Climate Adaptation Plan

Bibiani-Anhwiaso-Bekwai Municipal Assembly

Climate Adaptation Plan for Bibiani-Anhwiaso-Bekwai Municipal Assembly: Ghana

August 2025

Written by Foresight Planners and Research Africa Limited

Photo credit: iStock

About the NAP Global Network

This plan was developed with support from the NAP Global Network, an initiative created in 2014 to support developing countries in advancing their NAP processes and help accelerate adaptation efforts around the world. To achieve this, the Network facilitates South-South peer learning and exchange, supports national-level action on NAP formulation and implementation, and generates, synthesizes, and shares knowledge. The Network's members include individual participants from more than 155 countries involved in developing and implementing National Adaptation Plans. Financial support for the Network has been provided by Austria, Canada, Germany, Ireland, the Netherlands, the United Kingdom, and the United States. Additional support has been provided by ClimateWorks Foundation. The Secretariat is hosted by the International Institute for Sustainable Development (IISD). For more information, visit www.napglobalnetwork.org.

This project is undertaken with the financial support of:
Ce projet a été réalisé avec l'appui financier de :

Secretariat hosted by:
Secrétariat hébergé par :

Executive Summary

Climate change continues to wreak havoc on socioe-conomic development across the globe, with ramifications for livelihoods in developing countries such as Ghana. The Bibiani-Anhwiaso-Bekwai Municipal Assembly (BABMA) is confronted with increasing temperature patterns coupled with erratic rainfall patterns, which greatly influence the livelihoods of households and communities within the municipality. Addressing these consequences requires a holistic approach through adaptation planning.

The main objective of this adaptation plan is to build the capacity of the BABMA to facilitate its ability to manage climate-related threats facing the municipality, both now and in the future. Specifically, the BABMA's adaptation plan aims to (i) reduce vulnerability to the adverse impacts of climate change by identifying priority actions to build adaptive capacity and climate resilience, and (ii) facilitate the integration of climate change adaptation into policies, programs, and activities of the municipal assembly.

The formulation of the adaptation plan for BABMA followed an inclusive, interactive, and participatory approach.

To establish context and inform the plan's development, an extensive desk-based review of key documents and policies on climate change was conducted. This was complemented by a thorough Climate Risk and Vulnerability Assessment specific to the BAMBA, coupled with stakeholder consultations and workshops involving key stakeholders from sectors most affected by climate change.

The adaptation action plan highlights the historical, current, and projected climate trends and scenarios for the BAMBA. The action plan also provides an overview of the municipality's key climate change vulnerabilities and risks. The sectors covered in this action plan are those most impacted by climate change in the municipality and include agriculture, gender, human health, water resources, disaster risk reduction, biodiversity, forestry, and fisheries.

The action plan provides a compilation of sector-specific adaptation actions for each of these sectors. The institutional arrangements for implementing these adaptation actions are also detailed, with the roles played by each of the key stakeholders, including the municipal assembly, non-governmental organizations, civil society, and private sector institutions.

It is widely acknowledged that women, the elderly, and people living with disabilities will be disproportionality affected by climate change impacts in the municipality. Consequently, this adaptation action plan advocates for gender-responsive and socially inclusive actions that address the threats of climate change to the livelihoods of these socio-economic groups.

An estimated amount of GHC 171,429,795.00 will be needed to ensure the successful implementation of the adaptation actions proposed in this action plan, and this requires greater efforts by both the central government and municipal assembly in attracting both local and international funding.

Table of Contents

1.0 Introduction 1
2.0 Overview of the Bibiani-Anhwiaso-Bekwai Municipality 5
3.0 Institutional Arrangements and Municipal-Level Adaptation Governance 12
4.0 Current and Future Climate Scenarios for the Bibiani-Anhwiaso-Bekwai Municipal 20
5.0 Adaptation Action Planning 25
6.0 Framework for Adaptation Monitoring, Evaluation, and Learning 107
7.0 Conclusion and the Way Forward 111
References 113

List of Tables

Table 1. Relevant national policies on adaptation 15
Table 2. Relevant stakeholders, key roles, responsibilities, and expected outcome from engagement in implementation of the BAMBA's adaptation plan 18
Table 3. Historical versus future climate in the BABMA 20
Table 4. Climate hazards and key vulnerability factors 21
Table 5. Key sector vulnerabilities 22
Table 6. Methodology to identify adaptation options 25
Table 7. Distribution of adaptation options by sector 26
Table 8. Criteria for the assessment of the climate change adaptation options 29
Table 9. Ranking of adaptation options based 31
Table 10. Ranking of adaptation options for the biodiversity sector 32
Table 11. Adaptation actions for the biodiversity sector 33
Table 12. Ranking options for the fisheries sector 38
Table 13. Adaptation actions for the fisheries sector 39
Table 14. Ranking of adaptation options for the tourism sector 44
Table 15. Summary of the adaptation options for the tourism sector 45
Table 16. Ranking options for the disaster risk reduction sector 50
Table 17. Adaptation actions for the disaster risk reduction sector 51
Table 18. Ranking options for the agricultural sector 59
Table 19. Adaptation actions for the agriculture sector 60
Table 20. Ranking of adaptation options for water sector 74
Table 21. Adaptation actions for the water resources sector 75
Table 22. Ranking options for forestry sector 80
Table 23. Adaptation actions for the forestry sector 81
Table 24. Ranking adaptation options for the human health sector 88
Table 25. Adaptation actions for the human health sector 89

Table 26. Ranking adaptation options for gender sector 95
Table 27. Adaptation actions for the gender sector 96
Table 28. Summary of estimated costs 106
Table 29. Outline of approach to MEL of the BABMA's adaptation actions 109

List of Figures

Figure 1. Map of Bibiani-Anhwaiso-Bekwai Municipal Assembly 6
Figure 2. Population density map 7
Figure 3. Tourism map of the municipality 9

Abbreviations and Acronyms

ADB	Agricultural Development Bank
BABMA	Bibiani Anhwiaso Bekwai Municipal Assembly
CCTDA	Climate Change Technical and Development Assistance
CGIAR	Consultative Group on International Agricultural Research
CSIR	Council for Scientific and Industrial Research
CWSA	Community Water and Sanitation Agency
EPA	Environmental Protection Agency
FAO	Food and Agriculture Organization
FC	Forestry Commission
FSD	Forest Services Division
GARDB	Ghana Agricultural and Rural Development Bank
GASIP	Ghana Agricultural Sector Investment Programme
GEF	Global Environment Facility
GEPA	Ghana Export Promotion Authority
GES	Ghana Education Service
GHAMFIN	Ghana Microfinance Institutions Network
GHS	Ghana Health Service
GIDA	Ghana Irrigation Development Authority
GIPC	Ghana Investment Promotion Centre
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit (German Development Agency)
GMet	Ghana Meteorological Agency
GTMO	Ghana Timber Millers Organization

GWCL	Ghana Water Company Limited
ICCROM	International Centre for the Study of the Preservation and Restoration of Cultural Property
IFAD	International Fund for Agricultural Development
IPCC	Intergovernmental Panel on Climate Change
IUCN	International Union for Conservation of Nature
MASLOC	Microfinance and Small Loans Centre
MESTI	Ministry of Environment, Science, Technology, and Innovation
MLGDRD	Ministry of Local Government, Decentralization and Rural Development
MLNR	Ministry of Lands and Natural Resources
MoE	Ministry of Education
MoF	Ministry of Finance
MoFA	Ministry of Food and Agriculture
MOGCSP	Ministry of Gender, Children and Social Protection
MoH	Ministry of Health
MoTI	Ministry of Trade and Industry
MOWCSP	Ministry of Works and Housing and Social Protection
MSWR	Ministry of Sanitation and Water Resources
MTDP	Medium-Term Development Plan
NADMO	National Disaster Management Organization
MESTI	Ministry of Environment, Science, Technology, and Innovation
MLGDRD	Ministry of Local Government, Decentralization and Rural Development
MLNR	Ministry of Lands and Natural Resources
MoE	Ministry of Education
MoF	Ministry of Finance

MoFA	Ministry of Food and Agriculture
MOGCSP	Ministry of Gender, Children, and Social Protection
MoH	Ministry of Health
MoTI	Ministry of Trade and Industry
MOWCSP	Ministry of Works and Housing and Social Protection
MSWR	Ministry of Sanitation and Water Resources
MTDP	Medium-Term Development Plan
NADMO	National Disaster Management Organization
NAP	National Adaptation Plan
NBSSI	National Board for Small-Scale Industries
NCCE	National Commission for Civic Education
NDPC	National Development Planning Commission
NGO	Non-Governmental Organization
NMCP	National Malaria Control Program
TIDD	Timber Industry Development Division
UN	United Nations
UNCP	United Nations Common Program
UNDP	United Nations Development Program
UNDRR	United Nations Office for Disaster Risk Reduction
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNFCCC	United Nations Framework Convention on Climate Change
UNICEF	United Nations Children's Fund
UNWTO	United Nations World Tourism Organization
WHO	World Health Organization
WMO	World Meteorological Organization

WRC	Water Resources Commission
WSSCC	Water Supply and Sanitation Collaborative Council
WWF	Worldwide Fund for Nature

1.0 Introduction

1.1 Background and Context

Climate change presents significant challenges to developing countries where socio-economic sectors are climate-sensitive and most households and social systems have limited adaptive capacity to address the adverse impacts of climate change (Intergovernmental Panel on Climate Change [IPCC], 2021). Increasing droughts, floods, and heat stress closely linked to climate change have become common across Ghana's agroecological zones. These changes pose substantial threats to economic sectors, particularly agriculture, water resources, energy, health, and infrastructure. This has significant consequences for Ghana's sustainable development aspirations and could compromise commitments under the Paris Agreement. Addressing these threats requires effective and proactive adaptation planning aimed at building resilience in these climate-sensitive economic sectors.

In Ghana, rising temperatures and unpredictable rainfall patterns have intensified the risks of droughts, floods, and crop failures, affecting food and water security. These changes place immense pressure on agriculture, a primary livelihood for many in the region. Overall, the country's economy, health, and ecosystems are increasingly at risk, highlighting the need for comprehensive adaptation strategies to build resilience against climate impacts (Addaney et al., 2021).

Climate change has had significant impacts on the Bibiani-Anhwiaso-Bekwai Municipality, affecting various aspects of life and the environment. Rising temperatures, changing rainfall patterns, and increased frequency of extreme weather events are affecting the livelihoods of residents, particularly farmers. For example, climate change is altering the traditional rainfall patterns, leading to droughts and floods that impact agricultural productivity in the municipality (Affi-Donkor, 2021). Furthermore, changes in rainfall patterns and increased evaporation due to rising temperatures are leading to water scarcity affecting domestic and agricultural use in the municipality (Kumi-Aboagye, 2012). To address these challenges, adaptation actions are necessary to help reduce the vulnerability of the municipality to climate change impacts and promote sustainable development.

Ghana has implemented a range of initiatives to address the impacts of climate change, focusing on adaptation, mitigation, and sustainable development. A notable example is the National Adaptation Plan (NAP) process, which the country integrates into its development agenda, prioritizing vulnerable sectors like agriculture, water, and human health (NAP Global Network, 2018). Within this national framework, the Bibiani-Anhwiaso-Bekwai Municipal Assembly (BABMA) conducted a Climate Change Rapid Risk Assessment to identify and address the climate vulnerabilities specific to the municipality. This assessment revealed that agriculture, water resources, tourism, fisheries, forestry, biodiversity, and disaster risk reduction are highly vulnerable, with human health and gender also exposed to significant climate impacts. These findings form the basis for a tailored adaptation strategy for BABMA.

Adaptation involves adjusting practices, processes, and structures to minimize the adverse effects of climate change and take advantage of potential opportunities (IPCC, 2022). Gender-responsive adaptation is crucial for addressing the complex impacts of climate change in the BAMBA, as in other districts in Ghana's northern region, where socio-economic vulnerabilities and gender inequities are deeply interconnected.

Climate change impacts are context-specific, and adaptation planning should be targeted to the local level. As Ghana's NAP process progresses, it has become critically important to plan adaptation strategies that are tailored to address current and future climate impacts in specific locations. Such information is necessary in evaluating the levels of climate vulnerabilities for proactive adaptation planning. Similarly, Ghana's NAP process emphasizes the importance of location-specific approaches to adaptation planning. Ghana's NAP Framework is designed to moderate vulnerability to adverse impacts of climate risks by building strong adaptive capacity and resilience in local communities (Antwi-Agyei, 2018).

The adaptation plan for the BABMA was developed through a collaborative participatory process involving key stakeholders from sectors most affected by climate change. Workshops and consultations enabled these stakeholders to identify context-specific solutions that reflect the unique challenges of the BABMA. By aligning local and national adaptation efforts, Ghana aims to enhance its resilience to climate change while securing the future of its people and ecosystems.

1.2 Aims and Objectives

The main objective of this adaptation plan is to build the capacity of the BABMA to facilitate its ability to manage climate-related threats facing the metropolis both now and in the future. Specifically, the BABMA's adaptation plan aims to:

- Reduce vulnerability to the adverse impacts of climate change by identifying priority actions to build adaptive capacity and climate resilience in a gender-responsive mannner.
- Facilitate the integration of climate change adaptation into policies, programs, and activities of the municipal assembly.

1.3 Expected Outcomes

The adaptation plan will assist the municipality to:

- Address critical climate threats by implementing adaptation actions that are local, gender-responsive, relevant, cost-efficient, measurable, and timely for the municipality.
- Develop both short-term and long-term strategic plans informed by detailed vulnerability and risk assessments conducted for the municipality.
- Build the institutional and technical capacity of the BABMA staff to effectively navigate and respond to the complex challenges posed by climate change.
- Ensure seamless integration of the adaptation plan with the municipality's existing development frameworks and medium-term development plans (MTDPs) (Luna et al., 2023).
- Foster collaboration among stakeholders, including local communities, government agencies, and private sector partners, to support the successful implementation of adaptation measures.

1.4 Time Frame

The time frame for the implementation of the BABMA Adaptation Plan is 2025–2030, which is in alignment with Ghana's revised Nationally Determined Contributions (NDC) period (2020–2030) submitted under the Paris Agreement. This timeframe also coincides with the next iteration of the municipality's MTDP, 2025–2030. Typically, such plans are structured to span 5 to 10 years, allowing for phased implementation and continuous monitoring and evaluation. This timeframe ensures that the adaptation measures are effectively integrated into metropolitan development plans and that there is sufficient time to address the identified vulnerabilities in sectors such as agriculture, water and sanitation, disaster risk reduction, health, and gender.

1.5 Guiding Principles

- **Builds on Ghana's NAP process**: Ghana's NAP framework provides the overarching roadmap for climate change adaptation planning and implementation. The NAP process has identified stakeholder institutions and agencies, such as the Ministry of Food and Agriculture (MoFA).
- **Is gender responsive**: Notions of gender are socially constructed. As a result, in Ghana, much as the normative implications of gender are acknowledged and respected, gender is also conceived broadly to include women, children, youth, and persons with disabilities (PWD). These groups are recognized as being uniquely vulnerable to climate change impacts, and these particularities were taken into serious consideration in the development of the plan.
- **Incorporates nature-based adaptation solutions**: Adaptation solutions can often be found in nature, and the use of nature-based solutions is increasingly proving to positively impact the environment and build resilience against climate change.
- **Is informed by science**: Adaptation actions must be informed by current and future understanding of climate change impacts. This understanding, therefore, comes from a scientific appreciation of climate vulnerabilities and the vulnerability assessment process.
- **Uses traditional and indigenous knowledge**: The planned development placed a special focus on the knowledge and experiences of local people and made conscious efforts to tap into such knowledge systems to enhance the plan, especially from the perspective of selecting adaptation options.
- **Adopts participatory, inclusive, and local ownership**: Guided by the Ghana NAP framework, processes for both the vulnerability assessment and the development of the plan have as much as possible been participatory and inclusive to ensure that the plan is led and owned by local people.
- **Aligns with Sustainable Development Goals (SDGs) and National Development Goals**: Adaptation projects may provide benefits to or trade-offs with the United Nations SDGs and other national development priorities. As much as possible, the adaptation planning process must aim to reduce the trade-offs, as well as complement efforts to achieve the SDGs and national development goals.

1.6 Intended Users of this Adaptation Plan

Enhancing the capacity of the BAMBA to address climate change threats demands the development and implementation of district-specific adaptation plans. The document seeks to enhance community resilience by integrating gender equity into climate action using key stakeholders:

1. Policy-makers: Policy-makers at national, regional, and district levels are responsible for gender-responsive climate adaptation policies.

2. District assemblies: Local government authorities in Bibiani-Anhwiaso-Bekwai integrate adaptation strategies into budgeting, such as MDTPs and annual action plans to ensure climate interventions address community-specific needs.

3. Civil Society Organizations (CSOs): Women-led and community-based organizations champion equitable and sustainable adaptation. Furthermore, they advocate for marginalized groups by addressing climate vulnerabilities and promoting solutions that involve inclusivity.

4. International development partners: Agencies and institutions that support climate adaptation actions, promote inclusivity, and foster effective resilience-building efforts. These initiatives will enhance community capacity and equitable resource access.

5. Private sector: Businesses and industries operating within the district are crucial for implementing climate-resilient practices, investing in green technologies, and contributing to local adaptation initiatives through their operations and corporate social responsibility efforts (Environmental Protection Agency [EPA], 2020).

6. Academia and research institutions: Universities and research bodies can provide critical data, technical expertise, and innovative solutions, supporting evidence-based decision-making and continuous learning in climate adaptation planning and implementation.

2.0 Overview of the Bibiani-Anhwiaso-Bekwai Municipality

2.1 Geological Location and Size

The Bibiani-Anhwiaso-Bekwai Municipal Assembly (BABMA) covers a total land area of 833.7 km² and was carved out of the former Sefwi-Wiawso District in 1988 by Legislative Instrument 1387. It lies between latitude 6° 3' N and longitude 2° 3' W and is accessible through road networks linking it to various parts of the Western North, Ashanti, and Central Regions. The land area supports a variety of uses, with agriculture playing a central role in the district's economy, alongside human settlements and natural resources.

The district shares boundaries with the Atwima Mponua District in the Ashanti Region to the north, and to the south with the Wassa Amenfi District in the Western Region. To the west, it is bordered by the Sefwi-Wiawso District, while to the east, it shares boundaries with the Upper Denkyira West District in the Central Region and the Amansie Central District in the Ashanti Region. These boundaries influence the district's socio-economic interactions, trade relations, and development dynamics. The district capital, Bibiani, serves as the administrative and economic hub, facilitating connections with surrounding districts and driving growth within the municipality and beyond (Ghana Statistical Services [GSS], 2021).

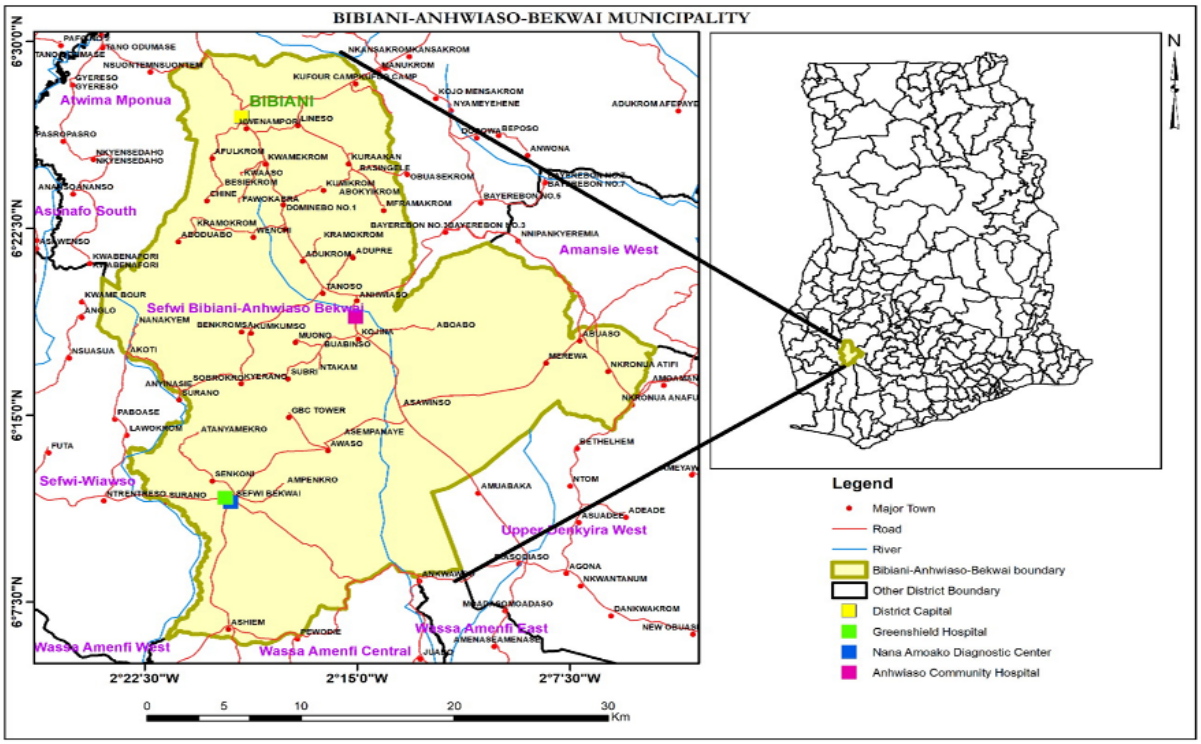
2.2 Topography and Climate

The topography of the Bibiani-Anhwiaso-Bekwai Municipal Assembly is characterized by a mix of gently rolling hills and valleys, which is typical of the forest-savannah transitional zone. The landscape is a blend of forested areas with patches of savannah grasslands, and it features a variety of tree species, both drought-resistant and moisture-loving, adapting to the municipality's climatic conditions (GSS, 2021). These geographic features make the area suitable for both rain-fed agriculture and livestock farming, which are key livelihoods in the municipality. Several rivers and streams, including the Ankobra River and its tributaries, flow through the district, serving as vital water sources. The rivers play an important role in supporting dry-season farming, fishing activities, and supplying water for domestic and livestock use, all of which contribute significantly to the district's socio-economic development (Medium-Term Development Plan, BABMA, 2022). With proper management, these water bodies also provide opportunities for developing small-scale irrigation systems and other water-based activities, which could boost local agriculture and livelihoods (Medium-Term Development Plan, BABMA, 2022).

The climate of the BAMBA is classified within the wet semi-equatorial climate zone, which is characteristic of southern Ghana. This climate is marked by two distinct rainy seasons—the major rainy season from April to July and the minor rainy season from September to November—which influence agricultural cycles. The municipality receives a significant amount of rainfall, with an annual average ranging from 1,200 mm to 1,800 mm, but there are growing concerns about rainfall irregularities and erratic weather patterns in recent years. During the dry season (December to March), evapotranspiration rates are high, leading to dry conditions and water shortages. The

temperature in BABMA typically ranges from 24°C to 32°C, with occasional spikes during dry spells. The peak of rainfall is typically observed in June and October, with these periods often accompanied by windstorms, which result in floods, surface runoff, and soil erosion, especially along the riverbanks (GSS, 2021). The increased frequency of these extreme weather events, including the occurrence of flash floods and droughts, is beginning to challenge agricultural productivity, particularly for those reliant on rain-fed agriculture, thus making water management and climate resilience strategies critical for the region's future.

Figure 1. Map of Bibiani-Anhwaiso-Bekwai Municipal Assembly



Source: Kwakye, 2023.

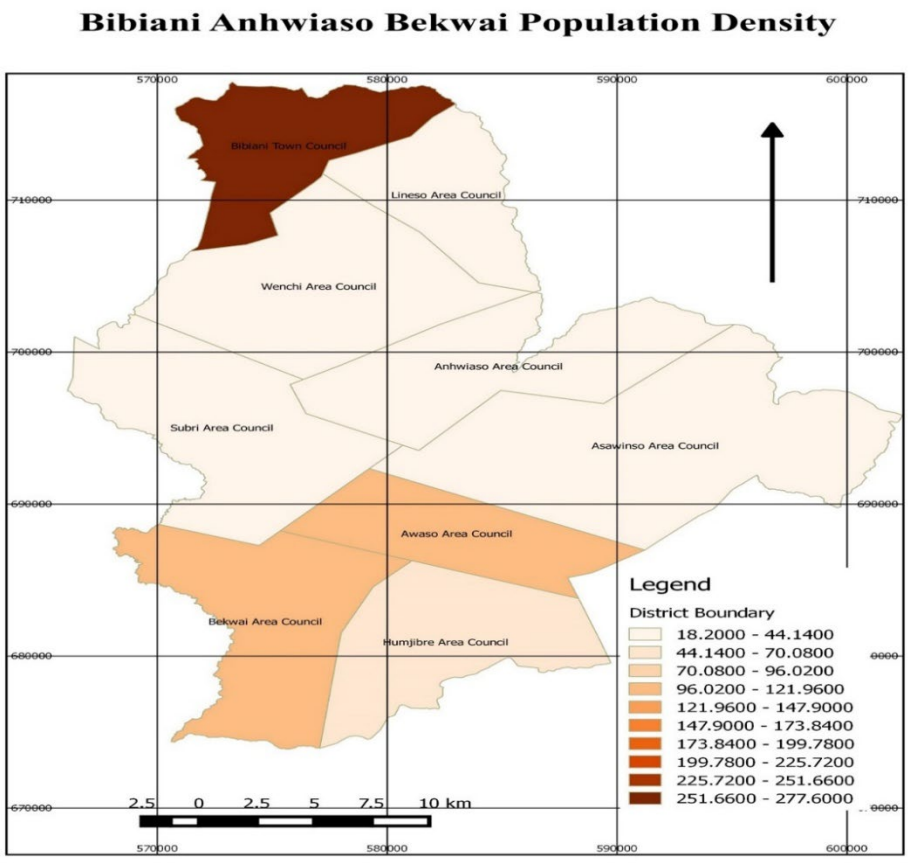
2.3 Vegetation

The Municipal Assembly falls within the equatorial rainforest zone (GSS, 2021). The natural vegetation is a moist deciduous forest. Tree species such as Odum, Mahogany, and Sapele form the basis of the flourishing Ghana Timber Industry. Hence, the district is a suitable location for the establishment of timber firms. There are eight forest reserves in the district with a total area of about 264 sq. km. These reserves, which include the Merewa forest reserve, could be developed in the future to serve as tourist attractions in the district. Other reserves in the district are the Afao Hills Reserve, Anhwiaso South Reserve, Anhwiaso East Reserve, Anhwiaso North Reserve, Sumtwitwi Reserve, Tano-Suraw Reserve, and Tano-Suraw Extension Reserve (GSS, 2021). The major river that drains the district is the River Ankobra. The Ankrobra River takes its source from the Merewa forest reserves, rising northeast of Wiawso, and flows about 120 miles (190 km) south to the Gulf of Guinea. Its entire course is in the southern part of Ghana. The rivers are close to the forest and are large enough to be used for the establishment of irrigation schemes for farming activities all year round and the production of potable water for the people in the district (GSS, 2021).

2.4 Key Demographic Characteristics of the Bibiani-Anhwiaso-Bekwai Municipal Assembly

The 2021 Population and Housing Census reports that the Bibiani-Anhwiaso-Bekwai Municipal Assembly (BABMA) has a population of 167,971, comprising 82,798 males and 85,173 females (GSS, 2021). The municipality is semi-urban, with both rural and urban settlements. Bibiani serves as the administrative and economic capital. The majority of the population is engaged in agriculture, mining, trading, and services. Like many parts of Ghana, BABMA also has a youthful age structure, with a substantial proportion of its population under the age of 15. The age distribution in the BABMA is as follows: 0–14 years constitute 44% of the population, 15–64 years make up 50%, and 65 years and above account for 6% (GSS, 2021). The municipality also has a total of 1,362 people living with disabilities, comprising 580 males and 782 females. The indigenous people of Bibiani-Anhwiaso-Bekwai are predominantly Sefwi, with other ethnic groups such as Akan, Ewe, and Mole-Dagbani also present due to mining and trading activities (GSS, 2021). The extended family system is common, and traditional social structures remain strong, especially in rural communities where cultural practices and communal living are widely observed.

Figure 2. Population density map



Source: BAMBA MTDP, 2021.

2.5 Economic Profile

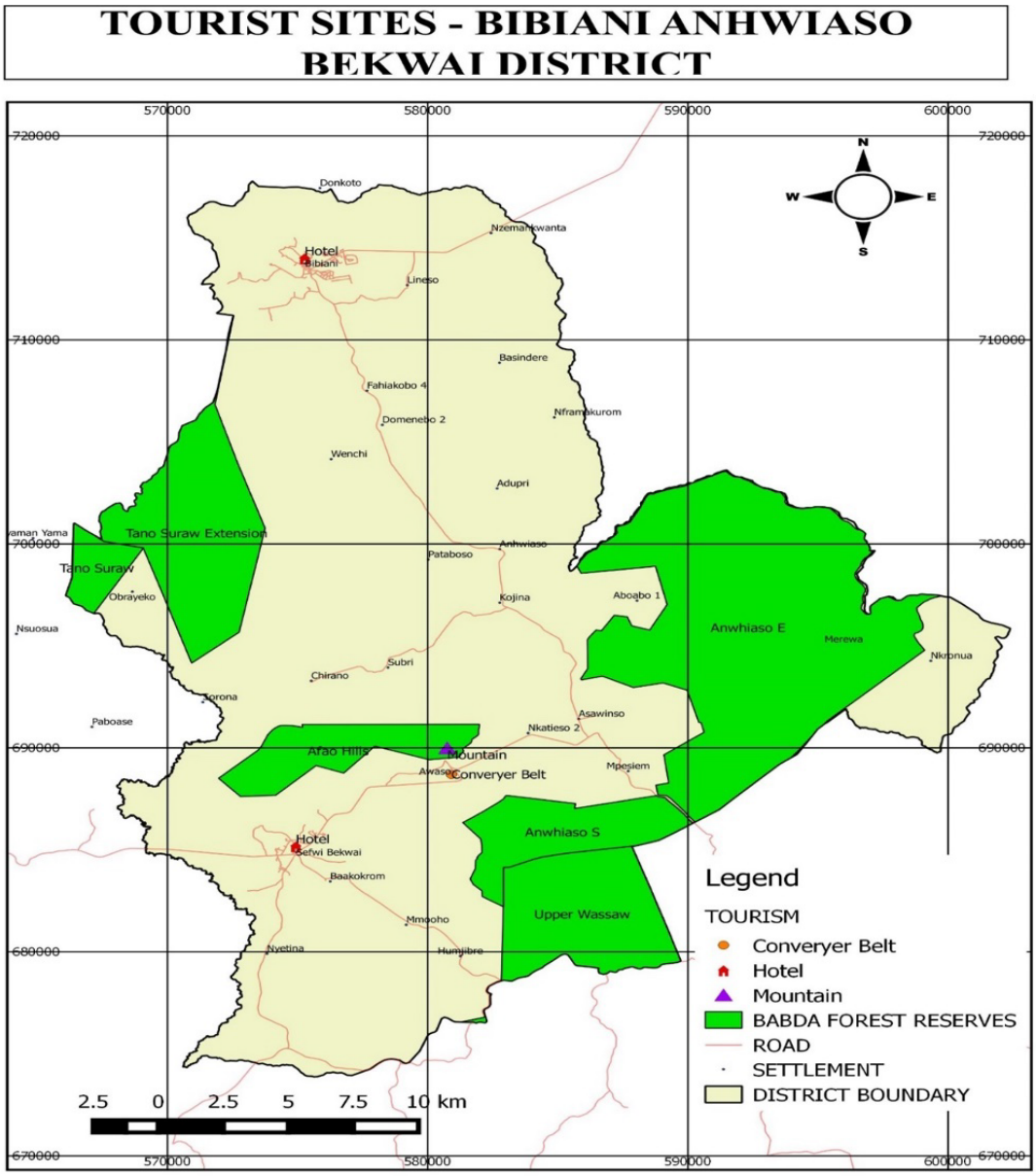
The BABMA is an important economic area in the Western North Region of Ghana. Agriculture plays a dominant role, with the cultivation of cocoa, cassava, maize, and plantain being key contributors to the local economy (GSS, 2021). The municipality is also known for its rich mineral resources, especially gold, which drives a significant mining industry. Trade and small-scale manufacturing further support the economy, along with services such as education, health care, and transportation. The private sector, particularly in agriculture, mining, and trade, is the largest employer in the region. The assembly generates revenue through taxes, mining royalties, agricultural activities, and local fees, although specific figures fluctuate based on market conditions (GSS, 2021). The municipality is moderately urbanized, with Bibiani as the main urban center. With an estimated population of about 167,971, the area is seeing growth driven by both urbanization and economic activities. The BABMA continues to focus on improving infrastructure, promoting agricultural productivity, and developing the mining sector for sustainable growth (GSS, 2021).

2.6 Tourism

Tourism has become one of the cornerstones of the BAMBA's economy. The municipality boasts a wide range of natural and built attractive features. For instance, the mining sites at Bibiani and Awaso and their operations are delightful sites to watch. Also, the appealing forest reserve at Bonkaso is endowed with beautiful plant species people will always love to see. The municipality is known for its rich cultural heritage which is showcased on occasions of 'Ellue' and 'Bronya' festivals. The major tourist sites in the municipality include:

- Natural forest reserves ideal for eco-tourism at Bonkaso, Kanayerebo, and Tano-Surano.
- Atta Nyamekrom mountain at 660 metres, the highest peak in the Western Region
- Mining sites at Bibiani, Awaso, and Chirano

Figure 3. Tourism map of the municipality



Source: BAMBA MTDP, 2021.

2.7 Observed Gender Gaps in the Bibiani-Anhwiaso-Bekwai Municipal Assembly

In the BABMA, notable gender gaps persist across several dimensions of community life, particularly in terms of health, education, agricultural and economic participation, sociocultural norms, and resilience to climate change. These gaps affect men and women differently and are further deepened among children, youth, the elderly, and PWDs, who often face compounded vulnerabilities.

In health, significant disparities exist across different population groups. Women, especially those in remote and underserved communities, face challenges accessing quality reproductive and maternal health care services. Cultural norms and limited resources often delay or prevent them from seeking

skilled medical care. Men, on the other hand, are generally less likely to engage in preventive health care due to societal expectations and gender stereotypes. Children in the BABMA, particularly in rural communities, experience malnutrition, poor immunization coverage, and limited access to pediatric care. Youth lack comprehensive, youth-friendly health services, with teenage pregnancies and sexually transmitted infections on the rise. The elderly population often struggles with access to geriatric care and support for chronic illnesses. PWDs face significant barriers, including physical inaccessibility of health facilities and lack of specialized medical services.

In the area of education, gender and social disparities are evident at all levels. Girls are more likely to drop out of school due to early marriage, pregnancy, and the absence of menstrual hygiene management support in schools. Boys, while generally having higher school retention rates, are also at risk of dropping out to engage in small-scale mining or other labour-intensive jobs, especially during economic hardship. The educational needs of youth are inadequately addressed, with limited opportunities for vocational and technical training relevant to local economic needs. Children across BABMA face challenges such as long travel distances to school, overcrowded classrooms, and under-resourced teachers, especially in farming communities. PWDs are frequently excluded from mainstream education due to stigma, lack of inclusive infrastructure, and limited support services. The elderly, though largely absent from formal education systems, remain important custodians of indigenous knowledge but are not often engaged in formal literacy or skills-building programs.

Agriculture and economic participation also reveal marked inequalities. Women are typically involved in subsistence farming and have limited access to land, credit, inputs, and agricultural extension services. In contrast, men often control more productive lands and are more likely to participate in commercial agriculture and higher-paying sectors such as mining. Youth in BABMA face barriers to land ownership and access to financing, which limits their potential to engage in agribusiness or adopt modern farming technologies. PWDs face exclusion from agricultural activities and income-generating opportunities due to physical constraints and prevailing societal stigmas. The elderly continue to work in agriculture, but their productivity is often limited due to aging and a lack of support systems. Children, particularly in farming households, are sometimes involved in labour during peak agricultural seasons, which can affect their education and well-being.

Sociocultural norms and practices continue to reinforce gender roles and exclusionary structures within the municipality. Patriarchal systems limit women's participation in decision-making at the household and community levels. Men are often under pressure to be sole breadwinners, which can lead to risky migration or overwork. Youth, despite making up a large portion of the population, are rarely given a platform to contribute to community development or local governance. PWDs experience stigma and are often excluded from social and economic activities due to deep-seated cultural beliefs and a lack of community awareness. The elderly are respected in traditional settings but face marginalization as modernity and urban migration shift social values. Children are typically raised under strict gender norms, which affect their development, future aspirations, and ability to participate equally in society.

Finally, the impacts of climate change in the BABMA reveal significant vulnerabilities among all groups. Women are particularly affected due to their dependence on natural resources for household survival and their caregiving responsibilities, which intensify during times of environmental stress. Men are also impacted, particularly through loss of livelihoods in farming and mining due to erratic rainfall,

droughts, and land degradation, often resulting in outmigration. Youth face rising unemployment as traditional livelihood options become less viable under changing climate conditions. Children suffer from the secondary impacts of climate change, such as food insecurity, increased disease burden, and disruption to schooling due to extreme weather events. The elderly, with limited mobility and access to information, are often excluded from adaptation efforts and are less able to recover from climate shocks. PWDs are the most vulnerable during disasters, often left out of evacuation and recovery efforts due to inaccessible infrastructure and lack of inclusive planning.

3.0 Institutional Arrangements and Municipal-Level Adaptation Governance

3.1 Current Institutional Arrangements

The BABMA operates under a structured framework designed to manage the administrative and developmental needs of the municipality effectively. Here are some key aspects of its institutional arrangements:

- **Leadership**: The Assembly is headed by the Municipal Chief Executive (MCE), who oversees the administration and implements policies per the government's development agenda. While specific gender balance at the MCE level can vary based on appointment, efforts are continually made to promote inclusive leadership across all levels.
- **Departments and directorates**: The Municipal Assembly comprises various departments and directorates, including those focused on education, health, agriculture, works, environment, and social welfare, to address specific areas of local governance and service delivery. The staffing of these departments generally reflects a mix of genders, though specific data on gender representation in leadership roles within each directorate could be further explored in future assessments.
- **Legislative body**: The Assembly acts as the legislative body, making decisions on governance issues, approving budgets, and ensuring the effective implementation of development plans through the collaboration of elected Assembly members. The composition of elected Assembly members, while primarily based on electoral outcomes, is an area where conscious efforts to encourage female participation are ongoing.
- **Community engagement**: The BABMA prioritizes community engagement through public consultations, meetings, and feedback mechanisms to address the needs and concerns of residents and foster participatory governance. These engagement platforms actively encourage the participation of women, youth, and other marginalized groups to ensure diverse voices are heard and considered in decision-making.
- **Service Charter**: The Assembly has a Service Charter that defines its commitments to improving service delivery, enhancing transparency, and ensuring that residents' needs are met in a timely and efficient manner. The principles of equity and non-discrimination embedded in the Service Charter guide efforts to ensure services are accessible and responsive to all residents, irrespective of gender.

3.2 Strengthening Institutional Capacity for Gender-Responsive Adaptation

To ensure the effective and equitable implementation of this Climate Adaptation Plan, it is imperative to strengthen the BAMBA's institutional capacity with a gender lens. This includes:

- **Capacity building on gender and climate change**: Conducting regular training and awareness programs for all levels of BAMBA staff, Assembly members, and relevant departmental heads on gender-responsive climate change adaptation. This will enhance their understanding of gender-differentiated impacts and the importance of inclusive planning and implementation.
- **Integrating gender-responsive budgeting**: Developing and implementing mechanisms for gender-responsive budgeting across all relevant departments. This ensures that financial resources are allocated equitably and effectively to address the specific needs and priorities of women, men, and marginalized groups in climate adaptation initiatives.
- **Promoting gender-balanced institutional arrangements**: Actively pursuing strategies to increase the representation and meaningful participation of women in leadership positions, decision-making bodies, and technical roles within the Assembly and its departments. This includes promoting gender balance in committees overseeing climate action and disaster risk reduction.
- **Establishing gender focal points**: Designating gender focal points within key departments (e.g., planning, agriculture, social welfare, environment) to champion gender mainstreaming efforts, monitor gender-sensitive indicators, and facilitate inter-departmental collaboration on gender and climate issues.
- **Enhancing data collection and analysis**: Strengthening the capacity to collect, analyze, and utilize gender-disaggregated data to inform adaptation planning, monitoring, and evaluation. This ensures that interventions are evidence-based and responsive to the distinct realities of different gender groups.

3.3 Relevant National or Municipal Policies on Climate Change Adaptations in the Bibiani-Anhwiaso-Bekwai Municipal Assembly

There is a broad legal and policy framework for climate change issues in Ghana. As a signatory to the United Nations Framework Convention on Climate Change (UNFCCC), Ghana has taken several steps in addressing the socio-economic impacts and the development challenges arising from climate change. The development of the action plan for the BAMBA is premised on existing national policies relating to climate change in Ghana. These policies include the National Climate Change Policy (NCCP) (2013), the National Climate Change Adaptation Strategy (2012), Ghana’s revised Nationally Determined Contributions (NDCs) (2021), National Adaptation Plan Framework (2018), Climate Change Master Plan (2015), and National Climate Change and Green Economy Learning Strategy (2016). We also reviewed non-governmental organizations with an interest in agricultural development issues in the country.

Ghana's NCCP provides an integrated response to the challenges of climate change. The NCCP seeks “to ensure a climate resilient and climate compatible economy while achieving sustainable development through equitable low carbon economic growth for Ghana.” The NCCP seeks to mainstream climate change into policies and sectoral activities for sustainable growth. Additionally, the NDCs provide further policy framework for the climate change issues in Ghana. Table 1 presents the relevant national policies on climate change adaptation at the national levels.

Table 1. Relevant national policies on adaptation

Policy	Year	Objective	Implementing agency
National Climate Change Policy (NCCP)	2013	Provides a framework for addressing climate change across sectors like agriculture, water, and infrastructure; promotes local-level adaptation	Ministry of Environment, Science, Technology and Innovation (MESTI); Environmental Protection Agency (EPA); District Assemblies
Ghana's intended Nationally Determined Contributions (NDCs)	2015	Highlights Ghana's climate commitments with a focus on reducing emissions and adapting in key sectors that impact the assembly	MESTI, EPA, Ministry of Energy; Ministry of Food and Agriculture (MoFA), National Disaster Management Organization (NADMO)
National Adaptation Program of Action	2008	Identifies urgent climate adaptation actions to reduce vulnerabilities in districts like BABMA	EPA, MESTI, MoFA, Ministry of Sanitation and Water Resources
Ghana's Climate-Smart Agriculture Policy	2016	Supports sustainable agricultural practices to help local farmers adapt to climate change and enhance food security	MoFA, EPA, MESTI, District Departments of Agriculture
National Water Policy	2007	Ensures sustainable water resource management and improved access to water, especially in the face of droughts and irregular rainfall	Ministry of Sanitation and Water Resources, Water Resources Commission, Ghana Water Company Ltd.
Ghana's Forest and Wildlife Policy	2012	Promotes conservation and sustainable forest management for climate adaptation, biodiversity, and carbon sequestration in the municipality	Forestry Commission, MESTI, Ministry of Lands and Natural Resources
Disaster Risk Reduction and Management Policy	2010	Assists in developing disaster response strategies and improving resilience to floods, storms, and droughts	NADMO, District Assemblies, Ghana Meteorological Agency (GMet)

Policy	Year	Objective	Implementing agency
National Energy Policy	2010	Encourages renewable energy use and energy efficiency, reducing climate impacts linked to energy systems in the municipality	Ministry of Energy, Energy Commission, Volta River Authority (VRA), Electricity Company of Ghana (ECG)
Local Economic Development Policy	2015	Supports climate-resilient local industries through green technology, sustainable livelihoods, and eco-friendly practices	Ministry of Local Government, Decentralization and Rural Development (MLGDRD), District Assemblies, Ghana Enterprises Agency
National Policy on Environment and Sustainable Development	2012	Offers a comprehensive guide for sustainable development planning and environmental management at the municipal level	MESTI, EPA, National Development Planning Commission (NDPC), District Planning Units

Source: Authors

3.4 Proposed Arrangements for Adaptation Governance

The BABMA has proposed several arrangements to enhance climate change adaptation governance. Some of the key elements are highlighted below:

- **Establishing a climate change adaptation unit**: A dedicated unit or office within the municipal assembly to oversee and coordinate all climate adaptation efforts. This unit could work across sectors to ensure that climate resilience is integrated into development planning, policy implementation, and resource allocation.
- **Strengthening multi-stakeholder coordination**: Establishing a platform for regular dialogue and collaboration between the municipal assembly, local communities, CSOs, private sector stakeholders, and other government agencies. This would ensure the incorporation of diverse perspectives and expertise in decision-making processes and foster collective ownership of climate adaptation initiatives.
- **Integrating climate adaptation into local development plans**: Formalizing the inclusion of climate change adaptation strategies within the assembly's annual development plans and policies. This would ensure that climate risks are considered in all major infrastructure, agricultural, and urban development projects, helping to promote climate-resilient development.
- **Capacity building and training for local authorities**: Providing training programs for municipal staff, local leaders, and community representatives on climate adaptation strategies, climate change science, and disaster risk reduction. This would build local capacity to effectively plan, implement, and monitor climate adaptation projects.
- **Promoting community-based adaptation**: Encouraging and supporting community-led climate adaptation initiatives. This could involve providing communities with the necessary tools, resources, and technical support to develop their solutions to local climate vulnerabilities, enhancing ownership and the sustainability of adaptation efforts.

3.5 Implementation Roles and Responsibilities

The implementation of the Climate Change Adaptation Plan for the BABMA involves various stakeholders, each with specific roles, responsibilities, and expected outcomes (Table 2).

Table 2. Relevant stakeholders, key roles, responsibilities, and expected outcome from engagement in implementation of the BAMBA's adaptation plan

Name of institution	Roles/responsibilities	Expected outcome from engagement
BABMA	Lead the implementation of the adaptation plan, coordinate activities among stakeholders, and ensure policy integration	Effective governance and coordination, and successful integration of climate adaptation measures into urban planning
Ministry of Environment, Science, Technology, and Innovation	Provide policy direction, funding, and technical support	Alignment of local adaptation efforts with national policies, adequate funding, and resources for implementation
Local communities	Participate in planning and decision-making processes and implement community-based adaptation measures	Increased community resilience, and locally relevant adaptation solutions
Non-governmental organizations (NGOs)	Support capacity building, provide technical expertise, and facilitate community engagement	Enhanced capacity for climate adaptation, and effective community participation
Private sector	Invest in climate-resilient infrastructure and develop and implement sustainable business practices	Increased investment in green infrastructure and building the climate resilience of businesses
Academic and research institutions	Research climate impacts and adaptation strategies, and provide data and evidence-based recommendations	Improved understanding of climate risks and informed decision-making based on scientific research
International development partners	Provide financial and technical assistance and share best practices and knowledge	Access to international funding and expertise, and adopting global best practices in climate adaptation
Media	Raise awareness about climate change and adaptation efforts and disseminate information to the public	Increased public awareness and support for climate adaptation initiatives

Name of institution	Roles/responsibilities	Expected outcome from engagement
Gender actors	Lead or participate in the implementation of gender-specific adaptation measures, such as adopting new farming techniques, managing water resources, or establishing early warning systems	Reduced gender-specific vulnerabilities

Source: Authors

4.0 Current and Future Climate Scenarios for the Bibiani-Anhwiaso-Bekwai Municipal

This section summarizes current and future climate projections and scenarios. For a more detailed assessment, refer to the BABMA Phase III Vulnerability Assessment report, which offers deeper insights into climate change in the metropolis. It is recommended that this adaptation plan be used alongside the vulnerability assessment report, especially the climate information it contains. This plan is based on observed and expected climate changes in the municipality, aiming to support climate-informed decision-making. The climate projections are tailored to the specific context and needs of the BABMA. Table 3 presents the historical climate and future climate of the BABMA.

Table 3. Historical versus future climate in the BABMA

Climate parameter	Historical climate	Future climate
Temperature	• Warm tropical climate with average temperatures ranging between 25°C and 30°C • Occasional spikes during hot periods, especially during March and April	• Projected temperature rise of 1.5°C to 2°C by the mid-21st century due to global warming • Increased frequency of higher-than-average temperatures
Rainfall patterns	• Bimodal rainfall with two distinct rainy seasons (March to July and September to November) • Average annual rainfall of approximately 1,200 to 1,500 mm • Periodic droughts and irregular rainfall distribution	• Increased rainfall variability, with more intense rainfall events during the rainy seasons • Projected reduction in total rainfall during the minor rainy season, and possible prolonged dry spells
Dry periods	• Dry periods (Harmattan) are common from November to February, with low humidity and dust • Prolonged dry spells have been observed in recent decades, impacting agriculture	• Rise in the frequency and intensity of dry periods, particularly during the minor rainy season • Onset of rains may become increasingly unpredictable, leading to longer initial dry spells
Humidity	• Generally high humidity throughout the year, especially during the rainy season	• Humidity levels may increase with rising temperatures, leading to more intense heat stress during the wet season

Climate parameter	Historical climate	Future climate
Extreme weather events	• Occasional flooding during intense rainfall events • Storms and heavy rains have caused localized damage to infrastructure	• Increased frequency of extreme weather events such as heavy rains, flooding, and storms • Projected rise in intensity and frequency of extreme weather events due to climate change
Wind patterns	• Winds are typically moderate, with stronger gusts during the rainy season and dry periods	• Wind patterns may change with the onset of stronger storms and prolonged dry spells, impacting agriculture and local weather patterns

Source: Armah et al., 2019.

4.1 Climate Hazards, Vulnerabilities, Risks, and Impacts

Table 4 presents the climate hazards and key vulnerability factors in the BABMA.

Table 4. Climate hazards and key vulnerability factors

Climate hazards	Key vulnerability factors
Rainfall variability and floods	• Inconsistent rainfall patterns in BABMA affect the predictability of the growing seasons for crops like cocoa and maize. • The municipality's towns, particularly Bibiani, have poor drainage systems, making urban areas susceptible to flooding during heavy rains. • Agricultural lands, especially in flood-prone areas near rivers, face regular inundation, resulting in crop loss and soil erosion. • The lack of reliable rainfall forecasting systems leaves farmers unprepared for sudden shifts in rainfall, which affect planting and harvesting schedules. • The unpredictable rain further exacerbates soil erosion and degradation, impacting agricultural productivity.

Climate hazards	Key vulnerability factors
Temperature and dry periods	• Increased temperatures in the BABMA threaten the yield of temperature-sensitive crops like cocoa, maize, and cassava. • Many farmers in the municipality rely on rain-fed agriculture, and prolonged dry periods exacerbate water scarcity, reducing crop yields. • The municipality's agricultural sector lacks irrigation infrastructure, making it vulnerable to dry spells that can cause crop failures. • Rising temperatures contribute to heat stress for both crops and livestock, impacting productivity and food security in the region. • The region's reliance on outdoor labour in agriculture exposes the local population to higher risks of heat-related health issues.

Source: Notes taken from BADMA (2024) and National Development Planning Commission (NDPC) (2024).

Table 5. Key sector vulnerabilities

Priority sectors	Key vulnerabilities
Agriculture	• Reduced crop yields due to erratic rainfall • Increased pest and disease outbreaks, especially in cocoa farming • Soil degradation and erosion are caused by erratic rainfall and dry spells • Water scarcity during extended dry periods affects crop growth • Heat stress on crops and livestock due to rising temperatures
Biodiversity	• Loss of habitat for native species due to deforestation and land use changes • Decline in species diversity due to temperature shifts and altered rainfall patterns • Increased risk of invasive species spreading as climate conditions favour their growth • Reduced resilience of ecosystems to climate change due to degraded habitats • Threat to wildlife, especially in forest reserves, from changing climate conditions
Forest	• Deforestation is driven by increased demand for land and climate change pressures

Priority sectors	Key vulnerabilities
	• Increased vulnerability of forests to pests and diseases due to changing temperatures • Forest fires are becoming more frequent during prolonged dry spells • Decline in forest cover due to erratic rainfall patterns and droughts • Disruption of forest-based livelihoods due to the loss of timber and non-timber forest products
Water resources	• Reduced water availability due to prolonged dry periods and droughts • Increased contamination of water sources during heavy rainfall and flooding • Decreased groundwater recharge due to erratic rainfall patterns • Impact on local water quality from changes in land use and agricultural runoff • Increased competition for water resources between agriculture, households, and industries
Fisheries	• Decreased fish populations due to changes in water temperature and quality • Disruption of fish migration patterns caused by altered rainfall and water flow • Reduced freshwater availability impacting aquaculture in the municipality • Increased risk of flooding affecting fish farms and aquatic ecosystems • Changes in the breeding patterns of local fish species due to altered climate conditions
Disaster risk reduction	• Increased frequency of floods, affecting communities and infrastructure • Higher vulnerability to droughts and heat waves is impacting agriculture and water supply • Poor disaster preparedness due to a lack of early warning systems • Increased property damage and displacement due to heavy rainfall and storms • Loss of lives and livelihoods due to more intense weather events (e.g., storms)
Human health	• Rising temperatures are contributing to heat-related illnesses such as heatstroke • Increased spread of vector-borne diseases like malaria due to changes in temperature and rainfall

Priority sectors	Key vulnerabilities
	• Reduced access to clean water during dry periods leads to waterborne diseases • Increased respiratory problems from air pollution and dust during dry spells • Poor nutrition and food security are impacting overall health due to climate-induced agricultural losses
Tourism	• Decline in eco-tourism activities due to damage to biodiversity and natural attractions • Increased vulnerability of tourism infrastructure to flooding and storms • Seasonal changes affecting the flow of tourists during altered climate conditions • Disruption of local tourism businesses due to extreme weather events • Reduced attractiveness of the municipality as a tourist destination due to climate-related damage to landscapes
Gender	• Women farmers face higher risks due to limited access to climate-resilient technologies • Increased burden on women due to water scarcity and the need to collect water during droughts • Gender inequality is exacerbated by climate-induced displacement, affecting women disproportionately • Reduced access to land and resources for women farmers affects food security • Women are more vulnerable to climate-related health impacts, especially during heat waves or waterborne diseases

Source: Notes taken from BABMA (2024) and NDPC (2024).

5.0 Adaptation Action Planning

The Bibiani-Anhwiaso-Bekwai Municipal Assembly is committed to addressing the pressing challenges posed by climate change while fostering sustainable development. Its Adaptation Action Planning framework is tailored to the municipality's unique context, ensuring that local communities, ecosystems, and infrastructure are better prepared for the effects of climate variability. This strategic plan integrates climate adaptation into all aspects of municipal planning and focuses on five key areas:

- **Climate risk identification**: Highlighting the municipality's major climate challenges, including floods, rainfall variability, and heatwaves, and assessing their impacts on livelihoods, agriculture, and infrastructure.
- **Community participation**: Actively involving farmers, traditional councils, women's cooperatives, and youth groups in crafting and executing solutions that meet the municipality's specific needs.
- **Localized solutions and interventions**: Implementing targeted initiatives such as enhancing irrigation facilities, promoting agroforestry, improving drainage systems, and protecting vulnerable ecosystems.
- **Knowledge sharing and capacity strengthening**: Providing education and training to municipal staff, community leaders, and residents to equip them with the tools and skills needed to adapt to climate change effectively.
- **Progress tracking and adaptation**: Establishing mechanisms to evaluate the success of implemented strategies, gather feedback, and adjust approaches to improve climate resilience across sectors.

5.1 Identification and Compilation of Sector-Specific Adaptation Actions

A detailed plan for climate change adaptation in the BABMA was developed, focusing on strategies specifically designed for the metropolis. This approach facilitated the evaluation of multiple potential measures and the selection of suitable actions. The team employed methods outlined in Table 6 to identify these options.

Table 6. Methodology to identify adaptation options

Vulnerability assessment report recommendations	The climate vulnerability analysis for the municipality proposed a range of adaptation strategies aimed at enhancing resilience, boosting adaptive capacity, and mitigating vulnerabilities. These strategies were carefully integrated into the adaptation planning process.

Literature review	A thorough examination of best practices and effective solutions was carried out. This involved analyzing government policy documents, scientific research, grey literature, municipal reports, and other resources to identify effective adaptation measures addressing comparable impacts and vulnerabilities.
Stakeholder consultation	Key stakeholders were actively involved through participatory workshops, fostering open dialogue and collaboration on adaptation strategies tailored to specific climate scenarios. These workshops considered existing and projected climate impacts and vulnerabilities. In the municipality, sectoral stakeholders were grouped to focus on eight key areas: 1. Agriculture 2. Gender (cross-cutting sector) 3. Tourism 4. Water resources 5. Human health 6. Disaster risk reduction 7. Forest 8. Biodiversity 9. Fisheries

Source: Author table based on the BABMA Adaptation Plan.

The strategies highlighted in Table 6 were utilized to compile a list of pertinent adaptation options, which are detailed in the tables found in Appendix B. In total, 88 adaptation options were identified across the nine sectors. Table 7 shows the distribution of these actions, with disaster risk reduction having the highest number of actions (12), followed by agriculture (10).

Table 7. Distribution of adaptation options by sector

Sectors	Number of adaptation actions	Rank
Biodiversity	7	8
Fisheries	8	6
Tourism	8	6
Disaster risk reduction	12	1
Agriculture	10	2
Water resources	7	2
Forestry	10	2
Human health	7	8
Gender	10	2

Source: Authors

5.2 Methodological Approach for Ranking Adaptation Options

Based on the key vulnerabilities and climate risks identified in the Bibiani-Anhwiaso-Bekwai municipality, a list of potential adaptation options was identified through a desk review literature search and interactions with key stakeholders. These adaptation options were then validated and screened with key stakeholders during stakeholder workshops. Following this, workshop participants were grouped based on their expertise and interests to evaluate, prioritize, and rank the key adaptation options presented. This exercise was facilitated by using clear information and criteria. This involved assessing how suitable the options were for the Bibiani-Anhwiaso-Bekwai municipality context, their ability to enhance resilience and reduce vulnerabilities identified in the Bibiani-Anhwiaso-Bekwai vulnerability assessment, and their overall impact on sustainable development.

This prioritization process aimed to make informed decisions that lead to effective adaptation and avoid maladaptation. To achieve this, relevant actors and stakeholders were involved in the assessment process to ensure the chosen adaptation options were appropriate and free from potential negative outcomes. Each of the nine key stakeholder groups (agriculture, biodiversity, water resource, human health, tourism, fisheries, disaster risk reduction, forestry, and gender) evaluated the proposed adaptation options using a multi-criteria decision-making (MCDM) analysis. This approach was necessary because each adaptation measure might perform differently across various criteria and could involve trade-offs. Therefore, they needed to be carefully and critically evaluated, and the results of the analysis integrated into decision-making about priority options.

An MCDM analysis is a systematic approach used to evaluate and prioritize multiple options based on various criteria. It involves identifying relevant criteria, assigning weights to each criterion based on their importance, and then scoring each option against these criteria. This method helps in making informed and balanced decisions, especially when dealing with complex issues involving multiple stakeholders and conflicting objectives (Dixit & McGray, 2013). The criteria for the evaluation of the climate change adaptation strategies are defined in Table 8.

Consultation with sector stakeholders for the ranking and prioritization exercise. Photo: Foresight Planners and Research Africa Limited

Table 8. Criteria for the assessment of the climate change adaptation options

S/N	Dimension	Indicators	Description
1	Technological	Effectiveness	Effectiveness or importance describes how well effective an adaptation option can mitigate climate damage. In essence, an effective option yields considerable benefits in terms of avoided consequences, albeit potentially at a high cost.
2	Economic	Affordability (cost efficiency)	This refers to the cost of implementing the adaptation option
3	Institutional	Institutional feasibility Alignment with district and/or national priorities	Institutional feasibility refers to institutional and legal capacity. The preferred adaptation option aligns with laws, regulations, and institutional structures. The extent to which this measure supports other development priorities of the district or the country
4	Technological	Technical feasibility	Technical feasibility focuses on evaluating the technological expertise and the availability of necessary human, financial, and administrative resources for a specific option
5	Social	Traditional acceptance of adaptation	Traditional acceptance refers to the degree of acceptability of an adaptation strategy aligning with the context of traditional values
6	Social	Social co-benefits	This entails evaluating whether the proposed adaptation aligns with existing social practices and customs and whether it is likely to be embraced by the affected community or population
7	Environmental	Flexibility	Flexibility refers to the ability to change behaviour in response to changing conditions

S/N	Dimension	Indicators	Description
8	Environmental	Environmental considerations	This evaluates the potential of the intervention to improve greenhouse gas emissions, biodiversity, human health, soil quality, water quality, air quality, climate, and landscape
9	Social	Gender responsiveness	This evaluates the extent to which the adaptation options address gender-related issues
10	Social	Equity	The extent to which the adaptation option will benefit vulnerable groups and communities
11	Technological	Replicability or scalability	This defines the ability or possibility of the intervention to be replicated elsewhere in the country or scaled up
12	Technological/economic/institutional/environmental or social	Barriers to implementation	This identifies potential institutional, economic, technological, and social barriers to the implementation of the adaptation option

Source: Dixit & McGray, 2013.

5.3 Assigning Weights to the Indicators for Ranking

After ranking the different indicators, it was essential to assign appropriate weights to them. An unequal weighting system, reflecting the relative importance of each indicator, was used (Zobeidi et al., 2024; Antwi-Agyei et al., 2013; UNFCCC, 2011). Therefore, a five-point Likert scale (Table 9) was utilized, where climate change experts, as well as agricultural and food experts, ranked the indicators based on their perceived importance, similar to the method used by Antwi-Agyei et al. (2013). The frequency with which each indicator was cited was used to develop the weighting system (Zobeidi et al., 2024; Antwi-Agyei et al., 2013; UNFCCC, 2011).

Table 9. Ranking of adaptation options based

1	Low
2	Neutral
3	Medium
4	High
(….)	Enclose a number in a bracket to show high uncertainty.

Source: Authors

5.4 Estimation of Adaptation Cost

One of the important considerations in any adaptation action plan is the estimation of the cost of implementing the adaptation options identified to address the key climate change vulnerabilities and risks in the municipality. After ranking the key adaptation actions, the list was sent to the municipal planning and finance offices of the BAMBA. The Finance Office constituted a committee to provide a reasonable estimate for each of the adaptation actions identified. This forms the basis of the cost element attached to each of the adaptation actions.

5.5 Adaptation Options for Priority Sectors

The prioritized climate change adaptation options are described in this section, highlighting the adaptation objective, justification, and critical considerations for each adaptation option.

5.5.1 Biodiversity Sector

From the Climate Change Rapid Risk Assessment for the BABMA, biodiversity was recognized as very vulnerable to the adverse impacts of climate change. The adaptation options for the biodiversity sector in the BABMA aim to enhance the resilience of ecosystems and agricultural landscapes while ensuring sustainable natural resource management (Table 10). Promoting community-based forest management and restoration projects seeks to empower local communities to restore degraded forests and maintain biodiversity through active participation. Similarly, agroforestry systems integrating native tree species with crops aim to improve soil fertility, increase carbon sequestration, and support sustainable livelihoods. Strengthening early warning systems and response plans for extreme weather events focuses on mitigating the impact of climate variability by equipping the

municipality with tools to predict, prepare for, and respond to natural disasters. Finally, creating seed banks and genetic repositories ensures the conservation of native plant species and genetic diversity, which are critical for adapting to changing climatic conditions and preserving local biodiversity. Together, these objectives contribute to enhancing ecosystem resilience, supporting sustainable livelihoods, and safeguarding the natural heritage of the municipality.

The vulnerability of the municipality to climate variability, including extreme weather events, requires proactive measures such as early warning systems and ecosystem-based solutions. These options were also chosen for their ability to involve communities, enhance resilience, and ensure long-term biodiversity conservation while supporting sustainable development in the face of climate change.

Table 10. Ranking of adaptation options for the biodiversity sector

Adaptation options	Final score from stakeholders	Rank
Promote community-based forest management and restoration projects	49	1
Promote agroforestry systems that integrate native tree species with agricultural crops	48	2
Strengthen early warning systems and response plans for extreme weather events	44	3
Create seed banks and genetic repositories	44	3

Source: Authors

Table 11. Adaptation actions for the biodiversity sector

Adaptation actions	**Objectives**	**Indicators of success**	**Time frame** (Short, medium, or long term)	**Resources** (finance, human, technology)	**Lead institution**	**Implementing partners**	**Estimated costs (GH₵)**
Promote community-based forest management and restoration projects	Involve local communities in forest management, giving them decision-making power and responsibility, which leads to greater sustainability	Increased community participation in forest management activities	Long term	Human, technology, finance	Ministry of Lands and Natural Resources	Local NGOs, traditional authorities, District Assemblies, United Nations Development Programme (UNDP), Global Environment Facility (GEF), International Union for Conservation of Nature (IUCN), ClimateWorks Foundation	1,800,000.00
		Improved forest cover and biodiversity through local restoration efforts					
		Enhanced livelihoods of communities through sustainable forest-based income activities					
Promote agroforestry systems that integrate native	Enhance ecosystem resilience and agricultural productivity by	Increased adoption of agroforestry practices by men and women farmers	Medium term	Human, technology, finance	MoFA	Farmer-based organizations, local NGOs, traditional authorities, research	2,467,890.00

Adaptation actions	**Objectives**	**Indicators of success**	**Time frame** (Short, medium, or long term)	**Resources** (finance, human, technology)	**Lead institution**	**Implementing partners**	**Estimated costs (GH₵)**
tree species with crops	combining native tree species with crops, which improves soil health, biodiversity, and climate adaptation	Improved soil health and crop yields in agroforestry systems Enhanced biodiversity and resilience of farming landscapes				institutions (e.g., Council of Scientific and Industrial Research), Food and Agriculture Organization (FAO), World Agroforestry Centre (ICRAF), UNDP	
Strengthen early warning systems and response plans for extreme weather events	Enhance communities' and sectors' resilience and adaptive capacity by strengthening early warning systems and response plans for extreme weather events through improved forecasting accuracy, efficient dissemination of information, and	Timely dissemination of early warnings to vulnerable communities Reduced damage to biodiversity and ecosystems from extreme weather events Increased community preparedness and	Short term	Human finance, technology	GMet	MESTI, local governments, traditional leaders, NADMO UN Office for Disaster Risk Reduction (UNDRR), World Bank, Red Cross, ClimateWorks Foundation	2,800,000.00

Adaptation actions	**Objectives**	**Indicators of success**	**Time frame** (Short, medium, or long term)	**Resources** (finance, human, technology)	**Lead institution**	**Implementing partners**	**Estimated costs (GH₵)**
	coordinated emergency preparedness measures	response capabilities					
Create seed banks and genetic repositories	Provide timely warnings to the community to minimize the impact of extreme weather events, such as floods and droughts	Increased collection and storage of diverse native plant species	Medium term	Technology, finance, human	CSIR	MoFA, local universities, Ghana Seed Company, traditional authorities, NGOs (e.g., A Rocha Ghana) FAO, Global Crop Diversity Trust, World Bank, IUCN	3,500,000.00
		Improved availability of seeds for restoration projects					
		Enhanced genetic diversity and resilience of plant species					
Implement reforestation programs using	Preserve the genetic diversity of native and resilient plant species, ensuring	Reduced soil erosion and improved soil fertility	Long term	Finance, human, technology	Ministry of Lands and Natural Resources,	MESTI, traditional authorities, Ghanaian NGOs, World Bank, United	6,000,000.00

Adaptation actions	**Objectives**	**Indicators of success**	**Time frame** (Short, medium, or long term)	**Resources** (finance, human, technology)	**Lead institution**	**Implementing partners**	**Estimated costs (GH₵)**
climate-resilient species	the availability of seeds for restoration and future adaptive needs in response to climate change	Increased agricultural productivity and reduced land degradation Enhanced carbon sequestration through sustainable practices			Forestry Commission of Ghana,	Nations Environment Programme (UNEP), IUCN, GEF	
Adopt sustainable land management practices to combat soil degradation	Reduce soil erosion by adopting land management practices that maintain soil structure and fertility	Reduced soil erosion and improved soil fertility Increased agricultural productivity and reduced land degradation Enhanced carbon sequestration	Medium term	Human, technology, finance	MoFA	EPA, Ghana Cocoa Board, traditional authorities, local farmers' associations, NGOs (e.g., A Rocha Ghana)	3,500,000.00

Adaptation actions	**Objectives**	**Indicators of success**	**Time frame** (Short, medium, or long term)	**Resources** (finance, human, technology)	**Lead institution**	**Implementing partners**	**Estimated costs (GH₵)**
		through sustainable practices					
Establish wildlife corridors to connect fragmented habitats	Create connections between isolated habitats, enabling wildlife to move freely and access essential resources such as food, water, and breeding areas	Increased movement and genetic diversity of wildlife species	Long term	Human, technology, finance	Ministry of Lands and Natural Resources	Local communities, traditional authorities, NGOs, WWF, UNDP, IUCN, World Bank	6,889,330.00
		Decrease in human-wildlife conflicts in corridor areas					
		Enhanced connectivity and restoration of fragmented ecosystems					

Source: Authors

5.5.2 Fisheries Sector

Out of the eight adaptation options that were identified and evaluated through the MCDM analysis, three were selected and prioritized (Table 12). Educating communities on climate-smart fishing practices seeks to equip local fishers with knowledge and techniques that minimize environmental impact, reduce overfishing, and promote sustainable resource use. Promoting aquaculture and diversifying fish species focus on reducing reliance on wild fisheries while increasing productivity and resilience to climate-induced challenges, such as changes in water temperature or availability. Establishing early warning systems for harmful algal blooms aims to protect aquatic ecosystems and fisheries by providing timely alerts to mitigate the negative impacts of these phenomena. Collectively, these objectives contribute to the sustainable management of fisheries, support the livelihoods of fishing communities, and enhance the resilience of the sector to climate change.

The BABMA prioritized these adaptation options due to the critical role of fisheries in supporting local livelihoods and food security, combined with the sector's vulnerability to climate change. Climate variability, including rising temperatures and water quality issues, threatens fish stocks and aquatic ecosystems, making adaptive strategies essential. Educating communities on sustainable practices was prioritized to foster local stewardship and ensure long-term resource availability. These measures align with the municipality's goals of promoting sustainable development, safeguarding natural resources, and building resilience in the fisheries sector.

Table 12. Ranking options for the fisheries sector

Adaptation options	Final scores from stakeholders	Rank
Educate communities on climate-smart fishing practices	50	1
Promote aquaculture and diversify fish species for climate resilience	46	2
Establish early warning systems for harmful algal blooms	44	3

Source: Authors

Table 13. Adaptation actions for the fisheries sector

Adaptation actions	**Objectives**	**Indicators of success**	**Time fame** (short, medium, or long term)	**Resources** (human, finance, technology)	**Lead institution**	**Implementing partners**	**Estimated costs (GH₵)**
Educate communities on climate-smart fishing practices	Enhance understanding of how climate change affects fish populations, ecosystems, and fishing livelihoods	High participation (over 80%) in training sessions for men and women on climate-smart fishing	Short term	Technology, human, finance	MoFAD	Local NGOs, traditional authorities, fisherfolk associations, community-based organizations (CBOs), FAO, WorldFish, WWF, and ClimateWorks Foundation	500,000.00
		Increased adoption of climate-resilient fishing techniques among local men and women fishers					
		Reduction in unsustainable fishing practices like dynamite fishing					
Promote aquaculture and diversify fish species for climate resilience	Enhance fish production and improve ecosystem resilience by diversifying aquaculture with	Increase in aquaculture production by 30% in target communities	Medium term	Human, technology, finance	MoFAD	Local fish farmers' associations, traditional authorities, agricultural extension services,	3,000,000.00
		Introduction of at least three climate-					

Adaptation actions	**Objectives**	**Indicators of success**	**Time fame** (short, medium, or long term)	**Resources** (human, finance, technology)	**Lead institution**	**Implementing partners**	**Estimated costs (GH₵)**
	climate-adapted fish species	resilient fish species in aquaculture systems				World Bank, FAO, African Development Bank, Aquaculture Stewardship Council, ClimateWorks Foundation	
		Enhanced livelihoods of men and women fish farmers through diversified income streams					
Establish early warning systems for harmful algal blooms	Detect and provide timely alerts for harmful algal blooms, enabling proactive responses to protect public health, marine life, and water quality	Timely alerts issued to communities, reducing fish mortality by at least 50%	Short term	Human, finance, technology	GMet	Local universities (e.g., University of Cape Coast), traditional authorities, coastal community groups, fisherfolk associations, World Meteorological Organization (WMO), UNEP, FAO	800,000.00
		Reduction in health risks associated with harmful algal blooms for local fishers and consumers					
		Increased public awareness and preparedness for algal bloom events					

Adaptation actions	**Objectives**	**Indicators of success**	**Time fame** (short, medium, or long term)	**Resources** (human, finance, technology)	**Lead institution**	**Implementing partners**	**Estimated costs (GH₵)**
Monitor water quality and implement pollution control measures	Ensure safe drinking water and recreational water quality by monitoring and mitigating pollutants that pose health risks	High participation (over 80%) in training sessions for men and women on climate-smart fishing	Medium term	Technology, human, finance	EPA, MoFAD	Water Resources Commission, Ghana Standards Authority, local governments, fisherfolk associations, UNEP, World Bank, FAO	1,200,000.00
		Increased adoption of climate-resilient fishing techniques among local men and women fishers					
		Reduction in unsustainable fishing practices like dynamite fishing					
Strengthen regulations against overfishing and illegal fishing practices	Establish regulations that ensure the sustainable management of fish stocks and prevent overfishing	Significant reduction in reported cases of illegal, unreported, and unregulated fishing	Medium term	Technology, human, finance	MoFAD	Marine Police Unit, Ghana Navy, local fisherfolk associations, traditional authorities, FAO, World Bank, UNEP,	500,000.00
		Increase in fish stocks due to effective					

Adaptation actions	**Objectives**	**Indicators of success**	**Time fame** (short, medium, or long term)	**Resources** (human, finance, technology)	**Lead institution**	**Implementing partners**	**Estimated costs (GH₵)**
		enforcement of fishing regulations				Global Fishing Watch, ClimateWorks Foundation	
		High compliance rate (over 75%) among registered men and women fishers					
Implement watershed management to reduce sediment runoff	Prevent soil erosion and minimize sedimentation in water bodies, thereby protecting aquatic ecosystems and enhancing water quality	Measurable decrease in sedimentation levels in coastal and freshwater bodies	Long term	Human, finance, technology	EPA	Local government authorities, traditional leaders, community water committees, agricultural extension services, UNEP, World Bank, FAO	2,800,000.00
		Improved water clarity and quality support healthier fish habitats					
		Enhanced ecosystem services, such as increased fish spawning grounds					
Develop artificial reefs and habitat structures	Restore and enhance marine biodiversity by providing habitats for fish and other marine	Increased fish populations and species diversity around artificial reefs	Long term	Finance, technology, human	MoFAD	Coastal development authority, local NGOs, fisherfolk	250,000.00

Adaptation actions	**Objectives**	**Indicators of success**	**Time fame** (short, medium, or long term)	**Resources** (human, finance, technology)	**Lead institution**	**Implementing partners**	**Estimated costs (GH₵)**
	species, improving ecosystem resilience against climate impacts	Enhanced protection and restoration of marine habitats				associations, traditional authorities, UNEP, FAO, WWF, Global Coral Reef Alliance	
		Positive feedback from local fishing communities on improved fish catches					
Adapt fishing practices to changing species and breeding cycles	Ensure safe drinking water and recreational water quality by monitoring and mitigating pollutants that pose health risks.	Timely alerts issued to communities, reducing fish mortality by at least 50%	Short term	Technology, Finance, Human	MoFAD	Traditional authorities, fisherfolk Cooperatives, research institutions, NGOs, FAO, WorldFish, IUCN	235,000.00
		Reduction in health risks associated with harmful algal blooms for local fishers and consumers					
		Increased public awareness and preparedness for algal bloom events					

Source: Authors

5.5.3 Tourism Sector

From the Climate Change Rapid Risk Assessment for the BABMA, tourism was recognized as very vulnerable to the adverse impacts of climate change. Out of the eight adaptation options that were identified and evaluated through the MCDM analysis, three were selected and prioritized (Table 14). Promoting sustainable eco-tourism practices, such as plastic-free trekking tours, aims to minimize the environmental footprint of tourism activities and preserve natural landscapes. Integrating biodiversity conservation into tourism planning ensures that tourism growth does not compromise the ecological integrity of the region but instead supports the protection of key species and habitats. Developing off-season tourism campaigns seeks to distribute tourism activities more evenly throughout the year, reducing pressure on resources during peak seasons and providing consistent economic opportunities for local communities. Off-season tourism campaigns were selected to address the economic challenges of seasonal fluctuations, providing year-round income opportunities for local stakeholders and reducing overuse of resources during peak seasons. Collectively, these objectives focus on fostering a sustainable tourism industry that contributes to biodiversity preservation, local economic development, and resilience to climate challenges.

Sustainable eco-tourism practices were prioritized to ensure tourism activities contribute positively to environmental preservation and community awareness. Integrating biodiversity conservation into planning was essential to safeguard the region's natural heritage while supporting long-term tourism growth. These strategies reflect the municipality's commitment to balancing economic development with environmental stewardship and climate resilience.

Table 14. Ranking of adaptation options for the tourism sector

Adaptation options	Final scores from stakeholders	Rank
Promote sustainable eco-tourism practices and activities e.g., plastic-free trekking tours	48	1
Integrate biodiversity conservation into tourism planning	48	1
Develop off-season tourism campaigns	47	3

Source: Authors

Table 15. Summary of the adaptation options for the tourism sector

Adaptation actions	**Objectives**	**Indicators of success**	**Time frame** (short, medium, or long term)	**Resources** (finance, human, technology)	**Lead**	**Implementing partners**	**Estimated costs (GH₵)**
Promote sustainable eco-tourism practices and activities, e.g., plastic-free trekking tours	Reduce the negative environmental effects of tourism by encouraging sustainable practices like plastic-free trekking tours	Increase in eco-tourism activities, with a significant number of tours following sustainable guidelines	Short term	Finance, technology, human	Ghana Tourism Authority (GTA)	Local eco-tourism associations, Ghana Wildlife Society, NGOs, traditional leaders, United Nations World Tourism Organization (UNWTO), WWF, IUCN, GIZ, ClimateWorks Foundation	240,000.00
		Significant reduction in plastic waste in eco-tourism areas					
		Positive feedback from men and women tourists on eco-friendly practices					
Integrate biodiversity conservation into tourism planning	Protect and maintain the biodiversity of tourism destinations by integrating conservation practices into tourism development and operations	Inclusion of biodiversity conservation measures in 90% of new tourism development plans	Medium term	Human, technology, finance	MoTAC	Ghana Wildlife Division, traditional authorities, local NGOs, tourism operators, UNEP, IUCN, UNDP, ClimateWorks Foundation	300,000.00
		Improved protection of endangered species and habitats at tourism sites					

Adaptation actions	**Objectives**	**Indicators of success**	**Time frame** (short, medium, or long term)	**Resources** (finance, human, technology)	**Lead**	**Implementing partners**	**Estimated costs (GH₵)**
		Increased collaboration between tourism operators and conservation organizations					
Develop off-season tourism campaigns	Diversify tourism demand and increase visitor numbers year-round, reducing pressure on peak-season resources and boosting local economic resilience	Increase in tourist arrivals during the off-season by 25%	Short term	Human, technology, finance	MoTAC	Travel agencies, local business associations, hospitality industry, traditional leaders, UNWTO, World Bank, GIZ	300,000.00
		Improved revenue generation for local businesses in off-peak periods					
		Enhanced awareness of alternative tourism experiences beyond peak seasons					
Implement renewable energy solutions at tourism facilities	Reduce carbon emissions and increase the sustainability of	Installation of solar panels or wind turbines at 50% of key tourist facilities	Medium term	Technology, finance, human	Ministry of Energy/ GTA	Renewable energy companies, local tourism boards, hotel associations,	500,000.00

Adaptation actions	**Objectives**	**Indicators of success**	**Time frame** (short, medium, or long term)	**Resources** (finance, human, technology)	**Lead**	**Implementing partners**	**Estimated costs (GH₵)**
	tourism operations by utilizing renewable energy sources such as solar and wind power	Reduction in the carbon footprint of tourism facilities by 40%				NGOs, UNDP, World Bank, GEF	
		Positive feedback from tourists on the use of green energy					
Restore degraded landscapes and protect cultural heritage sites	Rehabilitate damaged ecosystems and safeguard cultural heritage, enhancing the resilience of landscapes and preserving local historical and cultural assets	Successful rehabilitation of at least 70% of targeted degraded tourism sites	Long term	Finance, human	Ghana Museums and Monuments Board	Local district assemblies, traditional leaders, NGOs, Ghana Tourism Federation, UNESCO, World Bank, UNDP, ICCROM, ClimateWorks Foundation	1,000,000.00
		Increased tourist visits to restored cultural heritage sites					
		Enhanced local community involvement in site preservation					
Promote water conservation and alternative water	Minimize water usage in tourist facilities by	Reduction in water consumption by 30% at major tourist facilities	Medium term	Technology, human, finance	Ministry of Sanitation and Water	Local water boards, hotels and restaurants	500,000.00

Adaptation actions	**Objectives**	**Indicators of success**	**Time frame** (short, medium, or long term)	**Resources** (finance, human, technology)	**Lead**	**Implementing partners**	**Estimated costs (GH₵)**
sources for tourist facilities	promoting efficient practices and technologies, ensuring sustainable resource use	Installation of rainwater harvesting systems at key tourism sites			Resources (MSWR)	associations, NGOs, traditional authorities, UNEP, GIZ, World Bank, UNWTO	
		Increased use of greywater recycling in tourist accommodations					
Create awareness of the need for responsible tourism among visitors and locals	Educate visitors and locals on how their actions impact the environment, encouraging behaviours that contribute to the preservation of natural ecosystems	High participation rates among men and women (over 70%) in awareness campaigns	Short term	Technology, finance, human	Ministry of Energy, GTA	Media outlets, CBOs, traditional authorities, educational institutions, UNWTO, UNESCO, GIZ	560,000.00
		Increase in the adoption of responsible tourism behaviours by visitors					
		Positive feedback from local communities on reduced negative impacts of tourism					

Adaptation actions	**Objectives**	**Indicators of success**	**Time frame** (short, medium, or long term)	**Resources** (finance, human, technology)	**Lead**	**Implementing partners**	**Estimated costs (GH₵)**
Develop climate-resilient infrastructure for tourism sites	Protect tourism infrastructure from climate-related risks, ensuring the long-term sustainability of tourist attractions	Construction of flood-resistant facilities at key tourism sites	Long term	Finance, technology, human	MoTAC	GTA, Ghana Infrastructure Investment Fund, traditional authorities, World Bank, UNDP, African Development Bank, UNEP	2,356,000.00
		Increased visitor satisfaction due to improved safety and accessibility					
		Reduction in repair and maintenance costs due to climate-proof infrastructure					

Source: Authors

5.5.4 Disaster Risk Reduction Sector

From the Climate Change Rapid Risk Assessment for the BABMA, disaster risk reduction was recognized as very vulnerable to the adverse impacts of climate change (Table 16). The adaptation options for disaster risk reduction in the BABMA aim to enhance community resilience to climate-induced disasters and minimize the adverse impacts of extreme weather events. Implementing early warning systems and conducting community-based flood risk awareness campaigns focuses on proactive measures to improve preparedness and response to potential hazards, ensuring timely action to protect lives and property. Planting shade trees and diversifying crops with drought-tolerant varieties aim to mitigate the effects of heat and drought on communities and agricultural productivity. Improved community preparedness and emergency response plans, along with public education on heat protection measures, emphasize capacity building and awareness to reduce vulnerability.

The BABMA prioritized these adaptation options due to the municipality's exposure to climate-related disasters, including floods, droughts, heatwaves, and windstorms, which pose significant threats to lives, livelihoods, and infrastructure. Early warning systems and community awareness campaigns were prioritized to ensure timely communication and action during emergencies, reducing loss and damage. Planting shade trees and diversifying crops were selected to address the direct impacts of climate variability on agriculture and livelihoods, promoting food security and heat mitigation. These priorities align with the assembly's focus on building climate-resilient communities, protecting natural resources, and enhancing local capacities to adapt to changing climatic conditions effectively.

Table 16. Ranking options for the disaster risk reduction sector

Adaptation options	Final scores from stakeholders	Rank
Implementation of early warning systems	50	1
Community-based flood risk awareness campaigns	50	1
Planting shade trees in communities and farms	50	1
Improved community preparedness and emergency response plans	50	1
Public education on heat protection measures	49	5
Construction of wind-resistant structures	49	5
Diversification of crops to include drought-tolerant varieties	49	5

Source: Authors

Table 17. Adaptation actions for the disaster risk reduction sector

Action steps	**Objectives**	**Indicators of success**	**Time frame** (short, medium, or long term)	**Resources** (finance, human, technology)	**Lead institution**	**Implementing partners**	**Estimated costs (GH₵)**
Implementation of early warning systems	Improve the readiness of communities and stakeholders to respond effectively to extreme weather events and natural disasters	Timely and accurate dissemination of early warning messages to communities	Short term	Finance, human, technology	GMet	Ministry of Communication, media outlets, local governments, United Nations Office for Disaster Risk Reduction (UNDRR), WMO, Red Cross	500,000.00
		High response rate from the public during emergency alerts					
		Reduction in loss of life and property during disasters					
Community-based flood risk awareness campaigns	Enhance understanding of flood risks and their potential impacts on communities and	Increased knowledge of flood risks among community members	Short term	Technology, human, finance	NADMO	CBOs, traditional leaders, educational institutions, UNDP, GIZ, Oxfam	200,000.00
		Higher participation in					

Action steps	**Objectives**	**Indicators of success**	**Time frame** (short, medium, or long term)	**Resources** (finance, human, technology)	**Lead institution**	**Implementing partners**	**Estimated costs (GH₵)**
	individual households	community-led flood prevention activities					
		Reduction in property damage and casualties during floods					
Planting shade trees in communities and farms	Improve soil quality and fertility through the addition of organic matter and nutrient cycling facilitated by shade trees	Increase in the number of shade trees planted and surviving in communities	Medium term	Technology, human, finance	MESTI	Forestry Commission, local NGOs, traditional authorities, CBOs, UNEP, World Bank, WWF, GIZ, ClimateWorks Foundation	300,000.00
		Reduction in soil erosion and temperature in shaded areas					
		Improved comfort and productivity for farm workers					
Improved community	Educate community	Development of comprehensive	Short term			Local assemblies, traditional leaders,	200,000.00

Action steps	**Objectives**	**Indicators of success**	**Time frame** (short, medium, or long term)	**Resources** (finance, human, technology)	**Lead institution**	**Implementing partners**	**Estimated costs (GH₵)**
preparedness and emergency response plans	members about potential hazards and risks associated with climate change, including extreme weather events and natural disasters	emergency response plans in vulnerable communities		Human, finance, technology	NADMO, Ministry of the Interior	NGOs, CMOs, UNDRR, Red Cross, World Bank	
		Increase in community participation among men and women in emergency preparedness training					
		Faster response times during disasters and emergencies					
Public education on heat protection measures	Increase public awareness about the risks associated with extreme heat and the importance of	Increase in public awareness among men and women about heat risks and protective measures	Short term	Technology, Human, Finance	Ghana Health Service (GHS), Ministry of Information	Media houses, educational institutions, NGOs, community health workers, World	200,000.00

Action steps	**Objectives**	**Indicators of success**	**Time frame** (short, medium, or long term)	**Resources** (finance, human, technology)	**Lead institution**	**Implementing partners**	**Estimated costs (GH₵)**
	implementing heat protection measures	Reduction in heat-related illnesses reported in hospitals				Health Organization, UNICEF, Red Cross	
		High adoption rate of protective practices such as use of sunscreen and proper hydration					
Construction of wind-resistant structures	Ensure that buildings and infrastructure can withstand high winds and reduce the risk of damage during storms	Increase in the number of buildings with wind-resistant designs	Long term	Finance, technology	NADMO	Local builders, district assemblies, architects' associations, traditional authorities, UNDP, World Bank, African Development Bank	1,560,000.00
		Reduced damage to properties during strong winds or storms					
		Higher community satisfaction with					

Action steps	**Objectives**	**Indicators of success**	**Time frame** (short, medium, or long term)	**Resources** (finance, human, technology)	**Lead institution**	**Implementing partners**	**Estimated costs (GH₵)**
		safer housing infrastructure					
Diversification of crops to include drought-tolerant varieties	Ensure a stable food supply by growing crops that can withstand periods of low rainfall and high temperatures	Higher adoption rate of drought-tolerant crops among farmers	Medium term	Technology, human, finance	MoFA	Agricultural extension services, local farmers, traditional leaders, NGOs, FAO, International Fund for Agricultural Development, CGIAR	1,000,000.00
		Increase in overall crop yield during dry seasons					
		Reduced crop failure rates during periods of low rainfall					
Use of weather forecasting for better planning	Provide farmers with accurate weather predictions that inform their planting, irrigation, and	High accuracy of weather forecasts provided to communities	Short term	Technology, human	GMet	Agricultural extension services, Local media, traditional authorities, farmers' associations, WMO, FAO, UNDP	500,000.00
		Increase in the use of weather forecasts for					

Action steps	**Objectives**	**Indicators of success**	**Time frame** (short, medium, or long term)	**Resources** (finance, human, technology)	**Lead institution**	**Implementing partners**	**Estimated costs (GH₵)**
	harvesting schedules, optimizing crop yields	agricultural planning					
		Reduction in crop losses due to adverse weather conditions					
Construction of drainage systems	Reduce the risk of flooding in tourist areas by effectively channeling excess water away from critical infrastructure	Reduction in the frequency and severity of urban flooding	Long term	Finance, human, technology	NADMO	Local assemblies, Ghana Highways Authority, EPA, traditional authorities, World Bank, UNDP, ClimateWorks Foundation	2,000,000.00
		Improved water flow and reduced stagnant water issues in affected areas					
		Decrease in waterborne diseases in communities after heavy rains					

Action steps	**Objectives**	**Indicators of success**	**Time frame** (short, medium, or long term)	**Resources** (finance, human, technology)	**Lead institution**	**Implementing partners**	**Estimated costs (GH₵)**
Planting windbreaks around farmlands	Protect soil and crops from wind erosion, thereby maintaining soil health and productivity	Increase in the number of farms protected by windbreaks	Medium term	Human, finance	MoFA	Local farmers' associations, community groups, NGOs, agricultural extension services, FAO, UNEP, World Bank, GIZ	1,760,560.00
		Reduction in crop damage due to strong winds					
		Improved soil moisture retention in protected areas					
Promotion of water conservation techniques	Inform community members about the importance of water conservation and the impact of water scarcity and promote the adoption of practical water-saving techniques	Increase in water conservation practices adopted by households and industries	Medium term	Human, finance, technology	MSWR	Local water boards, NGOs, traditional authorities, Ghana Hotels Association, UNEP, World Bank, UNICEF, GIZ	460,660.00
		Reduction in water usage during drought periods					
		Improved groundwater					

Action steps	**Objectives**	**Indicators of success**	**Time frame** (short, medium, or long term)	**Resources** (finance, human, technology)	**Lead institution**	**Implementing partners**	**Estimated costs (GH₵)**
	in households and businesses	recharge and availability					
Development of drought-resistant crop varieties	Improve food availability and security by developing crop varieties that can withstand prolonged dry conditions	Introduction of at least three new drought-resistant crop varieties	Long term	Technology, human, finance	MoFA	Agricultural extension services, Local farmers' associations, universities, traditional leaders, FAO, IFAD, CGIAR	780,600.00
		Increase in crop yields during dry seasons					
		Higher adoption rate of drought-resistant varieties by farmers					

Source: Authors

5.5.5 Agricultural Sector

Out of the 10 adaptation options that were identified and evaluated through the MCDM analysis, five were selected and prioritized (Table 18). Rainwater harvesting for irrigation, encouraging the use of crop-resistant varieties, improving farmers' access to microcredit and insurance products, and promoting integrated pest management are essential adaptation strategies for the agricultural sector in the BABMA. Rainwater harvesting involves collecting and storing rainwater for irrigation purposes, providing an alternative water source during dry spells or droughts, and ensuring that crops receive adequate water even when rainfall is irregular. Encouraging the use of crop-resistant varieties, such as drought-tolerant or pest-resistant crops, helps farmers maintain productivity in the face of changing climatic conditions. Improving farmers' access to microcredit and insurance products allows them to invest in better farming practices, access quality inputs, and recover from climate-induced losses, ensuring financial security and continued productivity. Rainwater harvesting was seen as a crucial adaptation option to ensure a stable water supply for irrigation, particularly in areas where rainfall is erratic. The use of crop-resistant varieties was emphasized to reduce the vulnerability of crops to climate-related pests and diseases, ensuring food security in a changing climate. Improving access to microcredit and insurance was prioritized because financial support is essential for farmers to invest in adaptive measures, recover from losses, and sustain their livelihoods. Finally, promoting integrated pest management was seen as an effective way to address the rising threat of pests due to climate change, promoting sustainable farming practices, and reducing dependency on chemicals.

Table 18. Ranking options for the agricultural sector

Adaptation option	Final scores from stakeholders	Rank
Rainwater harvesting for irrigation	50	1
Encouraging the use of crop-resistant varieties	48	2
Improving farmers' access to microcredit and insurance products	48	2
Promoting integrated pest management	47	4

Source: Authors

Table 19. Adaptation actions for the agriculture sector

Adaptation actions	**Objectives**	**Indicators of success**	**Time frame** (short, medium, or long term)	**Resources** (finance, human, technology)	**Lead institution**	**Implementing partners**	**Estimated costs (GH₵)**
Employ rainwater harvesting systems for irrigation during dry periods	Enhance water availability for irrigation during dry periods, ensuring sustainable agricultural production amidst climate change impacts	Increase in water availability during dry spells, compared to previous years without rainwater harvesting	Medium term	Human multimedia (electronic and print media), other technology, finance	MoFA	CSIR, Ghana Agriculture Sector Investment Programme (GASIP), FAO, Ghana Irrigation Development Authority (GIDA), NDPC	8,960,000.00
		Improved soil moisture content, as the stored water is being used effectively to maintain suitable moisture for crops					
		The level of crop yield during drought or dry spells					

Adaptation actions	**Objectives**	**Indicators of success**	**Time frame** (short, medium, or long term)	**Resources** (finance, human, technology)	**Lead institution**	**Implementing partners**	**Estimated costs (GH₵)**
Encourage the use of crop varieties	Increase agricultural resilience by encouraging the use of crop varieties that are resistant to pests and diseases, thereby enhancing food security and reducing reliance on chemical inputs	A decrease in crop damage or losses caused by pests and diseases after adopting resistant varieties. Stable crop yields with resistant varieties compared to traditional varieties, indicating resilience to pest and disease pressures. Lower pesticide application rates due to natural resistance.	Short term	Human, technical /technology, finance	MoFA	EPA, CSIRM MESTI, GASIP, FAO	4,566,090.00

Adaptation actions	**Objectives**	**Indicators of success**	**Time frame** (short, medium, or long term)	**Resources** (finance, human, technology)	**Lead institution**	**Implementing partners**	**Estimated costs (GH₵)**
Improve access to microcredit and insurance products	Encourage long-term investments in climate-resilient technologies and practices by providing affordable financial options that reduce the risks associated with unpredictable weather patterns and market fluctuations	Adoption rates of climate-resilient practices (e.g., drought-resistant crops, improved irrigation)	Medium term	Human, technology, finance	MoFA	ADB, NGOs, GASIP, FAO, Ghana Microfinance Institutions Network (GHAMFIN), African Development Fund Rural Enterprises Programme, ClimateWorks Foundation	3,450,990.00
		Financial stability and quicker recovery following climate-related shocks (e.g., droughts, floods)					
		Consistent crop yields and stable incomes for farmers with access to financial support					
		Number of men and women farmers applying for and successfully receiving					

Adaptation actions	**Objectives**	**Indicators of success**	**Time frame** (short, medium, or long term)	**Resources** (finance, human, technology)	**Lead institution**	**Implementing partners**	**Estimated costs (GH₵)**
		microcredit or insurance					
		Number of men and women farmers purchasing quality seeds, fertilizers, irrigation equipment, and other inputs due to access to microcredit					
Promoting integrated pest management practices (IPM)	To enhance agricultural sustainability and resilience by promoting IPM practices that reduce reliance on chemical pesticides and minimize environmental	Increase in the use of natural pest predators (e.g., beneficial insects, birds) or biocontrol agents (e.g., neem oil, microbial pesticides) by men and women farmers	Medium term	Human, technology, finance	FAO	GASIP, NADMO, NDPCM MOFA, MESTI, CSIR	4,000,000.00

Adaptation actions	**Objectives**	**Indicators of success**	**Time frame** (short, medium, or long term)	**Resources** (finance, human, technology)	**Lead institution**	**Implementing partners**	**Estimated costs (GH₵)**
	and health impacts						
		Number of men and women farmers attending IPM training programs or workshops					
		Increase in the quality and yield of crops					
Providing farmers with timely weather forecasts and climate-related information	To enhance the adaptive capacity and decision-making of farmers by providing timely and accurate weather forecasts and climate-related information to support climate-resilient	The number of men and women farmers who report using weather forecasts and climate data to make critical decisions regarding crop management	Short term	Human, technology, finance	MoFA	GMet, MESTI, GASIP, NADMO, NDPC, African Center for Meteorological Applications for Development, NGOs, FAO	2,540,555.00

Adaptation actions	**Objectives**	**Indicators of success**	**Time frame** (short, medium, or long term)	**Resources** (finance, human, technology)	**Lead institution**	**Implementing partners**	**Estimated costs (GH₵)**
	agricultural practices						
		Percentage of crop yields and overall productivity					
		Number of men and women farmers understanding and aware of weather and climate patterns					
		Number of men and women farmers accessing weather information through mobile phones or other digital platforms					
Encourage the adoption of conservation agriculture and	To promote sustainable farming and build resilience to	Number of men and women farmers adopting no-till or	Medium term	Human, technology, finance	FAO	GIDA, EPA, CSIR, MESTI, GASIP, MoFA	4,200,000.00

Adaptation actions	**Objectives**	**Indicators of success**	**Time frame** (short, medium, or long term)	**Resources** (finance, human, technology)	**Lead institution**	**Implementing partners**	**Estimated costs (GH₵)**
climate-smart agriculture	climate change by encouraging the adoption of conservation agriculture and climate-smart agriculture practices, improving productivity while minimizing environmental impacts	reduced tillage practices					
		Increase in crop yields and overall productivity					
		Number of men and women farmers integrating trees and shrubs into their farming systems					

Adaptation actions	**Objectives**	**Indicators of success**	**Time frame** (short, medium, or long term)	**Resources** (finance, human, technology)	**Lead institution**	**Implementing partners**	**Estimated costs (GH₵)**
		Number of men and women farmers purchasing or renting irrigation equipment					
		Number of men and women farmers using organic inputs, such as compost, green manure, and biofertilizers					
Enhance access to resources, training, and markets	Foster collective adaptation efforts by encouraging the formation of farmer cooperatives and enhancing access to resources, training, and markets for improved	Number of men and women farmers attending formal or informal training programs on improved agricultural practices	Medium term	Human, technology, finance	MoFA	NGOs, GASIP, GIPC, MoTI, MASLOC, GCAP, NDPC, FAO	5,000,000.00

Adaptation actions	**Objectives**	**Indicators of success**	**Time frame** (short, medium, or long term)	**Resources** (finance, human, technology)	**Lead institution**	**Implementing partners**	**Estimated costs (GH₵)**
	resilience to climate change						
		Increase in the availability and access to critical resources for men and women farmers					
		The number of men and women farmers gaining access to both local and national markets					
		The number of men and women farmers joining agricultural cooperatives or farmer groups					
Encourage the diversification of income sources	Enhance the resilience of farming communities by encouraging the	Number of men and women farmers engaging in alternative income-generating activities	Medium term	Human, technology, finance	MoFA	NBSSI, GASIP, GEPA, NGOs, MoTI, REP, FAO	3,000,000.00

Adaptation actions	**Objectives**	**Indicators of success**	**Time frame** (short, medium, or long term)	**Resources** (finance, human, technology)	**Lead institution**	**Implementing partners**	**Estimated costs (GH₵)**
	diversification of income sources, reducing vulnerability to climate-related shocks, and ensuring economic stability						
		Increase in men and women farmers engaging in agro-processing activities (e.g., palm oil extraction, cocoa processing)					
		Number of men and women farmers participating in vocational training or skills development programs					

Adaptation actions	**Objectives**	**Indicators of success**	**Time frame** (short, medium, or long term)	**Resources** (finance, human, technology)	**Lead institution**	**Implementing partners**	**Estimated costs (GH₵)**
		Number of small businesses or enterprises established by men and women farmers					
Provide incentives for farmers to adopt sustainable and climate-resilient practices	Advocate for national policies that provide incentives for farmers to adopt sustainable and climate-resilient practices, enhancing agricultural sustainability and improving resilience to climate change impacts	Number of men and women farmers receiving subsidies or low-interest loans	Medium term	Human, technology, finance	FAO	NGOs, MESTI, GASIP, NAP, CCDA, ADB, MoFA	3,500,000.00

Adaptation actions	**Objectives**	**Indicators of success**	**Time frame** (short, medium, or long term)	**Resources** (finance, human, technology)	**Lead institution**	**Implementing partners**	**Estimated costs (GH₵)**
		The number of men and women farmers adopting climate-resilient practices such as drought-resistant crops, soil conservation methods, or integrated pest management due to the availability of incentives					
		Increase in farm productivity and income					
		Number of men and women farmers attending training workshops or seminars on sustainable agriculture					

Adaptation actions	**Objectives**	**Indicators of success**	**Time frame** (short, medium, or long term)	**Resources** (finance, human, technology)	**Lead institution**	**Implementing partners**	**Estimated costs (GH₵)**
		Number of men and women farmers investing in practices that improve soil health					
Adoption of efficient irrigation systems	Ensure sustainable water management in agriculture by promoting efficient irrigation systems that optimize water use and minimize wastage	Number of men and women farmers adopting water-efficient irrigation technologies	Medium term	Human, technology, finance	FAO	GIDA, EPA, CSIR, MESTI, GASIP, MoFA	8,000,000.00
		Increase in farmer income from crops grown using irrigation systems					
		Decrease in water wastage, as tracked through monitoring systems or farmer reports					
		Number of men and women farmers purchasing or					

Adaptation actions	**Objectives**	**Indicators of success**	**Time frame** (short, medium, or long term)	**Resources** (finance, human, technology)	**Lead institution**	**Implementing partners**	**Estimated costs (GH₵)**
		renting irrigation equipment					

Source: Authors

5.5.6 Water Resources Sector

Out of the seven adaptation options that were identified and evaluated through the MCDM analysis, five were selected and prioritized. Planting trees to restore degraded wetlands, educating communities about water practices, implementing integrated water resource management, ensuring inclusive decision-making in water resource management, and enhancing early warning systems for droughts and floods are key adaptation strategies for the water sector in the BABMA (Table 20). Educating communities about sustainable water practices aims to foster better water management habits, such as conservation, proper waste disposal, and efficient irrigation techniques, which are critical for ensuring long-term water security. Implementing integrated water resource management (IWRM) involves holistically managing water resources, considering social, environmental, and economic factors to ensure that water is available for all sectors of society. Ensuring inclusive decision-making in water resource management ensures that all stakeholders, especially marginalized groups, have a voice in water management processes, promoting fairness and equity. Educating communities about sustainable water practices was emphasized to build local knowledge and ensure that people are actively involved in protecting water resources, especially as water scarcity and contamination become more significant concerns. IWRM was prioritized because it offers a framework to manage water resources in an integrated way, ensuring equitable distribution and sustainable use across different sectors. Inclusive decision-making was recognized as essential to ensuring that water management policies address the needs of all community members, particularly women and marginalized groups who may be disproportionately affected by water scarcity Finally, enhancing early warning systems was identified as critical to helping communities anticipate and respond to climate-related events such as floods and droughts, ensuring that they can take proactive measures to protect water resources and livelihoods.

Table 20. Ranking of adaptation options for water sector

Adaptation option	Final score from stakeholders	Rank
Planting trees to restore degraded wetlands	47	1
Educating communities about water practices	47	1
Implementing integrated water resource management	46	3
Ensuring inclusive decision-making in water resource management	46	3
Enhancing early warning systems for droughts and floods	42	5

Source: Authors

Table 21. Adaptation actions for the water resources sector

Adaptation actions	**Objectives**	**Indicator of success**	**Time frame** (short, medium, or long term)	**Resources** (finance, human, technology)	**Lead institutions**	**Implementing partners**	**Estimated costs (GH₵)**
Installing rainwater collection systems	Install rainwater collection systems that harness and store rainwater enhancing water availability for domestic, agricultural, and environmental uses	Total count of functional rainwater harvesting systems installed in households, schools, and community centers	Medium term	Human, technology, finance	MSWR	MESTI, MLGDRD, WRC, GIDA, EPA, WSSCC, traditional leaders, MLNR, NGOs	3,200,000.00
		Increased use of rainwater for small-scale irrigation and other agricultural activities					
		A decline in the use of streams, wells, or boreholes during the rainy season					
Educating communities about water conservation practices	Educate communities about water conservation practices during dry spells, thereby reducing demand for water resources and	Number of community members attending water conservation workshops or training sessions	Short term	Human, technology, finance	MSWR	MLGDRD, MESTI, MoE,MoFA, EPA, GWCL, academia, NGOs, media outlets, traditional leaders	345,000.00
		Percentage of households implementing water-saving practices					

Adaptation actions	**Objectives**	**Indicator of success**	**Time frame** (short, medium, or long term)	**Resources** (finance, human, technology)	**Lead institutions**	**Implementing partners**	**Estimated costs (GH₵)**
	promoting sustainable usage	Increased awareness through media campaigns					
		Decreased average daily water usage per household					
Implementing integrated water resource management	Implement IWRM practices that promote the sustainable management of water resources, balancing social, economic, and environmental needs	Increased water storage capacity and quality	Long term	Human, technology, finance	MSWR	MESTI, MLGDRD, MoFA, WRC, EPA, NGOs, academia, GMet, NDPC	890,600.00
		Number of stakeholders actively participating in water management initiatives					
		Number of households with access to clean, potable water from improved sources					
Ensuring inclusive decision-making in water	Establish multi-stakeholder platforms where community members,	Percentage of women, youth, and marginalized groups represented on water management committees	Medium term		MSWR	MLGDRD, MOWCSP, NDPC, EPA, academia, NGOs	500,000.00

Adaptation actions	**Objectives**	**Indicator of success**	**Time frame** (short, medium, or long term)	**Resources** (finance, human, technology)	**Lead institutions**	**Implementing partners**	**Estimated costs (GH₵)**
resource management	government representatives, and NGOs can come together to discuss water resource issues	Increased attendance by diverse groups, including women and vulnerable populations, in water resource planning discussions					
		Establishment of committees where all stakeholders can voice their concerns about water resource management					
Enhancing early warning systems for droughts and floods	Improve early warning systems for droughts and floods enhancing data collection, forecasting, and timely communication for	Increased accuracy of drought and flood forecasts compared to actual events	Medium term	Human, technology, finance	WRC	MESTI, MoF, MoFA, MLGDRD, GMet, NADMO, EPA, academia, NGOs, media outlets	1,570,600.00
		Decline in reported damages to property, crops, and infrastructure due to timely action					

Adaptation actions	**Objectives**	**Indicator of success**	**Time frame** (short, medium, or long term)	**Resources** (finance, human, technology)	**Lead institutions**	**Implementing partners**	**Estimated costs (GH₵)**
	better water management and disaster preparedness	Percentage of residents who are aware of and understand how to respond to early warnings					
Installing rainwater collection systems	Install rainwater collection systems that harness and store rainwater, enhancing water availability for domestic, agricultural, and environmental uses	Total count of functional rainwater harvesting systems installed in households, schools, and community centers	Short term	Human, technology, finance, multimedia	MSWR	MESTI, MLGDRD, MoFA, WRC, EPA, NGOs, academia, GMet, NDPC,	800,790.00
		Increased use of rainwater for small-scale irrigation and other agricultural activities					
		A decline in the use of streams, wells, or boreholes during the rainy season					
Upgrading wastewater treatment	Upgrade wastewater treatment facilities to enhance their	Decrease in reported cases of diseases like cholera, typhoid, or	Long term		MSWR	MLGDRD, MESTI, EPA, MoF, WRC,	3,560,800.00

Adaptation actions	**Objectives**	**Indicator of success**	**Time frame** (short, medium, or long term)	**Resources** (finance, human, technology)	**Lead institutions**	**Implementing partners**	**Estimated costs (GH₵)**
facilities to prevent contamination of waterbodies	capacity and efficiency, preventing the contamination of local water bodies and protecting public health	diarrhea in communities near waterbodies		Human, technology, finance		GWCL, NGOs, NDPC	
		Treated wastewater meets or exceeds national environmental standards for effluent discharge					
		Higher volume of wastewater treated daily compared to the facility's capacity before upgrades					

Source: Authors

5.5.7 Forestry Sector

Out of the 10 adaptation options that were identified and evaluated through the MCDM analysis, three were selected and prioritized (Table 22). Conducting forest awareness campaigns on the impacts of climate change on forests, encouraging agroforestry, and initiating reforestation and afforestation projects are essential adaptation strategies for the forestry sector in the BABMA. Forest awareness campaigns aim to inform local communities about the vital role forests play in regulating the climate, maintaining biodiversity, and supporting livelihoods. These campaigns focus on the impact of deforestation and climate change on local ecosystems and highlight the benefits of forest conservation and sustainable management. Encouraging agroforestry involves integrating trees with agricultural systems to improve soil fertility, enhance biodiversity, and increase carbon sequestration. Initiating reforestation and afforestation projects is a long-term strategy to restore degraded lands, increase forest cover, and mitigate the effects of climate change, such as soil erosion and loss of biodiversity, while also providing a sustainable resource for future generations (Prempeh, 2023; Kohl et al., 2024).

Conducting forest awareness campaigns was seen as essential for raising public awareness about the importance of forests in climate adaptation and disaster risk reduction. Agroforestry was emphasized as an effective way to increase agricultural productivity while simultaneously restoring ecological balance and promoting sustainable land use. Reforestation and afforestation projects were prioritized to combat the loss of forest cover, which exacerbates climate change by reducing the carbon sink capacity of the region. These strategies aim to restore the health of the environment, increase community resilience to climate change, and ensure the long-term sustainability of both forests and agriculture in the region.

Table 22. Ranking options for forestry sector

Adaptation option	Final score from stakeholders	Rank
Conducting forest awareness campaigns on the impacts of climate change on forests	47	1
Encouraging agroforestry	46	2
Initiating reforestation and afforestation projects	45	3

Source: Authors

Table 23. Adaptation actions for the forestry sector

Adaptation actions	**Objectives**	**Indicator of success**	**Time frame** (short, medium, or long term)	**Resources** (Finance, Human, Technology)	**Lead institution**	**Implementing partners**	**Estimated costs (GH₵)**
Conducting forest awareness campaigns on the impacts of climate change on forests	Enhance community engagement and foster climate resilience by raising awareness about the critical role of forests in climate change mitigation and adaptation	Number of community members actively involved in forest conservation initiatives	Short term	Human, technology, finance	MLNR	MESTI, MoE, FC, NCCE, academia, NGOs	3,566,700.00
		Levels of knowledge among community members about the relationship between climate change and forest degradation					
		Increased involvement of local authorities, schools, traditional leaders, and civil society organizations in awareness campaigns					
		Growth in community participation or donations for tree planting and afforestation initiatives					

Adaptation actions	**Objectives**	**Indicator of success**	**Time frame** (short, medium, or long term)	**Resources** (Finance, Human, Technology)	**Lead institution**	**Implementing partners**	**Estimated costs (GH₵)**
Encouraging agroforestry	Promote agroforestry practices that integrate trees into agricultural systems, enhancing both productivity and environmental sustainability while supporting climate resilience	Number of farmers incorporating agroforestry practices in their agricultural systems	Long term	Human, technology, finance	FC	FC, MLNR, EPA, district assemblies, traditional authorities, NGOs, academia	3,566,700.00
		Percentage of crop yields from integrated tree farming systems					
		Increase in land area under agroforestry systems					
Initiating reforestation and afforestation projects	Engage local communities in tree planting initiatives, fostering a sense of ownership and stewardship while providing ecological, economic, and social benefits through the restoration of forest ecosystems	Expansion of forested areas	Long term	Human, technology, finance	MoFA	EPA, MESTI, MoFA, NDPC, FC, NGOs	5,000,000.00
		Survival rates of tree seedlings meeting or exceeding project targets					
		Active participation of local communities in planning, planting, and maintaining projects					

Adaptation actions	**Objectives**	**Indicator of success**	**Time frame** (short, medium, or long term)	**Resources** (Finance, Human, Technology)	**Lead institution**	**Implementing partners**	**Estimated costs (GH₵)**
Involving local communities in the conservation of forests	Enhance the sustainable management and conservation of forest resources by actively involving local communities in decision-making processes and stewardship practices	Number of active community groups engaged in forest management and conservation practices	Medium term	Human, technology finance	FC	MLNR, EPA, MESTI, MoFA, NGOs, traditional authorities, academia	355,000.00
		Increased participation in alternative income-generating activities					
		The decline in incidents of illegal logging, hunting, and encroachment into forest areas					
		Return or abundance of native plant and animal species					
Encouraging natural regeneration of forest areas	Enhance forest resilience and biodiversity by promoting natural regeneration	Number of trees per hectare in regeneration zones	Medium term	Human, technology, finance	MLNR	MESTI, MLGDRD, FC, EPA, academia, NGOs	2,000,000.00
		Return and flourishing of native plant species					

Adaptation actions	**Objectives**	**Indicator of success**	**Time frame** (short, medium, or long term)	**Resources** (Finance, Human, Technology)	**Lead institution**	**Implementing partners**	**Estimated costs (GH₵)**
	practices that restore degraded forest ecosystems	Increased involvement of local communities in protecting and monitoring natural regeneration areas					
Providing alternative income sources to reduce the dependence on forest resources	Reduce pressure on forest ecosystems and enhance community resilience by promoting sustainable livelihood alternatives that decrease reliance on forest resources	Increase in number of individuals engaged in sustainable alternatives	Medium term	Human, technology, finance	MLNR	MoTI, EPA, MoFA, FC, GIPC, MASLOC, NBSSI, NGOs	6,000,000.00
		Decrease in activities such as illegal logging, charcoal production, and hunting					
		Rise in the establishment of small businesses or cooperatives					
Establishing buffer zones around forests against human	Enhance the resilience of forest ecosystems by creating and	Decrease in illegal settlements, farming, and logging within forest boundaries	Long term	Human, technology, finance	MLNR	MESTI, MoFA, EPA, FC, academia, NGOs	3,110,230.00

Adaptation actions	**Objectives**	**Indicator of success**	**Time frame** (short, medium, or long term)	**Resources** (Finance, Human, Technology)	**Lead institution**	**Implementing partners**	**Estimated costs (GH₵)**
encroachment and agricultural runoff	maintaining buffer zones that reduce the impacts of agricultural runoff, prevent soil erosion, and limit human encroachment	Defined and actively managed buffer zones					
		Observable improvement in biodiversity, canopy cover, and reduced edge effects in forest					
Encouraging sustainable grazing practices	Improve the resilience of grazing lands and reduce environmental degradation by promoting sustainable grazing practices that balance livestock productivity with land conservation	Number of farmers and herders practicing rotational grazing to prevent overgrazing	Medium term	Human, technology, finance	MoFA	MLNR, MESTI, MLGDRD, NDPC, EPA, academia, NGOs, traditional leaders	2,000,000.00
		Recovery and sustained growth of vegetation in grazing areas					
		Decline in areas showing signs of overgrazing					
Promoting sustainable	Promote sustainable logging practices that ensure the long-	Increased adherence to government-regulated logging quotas	Medium term	Human, technology, finance	MLNR	MLNR, TIDD, EPA, GTMO,	1,111,900.00

Adaptation actions	**Objectives**	**Indicator of success**	**Time frame** (short, medium, or long term)	**Resources** (Finance, Human, Technology)	**Lead institution**	**Implementing partners**	**Estimated costs (GH₵)**
logging practices	term health and productivity of forest ecosystems while providing economic benefits to local communities	Evidence of replanting or afforestation programs linked to logging activities				NGO, academia, FSD	
		Number of logging companies and cooperatives certified by sustainable forestry standards					
Implementing pests and disease monitoring programs	Strengthen forest resilience by establishing early-warning systems and pest and disease monitoring programs that enable timely detection and management of outbreaks	Percentage of forested areas under pest and disease monitoring	Short term	Human, technology, finance	MLNR	MESTI, EPA, CSIR, FC, academia, NGOs	340,000.00
		Percentage decrease in pest and disease occurrences over time					
		Number of forestry staff and community members trained in pest and disease monitoring					

Source: Authors

5.5.8 Human Health Sector

The human health sector was recognized as vulnerable to the adverse impacts of climate change in the Climate Change Rapid Risk Assessment for the Bibiani-Anhwiaso-Bekwai Municipal Assembly. Out of the seven adaptation options that were identified and evaluated through the MCDM analysis, five were selected and prioritized (Table 24). Strengthening local clinics and hospitals with better equipment, predicting the outbreak of diseases based on climate forecasts, ensuring access to water, sanitation, and hygiene (WASH) programs, educating communities on proper hygiene practices, and planting trees to reduce air pollution are critical adaptation strategies for the human health sector in the Bibiani-Anhwiaso-Bekwai Municipal Assembly. Strengthening local health care infrastructure by equipping clinics and hospitals with better tools and resources ensures that communities can effectively manage climate-induced health challenges, such as heat stress, vector-borne diseases, and other health threats. Predicting the outbreak of diseases based on climate forecasts enables early detection and preparedness for diseases that may be exacerbated by changing weather patterns, such as malaria and cholera. Ensuring WASH services focus on improving access to clean water, sanitation facilities, and hygiene practices reduces the spread of waterborne diseases and improves public health. Educating communities about proper hygiene practices aims to change behaviours that contribute to disease transmission, such as improper waste disposal or lack of handwashing. Planting trees to reduce air pollution helps improve air quality by absorbing carbon dioxide and releasing oxygen, which can reduce respiratory illnesses linked to poor air quality (Antwi-Agyakwa et al., 2023; Sarfo et al., 2023; Acheampong et al., 2024).

Strengthening health care facilities was deemed essential to ensure that the local health system is equipped to respond to climate-related health emergencies, such as heatwaves or disease outbreaks. Predicting disease outbreaks was prioritized because climate change influences the spread of many diseases, and early warning systems are crucial to prevent outbreaks and protect vulnerable populations. Ensuring access to WASH services was recognized as fundamental to reducing waterborne diseases, especially in the face of climate change, which can disrupt water availability and sanitation systems. Educating communities on hygiene practices was seen as a proactive approach to disease prevention, empowering people with the knowledge to protect their health. Planting trees was prioritized to improve air quality and mitigate the health impacts of pollution, which can be exacerbated by climate change, particularly in urban and industrial areas.

Table 24. Ranking adaptation options for the human health sector

Adaptation option	Final score from stakeholders	Rank
Strengthening local clinics and hospitals with better equipment	50	1
Predicting the outbreak of diseases based on climate forecasts	49	2
Ensuring access to water, sanitation and hygiene (WASH) programs	49	2
Educating communities on proper hygiene practices	49	2
Planting trees to reduce air pollution	48	6

Source: Authors

Table 25. Adaptation actions for the human health sector

Adaptation actions	**Objectives**	**Indicator of success**	**Time frame** (short, medium or long term)	**Resources** (finance, human, technology)	**Lead institution**	**Implementing partners**	**Estimated costs (GH₵)**
Strengthening local clinics and hospitals with better facilities, equipment, and medical supplies to handle climate-induced health emergencies	Enhance the capacity of local clinics and hospitals by strengthening facilities, upgrading equipment, and ensuring a reliable supply of medical resources to effectively handle climate-induced health emergencies	Availability of critical medical supplies and equipment in clinics and hospitals	Long term	Human, technology, finance	MOH	GHS, MLGDRD, NMCP, NADMO, EPA, WHO	5,000,000.00
		Number of health care workers trained in climate-resilient health practices and emergency response for climate-induced illnesses					
		Percentage decrease in mortality and morbidity rates for climate-induced health conditions					
Predict the outbreak of	Improve public health preparedness and response by	Percentage decrease in disease incidence (e.g., malaria, cholera)	Short term		MOH	MLGDRD, GMet, EPA, GHS, academic	550,000.00

Adaptation actions	**Objectives**	**Indicator of success**	**Time frame** (short, medium or long term)	**Resources** (finance, human, technology)	**Lead institution**	**Implementing partners**	**Estimated costs (GH₵)**
diseases based on climate forecasts	establishing early warning systems that predict disease outbreaks based on climate forecasts, enhancing community resilience against climate-related health risks	during periods following accurate climate forecast predictions		Human, technology finance		institutions, NDPC, MESTI, NGOs	
		Time between climate forecast predictions and public health interventions (e.g., distribution of mosquito nets, vaccination campaigns) in response to predicted disease risks					
		Number of health systems (e.g., district hospitals, local health units) that incorporate climate forecast data into their disease prevention and management strategies					

Adaptation actions	**Objectives**	**Indicator of success**	**Time frame** (short, medium or long term)	**Resources** (finance, human, technology)	**Lead institution**	**Implementing partners**	**Estimated costs (GH₵)**
Ensuring access to water, sanitation and hygiene (WASH) programs	Improve public health and resilience to climate impacts by ensuring access to safe WASH services in vulnerable communities	Percentage of households or communities with access to clean drinking water	Medium term	Human, technology, finance, multimedia	MSWR	GHS, MLGDRD, EPA, WaterAid – Ghana, WRC, CWSA, MOH, NGOs, academia	4,500,000.00
		Number of reported cases of waterborne diseases					
		Number of water points, toilets, and sanitation systems that are functional and well-maintained after installation					
Educate communities on proper hygiene practices	Enhance public health and reduce the incidence of waterborne diseases by educating communities on	Increase in community members practicing proper hygiene behaviours based on direct observation or surveys	Short term	Human, technology, finance, multimedia	GHS	MLGDRD, academia, GES, NCCE, MOH, NGOs	860,000.00

Adaptation actions	**Objectives**	**Indicator of success**	**Time frame** (short, medium or long term)	**Resources** (finance, human, technology)	**Lead institution**	**Implementing partners**	**Estimated costs (GH₵)**
	proper hygiene practices, including boiling water and safe waste disposal methods	Number of reported cases of hygiene-related diseases					
		Number of households with access to soap, clean water, and sanitary facilities					
		Number of community-led hygiene initiatives					
Planting trees to reduce air pollution	Enhance urban and rural environments by planting trees that reduce air pollution and improve air quality through the absorption of carbon emissions and dust particles	Number of trees planted in target areas	Medium term	Human, technology, finance, multimedia	MESTI	EPA, MLGDRD, MESTI, FC, MLNR, NDPC, NGOs	3,000,000.00
		Decrease in respiratory and cardiovascular diseases or hospital admissions					
		Decrease in air pollution levels in areas where trees are planted					

Adaptation actions	**Objectives**	**Indicator of success**	**Time frame** (short, medium or long term)	**Resources** (finance, human, technology)	**Lead institution**	**Implementing partners**	**Estimated costs (GH₵)**
Strengthening vector control programs	Increase the effectiveness of disease prevention by enhancing vector control programs to address the growing risks of vector-borne diseases due to climate change	Decreased incidence of malaria, dengue, and other vector-borne diseases	Medium term	Human, technology, finance	MOH	EPA, MLGDRD, GHS, NMCP, EPA, academia, NGOs	350,000.00
		Percentage of the population aware of vector control measures					
		Number of community-based vector control activities conducted					
		Percentage reduction in hospital admissions and mortality rates due to vector-borne diseases					
Prevent contamination of water sources during floods	Enhance community resilience and public health by improving sanitation facilities and drainage	Number of waterborne disease cases reported during and after flood events compared to previous	Short term	Human, technology, finance	MOH	GHS, MLGDRD, NADMO, EPA, MoF, MOGCSP, WHO, UNICEF	4,100,500.00

Adaptation actions	**Objectives**	**Indicator of success**	**Time frame** (short, medium or long term)	**Resources** (finance, human, technology)	**Lead institution**	**Implementing partners**	**Estimated costs (GH₵)**
	systems, preventing the contamination of water sources during floods, and minimizing the risk of waterborne diseases	years without flood mitigation measures					
		Reduction in the levels of contaminants (e.g., E. coli, turbidity) in water sources during flood periods					
		Number of water sources and infrastructure (e.g., wells, water treatment plants) that are flood-resilient					
		Number of water supply disruptions due to flood contamination or damage to infrastructure					

Source: Authors

5.5.9 Gender (as a Cross-Cutting Sector)

Out of the 10 adaptation options that were identified and evaluated through the MCDM analysis, four were selected and prioritized (Table 26). Strengthening health care systems to provide accessible services for maternal health and reproductive health, encouraging men and women farmers to practice crop diversification, providing access to improved seed varieties for both men and women, and offering training sessions for both men and women on sustainable agricultural practices are vital adaptation strategies for the gender sector in the Bibiani-Anhwiaso-Bekwai Municipal Assembly. Strengthening health care systems to ensure access to quality maternal and reproductive health services is essential for protecting women's health and reducing maternal mortality, especially as climate change can strain health care resources and increase health risks during pregnancy and childbirth. Providing access to improved seed varieties for both men and women increases agricultural productivity, ensures better adaptation to climate stressors, and promotes gender equality by empowering women farmers to access the same resources as men.

Strengthening health care systems for maternal and reproductive health was prioritized to ensure that women, especially in rural areas, have access to essential health care services during climate-related health challenges, such as increased risks of infectious diseases and poor nutrition. Providing training sessions on sustainable agricultural practices was emphasized to empower both genders with the knowledge needed to improve farming techniques, increase yields, and adapt to environmental challenges. These strategies were selected to address the interconnected challenges of climate change, gender inequality, and health, fostering resilience and enhancing well-being for both men and women in the region (Adu and Owusu, 2023; Frempong et al., 2023).

Table 26. Ranking adaptation options for gender sector

Adaptation option	Final score from stakeholders	Rank
Strengthening health care systems to provide accessible services for maternal health and reproductive health	44	1
Encouraging men and women farmers to practice crop diversification	42	2
Providing access to improved seed varieties for both men and women	40	3
Providing training sessions for both men and women on sustainable agricultural practices	40	3

Source:

Table 27. Adaptation actions for the gender sector

Adaptation actions	**Objectives**	**Indicator of success**	**Time frame** (short, medium or long term)	**Resources** (finance, human, technology)	**Lead institution**	**Implementing partners**	**Estimated costs (GH₵)**
Strengthening health care systems to provide accessible services, particularly for maternal health, and reproductive health	Strengthen health care systems for the provision of accessible and equitable services, with a focus on improving maternal health and reproductive health outcomes, ensuring that all individuals, particularly women, receive quality care	Number of functioning maternal health facilities within a 5–10 km radius for rural communities	Long term	Human, technology, finance	MOH	MOGCSP, MLGDRD, MoF, GHS, MoE, academia, NGOs	600,000.00
		Reduction in maternal mortality rates					
		Increase in facilities equipped to provide emergency obstetric care					
		Higher ratio of health care workers, especially midwives and reproductive health specialists, to the population					
Encouraging men and women	Foster the adoption of crop diversification	Percentage of farmers who grow more than			MOGCSP	MOGCSP, MoF,	500,000.00

Adaptation actions	**Objectives**	**Indicator of success**	**Time frame** (short, medium or long term)	**Resources** (finance, human, technology)	**Lead institution**	**Implementing partners**	**Estimated costs (GH₵)**
farmers to practice crop diversification	among men and women farmers, enabling them to enhance farm productivity, adapt to changing climate conditions, and achieve economic stability while promoting sustainable agricultural practices and gender equity	one type of crop on their land	Medium term	Human, technology, finance		MLGDRD, MoTI, NASTAG, FAO, ADB, CSIR, academia, NGOs	
		Fewer crop failures due to pests or diseases because of diversified farming systems					
		Number of farmers successfully selling new crops introduced through diversification					
Providing access to improved seed varieties for both men and farmers	Ensure equitable access to improved seed varieties for both men and women farmers, enhancing agricultural productivity, climate resilience, and livelihood sustainability using high-yielding and	Percentage of men and women farmers using improved seed varieties compared to traditional seeds	Short term	Human, technology, finance	MoFA	MOGCSP, MoF, MLGDRD, MoTI, NASTAG, FAO, ADB, CSIR, academia, NGOs	310,000.00

Adaptation actions	**Objectives**	**Indicator of success**	**Time frame** (short, medium or long term)	**Resources** (finance, human, technology)	**Lead institution**	**Implementing partners**	**Estimated costs (GH₵)**
	climate-resistant varieties						
		Equal access to improved seed varieties for both male and female farmers					
		Availability of improved seed varieties through local vendors and agricultural supply stores					
		Higher crop yields reported by farmers using improved seed varieties					
Providing training sessions for both men and women on sustainable agricultural practices	Equip both men and women farmers with knowledge and skills in sustainable agricultural practices, fostering environmental	Percentage of men and women farmers attending training sessions on sustainable agricultural practices	Short term	Human, technology, finance	MOH	MoFA, MLGDRD, NDPC, FAO, EPA, academia,	400,000.00

Adaptation actions	**Objectives**	**Indicator of success**	**Time frame** (short, medium or long term)	**Resources** (finance, human, technology)	**Lead institution**	**Implementing partners**	**Estimated costs (GH₵)**
	conservation, improved productivity, and gender-inclusive capacity building for resilient farming systems					NGOs, media outlets	
		Number of farmers who can correctly identify and explain sustainable agricultural practices post-training					
		Percentage of farmers (both men and women) who adopt at least one sustainable agricultural practice after receiving training					
Developing and implementing gender-sensitive early warning systems	Establish gender-sensitive early warning systems that empower communities with accurate, timely, and	Percentage of women and men in the community who receive timely early warning alerts	Medium term	Human, technology, finance	MESTI	MOGCSP, MLGDRD, MoF, EPA, NADMO, GMet,	250,000.00

Adaptation actions	**Objectives**	**Indicator of success**	**Time frame** (short, medium or long term)	**Resources** (finance, human, technology)	**Lead institution**	**Implementing partners**	**Estimated costs (GH₵)**
	actionable information, enhancing preparedness and minimizing the impacts of disasters on livelihoods and well-being					academia, NGOs	
		Number of men and women trained in interpreting and acting on early warning information					
		Percentage of men and women actively involved in designing and planning the early warning system					
Providing road infrastructure to improve access to	Enhance road infrastructure in rural areas, ensuring	Decreased time required for farmers to transport goods to	Long term		MOH	MoFA, MOGCSP, MLGDRD,	12,000,000.00

Adaptation actions	**Objectives**	**Indicator of success**	**Time frame** (short, medium or long term)	**Resources** (finance, human, technology)	**Lead institution**	**Implementing partners**	**Estimated costs (GH₵)**
markets, especially during extreme weather events	improved access to markets for both men and women farmers, particularly during extreme weather events, to support economic growth, reduce post-harvest losses, and build climate-resilient communities	markets due to improved roads		Human, technology,finance		NDPC, GHA, EPA, NGOs, local government	
		Reduced instances of road closures or impassable roads during heavy rain					
		The number of farmers who can access markets regularly, even during adverse weather conditions					
Involving both men and women in community resilience planning processes	Involve both men and women in the community resilience planning process, ensuring that diverse perspectives are considered in developing strategies to strengthen local capacities against	The proportion of men and women on community resilience planning committees	Long term	Human, technology,finance	MESTI	MOGCSP, MLGDRD, EPA, NDPC, academia, NGOs, local government	200,000.00

Adaptation actions	**Objectives**	**Indicator of success**	**Time frame** (short, medium or long term)	**Resources** (finance, human, technology)	**Lead institution**	**Implementing partners**	**Estimated costs (GH₵)**
	social, environmental, and economic shocks						
		Inclusion of priorities and needs specific to men and women in resilience planning documents					
		Number of men and women involved in executing resilience-building activities					
Engaging with local government officials to advocate for gender-responsive climate policies	Collaborate with local government officials to advocate for the development and adoption of gender-responsive climate policies, ensuring that both men and women benefit equally from climate actions and that gender-specific	Number of local government officials participating in advocacy meetings and workshops	Medium term	Human, technology, finance	MESTI	MOGCSP, MLGDRD, MoFA, NADMO, EPA, NDPC, academia, NGOs, local government	350,000.00

Adaptation actions	**Objectives**	**Indicator of success**	**Time frame** (short, medium or long term)	**Resources** (finance, human, technology)	**Lead institution**	**Implementing partners**	**Estimated costs (GH₵)**
	needs are addressed in policy frameworks						
		Number of local leaders (male and female) publicly supporting gender-responsive climate actions					
		Number of collaborations between local government and community groups advocating for gender-responsive policies					
Developing and disseminating climate information services tailored to the needs of gender groups	Develop and disseminate climate information services that are tailored to the specific needs of gender groups, ensuring equitable access to relevant, timely, and actionable	Proportion of men and women involved in designing and validating climate information services	Medium term	Human, technology, finance, multimedia	MESTI	MOGCSP, MLGDRD, MoFA, GMet, EPA, academia, NGOs, local government	200,000.00

Adaptation actions	**Objectives**	**Indicator of success**	**Time frame** (short, medium or long term)	**Resources** (finance, human, technology)	**Lead institution**	**Implementing partners**	**Estimated costs (GH₵)**
	information for decision-making and planning						
		Proportion of men and women using climate information to make decisions					
		Completion of assessments identifying the distinct climate information needs of men and women					
Encouraging men and women farmers to invest in water harvesting and irrigation systems	Support both men and women farmers to invest in water harvesting and irrigation systems, improving water availability, crop productivity, and resilience to climate variability, while	Percentage of men and women farmers who install and use water harvesting and irrigation system	Medium term	Human, technology, finance	MoFA	MOGCSP, MoE, MoF, FAO, MLGDRD, NCCE, NBSSI, GIDA, academia, NGOs	230,000.00

Adaptation actions	**Objectives**	**Indicator of success**	**Time frame** (short, medium or long term)	**Resources** (finance, human, technology)	**Lead institution**	**Implementing partners**	**Estimated costs (GH₵)**
	promoting inclusive agricultural development						
		Increased crop yields due to the use of water harvesting and irrigation systems					
		Increased crop yields attributed to the use of water harvesting and irrigation systems					

Source: Authors

Table 28. Summary of estimated costs

S/N	Sector	Amount (GH₵)
1	Agriculture	47,217,635.00
2	Biodiversity	26,957,220.00
3	Fisheries	9,285,000.00
4	Tourism	5,756,000.00
5	Disaster risk reduction	9,461,820.00
6	Water resources	10,867,790.00
7	Forestry	28,483,830.00
8	Human health	18,360,500.00
9	Gender	15,040,000.00
Total		**171,429,795.00**

Source: Authors

6.0 Framework for Adaptation Monitoring, Evaluation, and Learning

According to Beauchamp et al. (2024), monitoring, evaluation, and learning (MEL) are crucial for effective adaptation actions in the municipal assembly for several reasons:

- **Assessing progress**: MEL helps track the implementation of adaptation initiatives, ensuring that actions align with set goals and timelines.
- **Identifying gaps**: Regular evaluations reveal shortcomings or inefficiencies in the adaptation strategies, enabling timely adjustments.
- **Ensuring accountability**: MEL promotes transparency by holding stakeholders accountable for their roles in climate adaptation efforts.
- **Measuring effectiveness**: MEL provides evidence of the impact of adaptation measures, helping to determine whether objectives like resilience-building and vulnerability reduction are being met.
- **Facilitating informed decision-making**: Data gathered through MEL informs policy-makers and planners, guiding the refinement of strategies based on observed outcomes.
- **Learning from experience**: MEL allows the assembly to draw lessons from successes and failures, improving future adaptation planning and execution.
- **Engaging stakeholders**: MEL processes foster collaboration by involving community members, government agencies, and other stakeholders in assessing outcomes and planning improvements.
- **Supporting resource allocation**: By demonstrating the effectiveness of certain measures, MEL helps prioritize funding and resources for the most impactful adaptation actions.

6.1 Building on Existing Structures to Facilitate Mainstreaming

Building on existing structures in the BABMA to facilitate the mainstreaming of MEL is essential for ensuring sustainable and effective climate adaptation actions. The municipal assembly can leverage its existing governance frameworks, such as its various departments, committees, and decentralized administrative systems, to seamlessly incorporate MEL processes into ongoing development planning and implementation. Embedding MEL indicators into the assembly's development plans and policies ensures that climate adaptation becomes a core component, minimizing duplication of efforts, and enhancing efficiency in tracking climate impacts and adaptation outcomes. Collaborations with local stakeholders, including NGOs, private sector actors, and academic institutions already operating in the area, can strengthen MEL activities by providing additional expertise, resources, and innovative solutions. Community networks and traditional leadership systems, which play a significant role in governance at the grassroots level, can be engaged to facilitate data gathering, monitor adaptation efforts, and support learning-based adjustments. Established communication platforms, such as municipal meetings, community radio, and newsletters, can be used to share MEL findings and foster

inclusive feedback mechanisms. By integrating MEL into ongoing training programs for municipal staff and community members, the municipality can build local capacity and ownership of the adaptation process. Aligning MEL activities with existing funding channels and municipal budgets ensures financial sustainability while expanding its reach and impact. This strategic integration strengthens the municipality's ability to monitor progress, evaluate adaptation outcomes, and refine strategies to build resilience and reduce vulnerabilities to climate change effectively.

6.2 Monitoring, Evaluation, and Learning

The National Development Planning Commission (NDPC) Act provides the legal basis for adaptation monitoring and evaluation (M&E) in Ghana. This act mandates the establishment of robust M&E frameworks to ensure that development plans—including climate adaptation strategies—are effectively implemented and assessed. The act emphasizes the importance of accountability and transparency in the planning and execution of national development initiatives. The framework for adaptation M&E in Ghana's NAP for the agricultural sector is designed to track progress, assess effectiveness, and facilitate learning to enhance climate resilience. The key components are:

Objectives of the MEL framework

- **Track** progress: Monitor the implementation of adaptation actions and measure progress against set targets and indicators, ensuring that progress is inclusive and benefits all community members equitably.
- **Evaluate effectiveness**: Assess the impact of adaptation strategies on enhancing resilience and reducing vulnerabilities in the agricultural sector, specifically evaluating their contribution to reducing gender inequalities and promoting social equity.
- **Facilitate learning**: Provide insights and lessons learned to inform future adaptation planning and implementation, emphasizing insights on what works for different gender and age groups to ensure adaptive management is gender-responsive.

Key Components

- **Indicators** and metrics: Develop specific, measurable, achievable, relevant, and time-bound (SMART) indicators to track adaptation actions. These indicators should cover various aspects such as crop yields, water usage efficiency, soil health, and farmer income levels.
- Crucially, these indicators will be designed to capture gender-differentiated impacts and will include gender-sensitive and age-disaggregated metrics wherever feasible to assess equitable outcomes.
- **Data collection and management**: Establish robust systems for collecting, managing, and analyzing data. This includes using remote sensing, field surveys, and farmer reports to gather relevant information. A key aspect of this system will be the systematic collection and analysis of gender- and age-disaggregated data to understand who is benefiting from adaptation interventions and to identify any disparities.

- **Baseline assessments**: Conduct baseline assessments to understand the current state of the agricultural sector and establish reference points for measuring progress.
- **Regular reporting**: Implement a schedule for regular reporting on adaptation activities and outcomes. This ensures transparency and accountability in the adaptation process.

Evaluation Processes

- **Periodic evaluations**: Conduct evaluations at strategic intervals to assess the effectiveness of adaptation measures. This includes mid-term reviews and end-of-project evaluations.
- **Impact assessments**: Perform impact assessments to determine the long-term effects of adaptation actions on agricultural productivity, food security, and livelihoods.
- **Stakeholder feedback**: Incorporate feedback from stakeholders, including farmers, policy-makers, and researchers, to refine and improve adaptation strategies.

Learning and Improvement

- **Knowledge sharing**: Facilitate the sharing of knowledge and best practices among stakeholders through workshops, seminars, and publications.
- **Adaptive management**: Use the insights gained from MEL activities to make informed adjustments to adaptation strategies. This ensures that the plan remains responsive to changing climatic conditions and emerging challenges.
- **Capacity building**: Strengthen the capacity of institutions and individuals involved in the MEL process through training and technical support.

Institutional Arrangements

- **Coordination mechanism**: Establish a coordination mechanism involving key institutions such as the MESTI, the MoFA, and the EPA to oversee the MEL process.
- **Roles and responsibilities**: Clearly define the roles and responsibilities of various stakeholders in the MEL framework to ensure effective implementation and accountability.

Table 29. Outline of approach to MEL of the BABMA's adaptation actions

Steps	Indicative activities—to be led by the BABMA Planning Coordination Unit
1. Monitoring the adaptation actions	• Identify adaptation activities that will be monitored through qualitative and quantitative performance measures to determine progress made toward the adaptation objective(s) • Define metrics and indicators for documenting progress for the adaptation activities identified for monitoring

Steps	Indicative activities—to be led by the BABMA Planning Coordination Unit
	• Collect information on the metrics and indicators throughout the adaptation process
2. Reviewing the adaptation process to assess progress, effectiveness, and gaps – Evaluation	• Determine the means for measuring and communicating levels of effectiveness and assessing gaps • Gather and combine insights from recent studies and new scientific developments, along with feedback and results from current adaptation efforts. This process is essential for evaluating and modernizing the approach or strategy in question • Revise the adaptation activities using evaluation information and metrics
3. Iteratively updating the NAP – Learning	• Update the adaptation activities based on the information collected • Document key lessons of what worked and what did not • Establish a basis of success and/or failure • Implement remedial measures • Align learning and correctional measures with broader targets within the BABMA MTDP
Steps	**Indicative activities—to be led by the KMA Municipal Planning Coordination Unit**
4. Communication Report progress, process effectiveness, outreach, and knowledge and information dissemination	• Disseminate adaptation documents and learning products • Provide information in the BABMA annual progress report on the progress and effectiveness of the adaptation process

Source: Adapted (and modified) from the Government of Liberia's four-step approach to the MEL of its NAP. See Environmental Protection Agency, Republic of Liberia, 2022.

7.0 Conclusion and the Way Forward

7.1 Conclusion

The Bibiani-Anhwiaso-Bekwai municipality is experiencing the manifestations of climate change through increased temperatures, dry spells, and erratic rainfall patterns, and this could jeopardize the livelihoods of thousands of households. This necessitates an action plan to manage the adverse impacts of these climate risks. When implemented, the adaptation action plan will build the capacity of the BABMA to manage climate-related threats facing the municipality both now and in the future. This will consequently reduce the overall climate change vulnerability of the municipality and build resilience into its systems, activities, and processes. Nonetheless, it should be stressed that the successful implementation of this adaptation action plan will require the concerted efforts and commitment of key stakeholders from the assembly as well as private sector players and traditional authorities in fostering effective adaptation in the municipality.

Given that this action plan advocates for gender-responsive adaptation strategies to address the threats of climate change, it is important to highlight the need to be inclusive and demonstrate consideration of the views and perspectives of the marginalized including women, the elderly, and the disabled in the implementation of this action plan. In this regard, monitoring and evaluation of the key adaptation actions proposed for each sector should be vigorously pursued. An estimated amount of GHC 171,429,795.00 will be needed to ensure the successful implementation of the adaptation actions proposed in this action plan.

Mining with its associated devastating consequences has emerged as a key sector within the BAMBA. It is therefore suggested that future adaptation plans should vigorously pursue actions aimed at addressing mining-related threats to the livelihoods of the people in the municipality.

7.2 The Way Forward

To ensure the successful implementation of the District Adaptation Action Plan, the following steps are recommended:

1. **Strengthen institutional frameworks**: Establish clear roles and responsibilities for institutions involved in the plan's execution, ensuring effective coordination and accountability. This could prevent the duplication of efforts and address coordination challenges by ministries, units, and departments charged with addressing climate change threats in the agricultural sector.
2. **Enhance financial and logistical support**: The implementation of the various adaptation actions proposed in this action plan would require significant investment. There is a need to establish strong partnerships with the private sector, incentivized through tax reliefs and recognition programs, which can further ensure that logistical support, such as equipment, transportation, and infrastructure, is adequately addressed.
3. **Capacity building**: Provide training and resources to stakeholders, particularly smallholder farmers, to enable them to adopt and sustain climate-resilient practices. Develop capacity

building and livelihood diversification of women and marginalized groups working in agriculture to help them deal with the economic impacts of climate change.

4. **Gender mainstreaming**: Strengthen gender considerations by actively involving women and marginalized groups in decision-making processes and access to resources. There is a need to improve existing national information regarding the role of women in agriculture through the collection of sex-disaggregated data and the generation of gender statistics.

References

Abebaw, Y., Wubetu, A., & Marelign, A. (2023). Enhancing Access and Adoption of Improved Seed for Food Security of Ethiopia (A Review). *development*, *13*(3).

Acheampong, A. O., Opoku, E. E. O., & Tetteh, G. K. (2024). Unveiling the effect of income inequality on safe drinking water, sanitation and hygiene (WASH): Does financial inclusion matter?. *World Development*, *178*, 106573.

Addaney, M., Asibey, M. O., Cobbinah, P. B., & Akudugu, J. A. (2021). Climate change in rural Ghana: perceptions and adaptive responses. *Local Environment*, *26*(12), 1461-1479.

Adu, J., & Owusu, M. F. (2023). How do we improve maternal and child health outcomes in Ghana?. *The International Journal of Health Planning and Management*, *38*(4), 898-903.

Affi-Donkor, V. (2021). *Assessing the effects of climate change and variability on cocoa production in the Bibiani-Anhwiaso-Bekwai municipality* (Master's thesis, Norwegian University of Life Sciences, Ås).

Akantege, R., Rahayu, A., Furqon, C., & Dirgantari, P. (2024). Microfinance Digital Financial Services And Rural Farmers' Welfare And Susceptibility To Poverty In Rural Ghana. *JHSS (JOURNAL OF HUMANITIES AND SOCIAL STUDIES)*, *8*(1), 026-031.

Amankwah, O., Choong, W. W., & Boakye-Agyeman, N. A. (2024). Patients satisfaction of core health-care business: the mediating effect of the quality of health-care infrastructure and equipment. *Journal of Facilities Management*, *22*(3), 365-381.

Amon-Armah, F., Baah, F., Owusu-Ansah, F., Adu-Acheampong, R., & Awudzi, G. K. (2023). Farmers' knowledge of major insect pests and their occurrence in cocoa plantations in Ghana. *International Journal of Pest Management*, *69*(1), 1-13.

ANTWI, D. M. B., AMANKWAA, I. K., Johannes, A., Agyekum, E., AMANIAMPONG, D., AGYEKUM, T. O., & BOATENG, H. K. (2024). A survey on the need to incorporate rainwater harvesting systems as an alternative domestic water source in Ghana. *Journal of Applied Science, Engineering, Technology and Management*, *2*(2), 15-24.

Antwi-Agyakwa, K. T., Afenyo, M. K., & Angnuureng, D. B. (2023). Know to predict, forecast to warn: a review of flood risk prediction tools. *Water*, *15*(3), 427.

Armah, A. A., Nti, C. A., & Otoo, G. E. (2019). Climate change and food and nutrition security in the Bibiani-Anhwiaso Bekwai district in the Western Region of Ghana. *Cogent Environmental Science*, *5*(1), 1681613.

Beauchamp, E., Leiter, T., Pringle, P., Brooks, N., Masud, S., & Guerdat, P. (2024). *Toolkit for monitoring, evaluation, and learning for National Adaptation Plan processes.* NAP Global Network & Adaptation Committee. https://napglobalnetwork.org/wp-content/uploads/2024/05/napgn-en-2024-mel-toolkit-nap-processes.pdf

Bedeke, Sisay Belay. "Climate change vulnerability and adaptation of crop producers in sub-Saharan Africa: a review on concepts, approaches and methods." *Environment, development and sustainability* 25.2 (2023): 1017-1051.

Bilalova, S., Newig, J., Tremblay-Lévesque, L. C., Roux, J., Herron, C., & Crane, S. (2023). Pathways to water sustainability? A global study assessing the benefits of integrated water resources management. *Journal of Environmental Management*, *343*, 118179.Environmental Protection Agency. (2020). *Ghana's Private Sector Engagement Strategy for the National Adaptation Plan*. Government of Ghana. https://napglobalnetwork.org/wp-content/uploads/2020/05/napgn-en-2020-ghana-private-sector-engagement-strategy-for-nap.pdf

Fremmpong, R. B., Gross, E., & Owusu, V. (2023). Crop diversity, sustainable food and nutritional security among smallholder farmers in Ghana. *British Food Journal*, *125*(12), 4372-4395.

Gamenyah, D. D., Kabange, N. R., Lee, S., Oh, K. W., Asante, M. D., & Lee, J. H. (2023). Introduction to Agriculture and Rice Breeding in Ghana. In *Proceedings of the Korean Society of Crop Science Conference* (pp. 23-23). The Korean Society of Crop Science.

IPCC (2022). *Climate Change 2022: Impacts, Adaptation, and Vulnerability*. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [H.-O. Pörtner, D.C. Roberts, M. Tignor, E.S. Poloczanska, K. Mintenbeck, A. Alegría, M. Craig, S. Langsdorf, S. Löschke, V. Möller, A. Okem, B. Rama (eds.)]. Cambridge University Press, Cambridge, UK and New York, NY, USA, 3056 pp. doi: 10.1017/9781009325844

Kohl, T., Niether, W., & Abdulai, I. (2024). Impact of common shade tree species on microclimate and cocoa growth in agroforestry systems in Ghana. *Agroforestry Systems*, *98*(6), 1579-1590.

Kwakye, R. (2023). *Human leukocyte antigen-g level, hematological and biochemical profile among pregnant women with plasmodium falciparum (pf) infection: A case control study at the bibiani anhwiaso bekwai municipality, Ghana* (Doctoral dissertation, University of Cape Coast).

Kumi-Aboagye, E. (2012). *An Assessment of the Water Quality Status of the Lake Amponsah in the Bibiani-Anhwiaso-Bekwai District, Ghana* (Doctoral dissertation)

Luna Rodríguez, M., Ledwell, C., & Bankole, O. (2023). Progress on vertical integration in national adaptation plan processes: Analysis of strategic linkages between national and sub-national levels (NAP Global Network synthesis report).

International Institute for Sustainable Development. https://napglobalnetwork.org/resource/progress-on-vertical-integration-in-nap-processes/

NAP Global Network (2018): Ghana's National Adaptation Plan Framework. https://napglobalnetwork.org/wp-content/uploads/2020/04/napgn-en-2018-ghana-nap-framework.pdf (Accessed on 01/12/2024)

Nash, N., Capstick, S., Whitmarsh, L., Chaudhary, I., & Manandhar, R. (2019). Perceptions of local environmental issues and the relevance of climate change in Nepal's Terai: Perspectives from two communities. *Frontiers in Sociology*, *4*, 60.

Okumah, M., Yeboah, A. S., & Amponsah, O. (2020). Stakeholders' willingness and motivations to support sustainable water resources management: Insights from a Ghanaian study. *Conservation science and practice*, *2*(3), e170.

Otobo, D., Nnodim, A. U., Deekor, H. L., & Kobani, D. (2024). Roles of Community Education Programmes on the Promotion of Healthy Living practices Among Women in Rivers State, Nigeria. *African Journal of Information, Economics and Management Research*, *2*(2).

Owusua, D. (2024). Empowering Ghanaian Women in Cocoa Farming: Contributions, Prospects and Challenges. *INTERDISCIPLINARY JOURNAL OF AFRICAN & ASIAN STUDIES (IJAAS)*, *10*(1).

Pienaah, C. K., Batung, E., Saaka, S. A., Mohammed, K., & Luginaah, I. (2023). Early warnings and perceived climate change preparedness among smallholder farmers in the Upper West Region of Ghana. *Land*, *12*(10), 1944.

Prempeh, D. O. M. I. N. I. C. (2023). *Exploring forest use and conservation policies and their communication to communities in forest zones a case of Pra-anum forest zone* (Doctoral dissertation, University of Education, Winneba).

Sarfo, I., Bi, S., Xu, X., Yeboah, E., Kwang, C., Batame, M., ... & Koku, J. E. (2023). Planning for cooler cities in Ghana: Contribution of green infrastructure to urban heat mitigation in Kumasi Metropolis. *Land Use Policy*, *133*, 106842.

Yiadom, E. B., Dziwornu, R. K., Mawutor, J. K., & Amankwah, R. F. (2023). Exploring the relationship between extreme weather events, urbanization, and food insecurity: Institutional quality perspective. *Environmental Challenges*, *13*, 100775.

Zing, M., & Shishkina, A. (2024). The Role of Women's Participation in Effective Decision-Making in Politics at the Local Level: The Experience of Ghana. In *Terrorism and political contention: New perspectives on North Africa and the Sahel region* (pp. 301-318). Cham: Springer Nature Switzerland.


BIBIANI - ANHWIASO - BEKWAI MUNICIPAL ASSEMBLY
BIBIANI
19
KYEA BIE TI
88


FREEDOM
AND
JUSTICE