on Tumbatu Island is courageously tackling a diverse array of environmental challenges that define the climate crisis. Strong winds, with their relentless gusts that whip through the landscape, have emerged as the foremost concern, with approximately 65% of residents deeming them the primary climate shock. These fierce winds disrupt household livelihoods, causing severe damage to homes and significantly reducing fishing yields, an essential source of sustenance for this close-knit community. In addition to strong winds, the islanders face a range of other climate-related issues, including prolonged droughts that parch the land, erratic rainfall patterns that disrupt planting cycles, and the slow but steady rise in sea levels that threatens their shores. While some community members perceive these secondary shocks as less urgent, they still contribute to a troubling narrative of crop failures and creeping food and water insecurity, which undermine the population's overall health and well-being.

In light of these pressing challenges, the community has expressed a clear desire for support with adaptation. A palpable sense of unity and purpose has emerged around the urgent need for mangrove restoration, coupled with the establishment of enforceable local bylaws to safeguard these vital coastal ecosystems. The community recognises mangroves not only as lush, biodiverse habitats but also as essential natural barriers that protect against the ravages of climate change, particularly sea-level rise.

Furthermore, there is strong demand for education and capacity-building initiatives, reflecting the community's determination to acquire the knowledge and skills needed to develop sustainable, long-term solutions. This proactive approach underscores their resolute commitment not just to endure but to thrive amidst the tumult of climate change, ensuring a resilient and flourishing future for generations to come.

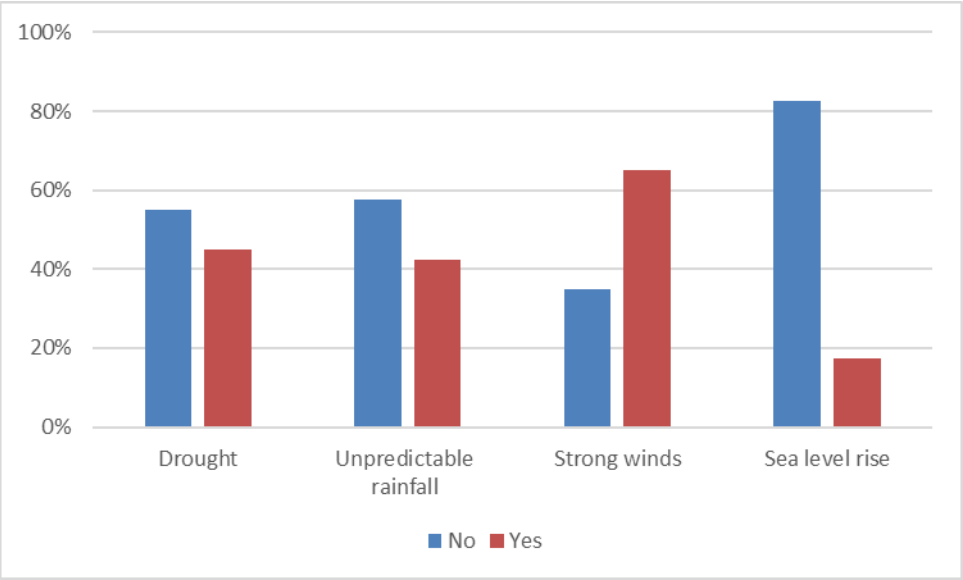

Figure 10. Climate shocks are facing community members in Tumbatu.

3.6.2. Climate Adaptation Strategies in Tumbatu Island

The community's adaptation strategies demonstrate a dynamic blend of collective and individual efforts, with particularly impactful initiatives such as mangrove replanting, innovative rainwater-harvesting techniques, and the construction of resilient housing designed to withstand storms. However, it is disheartening to note that approximately 18% of households remain without any adaptation strategies Figure 10, often feeling a sense of helplessness or believing that their circumstances are insurmountable.

Conversely, the remaining 82% of respondents who actively pursue adaptation measures tend to view their effectiveness as only moderate, indicating a significant room for improvement. This scenario reveals an invaluable opportunity: while the community is well aware of the critical actions necessary for resilience, such as restoring the vital ecosystems of degraded mangroves, capturing and utilising rainwater, and reinforcing homes against extreme weather, the potential for greater impact lies in enhanced collaboration.

Furthermore, integrating strategies such as diversifying livelihoods, cultivating drought-resistant crops, and promoting mixed farming could greatly increase their adaptive capacity. By leveraging available resources and fostering a cohesive, community-driven approach, these vital adaptations can be implemented more effectively, ultimately leading to a more resilient future.

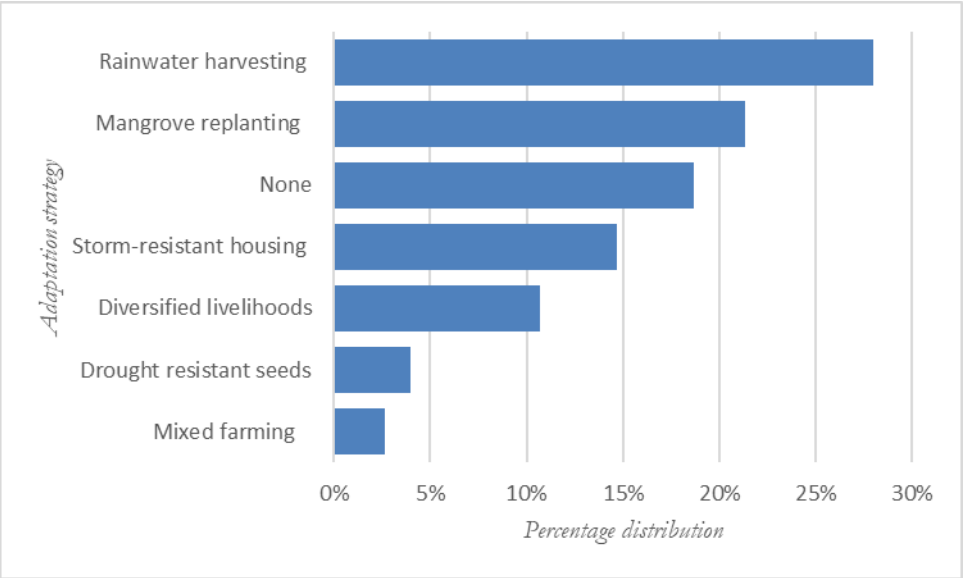

Figure 11. Per cent distribution of climate change strategies.

3.6.3. Climate Adaptation Capacitation

The implementation gap presents a significant opportunity to strengthen community planning structures. While some participants have actively engaged in dynamic workshops and capacity-building initiatives offered by both state and non-state actors, a considerable number of community members have yet to establish a consistent, structured community schedule to effectively address the pressing challenges posed by climate change **Error! Reference source not found.**. Descriptions of the current planning process often highlight areas for improvement, using terms such as "not operating ", "currently operating", and "low management." This language points to a need for a transformative shift toward more inclusive, grassroots strategies that could effectively convert existing awareness into sustainable, impactful action.

Encouragingly, the study found that approximately 84% of the community has access to vital weather and climate information. This widespread access provides a robust foundation for improving communication and collaboration, ultimately empowering the community to navigate and respond to climate challenges more strategically and cohesively.

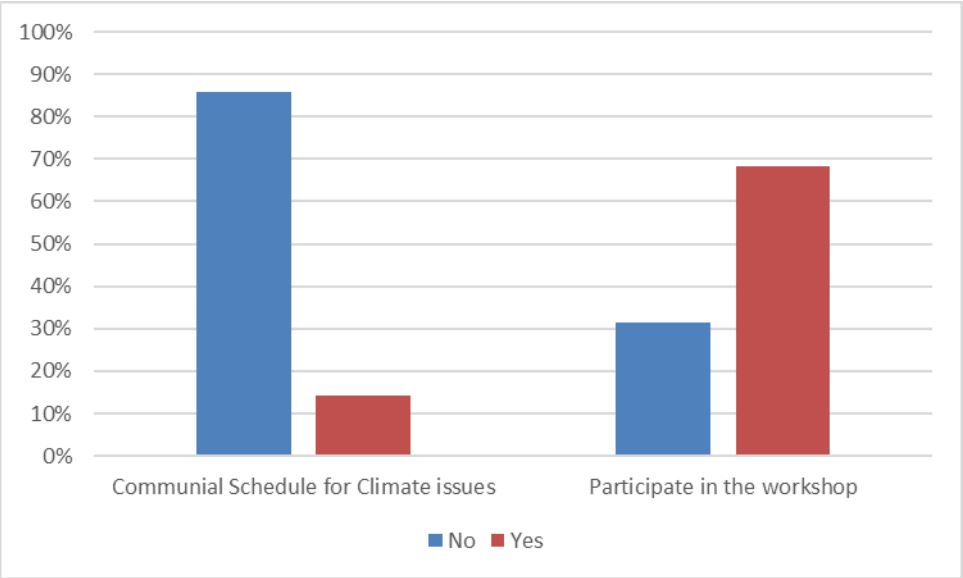

Figure 12. Community participation in climate capacitation workshops and seminars

A significant asset in the community's resilience is its access to weather information, predominantly through the familiar and trusted medium of radio **Error! Reference source not found.**. This channel resonates deeply with many residents, enabling them to confidently make informed decisions about their daily livelihoods and safety. The tangible impact of this information underscores a solid foundation for developing an even more robust early-warning system. By leveraging this well-established communication infrastructure, we can go beyond mere forecasts. We could offer tailored adaptation advisories that link timely and accurate weather data to actionable preparedness steps. This enriched approach would not only enhance the community's responsiveness but also empower individuals to navigate challenges with greater assurance and foresight.

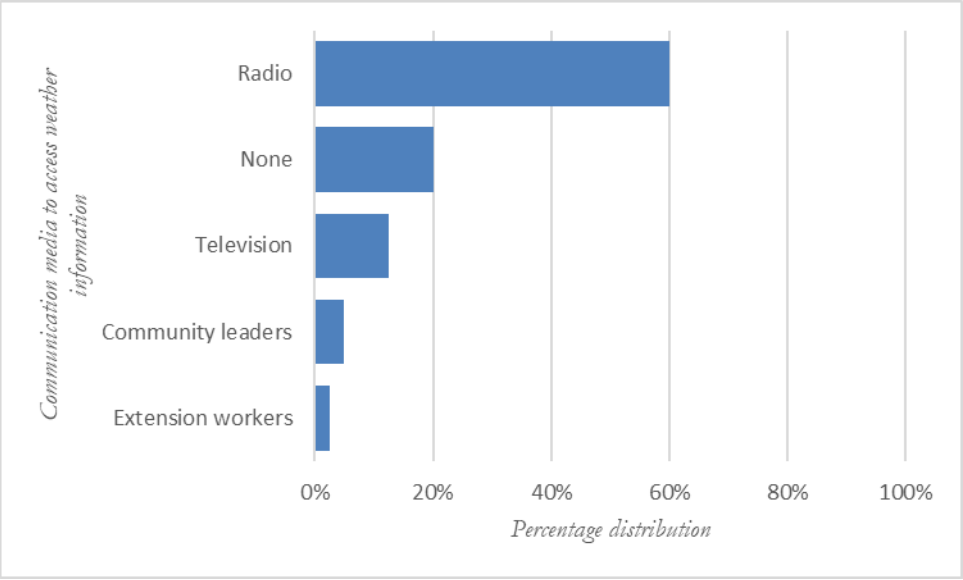

Figure 13. Means of access to weather and climate information.

3.7. Resource Governance and Coordination

3.7.1. Resolution Mechanism for Natural Resources Disputes

The effective management and utilisation of natural resources are essential for ensuring their long-term sustainability. A recent survey provides illuminating insights into the pivotal role of local leaders in addressing community conflicts. **Error! Reference source not found.** indicates an impressive 90% of respondents expressed strong confidence in these leaders' ability to navigate and resolve community issues. Only a small fraction, approximately 10%, indicated ambivalence or disagreement, indicating robust confidence in local leadership. This trust reflects the community's recognition of their leaders as effective mediators capable of fostering unity and understanding.

Furthermore, traditional leaders are a cornerstone in resolving disputes, particularly those concerning valuable resources. The survey results clearly illustrate this trend, with approximately 95% of participants reporting that traditional leaders are the most relied-upon avenue for conflict resolution. This overwhelming endorsement underscores the critical role these figures play in maintaining community harmony and managing resource-related challenges, thereby promoting social cohesion and sustainable practices.

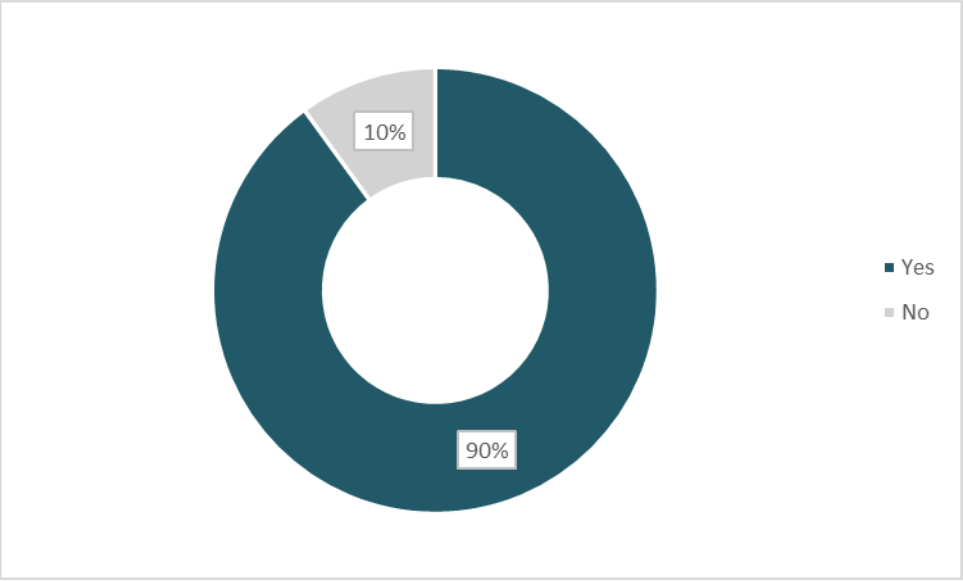

Figure 14. The capability of the local leaders in solving community conflicts

Government mediators play a crucial role as an alternative for conflict resolution within the community, although they are utilised by only 57% of respondents. In contrast, formal judicial institutions, such as local courts, are the least favoured option, with a mere 27% indicating their involvement in conflict resolution. This data paints a vivid picture of the community's reliance on

deeply entrenched informal practices and traditional methods. There's a notable inclination towards customary systems, guided by respected traditional authorities, rather than the more formal structures of government and judiciary. This preference suggests that strengthening and celebrating these traditional practices could significantly enhance community unity and foster more effective and relatable avenues for resolving conflicts **Error! Reference source not found.**.

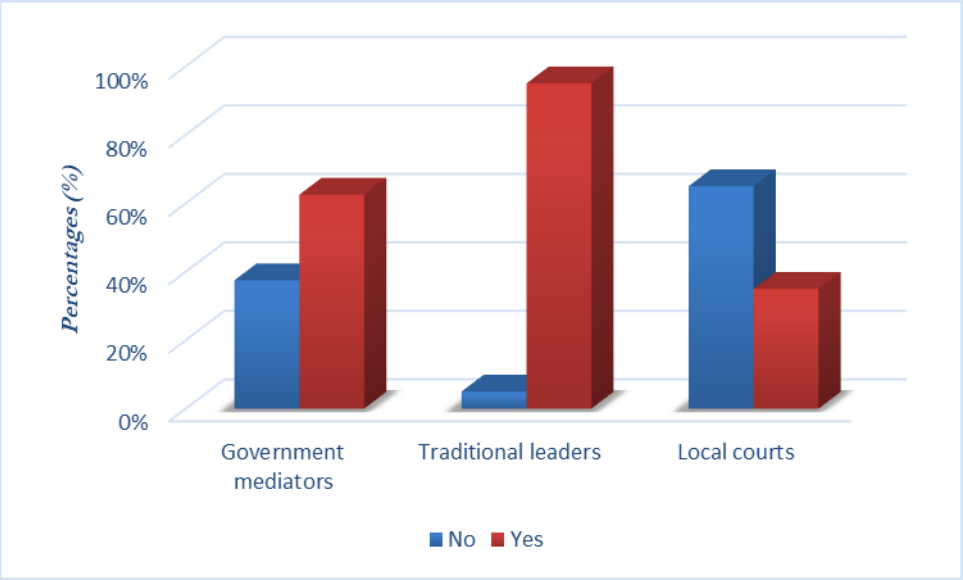

Figure 15. Conflict resolution mechanisms in Tumbatu Island.

Survey data indicate that the use of authority is the predominant method of conflict resolution, endorsed by 96% of respondents. This approach is often enhanced by the integration of incentives, a strategy reported by approximately 40% of participants, which provides an additional layer of motivation to the resolution process. While decisions made through authoritative channels can effectively provide swift and decisive outcomes, it's crucial to acknowledge the inherent limitations of this approach.

When resolution relies exclusively on hierarchical power, it may create perceptions of unfairness or lack of legitimacy among those involved. Consequently, this can lead to feelings of resentment or compliance devoid of genuine commitment. To cultivate a more positive and constructive atmosphere, fostering a collaborative environment is essential. This could involve creating spaces for open dialogue and engagement, where consensus can be built organically and integrating tangible incentives that align diverse interests. By doing so, the process can become one in which each participant feels valued and empowered, ultimately leading to more sustainable and mutually agreeable solutions that resonate with all parties involved.

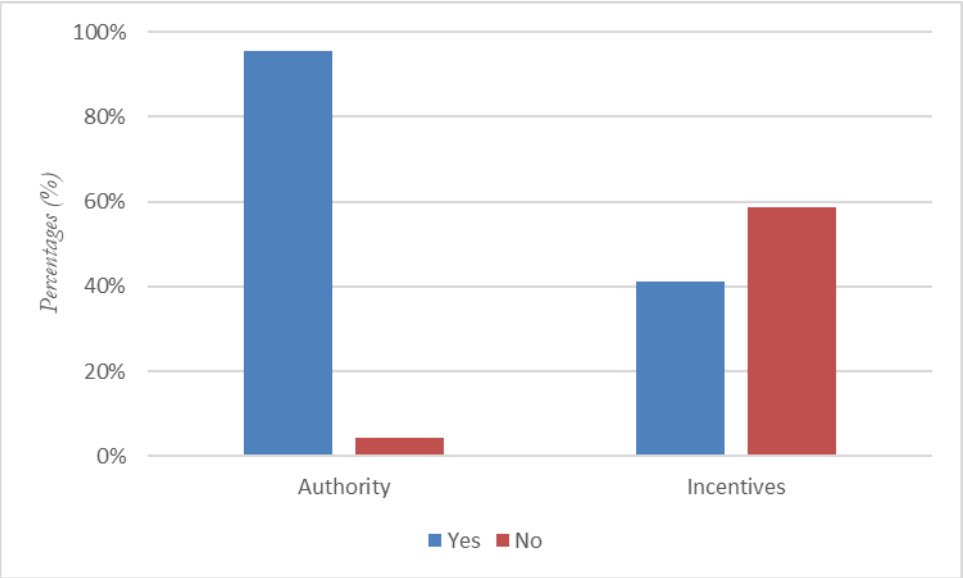

Figure 16. The common method used for conflict resolution.

3.7.2. Accountability and Coordination in Natural Resources Management

Accountability and transparency are vital cornerstones of effective governance, particularly in natural resource management. They serve not only as benchmarks for measuring success but also as essential components in fostering public trust and engagement. A recent survey provided insight into respondents' perceptions of their leaders' accountability and transparency in budget allocation for environmental and climate change initiatives. The results reveal a landscape marked by uncertainty and a pressing need for enhanced public awareness. A striking 50% of participants selected the response "I don't know," reflecting a troubling gap in understanding, while 37% affirmed the leaders' efforts with a "Yes," and 14% responded "No."

This substantial proportion of uncertain responses underscores a critical opportunity to improve communication strategies. It highlights the need for government bodies to clearly articulate how public funds are being managed and directed towards essential environmental issues. By reframing this dialogue, we can not only clarify the intentions behind financial decisions but also empower the community, foster greater trust, and cultivate a more informed public discourse on the challenges and initiatives that shape the planet's future.

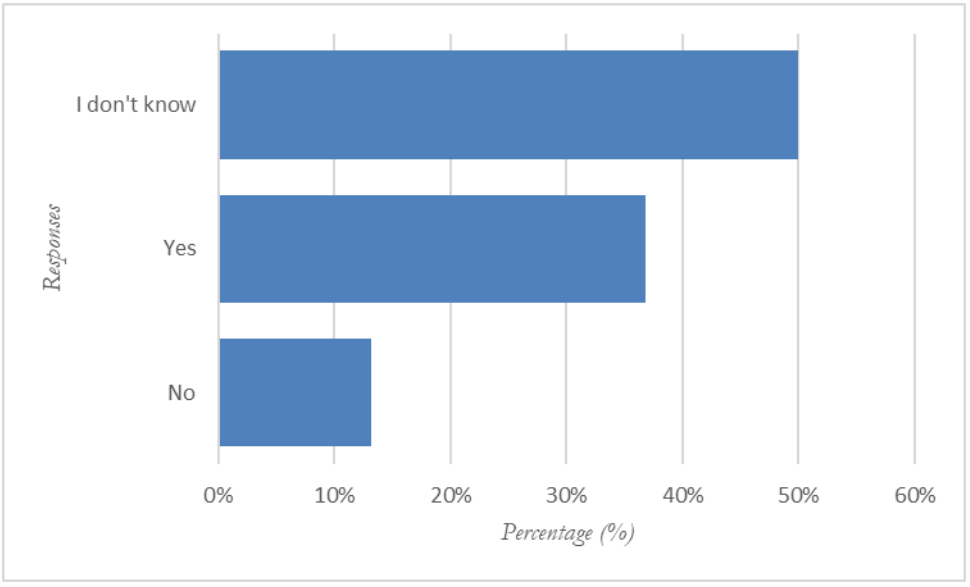

Figure 17. Community perceptions of leaders' accountability and transparency.

The current landscape presents a compelling opportunity to enhance transparency and financial accountability, two pillars essential for cultivating public trust and optimising resource allocation. By engaging more effectively with diverse community segments during consultations, the project can create meaningful dialogue that not only gathers public input but also fosters a shared understanding of budgetary priorities. This shift towards a more inclusive approach in decision-making processes is expected to empower stakeholders and enrich community engagement.

Additionally, addressing the existing challenges in stakeholder coordination on Tumbatu Island is vital for unlocking the full potential of natural resource management. Strengthening vertical and horizontal alignment across national, regional, and local government levels, and fostering horizontal collaboration among various community groups, NGOs, and private sector actors, can enhance governance structures. Such collaborative efforts can lead to more cohesive and effective implementation of conservation and sustainability initiatives, ultimately benefiting the entire ecosystem.

The analysis of key barriers to climate policy implementation within local community initiatives vividly illustrates the critical challenges that lie ahead. The most significant hurdles, identified as funding gaps (33%) and bureaucratic delays (27%), illustrate urgent areas for intervention. By exploring innovative funding mechanisms and streamlining bureaucratic processes, the project can pave the way for new action. Moreover, bridging the information gap, as evidenced by the 25% who face information asymmetry, through the provision of clear, transparent, and easily accessible information can empower local communities, enabling them to make informed and strategic decisions.

Furthermore, establishing robust local feedback loops (10%) is crucial to creating a dynamic, responsive relationship between policymakers and the community. By facilitating continuous communication, we can nurture a collaborative environment where citizens' voices genuinely influence policy decisions. Addressing these multifaceted barriers with thoughtful and targeted strategies can transform the cycle of challenges faced by well-intentioned local policies. By ensuring the availability of both financial and human resources and by developing well-structured communication channels between various tiers of government and the communities they serve, we can significantly enhance the likelihood of success for these strategic policies, fostering a more resilient and sustainable future.

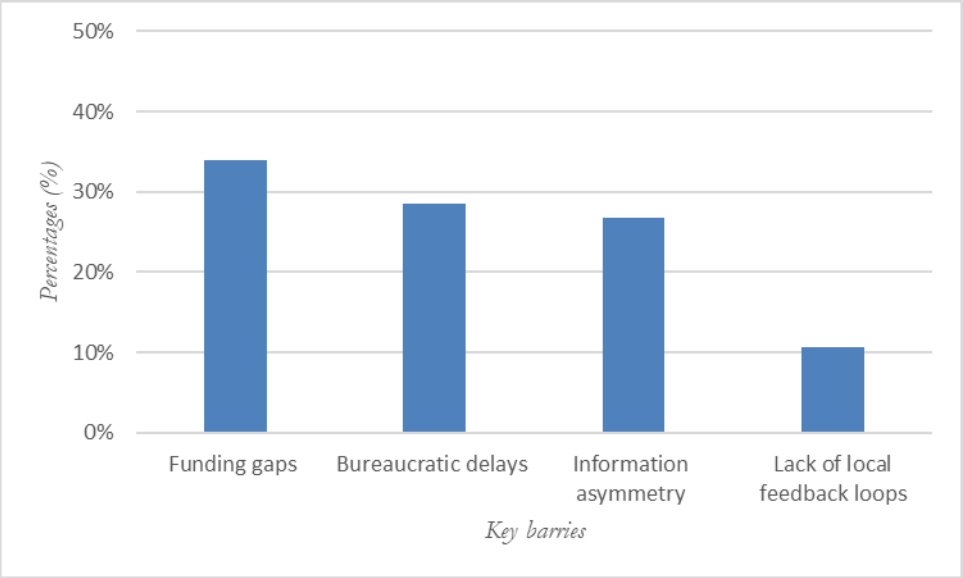

Figure 18. Key barriers for integrating climate policy in the local context.

CHAPTER 4

3. DISCUSSION, CONCLUSION AND RECOMMENDATIONS

3.1. Discussion

3.1.1. Interconnected Climate Vulnerability and Ecosystem Degradation

The findings illuminate the complex challenges currently faced by Tumbatu Island, presenting a pivotal opportunity for strategic intervention that spans the interrelated realms of climate, environment, and livelihoods. These intricate dynamic underscores a broader narrative seen across small island systems globally, where the health of natural ecosystems is inextricably linked to the resilience of communities.

The evidence gathered in this study paints a vivid picture of the critical issues at play: mangrove degradation, coastal erosion, water scarcity, and solid waste pollution. These are not mere isolated environmental concerns but rather deeply interconnected challenges that, if addressed holistically, can lead to profound and sustainable solutions. For example, the vibrant mangrove forests that line the coast serve as natural barriers, their complex root systems safeguarding shorelines by preventing erosion and stabilising sediments. Protecting these lush habitats not only shields vital agricultural lands and infrastructure from the ravages of storm surges but also enhances the rich biodiversity they support. In tandem, bolstering waste management systems can mitigate the impacts of marine and terrestrial pollution, fostering a cleaner, healthier environment that nurtures both ecosystem productivity and public health.

These findings resonate with global insights from the Intergovernmental Panel on Climate Change, which emphasises that coastal ecosystems are essential protective barriers for small island communities. The deterioration of these vital ecosystems heightens vulnerability to climate hazards, intensifying exposure and reducing the community's capacity to adapt.

In the vibrant context of Zanzibar, coastal ecosystems are not just environmental assets; they are lifelines that underpin fisheries productivity and the stability of local livelihoods. Thus, environmental decline heralds a direct threat to income security, amplifying socio-economic vulnerabilities in the community. By prioritising the restoration and preservation of these invaluable ecosystems, we unlock pathways to enhanced resilience. This proactive approach can bolster income security and promote sustainable development, ensuring that Tumbatu Island not only survives but thrives amid the challenges of our changing climate. Through collaboration and innovative, community-driven solutions, we can pave the way toward a more resilient and prosperous future for Tumbatu Island.

3.1.2. Livelihood Dependence and Limited Adaptive Capacity

The findings reveal a profound dependence on climate-sensitive livelihoods, particularly in fishing and small-scale agriculture. These crucial activities not only provide essential income streams for households but are also highly vulnerable to the whims of climate variability, manifesting as fierce winds, prolonged droughts, and erratic rainfall patterns. To cultivate resilience and ensure sustainable development, it is imperative to promote diversified livelihoods, even though many community members are aware of the environmental risks they face. This awareness highlights that vulnerability stems not merely from a lack of information but is also deeply entrenched in structural barriers, including:

- Limited access to financial resources that could enable investment in diverse opportunities
- A significant gap in technical skills that stifles innovation and adaptation
- Cultural norms that dictate livelihood choices, often limiting options to traditional practices
- Deep-seated perceptions of risk that hinder experimentation with new methods
- Fragile market linkages that restrict access to fair prices and reliable markets

Addressing these pressing challenges is vital to closing the adaptation gap in numerous coastal communities, where knowledge of climate risks coexists with constrained capacity to respond dynamically and effectively.

Furthermore, gender disparities play a critical role in magnifying vulnerability within these contexts. Women, who are often the backbone of household food security and resource management, frequently face lower incomes, limited access to financial resources, and minimal representation in decision-making processes. This disparity not only limits their adaptive capacity but also heightens households' overall vulnerability. By empowering women and fostering their participation in decision-making, we can enhance adaptive capacities across the board, leading to stronger, more resilient communities. Through collective efforts to dismantle these barriers, we can foster a more sustainable and equitable future for all.

3.1.3. Water Insecurity as a Critical Development Constraint

Water scarcity poses a formidable challenge for the community, but it also offers an opportunity to pave the way for innovative, sustainable solutions. When we prioritise access to safe water, we can significantly diminish both the economic and health burdens that have long affected our residents, while simultaneously strengthening our ability to withstand prolonged droughts.

Enhancing water security not only addresses immediate needs but also acts as a powerful catalyst

for transformative change:

- It has the potential to invigorate household productivity, allowing families to thrive and pursue economic opportunities.
- By reducing dependence on purchased water, we can alleviate financial stress and redirect funds towards other essential needs.
- Increased access to water can empower agricultural activities, promote food security and enable farmers to cultivate their land more effectively.
- Improved water access can lead to healthier communities by lowering the incidence of waterborne diseases and safeguarding public health.
- Ultimately, better water management fosters resilience against climate shocks, equipping our community to adapt and thrive in an ever-changing environment.

By confronting the issue of water access directly, we create the foundation for broader adaptation strategies that yield sustainable, positive outcomes for all community members.

3.1.4. Governance Strengths and Institutional Gaps

The governance assessment unveils a rich and intricate institutional landscape that presents both promising strengths and notable opportunities for growth.

On a positive note, communities display a robust trust in traditional leadership structures, which play a crucial role in conflict resolution and the management of local resources. This trust serves as an invaluable social asset, fostering an environment ripe for participatory governance and collective action, where local voices can meaningfully contribute to decision-making.

Conversely, several structural challenges hinder effective environmental management and must be addressed to fully harness this potential:

- Transparency in environmental budgeting is limited, detracting from stakeholder confidence and inhibiting collaborative efforts.
- Fragmented coordination among agencies leads to a disjointed approach, often resulting in overlapping responsibilities and missed opportunities for synergy.
- Bureaucratic delays in policy implementation can stall initiatives that require timely action, undermining the effectiveness of governance efforts.
- Insufficient community participation in planning processes restricts the inclusion of diverse perspectives, which are vital for developing well-rounded and sustainable solutions.

These findings illuminate that the challenges in governance extend beyond issues of legitimacy; they are fundamentally tied to enhancing institutional capacity, fostering coordination, and

bolstering accountability. To cultivate effective resource management, it is essential to strengthen collaboration among diverse stakeholders. This includes building robust partnerships among local governments, conservation authorities, and regulatory bodies such as the Zanzibar Environmental Management Authority. By uniting these efforts, we can create a cohesive, dynamic strategy that promotes environmental stewardship and engages communities in meaningful, impactful ways.

3.1.5. Conservation Opportunities and Social Acceptability

The study reveals a range of promising livelihood and conservation options with significant potential to enhance both ecological health and community prosperity. Among these options are recycling, which has garnered notable interest, as well as mangrove-based aquaculture, beekeeping, and eco-tourism, each offering unique benefits.

Recycling stands out as a particularly appealing choice for the community, largely due to its tangible economic advantages and improvements in public health. However, the uptake of other initiatives varies considerably, often hindered by social, cultural, and informational barriers that need to be addressed.

This observation highlights a crucial development principle: while the technical feasibility of these options is vital, it is far from the only factor influencing adoption. The intricate interplay among social acceptability, perceived risks, cultural traditions, and economic incentives shapes community engagement.

To foster successful interventions, it is essential to weave together several key elements:

- Cultivating awareness and driving behavioural change to inspire community involvement
- Offering tailored skills development to empower individuals and enhance their capacity
- Implementing demonstration pilots that effectively showcase the benefits and feasibility of these initiatives
- Providing attractive financial incentives to motivate participation and investment
- Ensuring active community involvement in the design and planning stages, fostering ownership and commitment

By focusing on these enriching and integrated approaches, we can significantly improve the chances of successful adoption and long-term sustainability of diverse livelihood and conservation strategies.

3.1.6. Climate Information and Community Preparedness

Access to weather and climate information through radio is a vital resource that enhances

community resilience. Despite its importance, existing information systems primarily emphasise forecasts, often overlooking the need for actionable guidance that can directly impact daily decision-making. By effectively linking climate information to advisory services, we can significantly enhance adaptive capacity, empowering communities to make informed choices about their livelihoods. Achieving this vision will require fostering deeper collaboration with key institutions, such as the Tanzania Meteorological Authority, to create a more integrated approach that meets the diverse needs of those affected by climate variability.

3.2. Conclusion

This baseline assessment provided an insightful exploration into the complex interplay of environmental, socio-economic, and institutional dynamics shaping climate resilience on Tumbatu Island. The findings illuminate a critical landscape where ecological degradation, livelihood vulnerability, and governance challenges converge, presenting both significant risks and potential pathways toward enhanced adaptive capacity. At the heart of the ecological challenges is the island's precious natural resource base, encompassing vibrant mangrove ecosystems, dynamic coastal zones, and vital freshwater systems. These ecosystems not only act as living barriers against the relentless forces of nature, safeguarding shorelines from erosion, but they also underpin local fisheries, regulate water availability, and foster a rich tapestry of biodiversity. The ongoing degradation of these ecological treasures represents a profound loss not merely in environmental terms, but as a direct threat to the livelihoods and safety of the community members who rely on these resources. This decline echoes global trends identified by the Intergovernmental Panel on Climate Change, highlighting the urgent need for innovative strategies to bolster the resilience of small island and coastal communities.

Further accentuating the significance of these findings is Tumbatu's location within the Tumbatu Marine Conservation Area (TUMCA), a unique ecological sanctuary that plays a pivotal role in fostering regional biodiversity and sustaining fisheries productivity. The continued decline of these ecosystems presents not only challenges for the immediate community but also poses risks to the intricate balance of marine ecological health, ultimately affecting long-term resource sustainability across the region.

On the socio-economic front, the analysis reveals that household livelihoods are intricately linked to climate-sensitive activities, primarily fishing, petty business, and small-scale agriculture. While this reliance on natural resources presents vulnerabilities, it also offers an opportunity to diversify income sources, thus providing a buffer against climate-related shocks such as fierce winds, prolonged droughts, and unpredictable rainfall patterns. Addressing the underlying issues of income inequality and gender disparities is crucial; empowering women to gain equitable access to

financial resources, livelihood assets, and decision-making roles can significantly enhance the community's capacity to adapt to climate risks. By focusing on these multidimensional challenges and opportunities, Tumbatu Island can cultivate a more resilient and sustainable future for its residents, fostering a community that thrives amid environmental changes. This baseline assessment provides an insightful exploration into the complex interplay of environmental, socio-economic, and institutional dynamics shaping climate resilience on Tumbatu Island. The findings illuminate a critical landscape where ecological degradation, livelihood vulnerability, and governance challenges converge, presenting both significant risks and potential pathways toward enhanced adaptive capacity.

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The study offers a compelling exploration of the intricate relationship between community engagement and environmental sustainability, revealing both challenges and promising opportunities for progress. It highlights a significant disconnect between heightened awareness of environmental degradation and the effective implementation of sustainable practices within the community. While residents clearly acknowledge the urgent threats posed by environmental issues, the movement towards adopting alternative livelihoods and conservation initiatives remains inconsistent. Influencing factors such as cultural perceptions, varying levels of technical knowledge, financial constraints, and uncertainty about economic returns all play critical roles in shaping how communities engage with proposed interventions. Thus, to effectively build resilience, it's essential to shift focus from mere awareness-raising to fostering sustained capacity development and transformative livelihood strategies.

In addition, governance and institutional dynamics are crucial aspects of vulnerability that warrant deeper examination. Traditional leadership structures are respected and remain influential, particularly in conflict resolution and community organisation. However, the need for enhanced cohesion and coordination among various institutions is evident. Increasing transparency in environmental financing, fostering stronger integration across governance levels, and creating

robust mechanisms for meaningful community participation can all play pivotal roles in improving natural resource management. By addressing these institutional shortcomings, we can enhance the effectiveness of policies and accelerate the implementation of locally relevant adaptation measures. Consequently, fortifying governance systems is as imperative as pursuing ecological restoration and diversifying livelihoods to achieve enduring resilience.

Water insecurity emerges prominently as a critical, cross-cutting challenge that communities face. Chronic seasonal shortages not only impose a significant economic burden on households but also heighten health risks and increase sensitivity to the whims of climate variability. As climate change exacerbates rainfall unpredictability and increases drought frequency, tackling water stress becomes a central priority for mitigating vulnerability.

Amid these challenges, the assessment uncovers rich foundations for resilience embedded within the communities themselves. Residents demonstrate a wealth of local knowledge, strong social networks, and a spirited willingness to embrace practical solutions, such as innovative recycling initiatives and dedicated mangrove restoration efforts. Access to crucial climate information through radio broadcasts and community networks is a powerful tool for strengthening early warning systems and facilitating climate-informed decision-making. Furthermore, the presence of proactive institutional actors, including Climate Action Network Tanzania and credible partners such as Bread for the World, creates fertile ground for coordinated resilience interventions.

Overall, the findings reveal that Tumbatu Island's vulnerabilities are deeply interwoven and systemic, transcending individual sectors. The interconnected challenges of environmental degradation, livelihood insecurity, governance constraints, and social inequality create a compelling cycle that intensifies exposure to climate risks. Breaking this cycle necessitates integrated interventions that simultaneously restore ecosystems, fortify livelihoods, enhance the effectiveness of institutions, and empower communities.

The pathway to resilience, therefore, lies not in isolated efforts but in the orchestration of coordinated, multi-level strategies that harmonise ecological restoration, economic transformation, and comprehensive governance reform. The baseline established by this study serves as a critical benchmark, illuminating a clear trajectory for measuring progress along the transformative pathway toward resilience.

3.3. Recommendations

Enhancing climate resilience on Tumbatu Island requires a collaborative, comprehensive strategy that integrates environmental sustainability, economic stability, institutional development, and social equity. The following recommendations outline strategic priorities to foster effective program implementation, engage in forward-thinking policy dialogue, and secure sustainable, long-

term investments that collectively bolster the island's capacity to adapt to climate challenges.

3.3.1. Ecosystem Restoration and Environmental Management

Making the restoration of degraded ecosystems the centrepiece of community resilience-building initiatives offers a transformative pathway to revitalising natural landscapes. By dedicating efforts to rehabilitate lush mangrove forests, vibrant coastal vegetation, and diverse marine habitats, the project can rejuvenate their crucial protective and productive roles in our environment. These restoration strategies should not only focus on ecological rehabilitation but also embrace community-based stewardship initiatives that empower local communities, fostering a sense of ownership and ensuring the sustainability of these vital ecosystems for generations to come.

In parallel, establishing comprehensive, environmentally sound waste management systems is essential to significantly reduce open dumping and burning that plague our communities. By investing in innovative waste reduction strategies and supporting the growth of recycling enterprises, we can create robust community collection systems that not only improve environmental health but also generate meaningful livelihood opportunities for local residents.

Furthermore, enhancing institutional collaboration with regulatory bodies, such as the Zanzibar Environmental Management Authority, will be instrumental in ensuring that environmental regulations are effectively enforced and that ongoing ecosystem monitoring becomes standardised. This strengthened partnership will enhance our collective ability to safeguard our natural resources, ensuring that our efforts yield lasting benefits for both the environment and the communities that depend on it.

3.3.2. Water Security and Climate-Resilient Infrastructure

Investing in water security is vital for alleviating household vulnerability and fostering sustainable livelihoods. By scaling up community and household rainwater harvesting systems, we can harness rainfall more effectively while also enhancing infrastructure for water storage, treatment, and distribution to ensure that clean water is accessible to all.

Furthermore, embedding climate-resilient infrastructure planning within local development frameworks will significantly strengthen community resilience. By prioritising initiatives such as shoreline protection, erosion control, and the construction of storm-resistant buildings, we can create a robust framework that safeguards our natural resources and enhances the safety and well-being of our communities in the face of climate change.

3.3.3. Livelihood Diversification and Economic Resilience

To cultivate robust economic resilience, it is vital to reduce reliance on livelihoods that are sensitive to climate fluctuations. Prioritising the development of diverse alternative income sources can

significantly bolster community stability. This includes promoting innovative recycling enterprises, fostering nature-based livelihoods aligned with environmental stewardship, and supporting small-scale businesses that can withstand the impacts of climate change.

Effective interventions should encompass a range of supportive measures, including comprehensive technical training programs to equip individuals with essential skills, enhanced access to financial resources to fuel entrepreneurial ventures, and the establishment of market linkages that connect local producers with broader commercial opportunities. Additionally, tailored business development support can provide the guidance needed to navigate new challenges.

Crucially, the design of livelihood diversification programs should inherently involve strong community participation. By engaging local stakeholders throughout the process, we can ensure that initiatives are not only culturally resonant but also economically feasible. This inclusive approach can unlock sustainable growth and create a thriving, resilient economic landscape that benefits all members of the community.

3.3.4. Gender Equity and Social Inclusion

To effectively enhance resilience, it is crucial to address existing gender disparities in income, access to resources, and decision-making roles. By intentionally strengthening women's participation in livelihood programs, natural resource governance, and community planning initiatives, we can unlock their potential and ensure their voices are heard. This can be achieved through comprehensive capacity-building programs and the establishment of inclusive institutional frameworks that actively support women's involvement.

Furthermore, by prioritising vulnerable households within social protection mechanisms, we can create a safety net that reduces inequality in adaptive capacity. This approach fosters a more equitable and resilient community, empowering individuals and families to better navigate and adapt to challenges while promoting social cohesion and long-term sustainability.

3.3.5. Institutional Strengthening and Governance Reform

Strengthening governance effectiveness is vital to fostering sustainable resource management. To achieve this, we can bolster mechanisms that promote financial transparency, cultivate participatory planning processes, and enhance cross-institutional coordination at all levels of governance.

By formalising community-based resource management committees, we can empower local communities to meaningfully engage in environmental decision-making, ensuring that their voices and insights shape policies that affect their resources. Moreover, integrating traditional leadership systems with formal governance structures can significantly enhance the legitimacy of these processes, fostering trust and compliance among community members. This harmonious

collaboration between traditional and formal systems encourages a more inclusive and holistic approach to resource management, ultimately contributing to the preservation of our environment for future generations.

3.3.6. Climate Information, Knowledge, and Capacity Development

To effectively address the pressing challenges posed by climate change, we must prioritise expanding climate services and early warning systems, ensuring they are closely tied to actionable adaptation guidance. By harnessing existing communication channels, particularly trusted media such as radio and community networks, we can disseminate vital climate information that empowers individuals and communities to take informed action.

Furthermore, robust capacity-building programs are crucial for equipping communities with essential skills for ecosystem restoration, fostering climate-resilient livelihoods, and enhancing disaster preparedness. These initiatives will not only bolster community resilience but also cultivate sustainable practices, creating a brighter and more secure future for all. Through this collaborative effort, we can pave the way for thriving ecosystems and resilient communities amid changing environmental conditions.

3.3.7. Monitoring, Evaluation, and Learning

Establishing a comprehensive monitoring framework is crucial for effectively tracking the intricate processes of ecosystem recovery, livelihood diversification, governance performance, and social inclusion outcomes. The baseline indicators identified in this study will provide a robust foundation for longitudinal monitoring, ensuring a clear reference point for future assessments.

Incorporating participatory monitoring approaches will significantly enhance our efforts, as these methods encourage community members to actively engage in data collection and evaluation. By involving local voices in the process, we not only strengthen accountability but also promote adaptive management that is responsive to the community's evolving needs and aspirations. This collaborative approach will enrich the overall assessment and foster a deeper connection between the community and the monitoring efforts.

3.3.8. Long-Term Investment and Sustainability

Enhancing resilience requires sustained financial investment that transcends individual project cycles. To achieve this, it is vital to cultivate robust partnerships with development organisations, public institutions, and community-based groups, all aimed at fostering long-term ecosystem stewardship and advancing livelihoods. By weaving resilience priorities into the fabric of regional development planning in Zanzibar, we can ensure a seamless continuity of efforts and create a cohesive policy framework that maximises impact and nurtures sustainable growth.

3.3.9. Strategic Message

The thriving future of Tumbatu Island is intricately linked to recognising that environmental sustainability, economic security, and effective governance are not just separate goals but interconnected pillars that bolster long-term development. By making strategic investments in restoring our precious ecosystems, nurturing inclusive livelihoods that provide equitable opportunities for all, and fostering a culture of accountable governance, we can significantly reduce climate vulnerability while simultaneously enhancing the social and economic vitality of our communities. This foundational insight serves as both a roadmap and a catalyst for meaningful transformation, guiding us toward a more resilient and prosperous future.

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ANNEXES

Annex 1: Project Baseline Assessment Survey/Questionnaire

Project: [A-TZA-2025-0089]
Location: Tumbatu Sub-District, Unguja B

GPS: Lat ---------- Long ----------
Interview Date: ----------
Interviewer: ----------
Respondent ID: ----------

Thank you for participating in this survey. Your feedback is crucial for understanding the baseline information before commencing the interventions of our project aimed at strengthening the contribution of local actors for a climate-resilient society in Tumbatu. This survey should take approximately 10-15 minutes to complete. Kindly select the most suitable response for each question.

Section 1: Household and Socio-Economic Profile

1. **Household Demographics**
    - Household member: Total ..... Children (<18)..... Elderly (>59) .....
    - Gender of HH head: Male [ ] Female [ ]
    - Primary livelihood: Fishing [ ] Farming [ ] Tourism [ ] Trade [ ] Labour [ ]
2. **Income & Shocks (Last 12 Months)**
    - Main income sources (rank top 3)
        i. .....
        ii. .....
        iii. .....
    - Monthy income range

    <TZS 150,000 [ ] TZS 150k –500k [ ] TZS 500k–1M [ ] >TZS 1M [ ]
    - Climate shocks experienced (rank severity 1-5)

    Floods....., Coastal erosion....., Drought ....., Crop failure....., Water scarcity.....
3. **Climate vulnerability**
    - Rank climate impacts on livelihood (1 = most severe, 3 = moderate, 5 = least severe)

    Flooding....., Coastal erosion....., Drought ....., Crop failure....., Water scarcity....., Other:
4. **Assets & Resilience Capacity**
    - Access to: Clean water [ ] Climate-resilient seeds [ ] Savings group [ ] Early warning system [ ]
    - Can your HH recover from a climate shock within 1 month? Yes [ ] No [ ]

Section 2: Climate Resilience/Adaptation Practices, Awareness and Action Plans

5. **Existing Adaptation strategies and plans**

(PACDR/PICSA linkage)

- Which Adaptation strategy do you use? (Select all):
  Mangrove replanting [ ] Diversified crops [ ] Rainwater harvesting [ ] Storm-resistant housing [ ] None [ ]
- Effectiveness of strategies (1=low, 5=high): ___
- Is there a community-led climate adaptation plan? [ ] Yes [ ] No
- If yes, how was it developed? [ ] PACDR [ ] PICSA [ ] Traditional methods [ ] Other: _____
- How often is it reviewed? [ ] Annually [ ] Biannually [ ] Never
- Who disseminates climate info? [ ] Local Gov't [ ] NGOs [ ] Radio [ ] Community leaders

6. **Community participation**

- Have you participated in climate planning workshops? [ ] Yes [ ] No
- If yes, were PACDR/PICSA tools used? [ ] Yes [ ] No [ ] Unsure
- What barriers exist to implementing plans? (e.g., funding, skills, resources):

Section 3: Environmental Degradation & Risks

(Site-specific vulnerabilities)

7. **Local Environmental Changes**

- Mangrove cover: Increased [ ] Decreased [ ] Stable [ ]
- Coastal erosion severity (1=mild, 5=severe): ___
- Waste pollution hotspots: _____

8. **Water Security:**

- Dry months without reliable water: _____ months/year
- Primary water source: Pipe [ ] Well [ ] Rainwater [ ] River [ ]

Section 4: Environmentally Friendly Livelihoods

(Alternative livelihood identification)

9. **Current Livelihood Challenges:**

- How has climate change affected your primary livelihood?
  [ ] Reduced income [ ] Increased costs [ ] Resource scarcity [ ] Other: _____

10. **Alternative Livelihood Interest:**

- Rank interest in these eco-friendly options (1 = most interested, 3 = moderate, 5 = least interested):
  Beekeeping ___ Mangrove-based aquaculture ___ Eco-tourism ___ Recycling initiatives ___ Other: _____
- What training/support is needed? (e.g., capital, skills):

11. **Beekeeping Potential:**

- Are mangroves near your community used for livelihoods? [ ] Yes [ ] No
- Would you engage in mangrove-linked beekeeping? Yes [ ] No [ ]
- If no, why? _____

Section 5: Livelihood Diversification & Economic Empowerment

(Beekeeping, mangrove conservation, capacity building)

12. Diversification Readiness:

- What skills do you have for climate-resilient livelihoods? (e.g., carpentry, tailoring).....
- Would you join a "Climate-Resilient Livelihoods Group"? Yes [ ] No [ ]

13. Mangrove Conservation:

- Are you involved in mangrove conservation? [ ] Yes [ ] No
- If yes, what activities? Planting [ ] Patrols [ ] Education [ ] Other: _____
- How could beekeeping support mangrove conservation? .....

.....

14. Training Needs:

- Rank needed training (1=most urgent, 3=Meoderate, 5=least urgent): Beekeeping ___ Financial literacy ___ Climate-smart farming ___ Business development ___

Section 6: Solid Waste Management (Chuini - Specific)

15. Current Waste Practices:

- How is household waste disposed?
  Open dumping [ ] Burning [ ] Local collection [ ] Recycling [ ] Other: _____
- Are you aware of waste-related health risks? [ ] Yes [ ] No

16. Waste Management Initiatives:

- Would you use a community waste collection site? [ ] Yes [ ] No
- What waste types are most common? (Select top 2):
  Plastic [ ] Organic [ ] E-waste [ ] Textiles [ ]
- Suggested locations for a demo waste site: .....

Section 7: Further Suggestions

17. Additional Priorities:

- What climate adaptation support is most urgent for your community?

18. Project Suggestions:

- Any input for the project team?

Closing Consent & Signature

- "Your input will shape climate resilience projects in your community. All responses are confidential."
- Consent: [ ] Verbal [ ] Written

Thank you for your valuable input! Your responses will help us enhance our efforts in strengthening the climate resilience of Zanzibar's society

Respondent Signature: _____

Annex 2: Focus Group Discussion on IK in Weather/Climate Prediction

Focus group discussions under this study are intended to learn and gather in-depth information related to climate change impacts and local led actions and solutions with respect to climate services that will inform the climate adaptability and resilience of smallholders in Zanzibar. To capture key information from such discussions, a facilitator should always remember to switch on mobile or computer audio recorder tool where necessary.

FGD Location					
Facilitator					
Participants	**Name**	**sex**	**Age**	**Occupation**	**Contact**
	1.				
	2.				
	3.				
	4.				
	5.				
	6.				
	7.				
	8.				

A. *Relaxer/Ice breaker: A round of introduction. Ask/talk about general (interesting subject to them based on visible settings-housing, population, health/education facilities) that will make relax and feel free to talk.*

B. *Determine group social-cultural dynamics (e.g., need to separate women from men?) where needed and necessary to do so.*

DISCUSSION GUIDE

1. What are your major socioeconomic livelihoods?
2. Do people know anything about climate change and the associated impacts?
3. What are the major climate change impacts have been observed/experiences in your locality for the past five to ten years? *(Make sure you do probe for detailed discussion including timing/years, impacts, etc.)*
4. How do you locally responds/have been responding to climate change events and impacts?
5. How and where do you get weather forecast information? *(Here they need to mention/list all form of media used to access weather forecast, you may also need to know the contents and frequencies)*

6. Which weather elements are included in the shared and/or received weather forecast? *(Here they need to mention them)*
7. Which weather elements do you think are useful and in need but not included in the shared and/or received weather forecast? *(Here they might have demand for a certain weather element as per their locality need with respect to their livelihoods)*
8. Are the shared weather forecast useful and helpful in informing your livelihood? *(Probe for further discussion on how useful and helpful, how weather forecast governs their livelihood plan and execution).*
9. What are the traditional ways of predicting weather and climate change in your village and/or ward?
10. Who predicts? (Age, gender wise, seek for the names of experts).
11. Which weather elements are included in the traditional prediction (e.g. rainfall, temperature, wind, etc).
12. Do people prefer to use the traditional prediction rather than conventional one? *(Aim here is to see and assess level of preferences, you may need to know the why side of the response)*
13. Who are the community group largely using the traditional weather forecast? *(You may need to know the type of livelihood these group practices and the why side of the use of traditional forecast rather than conventional one)*
14. How are the traditional forecast results shared in village? Is there any common means of sharing? *(In this question we need to assess how traditional weather forecast are disseminated to end users, you may assess the available setbacks/challenges in that form of dissemination)*
15. Does the traditional prediction reliable?
16. How can you compare the reliability of modern climate services and the traditional ones? *(Here you may probe them to rank the two with respect to their needs and uses)*
17. What are the recommendations would you like to make to the government and NGOs on with regards to climate change and variability?

THANK YOU

Annex 3: Key/Expert Informant Interviews

Target Population:

- District Officers (Agriculture, Fisheries, Livestock, and Environment Officers)
- Extension workers (Agriculture, livestock)
- CSO (FBO, NGO)
- CAN Members and other Organizations

INTERVIEW DATE/TIME			
ORGANIZATION			
INTERVIEWEE'S NAME & TITLE,			
CONTACT AND SEX			
DISTRICT			
INTERVIEWER'S NAME			

Can I hear a story about climate change and variability as well as the impacts within your district?
(Relate to agriculture, fisheries and/ or pastoralism)

1. Have you ever heard about climate services? **YES** ☐ **NO** ☐

2. Tell a little bit about Climate Services in your area?

3. What are the major impacts of climate change evidently and/or experienced in your district?
Please explain!

4. Do local community specifically smallholder have access to weather forecast in your district? **Yes** ☐ **or NO**☐. If yes tell us the channels they use to get the services and who generates such services?

5. Which weather elements do you think are useful and in need but not included in the shared and/or received weather forecast to smallholders in your district?

6. Is there any challenge or opportunity that you can highlight on the access and utilization of weather forecast including climate services among community groups in your society?

7. Are there any district strategies in place to promote the access and utilization of weather forecast including climate services to enhance climate adaptability amongst community in your district? *Please let me know*

8. How does your organization/district authority work with the Tanzania Meteorological Authority (TMA)?

9. Comment and recommend on the quality of weather forecast and climate services you have been receiving.

10. Are you interested in receiving climate services? For what purposes?

11. Is there anything would you like to add?

THANK YOU