

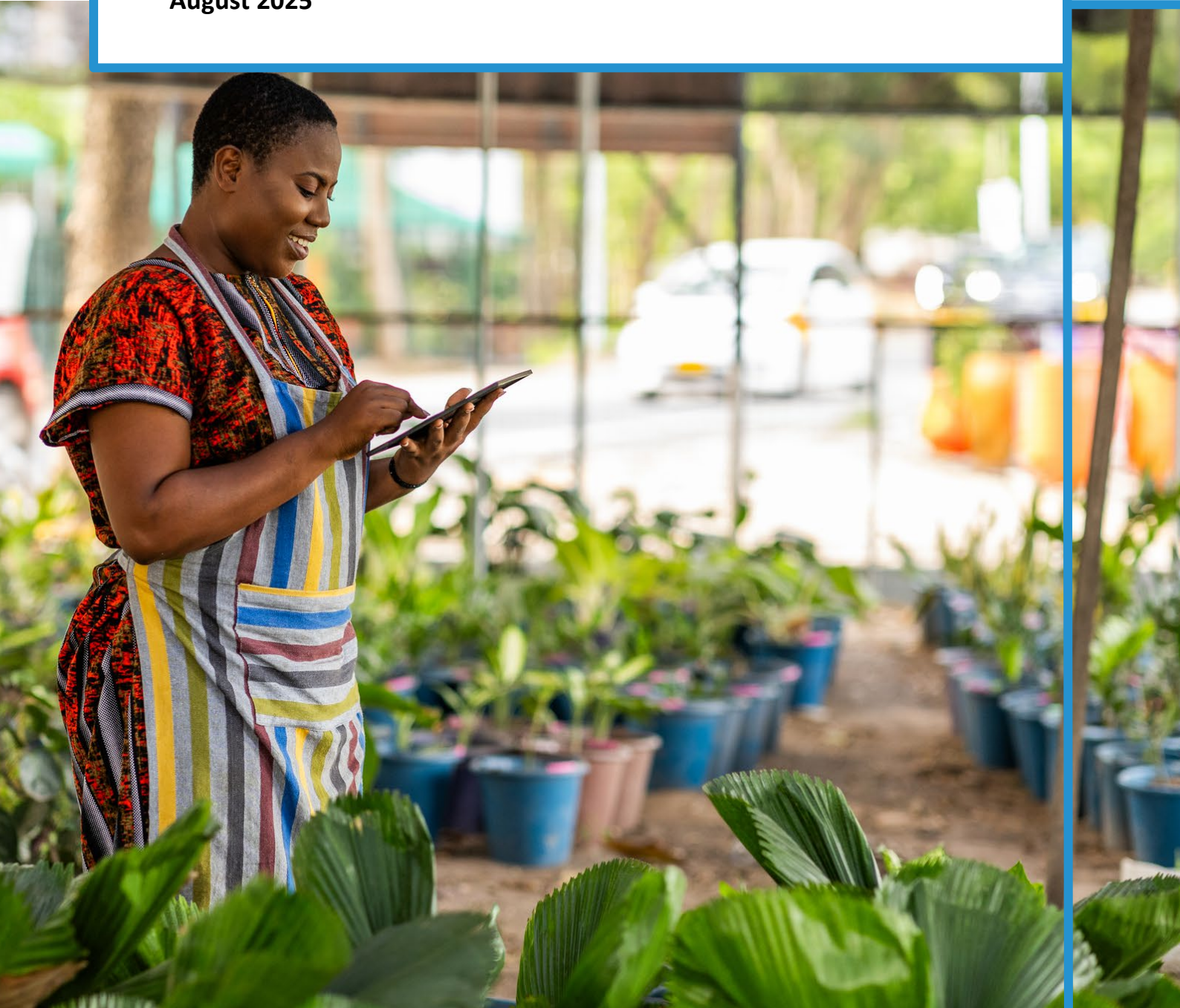


KINTAMPO MUNICIPAL
ASSEMBLY



The Kintampo Municipal Assembly Climate Adaptation Plan: Ghana

August 2025



© Government of Ghana

The Kintampo Municipal Assembly Climate Adaptation Plan: 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 :



Government
of Ireland
International
Development
Programme



Executive Summary

The Kintampo Municipal Assembly Climate Adaptation Plan (KMAP) has been developed as a strategic and forward-looking framework to address the increasing risks and impacts of climate change within the municipality. As a transitional agroecological zone with savannah and forest ecosystems, the Kintampo Municipality is particularly vulnerable to climate-induced hazards, including droughts, floods, bushfires, windstorms, and erratic rainfall patterns. These risks pose significant challenges to agriculture, water resources, health, tourism, forestry, and infrastructure across the municipality.

Situated in Ghana's Bono East Region, the Kintampo Municipality serves as a key agricultural hub with extensive reliance on rain-fed farming. This dependence, coupled with inadequate infrastructure and limited access to climate-resilient technologies, has heightened the municipality's exposure and reduced its adaptive capacity. Recognizing the urgency of these threats, the Kintampo Municipal Assembly (KiMA), with support from national and international stakeholders, has taken proactive steps to enhance the municipality's resilience through this comprehensive Climate Adaptation Plan.

The KMAP builds directly on the findings of the Kintampo Climate Change Vulnerability Assessment (CCVA), which identified sector-specific vulnerabilities, community-level risks, and spatial hotspots of climate exposure. It aligns with Ghana's National Adaptation Plan (NAP) framework, the updated Nationally Determined Contributions (NDCs) (MESTI, 2021), under the Paris Agreement, and the Sustainable Development Goals (SDGs)—particularly those related to climate action, sustainable cities, and reduced inequalities.

Key Components

The KMAP is structured around four key components:

- **Risk assessment and vulnerability analysis:** Identifying critical climate risks affecting agriculture, water resources, health, tourism, forestry, and infrastructure. The assessment highlights that sectors such as agriculture (particularly in rural communities) and flood-prone areas have the highest vulnerability scores, indicating inadequate adaptive capacity to counteract their exposure and sensitivity to climate risks.
- **Implementation of adaptation measures:** Practical, scalable interventions categorized into On-farm adaptation actions, off-farm adaptation actions, gender-based adaptation, and gender-disaggregated data and research.
- **Funding and investment framework:** A strategic approach to mobilizing resources from government programs, international donors, public-private partnerships, community fundraising, and innovative financial mechanisms.
- **Monitoring, evaluation, and learning (MEL):** A dynamic framework for tracking progress, evaluating outcomes, and refining strategies for sustained resilience.

Prioritized Adaptation Measures

Adaptation measures were ranked using a multi-criteria decision-making (MCDM) framework based on feasibility, effectiveness, and alignment with municipal priorities. The prioritized measures include:

- Conservation agriculture: Enhancing soil health through minimal tillage, crop residue management, manure production, and cover cropping.
- Irrigation schemes: Development of small-scale irrigation dams, rehabilitation of non-functional systems, and adoption of efficient sprinkler and drip systems.
- Agroforestry promotion: Water conservation planting, alley cropping, adaptive trials, and shea butter agroforestry to combat land degradation and improve water conservation.
- Bushfire management: Establishment of fire belts, community fire management committees, and promotion of alternative land preparation methods.
- Gender-based adaptation: Ensuring gender-responsive programs, training in climate-smart practices, leadership platforms, income diversification, and equitable participation in decision making.
- Gender-disaggregated data and research: Addressing the unique needs of women, youth, and marginalized groups through targeted data collection and collaborative research.

The KMAP highlights the importance of a multistakeholder approach in addressing climate change adaptation. Recommendations include strengthening partnerships, ensuring transparency in resource allocation, promoting sustainable practices, integrating indigenous knowledge with modern approaches, and enhancing the technical capacity of local actors. Additionally, training on proposal development for accessing funding opportunities was identified as a priority.

The KMAP provides a comprehensive framework for building climate resilience in the Kintampo Municipality. Through its inclusive and evidence-based approach, the plan aims to mitigate climate risks, enhance adaptive capacity, and promote sustainable development. Effective implementation of this plan will require coordinated efforts among government agencies, community organizations, the private sector, and development partners.

Table of Contents

1.0 The Kintampo Municipal Assembly Climate Adaptation Plan	1
1.1 Introduction	1
1.2 Identification and Compilation of Sector-Specific Adaptation Actions	2
1.3 Methodological Approach for Ranking Adaptation Options	4
2.0 Climate Risks and Vulnerabilities in the Kintampo Municipality	12
2.1 Introduction	12
2.2 Overview of Climate Risks in Kintampo	12
2.2.1 Droughts and Dry Spells	12
2.2.2 Flooding.....	13
2.2.3 Bushfires.....	13
2.2.4 Windstorms.....	13
2.2.5 Pests and Diseases	13
2.2.6 Climate-Induced Erosion.....	13
2.2.7 Rising Temperatures	13
2.3 Sectoral Vulnerability Analysis.....	13
2.3.1 Agriculture.....	14
2.3.2 Water Resources	14
2.3.3 Health.....	14
2.3.4 Tourism	15
2.3.5 Forestry	16
2.3.6 Infrastructure	16
2.4 Vulnerable Populations and Spatial Hotspots.....	17
2.4.1 Vulnerable Populations.....	17
2.4.2 Spatial Hotspots of Vulnerability	18
3.0 Adaptation Options for the Kintampo Municipality	20
3.1 Introduction	20
3.2 On-Farm Adaptation	22
3.2.1 Conservation Agriculture	22
3.2.2 Irrigation Schemes	28
3.2.3 Agroforestry Promotion.....	32
3.2.4 Bushfire Management	36

3.3 Off-Farm Adaptation	39
3.4 Gender-Based Adaptation	44
3.4.1 Gender-Based Vulnerability Reductions and Sustainability in Kintampo	44
3.4.2 Gender-Disaggregated Data and Research in Kintampo	49
4.0 Strategic Funding and Investment Framework.....	52
4.1 Introduction	52
4.2 Potential Funding Sources for Kintampo	52
4.2.1 Government Funding (National and Local)	52
4.2.2 International Aid and Grants.....	54
4.2.3 Public-Private Partnerships.....	55
4.2.4 Community and Local Fundraising.....	57
4.2.5 Innovative Financing Mechanisms.....	58
4.3 Criteria for Allocation and Prioritization of Funds	59
4.4 Implementation Process	63
5.0 Framework for Adaptation Monitoring, Evaluation, and Learning.....	64
5.1 Introduction	64
5.2 MEL Design for the Kintampo Municipal Assembly.....	65
5.2.1 Monitoring Framework.....	65
5.2.2 Objectives of the Monitoring Framework.....	65
5.2.3 Key Indicators and Metrics	66
5.2.4 Data Collection Methods	67
5.2.5 Roles and Responsibilities.....	67
5.2.6 Learning and Adaptive Management.....	68
5.3 Steps in Implementing the MEL Framework.....	69
5.4 Sustainability of the MEL Framework.....	69
6.0 Institutional Arrangements and Coordination Mechanisms.....	71
6.1 Introduction	71
6.2 Lead Coordinating Entity: KiMA Climate Desk.....	71
6.3 Sectoral Leads and Institutional Responsibilities.....	71
6.4 National and Regional Collaboration	72
6.5 Stakeholder Engagement and Coordination Mechanism	72
6.6 Capacity Building and Institutional Learning	73
6.7 Roles of Traditional Authorities and the Private Sector	73

6.8 Institutional Risks and Mitigation Measures	73
6.9 Institutional Coordination Organogram.....	74
7.0 Conclusion and Recommendations	76
7.1 Introduction	76
7.2 Recommendations	76
7.3 Conclusion	77
References.....	79

List of Tables

Table 1. Criteria for the assessment of the climate change adaptation options.....	7
Table 2. Ranking of adaptation options based on MCA framework.....	8
Table 3. Spatial hotspots of vulnerability in the Kintampo Municipality.....	19
Table 4. Summary of adaptation options for conservation agriculture in KiMA	26
Table 5. Summary of adaptation options for irrigation schemes in KiMA.....	30
Table 6. Summary of adaptation options for agroforestry promotion in Kintampo	34
Table 7. Ranked adaptation options for bushfire management.....	38
Table 8. Summary of off-farm adaptation options in Kintampo.....	41
Table 9. Gender-based vulnerability reductions and sustainability in Kintampo	47
Table 10. Gender-disaggregated data and research in Kintampo	50
Table 11. Sectoral leads and institutional responsibilities.....	72

List of Figures

Figure 1. Approach to Kintampo Municipal Assembly adaptation planning	2
Figure 2. Steps for the Kintampo Climate Adaptation Plan	4
Figure 3. Title	20
Figure 4. Categorized adaptation option for the Kintampo Municipal Assembly	22
Figure 5. Ranked adaptation options for conservation agriculture.....	23
Figure 6. Ranked adaptation options for irrigation schemes	29
Figure 7. Ranked adaptation options for agroforestry promotion	33
Figure 8. Ranked adaptation actions for bushfire management in Kintampo.....	36
Figure 9. Ranked adaptation options for off-farm adaptation in Kintampo.....	39
Figure 10. Ranked adaptation options for gender-based vulnerability reductions and sustainability in Kintampo.....	46
Figure 11. Ranked adaptation options for gender-disaggregated data and research in Kintampo	49
Figure 12. Criteria for allocation and prioritization of funds	60
Figure 13. Learning and adaptive management	68
Figure 14. Institutional coordination organogram for climate action in the Kintampo Municipality ..	75

Acronyms and Abbreviations

AWARD	African Women in Agricultural Research and Development
CA	conservation agriculture
CCVA	Climate Change Vulnerability Assessment
EPA	Environmental Protection Agency
FAO	Food and Agriculture Organization
GASIP	Ghana Agricultural Sector Investment Programme
GH¢	Ghanaian cedi
IIRR	International Institute of Rural Reconstruction
IT	information technology
IWMI	International Water Management Institute
KMAP	Kintampo Municipal Assembly Climate Adaptation Plan
KiMA	Kintampo Municipal Assembly
MDBs	multilateral development banks
MCA	multi-criteria analysis
MCDM	multi-criteria decision making
MEL	monitoring, evaluation, and learning
MOFA	Ministry of Food and Agriculture
NAP	national adaptation plan
NADMO	National Disaster Management Organization
NDCs	nationally determined contributions
NGO	non-governmental organization
PPP	public-private partnership
PWDs	persons with disabilities
SDG	Sustainable Development Goal
UNDP	United Nations Development Programme

UNFCCC	United Nations Framework Convention on Climate Change
CACP	Climate Adaptation Coordination Platform
CHPS	Community-Based Health Planning and Services
CWSA	Community Water and Sanitation Agency
GCF	Green Climate Fund
GMet	Ghana Meteorological Agency
MESTI	Ministry of Environment, Science, Technology and Innovation
MTDP	medium-term development plan
NDPC	National Development Planning Commission
RCC	Regional Coordinating Council

1.0 The Kintampo Municipal Assembly Climate Adaptation Plan

1.1 Introduction

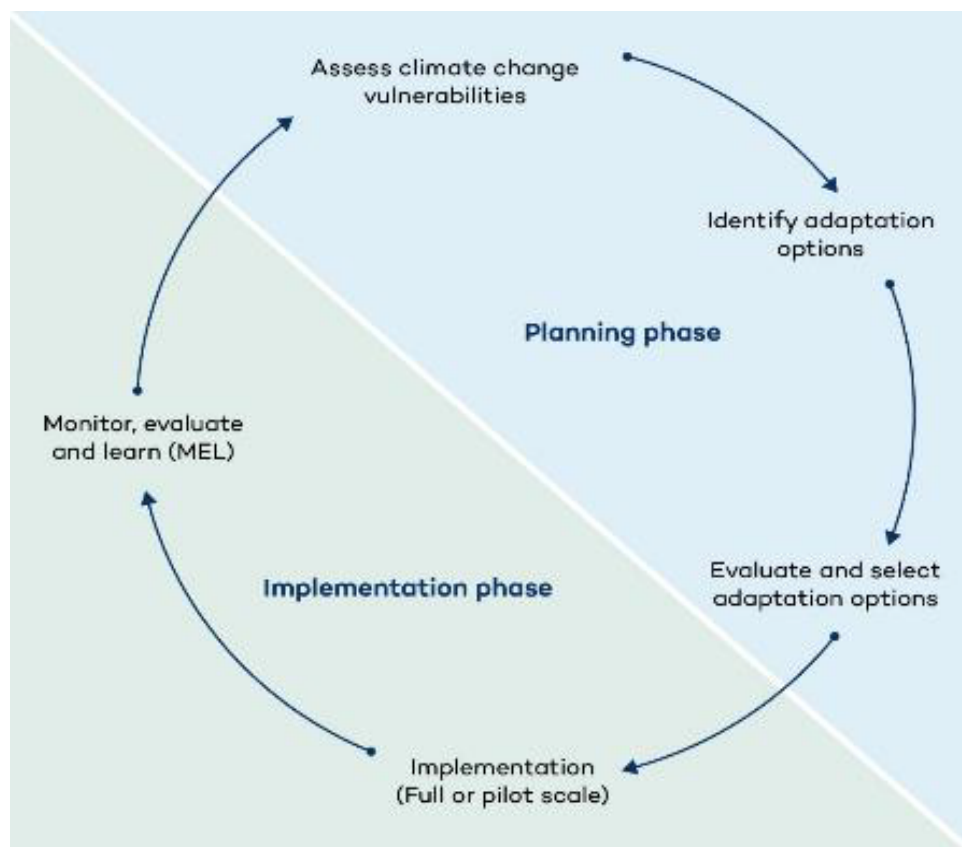
The Kintampo Municipality, located within the Bono East Region of Ghana, is a dynamic area characterized by its diverse ecological landscape, where savannah and forest ecosystems converge. As an essential agricultural hub with significant natural resources, the municipality plays a vital role in regional food security and economic growth. However, its heavy reliance on rain-fed agriculture, coupled with inadequate infrastructure and evolving socio-economic pressures, renders it particularly vulnerable to the impacts of climate change. Increasingly, the Kintampo Municipality faces a range of climate-induced hazards, including prolonged droughts, erratic rainfall, bushfires, windstorms, and flooding. These climate risks pose significant challenges to agriculture, water resources, forestry, infrastructure, and livelihoods. Vulnerable groups, especially women, children, low-income households, and persons with disabilities (PWDs), are disproportionately affected, underscoring the need for inclusive and equitable adaptation measures.

The Kintampo Municipal Adaptation Plan has been developed to address these vulnerabilities through a strategic and participatory framework. Building on the findings of the Kintampo Climate Change Vulnerability Assessment (CCVA), the Kintampo Municipality Climate Adaptation Plan (KMAP) integrates scientific analysis with community-level insights to ensure that proposed interventions are contextually relevant, inclusive, and feasible. Aligned with Ghana's National Adaptation Plan (NAP) framework, updated Nationally Determined Contributions (MESTI, 2021) and the Sustainable Development Goals (SDGs), the KMAP offers a pathway for integrating climate resilience into local development strategies. By fostering collaboration between government agencies, community organizations, and external partners, the plan aims to enhance adaptive capacity, reduce vulnerabilities, and promote sustainable development.

The KMAP is structured around four key components:

1. **Risk assessment and vulnerability analysis:** Identifying and analyzing the most critical climate risks and vulnerabilities in sectors such as agriculture, water resources, forestry, and infrastructure. This analysis serves as the foundation for targeted interventions to reduce exposure and enhance adaptive capacity.
2. **Stakeholder engagement:** Emphasizing active participation of diverse stakeholders, including marginalized groups, in the planning and implementation process to ensure broad support and effectiveness.
3. **Implementation of adaptation measures:** Introducing practical and scalable interventions such as conservation agriculture, agroforestry initiatives, irrigation improvements, and early warning systems to address identified climate risks.
4. **Monitoring and evaluation:** Establishing a dynamic framework to track progress, evaluate outcomes, and refine strategies to ensure the plan's long-term sustainability and relevance in changing climate scenarios.

Figure 1. Approach to Kintampo Municipal Assembly adaptation planning



Source: Authors.

1.2 Identification and Compilation of Sector-Specific Adaptation Actions

The KMAP is a detailed and targeted framework designed to address the municipality's unique challenges and vulnerabilities to climate change. This process involved the meticulous identification and integration of specific adaptation strategies, ensuring their relevance to the socio-economic, environmental, and infrastructural realities of the municipality. These actions aim to build resilience, reduce vulnerabilities, and safeguard the livelihoods of Kintampo's communities.

The methodologies and techniques employed to identify these adaptation measures are summarized in Table 1 and Figure 1. These tools ensured the plan's inclusivity, evidence-based foundation, and alignment with both national and local priorities. The plan prioritizes the following:

- **On-farm adaptation actions**
 - Conservation agriculture
 - Irrigation schemes
 - Agroforestry promotion
 - Bushfire management

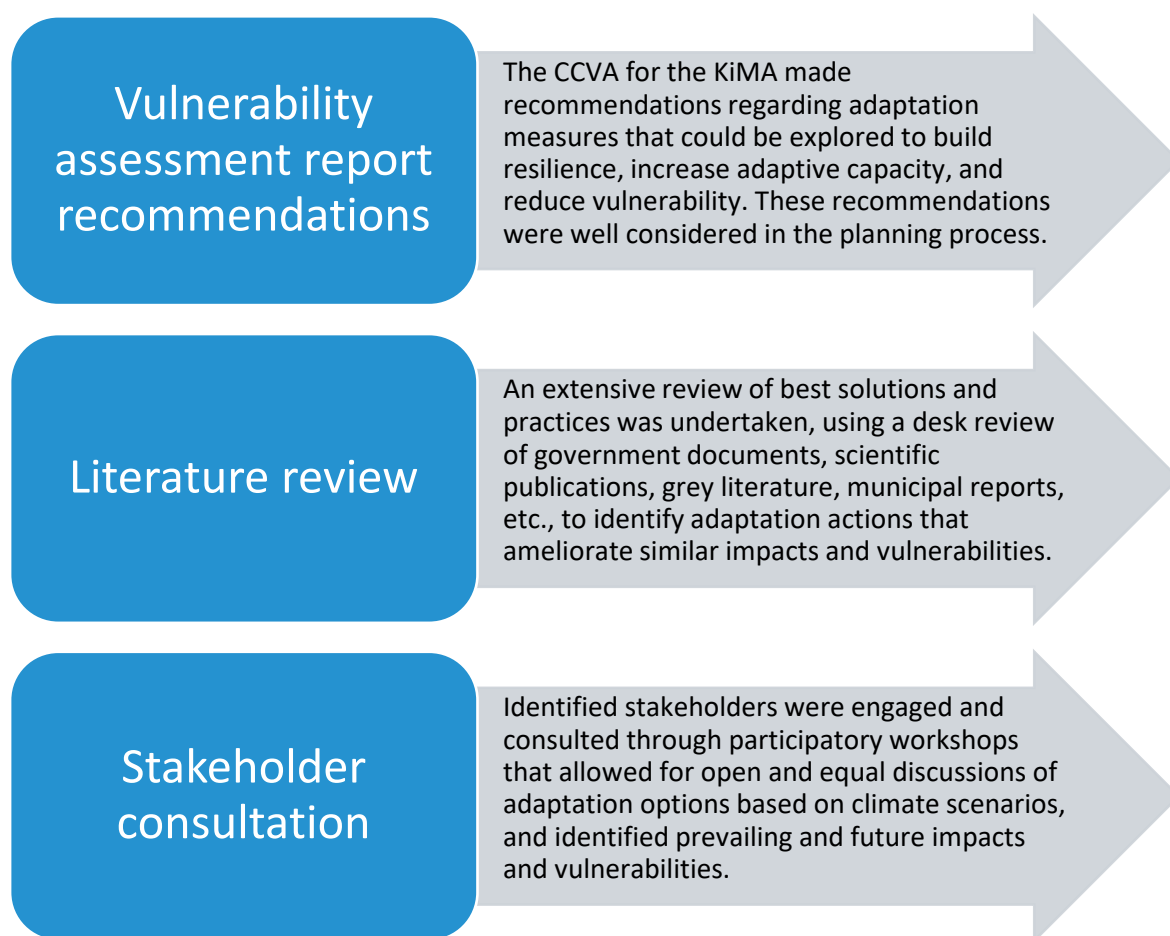
- **Off-farm adaptation actions**
 - Access to financial support
 - Awareness and knowledge creation
 - Access to weather information and early warning systems.
- **Gender-based vulnerability reductions and sustainability**
 - Capacity building and training
 - Access to resources and livelihood diversification
 - Promoting women's participation and leadership
- **Gender-disaggregated data and research**
 - Climate-smart agriculture and conservation practices
 - Access to climate information and services
 - Gender-disaggregated data and research

Vulnerability assessment recommendations: The Climate Change Vulnerability Assessment for Kintampo provided the foundation for identifying adaptation measures. It highlighted specific climate risks affecting key sectors such as agriculture, water resources, health, and infrastructure. These recommendations were central to the planning process, ensuring that identified actions directly addressed the municipality's most pressing challenges.

Literature review: A detailed review of relevant documents, including government policies, municipal reports, scientific publications, and grey literature, was conducted. This step focused on identifying best practices and adaptation strategies that have proven effective in addressing similar climate impacts elsewhere. The literature review provided critical insights to shape innovative and practical solutions for Kintampo.

Stakeholder consultation: Stakeholder engagement was integral to the process, ensuring inclusivity and local relevance. Representatives from local communities, traditional authorities, government agencies, NGOs, and private sector actors participated in workshops. These consultations facilitated open discussions on adaptation options, validated findings, and prioritized actions based on feasibility and impact.

Figure 2. Steps for the Kintampo Climate Adaptation Plan



Source: Authors

1.3 Methodological Approach for Ranking Adaptation Options

Based on the key vulnerabilities and climate risks identified in the Kintampo Municipality, a comprehensive list of potential adaptation options was developed through a detailed desk review, literature search, and interactions with key stakeholders. These options were then validated and refined during participatory stakeholder workshops, ensuring their alignment with local priorities and realities.

During the workshops, participants were grouped according to their expertise and interest areas. These groups, representing critical sectors, were categorized into seven distinct clusters, ensuring that the prioritized actions addressed sector-specific challenges while aligning with local socio-economic and environmental realities.

The grouping of adaptation options was as follows:

- On-farm adaptation actions (subdivided into four thematic groups):
 - Conservation agriculture
 - Irrigation schemes

- Agroforestry promotion
- Bushfire management
- Off-farm adaptation actions (e.g., financial support, awareness creation, and weather information systems)
- Gender-based vulnerability reduction and sustainability
- Gender-disaggregated data and research

This grouping allowed for focused discussions and evaluations of adaptation options. Stakeholders assessed the suitability of proposed measures for the Kintampo context, their potential to enhance resilience, reduce vulnerabilities, and support sustainable development.

This prioritization process aimed to ensure that decisions were informed, effective, and avoided the risks of maladaptation. Relevant actors, including municipal officials, traditional leaders, community representatives, and technical experts, were actively involved in the assessment to guarantee the appropriateness of the selected options. Careful attention was given to avoiding measures that could unintentionally exacerbate vulnerabilities or create new challenges.

To evaluate and rank the adaptation options, a multicriteria decision-making (MCDM) analysis was employed. This systematic approach allowed stakeholders to assess each adaptation measure against multiple criteria, ensuring balanced and well-informed decisions. The MCDM approach acknowledged that different adaptation measures might perform variably across criteria and could involve trade-offs. The methodology included defining relevant criteria, assigning weights to each criterion based on their significance, and scoring the adaptation options accordingly. This method enabled the evaluation of complex options, incorporating input from diverse stakeholders to balance competing objectives.

After ranking the different indicators, it was essential to assign appropriate weights to reflect their relative importance. (Zobeidi et al., 2024; Antwi-Agyei et al., 2013; UNFCCC, 2011). Therefore, a five-point Likert scale (Table 11) was used, 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).

The Kintampo Municipal Assembly Climate Adaptation Plan: Ghana



Validation workshop participants engaging in group exercises. Credit: Authors

Table 1. Criteria for the assessment of the climate change adaptation options

S/N	Dimension	Indicators	Description
1	Technological	Effectiveness	Effectiveness of importance describes how effective an adaptation option is in mitigating 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 municipal and/or national priorities	Institutional feasibility refers to institutional and legal capacity. The preferred adaptation option aligns with laws, regulations, and institutional structures. To what extent does this measure support other development priorities of the municipal 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.
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 option addresses gender-related issues.
10	Social	Equity	The extent to which the adaptation option benefits 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: Adapted from Dixit & McGray, 2013.

Table 2. Ranking of adaptation options based on MCA framework

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

Source: Authors

Stakeholder Validation Workshop

The Validation Workshop, held on March 3, 2025, at the KiMA Office, Kintampo, served as the final stage of the prioritization process. The objective was to review, validate, and confirm adaptation options previously identified and ranked through stakeholder consultations and the multi-criteria decision-making (MCDM) process.

The workshop brought together approximately 40 participants, including municipal assembly officials, traditional authorities, farmers, fire service personnel, women's groups, PWDs, NADMO representatives, forestry experts, youth leaders, civil society organizations, and other relevant groups. Their inclusion ensured that the validation process was participatory, equitable, and reflective of the municipality's broader development goals.

The presentation delivered during the workshop focused on the following prioritized adaptation options:

- Conservation agriculture
- Irrigation schemes
- Agroforestry promotion
- Bushfire management
- Off-farm adaptation actions
- Gender-based vulnerability reduction and sustainability
- Gender-disaggregated data and research

These adaptation options were categorized into on-farm and off-farm interventions, gender-responsive initiatives, and data-driven research efforts to enhance resilience across sectors.

Following the presentation, participants engaged in a discussion session to provide feedback and suggest practical improvements. Critical points raised included:

- Political interference in bushfire management: Fire service personnel highlighted the challenge of enforcing bushfire regulations due to political interference and inadequate resources.
- Water resource conflicts: Farmers and traditional leaders emphasized ongoing competition between livestock and human populations over water resources.
- Limited access to climate change programs: Concerns were raised about inadequate communication regarding available programs and funding opportunities.
- Inclusivity and equity: PWDs and youth representatives stressed the importance of developing adaptation measures accessible to all demographic groups, particularly vulnerable populations.
- Awareness creation: Calls were made for the media to play a more prominent role in disseminating climate-related information and promoting adaptation initiatives.

During the discussions, participants also referred to various funding sources previously identified in the Adaptation Plan, including the Climate Change Fund, the Adaptation Fund, the Ministry of Food and Agriculture (MoFA), the District Assemblies Common Fund, Ghana Agricultural Sector Investment Programme (GASIP), Forestry Commission funding, Public-private partnerships (PPP), international aid and grants, community fundraising initiatives, and multilateral development banks (MDBs).

The workshop concluded with recommendations aimed at enhancing the robustness of the adaptation planning process. Key recommendations included:

- Strengthening partnerships among government agencies, NGOs, community organizations, and the private sector.
- Ensuring transparency and accountability in fund allocation and resource management.
- Promoting sustainable practices and adaptive livelihoods, particularly for vulnerable groups.
- Integrating indigenous knowledge with modern adaptation approaches to enhance resilience and cultural relevance.
- Proposal development training: Participants identified the need for training on proposal development to enhance capacity for accessing funding opportunities and implementing adaptation projects effectively.

The Validation Workshop provided an essential opportunity to confirm that proposed adaptation measures were technically sound, socially inclusive, and supported by local stakeholders. The feedback received was incorporated into the final scoring under the MCDM framework, ensuring that the adaptation plan was vigorous, inclusive, and aligned with the broader development agenda of the Kintampo Municipality.

The Kintampo Municipal Assembly Climate Adaptation Plan: Ghana



Photocall with workshop participants at the Kintampo Municipal Assembly. Credit: Authors



Question-and-answer sessions during the workshop. Credit: Authors

Box 1. Extreme heat and its multiple impacts in Kintampo

During the stakeholder validation workshop, one of the most resounding concerns echoed across all groups was the growing intensity and frequency of extreme heat events in the Kintampo Municipality. Participants described a palpable shift in seasonal temperatures—with many remarking that “it’s getting too hot lately”—and expressed alarm at how this rising heat has begun to strain every facet of life, from personal health to farming routines and community cohesion.

Farmers reported early wilting of crops, especially maize and vegetables, due to rapid moisture loss from the soil. Livestock farmers also noted increased animal stress and reduced milk production. Schoolteachers and health workers lamented the effect of extreme heat on children’s concentration and attendance, while elderly and vulnerable populations reported symptoms of heat exhaustion and dehydration. In towns like Babatokuma and Dawadawa, the lack of shade in market areas and along major roads was mentioned as a growing concern for both traders and pedestrians.

Health practitioners at the workshop highlighted a noticeable rise in heat-related illnesses—including headaches, skin irritations, and heat stroke—particularly among children and outdoor workers. They emphasized the urgent need for shaded public spaces and community education on hydration and heat preparedness.

Several youth leaders and women’s group representatives pointed to the compounding effect of extreme heat on domestic burdens. Women fetching water or working on the farm face longer, more arduous hours under an unforgiving sun, which also affects household energy use, particularly among families using biomass for cooking.

These multifaceted challenges prompted a strong call among participants for integrated solutions—including the planting of shade trees, improved building ventilation, early warning systems, and targeted public health campaigns. The extreme heat discussions reinforced the urgency of treating heat not just as a weather anomaly but as a structural threat to development, resilience, and well-being in Kintampo.

Source: Field survey and workshops.

2.0 Climate Risks and Vulnerabilities in the Kintampo Municipality

2.1 Introduction

The Kintampo Municipality, situated within the Bono East Region of Ghana, occupies a critical position in the country's transitional agroecological zone, which features a mix of savannah and forest ecosystems. This unique geographical location renders the municipality particularly vulnerable to climate change impacts, which manifest as alterations in temperature, precipitation patterns, and the increased frequency and intensity of extreme weather events.

The municipality has experienced notable climate-related threats in recent years, including droughts, floods, bushfires, windstorms, and pest infestations. These hazards have had far-reaching implications on critical socio-economic sectors such as agriculture, water resources, health, tourism, forestry, and infrastructure. As a predominantly agrarian society, the Kintampo Municipality's high dependence on rain-fed agriculture and natural resources exacerbates its susceptibility to climatic changes. Additionally, limited infrastructure, inadequate access to climate-resilient technologies, and insufficient financial support further heighten the vulnerability of local communities.

Gender disparities in access to resources, decision-making processes, and adaptive capacity add another dimension to the municipality's climate vulnerabilities. Women, youth, and marginalized groups often face disproportionate impacts, complicating efforts to enhance community resilience and overall adaptive capacity. Understanding the vulnerabilities specific to various sectors and groups is essential for developing inclusive and effective adaptation strategies.

This chapter provides an overview of the climate risks and vulnerabilities facing the Kintampo Municipality. It highlights the main climate-related hazards, the sectors most at risk, and the socio-economic factors contributing to increased vulnerability.

2.2 Overview of Climate Risks in Kintampo

The Kintampo Municipality is exposed to a variety of climate-related risks resulting from its location within the transitional zone of Ghana, which experiences significant climatic variability. The municipality is increasingly susceptible to multiple climate hazards that threaten lives, livelihoods, ecosystems, and infrastructure. The main climate-related hazards identified in the Kintampo Municipality include the following.

2.2.1 Droughts and Dry Spells

Prolonged periods of below-average rainfall have become increasingly common in the municipality. This has resulted in water scarcity, reduced agricultural productivity, and degradation of soil fertility. The municipality's heavy reliance on rain-fed agriculture makes it particularly vulnerable to these conditions, which can exacerbate food insecurity and loss of livelihoods.

2.2.2 Flooding

Heavy rainfall events, particularly during the peak rainy seasons, have led to flash floods and waterlogging in low-lying areas. The municipality's poor drainage systems and improper land use planning have contributed to increased flood risks, causing damage to infrastructure, disrupting economic activities, and threatening public health.

2.2.3 Bushfires

Uncontrolled bushfires, often fueled by prolonged dry conditions and human activities such as slash-and-burn farming and hunting, pose a significant threat to the environment and agricultural activities. Bushfires have resulted in the destruction of crops, forests, and biodiversity, thereby undermining both livelihoods and ecological stability.

2.2.4 Windstorms

The municipality has experienced episodes of severe windstorms that damage buildings, crops, and other infrastructure. Increased temperature and erratic rainfall patterns contribute to the occurrence of windstorms, which can result in loss of property and disruptions to economic activities.

2.2.5 Pests and Diseases

Changes in temperature and rainfall patterns have altered the distribution and prevalence of pests and diseases affecting crops and livestock. These challenges threaten agricultural productivity, food security, and local economies dependent on agriculture.

2.2.6 Climate-Induced Erosion

Increased rainfall intensity and irregular precipitation patterns contribute to soil erosion, which degrades soil quality and negatively impacts agricultural productivity. Areas prone to erosion are often left barren, with limited potential for crop cultivation.

2.2.7 Rising Temperatures

Average temperatures in the municipality have shown a significant increasing trend over the past few decades. Rising temperatures, particularly during the dry season, pose risks to agricultural production, livestock health, and human well-being. Increased heat can also exacerbate the frequency and intensity of other hazards such as droughts, bushfires, and pest infestations.

These climate risks have direct and indirect implications for various socio-economic sectors within the Kintampo Municipality. The agriculture, water resources, health, tourism, forestry, and infrastructure sectors are particularly vulnerable. Additionally, gender disparities, inadequate access to climate-resilient infrastructure, and insufficient financial support compound the municipality's overall vulnerability.

2.3 Sectoral Vulnerability Analysis

The vulnerability of the Kintampo Municipality to climate change is multi-dimensional, affecting various socio-economic sectors that contribute to the municipality's growth and sustainability. The

key sectors analyzed include agriculture, water resources, health, tourism, forestry, and infrastructure. This section explores the vulnerabilities specific to each sector, highlighting the climate-related hazards affecting them and the socio-economic implications of those impacts.

2.3.1 Agriculture

Agriculture is the backbone of the Kintampo Municipality's economy, with approximately 70% of the population directly or indirectly engaged in the sector. The municipality's dependence on rain-fed agriculture makes it particularly susceptible to climate change impacts such as droughts, floods, heatwaves, and pest infestations.

- Droughts and dry spells: Prolonged periods of drought lead to reduced crop yields, food insecurity, and loss of livelihoods. Water scarcity during dry spells limits irrigation efforts and contributes to crop failure, especially for staples like maize, yam, and cassava.
- Flooding: Heavy rainfall events cause soil erosion, leaching of nutrients, and destruction of farmlands. Flooding also disrupts the planting and harvesting cycles, further reducing productivity.
- Bushfires: The prevalence of bushfires during the dry season threatens farmlands, particularly those dedicated to crops such as cashew and maize. Bushfires also contribute to soil degradation, making it difficult for farmers to achieve high productivity.
- Pests and diseases: Climate variability, particularly increasing temperatures, promotes the spread of pests and diseases. Crops such as maize, yam, and cassava are especially vulnerable, with pest infestations causing significant yield losses.

2.3.2 Water Resources

The availability and quality of water resources in the Kintampo Municipality are increasingly threatened by climate change. The municipality relies heavily on surface and groundwater sources for domestic, agricultural, and industrial use.

- Droughts and reduced rainfall: Prolonged dry periods result in reduced river flows and drying up of water bodies. This scarcity affects agriculture, particularly during critical growing periods, and limits access to potable water for households.
- Flooding: Intense rainfall events cause rivers and streams to overflow, contaminating water sources and leading to waterborne diseases. Flooding also affects infrastructure such as wells and boreholes, reducing water availability for communities.
- Climate-induced erosion: Soil erosion resulting from heavy rainfall and runoff degrades water quality by increasing sedimentation and pollutants in water bodies.

2.3.3 Health

Climate change poses direct and indirect health risks to the population of the Kintampo Municipality. Vulnerabilities in the health sector are primarily linked to extreme weather events, poor water quality, and changes in disease vectors.

- Heatwaves: Rising temperatures increase the risk of heat-related illnesses, particularly among vulnerable populations such as the elderly and children.
- Flooding and waterborne diseases: Flooding leads to the contamination of water sources, resulting in outbreaks of waterborne diseases such as cholera and dysentery.
- Pests and diseases: Shifts in temperature and rainfall patterns facilitate the spread of vector-borne diseases such as malaria, especially in areas with poor health infrastructure.

2.3.4 Tourism

The Kintampo Municipality has significant tourism potential, with attractions such as Kintampo Waterfalls and Fuller Waterfalls. However, climate change threatens the sustainability of these natural resources and related economic activities.

- Bushfires: Fires resulting from prolonged dry spells can damage natural landscapes, reducing the aesthetic value of tourist attractions and affecting biodiversity.
- Flooding: Heavy rainfall and subsequent flooding can damage infrastructure such as roads and bridges, limiting accessibility to tourist sites.
- Rising temperatures: Increasing temperatures may reduce the attractiveness of natural sites for visitors, especially during the dry season when water bodies may dry up or become less appealing.



Kintampo Waterfalls is a popular tourism destination in the KiMA. Credit: Boafo, YA, 2024.



Fuller Waterfalls is less developed but has great potential. Credit: Bofo, YA, 2025.

2.3.5 Forestry

Forestry resources in the Kintampo Municipality are vital for ecosystem services, livelihoods, and biodiversity. However, the sector faces severe challenges from climate change.

- Bushfires: Increased temperatures and prolonged dry spells lead to frequent and intense bushfires, which destroy valuable forest resources.
- Climate-induced erosion: Deforestation and soil degradation from heavy rainfall events contribute to the loss of forest cover and reduced soil fertility.
- Changes in rainfall patterns: Irregular rainfall affects tree growth and productivity, threatening both natural forests and agroforestry systems.

2.3.6 Infrastructure

Infrastructure in the Kintampo Municipality, including roads, bridges, buildings, and drainage systems, is highly susceptible to climate-related hazards.

- Flooding: Poorly constructed drainage systems are overwhelmed during heavy rainfall, resulting in localized flooding that damages infrastructure and disrupts economic activities.
- Windstorms: Intense storms damage buildings, power lines, and communication networks, disrupting essential services and posing safety risks.
- Temperature extremes: Rising temperatures increase energy demand for cooling, putting additional strain on existing infrastructure.

2.4 Vulnerable Populations and Spatial Hotspots

2.4.1 Vulnerable Populations

The vulnerability of populations within the Kintampo Municipality to climate change is influenced by various socio-economic, demographic, and geographic factors. Certain groups are disproportionately affected due to their limited adaptive capacity, socio-economic status, geographic location, and livelihood dependence on climate-sensitive sectors.

Key vulnerable populations include:

- Farmers and agricultural workers
 - Agriculture is the dominant livelihood activity in the Kintampo Municipality, employing approximately 70% of the population.
 - Farmers reliant on rain-fed agriculture are particularly vulnerable to droughts, erratic rainfall, and flooding. Crop failures and reduced yields can have devastating economic and food security implications.
- Women and female-headed households
 - Women, particularly those in rural areas, face significant barriers in accessing resources, technology, and financial services necessary for climate adaptation.
 - Female-headed households are more vulnerable due to their limited access to land, income disparities, and lower adaptive capacity. Women often bear the additional burden of ensuring household food security and managing water resources.
- Youth and children
 - Youth and children are especially vulnerable to heat stress, food insecurity, and waterborne diseases.
 - Limited employment opportunities for youth in agriculture and other sectors reduce their ability to adapt to climate change.
- Elderly population
 - Older adults are particularly susceptible to heatwaves, extreme weather events, and health-related impacts due to declining physical resilience and limited access to health care facilities.
- Low-income households
 - Households with limited financial resources are less able to invest in adaptive measures such as improved infrastructure, diversified livelihoods, or climate-resilient technologies.
 - Low-income communities residing in flood-prone or erosion-prone areas face heightened risks during extreme weather events.
- Persons with disabilities

- Physical and mental disabilities can limit individuals' capacity to respond effectively to climate-related risks.
 - Inadequate infrastructure and lack of access to climate information and resources exacerbate their vulnerabilities.
- Migrants and seasonal workers
 - Migrants and seasonal workers often have less secure livelihoods and reduced access to social safety nets.
 - Their reliance on temporary or informal employment increases their vulnerability to climate-induced disruptions.

2.4.2 Spatial Hotspots of Vulnerability

Spatial hotspots of vulnerability in the Kintampo Municipality are areas where climate hazards intersect with high exposure, sensitivity, and low adaptive capacity. The identification of these hotspots is critical for prioritizing adaptation interventions.

Table 3. Spatial hotspots of vulnerability in the Kintampo Municipality

Hotspot area	Climate risk	Description
Agricultural areas (rural communities)	Droughts, bushfires, erratic rainfall	High exposure to climate risks, affecting crop yields and food security. Areas include Kadelso, New Longoro, and Babatokuma.
Flood-prone areas (low-lying settlements)	Flooding	Recurrent flooding damages property, infrastructure, and agricultural lands. Areas around Kintampo town are particularly vulnerable.
Forest and agroforestry areas	Bushfires, deforestation, soil erosion	Threats to biodiversity and declining agricultural productivity due to soil degradation. Includes Bosomoa Forest Reserve.
Tourism sites	Bushfires, flooding, erosion	Damage to attractions such as Kintampo Waterfalls and Fuller Waterfalls affects tourism revenue and local employment.
Water-scarce areas	Droughts, declining rainfall	Limited access to potable water complicates health and sanitation. Highly vulnerable during prolonged dry spells.
Urban settlements	Flooding, heat stress, infrastructure damage	Poorly planned urban areas, especially Kintampo town, face increasing flood risks due to inadequate drainage systems.

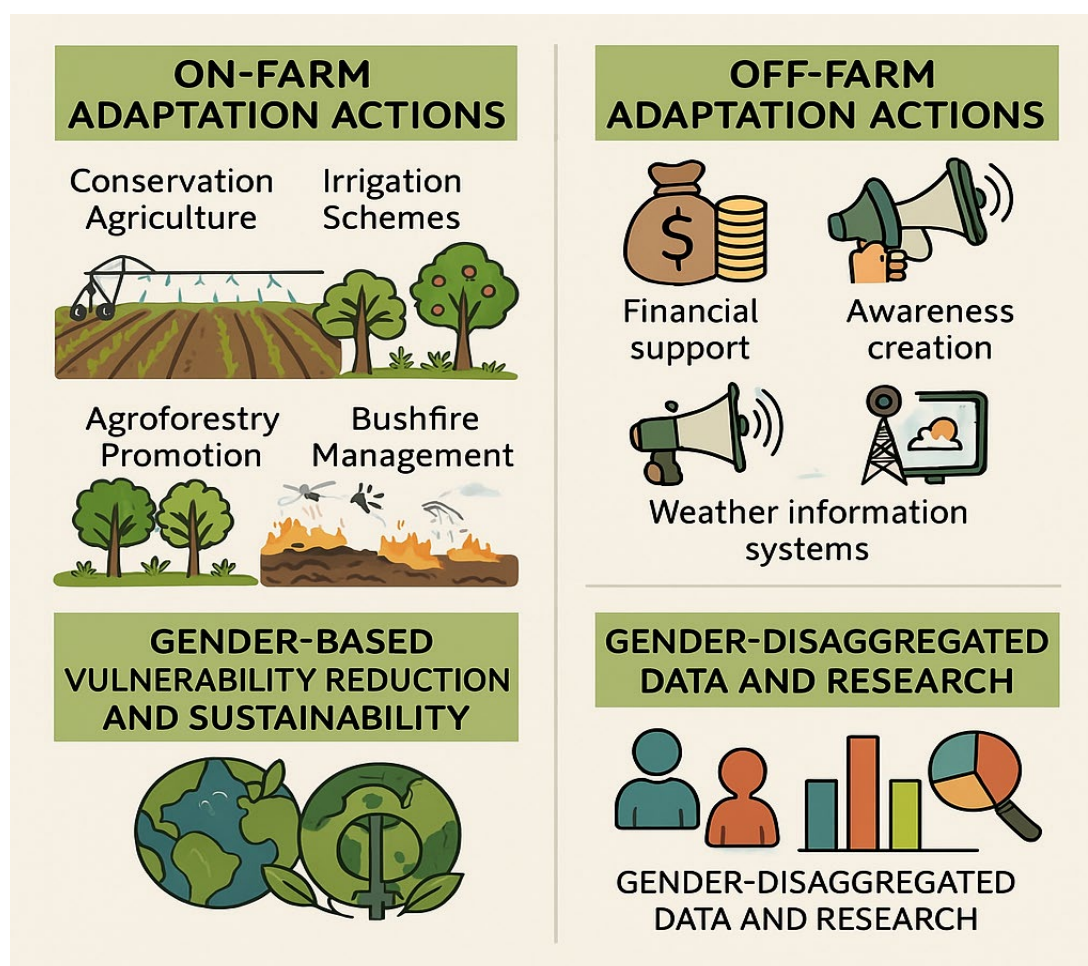
Source: Authors

3.0 Adaptation Options for the Kintampo Municipality

3.1 Introduction

The adaptation options for the Kintampo Municipality are designed to address the unique vulnerabilities and climate risks identified during the Climate Change Vulnerability Assessment and stakeholder consultations. These options focus on building resilience across critical sectors such as agriculture, forestry, water resources, health, and infrastructure. Each action has been developed and prioritized based on its relevance to the socio-economic realities of Kintampo, as well as its potential to mitigate risks, support sustainable development, and promote equity.

Figure 3. Examples of adaptation options for the Kintampo Municipality



Source: Authors

The process of identifying adaptation options involved a participatory approach, ensuring the inclusion of diverse stakeholder perspectives. Local government officials, community representatives, traditional authorities, and technical experts contributed to the assessment and ranking of these options. This collaborative process ensured that the measures selected were practical, contextually

relevant, and aligned with both municipal priorities and Ghana's National Adaptation Plan (NAP) framework.

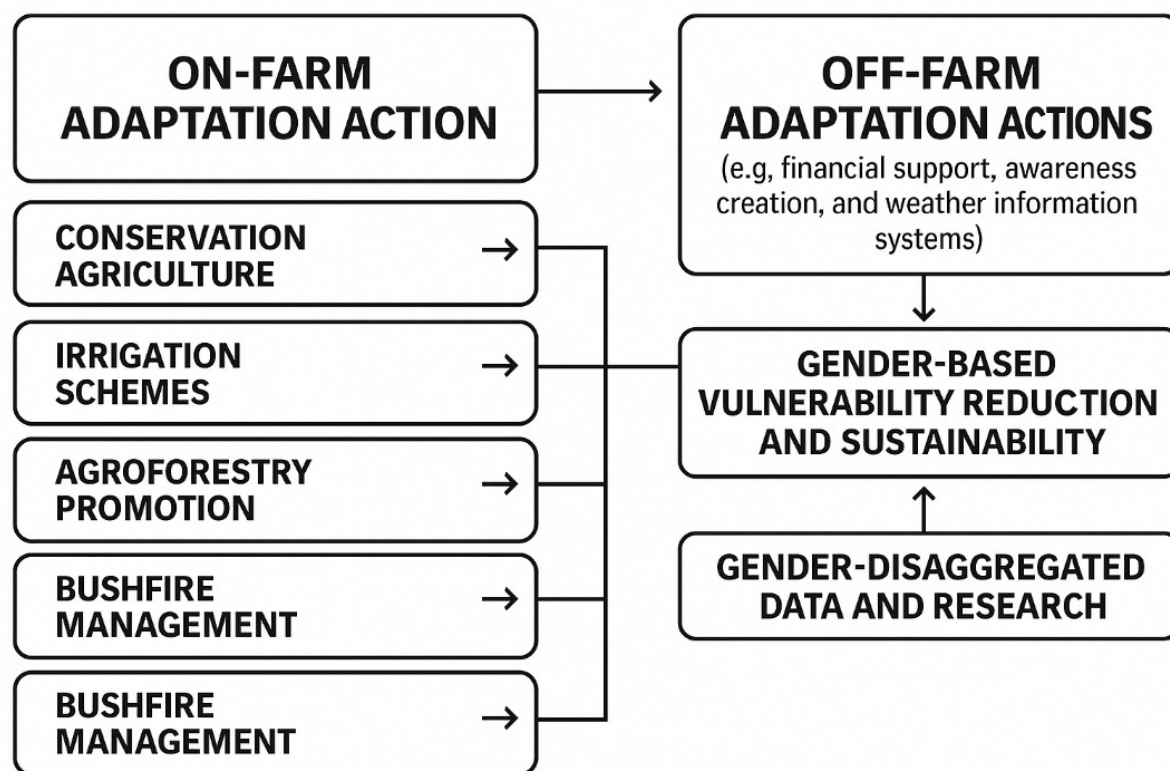
The adaptation time frames were categorized as short-term (0 to 2 years), medium-term (2 to 5 years), and long-term (more than 5 years) to align interventions with their complexity, resource requirements, and expected implementation duration. This phased approach ensures that urgent and low-cost actions can be deployed quickly, while more complex or capital-intensive measures are planned and resourced over time. It also allows for gradual capacity-building, integration into development planning cycles, and adaptive learning as projects scale.

The estimated costs presented in this report were generated by breaking down each adaptation action into its core resource components (e.g., training, equipment, construction materials, personnel). These components were then assigned indicative cost ranges in Ghana Cedis (GH¢), informed by prevailing market prices in Ghana and the provided exchange rate of 1 USD ≈ 10.25 GH¢. It is crucial to understand that these figures are broad estimates and serve primarily as a guide for initial planning and conceptualization. They do not account for real-time market fluctuations, specific regional variations within Ghana beyond general averages, or the precise scope and scale of individual interventions. Factors such as detailed engineering designs, specific procurement processes, unforeseen logistical challenges, and inflation over the project's time frame can significantly impact actual expenditures. Therefore, these estimates should be interpreted with caution and necessitate comprehensive feasibility studies, detailed budgetary planning, and local market assessments before any financial commitments are made.

The adaptation options for Kintampo have been categorized into on-farm and off-farm actions, gender-responsive initiatives, and broader interventions aimed at addressing systemic challenges. To ensure effectiveness, each option has been evaluated using a multi-criteria analysis (MCA) framework. This evaluation considered factors such as technical feasibility, cost-effectiveness, environmental sustainability, and social acceptance, ensuring that the most impactful and implementable actions were prioritized.

Through this systematic approach, the adaptation options aim to reduce vulnerabilities, enhance adaptive capacity, and safeguard the livelihoods and ecosystems of the Kintampo Municipality. The following sections detail the identified adaptation measures, their prioritization, and their alignment with the municipality's long-term development goals.

Figure 4. Categorized adaptation option for the Kintampo Municipal Assembly



Source: Authors

3.2 On-Farm Adaptation

Agriculture is the backbone of livelihoods in the Kintampo Municipality, with the majority of households relying on farming for food and income. However, the sector is increasingly vulnerable to the impacts of climate change, including erratic rainfall, prolonged dry spells, rising temperatures, and soil degradation. These challenges threaten agricultural productivity, food security, and the socio-economic stability of farming communities.

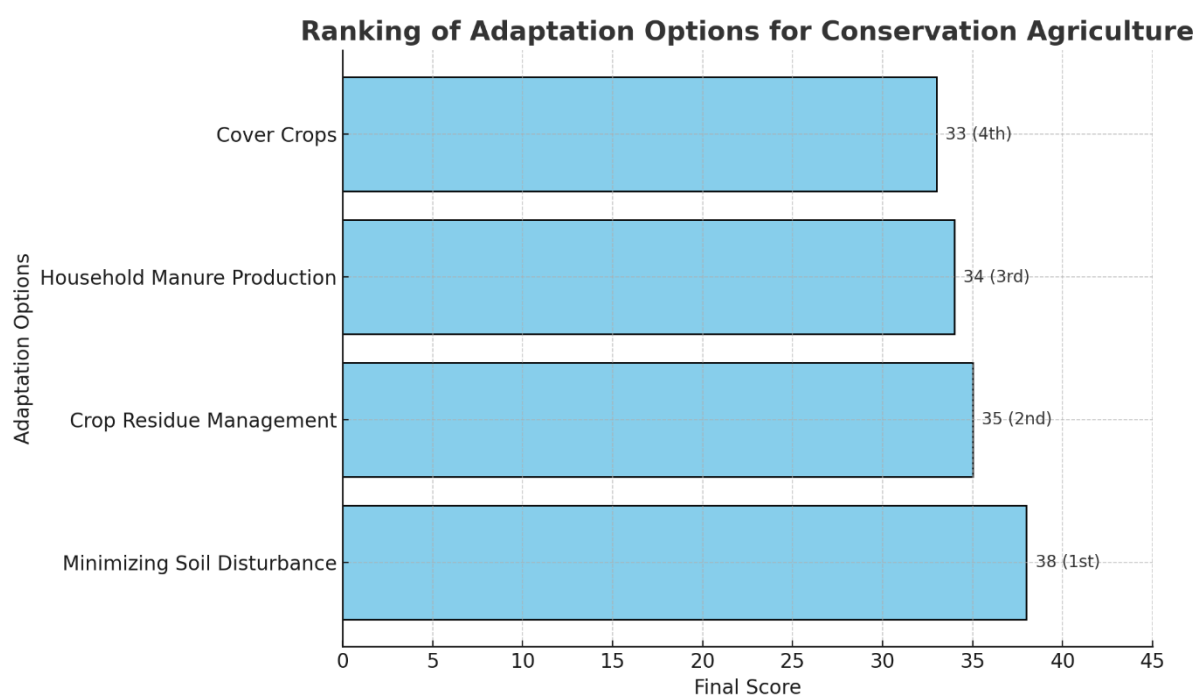
To address these vulnerabilities, on-farm adaptation actions have been identified as a critical component of the Kintampo climate adaptation strategy. These actions are aimed at strengthening the resilience of agricultural systems, promoting sustainable farming practices, improving resource management, and enhancing the adaptive capacity of farmers. In addition, focusing on both short-term solutions and long-term sustainability, on-farm adaptation actions play a pivotal role in ensuring food security, maintaining environmental health, and protecting livelihoods. The on-farm adaptation actions in KiMA are categorized into four thematic areas as follows.

3.2.1 Conservation Agriculture

Agriculture in the Kintampo Municipality faces significant challenges due to soil degradation, erratic rainfall, and prolonged dry spells. These factors jeopardize productivity and livelihoods, especially in farming communities like Dawadawa, Anyima, and Babatokuma, where rain-fed agriculture

dominates. Conservation agriculture has been identified as a crucial strategy to address these challenges by enhancing soil health, conserving water, and promoting sustainable farming practices. Through a participatory process and multi-criteria analysis (MCA), several conservation agriculture options were evaluated and ranked as seen in Figure 5 and Table 4.

Figure 5. Ranked adaptation options for conservation agriculture



Source: Authors

Conservation agriculture (CA) is increasingly recognized as a sustainable farming practice that integrates minimum soil disturbance, crop residue retention, and diversified cropping systems to enhance soil fertility, improve moisture retention, and promote ecosystem resilience (Carceles Rodriguez & Cuadros Tavera, 2022; Kassam & Derpsch, 2019). It has been promoted globally to increase productivity, improve food security, and enhance resilience to climate variability (Joshi & Clay, 2021). Studies indicate that CA practices can significantly reduce soil erosion, enhance water infiltration, and improve soil organic matter content (Lal, 2015). According to Kassam, (2019), CA can improve soil structure, reduce runoff, and increase carbon sequestration, thereby contributing to both agricultural productivity and climate change mitigation. Additionally, CA practices have been shown to enhance yields by up to 30% in rain-fed agricultural systems (Farooq & Siddique, 2020).

In Ghana, conservation agriculture is increasingly advocated as a strategy to mitigate the adverse impacts of climate change on smallholder farming systems. However, adoption rates remain low due to limited awareness, lack of technical support, and socio-economic barriers (Antwi-Agyei & Baffour-Atta, 2021).

Minimizing soil disturbance, ranked first, is an essential intervention to reduce erosion, conserve soil organisms, and improve soil structure. Research has demonstrated that reduced tillage significantly improves soil water retention, increases organic matter, and enhances microbial activity (Li & Chang,

2020). Reduced tillage has also been shown to improve crop yields and lower production costs in various agricultural systems (Jacobs & McCulley, 2022). According to Taghvaei, (2015), no-till practices can improve crop yields by approximately 10% in rain-fed systems compared to conventional tillage, especially in dry climates where soil moisture conservation is critical. Additionally, reduced tillage contributes to enhanced carbon sequestration, promoting soil fertility and resilience to climate variability (Hussain & EL-Esawi, 2021). Communities in Babatokuma have already begun adopting this method, reporting improved productivity and reduced labour requirements, as noted during the stakeholder engagement. With its significant environmental and economic benefits, this measure is a priority for scaling across the municipality. This option specifically addresses soil degradation issues prevalent across Babatokuma, Anyima, and Dawadawa, where over-tillage, erosion, and fertility loss are major concerns.

Crop residue management, ranked second, involves leaving crop residues on fields as mulch to enrich soil nutrients, reduce erosion, and improve moisture retention. Studies have shown that residue retention can increase soil organic matter, enhance nutrient cycling, and reduce water runoff (Kumari & Kumar, 2019). This practice is particularly effective in semi-arid regions where soil moisture conservation is critical for productivity. Stakeholders noted during the engagement that residue burning remains a common practice, particularly in Dawadawa, contributing to soil degradation. Promoting this practice can provide a viable alternative to harmful practices like charcoal production, which is particularly prevalent in Babatokuma and Dawadawa.



Bags of charcoal ready for the market at Babatokuma. Credit: Authors

Household manure production, ranked third, provides an effective way to enhance soil fertility by utilizing organic household waste. Studies have demonstrated that manure application can improve soil structure, enhance microbial activity, and increase nutrient availability (Rayne & Aula, 2020). This practice is particularly beneficial in areas with degraded soils and limited access to synthetic fertilizers. According to Layek and Paramanik (2023), integrating organic manure into farming systems can boost yields by up to 25% in low-input farming systems. However, challenges such as transportation and the limited availability of manure hinder broader adoption. Pilot composting initiatives in Anyima, supported by local NGOs, aim to address these logistical challenges, increasing its potential impact across the municipality. Stakeholder engagement revealed that broader adoption remains limited due to logistical challenges despite positive outcomes from pilot initiatives.

Cover crops, ranked fourth, offer a sustainable solution to improve soil structure, enhance fertility, and suppress weeds. Though it currently ranks lower, cover cropping is gaining interest among farmers seeking affordable methods to rehabilitate degraded lands. Its scalability and long-term environmental benefits make it an important complementary measure for conservation agriculture across degraded areas such as Dawadawa, Anyima, and Babatokuma. Research has shown that cover cropping can enhance soil organic matter, improve nutrient cycling, and increase resilience to climate variability (Pretty, 2008). According to Demir and Isik (2019), cover crops can reduce erosion by up to 70% compared to bare soils, particularly in areas with high rainfall variability. Additionally, they can contribute to increased yields by improving soil moisture retention and nutrient availability. Participants acknowledged the potential benefits of cover crops but noted the need for technical support and awareness creation.

Table 4. Summary of adaptation options for conservation agriculture in KiMA

Adaptation action	Objectives	Indicators of success	Time frame	Resources (finance, human, technology)	Implementing partners	Estimated cost (GH¢)
Minimizing soil disturbance	To reduce soil erosion, conserve soil organisms, and maintain soil structure by minimizing tillage activities. This measure ensures improved water retention, reduced labour, and enhanced crop productivity for farming communities in Babatokuma and Dawadawa.	Reduction in soil erosion rates Improved soil structure and water retention Increased crop yields and reduced operational costs for farmers	Short term	Training sessions on minimal tillage methods Basic tillage equipment procurement Financial support for awareness programs	Kintampo Municipal Assembly (lead), farmer-based organizations, NGOs	150,000–400,000
Crop residue management	To enhance soil fertility, improve moisture retention, and protect against erosion by encouraging farmers to leave crop residues on their fields as mulch. This method integrates seamlessly with traditional practices in Dawadawa, ensuring high adoption rates.	Percentage of fields with crop residues used as mulch Increased levels of soil organic matter Enhanced soil moisture and reduced erosion rates	Short term	Farmer training programs in crop residue management Community awareness campaigns about the benefits of mulch practices Low-cost implementation strategies	Kintampo Municipal Assembly (lead), agricultural extension services, local NGOs	100,000–300,000

The Kintampo Municipal Assembly Climate Adaptation Plan: Ghana

Adaptation action	Objectives	Indicators of success	Time frame	Resources (finance, human, technology)	Implementing partners	Estimated cost (GH¢)
Household manure production	To increase soil nutrient levels through the use of household organic waste converted into manure. This measure addresses nutrient deficiencies while promoting sustainable agricultural practices. Composting systems are being piloted in Anyima to support this initiative.	Volume of compost manure produced and applied to fields Percentage of farmers adopting the use of composted manure Improvement in soil fertility metrics over time	Short to medium term	Composting facilities and equipment for communities Farmer capacity-building workshops on composting techniques Logistical support for the transportation of manure to fields	Local NGOs, farmer-based organizations, community groups	200,000–600,000
Cover crops	To enhance soil health, reduce soil erosion, and suppress weeds by planting cover crops. This practice improves overall soil fertility and provides an affordable, scalable solution to rehabilitate degraded lands in the Kintampo Municipality.	Percentage of farms adopting cover cropping practices Reduction in weed prevalence and better soil moisture retention Increased soil organic matter and improved fertility levels	Medium term	Supply of seeds for cover crops Establishment of demonstration plots to showcase cover cropping benefits Technical expertise to guide implementation and scaling	Kintampo Municipal Assembly (lead), research institutions, agricultural extension services	180,000–500,000

Source: Adaptation options prioritization workshop, 2025. Estimated cost (GH¢) figures are approximate and subject to change based on fluctuating exchange rates (USD 1 ≈ GH¢ 10.25 at time of estimation) and local market prices (June 10, 2025).

3.2.2 Irrigation Schemes

Water management remains a critical challenge for agricultural productivity in the Kintampo Municipality, particularly due to erratic rainfall, prolonged dry spells, and high demand for water among households and communities. Reports indicate that water scarcity is a major issue affecting communities such as Cheranda, Dawadawa, Anyima, Babatokuma, Gulumpe, Kwampe, and Atta Akura, where rivers and streams have been drying up due to high temperatures and inconsistent rainfall. This water scarcity is further complicated by conflicts over water use, particularly where water diversion for irrigation limits access for domestic purposes. Additionally, heavy rains have led to flooding, damaging infrastructure, and disrupting irrigation systems.

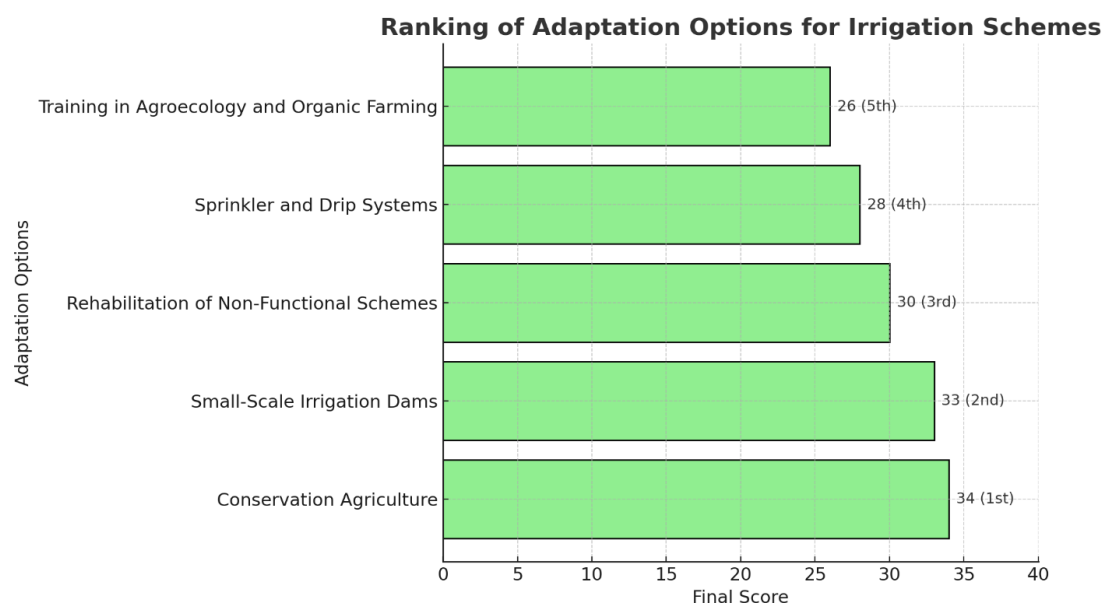
In communities like Busuama, New Longoro, Dawadawa, and Babatokuma, inadequate access to irrigation infrastructure increases vulnerability to droughts and erratic rainfall. The adoption of irrigation schemes has been identified as a priority to ensure water availability, enhance crop yields, and improve resilience to climate change. Several irrigation-related adaptation options were evaluated and ranked based on their feasibility, affordability, and potential impact (Figure 6 and Table 5).

Conservation agriculture, although not directly an irrigation scheme, ranked first. Conservation agriculture plays a critical role in improving soil moisture retention, thereby reducing water stress during dry periods. Incorporating minimal tillage, crop residue management, and crop rotation helps maintain soil structure, reduce evaporation, and enhance water infiltration (Wall & Govaerts, 2020). Studies have shown that conservation agriculture can increase water-use efficiency by up to 30% in rain-fed systems, especially in semi-arid and transitional zones like the Kintampo Municipality (Giller et al., 2015). This method is already practiced across the municipality and has proven effective in mitigating the effects of prolonged dry spells and improving water retention in the soil.

Small-scale irrigation dams, ranked second, provide a sustainable solution for addressing water scarcity. These dams are effective in storing water for agricultural use and are already practiced in surrounding areas, demonstrating their feasibility. According to Jambo & Tasew (2021), small-scale irrigation systems can increase agricultural productivity by up to 50% and improve household food security. Studies conducted in sub-Saharan Africa have demonstrated the feasibility and benefits of small-scale irrigation systems in improving resilience to climate variability (Abegunde & Obi, 2019). In the Kintampo Municipality, expanding the use of these systems could significantly enhance resilience to dry spells.

Rehabilitation of non-functional schemes, ranked third, focuses on revitalizing existing but non-operational irrigation systems. While not commonly practiced in the municipality, these rehabilitated schemes could provide a valuable resource for farming communities. However, challenges such as institutional coordination, technical expertise, and financing have hindered effective rehabilitation efforts. Research shows that rehabilitating irrigation systems can increase productivity in areas where systems were previously functional but abandoned due to poor maintenance (Angelakis & Fereres, 2020).

Figure 6. Ranked adaptation options for irrigation schemes



Source: Authors

Sprinkler and drip systems, ranked fourth, offer precise and efficient water delivery to crops, reducing wastage and improving productivity. However, the high costs associated with purchasing and maintaining these systems limit their widespread adoption, particularly among smallholder farmers in communities such as Dawadawa and Gulumpe. Studies indicate that drip irrigation systems can reduce water use by 40 to 50% while improving crop yields by up to 30% (Li & Li, 2021). Therefore, there is the need for external support or subsidies to make these technologies accessible. This adaptation option is crucial for addressing water management issues through efficient water use.

Training in agroecology and organic farming, ranked fifth, emphasizes sustainable water and soil management techniques. Agroecology and organic farming emphasize sustainable water and soil management techniques that can enhance resilience to climate variability (Altieri & Nicholls, 2005). This approach also promotes integrated pest management, reducing reliance on chemical inputs and enhancing biodiversity. Training programs to enhance farmers' knowledge of agroecological practices have been found to improve productivity and resilience in several African countries (Sinclair & Harrison 2019).

Table 5. Summary of adaptation options for irrigation schemes in KiMA

Objectives	Indicators of success	Time frame	Resources (finance, human, technology)	Implementing partners	Estimated cost (GH¢)
Adaptation action: Conservation agriculture					
To retain soil moisture and reduce water stress by enhancing soil structure through minimal tillage and crop residue management. This aligns with traditional practices and supports sustainable water usage.	Increased soil moisture retention Enhanced crop yields Reduction in soil erosion rates	Short term	Farmer training programs Basic equipment for minimal tillage Financial support for implementation	Kintampo Municipal Assembly (lead), farmer-based organizations, NGOs	150,000–400,000
Adaptation action: Small-scale irrigation dams					
To address water scarcity by providing reliable water storage systems for agricultural use. This supports year-round farming and improves resilience to prolonged dry spells.	Increased water availability during dry periods Number of small-scale dams constructed or rehabilitated Improved crop productivity	Medium term	Construction materials for dams Technical expertise for site selection and design Community mobilization resources	Kintampo Municipal Assembly (lead), Water Resources Commission, local NGOs	800,000–3,000,000
Adaptation action: Rehabilitation of non-functional schemes					
To revitalize non-functional irrigation schemes, providing valuable water resources for farming communities while improving overall water access.	Percentage of farms adopting sprinkler/drip systems Reduction in water wastage Increased productivity per unit of water used	Medium to long term	Funding for rehabilitation Engineering expertise for system restoration Community participation for management	Kintampo Municipal Assembly (lead), engineering firms, community groups	1,500,000–6,000,000

The Kintampo Municipal Assembly Climate Adaptation Plan: Ghana

Objectives	Indicators of success	Time frame	Resources (finance, human, technology)	Implementing partners	Estimated cost (GH¢)
Adaptation action: Sprinkler and drip systems					
To deliver water efficiently to crops with minimal wastage, enhancing productivity. This system is highly precise but costly to maintain and operate.	Percentage of farms adopting sprinkler/drip systems Reduction in water wastage Increased productivity per unit of water used	Medium term	High-precision irrigation equipment Maintenance resources Technical training for farmers	Kintampo Municipal Assembly (lead), agricultural extension services, private sector	300,000–1,000,000
Adaptation action: Training in agroecology and organic farming					
To build farmer capacity in sustainable farming techniques that integrate water and soil management practices for long-term agricultural resilience.	Number of farmers trained Adoption of agroecology practices Improved long-term resilience metrics	Short to medium term	Training materials and facilitators Financial support for workshops Demonstration plots for hands-on learning	Kintampo Municipal Assembly (lead), research institutions, farmer-based organizations	120,000–350,000

Source: Adaptation options prioritization workshop, 2025. Estimated cost (GH¢) figures are approximate and subject to change based on fluctuating exchange rates (USD 1 ≈ GH¢ 10.25 at time of estimation) and local market prices (June 10, 2025).

3.2.3 Agroforestry Promotion

Agroforestry is a crucial strategy for addressing climate vulnerabilities in the Kintampo Municipality, particularly in combating land degradation, enhancing soil fertility, and improving water conservation. Integrating trees and shrubs into agricultural systems, agroforestry promotes sustainable land use while offering additional economic benefits. Stakeholders emphasized that agroforestry practices can address issues such as deforestation, soil degradation, and water conservation challenges reported in various communities. Figure 7 and Table 6 show the prioritization and adaptation actions.

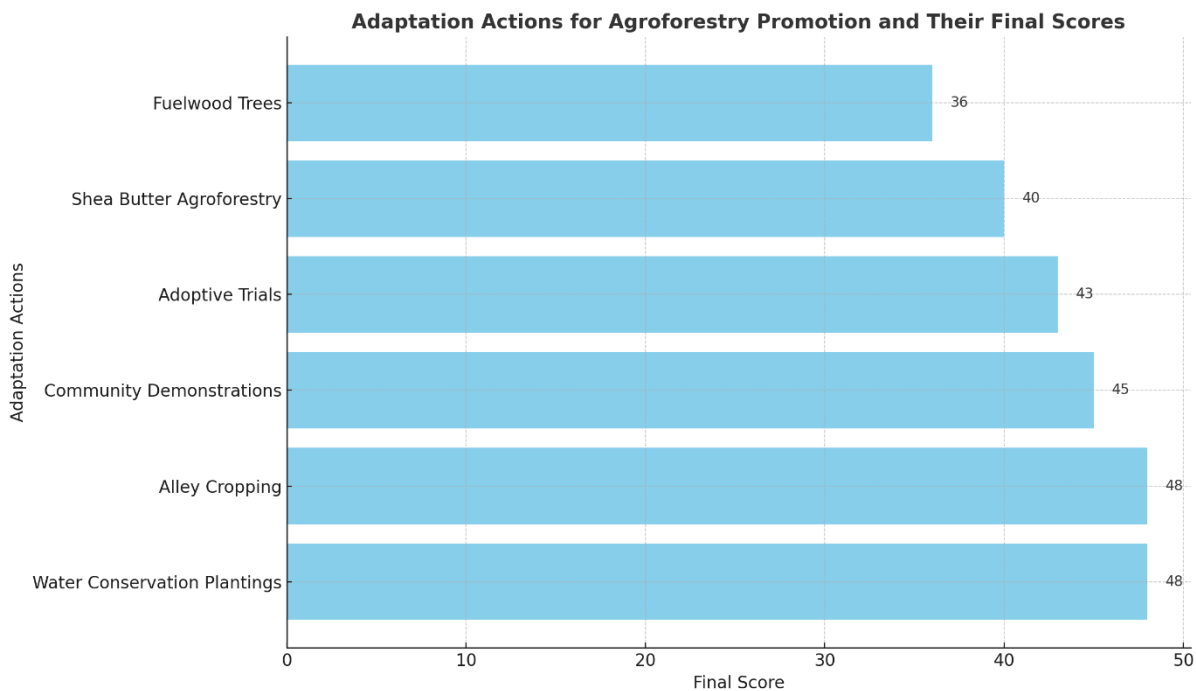
Water conservation plantings, ranked first, is the most accessible and widely applicable agroforestry practice. Water conservation plantings involve the strategic planting of trees and shrubs to reduce soil erosion, enhance water retention, and improve soil fertility. This practice is particularly effective in areas experiencing high rainfall variability, soil erosion, and land degradation (Sharma & Tiwari, 2017). According to Abdallah and Jak (2021), water conservation plantings improve infiltration rates and reduce surface runoff, thereby contributing to soil moisture conservation. Additionally, this practice helps in stabilizing stream banks and reducing the risk of floods during heavy rainfall periods. A study by Jinger and Singhal (2022), shows that integrating trees into agricultural landscapes can reduce soil erosion by up to 50% while simultaneously improving soil organic matter and water retention. Such measures are particularly relevant for communities like Busuama, Dawadawa, Anyima, and Gulumpe, where water scarcity and soil erosion are prevalent issues.

Alley cropping, ranked second, involves planting rows of trees or shrubs between crops to improve soil structure, reduce erosion, and enhance crop yields. This method is especially beneficial for addressing soil fertility decline and enhancing moisture retention in degraded areas (Hombegowda & Madhu, 2022). Research by Kongsager (2017), indicates that alley cropping improves nutrient cycling, increases soil organic matter, and enhances agricultural productivity. Moreover, the practice offers flexibility, allowing farmers to tailor tree species selection to their specific ecological and economic needs (Bambrick et al., 2010).

Community demonstrations, ranked third, play a vital role in showcasing agroforestry practices and building farmer capacity. Demonstrations facilitate knowledge transfer and improve adoption rates, especially in areas where awareness of agroforestry benefits remains low. Studies have shown that farmer-to-farmer learning and demonstration plots significantly enhance the adoption of agroforestry practices by providing tangible evidence of their benefits (Kansanga & Luginaah, 2021). However, setting up effective demonstration sites requires financial and technical resources, which can be a barrier in resource-constrained communities like Babatokuma, Gulumpe, and New Longoro.

Adaptive trials, ranked fourth, focus on testing and promoting drought-resistant and disease-resistant crop varieties within agroforestry systems. This approach is particularly valuable for improving productivity in areas prone to drought and pest infestations (Elias & Sutherland, 2019). Research shows that incorporating adaptive trials into agroforestry systems can improve crop yields in degraded areas by enhancing nutrient availability and promoting soil fertility (Sileshi, 2020).

Figure 7. Ranked adaptation options for agroforestry promotion



Source: Authors

Shea butter agroforestry, ranked fifth, leverages the cultivation of shea trees alongside traditional crops to enhance soil fertility and provide alternative income streams for farmers. This practice is particularly beneficial for women, who are often involved in the shea butter value chain (Hammond & Dauncey, 2019). Stakeholders in Babatokuma, Dawadawa, and Cheranda expressed interest in expanding shea butter agroforestry practices, acknowledging the potential economic benefits. However, it requires longer-term investments and careful management to realize its full potential.

Fuelwood trees, ranked sixth, involve planting fast-growing tree species for firewood production, reducing pressure on natural forests. Stakeholders reported that communities like Gulumpe, Busuama, and Babatokuma are experiencing high demand for fuelwood, contributing to deforestation. According to Karalliyadda (2025), agroforestry systems that incorporate fuelwood trees can enhance soil fertility, reduce pressure on natural forests, and provide renewable energy sources. However, adoption is often limited by competing land uses and lower traditional acceptance.

Table 6. Summary of adaptation options for agroforestry promotion in Kintampo

Objectives	Indicators of success	Time frame	Resources (finance, human, technology)	Implementing partners	Estimated cost (GH¢)
Adaptation action: Water conservation plantings					
To prevent soil erosion, improve water retention, and enhance overall environmental sustainability through planting water-conserving trees and shrubs. This measure is simple, cost-effective, and widely adoptable by farmers.	Reduction in soil erosion rates Increased water retention capacity Higher adoption rates by farmers	Short to medium term	Planting materials (trees and shrubs) Farmer training sessions Community awareness programs	Kintampo Municipal Assembly (lead), local NGOs, farmer-based organizations	180,000–500,000
Adaptation action: Community demonstrations					
To provide hands-on learning and promote the adoption of agroforestry practices through organized demonstrations. These demonstrations aim to improve knowledge transfer and farmer capacity in sustainable farming.	Number of demonstrations conducted Farmer participation rates Increased adoption of demonstrated practices	Short to medium term	Funding for demonstrations Technical experts and facilitators Equipment for demonstration plots	Kintampo Municipal Assembly (lead), research institutions, agricultural extension services	150,000–450,000
Adaptation action: Alley cropping					
To improve soil fertility, reduce erosion, and enhance crop yields by integrating rows of trees and shrubs within croplands. This flexible and scalable approach supports sustainable land management.	Increased soil fertility metrics Reduction in erosion rates Percentage of farmers adopting alley cropping	Medium term	Seeds and seedlings for alley cropping Training programs Technical support for implementation	Kintampo Municipal Assembly (lead), farmer-based organizations, technical experts	200,000–600,000

The Kintampo Municipal Assembly Climate Adaptation Plan: Ghana

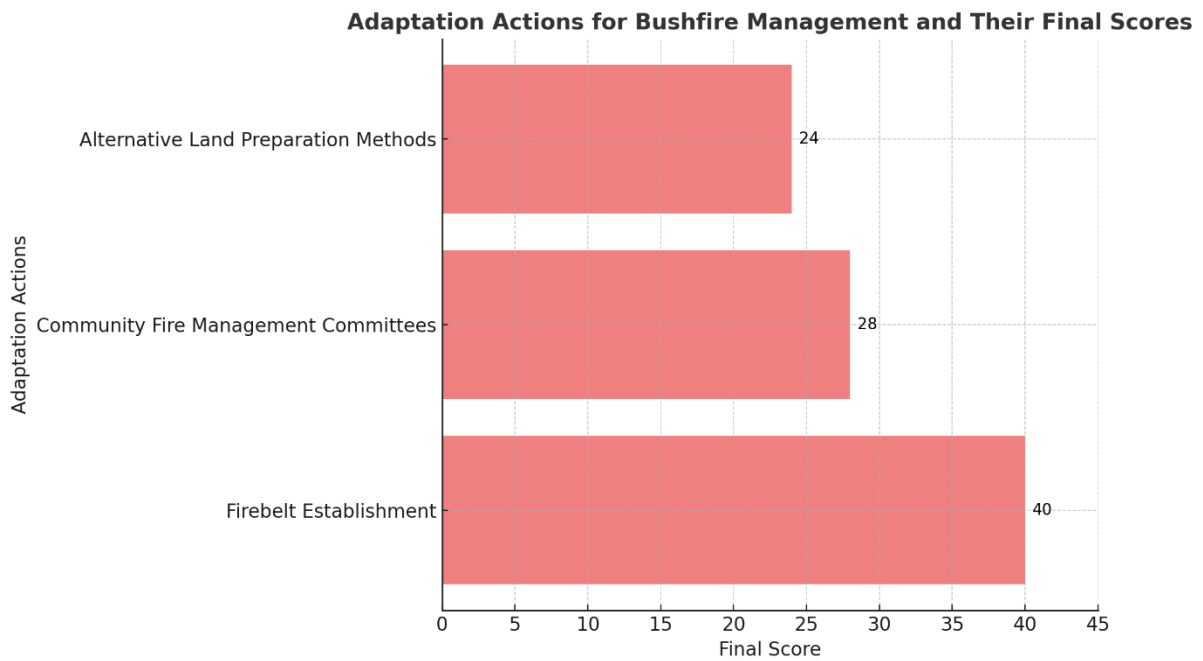
Objectives	Indicators of success	Time frame	Resources (finance, human, technology)	Implementing partners	Estimated cost (GH¢)
Adaptation action: Adaptive trials (drought-resistant crops, disease-resistant crops)					
To test and introduce drought-resistant and disease-resistant crop varieties within agroforestry systems, enhancing resilience to climate variability and improving productivity.	Number of trials conducted Improved yields of drought-resistant crops Farmer adoption rates of trial outcomes	Medium term	Research funding Technical expertise for trials Farmer extension services for capacity building	Kintampo Municipal Assembly (lead), research institutions, agricultural extension services	250,000–750,000
Adaptation action: Shea butter agroforestry					
To enhance soil fertility, promote biodiversity, and provide alternative income streams through the cultivation of shea trees alongside traditional crops. This approach benefits women engaged in the shea butter value chain.	Increased shea tree cultivation areas Improved soil fertility metrics Increased income from shea butter products	Long term	Funding for shea tree cultivation Extension services to support women-led initiatives Tools for shea product processing	Kintampo Municipal Assembly (lead), women's groups, local NGOs	300,000–900,000
Adaptation action: Fuelwood trees					
To address deforestation and reduce pressure on natural forests by planting fast-growing tree species for firewood production, providing economic and environmental benefits.	Number of fuelwood trees planted Reduction in deforestation rates Increased availability of fuelwood for local use	Medium to long term	Fast-growing tree seedlings Awareness campaigns on sustainable firewood use Financial support for planting programs	Kintampo Municipal Assembly (lead), Forestry Commission, local communities	200,000–600,000

Source: Adaptation options prioritization workshop, 2025. Estimated cost (GH¢) figures are approximate and subject to change based on fluctuating exchange rates (USD 1 ≈ GH¢ 10.25 at time of estimation) and local market prices (June 10, 2025).

3.2.4 Bushfire Management

Bushfires pose a significant threat to the Kintampo Municipality, particularly to agricultural productivity, forestry resources, and community livelihoods. To address these challenges, a set of bushfire management measures has been identified and evaluated. These options (Figure 8 and Table 7) focus on preventing bushfires, mitigating their impact, and promoting sustainable land management practices.

Figure 8. Ranked adaptation actions for bushfire management in Kintampo



Source: Authors

Fire belt establishment, ranked first, is a cost-effective and feasible intervention that involves creating fire-resistant barriers around farms and forests. This practice is particularly effective in minimizing the spread of bushfires and protecting valuable agricultural and forestry resources. Studies indicate that fire belts, when properly maintained, can significantly reduce the risk of wildfire damage by providing a buffer zone that stops or slows the spread of fires (Jean-Louis & Corte, 2019). According to Hussein and Issifu (2020), fire belts are especially effective in areas where frequent fires threaten agricultural and forest resources. They also provide ecological benefits by preserving soil structure, maintaining biodiversity, and enhancing habitat quality. With trained municipal personnel already available to implement this measure, it is highly practical and aligned with district priorities.

Community fire management committees, ranked second, involve establishing local committees to coordinate fire prevention and response activities. These committees raise awareness, monitor fire risks, and mobilize community members to mitigate and respond to bushfires. This approach emphasizes traditional knowledge, local leadership, and participatory management to enhance fire prevention and control (Lake & Stevens-Rumann, 2017). Research by Dube (2013), highlights the importance of integrating community participation into fire management systems, especially in areas where conventional firefighting resources are scarce. Establishing community fire management

committees can enhance awareness, improve early warning systems, and promote sustainable land management practices. However, challenges such as a lack of resources, inconsistent participation, and inadequate training often limit the effectiveness of these committees (Fernandes, 2023).

Alternative land preparation methods, ranked third, focus on reducing reliance on fire-based land clearing techniques by promoting sustainable alternatives such as mulching and minimal tillage. While this practice offers significant environmental benefits, its adoption is constrained by traditional farming habits and limited awareness among farmers.

Table 7. Ranked adaptation options for bushfire management

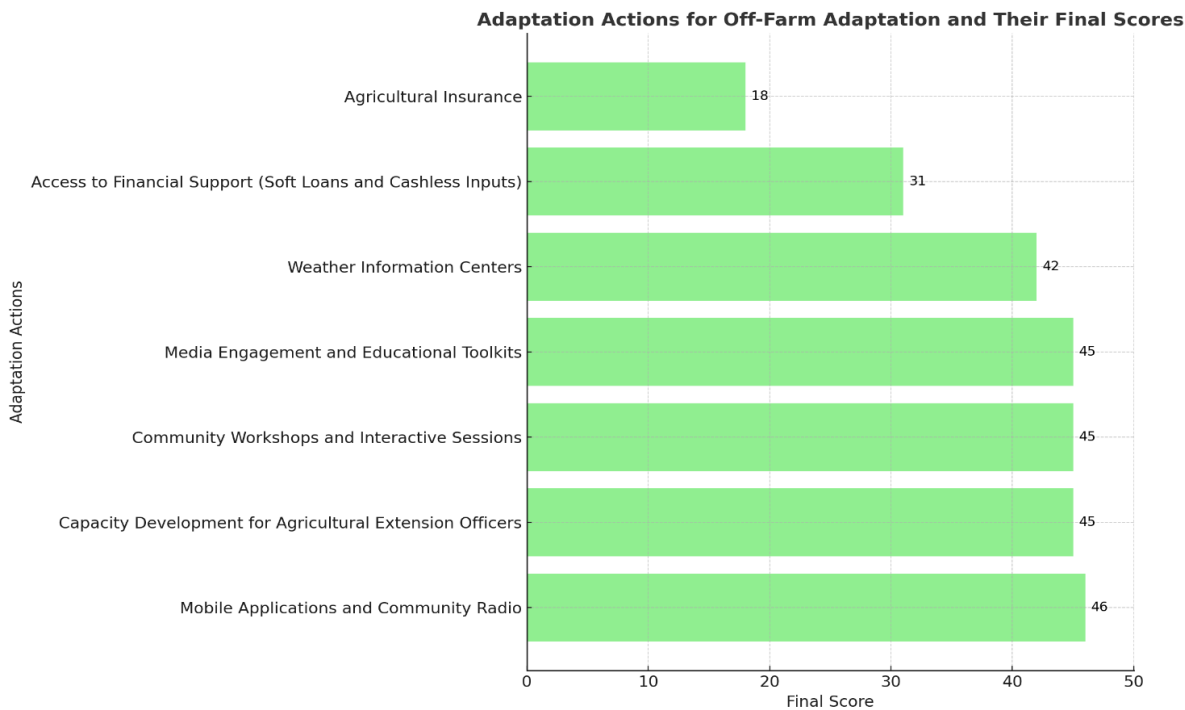
Objectives	Indicators of success	Time frame	Resources (finance, human, technology)	Implementing partners	Estimated cost (GH¢)
Adaptation action: Fire belt establishment					
To reduce the spread of bushfires and protect agricultural and forestry resources by creating fire-resistant barriers around farms and forests.	Kilometres of fire belts established Reduction in bushfire occurrences Number of personnel trained in fire belt management	Short to medium term	Trained municipal personnel Tools and equipment for fire belt creation Community awareness programs	Kintampo Municipal Assembly (lead), Forestry Commission, community groups	250,000–750,000
Adaptation action: Community fire management committees					
To establish community-led committees to coordinate fire prevention, awareness, and response activities, reducing bushfire risks and impacts.	Number of active fire management committees Reduction in bushfire incidents Community participation rates	Medium term	Training programs for committee members Monitoring tools and equipment Funding for awareness campaigns	Kintampo Municipal Assembly (lead), NGOs, traditional authorities	150,000–400,000
Adaptation action: Alternative land preparation methods					
To promote sustainable alternatives to fire-based land clearing, such as mulching and minimal tillage, reducing environmental degradation.	Number of farmers adopting alternative methods Reduction in fire-based land clearing incidents Improved soil health metrics	Medium term	Farmer training sessions Equipment for mulching and minimal tillage Financial support for awareness campaigns	Kintampo Municipal Assembly (lead), agricultural extension services, farmer-based organizations	120,000–350,000

Source: Adaptation options prioritization workshop, 2025. Estimated cost (GH¢) figures are approximate and subject to change based on fluctuating exchange rates (USD 1 ≈ GH¢ 10.25 at time of estimation) and local market prices (June 10, 2025).

3.3 Off-Farm Adaptation

Off-farm adaptation options (Figure 9 and Table 8) in the Kintampo Municipality focus on improving the resilience of farmers and communities to climate change by enhancing knowledge, providing access to critical resources, and improving decision-making capacity. These measures complement on-farm practices, ensuring a holistic approach to climate adaptation.

Figure 9. Ranked adaptation options for off-farm adaptation in Kintampo



Source: Authors

Mobile applications and community radio, ranked first, is an effective tool for disseminating weather information and climate updates. According to Suresha (2019), mobile technology provides real-time information on weather forecasts, planting schedules, pest management, and market prices, which significantly influences farming decisions and enhances productivity. Community radio, in particular, has been successful in reaching remote and marginalized communities, providing localized information that aligns with traditional practices and knowledge systems (Pavarala & Malik, 2021). In Ghana, the use of community radio has improved the dissemination of agricultural extension messages, especially where internet access is limited (Attuh & Kankam, 2024).

Capacity development for agricultural extension officers, ranked second, focuses on equipping extension officers with technical knowledge and skills to support farmers in adopting climate-resilient practices. Effective training programs improve the officers’ technical knowledge, communication skills, and ability to provide tailored advice on climate-smart agriculture. According to Becerra-Encinales & Cruz (2024), agricultural extension systems in developing countries often lack sufficient training resources, leading to inadequate dissemination of climate adaptation techniques.

Strengthening capacity through continuous education, workshops, and participatory learning has proven successful in improving resilience and productivity.

Community workshops and interactive sessions, ranked third, play a vital role in raising awareness of climate change impacts and adaptation strategies. These workshops provide a platform for farmers to share knowledge, learn from experts, and collaborate on sustainable practices. Their interactive nature ensures active participation and better understanding among community members.

Media engagement and educational toolkits, ranked fourth, leverage print, digital, and broadcast media to raise awareness of climate risks and solutions. Educational materials like brochures, videos, and toolkits ensure that farmers and communities have access to reliable and actionable information.

Weather information centres, ranked fifth, provide localized, accurate weather data that helps farmers plan their agricultural activities effectively. According to Hansen et al. (2019), providing farmers with tailored climate information enhances decision making, reduces risk, and improves productivity. In Ghana, weather information centres have been found to increase agricultural productivity by 10% to 15% when integrated with local extension systems (Antwi-Agyei & Stringer, 2021). However, establishing these centres requires significant technical and institutional support.

Access to financial support (soft loans and cashless inputs), ranked sixth, enables farmers to invest in climate-resilient practices and technologies. While this option has high potential, its success depends on robust institutional frameworks to ensure accessibility and equitable distribution.

Agricultural insurance, ranked seventh, provides a safety net for farmers against climate-induced losses. However, low affordability and limited adoption make this a lower-priority option in the municipality.

Table 8. Summary of off-farm adaptation options in Kintampo

Objectives	Indicators of success	Time frame	Resources (finance, human, technology)	Implementing partners	Estimated cost (GH¢)
Adaptation action: Mobile applications and community radio					
To provide real-time weather information and climate updates to farmers, improving decision making for planting, harvesting, and pest control. Accessible through mobile apps and radio broadcasts.	Number of farmers accessing weather updates Increased adoption of timely farming practices Reduction in climate-related losses	Short to medium term	Mobile app development Radio broadcasting resources Financial support for IT infrastructure	Kintampo Municipal Assembly (lead), telecommunications companies, local NGOs	200,000–600,000
Adaptation action: Capacity development for agricultural extension officers					
To enhance the technical capacity of extension officers, enabling them to support farmers in adopting climate-smart practices and sustainable agriculture.	Number of extension officers trained Improved adoption of climate-smart practices among farmers Increased resilience in farming systems	Short to medium term	Training materials and facilitators Technical resources for capacity building Institutional support for training programs	Kintampo Municipal Assembly (lead), agricultural extension services, research institutions	150,000–450,000
Adaptation action: Community workshops and interactive sessions					
To raise awareness about climate change impacts and adaptation strategies through interactive workshops, fostering knowledge sharing and collaboration among farmers.	Number of workshops conducted Community participation rates Improved knowledge of climate risks and adaptation options	Short term	Funding for workshops Skilled facilitators Community engagement tools	Kintampo Municipal Assembly (lead), community leaders, local NGOs	100,000–300,000

The Kintampo Municipal Assembly Climate Adaptation Plan: Ghana

Objectives	Indicators of success	Time frame	Resources (finance, human, technology)	Implementing partners	Estimated cost (GH¢)
Adaptation action: Media engagement and educational toolkits					
To use media channels, including print and digital platforms, to disseminate educational materials and promote climate adaptation practices among communities.	Number of educational materials distributed Increased awareness of climate change impacts and solutions Improved community engagement in adaptation practices	Short term	Printing and distribution of materials Development of educational toolkits Media airtime and production costs	Kintampo Municipal Assembly (lead), media organizations, NGOs	120,000–380,000
Adaptation action: Weather information centres					
To establish localized centres that provide accurate weather data, enabling farmers to plan agricultural activities more effectively.	Number of operational weather information centres Increased farmer access to localized weather forecasts Reduction in climate-related crop failures	Medium term	Meteorological equipment Data analysis tools Technical expertise for managing information centres	Kintampo Municipal Assembly (lead), Ghana Meteorological Agency, local NGOs	300,000–900,000
Adaptation action: Access to financial support (soft loans and cashless inputs)					
To offer financial support, including soft loans and cashless inputs, to help farmers invest in climate-resilient technologies and practices.	Number of farmers receiving financial support Increased adoption of resilient farming technologies Enhanced economic stability for farmers	Short to medium term	Loan facilities Institutional frameworks for distribution Financial literacy programs for farmers	Kintampo Municipal Assembly (lead), financial institutions, agricultural cooperatives	500,000–2,000,000

The Kintampo Municipal Assembly Climate Adaptation Plan: Ghana

Objectives	Indicators of success	Time frame	Resources (finance, human, technology)	Implementing partners	Estimated cost (GH¢)
Adaptation action: Agricultural insurance					
To provide insurance to farmers, offering financial protection against climate-induced losses such as crop failure and extreme weather events.	Number of farmers enrolled in insurance programs Reduction in financial losses due to extreme weather events Improved farmer confidence in managing climate risks	Medium to long term	Insurance packages tailored for farmers Awareness campaigns on insurance benefits Institutional support for policy management	Kintampo Municipal Assembly (lead), insurance companies, farmer-based organizations	300,000–1,000,000

Source: Adaptation options prioritization workshop, 2025. Estimated cost (GH¢) figures are approximate and subject to change based on fluctuating exchange rates (USD 1 ≈ GH¢ 10.25 at time of estimation) and local market prices (June 10, 2025).

3.4 Gender-Based Adaptation

Gender-based adaptation in the Kintampo Municipality focuses on addressing the differentiated impacts of climate change on men, women, and other vulnerable groups. Due to existing social, economic, and cultural inequalities, women, children, persons with disabilities (PWDs), and marginalized groups are disproportionately affected by climate change impacts such as droughts, floods, and food insecurity. As primary caretakers, food producers, and water collectors, women face increased workloads, reduced income opportunities, and greater exposure to climate-induced risks. Ensuring gender-responsive adaptation strategies is therefore essential for achieving equitable and sustainable resilience.

Stakeholders emphasized that mainstreaming gender in climate adaptation planning requires deliberate efforts to include women and vulnerable groups in decision-making processes, capacity-building initiatives, and resource allocation. Effective gender-based adaptation involves addressing institutional, social, and economic barriers that hinder the full participation of women and marginalized groups in adaptation efforts.

3.4.1 Gender-Based Vulnerability Reductions and Sustainability in Kintampo

Gender-based vulnerability reductions and sustainability in the Kintampo Municipality aim to enhance the resilience of women, PWDs, and other vulnerable groups to climate change impacts. This involves promoting adaptive strategies that consider the specific needs, knowledge, and experiences of these groups while ensuring their inclusion in adaptation planning and implementation processes.

Empowering women through access to education, training, financial resources, and decision-making opportunities is important for achieving equitable adaptation outcomes. Integrating gender-responsive strategies into broader adaptation initiatives can significantly improve the sustainability and effectiveness of interventions. Efforts to enhance resilience among vulnerable groups include promoting alternative livelihoods, strengthening social protection mechanisms, and ensuring equal access to adaptation resources and opportunities.

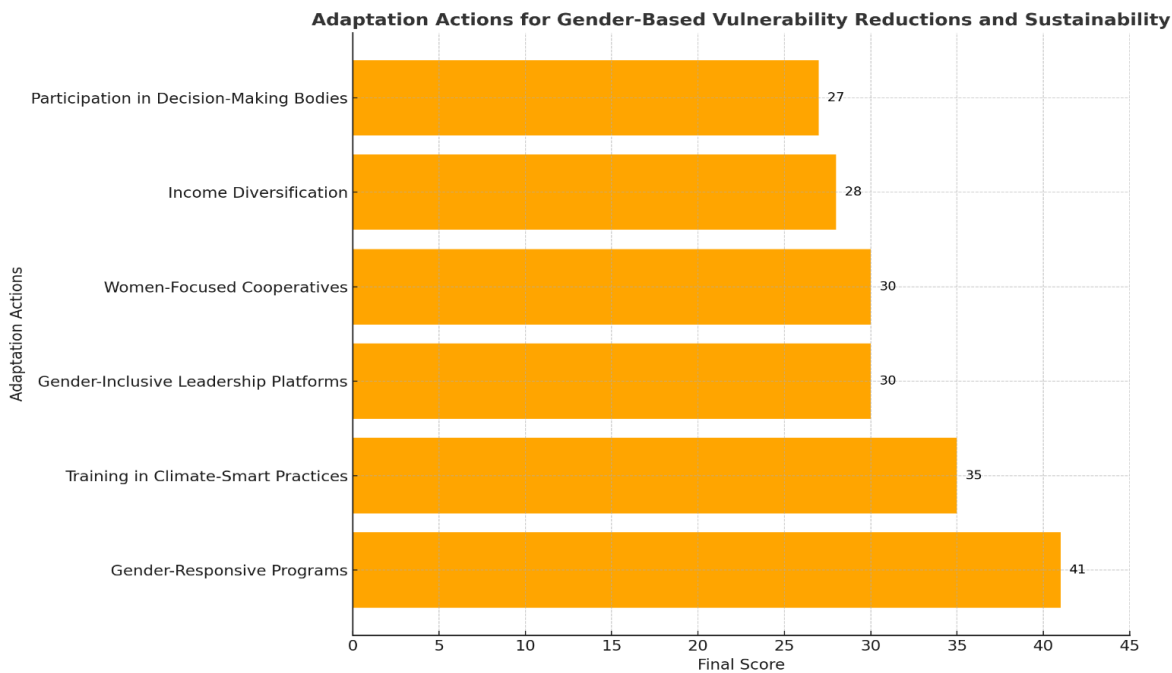
In the Kintampo Municipality, various gender-based adaptation actions have been identified and evaluated (Figure 10 and Table 9). The adaptation actions include:

- **Gender-responsive programs** (ranked first): Initiatives aimed at ensuring women's active participation in adaptation planning and implementation have been prioritized. Effective gender-responsive programs address barriers faced by women and marginalized groups in accessing resources, participating in decision making, and benefiting from adaptation interventions. According to the United Nations Development Programme (UNDP) (2023), integrating gender considerations into climate action enhances the effectiveness and sustainability of adaptation efforts. Furthermore, the World Resources Institute (WRI) (2023) emphasizes that gender-responsive approaches in locally led adaptation processes can lead to more equitable and resilient outcomes.
- **Training in climate-smart practices** (ranked second): Providing tailored training programs focused on climate-smart agriculture and sustainable livelihoods can improve resilience. Such

programs enhance skills related to water conservation, sustainable farming practices, and alternative livelihoods. The Food and Agriculture Organization (FAO) (2015) highlights that women play a pivotal role in climate change adaptation and mitigation in the agriculture sector and empowering them through training is crucial. Additionally, UN Women (2022) has developed programming guides to promote gender-responsive approaches in climate-smart agriculture, emphasizing the importance of capacity-building for women farmers.

- **Gender-inclusive leadership platforms and women-focused cooperatives** (ranked third): Establishing platforms where women and other vulnerable groups can participate in decision-making processes is essential for promoting inclusive adaptation. Ensuring that women have a voice in local governance structures enhances the overall effectiveness of adaptation planning. According to We Effect (2025), cooperatives can create a solid foundation for gender-inclusive leadership development, subsequently promoting women's economic autonomy. Moreover, the African Women in Agricultural Research and Development (AWARD) program (2024) focuses on accelerating African women's leadership in climate action, highlighting the importance of mentorship and leadership training.
- **Income diversification** (ranked fourth): Promoting alternative livelihoods and income-generating activities among women and vulnerable groups is critical for enhancing resilience. Income diversification helps mitigate climate-induced economic vulnerabilities by providing additional revenue streams (Shahin & Sharif, 2022).
- **Participation in decision-making bodies** (ranked fifth): Enhancing the involvement of women and vulnerable groups in local governance structures and climate adaptation planning processes remains a priority. While some progress has been made, there is still a need to improve inclusivity in decision making.

Figure 10. Ranked adaptation options for gender-based vulnerability reductions and sustainability in Kintampo



Source: Authors

Table 9. Gender-based vulnerability reductions and sustainability in Kintampo

Objectives	Indicators of success	Time frame	Resources (finance, human, technology)	Implementing partners	Estimated cost (GH¢)
Adaptation action: Income diversification					
To reduce dependency on farming as the sole income source by promoting alternative livelihoods, improving household financial security, and enhancing climate resilience.	Number of households adopting alternative livelihoods Increase in household incomes Reduced climate vulnerability	Medium term	Financial support for alternative livelihoods Skills training programs Market access facilitation	Kintampo Municipal Assembly (lead), NGOs, agricultural cooperatives	400,000–1,200,000
Adaptation action: Participation in decision-making bodies					
To foster inclusive decision-making processes by encouraging women's active participation in governance and community planning.	Number of women in decision-making positions Increased representation of women in governance structures Improved community engagement	Medium term	Awareness campaigns Leadership training for women Institutional support for inclusive governance	Kintampo Municipal Assembly (lead), community leaders, women's groups	150,000–450,000
Adaptation action: Gender-inclusive leadership platforms					
To ensure equal representation and participation of women in leadership roles within community and municipal structures.	Increase in women-led initiatives Number of leadership platforms established Improved gender balance in governance	Medium term	Funding for leadership platforms Training programs for women Community engagement initiatives	Kintampo Municipal Assembly (lead), NGOs, local leaders	200,000–600,000

The Kintampo Municipal Assembly Climate Adaptation Plan: Ghana

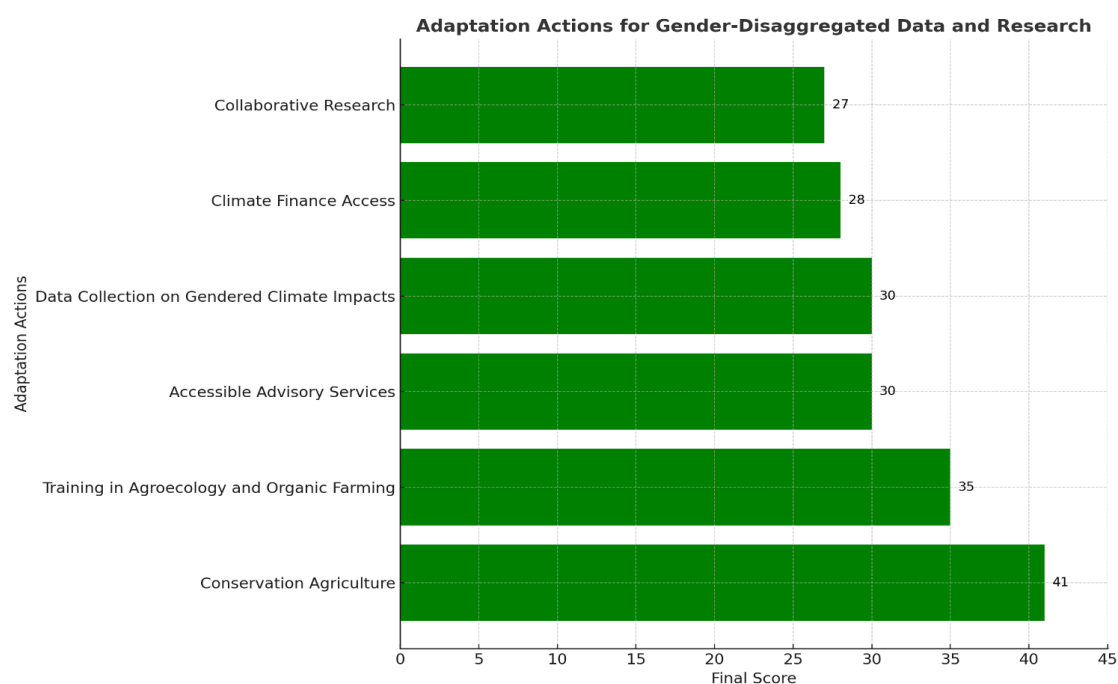
Objectives	Indicators of success	Time frame	Resources (finance, human, technology)	Implementing partners	Estimated cost (GH¢)
Adaptation action: Gender-responsive programs					
To address gender-specific vulnerabilities and barriers, promoting equitable access to resources and opportunities for women.	Number of women benefiting from programs Increased access to resources for women Reduction in gender disparities	Medium term	Financial support for gender programs Awareness and advocacy campaigns Training resources for women	Kintampo Municipal Assembly (lead), NGOs, advocacy groups	300,000–900,000
Adaptation action: Training in climate-smart practices					
To build the capacity of women farmers to adopt sustainable and climate-smart agricultural techniques, improving productivity and resilience.	Number of women trained Adoption rates of climate-smart practices Improved agricultural yields and resilience	Medium term	Training materials and facilitators Demonstration plots Financial support for training programs	Kintampo Municipal Assembly (lead), agricultural extension services, NGOs	180,000–550,000
Adaptation action: Women-focused cooperatives					
To promote collective action and resource sharing among women, fostering resilience and economic stability.	Number of cooperatives established Increased participation of women in cooperatives Enhanced access to shared resources	Medium to long term	Funding for cooperative formation Training programs for women Institutional support for cooperatives	Kintampo Municipal Assembly (lead), women's associations, NGOs	250,000–800,000

Source: Adaptation options prioritization workshop, 2025. Estimated cost (GH¢) figures are approximate and subject to change based on fluctuating exchange rates (USD 1 ≈ GH¢ 10.25 at time of estimation) and local market prices (June 10, 2025).

3.4.2 Gender-Disaggregated Data and Research in Kintampo

Gender-disaggregated data and research are critical for understanding and addressing the unique challenges faced by women and marginalized groups in the Kintampo Municipality. Promoting gender-responsive programs and leadership opportunities, these adaptation options (Figure 11 and Table 10) aim to empower women, improve livelihoods, and foster inclusive decision making.

Figure 11. Ranked adaptation options for gender-disaggregated data and research in Kintampo



Source: Authors

Conservation agriculture, ranked first, promotes sustainable farming practices that improve soil health, enhance productivity, and increase resilience to climate change. Its alignment with district priorities and high technical feasibility makes it a top choice for implementation. Training in agroecology and organic farming, ranked second, focuses on equipping farmers, particularly women, with the knowledge and skills to adopt sustainable farming methods. This training empowers communities to transition to environmentally friendly and climate-resilient agricultural practices.

Accessible advisory services, ranked third, aim to provide farmers with timely and accurate climate information to guide decision making. This option enhances awareness and preparedness for climate-related risks. Data collection on gendered climate impacts, ranked fourth, seeks to generate detailed insights into how climate change affects men and women differently. These data inform targeted interventions to address gender disparities in climate adaptation.

Climate finance access, ranked fifth, supports farmers, particularly women, by facilitating access to funding for climate-resilient technologies and practices. While impactful, its feasibility is constrained by limited institutional capacity. Collaborative research, ranked sixth, promotes partnerships among stakeholders to advance inclusive and gender-responsive climate adaptation strategies. However, resource limitations and technical challenges affect its broader adoption.

Table 10. Gender-disaggregated data and research in Kintampo

Objectives	Indicators of success	Time frame	Resources (finance, human, technology)	Implementing partners	Estimated cost (GH¢)
Adaptation action: Conservation agriculture					
To promote sustainable farming practices that enhance soil fertility, increase productivity, and build resilience to climate change impacts.	Number of farmers adopting conservation practices Improved soil health metrics Increased crop yields	Medium term	Training programs for farmers Demonstration plots Technical support for implementation	Kintampo Municipal Assembly (lead), farmer-based organizations, NGOs	150,000–450,000
Adaptation action: Training in agroecology and organic farming					
To equip farmers with knowledge and skills to adopt environmentally friendly and climate-resilient farming techniques.	Number of training sessions conducted Percentage of farmers adopting agroecology practices Improved agricultural resilience	Medium term	Training materials and facilitators Financial support for workshops Farmer extension services	Kintampo Municipal Assembly (lead), agricultural extension services, NGOs	120,000–380,000
Adaptation action: Accessible advisory services					
To provide farmers with reliable and timely climate-related information to guide agricultural decision making.	Number of advisory services established Farmer access rates to advisory services Reduction in climate-related crop losses	Short to medium term	Advisory service centres ICT tools for information dissemination Technical expertise for service delivery	Kintampo Municipal Assembly (lead), research institutions, local NGOs	250,000–800,000
Adaptation action: Data collection on gendered climate impacts					
To generate detailed data on how climate change impacts men and women differently,	Number of gender-focused studies conducted	Medium term	Funding for data collection Research tools and resources	Kintampo Municipal Assembly (lead), research institutions, advocacy groups	200,000–700,000

The Kintampo Municipal Assembly Climate Adaptation Plan: Ghana

Objectives	Indicators of success	Time frame	Resources (finance, human, technology)	Implementing partners	Estimated cost (GH¢)
informing targeted adaptation measures.	Policy changes based on research findings Improved gender equity in adaptation measures		Skilled personnel for gender-focused research		
Adaptation action: Climate finance access					
To facilitate access to funding for climate-resilient technologies and practices, especially for women and marginalized groups.	Number of farmers accessing climate finance Increased investment in climate-smart technologies Improved financial resilience	Medium to long term	Loan facilities Institutional frameworks for financial distribution Training on financial literacy	Kintampo Municipal Assembly (lead), financial institutions, agricultural cooperatives	500,000–2,000,000
Adaptation action: Collaborative research					
To promote partnerships among stakeholders to advance inclusive and gender-responsive climate adaptation strategies.	Number of collaborative research projects initiated Research outputs integrated into policies Increased stakeholder engagement	Medium term	Research funding Institutional support for partnerships Technical resources for collaborative projects	Kintampo Municipal Assembly (lead), research institutions, local NGOs	180,000–550,000

Source: Adaptation options prioritization workshop, 2025. Estimated cost (GH¢) figures are approximate and subject to change based on fluctuating exchange rates (USD 1 ≈ GH¢ 10.25 at time of estimation) and local market prices (June 10, 2025).

4.0 Strategic Funding and Investment Framework

4.1 Introduction

The implementation of climate adaptation measures in the Kintampo Municipality necessitates a tailored and strategic approach to funding that reflects the unique vulnerabilities and opportunities within the district. The Kintampo Municipality faces multifaceted climate challenges, including erratic rainfall, deforestation, water scarcity, and agricultural productivity losses, which demand targeted financial strategies.

This framework aims to achieve two primary objectives: to identify and mobilize diverse funding sources and to establish clear criteria for prioritizing resource allocation. These objectives are grounded in the municipality's commitment to addressing climate vulnerabilities while fostering economic growth, environmental sustainability, and social equity.

Kintampo's funding strategy emphasizes leveraging a mix of local, national, and international financial streams. This includes mobilizing resources from government budgets, engaging with global climate funds, fostering public-private partnerships, and empowering local communities to contribute actively. Such an approach ensures financial resilience, especially in the context of fluctuating economic conditions and evolving climate risks.

Prioritization of funding will be guided by the municipality's development agenda, focusing on actions that address the most pressing climate risks, maximize community benefits, and ensure long-term sustainability. Special emphasis will be placed on gender-responsive programs, ecosystem-based solutions, and initiatives that enhance local capacity for climate resilience.

This framework serves as a roadmap to secure and manage the financial resources required for transforming Kintampo's Adaptation Plan into actionable solutions, aligning global best practices with local realities for a sustainable and resilient future.

4.2 Potential Funding Sources for Kintampo

The implementation of climate adaptation strategies in the Kintampo Municipality hinges on securing diverse funding streams that align with its specific vulnerabilities and priorities. Kintampo faces critical challenges, including deforestation, unreliable water supplies, agricultural stress due to erratic rainfall, and limited infrastructure resilience. The following funding sources are identified as key enablers for addressing these challenges.

4.2.1 Government Funding (National and Local)

Government funding remains a critical pillar in addressing Kintampo climate adaptation needs, providing essential financial support for implementing projects that align with national development goals and the unique vulnerabilities of the district. Given the municipality's reliance on rain-fed agriculture, vulnerable ecosystems, and limited infrastructure, targeted government support is essential to mitigate climate risks, enhance resilience, and sustain livelihoods.

Kintampo's adaptation priorities include improving water resource management, promoting sustainable agriculture, rehabilitating forests, and building disaster-resilient infrastructure. These priorities align with Ghana's broader climate strategies, including the National Climate Change Policy (NCCP) and the National Adaptation Plan, which emphasize resource mobilization at both national and local levels.

Key government funding mechanisms:

- **Climate Financing Division in the Ministry of Finance:** The Climate Change Fund provides targeted funding for climate adaptation and mitigation projects in vulnerable communities. This fund can address Kintampo's adaptation needs by supporting:
 - Water resource management: Funding rainwater harvesting and borehole development to improve water security for agriculture and households.
 - Forestry rehabilitation: Financing reforestation programs to combat deforestation and restore degraded forest areas.
 - Community resilience: Supporting disaster preparedness training and early warning systems to minimize the impact of extreme weather events.
- **District Assemblies Common Fund (DACF):** The DACF is a critical resource for local-level projects. It allows assemblies like Kintampo to design and implement grassroots adaptation measures, including:
 - Small-scale irrigation systems: Providing farmers with affordable and efficient water systems to reduce reliance on rainfall.
 - Training in climate-smart practices: Funding workshops and demonstrations to equip farmers with sustainable agricultural techniques, such as conservation agriculture.
 - Rural infrastructure: Financing the construction of flood-resilient roads and drainage systems to reduce damage during heavy rains.
- **Ministry of Food and Agriculture (MoFA):** MoFA provides sector-specific funding to enhance food security and support farmers. It is particularly relevant for:
 - Drought-resistant crops: Distributing improved crop varieties suitable for Kintampo's changing climate.
 - Farmer cooperatives: Establishing cooperatives to improve access to resources and markets.
 - Agroforestry promotion: Encouraging the integration of trees into farming systems to reduce erosion and enhance soil fertility.
- **Ministry of Environment, Science, Technology, and Innovation (MESTI):** MESTI supports innovative and nature-based climate adaptation strategies. Funding opportunities include:
 - Reforestation and biodiversity conservation: Supporting the establishment of community-managed forest reserves.

- Sustainable energy solutions: Introducing solar-powered irrigation and water systems to reduce energy costs and improve water access.
 - Climate impact research: Funding localized studies to assess vulnerabilities and design evidence-based interventions.
- **Ghana Infrastructure Investment Fund (GIIF):** The GIIF supports large-scale infrastructure projects that enhance resilience to climate impacts. For Kintampo, this fund can finance:
 - Flood-resilient roads and bridges: Upgrading transport networks to withstand extreme weather.
 - Drainage systems: Developing urban and rural drainage to manage flood risks.
 - Renewable energy infrastructure: Supporting the deployment of solar-powered systems in rural communities.
- **Forestry commission funding:** The Forestry Commission supports programs to combat deforestation and promote sustainable land use. In Kintampo, this funding can be used for:
 - Forest restoration projects: Planting native tree species to rehabilitate degraded lands.
 - Community-based conservation: Engaging local communities in managing and protecting forest resources.
 - Fuelwood alternatives: Promoting the adoption of biomass briquettes to reduce pressure on forest resources.

4.2.2 International Aid and Grants

International aid and grants play a critical role in bridging the resource gaps required for implementing climate adaptation measures in Kintampo. These funding sources provide both financial and technical support to address pressing climate vulnerabilities such as erratic rainfall, deforestation, declining agricultural productivity, and inadequate water resources. By tapping into international mechanisms, Kintampo can accelerate its efforts to build resilience across sectors while ensuring sustainability.

The Green Climate Fund (GCF), established under the United Nations Framework Convention on Climate Change (UNFCCC), is one of the largest climate finance mechanisms available to developing countries. GCF offers significant funding opportunities for both mitigation and adaptation projects. For Kintampo, GCF resources could be directed toward agroforestry promotion and the restoration of degraded forests, addressing the district's urgent need to combat deforestation and enhance ecosystem services. Additionally, the fund could support the installation of solar-powered water systems to improve access to reliable water supplies for agriculture and household use, mitigating the impacts of erratic rainfall and prolonged droughts.

Similarly, the Adaptation Fund, also established under the UNFCCC, is well-suited for financing localized, community-driven adaptation projects in Kintampo. This fund emphasizes initiatives that enhance the resilience of vulnerable populations. In Kintampo, it could be used to develop rainwater harvesting systems in underserved areas or to upgrade health facilities to address climate-induced health risks, such as heat-related illnesses and waterborne diseases. The Adaptation Fund's focus on

direct community benefits aligns with Kintampo's priority to empower local populations while building resilience.

The Global Environment Facility (GEF) is another critical source of international funding, offering grants for projects that address biodiversity conservation, land restoration, and sustainable land use. For Kintampo, the GEF could support community-based reforestation programs aimed at restoring degraded lands and protecting watersheds. Such projects not only combat deforestation but also provide alternative livelihoods for forest-dependent communities, aligning with the district's goals of poverty alleviation and ecosystem restoration.

Bilateral partnerships with development agencies such as Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ), and the UK's Foreign, Commonwealth & Development Office (FCDO) present additional opportunities for Kintampo. These organizations often fund projects that integrate climate resilience into local development. For example, GIZ could provide technical and financial support for training programs on climate-smart agriculture, equipping farmers with the skills to adopt sustainable practices like crop rotation and soil conservation.

In addition to bilateral aid, global philanthropic organizations such as the Gates Foundation and the Rockefeller Foundation have demonstrated a commitment to funding innovative solutions for climate adaptation. These foundations can provide grants for projects like mobile-based weather information systems, which would enable Kintampo's farmers to make informed decisions about planting and harvesting. Philanthropic support could also fund educational campaigns to raise awareness about the benefits of adopting climate-smart practices.

Multilateral development banks (MDBs), including the World Bank and the African Development Bank (AfDB), offer concessional loans and grants for large-scale infrastructure projects. Kintampo could leverage these resources to construct flood-resilient roads and drainage systems, which are critical for reducing the impacts of extreme weather events on livelihoods and infrastructure. These banks also support renewable energy installations, such as solar grids, which could be deployed in off-grid areas to enhance energy access.

Lastly, the Climate Investment Funds (CIF), through programs like the Pilot Program for Climate Resilience (PPCR), provide opportunities to integrate climate resilience into municipal planning. For Kintampo, this could mean securing funding to align its adaptation strategies with national policies, such as Ghana's National Adaptation Plan, while focusing on vulnerable groups like women and youth.

4.2.3 Public-Private Partnerships

Public-private partnerships (PPPs) represent a transformative approach to addressing climate adaptation challenges in the Kintampo Municipality. Leveraging the financial resources, technological expertise, and operational efficiency of private sector actors, PPPs can complement public sector efforts to implement large-scale, high-impact projects that build resilience to climate change. In Kintampo, where vulnerabilities include deforestation, inadequate water resources, and limited infrastructure, PPPs can be instrumental in bridging the resource and capacity gaps.

One of the key areas where PPPs can create significant impact—particularly from an adaptation perspective—is the deployment of renewable energy solutions to strengthen the resilience of basic services such as rural electrification and water supply systems. Solar-powered water systems, for example, offer a climate-resilient response to increasing water scarcity and erratic power supply—both of which are exacerbated by rising temperatures, prolonged dry spells, and unpredictable rainfall patterns. By ensuring a steady and decentralized supply of water for agricultural and domestic use, these systems enhance community adaptive capacity in the face of worsening climate variability.

From a mitigation standpoint, these systems also contribute to reducing greenhouse gas emissions by replacing fossil fuel-based energy sources. However, the primary value in this context is adaptive, ensuring that vulnerable communities can maintain access to essential water and energy services under changing climate conditions. Through PPPs, private actors provide technical expertise and maintenance support, while the municipal assembly facilitates alignment with local priorities and ensures that infrastructure is accessible, affordable, and climate resilient.

PPPs can also play a pivotal role in climate-resilient infrastructure development. The construction of flood-resistant roads and bridges is critical for minimizing disruptions caused by extreme weather events, such as heavy rainfall and flooding, which are common in Kintampo. Through PPPs, the private sector could provide the capital and engineering expertise needed to implement such projects, while the public sector ensures that these developments align with national climate policies and local needs. These partnerships not only enhance infrastructure resilience but also create employment opportunities for local residents.

In the agricultural sector, PPPs can support the adoption of climate-smart technologies, such as precision farming tools and improved irrigation systems. Private agribusinesses and technology firms could collaborate with the municipality to introduce these innovations, reducing farmers' vulnerability to erratic rainfall and improving productivity. For example, drip irrigation systems—although costly for individual farmers—can become more accessible through co-financing arrangements between the public sector and private entities. This approach fosters inclusive growth by enabling smallholder farmers to adapt to climate challenges.

Another critical area for PPPs is forest conservation and ecosystem restoration. Deforestation is a significant issue in Kintampo, threatening biodiversity and increasing the risk of soil erosion. Partnerships with private forestry companies and environmental organizations can facilitate large-scale reforestation efforts. These initiatives could involve tree planting campaigns, agroforestry projects, and the sustainable harvesting of timber and non-timber products. Private sector involvement ensures the availability of financial resources and technical expertise, while the public sector provides regulatory oversight and facilitates community engagement.

Additionally, PPPs offer an avenue for implementing waste management solutions that promote both climate adaptation and mitigation. Waste-to-energy projects, for example, can transform agricultural and organic waste into renewable energy sources, reducing methane emissions while providing clean energy to communities. Private firms specializing in waste management can invest in the necessary infrastructure and technologies, supported by the municipality's regulatory framework and incentives.

To maximize the effectiveness of PPPs, the Kintampo Municipality must establish a conducive environment for collaboration. This includes developing clear policies, offering incentives such as tax breaks for private investors, and ensuring transparency in project implementation. Regular stakeholder consultations are also essential to align private sector interests with public sector goals and community needs.

4.2.4 Community and Local Fundraising

Community and local fundraising are vital for mobilizing resources to address the Kintampo Municipality's unique climate vulnerabilities, including erratic rainfall, deforestation, and agricultural productivity challenges. These approaches rely on the active participation of residents, traditional leaders, and local businesses to raise funds and contribute in-kind support for climate adaptation projects. Below are the key mechanisms tailored to Kintampo's context.

Savings Groups and Cooperatives

Savings groups and cooperatives provide a platform for collective financial resource mobilization, particularly in agricultural communities. In Kintampo, farmer cooperatives, women's groups, and youth associations can pool resources to support small-scale adaptation projects. For instance, cooperatives could fund community-led rainwater harvesting systems or invest in agroforestry programs that integrate trees into farmlands, improving soil fertility and reducing erosion. These groups are particularly effective in fostering inclusivity, as they enable even low-income households to contribute to and benefit from adaptation initiatives.

In-Kind Contributions

In-kind contributions, such as labour, materials, and equipment, reduce the financial burden of climate adaptation projects while fostering a sense of community ownership. In Kintampo, residents can provide labour for reforestation campaigns, such as planting trees to restore degraded lands and stabilize watersheds. Similarly, community members can supply locally available materials, like sand and stones, for constructing small-scale flood defences. These contributions ensure that projects are implemented cost-effectively while engaging local populations in meaningful ways.

Local Fundraising Events

Local fundraising events integrated into cultural and social activities offer a creative way to raise resources. In Kintampo, traditional festivals, such as yam or harvest festivals, could include fundraising activities like auctions, raffles, or community competitions. Proceeds from these events could be directed toward projects like borehole construction or training sessions on climate-smart agriculture. Tying fundraising efforts to cultural events, the municipality can enhance community participation and align initiatives with local traditions.

Partnerships With Local Businesses

Local businesses, including agro-processors, timber companies, and traders, are critical stakeholders in climate adaptation. These businesses can sponsor specific projects that align with their operations and benefit the wider community. For example, timber companies could co-finance reforestation

programs to ensure sustainable wood supply while contributing to ecosystem restoration. Similarly, agro-processors could sponsor solar-powered irrigation systems, ensuring consistent agricultural output and reducing water stress during dry seasons. Such partnerships create a win-win situation, where businesses enhance their reputations while supporting local development.

Voluntary Contributions and Micro-Donations

Voluntary contributions from individuals and households can collectively fund impactful projects. In Kintampo, households could contribute small amounts to a community fund dedicated to projects like improving rural drainage systems or purchasing drought-resistant seeds. Leveraging mobile money platforms can further simplify micro-donations, allowing residents to contribute conveniently. This approach ensures that everyone, regardless of income level, can participate in building resilience within their communities.

Engaging Religious and Traditional Leaders

Religious and traditional leaders in Kintampo are influential figures who can rally communities to support climate adaptation initiatives. Chiefs, elders, pastors, and imams can advocate for fundraising efforts during community meetings, religious gatherings, and cultural events. For example, churches and mosques could host environmental stewardship campaigns, encouraging congregants to donate toward reforestation or water management projects. Traditional leaders could use their platforms to promote voluntary labour contributions for community infrastructure upgrades, such as building flood-resilient roads.

Leveraging Local Knowledge and Expertise

Local knowledge and expertise are invaluable assets in designing and implementing adaptation projects. Farmers in Kintampo possess indigenous knowledge on water conservation techniques and soil management practices that can inform sustainable agriculture initiatives. Similarly, local artisans and craftsmen can contribute to constructing climate-resilient infrastructure, such as culverts and retaining walls. Integrating local expertise into adaptation efforts ensures that projects are practical, cost-effective, and culturally appropriate.

4.2.5 Innovative Financing Mechanisms

Innovative financing mechanisms present an opportunity for the Kintampo Municipality to secure sustainable resources for implementing climate adaptation projects. These mechanisms go beyond conventional funding approaches by combining market-based tools, incentives, and partnerships to address critical challenges such as water scarcity, deforestation, and the need for climate-resilient agriculture. They are designed to create financial pathways that not only address Kintampo's immediate vulnerabilities but also promote long-term environmental sustainability and economic growth.

Green bonds are financial tools issued to fund environmentally sustainable projects, providing a viable solution for Kintampo's infrastructure and energy needs. In Kintampo, green bonds could be used to finance the construction of flood-resilient infrastructure in flood-prone areas, such as upgraded drainage systems and weather-resistant roads. Additionally, these bonds could support solar-powered

irrigation schemes that would address water scarcity and increase agricultural productivity. Kintampo's commitment to climate-smart projects would attract both national and international investors interested in contributing to sustainable development.

Payments for ecosystem services (PES) are financing arrangements where beneficiaries of ecosystem services—such as clean water, biodiversity, and carbon storage—pay those who manage or restore these ecosystems. In Kintampo, PES schemes could incentivize communities to participate in forest conservation and sustainable land use practices. For instance, industries downstream that rely on stable water supplies could provide payments to upstream communities for maintaining forest cover, which stabilizes water flows and reduces erosion.

Carbon markets offer a platform for Kintampo to generate revenue by reducing greenhouse gas emissions through reforestation, afforestation, and sustainable energy projects. Communities engaging in tree planting or adopting biomass briquettes to reduce reliance on traditional fuelwood could generate carbon credits. These credits could then be sold to industries or organizations seeking to offset their emissions. For example, implementing large-scale reforestation programs in Kintampo's degraded forest areas could not only restore biodiversity but also create a steady revenue stream. Carbon market participation would require capacity building for local stakeholders to manage and report emissions reductions effectively.

Blended finance combines public and private sector resources to de-risk investments in large-scale adaptation projects. For Kintampo, this mechanism could attract private sector funding for renewable energy installations, such as community solar grids, by supplementing the investment with public grants or concessional loans. Similarly, blended finance could support the construction of flood-resilient housing in vulnerable areas, with public funds used to lower financial risks for private investors.

This approach ensures that transformative projects—such as large-scale irrigation systems or renewable energy hubs—are financially feasible, while aligning public and private interests for mutual benefit.

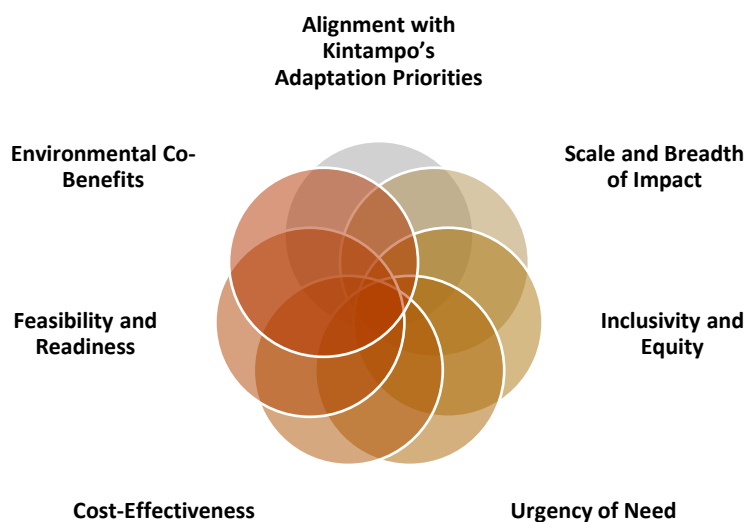
Impact investments are financial commitments made with the intention of generating measurable social and environmental benefits alongside financial returns. Kintampo could attract impact investors for projects like community-based renewable energy initiatives or eco-tourism development. For instance, establishing sustainable agro-processing facilities could reduce post-harvest losses, improve farmer incomes, and support food security—all while offering economic returns to investors. Impact investment projects in Kintampo should highlight clear benefits, such as reduced vulnerability to climate change, improved livelihoods, and alignment with global sustainability goals.

4.3 Criteria for Allocation and Prioritization of Funds

Efficient allocation and prioritization of funds are essential for ensuring that the Kintampo Municipality effectively addresses its climate adaptation challenges, including erratic rainfall, deforestation, agricultural vulnerabilities, and water scarcity. A well-defined set of criteria ensures that resources are directed toward impactful, equitable, and sustainable projects. The following

sections provide an in-depth expansion of each criterion, demonstrating their relevance to Kintampo’s unique context.

Figure 12. Criteria for allocation and prioritization of funds



Source: Authors

1. Alignment with Kintampo’s adaptation priorities

Adaptation projects must address the most critical vulnerabilities identified in Kintampo’s Climate Change Vulnerability Assessment report (Government of Ghana, 2024). These priorities include water resource management, sustainable agriculture, reforestation, and infrastructure resilience. Projects that directly support these goals will be prioritized to ensure coherence with the municipality’s broader development strategy. For example, funding for agroforestry initiatives aligns with KiMA’s need to combat deforestation and soil degradation while enhancing livelihoods. Similarly, water resource projects such as boreholes and rainwater harvesting systems address the pressing challenge of water scarcity, particularly in underserved rural areas. Alignment ensures that resources are used strategically to achieve meaningful and measurable progress.

2. Scale and breadth of impact

The scale and breadth of a project’s impact are essential factors in prioritization. Projects that benefit large segments of the population or address widespread vulnerabilities are prioritized to maximize the value of limited resources. For instance, constructing flood-resilient roads and drainage systems would have far-reaching benefits by safeguarding both infrastructure and livelihoods during extreme weather events. In KiMA, reforestation programs covering degraded forest areas would impact the broader ecosystem while providing tangible benefits to farmers and downstream water users. Projects with multi-sectoral impacts, such as agroforestry systems that improve soil health, increase agricultural productivity, and sequester carbon, are particularly valued.

3. Inclusivity and equity

Equity is a cornerstone of fund allocation, ensuring that vulnerable and marginalized groups—such as women, youth, and low-income households—are not left behind. In the Kintampo metropolis, women and youth play critical roles in agriculture and natural resource management but often face barriers to accessing resources and training. Adaptation initiatives that address these disparities, such as gender-responsive programs or youth-focused agricultural training, will receive priority funding. For example, a program offering women-led cooperatives access to drought-resistant seeds and training on climate-smart farming techniques not only promotes inclusivity but also strengthens food security and household resilience. Equity-focused projects ensure that benefits are distributed fairly and foster broader community support for adaptation efforts.

4. Urgency of need

Given the immediate threats posed by climate change, projects addressing critical and time-sensitive vulnerabilities will be prioritized. For instance, communities in flood-prone areas require urgent investments in drainage systems, flood defences, and resilient housing to minimize losses during extreme weather events. Similarly, areas experiencing prolonged dry spells would benefit from fast-tracked funding for boreholes and small-scale irrigation systems to stabilize water supply.

Prioritizing urgent needs ensures that funding is directed to areas where it will have the most immediate and life-saving impact. This approach helps avert crises while laying the foundation for long-term adaptation.

5. Cost effectiveness

Cost effectiveness is essential to maximize the impact of limited funds. Projects must demonstrate efficient use of resources by achieving significant outcomes relative to their costs. For instance, community-led reforestation programs—relying on local labour and in-kind contributions—are cost-effective compared to mechanized restoration projects. Similarly, training farmers on low-cost climate-smart practices, such as crop rotation and composting, yields high returns in terms of productivity and sustainability.

Cost-effective projects allow Kintampo to stretch its resources further while delivering tangible benefits to communities. This criterion also ensures accountability by prioritizing initiatives that make prudent use of public and donor funds.

6. Feasibility and readiness

Feasibility assesses whether a project can be successfully implemented given existing technical, institutional, and operational capacities. Projects with well-defined implementation plans, clear timelines, and reliable technical support are more likely to succeed and, therefore, receive priority funding. For example, a reforestation program with established nursery sites, community buy-in, and trained facilitators demonstrates readiness for execution.

Feasibility also includes institutional backing, such as support from local government departments or NGOs. Ensuring that projects are realistic and achievable minimizes delays and enhances the likelihood of successful outcomes.

7. Environmental co-benefits

Adaptation projects that deliver additional environmental benefits are highly valued. For instance, agroforestry programs in Kintampo not only improve soil fertility and support agriculture but also enhance biodiversity, sequester carbon, and stabilize water cycles. Similarly, conservation agriculture practices reduce erosion, improve water retention, and enhance ecosystem services.

Projects with multiple environmental co-benefits help address interconnected challenges, making them more impactful and sustainable. These initiatives also align with global goals, such as reducing greenhouse gas emissions and promoting biodiversity conservation.

8. Long-term sustainability and scalability

Sustainability ensures that funded projects continue to deliver benefits long after their initial implementation phase. In Kintampo, community-managed water systems or cooperatively run agroforestry projects are examples of sustainable initiatives that empower local populations to maintain and scale their benefits.

Scalability is another critical factor—projects that can be expanded to other areas of Kintampo or replicated in similar contexts are prioritized. For instance, piloting a successful rainwater harvesting system in one community could inform broader rollouts across the municipality.

9. Community participation and ownership

Projects that actively involve local communities in planning, implementation, and management foster ownership, accountability, and long-term success. In Kintampo, community-driven initiatives, such as village-led reforestation efforts or participatory water resource management, ensure that projects are culturally appropriate and meet local needs.

Engaging communities in adaptation projects not only builds trust but also enhances their capacity to sustain these efforts over time. When communities feel ownership of projects, they are more likely to protect and maintain the investments.

10. Potential for leveraging additional funding

Projects that attract co-funding from external sources, such as international donors, government programs, or private sector partners, will be prioritized. For example, a solar-powered irrigation project co-funded by international aid organizations and local businesses leverages additional resources while reducing the financial burden on the municipality.

Leveraging external funding also enhances the municipality's credibility, demonstrating its ability to manage resources effectively and deliver impactful projects. This criterion ensures that Kintampo maximizes its financial resources by building strategic partnerships.

4.4 Implementation Process

1. **Scoring and ranking:** Each project will be evaluated against the criteria and scored based on its alignment with priorities, feasibility, and potential impact. High-scoring projects will be prioritized.
2. **Stakeholder consultations:** Regular consultations with local communities, NGOs, government agencies, and private sector stakeholders ensure that prioritization reflects diverse perspectives and needs.
3. **Monitoring and evaluation:** A robust monitoring framework will track the progress and outcomes of funded projects, ensuring accountability and providing insights for future adaptation efforts.

5.0 Framework for Adaptation Monitoring, Evaluation, and Learning

5.1 Introduction

The framework for monitoring, evaluation, and learning (MEL) is an essential component of the Kintampo Municipality's climate adaptation plan. It ensures that adaptation measures are effectively implemented, progress is continuously tracked, and lessons learned are integrated into future planning. This framework is particularly critical given Kintampo's vulnerabilities to erratic rainfall, deforestation, agricultural challenges, and water scarcity, which require adaptive and evidence-based approaches to address effectively.

The MEL framework is designed to provide a systematic approach to evaluating the success of adaptation initiatives, measuring their impact on vulnerable communities—including women, youth, persons with disabilities, and informal workers—and identifying opportunities for improvement. It goes beyond traditional monitoring and evaluation by incorporating a learning component that captures best practices, promotes innovation, and enhances resilience at both community and municipal levels.

Aligned with Ghana's National Adaptation Plan (NAP), the framework ensures accountability and transparency by engaging stakeholders, including local communities, municipal authorities, NGOs, and funding partners. The participatory nature of the MEL framework fosters inclusivity and ensures that the voices, priorities, and capacities of women and marginalized groups are integrated throughout the adaptation process. It also emphasizes the importance of data-driven decision making, using measurable indicators to assess project outcomes and inform future interventions.

Objectives of the MEL Framework

The objectives of the MEL framework for the Kintampo Municipality are centered on ensuring that adaptation initiatives are effective, equitable, gender-responsive, and sustainable. By clearly defining goals and establishing measurable outcomes, the framework enhances the ability of stakeholders to assess progress, address challenges, and improve future interventions. The key objectives are as follows:

- **Track progress and performance:** To monitor the implementation of adaptation projects and evaluate their progress against predefined targets. This ensures that interventions remain on schedule and within budget, while delivering expected results (see Beauchamp et al., 2024).
- **Assess effectiveness and impact:** To evaluate the effectiveness of adaptation measures in reducing vulnerabilities, enhancing resilience, and achieving long-term sustainability. This includes assessing gender-specific outcomes, such as women's access to adaptation resources or leadership roles.
- **Promote accountability and transparency:** To establish clear mechanisms for accountability by providing stakeholders, including government agencies, donors, and local communities,

with evidence-based insights into how resources are being used and the outcomes achieved. All reports will include sex- and age-disaggregated data.

- **Foster learning and knowledge sharing:** To capture lessons learned, best practices, and innovations from adaptation efforts and disseminate them across sectors and communities. This promotes continuous improvement and informs the design of future projects. Case studies will also highlight gender-transformative practices.
- **Support adaptive management:** To enable real-time adjustments to projects and policies based on monitoring and evaluation findings. This ensures that adaptation efforts remain flexible and responsive to changing conditions and emerging challenges.
- **Strengthen institutional and community capacity:** To enhance the capacity of municipal authorities, local communities, and other stakeholders to implement, monitor, and evaluate adaptation measures effectively. This includes training, technical assistance, and the provision of tools and resources for data collection and analysis. Training and mentorship will target women leaders, youth groups, and underrepresented stakeholders.
- **Align with national and global goals:** To ensure that Kintampo's adaptation efforts align with Ghana's National Adaptation Plan (NAP), the Sustainable Development Goals (SDGs), and other international climate frameworks—including SDG 5 on gender equality and the UNFCCC Gender Action Plan.

5.2 MEL Design for the Kintampo Municipal Assembly

The MEL framework for the Kintampo Municipal Assembly is tailored to address the unique vulnerabilities and priorities of the region. Climate risks such as erratic rainfall, deforestation, and declining agricultural productivity require a robust system for tracking progress, evaluating results, and integrating lessons learned. This framework emphasizes a participatory approach, inclusivity, and adaptive management to ensure that adaptation initiatives are impactful, sustainable, and aligned with the needs of Kintampo's residents.

5.2.1 Monitoring Framework

Monitoring will focus on both quantitative and qualitative data—including gender-disaggregated and intersectional insights—to provide a holistic view of project progress. Monitoring will cover:

- Infrastructure projects like boreholes and flood defences
- Community-led initiatives such as agroforestry and conservation agriculture
- Participation and leadership of women and vulnerable groups in project design, decision making, and implementation

5.2.2 Objectives of the Monitoring Framework

1. Track progress of key adaptation measures: The monitoring framework ensures that projects such as irrigation systems, rainwater harvesting, and reforestation efforts are implemented according to

schedule and meet their intended objectives. Progress tracking allows stakeholders to assess whether resources are being utilized effectively and whether timelines are being met.

2. Identify challenges and enable timely corrections: One of the key objectives is to detect potential delays, resource shortages, or operational challenges during project implementation. Early identification allows for swift corrective measures, ensuring that projects remain on track.

3. Ensure accountability and transparency: The monitoring framework provides a mechanism for reporting progress to all stakeholders, including local communities, municipal authorities, NGOs, and donors. Transparent reporting builds trust and ensures that resources are used responsibly.

4. Enable data-driven decision making: Reliable data collected through monitoring informs evidence-based decisions, allowing for the optimization of project designs and resource allocation. This ensures that adaptation measures are effective and responsive to changing conditions.

5. Promote gender equity and inclusion: Track gender-related indicators (e.g., percentage of women accessing advisory services or involved in leadership roles) and ensure women's lived experiences shape adaptation interventions.

6. Evaluate long-term impacts: Monitoring goes beyond immediate results by assessing the long-term sustainability of adaptation measures. This includes evaluating whether projects have achieved their goals of reducing vulnerabilities and building resilience.

5.2.3 Key Indicators and Metrics

To ensure the success of adaptation initiatives, a set of tailored indicators and metrics will be used to track progress and assess impacts. These indicators are aligned with Kintampo's specific climate challenges and socio-economic priorities.

Key Indicators and Metrics

1. Reduction in climate vulnerabilities: Indicators will measure the extent to which adaptation initiatives have reduced the risks posed by climate hazards, such as droughts, floods, and deforestation.

Example: Monitoring the decrease in flood-related damages to homes and infrastructure after the construction of drainage systems.

2. Community participation rates: Indicators will track the engagement of local communities in adaptation projects, with a focus on inclusivity and equity.

Example: Assessing the participation of women and youth in tree-planting campaigns or training programs on climate-smart agriculture.

3. Environmental recovery metrics: Metrics will evaluate the restoration of ecosystems, such as forest cover, water resources, and biodiversity.

Example: Measuring improvements in vegetation cover in areas undergoing reforestation.

4. Agricultural productivity: Indicators will assess the effectiveness of climate-smart farming practices in improving yields and reducing losses due to climate variability.

Example: Tracking the adoption of drought-resistant crops and the corresponding increase in yields.

5. Infrastructure sustainability: Metrics will evaluate the durability and performance of infrastructure projects, such as boreholes, flood barriers, and irrigation systems.

Example: Monitoring the long-term functionality of water supply systems in rural areas.

5.2.4 Data Collection Methods

The MEL framework employs a combination of innovative and traditional methods to gather reliable and inclusive data. All survey tools and Focus Group Discussion protocols will be designed to collect sex- and age-disaggregated data. CSOs working with women, persons with disabilities, and youth will facilitate inclusive reporting. Participatory rural appraisal tools will be tailored to capture diverse perspectives, especially from women in farming or trading. These methods are designed to reflect Kintampo's socio-economic and environmental context.

1. Community-based reporting: Local communities will be empowered to collect and report data using mobile technology and participatory tools. This approach fosters ownership and ensures that data reflects on-the-ground realities.

2. Remote sensing and GIS technology: Satellite imagery and GIS mapping will track changes in land use, forest cover, and water resources. This method provides precise spatial data to inform decision making.

3. Household surveys and focus groups: Surveys and focus groups will capture qualitative and quantitative insights from project beneficiaries, ensuring that their perspectives are integrated into the evaluation process.

4. Environmental sensors: Sensors will be deployed to measure critical environmental parameters, such as rainfall, soil moisture, and water quality.

5. Integration of traditional knowledge: Local knowledge systems will complement scientific data, providing context-specific insights into climate patterns and adaptation practices.

5.2.5 Roles and Responsibilities

To ensure the effective implementation of the MEL framework, clear roles and responsibilities will be assigned to various stakeholders:

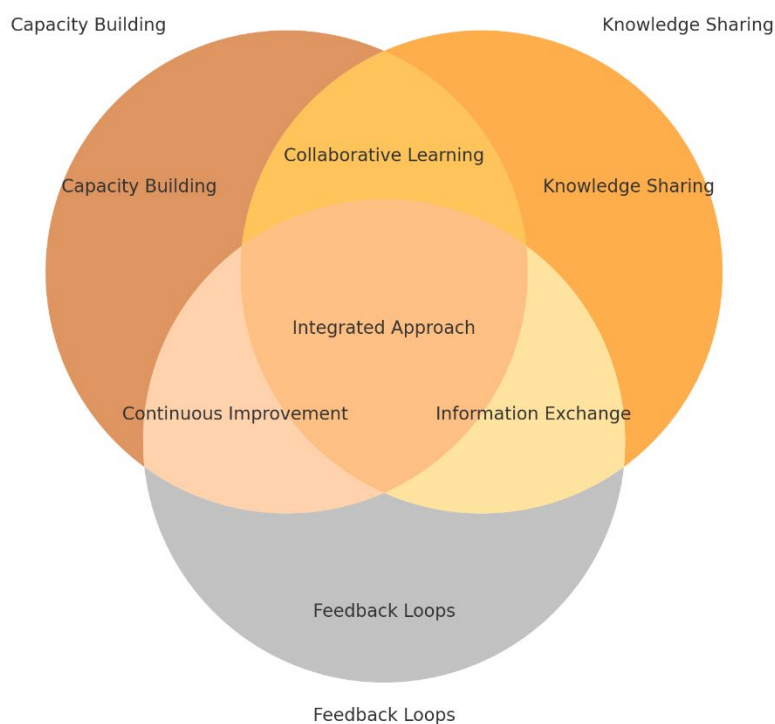
- **The Kintampo Municipal Assembly:** The assembly will oversee MEL activities, ensuring alignment with district development plans and national policies.

- **Community members and groups:** Local groups, including women's associations and youth clubs, will actively participate in monitoring and data collection.
- **Traditional leaders:** Chiefs and elders will mobilize community participation and contextualize findings based on local knowledge.
- **NGOs and academic partners:** These stakeholders will provide technical expertise, conduct independent evaluations, and build capacity for data collection and analysis.
- **Project implementation teams:** Teams responsible for executing projects will collect and manage data, ensuring compliance with MEL requirements.

5.2.6 Learning and Adaptive Management

The learning component ensures that insights from MEL activities are used to refine future projects and improve adaptation strategies. Learning materials and capacity-building programs will be gender-sensitive, accessible to women and girls, and designed to bridge digital or literacy gaps.

Figure 13. Learning and adaptive management



Source: Authors

1. **Feedback loops:** Regular feedback from stakeholders is integrated into project planning and implementation. Feedback will be drawn from focus groups with women's associations, youth leaders, and traditional authorities.
2. **Knowledge sharing:** Lessons learned are disseminated across sectors and communities to promote innovation and scalability.

3. **Capacity building:** Training programs will enhance the skills of municipal staff, community members, and partners in MEL implementation.

5.3 Steps in Implementing the MEL Framework

The implementation of the MEL framework in the Kintampo Municipal Assembly requires a structured and phased approach to ensure efficiency, inclusivity, and alignment with the municipality's climate adaptation goals. At each step, gender-sensitive tools and frameworks (e.g., gender scorecards, social audits) will be applied to ensure inclusive outcomes. The steps outlined below are designed to integrate data collection, stakeholder involvement, and adaptive management seamlessly.

1. **Establish baselines and targets:** define the starting point for monitoring and the specific goals for each adaptation project. This step ensures that progress can be measured accurately over time.
2. **Develop monitoring and evaluation plans:** create detailed plans outlining key performance indicators (KPIs), data collection methods, timelines, and roles and responsibilities.
3. **Build capacity for implementation:** train stakeholders, including municipal staff, community members, and project teams, on data collection tools, reporting methods, and adaptive management techniques.
4. **Conduct participatory data collection:** engage stakeholders in gathering quantitative and qualitative data to ensure inclusivity and accuracy.
5. **Analyze and validate data:** compile and analyze data to assess project performance and identify trends or challenges. Validation ensures data accuracy and stakeholder confidence.
6. **Generate reports and share findings:** produce clear and accessible reports to inform stakeholders about project progress, challenges, and successes.
7. **Facilitate stakeholder feedback:** organize regular meetings and workshops to gather input from stakeholders and incorporate their perspectives into the evaluation process.
8. **Apply learning to improve adaptation strategies:** use insights from monitoring and evaluation to refine current projects and inform the design of future initiatives.
9. **Establish feedback loops for continuous improvement:** create mechanisms for ongoing learning and adaptation, ensuring that MEL results are integrated into municipal planning processes.

5.4 Sustainability of the MEL Framework

Ensuring the sustainability of the MEL framework in Kintampo requires a long-term vision and commitment from all stakeholders. The following strategies will ensure that the MEL framework remains operational, impactful, and adaptive to changing conditions:

1. **Institutionalization of the MEL framework:** embed the MEL framework into the core operations of the Kintampo Municipal Assembly. This involves integrating MEL processes into municipal plans and budgets.
2. **Capacity building for long-term implementation:** continuously train municipal staff, community members, and project teams to sustain the MEL framework. Capacity building ensures that local stakeholders have the skills to manage monitoring and evaluation independently.
3. **Leveraging partnerships for technical and financial support:** build and maintain partnerships with NGOs, academic institutions, and international agencies to provide technical expertise and funding for MEL activities.
4. **Promoting community ownership:** foster local ownership of the MEL framework by actively involving community members in monitoring and decision-making processes. This ensures buy-in and sustained participation.
5. **Ensuring financial sustainability:** develop diverse funding streams to support MEL activities, including government allocations, donor contributions, and community fundraising.
6. **Adapting to evolving climate risks:** ensure the MEL framework remains flexible and responsive to new challenges and opportunities. This involves regular reviews and updates to the framework.
7. **Knowledge management and dissemination:** create a centralized system for storing and sharing MEL data, ensuring that lessons learned are accessible to all stakeholders.
8. **Strengthening feedback mechanisms:** develop systems for regular feedback between stakeholders to ensure that MEL results inform planning and implementation at all levels.
9. **Train gender focal persons:** establish trained gender leads within sector departments to guide MEL efforts.

6.0 Institutional Arrangements and Coordination Mechanisms

6.1 Introduction

In the Kintampo Municipality, the successful implementation of climate adaptation measures hinges on the strength of local institutions, the clarity of roles, and the integration of traditional and modern governance systems. As a municipality shaped by both ecological diversity and socio-economic vulnerability, Kintampo faces complex climate risks—ranging from bushfires and seasonal droughts to flooding and land degradation. Addressing these challenges demands an institutional framework that is not only technically competent but also inclusive, participatory, and grounded in local realities.

This chapter outlines the governance and coordination structures designed to support the Kintampo Municipal Adaptation Plan (KMAP). It builds upon the existing mandates of municipal departments, incorporates traditional leadership and community structures, and aligns with national climate policy instruments such as the National Adaptation Plan (NAP) and the National Climate Change Policy (NCCP). The framework emphasizes collaboration across scales—from community to national level—ensuring that adaptation actions are both locally owned and strategically aligned.

6.2 Lead Coordinating Entity: KiMA Climate Desk

The Climate Desk, situated within the Municipal Planning and Coordinating Unit (MPCU), will serve as the central coordinating body for the KMAP. This unit will ensure integration of climate adaptation into all facets of municipal governance, from planning and budgeting to monitoring and stakeholder engagement.

Key roles and responsibilities:

- Embed climate actions into the Medium-Term Development Plan (MTDP) and annual plans
- Coordinate implementation with decentralized departments and development partners
- Track adaptation outcomes through a municipal monitoring, evaluation, and learning system
- Liaise with regional and national climate institutions, including the Bono East Regional Coordinating Council, Environmental Protection Agency (EPA), MESTI, and NDPC.

6.3 Sectoral Leads and Institutional Responsibilities

KMAP interventions will be delivered through existing municipal structures (Table 11), with specific departments assigned to lead sectoral priorities.

Table 11. Sectoral leads and institutional responsibilities

Sector	Lead institution	Supporting stakeholders
Agriculture	Department of Agriculture	Farmer groups, NGOs, MoFA District Office
Water and sanitation	Municipal Works Unit	CWSA, community water boards
Health	Municipal Health Directorate	CHPS compounds, Red Cross, Environmental Health Unit
Livelihoods and gender	Social Welfare and Gender Desk	Women's and youth groups, training centres
Environment and forestry	Environmental Health and Forestry Unit	EPA, Forestry Commission, traditional authorities
Disaster preparedness	NADMO (District Office)	Fire service, Ghana police, Traditional councils

Source: Authors

Example: In areas like Gulumpe and Anyima, the Forestry Unit will coordinate with traditional leaders and fire service units to establish fire belts and train volunteer bushfire squads.

6.4 National and Regional Collaboration

To ensure policy coherence and technical support, KiMA will maintain close collaboration with key institutions:

- Ministry of Environment, Science, Technology and Innovation (MESTI) – Policy leadership and coordination of climate-related national programs.
- Environmental Protection Agency (EPA) – Oversight, technical support, and climate policy enforcement.
- Ghana Meteorological Agency (GMet) – Seasonal forecasts and early warning data.
- National Development Planning Commission (NDPC) – Monitoring and evaluation integration with national indicators.
- Bono East Regional Coordinating Council (RCC) – Oversight and facilitation of inter-district coordination.

6.5 Stakeholder Engagement and Coordination Mechanism

A Climate Adaptation Coordination Platform (CACP) will be established to enhance stakeholder engagement and inter-sectoral collaboration. This platform will convene municipal departments, traditional authorities, civil society, and private sector actors to co-lead the planning and implementation of KMAP.

Members will include:

- Representatives from all municipal departments

- Chiefs and traditional councils from climate hotspot communities
- Farmer and women's associations
- Local NGOs and CVOs
- Youth groups and persons with disabilities (PWDs)
- Private sector entities (e.g., agro-dealers, solar providers)

The CACP will meet twice a year to:

- Review progress and address implementation bottlenecks
- Validate annual adaptation work plans and MEL tools
- Facilitate learning and knowledge exchange across stakeholder groups

6.6 Capacity Building and Institutional Learning

To strengthen institutional readiness, the following capacity-building priorities will be implemented:

- Training for assembly staff on climate finance, MEL, and GIS for adaptation planning
- Public education on climate risks through durbars, school clubs, and local radio
- Research and internship partnerships with institutions.
- Districts (e.g., Techiman, Krachi East)

6.7 Roles of Traditional Authorities and the Private Sector

Traditional authorities: Chiefs will play a critical role in land access for adaptation interventions, enforcement of environmental by-laws, and mobilization of community labour and resources.

Private sector: Actors such as agro-input dealers, microfinance institutions, and ICT providers will be engaged in delivering climate-resilient technologies, financial inclusion, and logistics support for adaptation rollout.

6.8 Institutional Risks and Mitigation Measures

Understanding institutional risks is essential for enhancing the effectiveness and sustainability of climate adaptation actions. This section presents key risks that may hinder coordination, implementation, and learning—and outlines targeted mitigation strategies to address them.

Table 12. Institutional risks and mitigation measures

Risk	Mitigation strategy
Capacity gaps among implementers	Establish training programs with support from NGOs, EPA, and regional networks
Poor cross-sectoral coordination	Institutionalize quarterly joint review meetings and shared reporting formats
Low community participation	Use inclusive tools such as participatory rural appraisal and traditional fora
Resource limitations	Mobilize NAP-linked funding, blended finance, and PPPs
Delayed data reporting	Deploy digital tools for real-time MEL updates and field monitoring

Source: Authors

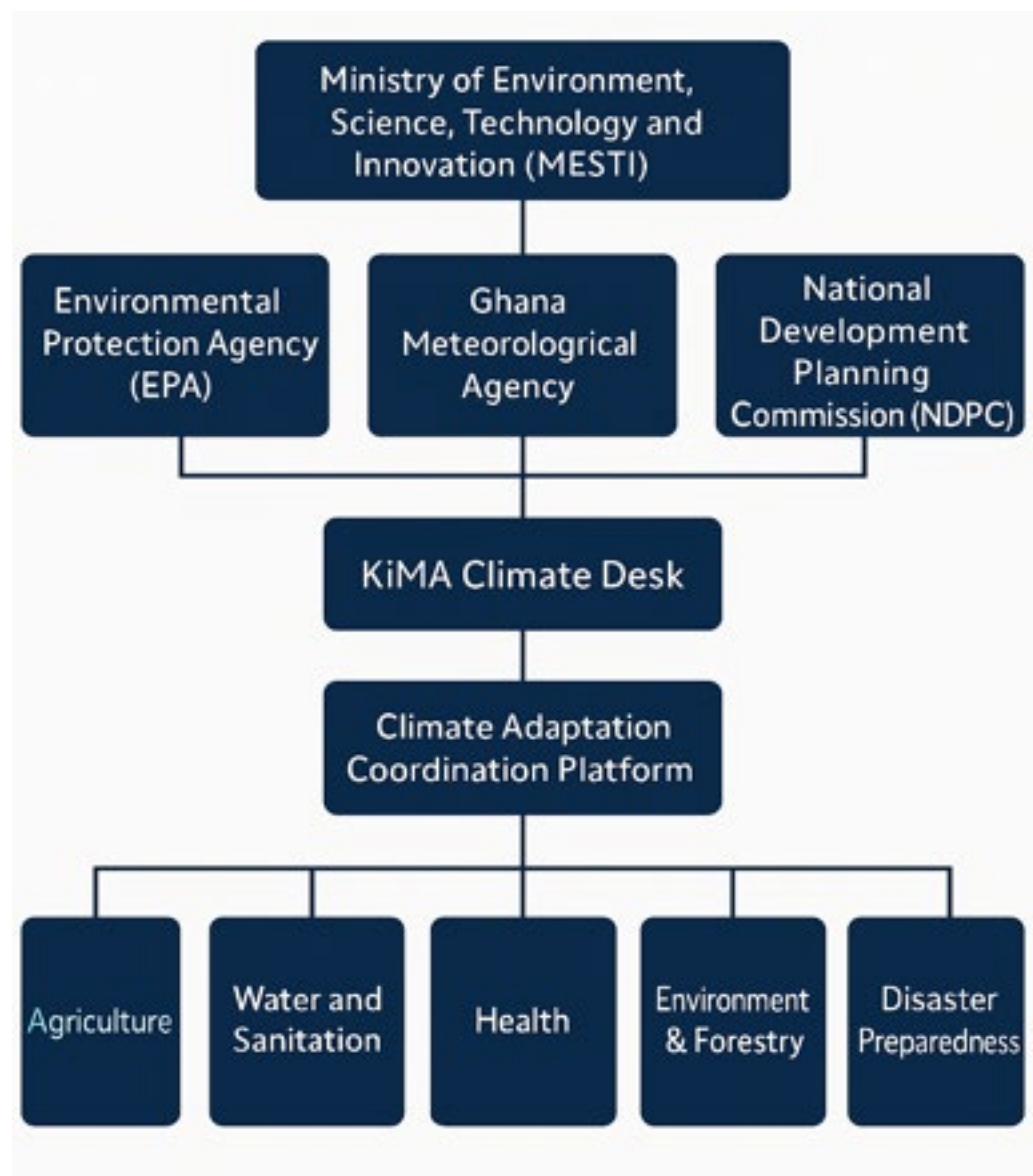
6.9 Institutional Coordination Organogram

The institutional coordination organogram (Figure 14) for the Kintampo Municipality outlines a multi-tiered structure that ensures clear roles, streamlined communication, and integrated implementation of climate adaptation initiatives. At the apex is the Ministry of Environment, Science, Technology and Innovation (MESTI), which provides national policy guidance and oversees agencies such as the EPA and GMet.

Below MESTI is the Bono East Regional Coordinating Council (RCC), serving as the intermediary link between national policy and local execution. The Kintampo Municipal Assembly leads the municipal-level adaptation process, with the Municipal Planning and Coordinating Unit (MPCU) housing the Climate Desk, which acts as the central coordinating entity.

Sector-specific departments and technical leads operate under the Climate Desk, driving implementation across agriculture, water, health, gender, and forestry. The base of the structure includes the Climate Adaptation Coordination Platform (CACP) and community stakeholders, ensuring participatory engagement, local ownership, and alignment of grassroots efforts with broader policy objectives.

Figure 14. Institutional coordination organogram for climate action in the Kintampo Municipality



Source: Authors

7.0 Conclusion and Recommendations

7.1 Introduction

The Kintampo Municipal Adaptation Plan presents a decisive and evidence-based approach to reducing climate risks and strengthening resilience across communities and sectors. Grounded in detailed climate risk and vulnerability assessment, including spatial mapping, sectoral analysis, and gender-based impacts, the plan provides a roadmap for targeted and inclusive adaptation. Through prioritized actions developed via a participatory multi-criteria analysis (MCA), and coordinated by a clearly defined institutional framework, KMAP represents both a technical strategy and a social compact for climate-resilient development.

The adaptation plan is built on the foundation of a robust and inclusive monitoring, evaluation, and learning framework, which ensures continuous feedback, learning, and accountability. Aligning local adaptation actions with national strategies such as the National Adaptation Plan process and the National Climate Change Policy (NCCP), the municipality has demonstrated its readiness to tackle both immediate threats and long-term climate challenges. However, success will depend on continued commitment to implementation, innovation, and local ownership. The following recommendations offer a roadmap to consolidate progress and address remaining gaps.

7.2 Recommendations

To ensure the long-term success and sustainability of Kintampo's adaptation efforts, a multi-faceted approach is essential. This involves strengthening institutional capacity, fostering community engagement, ensuring financial sustainability, and promoting inclusivity in all adaptation measures.

One of the critical recommendations is to enhance the institutional capacity of the municipal assembly and its stakeholders. Climate adaptation initiatives require robust planning, execution, and monitoring, which are only possible with skilled and dedicated personnel. Training programs must be organized regularly to equip municipal staff, project teams, and community leaders with the necessary skills in data analysis, project management, and stakeholder engagement. Establishing a dedicated climate adaptation unit within the assembly would ensure that these activities are not only coordinated effectively but also aligned with broader municipal and national goals. This unit could also act as a hub for integrating adaptation insights into local planning processes, such as the Medium-Term Development Plan (MTDP).

Community engagement is another cornerstone of successful adaptation. Active participation from local communities ensures that adaptation measures are culturally appropriate, inclusive, and sustainable. The involvement of women, youth, and marginalized groups must be prioritized to ensure equity and leverage the unique perspectives these groups bring to the table. For instance, women's cooperatives could be instrumental in managing agroforestry programs, while youth groups could lead reforestation and environmental monitoring initiatives. Building local ownership of adaptation projects through capacity-building workshops and participatory decision-making processes will not only enhance the effectiveness of these initiatives but also ensure their longevity.

Financial sustainability is also crucial for scaling up and sustaining adaptation measures. While government funding forms the backbone of many initiatives, diversifying funding sources is necessary to bridge financial gaps and reduce dependency on single streams. Innovative mechanisms such as green bonds, payments for ecosystem services (PES), and public-private partnerships (PPPs) can provide additional resources for large-scale projects like flood-resilient infrastructure and renewable energy systems. Furthermore, developing well-prepared proposals to access international climate finances such as the Green Climate Fund or the Adaptation Fund—will unlock significant resources to support Kintampo’s adaptation strategies. Ensuring that local fundraising efforts, such as community savings groups, complement external funding will also foster a sense of collective responsibility and shared success.

Inclusivity, particularly with regard to gender, is a vital aspect of any adaptation plan. Women often bear the brunt of climate impacts but are also powerful agents of change when given the opportunity. Gender-responsive adaptation measures should include targeted training programs for women in climate-smart agriculture, support for female-led cooperatives, and access to financial resources to enhance their participation in adaptation initiatives. Moreover, monitoring frameworks should include metrics to evaluate gender equity, ensuring that women’s voices and contributions are recognized and integrated into decision-making processes.

Technological innovation is another area that holds immense potential for improving the effectiveness of adaptation measures. The use of GIS mapping, environmental sensors, and mobile applications can revolutionize data collection and monitoring efforts, making them more accurate, efficient, and accessible. For example, mobile apps could be deployed to gather real-time data from farmers about rainfall patterns or crop health, while GIS tools could track changes in forest cover and land use. Training stakeholders to use these tools effectively will be critical for ensuring that the data collected translates into actionable insights.

Finally, knowledge sharing and learning must be embedded in Kintampo’s adaptation approach. Creating platforms for exchanging best practices, both within the municipality and across other regions, will foster innovation and scalability. Regular stakeholder workshops, online repositories for sharing MEL findings, and collaborations with research institutions can help integrate scientific knowledge with local practices. This ensures that adaptation measures are not only rooted in evidence but also evolve in response to changing circumstances.

7.3 Conclusion

The Kintampo Municipal Assembly has taken significant steps toward addressing its climate vulnerabilities through targeted adaptation measures, inclusive stakeholder engagement, and the implementation of a robust MEL framework. These efforts have laid a strong foundation for enhancing resilience and promoting sustainable development in the face of climate change.

The recommendations provided in this chapter offer a comprehensive roadmap for advancing Kintampo’s adaptation strategies. By strengthening institutional capacity, fostering community engagement, diversifying funding sources, and promoting inclusivity, the municipality can ensure that its adaptation measures are not only effective but also sustainable. The plan is further supported by a

multistakeholder Climate Adaptation Coordination Platform (CACP), spatial vulnerability mapping, and prioritization of sectoral interventions.

Additionally, leveraging technological advancements and fostering a culture of knowledge sharing will further enhance the impact and scalability of these initiatives. Kintampo's adaptation plan is not just a response to current climate challenges but a vision for a resilient, equitable, and thriving future. Committing to continuous improvement and aligning local efforts with national and global goals, the municipality can serve as a model for climate adaptation in Ghana and beyond.

References

- Abdallah, A. M., Jat, H. S., Choudhary, M., Abdelaty, E. F., Sharma, P. C., & Jat, M. L. (2021). Conservation agriculture effects on soil water holding capacity and water-saving varied with management practices and agroecological conditions: A Review. *Agronomy*, 11(9), 1681.
- Abegunde, V. O., Sibanda, M., & Obi, A. (2019). The dynamics of climate change adaptation in Sub-Saharan Africa: A review of climate-smart agriculture among small-scale farmers. *Climate*, 7(11), 132.
- Adger, W. N., Arnell, N. W., & Tompkins, E. L. (2005). Successful adaptation to climate change across scales. *Global Environmental Change*, 15(2), 77–86.
- Africa Adaptation Initiative (AAI). (2021). Mobilizing Climate Finance for Africa’s Adaptation Needs: Best Practices and Opportunities. Nairobi: AAI Secretariat.
- Angelakis, A. N., Zaccaria, D., Krasilnikoff, J., Salgot, M., Bazza, M., Roccaro, P., ... & Fereres, E. (2020). Irrigation of world agricultural lands: Evolution through the millennia. *Water*, 12(5), 1285.
- Antwi-Agyei, P., Dougill, A. J., Fraser, E. D., & Stringer, L. C. (2013). Characterising the nature of household vulnerability to climate variability: Empirical evidence from two regions of Ghana. *Environment, development and sustainability*, 15, 903-926.
- Antwi-Agyei, P., & Stringer, L. C. (2021). Improving the effectiveness of agricultural extension services in supporting farmers to adapt to climate change: Insights from northeastern Ghana. *Climate Risk Management*, 32, 100304.
- Antwi-Agyei, P., Abalo, E. M., Dougill, A. J., & Baffour-Ata, F. (2021). Motivations, enablers and barriers to the adoption of climate-smart agricultural practices by smallholder farmers: Evidence from the transitional and savannah agroecological zones of Ghana. *Regional Sustainability*, 2(4), 375-386.
- Attuh, S., & Kankam, P. K. (2024). Community radio as information dissemination tool for sustainable rural development in Ghana. *Journal of Radio & Audio Media*, 31(1), 248-270.
- 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>
- Becerra-Encinales, J. F., Bernal-Hernandez, P., Beltrán-Giraldo, J. A., Cooman, A. P., Reyes, L. H., & Cruz, J. C. (2024). Agricultural extension for adopting technological practices in developing countries: A scoping review of barriers and dimensions. *Sustainability*, 16(9), 3555.
- Kintampo Municipal Assembly. (2021). *Medium-Term Development Plan (2022–2025)*. Unpublished.

- Cárceles Rodríguez, B., Durán-Zuazo, V. H., Soriano Rodríguez, M., García-Tejero, I. F., Gálvez Ruiz, B., & Cuadros Tavira, S. (2022). Conservation agriculture as a sustainable system for soil health: A review. *Soil Systems*, 6(4), 87.
- Demir, Z., Tursun, N., & Işık, D. (2019). Effects of different cover crops on soil quality parameters and yield in an apricot orchard. *International Journal of Agriculture and Biology*. 8–0705/2019/21–2–399–408
- Dovie, D. B. K., & Dzanku, F. M. (2020). Climate Change Vulnerability and Adaptation Planning at the District Level in Ghana. *Climate and Development*, 12(3), 245–258.
<https://doi.org/10.1080/17565529.2019.1687079>
- Dube, O. P. (2013). Challenges of wildland fire management in Botswana: Towards a community inclusive fire management approach. *Weather and Climate Extremes*, 1, 26-41.
- Elias, E. H., Flynn, R., Idowu, O. J., Reyes, J., Sanogo, S., Schutte, B. J., ... & Sutherland, C. (2019). Crop vulnerability to weather and climate risk: Analysis of interacting systems and adaptation efficacy for sustainable crop production. *Sustainability*, 11(23), 6619.
- 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>
- Environmental Protection Agency (EPA). (2020). *Ghana's National Adaptation Plan Framework*. Accra: Ministry of Environment, Science, Technology and Innovation (MESTI).
- Environmental Protection Authority (formerly EPA). (2024). Kintampo Climate Vulnerability Assessment. Unpublished report under the NAP-Green Climate Fund Project.
- Farooq, M., Nawaz, A., Saharawat, Y. S., Reeves, T., & Siddique, K. (2020). Crop and cropping systems management practices and benefits in Conservation Agriculture systems. In *Advances in Conservation Agriculture* (pp. 37-74). Burleigh Dodds Science Publishing.
- Fernandes, J. B. (2023). *Stakeholders' perspectives on opportunities and challenges in engaging communities in fire risk management* (Master's thesis, Universidade de Coimbra (Portugal)).
- Food and Agriculture Organization. (2015). *Climate-smart agriculture: A call for action*. Retrieved April 7, 2025, from <https://www.fao.org/3/i4908e/i4908e.pdf>
- Forestry Commission of Ghana. (2022). Strategic Forest Investment Plan for Ghana. Accra: Ministry of Lands and Natural Resources.
- Ghana Infrastructure Investment Fund (GIIF). (2021). Annual Report and Investment Guidelines. Accra: GIIF Secretariat.

- Ghana Statistical Service (GSS). (2021). 2021 Population and Housing Census: Kintampo Municipal Assembly Analytical Report. Accra: GSS.
- Giller, K. E., Andersson, J. A., Corbeels, M., Kirkegaard, J., Mortensen, D., Erenstein, O., & Vanlauwe, B. (2015). Beyond conservation agriculture. *Frontiers in plant science*, 6, 870.
- Global Environment Facility (GEF). (2018). GEF Programming Directions: Biodiversity, Climate Change, Land Degradation and Chemicals and Waste Focal Areas. Washington, DC: GEF Secretariat.
- Green Climate Fund (GCF). (2022). GCF Programming Manual: Policies and Processes for Programming. Incheon: GCF. edited volume. *Climate and Development*, 6(3), 241–242.
- Hammond, J., van Wijk, M., Pagella, T., Carpena, P., Skirrow, T., & Dauncey, V. (2019). Shea butter: a pro-poor, pro-female route to increased income. *The Climate-Smart Agriculture Papers: Investigating the Business of a Productive, Resilient and Low Emission Future*, 215-226.
- Hansen, J. W., Vaughan, C., Kagabo, D. M., Dinku, T., Carr, E. R., Körner, J., & Zougmore, R. B. (2019). Climate services can support african farmers' context-specific adaptation needs at scale. *Frontiers in Sustainable Food Systems*, 3, 21.
- Hombegowda, H. C., Adhikary, P. P., Jakhar, P., & Madhu, M. (2022). Alley cropping agroforestry system for improvement of soil health. In *Soil Health and Environmental Sustainability: Application of Geospatial Technology* (pp. 529-549). Cham: Springer International Publishing.
- Hussain, S., Hussain, S., Guo, R., Sarwar, M., Ren, X., Krstic, D., ... & El-Esawi, M. A. (2021). Carbon sequestration to avoid soil degradation: A review on the role of conservation tillage. *Plants*, 10(10), 2001.
- Husseini, R., Aboah, D. T., & Issifu, H. (2020). Fire control systems in forest reserves: An assessment of three forest districts in the Northern region, Ghana. *Scientific African*, 7, e00245.
- Intergovernmental Panel on Climate Change (IPCC). (2022). Climate Change 2022: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report. Cambridge University Press.
- International Institute of Rural Reconstruction. (2022). *2022 Impact Report*. Retrieved April 7, 2025, from https://iirr.org/wp-content/uploads/2023/08/IIRR-Annual-Report-2022_Full-Version_v5.pdf
- International Water Management Institute. (2023). *Gendered climate vulnerability hotspot mapping for inclusive action in Ghana*. Retrieved April 7, 2025, from <https://www.iwmi.org/blogs/gendered-climate-vulnerability-hotspot-mapping-for-inclusive-action-in-ghana/>

- Jacobs, A. A., Evans, R. S., Allison, J. K., Garner, E. R., Kingery, W. L., & McCulley, R. L. (2022). Cover crops and no-tillage reduce crop production costs and soil loss, compensating for lack of short-term soil quality improvement in a maize and soybean production system. *Soil and Tillage Research*, 218, 105310.
- Jambo, Y., Alemu, A., & Tasew, W. (2021). Impact of small-scale irrigation on household food security: evidence from Ethiopia. *Agriculture & Food Security*, 10, 1-16.
- Jinger, D., Kumar, R., Kakade, V., Dinesh, D., Singh, G., Pande, V. C., ... & Singhal, V. (2022). Agroforestry for controlling soil erosion and enhancing system productivity in ravine lands of Western India under climate change scenario. *Environmental Monitoring and Assessment*, 194(4), 267.
- Joshi, D. R., Ghimire, R., Kharel, T., Mishra, U., & Clay, S. A. (2021). Conservation agriculture for food security and climate resilience in Nepal. *Agronomy Journal*, 113(6), 4484-4493.
- Kansanga, M. M., Kerr, R. B., Lupafya, E., Dakishoni, L., & Luginaah, I. (2021). Does participatory farmer-to-farmer training improve the adoption of sustainable land management practices? *Land use policy*, 108, 105477.
- Karalliyadda, S. M. C. B., Navodya, H. A. H., & Jayakody, J. D. T. D. (2025). Agroforestry for Sustainable. *Agroforestry for a Climate-Smart Future*, 73.
- Kassam, A. (2019). Integrating conservation into agriculture. *Innovations in Sustainable Agriculture*, 27-41.
- Kassam, A., Friedrich, T., & Derpsch, R. (2022). Successful experiences and lessons from conservation agriculture worldwide. *Agronomy*, 12(4), 769.
- Kongsager, R. (2017). Barriers to the adoption of alley cropping as a climate-smart agriculture practice: Lessons from maize cultivation among the Maya in southern Belize. *Forests*, 8(7), 260.
- Kumari, R., Singh, R., & Kumar, N. (2019). Effect of crop residue management on soil organic carbon, soil organic matter and crop yield: An overview. *Journal of Applied and Natural Science*, 11(3), 712.
- Lake, F. K., Wright, V., Morgan, P., McFadzen, M., McWethy, D., & Stevens-Rumann, C. (2017). Returning fire to the land: celebrating traditional knowledge and fire. *Journal of Forestry*, 115(5), 343-353.
- Lal, R. (2015). Sequestering carbon and increasing productivity by conservation agriculture. *Journal of soil and water conservation*, 70(3), 55A-62A.
- Layek, J., Das, A., Ansari, M. A., Mishra, V. K., Rangappa, K., Ravisankar, N., ... & Paramanik, B. (2023). An integrated organic farming system: innovations for farm diversification, sustainability, and livelihood improvement of hill farmers. *Frontiers in Sustainable Food Systems*, 7, 1151113.

- Li, H., Mei, X., Wang, J., Huang, F., Hao, W., & Li, B. (2021). Drip fertigation significantly increased crop yield, water productivity and nitrogen use efficiency with respect to traditional irrigation and fertilization practices: A meta-analysis in China. *Agricultural Water Management*, 244, 106534.
- Li, Y., Zhang, Q., Cai, Y., Yang, Q., & Chang, S. X. (2020). Minimum tillage and residue retention increase soil microbial population size and diversity: Implications for conservation tillage. *Science of the Total Environment*, 716, 137164.
- MESTI. (2021). Ghana: Updated Nationally Determined Contribution under the Paris Agreement (2020 – 2030) Environmental Protection Agency, Ministry of Environment, Science, Technology and Innovation, Accra.
- Ministry of Environment, Science, Technology and Innovation (MESTI). (2013). Ghana National Climate Change Policy (NCCP). Accra: Government of Ghana.
- Ministry of Finance. (2019). Ghana's Medium-Term National Development Policy Framework (MTNDPF) 2018–2021. Accra: National Development Planning Commission.
- Ministry of Local Government, Decentralisation and Rural Development (MLGDRD). (2021). Guidelines for the Preparation of District Development Plans under the MTDPF (2022–2025).
- Ministry of Sanitation and Water Resources. (2020). National Water Policy Review Report. Accra: Government of Ghana.
- NAP Global Network. (2020). *Integrating gender considerations into Ghana's national adaptation plan process*. International Institute for Sustainable Development.
<https://napglobalnetwork.org/wp-content/uploads/2020/12/napgn-en-2020-integrating-gender-considerations-into-ghanas-nap-process.pdf>
- NAP Global Network & United Nations Framework Convention on Climate Change. (2019). *Toolkit for a gender-responsive process to formulate and implement national adaptation plans (NAPs)*. International Institute for Sustainable Development.
<http://napglobalnetwork.org/resource/toolkit-for-gender-responsive-national-adaptation-plans/>
- Pavarala, V., & Malik, K. K. (2021). Community radio for social change: Restoring decentralized democratic discursive spaces. In *Handbook of communication and development* (pp. 190-212). Edward Elgar Publishing.
- Rayne, N., & Aula, L. (2020). Livestock manure and the impacts on soil health: A review. *Soil Systems*, 4(4), 64.
- Reid, H., & Schipper, E. L. F. (2014). Upscaling community-based adaptation: An introduction to the United Nations Framework Convention on Climate Change (UNFCCC). (2015). The Paris Agreement. Bonn: UNFCCC Secretariat.

- Shahin, M., Khanam, M., Aktar, S., Siddiqua, A., & Sharif, N. (2022). Resiliency of livelihood and empowerment of women: Results of a cash-based intervention in Bangladesh's Lalmonirhat District. *International Journal of Disaster Risk Reduction*, 79, 103137.
- Sharma, P., Singh, M. K., & Tiwari, P. (2017). Agroforestry: a land degradation control and mitigation approach. *Bulletin of Environment, Pharmacology and Life Sciences*, 6(5), 312-317.
- Sileshi, G. W., Mafongoya, P. L., & Nath, A. J. (2020). Agroforestry systems for improving nutrient recycling and soil fertility on degraded lands. *Agroforestry for Degraded Landscapes: Recent Advances and Emerging Challenges*-Vol. 1, 225-253.
- Sinclair, F., Wezel, A., Mbow, C., Chomba, S., Robiglio, V., & Harrison, R. (2019). The contribution of agroecological approaches to realizing climate-resilient agriculture. GCA: Rotterdam, The Netherlands.
- Suresha, R. S., & Vishwavidyalaya, I. G. K. (2019). *An analysis of mobile application deployment and delivery strategy in agriculture extension system* (Doctoral dissertation, M. Sc. thesis, Indira Gandhi Vishwavidyalaya, Raipur, India).
- UN Women. (2022). *Women and climate-smart agriculture: A programming guide for Eastern and Southern Africa*. <https://africa.unwomen.org/en/digital-library/publications/2023/05/women-and-climate-smart-agriculture-a-programming-guide-for-eastern-and-southern-africa>
- United Nations Development Programme (UNDP). (2020). *National Adaptation Plans in Action: Lessons from Developing Countries*. New York: UNDP.
- United Nations Development Programme. (2019). *Ghana gender analysis*. https://climatepromise.undp.org/sites/default/files/research_report_document/undp-ndcsp-ghana-gender-analysis-final2.pdf
- UNFCCC. (2011). Assessing the costs and benefits of adaptation options: an overview of approaches. *The Nairobi work Programme on impacts, vulnerability and adaptation to climate change*, 52.
- United Nations Office for Disaster Risk Reduction (UNDRR). (2015). *Sendai Framework for Disaster Risk Reduction 2015–2030*. Geneva: UNDRR.
- Wall, P., Thierfelder, C., Hobbs, P., Hellin, J., & Govaerts, B. (2020). Benefits of conservation agriculture to farmers and society. In *Advances in conservation agriculture* (pp. 335-376). Burleigh Dodds Science Publishing.
- Zobeidi, T., Yazdanpanah, M., Komendantova, N., Löhr, K., & Sieber, S. (2024). Evaluating climate change adaptation options in the agriculture sector: A PROMETHEE-GAIA analysis. *Environmental and Sustainability Indicators*, 22, 100395.



KINTAMPO MUNICIPAL
ASSEMBLY

