

Adapting Together, Thriving Tomorrow



Climate Change Adaptation Action Plan for the Cities and Disaster Risk Reduction Sector in Ghana

Enhancing Multi-Sector Planning and
Capacity for Effective Adaptation in Ghana



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This symbol in the NAP Logo represents the adaptation plan for cities and disaster risk reduction.



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ACRONYMS

Abbreviation	Connotation
AAFORD	Affordable Agricultural Financing for Resilient Rural Development
ADB	Agricultural Development Bank of Ghana
AICCRA	Accelerating Impacts of CGIAR's Climate Research for Africa
CBRDP	Community Based Rural Development Project
COCOBOD	Ghana Cocoa Board
CPA	Coastal Protection Agency
CRICA	Climate Resilient Infrastructure for Coastal Areas
CSIR	Council of Scientific & Industrial Research
CSO	Civil Society Organizations
CUMT	Capacity Building for Urban Transport and Mobility
DRH	Department of Rural Housing
DRR	Disaster Risk Reduction
EbA	Ecosystem-based adaptation
EPA	Environmental Protection Agency
EPA	Environmental Protection Agency
FAO	Food and Agriculture Organization
GAMA	Greater Accra Metropolitan Area
GAMA	Ghana Accra Metropolitan Area
GARID	Greater Accra Resilient and Integrated Development
GCAP	Ghana Commercial Agriculture Project

Abbreviation	Connotation
GCF	Green Climate Fund
GCMi	Ghana Coastal Management Initiative
GCX	Ghana Commodity Exchange
GDP	Gross Domestic Product
GIDA	Ghana Irrigation Development Authority
GIS	Geographical Information System
GLRSSMP	Ghana Landscape Restoration and Small-Scale Mining Project
GMet	Ghana Meteorological Authority
GNFS	Ghana National Fire Service
GPHA	Ghana Ports and Harbours Authority
GPRTU	Ghana Private Road Transport Union
GPVVCP	The Ghana Peri-Urban Vegetables Value Chain Project
GRA	Ghana Railway Authority
GSS	Ghana Statistical Service
GUMAP	Ghana Urban Mobility and Accessibility Project
ICZM	Integrated Coastal Zone Management Program
IITA	International Institute of Tropical Agriculture
KUMAP	Kumasi Urban Mobility and Accessibility Project
LUSPA	Land Use and Spatial Planning Authority
MAG	Modernisation of Agriculture in Ghana
MCA's	Multi-Criteria Analysis
MEL	Monitoring, Evaluation and Learning



Abbreviation	Connotation
MESTI	Ministry of Environment, Science, Technology, and Innovation
MMDA	Metropolitan, Municipal and District Assembly
MOFAD	Ministry of Fisheries and Aquaculture Development
MOI	Ministry of Information
MoT	Ministry of Transport
MoT	Motor Transport Authority
MTTU	Ghana Police Service's Motor Transport and Traffic Unit
NADMO	National Disaster Management Organization
NAFCA	National Farmers' and Fishermen's Council
NAFCO	National Food Buffer Stock Company
NAPs	National Adaptation Plans
NCCE	National Commission of Civic Education
NDPC	National Development Planning Commission
NFCP	National Flood Control Programme
NGOs	Non-Governmental Organizations
NORST	Northern Region Small Towns Water and Sanitation Project
P4D	Planning for Drought
PARADes	Participatory Assessment of flood-Related Disaster prevention and development of an adapted coping system in Ghana
PFJ	Planting for Food and Jobs
PSHLSB	Public Servants' Housing Loans Scheme Board

Abbreviation	Connotation
REACH-STR	Resilience Against Climate Change – Social Transformation Research and Policy Advocacy
ReDAW	Regenerative Development of Anlo Wetlands
RSDP	Road Sector Development Programme
UNDP	United Nations Development Programme
UNDRR	United Nations Office for Disaster Risk Reduction
UNISDR	United Nations Office for Disaster Risk Reduction
VBA	Volta Basin Authority
VFDM	Volta Flood and Drought Management
WASCAL	West African Science Service Centre on Climate Change and Adapted Land Use
WRC	Water Resources Commission





EXECUTIVE SUMMARY

The Sectoral Adaptation Plan for the Cities and Disaster Risk Reduction (DRR) sector in Ghana outlines a robust framework to strengthen urban resilience and address the growing impacts of climate change. It adopts a systematic, inclusive, and participatory approach to adaptation planning, ensuring the diverse needs of both urban and rural communities are effectively addressed. The plan is closely aligned with national policies and frameworks, offering clear guidance to sectoral experts while fostering collaboration among stakeholders across various sectors.

Climate change poses significant risks to Ghana's urban and rural populations, especially in rapidly expanding cities. Challenges such as heat stress, flooding, and public health threats are becoming increasingly severe. To tackle these issues, the plan proposes targeted adaptation strategies, including enhancing urban infrastructure, upgrading water and sanitation systems, strengthening disaster preparedness, and ensuring the inclusion of vulnerable groups—such as women, youth, and marginalized communities—in all planning and implementation efforts.

Effective implementation of the plan requires strong institutional arrangements involving national ministries, local governments, civil society, non-governmental organizations, and development partners. This multi-stakeholder approach aims to integrate climate adaptation and disaster risk reduction measures into urban development processes, laying the foundation for sustainable, climate-resilient cities and communities. The adaptation strategies proposed aim to address these risks by prioritizing the following key adaptation areas identified:

1. Urban and Rural Flood Risk Management and Resilience Enhancement.
2. Improved Water Supply and Sanitation Systems
3. Drought-Resistant Agricultural Practices and Urban Food Security.

4. Strengthened Disaster Preparedness and Emergency Response
5. Climate-Resilient Housing and Infrastructure.
6. Sustainable Urban and Rural Transport Systems.
7. Ecosystem-Based Adaptation (EbA) for Urban and Rural Areas.
8. Coastal Resilience Against Sea-Level Rise and Erosion.

The Sectoral Adaptation Plan for the Cities and Disaster Risk Reduction (DRR) sector in Ghana outlines a robust framework to strengthen urban resilience and address the growing impacts of climate change. It adopts a systematic, inclusive, and participatory approach to adaptation planning, ensuring the diverse needs of both urban and rural communities are effectively addressed. The plan is closely aligned with national policies and frameworks, offering clear guidance to sectoral experts while fostering collaboration among stakeholders across various sectors.

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Effective implementation of the plan requires strong institutional arrangements involving national ministries, local governments, civil society, non-governmental organizations, and development partners. This multi-stakeholder approach aims to integrate climate adaptation and disaster risk reduction measures into urban development processes, laying the foundation for sustainable, climate-resilient cities and communities.



By embedding climate adaptation and disaster risk reduction into urban development, Ghana can build sustainable, climate-resilient cities and communities, safeguarding livelihoods and critical infrastructure while promoting long-term resilience. To ensure effective implementation, the following are key:

Institutional Collaboration: Strong partnerships across national and local governments, civil society, NGOs, and the private sector are essential.

Capacity Building: Sectoral experts and local authorities require enhanced skills to implement and sustain adaptation measures.

Policy Integration: Urban planning efforts must align with climate adaptation strategies to ensure long-term resilience through infrastructure investments and policy reforms.

Community Focus: Addressing the unique vulnerabilities of at-risk groups ensures that adaptation measures are inclusive and equitable.





1. CONTEXT AND RATIONALE

1.1. Project Background

Cities are home to the majority of the Earth's population, currently housing about 4.2 billion people (UN-Habitat, 2020). Urban areas are however increasingly vulnerable to climate change, particularly in informal settlements with low adaptive capacity (IPCC, 2022). Much of the rapid urban population growth is occurring in less developed regions, further straining resources and infrastructure (World Bank, 2021). Globally, climate change impacts cities through rising sea levels causing coastal flooding, extreme heat waves, more intense storms, disruptions to water supplies, and increased spread of diseases, particularly in densely populated urban areas. Cities are major contributors to greenhouse gas emissions due to their high concentration of people and activities, making them both victims and perpetrators of climate change (Malhi et al 2020).

A single hazard in urban areas can lead to cascading events. For instance, floodwaters that damage power infrastructure can disrupt financial systems, amplifying the impact (Dodman et al., 2019). Urban populations are projected to grow significantly by 2050, with an additional 2.5 billion people expected to reside in cities, 90% of whom will be concentrated in Asia and Africa (United Nations, 2018). This growth will expose cities to heightened risks from climate-related hazards such as sea-level rise, extreme heat, tropical cyclones, storm surges, intense rainfall, and coastal flooding (IPCC, 2022). The number of people in cities facing risks of drought and water scarcity will also rise with increasing global temperatures. At 1.5°C of warming, 350 million urban residents will be at risk, while this number will increase to 410 million at 2°C of warming (Hof et al., 2020). These projections underscore the urgent need for adaptive measures to mitigate climate risks in rapidly growing urban areas.

In Ghana, climate change is significantly impacting cities primarily through rising sea levels, increased flooding due to intense rainfall, droughts, extreme heat, and

erratic weather patterns, which disproportionately affect vulnerable communities in urban slums, putting pressure on infrastructure, food security, and public health due to waterborne diseases and poor sanitation (Damte et al. 2023). Coastal flooding due to rising sea levels poses a significant threat to Ghana's coastal cities, causing frequent flooding, coastal erosion, and extensive damage to critical infrastructure, particularly in densely populated areas (Appeaning Addo et al., 2018).

Increased urbanization exacerbates heat waves and heightens health risks related to extreme heat (Amoako & Frimpong Boamah, 2015). Irregular and unpredictable rainfall patterns result in water scarcity, forcing urban communities to rely on unreliable or unsafe water sources, which negatively impacts sanitation and hygiene standards (Agyemang et al., 2020). Additionally, many cities struggle with stormwater drainage issues as inadequate systems fail to manage heavy rainfall, leading to frequent urban flooding and disruptions to daily life and economic activities (Karley, 2009). Furthermore, changes in rainfall patterns and extreme weather events have reduced agricultural productivity, threatening food security, especially for urban communities reliant on small-scale farming in peri-urban areas (Antwi-Agyei et al., 2018). Addressing these issues requires improved urban planning, with a focus on developing and implementing sustainable urban development strategies.

The Government of Ghana, through the Environmental Protection Agency (EPA), is implementing a 3-year project under the Green Climate Fund's (GCF) Readiness Program for National Adaptation Plans (NAPs). This initiative is aligned with the Ministry of Environment, Science, Technology, and Innovation's (MESTI) mandate to build the country's capacity to address climate change adaptation. The project is being supported by UN Environment, which acts as the Delivery Partner and plays a pivotal role in overseeing the implementation of the project's activities.



The overarching goal of the project is to support Ghana in advancing its climate adaptation efforts by strengthening national and sub-national planning processes. The project seeks to achieve this by focusing on enhancing the institutional and technical capacities needed for effective adaptation planning, especially in climate-vulnerable sectors. Through this initiative, Ghana aims to develop a comprehensive, long-term national strategy for adapting to climate change, which incorporates both current and projected climate risks.

As part of this endeavour, the Government of Ghana, in collaboration with its development partners, has embarked on identifying, quantifying, and understanding the direct and indirect impacts of climate change on various sectors. This includes assessing the effects of climate change on both the environment and human systems, particularly in relation to **Cities and Disaster Risk reduction**, agriculture, water resources and ecosystems. In doing so, the government aims to develop the necessary adaptation measures that will be implemented across multiple sectors to enhance resilience to climate impacts.

Ghana's National Adaptation Plan (NAP) serves as the central vehicle for mainstreaming adaptation strategies into national policies, programs, and projects. A key feature of Ghana's NAP process is its targeted sectoral and subnational adaptation planning. This approach uses risk and vulnerability assessments as a foundation for developing and implementing adaptation plans. These assessments are essential for understanding the specific climate challenges faced by different regions and sectors, enabling tailored solutions that address local needs and vulnerabilities.

By adopting this sectoral-level approach, the government ensures that adaptation measures are not only based on broad national frameworks but also deeply rooted in the realities and challenges faced at multiple levels. The approach involves collaboration with local governments, stakeholders, and communities to ensure that climate adaptation planning is inclusive, participatory, and context specific. This helps foster ownership, accountability, and the successful implementation

of adaptation actions at the grassroots level, ensuring that Ghana's climate adaptation efforts are both sustainable and effective.

1.2. Aims and Objectives

Ghana's National Adaptation Plan (NAP) focusing on the Cities and Disaster Risk Reduction (DRR) sector addresses the challenges posed by climate change to Ghana's urbanized and disaster-prone regions. Resilient cities are crucial to the country's economic growth and social stability. The plan focuses on reducing urban vulnerability to climate impacts by enhancing adaptive capacity and fostering resilience. It seeks to incorporate climate adaptation measures into existing and future urban planning, disaster management and reduction.

A critical aim of this assignment for the Cities/DRR Sector Adaptation Plan is to formulate a costed sectoral adaptation plan and strengthen the DRR sector's capacity to integrate adaptation considerations into urban development and disaster risk reduction policies in Ghana

The goal is to ensure that urban growth aligns with climate-resilient strategies. The plan emphasizes capacity-building for city officials, disaster response teams, and local communities through training, education, and access to climate-resilient infrastructure. Additionally, it highlights the importance of research and innovation in designing adaptive technologies and urban systems. This includes developing solutions for flood management, resilient housing and effective early-warning systems. The plan also aims to mobilize resources from domestic and international sources to fund adaptation projects for urban resilience and disaster preparedness. The assessment is guided by the following specific goals:

- Conduct rapid climate risk assessments within the DRR and urban contexts.
- Develop a costed adaptation plan tailored to the Cities and DRR sector.



1.3. Rationale for assessing Cities and DRR sector of Ghana

Assessing cities and disaster risk reduction (DRR) within the framework of Ghana's National Adaptation Plan (NAP) is essential to addressing the increasing challenges posed by climate change. For instance, Accra, as a low-lying coastal city, is highly vulnerable to rising sea levels and frequently experiences flooding events. Slum areas in Accra face heightened risks due to poor drainage systems and inadequate housing infrastructure (Apeaning Addo et al., 2018). Tema, another coastal city, contends with similar challenges, including coastal flooding and erosion, which jeopardize both its infrastructure and residential zones. Meanwhile, Kumasi, although inland, is affected by shifting rainfall patterns that lead to potential water scarcity and challenges in sanitation and urban agriculture (Agyemang et al., 2020).

Given these vulnerabilities, targeted strategies for the Cities and DRR sector are imperative. These strategies should prioritize green infrastructure, such as urban forests and wetlands, alongside effective flood control systems and resilient building designs to enhance urban adaptation (UN-Habitat, 2020). Additionally, climate adaptation initiatives should include investments in early warning systems for extreme weather events, community-based preparedness programs, and water management projects to ensure a reliable water supply (IPCC, 2022). Transitioning to renewable energy sources like solar and wind power can help reduce carbon emissions and mitigate the urban heat island effect, further strengthening urban resilience (IRENA, 2020). Policy interventions should also promote sustainable land use, protect coastal ecosystems through conservation and restoration, and provide targeted support to vulnerable communities to build resilience against climate impacts (UNFCCC, 2021).

To guide these efforts, an assessment for the Cities/Disaster Risk Reduction (DRR) sector in Ghana would provide a structured framework for integrating climate adaptation into urban planning, city development, and DRR initiatives. This

assessment offers a standardized approach to understanding and addressing climate risks that cities in Ghana face, ensuring adaptation plans are contextually relevant and aligned with national resilience objectives. It emphasizes the need for inclusive and participatory planning processes, engaging local governments, communities, and relevant stakeholders to identify risks and co-develop adaptive solutions.

This assessment brings clarity and uniformity to the adaptation planning process by outlining methodologies and steps for developing sectoral adaptation plans for cities and DRR. It serves as a valuable resource for central and local governments, private sector actors, NGOs/CSOs, development partners, and experts working in the Cities/DRR sector. The assessment underscores the importance of consistent data collection, vulnerability assessments, and integrating scientific knowledge with local expertise. It also provides practical tools for conducting risk assessments and identifying critical urban challenges in disaster risk reduction.

By ensuring consistency across regions and urban settings in Ghana, this assessment facilitates the integration of climate adaptation strategies at the national level, fostering a unified approach to addressing climate challenges across sectors. Adhering to the guide enables the development of robust, contextually appropriate sectoral adaptation plans that incorporate principles of resilience, sustainability, and disaster risk reduction. Ultimately, the assessment would empower experts to create actionable plans that contribute to long-term urban climate resilience, helping Ghanaian cities become stronger and better prepared for future climate-related challenges.



1.4. A Gender-Responsive Action Plan for the Cities/DRR Sector

Climate change is expected to intensify urban poverty and deepen inequalities due to gender differences in sociocultural and economic roles and responsibilities. Gender-based disparities significantly affect access to resources, work opportunities, wages, and leadership roles, as well as participation in decision-making processes in urban areas (UN-Habitat, 2016).

In the Cities and Disaster Risk Reduction (DRR) sector, a gender-sensitive approach ensures that women's perspectives are included in formulating and implementing adaptation strategies, leading to more inclusive and effective outcomes (Adzawla et. al., 2019). Addressing gender-specific barriers—such as social norms that limit women's participation in urban planning and disaster preparedness—is essential. This involves challenging discriminatory practices and fostering gender equality in all aspects of urban resilience and DRR planning (Chingarande et. al., 2020).

Integrating gender perspectives into DRR planning provides a more comprehensive understanding of vulnerabilities and capacities within urban communities. This can result in more sustainable and effective adaptation strategies, particularly for marginalized groups (Owusu et. al., 2019). For Ghana's cities, incorporating gender-responsive approaches will improve the inclusivity and effectiveness of adaptation measures, addressing the unique challenges posed by climate change in urban contexts while promoting gender equality.

A gender-responsive strategy strengthens resilience by leveraging the diverse capacities, experiences, and perspectives of both women and men in adaptation initiatives. Such an approach allows stakeholders to identify and address gender-specific needs, opportunities, and capacities. It also ensures equitable participation in decision-making processes and equitable access to financial resources and benefits from adaptation investments (Adzawla et. al., 2019). By

adopting these considerations, Ghana can develop an inclusive adaptation plan for the Cities and DRR sector that not only mitigates climate impacts but also promotes gender equality and empowers women in urban development and disaster risk reduction.



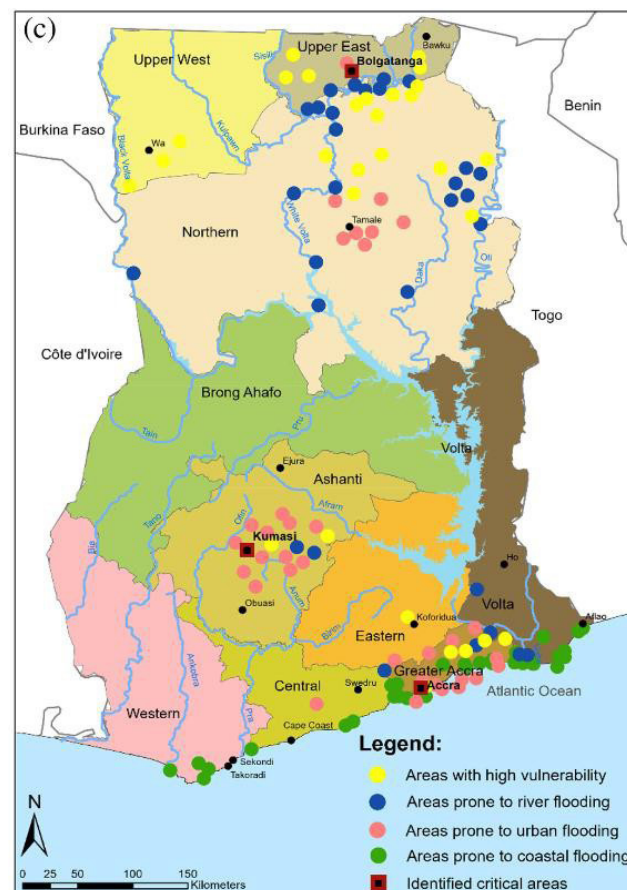
1.5. Purpose of the Sectoral Adaptation

Ghana's urban landscape has undergone significant transformations over the last few decades, with rapid urbanization bringing both opportunities and challenges. Cities such as Accra, Tema, Kumasi, Takoradi and Tamale are growing at unprecedented rates, driven by rural-urban migration, population growth, and economic diversification (UN-Habitat, 2020). However, this rapid urbanization has exposed cities to increased vulnerability to natural and man-made disasters. According to a study by Almoradie et al 2020, areas in Ghana identified as most critical to flood risk include Accra, Kumasi, Tamale, Volta among others (

Figure 1). The word cloud of the critical areas according to Almoradie et al shows most urban areas in Ghana Figure 2).

Cities and town in Ghana face unique vulnerabilities stemming from largely unplanned urban growth, inadequate infrastructure, and limited enforcement of land-use regulations (Amoako & Frimpong Boamah, 2015). These risks are compounded by climate change, which intensifies the frequency and severity of extreme weather events (IPCC, 2022).

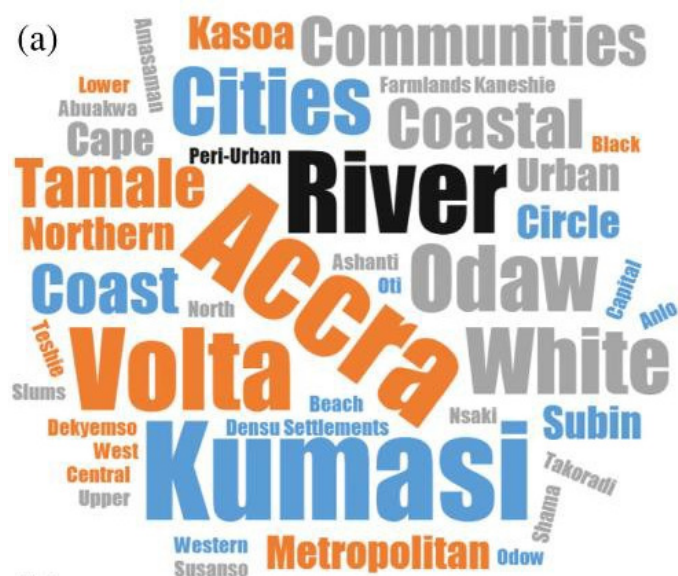
Figure 1: Critical areas in Ghana prone to flood risk



Source: Almoradie et al 2020



Figure 2: Word cloud of critical areas in Ghana prone to flood risk



Source: Almoradie et al 2020

Further, urban and peri-urban areas in Ghana host diverse populations, including vulnerable groups such as the poor, informal settlers, and migrants, who often reside in hazard-prone areas (World Bank, 2018). The lack of access to infrastructure, social and economic vulnerabilities limit their ability to cope with disasters. (UN Women, 2015).

Moreover, cities are economic hubs and drivers of national development, hosting critical infrastructure such as markets, transportation networks, and industries. As such, disruptions caused by disasters not only result in immediate economic losses but also hinder long-term development goals (United Nations Office for Disaster Risk Reduction [UNDRR], 2020). These events emphasize the

importance of integrating disaster risk considerations into urban development and governance to sustain economic growth and development.

Adaptation planning for Ghana's Cities and the DRR sector thus no longer becomes optional but an imperative. The intersection of urbanization and disaster risks underscores the urgent need for targeted adaptation planning to safeguard lives, infrastructure, and economic stability. As developing robust adaptation plans can strengthen institutional capacities, enhance community resilience, and mitigate the adverse impacts of disasters on urban populations. The overall purpose of the plan is thus to provide a strategic framework for building climate-resilient cities by providing a strategic framework that guides the integration of climate adaptation and disaster risk reduction into urban development. This plan aims to reduce vulnerabilities, enhance the capacity of cities to manage climate risks and ensure sustainable urban growth that protects communities, infrastructure, and ecosystems from climate-related hazards. Specifically, the guide aims to:

1. Develop a structured approach to guide cities in integrating climate adaptation measures into urban planning and disaster risk reduction initiatives.
2. Establish standardized methodologies for assessing climate-related risks and vulnerabilities in urban areas, focusing on flood risks, heat stress, and infrastructure resilience.
3. Promote inclusive and participatory planning processes that involve local governments, communities, and relevant stakeholders in identifying risks and co-developing adaptive solutions.
4. Provide clear guidelines for incorporating early warning systems, effective communication strategies, and preparedness measures into urban adaptation plans to reduce disaster impacts.



5. Align adaptation planning with national policies, international frameworks, and Ghana's urban development goals, ensuring sustainable financing and long-term effectiveness.

The adaptation plan for the cities and disaster risk reduction (DRR) sector outlines strategic actions to address the impacts of climate change and enhance resilience in urban areas across Ghana. These actions include:

- **Comprehensive Risk Assessment and Management:** Conducting detailed assessments of climate risks and vulnerabilities specific to cities to identify priority areas for intervention. This enables the development of targeted and effective strategies to reduce risks, such as flooding, heatwaves, and infrastructure damage.
- **Capacity Building and Stakeholder Empowerment:** Strengthening the capacities of urban planners, local governments, and communities through training and education on disaster risk reduction and climate-resilient urban development. This ensures that key stakeholders are equipped with the knowledge and tools needed for effective adaptation.
- **Research and Innovation for Urban Resilience:** Investing in research and the development of innovative solutions tailored to Ghana's urban context. This includes designing flood-resilient infrastructure, implementing green urban spaces to mitigate the urban heat island effect, and developing efficient early warning systems for extreme weather events.
- **Policy Integration and Alignment:** Embedding climate adaptation and disaster risk reduction strategies into national and local urban policies and planning processes. This ensures a coordinated and cohesive approach

across government agencies, municipalities, and other stakeholders to address climate impacts in cities.

- **Monitoring, Evaluation, and Adaptive Management:** Establishing robust mechanisms to monitor and evaluate the effectiveness of DRR initiatives. Continuous assessment allows for timely adjustments and improvements to ensure that adaptation actions remain effective and responsive to emerging risks.

The Sectoral Adaptation Plan for Cities and Disaster Risk Reduction is a critical component of Ghana's overall climate strategy. By prioritizing urban safety, enhancing infrastructure resilience, promoting sustainable development, and fostering inclusive planning, the plan aims to create cities that can withstand the challenges of a changing climate. Through coordinated efforts and strategic investments, Ghana can ensure a sustainable and secure future for its urban areas and their inhabitants.



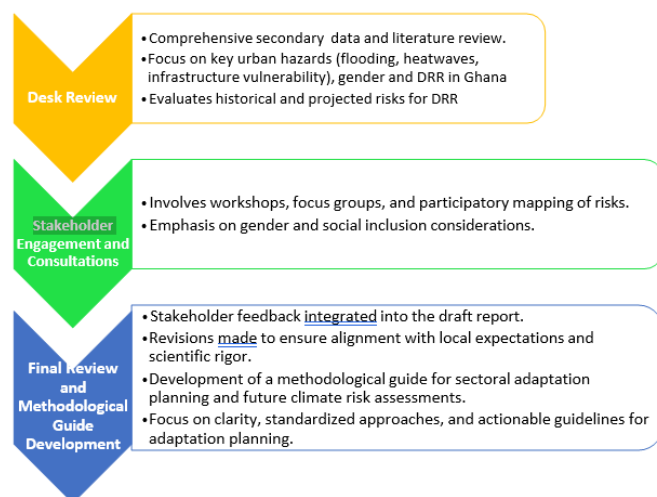


2. METHODOLOGY FOR THE DEVELOPMENT OF THE SECTOR ADAPTATION PLAN

2.1. Approach for Cities/DRR Sector Adaptation Plan

The development of the Sector Adaptation Plan for the Cities and DRR sector is guided by a systematic and participatory framework designed to ensure inclusivity, relevance, and actionable outcomes. The approach used in gathering the information for this framework involved three interlinked phases: a desk-based review, stakeholder consultations and a national validation workshop.

Figure 3: Overall Methodology Overview for Climate Risk and Vulnerability Assessment



Source: Author's own depiction

Desk Review

The development process began with a comprehensive desk review, which laid the groundwork for understanding the risk landscape of urban areas in the context of disaster risk reduction. This review involved gathering secondary data from diverse sources, including government reports, academic research, and climate models. Focusing on key urban hazards such as flooding, heatwaves, and infrastructure vulnerability, the review evaluated both historical and projected risks.

After the desk review, information synthesis followed and focused on transforming the extensive data collected into a structured and comprehensive synthesis report. This was pivotal in converting raw data into actionable insights by highlighting key findings, identifying trends, and addressing gaps uncovered during the desk review. The synthesis phase played a critical role in setting the agenda for further research and consultation, bridging the gap between data collection and actionable planning while fostering inclusivity and responsiveness to stakeholder needs.

Stakeholder Engagement and Consultations

Stakeholder engagement is a key aspect of the methodology, ensuring that the adaptation plan is both locally relevant and inclusive. Stakeholder engagement was a key phase in the assessment, ensuring that the outcomes reflected local realities and priorities. This phase involved targeted workshops with diverse stakeholder groups, including policymakers, and local NGOs. The input gathered from stakeholders was instrumental in validating the findings from the information synthesis and identifying additional vulnerabilities and opportunities that might have been overlooked during earlier stages.



Final Review and Methodological Guide Development

Following the stakeholder consultation, the final review and methodological guide development phase was carried out. In this phase, the feedback gathered from stakeholders was integrated into the draft report, and revisions were made to ensure that the findings, recommendations, and methodologies aligned with local expectations and scientific rigor. The methodological guide developed during this phase served as a key reference for creating sectoral adaptation plans, particularly within the context of Ghana's cities and disaster risk reduction efforts.

The final guide outlined the processes and methodologies used throughout the assessment, providing future assessments with a clear, standardized approach to evaluating climate risks. It also included guidelines for integrating stakeholder inputs, data synthesis, and vulnerability analysis into the adaptation planning process. This phase ensured that the guide was technically sound, practically applicable, and relevant for building long-term climate resilience.

2.2. Structure of the Sectoral Plan

The Methodological Guide for Developing a Sectoral Adaptation Plan in Ghana's Cities & Disaster Risk Reduction (DRR) Sector begins with an introduction to the project background, highlighting the rationale, purpose and context for adaptation planning in Ghana, in Chapter 1, Context and rationale).

Chapter 2 details the methodology, including data collection, analysis, and stakeholder participation. Chapters 3 and 4 provide an in-depth review of Ghana's national circumstances and climate change impacts, including past trends, projected changes, and risk analyses.

The policy and institutional frameworks are covered in Chapter 5, which also proposes institutional arrangements for effective implementation. Chapter 6 presents prioritized sectoral adaptation actions developed through consultations and workshops. With chapter 7, identifying possible challenges in implementing

the adaptation plans. Chapter 8 further details the genders considerations for adaptation planning in the Cities/DRR sector, ensuring inclusivity and equity in adaptation efforts. While chapter

9 provides the framework for effective monitoring, evaluation and learning of adaptation plans implementation

Finally, Chapter 10 emphasizes the study conclusions and actionable recommendations for operationalizing the plan. This structured approach ensures the guide is both comprehensive and actionable for urban resilience and disaster risk reduction.

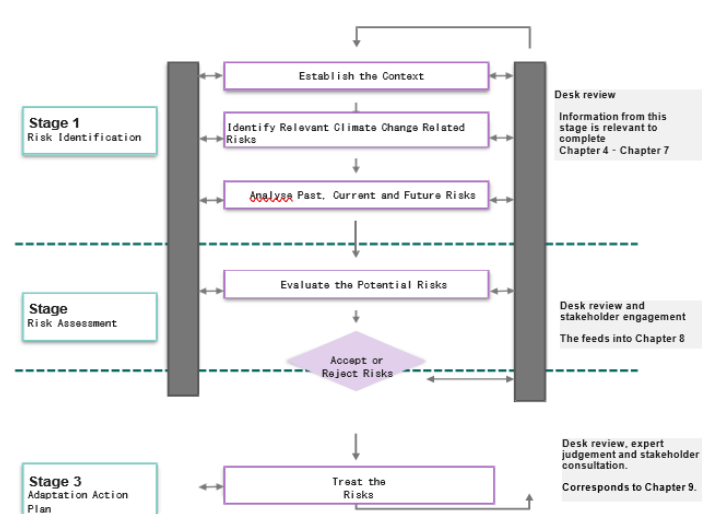
2.3. Methodology

2.3.1. Cities and Disaster Risk Reduction (DRR) Risk Assessment

The Cities and Disaster Risk Reduction (DRR) Risk Assessment for Ghana adopted a methodology similar to that of Norman et al. (2014), tailored to the unique challenges of urban areas and disaster risk reduction. This structured approach was divided into three primary stages, each addressing specific components of risk identification, assessment, and management (see Figure 4). The methodology also integrated gender dimensions to ensure a comprehensive and equitable evaluation of vulnerabilities and adaptive capacities in the cities and DRR sector.



Figure 4: Methodology for Climate Change Risk Assessment (CCRA) in Biodiversity and Ecosystem Sector



Source: Adapted from (Norman, et al., 2014)

Stage 1: Risk Identification

The first stage of the risk identification process for cities and disaster risk reduction (DRR) involved establishing the assessment context. This step defined the parameters influencing climate risk management for Ghana's urban areas, including cities such as Accra, Kumasi, and Tema. Desk reviews formed a critical part of this stage, focusing on gathering and analysing relevant information from existing literature, reports, and datasets. These reviews explored historical trends, urban vulnerabilities, and socio-economic attributes to provide a foundational understanding of risks to cities and their infrastructure.

Once the context was established, the next step was identifying potential climate change-related risks to cities and DRR. These risks included

flooding, heatwaves, infrastructure damage, and increased frequency of extreme weather events. The identification process highlighted how these risks threaten urban systems, essential services, and economic activities. This stage laid the groundwork for analysing the risks in greater detail and informed the design of the subsequent risk assessment process.

Stage 2: Risk Assessment

The second stage involved analysing the identified risks to evaluate their potential impacts and likelihood. This phase was crucial in understanding the severity and implications of the risks, enabling informed decision-making for adaptive action. The risk assessment began with a detailed analysis of past, current, and projected climate risks to cities and their systems. Historical events, such as flooding in Accra's low-lying areas or water scarcity in Kumasi, were analysed alongside current trends to project future scenarios.

Desk reviews and stakeholder engagement were key activities in this stage. The desk reviews focused on synthesizing scientific reports, case studies, and historical data to understand the nature and extent of risks. Stakeholder engagement involved targeted workshops with key groups, including local governments, urban planners, community representatives, and disaster management agencies, to gather diverse perspectives and validate findings. This participatory approach ensured that the risk assessment captured local realities and priorities.



The findings were meticulously documented, with hazards examined and prioritized based on their potential consequences and likelihood of occurrence. Key considerations in this prioritization process included the severity of impacts on critical urban systems, the financial costs associated with adaptation, and the implications for vulnerable groups, particularly those living in informal settlements. This thorough decision-making process provided a strategic foundation for developing the Cities and DRR Adaptation Action Plan, ensuring that resources and efforts were directed toward addressing the most pressing threats.

Stage 3: Adaptation Action Plan

The final stage of the methodology focused on formulating and implementing an Adaptation Action Plan to address the identified risks. The primary objective of the adaptation action plan was to enhance the resilience of Ghana's urban areas to climate change impacts, ensuring the continuity of essential services and sustainable urban development.

The adaptation action plan outlined specific strategies and actions for mitigating risks, including timelines, responsibilities, and required resources. Key strategies included improving stormwater drainage systems, integrating green infrastructure such as urban wetlands and forests, implementing resilient building codes, and developing early warning systems for extreme weather events. The plan also integrated gender-responsive measures to address the unique vulnerabilities and contributions of men and women in disaster risk reduction efforts.

Monitoring and evaluation mechanisms were incorporated into the adaptation action plan to track the effectiveness of the implemented strategies. These mechanisms provided a feedback loop, enabling adjustments to actions based on observed outcomes and emerging challenges.



The methodology emphasized a collaborative approach, leveraging diverse expertise and stakeholder inputs to shape the risk assessment and action plan. This process ensured the development of a robust, contextually tailored strategy for cities and DRR adaptation in Ghana, aligning with the country's National Adaptation Plan and international commitments such as the Sendai Framework for Disaster Risk Reduction (SFDRR).

2.3.2. Identification and Compilation of Sector-Specific Adaptation Actions

The development of the National Adaptation Action Plan for the Cities and DRR Sector involved a meticulous process to identify, evaluate, and compile targeted adaptation strategies. This process ensured that the actions proposed were tailored to address the unique vulnerabilities of urban areas while fostering resilience and sustainability. The planning team utilized a robust methodology, detailed in Table 1, to determine these adaptation options.

Table 1: Methodology to Identify Adaptation Options

Methodology	Description
Vulnerability Assessment Report Recommendations	The vulnerability assessments conducted for Ghana's cities and disaster risk reduction (DRR) provided actionable recommendations for adaptation. These assessments identified the key risks and vulnerabilities facing urban areas, such as flooding, heatwaves, and infrastructure fragility, and proposed specific measures to mitigate them. These recommendations formed a critical foundation for the planning process.

Literature Review	An extensive review of scientific literature, government policy documents, urban planning frameworks, and global best practices was undertaken. The review included strategies for enhancing disaster risk reduction and urban resilience in similar climatic and socio-economic contexts, such as the development of efficient stormwater drainage systems in flood-prone areas and the implementation of green infrastructure in densely populated urban zones.
Stakeholder Consultation	Engagement with a wide range of stakeholders, including government agencies, local communities, non-governmental organizations, academic institutions, and private sector actors, ensured the inclusion of diverse perspectives. Participatory workshops facilitated discussions of climate scenarios, potential adaptation measures, and implementation challenges. Ecosystem-specific stakeholders, such as forest managers, fisheries authorities, and conservation NGOs, provided critical input.

Source: Author's construct (2024)

Following the compilation of potential adaptation measures, an evaluation and prioritization process was undertaken to ensure the effectiveness, feasibility, and sustainability of the proposed actions (Table 2). This process involved assessing the suitability of each option in enhancing ecosystem resilience, reducing vulnerabilities, and contributing to sustainable

development. Stakeholders from diverse backgrounds were actively involved to ensure the selected measures were context-specific, equitable, and free from maladaptive outcomes.

To facilitate this process, a Multicriteria Decision Making (MCDM) Analysis was employed. MCDM is a systematic framework that enables the evaluation and prioritization of multiple options based on predefined criteria. The methodology helps address the complexities of decision-making in sectors where trade-offs may exist among competing objectives, such as conservation, economic development, and community well-being.

Table 2: Criteria for Evaluating Adaptation Options in the cities and DRR Sector

Criteria	Description
Ecological Effectiveness	Measures the potential of the action to enhance ecosystem resilience and protect biodiversity.
Feasibility	Assesses the technical, financial, and operational viability of implementing the adaptation measure.
Social Equity	Evaluates the extent to which the action promotes inclusivity and benefits vulnerable and marginalized groups.
Cost-Effectiveness	Considers the economic efficiency of the measure, including long-term benefits relative to its costs.
Sustainability	Assesses the ability of the adaptation action to provide enduring benefits without degrading resources.
Stakeholder Acceptance	Evaluates the level of community and institutional support for the proposed measure.



Policy Alignment	Determines how well the adaptation action aligns with national policies, international frameworks, and sectoral goals.
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Source: Adapted from Dixit & McGray (2013)

The MCDM framework allowed stakeholders to assign weights to each criterion, reflecting its relative importance to the cities and disaster risk reduction (DRR) sector. Proposed adaptation actions were then scored against these criteria, ensuring a transparent and participatory prioritization process. For instance, actions such as implementing stormwater drainage systems, enhancing urban green spaces, and developing early warning systems for extreme weather events were evaluated for their effectiveness, cost-efficiency, and alignment with Ghana's National Climate Change Policy and Sustainable Development Goals.

After ranking the various indicators, assigning appropriate weights to them was a critical step in the prioritization process. A weighted scoring system was employed, where indicators were evaluated based on their relative importance to the cities and DRR sector. Unlike equal weighting systems, this approach allowed for a nuanced evaluation that reflected the specific needs and priorities of the sector (Zobeidi et al., 2024; Antwi-Agyei et al., 2013; UNFCCC, 2011).

To achieve this, a five-point Likert scale was used to rank the indicators (Table 3). This method engaged climate change experts, urban planners, and disaster management professionals who provided rankings based on their expertise and the perceived importance of each indicator. Drawing inspiration from the methodology used by Antwi-Agyei et al. (2013), the frequency and consensus with which each indicator was cited contributed to the final weighting system (Zobeidi et al., 2024; UNFCCC, 2011).

Table 3: Ranking of Adaptation Options

Rank	Interpretation
1	Low
2	Neutral
3	Medium
4	High
(....)	Enclosed number indicates high uncertainty

This ranking framework provided a structured and transparent method for integrating expert insights into the decision-making process. Additionally, the inclusion of a mechanism to denote high uncertainty (e.g., enclosing a number in brackets) allowed for greater flexibility and caution in interpreting results, particularly in areas where data or consensus was limited. The finalized weighting and ranking system thus ensured that adaptation options were not only scientifically rigorous but also contextually appropriate for the cities and disaster risk reduction (DRR) sector.





3. NATIONAL CIRCUMSTANCE FOR THE CITIES AND DRR SECTOR

3.1. Background

Ghana's population has grown almost fivefold since the first post-independence census was conducted in 1960 and it continues to grow with each passing year (GSS, 2021). As a result of this growth, Ghana experiences increased migration, population expansion and surge urbanization processes which have become a defining character of most cities in ways that have brought most governments and their city planning authorities under tremendous pressures (Damte et al., 2023). It is undeniable that many cities in developing countries face significant challenges in providing safe and affordable housing, supplying quality drinking water and basic sanitation, providing energy to businesses and residents, ensuring safe and livable communities, and fostering an environment for economic success (UNDRR, 2019).

Continuous occurrence of disasters in the country has negative consequences on the entire population, property, and the environment in terms of its cost and destruction (Kelly & Addo, 2023). There arises the need for Ghana to build resilient cities that would bear the mandate of reducing the impacts of climate change and urbanization on cities. A resilient city is an urban system that not only adapts to climate change, but it is also able to plan and manage a long-term strategy that will guarantee social stability through shared governance, building conditions for a low-carbon civilization (Pinto, 2014).

Cities that conduct risk and vulnerability assessments typically are able to identify the projected impacts and climate-related threats that they may face. These specific issues naturally vary from city to city, as risks and vulnerabilities are location-specific (Nadkarni et al., 2012). It is therefore necessary for Ghanaian cities to provide the appropriate countermeasures to prevent or reduce the effects

of these projected impacts and threats (Pinto, 2014). Disaster Risk Reduction is highly critical for Ghana as it aims at preventing new and reducing existing disaster risks as well as managing residual risks, all of which contribute to strengthening resilience and achieving sustainable development (OECD, 2020).

While there isn't much data on DRR's contribution to the Ghanaian economy, (Gyamfi Ackomah et al., 2024) indicates that disasters positively affect economic growth due to the reconstructive efforts which drive financial injections for economic activities. Over the years, numerous studies have been conducted to analyse the effects of single or multiple disasters globally. (Botzen et al., 2019) utilized a panel model with country fixed effects and data spanning 1970–2006 to investigate the impact of cyclone intensity (measured as energy dissipation) on economic activity (measured by GDP) across 28 countries in the Caribbean basin. When examining specific industrial sectors, the effects varied significantly, with notable negative and positive responses. Sectors such as agriculture, wholesale and retail trade, and tourism experienced substantial negative impacts, while the construction sector benefited, likely due to increased reconstruction activities. Additionally, a dynamic relationship between past cyclone intensity and current sectoral GDP was identified, indicating that the economic repercussions of cyclones can persist beyond the year of their occurrence. Between 2016 and 2018, an average of \$263 million has been spent on DRR activities (UNDRR, 2020). This amounts to 2% of the national budget and represent 2.8% of total domestic national budget).

Further, available literature does not explicitly mention, in terms of numbers, how many people are employed by or depend on the Disaster Risk Reduction sector for their livelihoods in Ghana. However, by addressing systemic vulnerabilities faced by marginalized and vulnerable populations which is crucial to ensure that these groups are not only protected during disasters but are also empowered to actively participate in building resilience (UN-Habitat, 2019).



Disaster Risk Reduction actively seeks to uplift vulnerable groups by involving them in strategies, enhancing their resilience and improving their livelihood. It is also known that women, often primary caregivers, are uniquely positioned to act as agents of change in disaster preparedness and response (UNDRR, 2019)). Moreover, the adverse effects climate impacts place unique burdens on the urban poor, residents of informal settlements, and other vulnerable groups, such as women, children, the elderly and disabled, and minority populations. By including vulnerable groups into urban adaptation plans, cities ensure equitable access to resources and the benefits of sustainable urban development (UN-Habitat, 2019). This reflects how the sector strives to create inclusive benefits for marginalized populations, such as equitable access to disaster adaptation resources.

Disaster Risk Reduction solutions, however, must raise awareness about specific climate change impacts on the most vulnerable, include vulnerable groups in the adaptation planning and policy-making process, incorporate community-based adaptation into city plans, when appropriate, support organizations that already work with the vulnerable groups and strengthen land administration and regulation (UNDRR, 2019). In pursuing such efforts, it is important to fully recognize the resourcefulness of the informal sector in cities. Additionally, women's limited personal assets, dependency on male family members, and lack of education or power in decision-making reduce their ability to adapt effectively to disasters. Furthermore, women's roles as caretakers and first responders during disasters place additional burdens on them. Therefore, to optimize the results of DRR in Ghana, it would be extremely beneficial, to follow a country-driven, gender-sensitive, participatory and fully transparent approach, taking into consideration vulnerable groups, communities and ecosystems (UN-Habitat, 2019). However, community-based organizations that work with the most vulnerable groups within the city (such as the elderly, children, low-income groups, and sick or disabled people) may be more trusted among close-knit social networks than some city governments (UNDRR, 2019).



Mapping vulnerabilities, understanding development pressures, and implementing policies and infrastructure investments that encourage urban expansion in safe areas can require land-use data and technical capacity. Smaller cities without the resources to pursue these planning activities in-house can consider collaborating with external partners, such as regional or national-level governments, who have expertise with planning tools, such as advanced geographical information system (GIS) and scenario-based planning methods (UNDRR, 2019).

Across the globe and regions, the existence of campaigns such as the UNISDR's "Making Cities Resilient—My City is Getting Ready!" promote increased understanding and commitment by cities and local governments to risk reduction and to build cities that are resilient to disasters and climate change. Although cities around the world are facing many similar impacts and planning challenges, a number of regional variations are present. African cities are distinguished by their high level of sector-based planning as well as engagement in implementation. Compared to the global average, African cities have higher levels of NGO involvement in planning and lower levels of community group and local resident involvement (Nadkarni et al., 2012).

3.2. Overview of cities and DRR sector

Disaster Risk Reduction (DRR) activities have increasingly focused on urban infrastructure, prioritizing resilience in city planning and development (Etinay et al., 2018). Vulnerability assessments of cities play a critical role in understanding exposure to extreme events, the sensitivity of populations to external stresses, and their capacity to adapt to climate change (Meerow, Pajouhesh, and Miller, 2019). These assessments are essential for designing effective intervention strategies, policies, and actions to mitigate risks and foster adaptation. Urban climate adaptation aligns closely with the Sendai Framework for Disaster Risk Reduction, which emphasizes integrating disaster risk considerations into urban governance and planning (UNDRR, 2019). The framework promotes embedding DRR into

municipal planning through sustainable mobility, eco-friendly infrastructure, and comprehensive risk governance strategies (Olazabal et al., 2018).

Urban areas are growing rapidly throughout the world and this greatly contributes to the vulnerabilities cities face (UN-Habitat, 2019). This rapid urbanization and soaring migration from rural areas, combined with lack of affordable housing, has been associated with the development of informal settlements on marginal land in and near cities (World Bank, 2011).

Also, weak land administration and regulation, creation of informal and unplanned settlements on marginal land (for example, floodplains, steep hillsides, or landfills) lack of secure land tenure lack of access to infrastructure and basic services (for example, water, sanitation, public health, or electricity), overcrowding and stress on existing infrastructure, social fragmentation, conflict, and crime are all non-climatic factors that increase cities' vulnerabilities and adversely affect the performance of the sector (UNDRR, 2019).

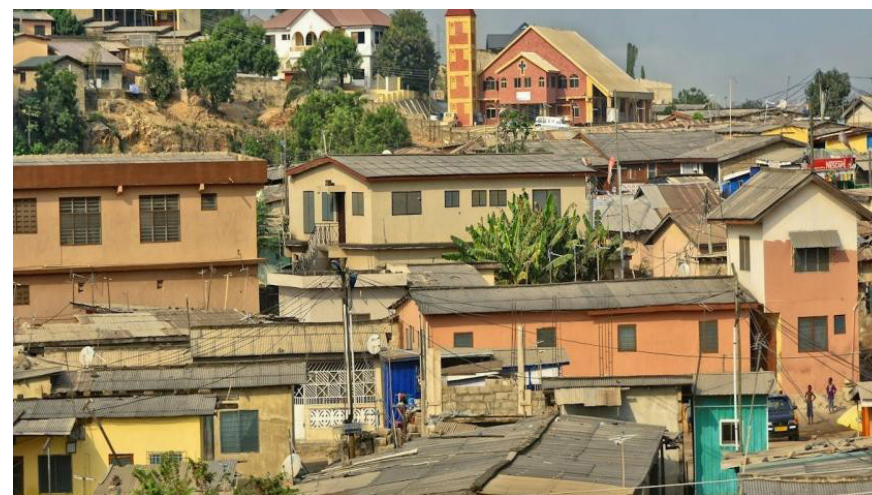
Importantly, urban DRR encompasses various categories, including housing, infrastructure, public health, and waste management.

3.2.1. Housing

Ghana's urban areas, particularly Accra and Kumasi, face significant challenges related to informal settlements. Poorly built housing structures are highly vulnerable to hazards such as floods, fires, and heatwaves (UN-Habitat, 2020). The housing sub sector is a critical determinant of urban resilience, as poorly constructed homes exacerbate disaster vulnerabilities. Many cities and towns lack climate-resilient infrastructure, and urbanization has outpaced the development of climate-adaptive systems. As well, urbanisation in vulnerable areas, particularly along the coast and floodplains, has led to increased exposure to climate risks (GoG, 2024).

Over 40% of urban dwellers in Ghana live in **informal settlements** with inadequate adherence to building codes, making them highly susceptible to disasters such as floods and fires (UN-Habitat, 2020). High housing costs force low-income families into high-risk areas like floodplains or near open drains (World Bank Group, 2021). Due to gender inequalities, women face limited access to secure land tenure and are less likely to invest in disaster-resilient housing due to social and economic barriers (Antwi-Agyei et al., 2015).

Figure 5: Accra's informal housing settlement



Source: Online search

Strengthening regulatory frameworks and promoting flood-resilient housing designs can mitigate risks (Oxford Business Group, 2024). As well, providing legal frameworks that enhance women's access to land and housing can empower them to invest in resilient solutions. Upgrading



informal settlements through participatory planning and sustainable housing initiatives can improve resilience (UN-Habitat, 2020).

3.2.2. Infrastructure

Inadequate drainage systems, poorly maintained roads, and insufficient energy supplies exacerbate disaster risks in cities. Infrastructure failures during extreme weather events and disasters, such as the Accra floods of 2015, demonstrate the urgent need for resilient urban planning (Oxford Business Group, 2024). Infrastructure resilience is central to urban DRR, particularly for **transportation, drainage, and energy systems**.

Figure 6: Urban flooding and its impact on transportation systems - a consequence of poor drainage in urban areas of Ghana



Source: Online search

Blocked or insufficient drainage systems contribute to recurrent urban flooding (KCCI, 2023). Weak transportation networks and poor road infrastructure limits evacuation efforts and emergency response during disasters (World Bank Group, 2021). Unreliable energy supply and power outages during disasters compound risks, especially for urban populations in informal settlements (Badmos et al., 2018).

Investing in resilient infrastructure through expanding drainage systems, maintaining roads, and modernizing energy grids can significantly reduce disaster risks. Nature-Based Solutions targeting incorporation of green infrastructure like urban wetlands, green roofs, and permeable pavements would help mitigate flooding (UNDP, 2022). Developing resilient transportation systems for disaster-friendly urban mobility with evacuation routes and safe zones enhances urban preparedness (Ayumah et al., 2020).

3.2.3. Public Health

Urban disasters, such as floods, increase the risk of disease outbreaks, particularly in densely populated areas. Women and children are disproportionately affected due to limited access to **healthcare and sanitation facilities** during emergencies (Ayumah et al., 2020). Urban disasters pose significant public health risks, particularly for vulnerable groups such as women, children, and the elderly. Poor sanitation and flooding in urban areas lead to outbreaks of waterborne diseases such as cholera and malaria (World Bank Group, 2021). Overburdened health systems together with inadequate healthcare facilities hinder urban resilience and disaster response (Ayumah et al., 2020). Gender-specific vulnerabilities presents additional health risks during disasters, such as limited access to maternal healthcare and sanitation facilities (Antwi-Agyei et al., 2015).



Figure 7: Poor sanitation along informal settlements



Source: Online search

Strengthening health systems and building capacity in urban healthcare facilities, especially in underserved areas, can improve disaster resilience (UNDP, 2022).

Educating urban residents on hygiene and disaster preparedness can reduce the health impacts of disasters. Gender-inclusive planning, ensuring access to maternal health services and sanitation for women during emergencies is critical for resilience (Ayumah et al., 2020).

3.2.4. Waste management

Poor **waste disposal** practices in urban areas clog drainage systems, contributing to urban flooding (KCCI, 2023). Women, who often manage household waste, are critical stakeholders in efforts to improve waste management practices (World Bank Group, 2017). Effective waste management is essential for urban resilience, as waste-related challenges directly contribute to disasters like flooding. Improper waste disposal blocks drains due to poor waste management exacerbate urban flooding. Limited recycling infrastructure for **waste segregation and recycling practices** increases environmental and disaster risks. Women dominate the informal waste sector but face unsafe working conditions and limited opportunities for formal employment (Antwi-Agyei et al., 2015).

Figure 8: Appropriate urban waste management



Source: Online search



Comprehensive waste collection, expanding municipal waste management systems can prevent blockages and reduce disaster risks. Encouraging circular economy initiatives like recycling and waste-to-energy projects can address waste management challenges while creating economic opportunities (Badmos et al., 2018). Raising awareness about proper waste disposal and integrating women into formal waste management systems can enhance resilience (UNDP, 2022).

3.3. Way Forward - Integrated Approach to urban resilience and disaster risk reduction

In the absence of strong city planning, cities can experience sprawl and other unsustainable land use patterns because of uncontrolled growth (UNDRR, 2019). A single city agency usually does not have the authority for all planning decisions and investments that shape urban form. Therefore, effective collaboration across agencies and even sectors is critical for successful adaptation of a city's physical landscape. Various ministries, representing the different sectors, and different levels of government will need to be consulted as part of a thorough process of vertical and horizontal coordination (*UN-Habitat, 2019*). Any breach in this communication and coordination can adversely jeopardize the performance of the DRR sector.

To effectively address these challenges, urban DRR strategies must adopt integrated, multi-sectoral approaches. Such approach include collaborative urban planning involving all stakeholders from housing, infrastructure, public health, and waste management sectors to ensure cohesive implementation (KCCI, 2023). Leveraging technology such as early warning systems, geospatial mapping, and digital tools can improve disaster preparedness and response (UNDP, 2022).



Incorporating gender perspectives into urban planning ensures equitable and inclusive DRR strategies (Antwi-Agyei et al., 2015). As well, training urban

planners, municipal officials, and community leaders in resilience-building techniques is essential for sustained progress (Ayumah et al., 2020). Urban disaster risk reduction (DRR) efforts in Ghana would require an integrated and multi-sectoral approach to address vulnerabilities in housing, infrastructure, public health, and waste management. These sectors face unique challenges due to rapid urbanization, inadequate planning, and socio-economic inequalities, particularly in cities like Accra, Kumasi, and Tamale.



4. CLIMATE CHANGE IMPACTS AND ANALYSIS FOR THE SECTOR

Ghana's cities and disaster risk are at serious risk from climate change. These impacts manifest through both direct effects, such as altered rainfall patterns and rising temperatures, and indirect consequences that increase existing vulnerabilities within communities (World Bank 2021). Understanding these risks is important for developing effective adaptation strategies that can protect livelihoods and enhance resilience, particularly for marginalized groups such as women and youth. This section involves stocktaking to understanding the context of climate change and the key climate risks of the DRR sector.

4.1. Past Climate Trends

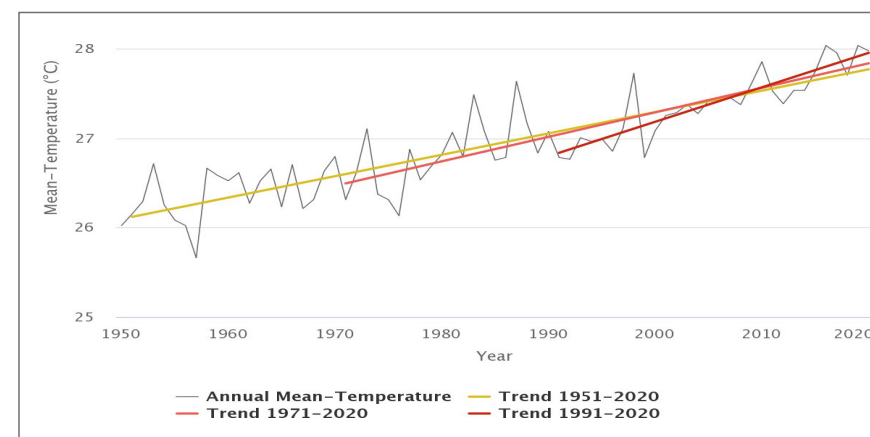
Ghana's climate has undergone significant changes over the past decades, particularly in terms of temperature and rainfall patterns.

4.1.1. Temperature Trends

According to historical data, temperatures have been steadily increasing throughout Ghana, with the northern regions feeling the effects of warming more than the south. Since the 1970s, Ghana's average temperature has increased by about 0.21°C every ten years, and projections suggest that by 2050, temperatures in the northern regions could rise by 2.1°C to 2.4°C, posing a significant risk to urban infrastructure and public health due to heat stress and erratic weather patterns (Asante et al., 2014). In contrast, Greater Accra and other coastal areas are warming more slowly. While cities like Accra are expected to see temperature increases of 1.4°C to 1.9°C by 2050, rapid urbanization has exacerbated the urban heat island effect, making extreme heat occurrences exceeding 35°C and 40°C more common (Asabre, 2020).

In northern Ghana, cities are increasingly affected by heat stress and its impacts on public health, such as an increase in heat-related illnesses and fatalities. Urban growth in cities like Accra has led to a reduction in green spaces and an expansion of hard surfaces, raising energy demands for cooling and increasing nighttime temperatures. These changes disproportionately affect vulnerable groups, including the elderly, children, and low-income communities, who are at greater risk during heatwaves (Puplampu et al., 2021).

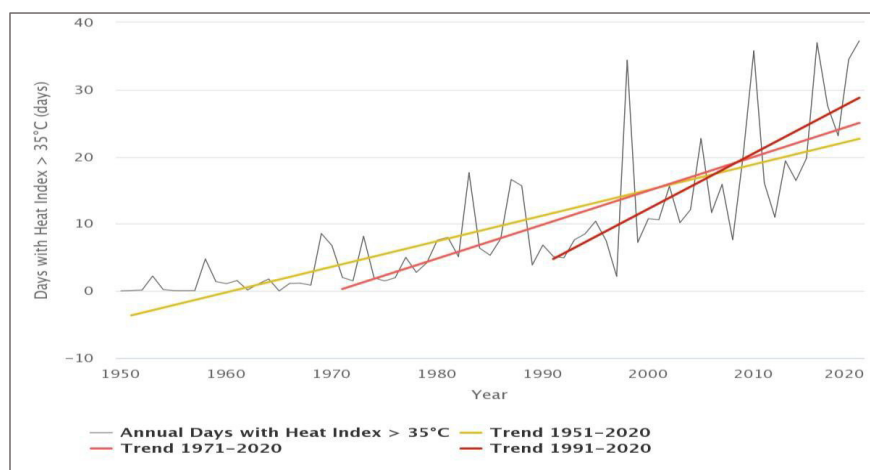
Figure 9: Mean Annual Temperature trends for Ghana.



Source: CCKP from UNEP 2023



Figure 10: Days with Heat Index > 35°C trends for Ghana



Source: CCKP from UNEP 2023

4.1.2. Rainfall Patterns

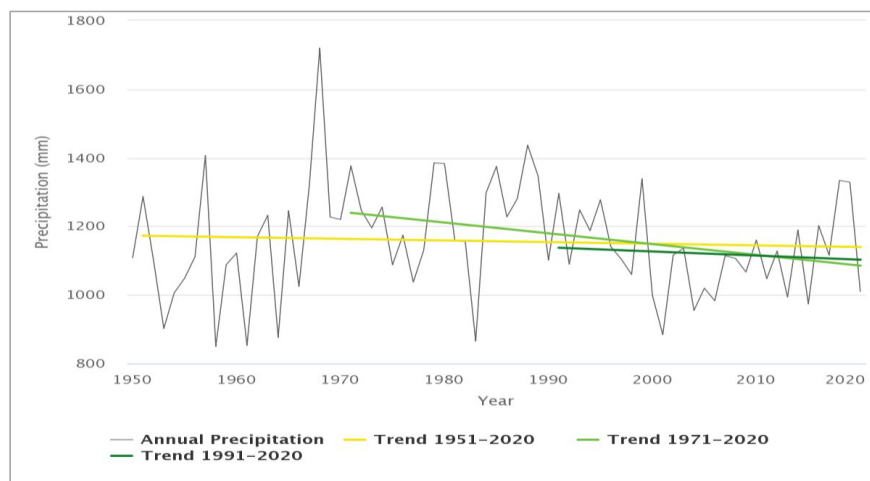
According to Incoom et. al., (2020), there has been a general reduction in annual rainfall in Ghana, particularly during the major rainy season (April to October), along with significant variations in rainfall trends. Ghana's economy, heavily reliant on agriculture, which is predominantly rainfed, is being increasingly affected by these changes in rainfall patterns (Yaro et al., 2010). Both the Transition and Coastal Savannah agro-ecological zones have experienced declining rainfall trends, as revealed by a study examining rainfall data from 1968 to 2011 (Atiah et al., 2019). This has complicated agricultural planning, as the rainy season has become more unpredictable, with delays in its onset and early cessation (Guodaar et al., 2021).

The dry season is also characterized by longer dry spells, raising concerns about water availability for agriculture and domestic use. The effects of climate change in Ghana have been profound, impacting key sectors such as agriculture, water resources, and public health (Asante & Amuakwa-Mensah, 2014). Farmers are struggling to plan and maintain productivity due to decreased crop yields, especially for staple crops like maize and cassava, driven by rising temperatures and erratic rainfall patterns (Kosoe & Ahmed, 2022). The reduction in rainfall has also contributed to widespread water scarcity, making it challenging to access water for both household use and agricultural irrigation.

The reduction in rainfall has also contributed to widespread water scarcity, making it challenging to access water for both household use and agricultural irrigation. Rural and urban communities alike are particularly vulnerable to the health effects of these climate trends, including increased heat-related illnesses and the spread of vector-borne diseases like malaria (Khezzani et al., 2023). The increased risk of floods, coupled with a lack of adequate urban infrastructure for stormwater management, further complicates DRR efforts in cities, leaving communities more exposed to climate risks.



Figure 11: Annual precipitation trends for Ghana Source: CCKP from UNEP 2023

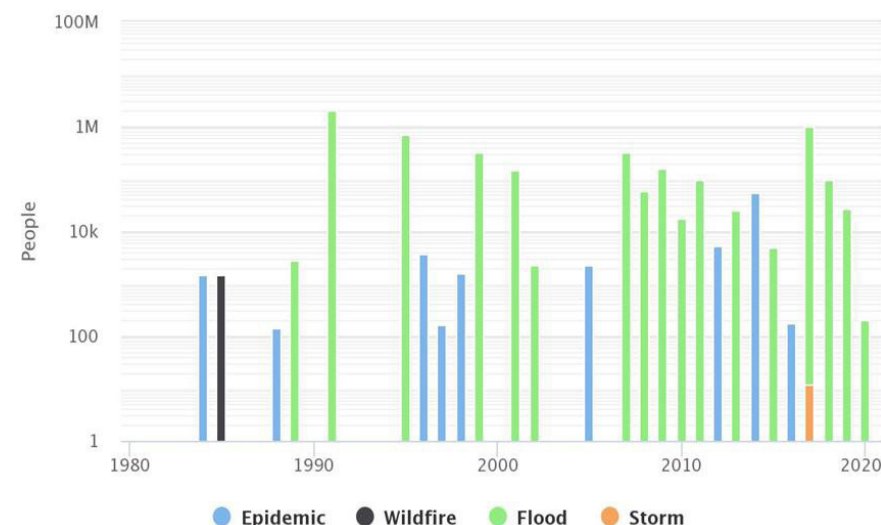


4.1.3. Climate hazards and extreme events

Ghana faces escalating vulnerability to climate hazards such as floods, droughts, and coastal erosion, which significantly impact its ecology, economy, and society. According to Ghana’s first Biennial Transparency Report to the UNFCCC, over the past 50 years, these hazards have affected over 16 million people and caused widespread damage and loss of life (GoG, 2024). Flooding, the second most severe natural disaster in the country, has become an almost annual occurrence since the 1990s, particularly in urban areas and coastal regions. Rapid urbanization, environmental degradation, and inadequate infrastructure exacerbate the risks, with urban flooding posing recurring challenges in major cities. Since around 1990, flood events have occurred nearly every year (**Error! Reference source not found.**). Coastal communities also face additional threats from storm surges and erosion, while the northern Savannah

region is highly susceptible to droughts and rising aridity. These hazards not only cause immediate destruction but also result in long-term socio-economic consequences, emphasizing the critical need for sustainable urban planning, improved infrastructure, and robust disaster risk reduction strategies tailored to Ghana’s unique vulnerabilities.

Figure 12: Summary statistics of key natural hazard events (number of people affected) for Ghana from 1980 to 2020



Source: CCKP from UNEP 2023

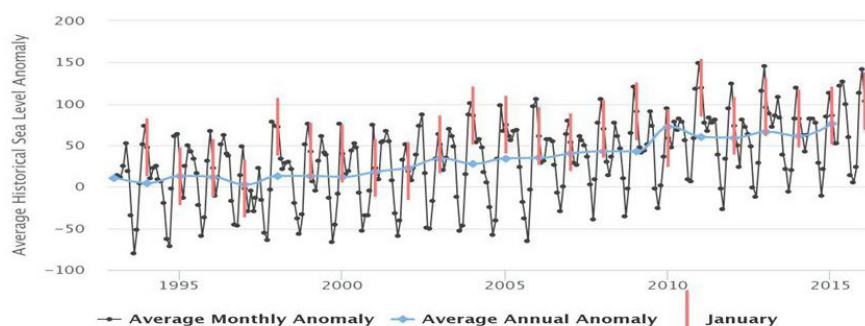
4.1.4. Trends in sea level rise

Ghana’s coastline is highly vulnerable to erosion, posing significant risks to critical infrastructure and coastal communities. Climate change exacerbates this challenge through rising sea levels driven by thermal expansion and the melting of glaciers and sea ice. While the global average rate of sea level rise is approximately 3 mm per year, the rate along Ghana’s coast



is notably higher at 4 mm per year (Figure 8). This accelerated coastal retreat is expected to worsen due to future sea level rise, coupled with more frequent and intense storm surges and stronger winds associated with climate change. These dynamics underscore the urgent need for proactive coastal management and adaptation strategies.

Figure 13: Historical Sea level for Ghana (1993-2015) – observed anomalies relative to mean of 1993-2012



Source: The World Bank Group, 2021

4.2. Projected Climate Trends

4.2.1. Temperature Projections

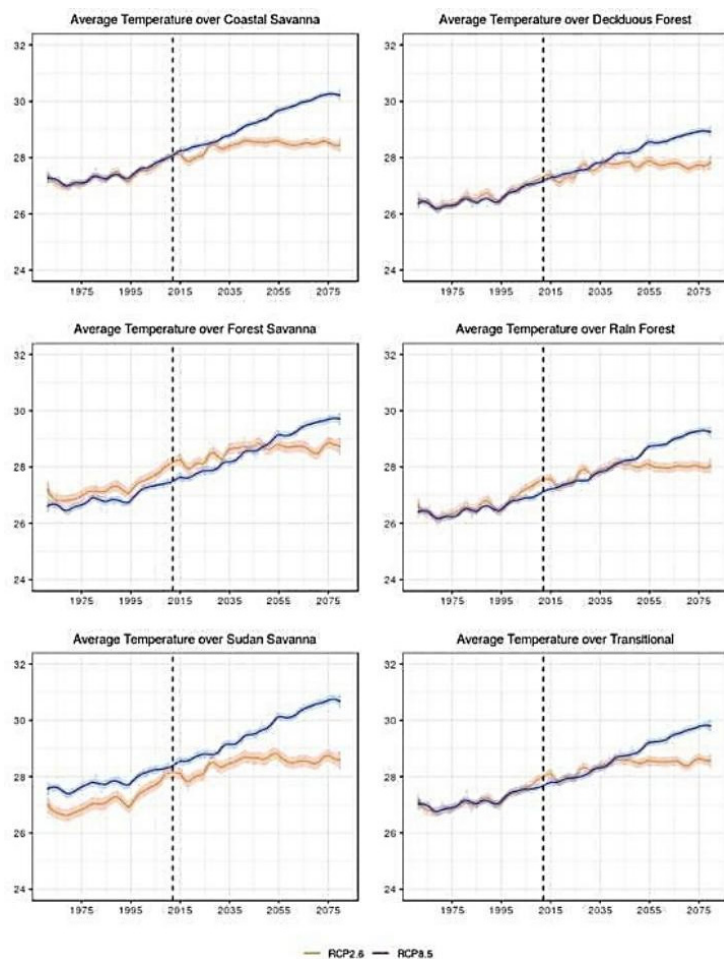
Average temperatures in Ghana are rising significantly; according to the National Climate Change Policy (2013), they have already increased by about 1°C since 1960. Given current projections, average temperatures may rise by an extra 1°C to 3°C by the 2050s. Depending on scenarios concerning greenhouse gas emissions, projections suggest possible increases by the end of the century might range from 2.3°C to 7°C (Ghana National Climate Change Policy, 2013). Compared to coastal areas, this

warming trend is probably more evident in northern regions. This could worsen heat stress on crops and livestock, affecting livelihoods and food security (Addaney et al., 2021).

Ghana's average yearly temperature is expected to rise by 1.0 to 3.0°C by the 2060s and 1.5 to 5.2°C by the 2090s, according to research (Ghana National Climate Change Adaptation Strategy, 2019). Ghana's northern inland regions are expected to warm at a faster rate than its coastal regions, which could result in a rise in heat-related illnesses and deaths (Climate Risk Country Profile: Ghana, 2023). Heat stress on agricultural systems will probably be enhanced by rising temperatures, making it more challenging for farmers to maintain productivity (Asante et al. 2014). In addition, coastal areas are facing temperature increases due to urban heat islands, especially in cities like Accra. Urbanization has intensified these effects, leading to higher nighttime temperatures and increased energy demands for cooling (Wemegah et al., 2020).



Figure 14: Past and future temperature patterns in six agro-ecological zones of Ghana. The pink and blue lines show the mean trend in temperature. The enveloped around mean line shows the degree of variability of change in the past and future climate as indicated by the dotted vertical line.



Source: Ghana's Fourth National Communication to the United Nations Framework Convention on Climate Change, 2020.

4.2.2. Rainfall Projections

Ghana's rainfall patterns are highly unpredictable, and projections for the future show that the country's total annual rainfall is likely to remain unknown. According to the National Climate Change Adaptation Strategy (2012), total annual rainfall may decrease in some places while rainfall intensity may increase in others. These shifts in rainfall are critical for DRR, as they directly affect water resources, agricultural productivity, and urban infrastructure. For instance, while coastal areas of Ghana receive between 750 mm to 2,200 mm of rainfall annually (Owusu and Waylen, 2009), future projections indicate increased variability in rainfall, which poses significant risks to urban planning and the ability to respond to disasters.

Rainfall variability is projected to rise according to the Revised Nationally Determined Contributions (2021), with projections suggesting that the frequency of severe rainfall events may increase even while overall annual rainfall declines. Projections indicate that by the 2050s, the total annual rainfall in northern Ghana could decline by as much as 10%, hence worsening drought conditions (Ghana National Climate Change Adaptation Strategy, 2019). These changes present a serious challenge for DRR efforts, as they increase the frequency of both droughts and floods, requiring improved infrastructure, water management, and early warning systems in urban areas.

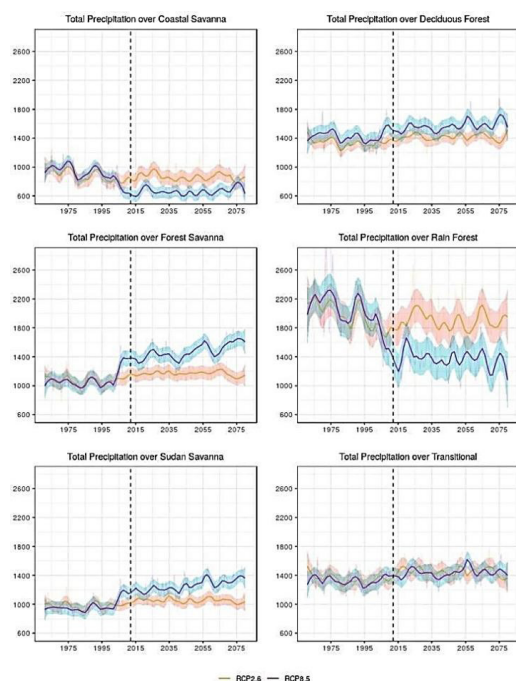
On the other hand, more rainfall during certain periods may lead to a rise in extreme weather events, such as flooding, in southern regions. Research has shown that rainfall varies greatly in Ghana's middle regions, with rates of variation ranging from 25.3% to 70.8% (Braithwaite et al., 2022). Agricultural productivity is severely impacted by this change, especially in rain-fed systems. These climate trends have had a significant impact on Ghana, influencing important areas including agriculture, water resources, and health. Reduced agricultural yields have resulted from rising temperatures



and unpredictable rainfall patterns in agriculture, especially for key crops like maize and cassava.

Farmers find it more and more challenging to plan ahead and maintain production because of this uncertainty (Guodaar et al., 2021). Decreased rainfall has resulted in widespread water scarcity, which has a significant impact on water resources and makes it difficult to get water for household use as well as for agricultural irrigation posing risks of food security in Ghana (Ingrao et al., 2023).

Figure 15: Past and future rainfall patterns in six agro-ecological zones of Ghana. The pink and blue lines are showing the mean trend in rainfall. The enveloped around mean line shows the degree of variability of change in the past and future climate as indicated by the dotted vertical line.

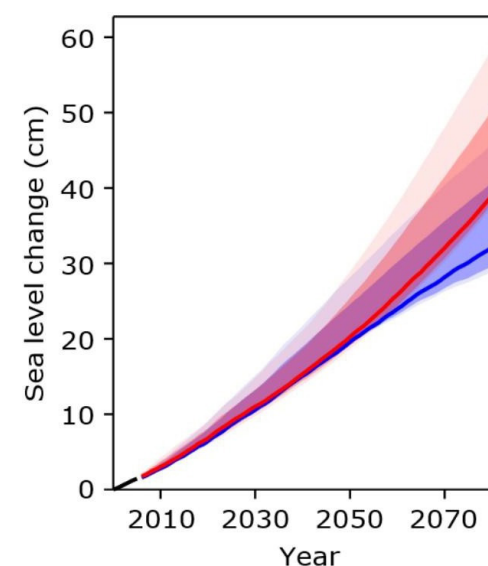


Source: Ghana's Fourth National Communication to the UNFCCC, 2020.

4.2.3. Sea Level Rise Projections

Sea levels along Ghana's coast are projected to rise significantly in the coming decades (Figure 16). Under the RCP6.0 scenario, sea levels are expected to increase by 11 cm by 2030, 20 cm by 2050, and 39 cm by 2080, according to projections from the Inter-Sectoral Impact Model Intercomparison Project (ISIMIP). This rise poses substantial risks to coastal communities, infrastructure, and ecosystems, intensifying challenges such as coastal erosion, saltwater intrusion, and higher storm surges. These impacts can result in land loss, contamination of freshwater resources, and severe damage to property and livelihoods. To address these threats, Ghana's adaptation strategy must prioritize effective coastal zone management, protective infrastructure development, and proactive community relocation plans (GoG, 2021).

Figure 16: Sea level rise projections for the coast of Ghana for different GHG emissions scenarios, relative to the year 2000.



Source: GoG, 2021.



4.3. Climate Change Impacts Risk Analysis of the Sector

Urban areas are at significant risk from climate change due to more frequent and intense extreme weather events, such as heat waves, heavy rains, and flooding (Nadkarni et al., 2012). These events threaten public health, disrupt essential services, and damage infrastructure, particularly in cities with inadequate infrastructure and socio-economic inequalities (Tay & Ocansey, 2022). Flooding exacerbates water quality and shortage issues, while droughts reduce water supply, posing serious health risks, especially for vulnerable groups like low-income and marginalized populations (Guide to Climate Change Adaptation in Cities, 2011). Moreover, competing goals, political inertia, and financial constraints hinder effective policy implementation, making it difficult to integrate disaster risk reduction (DRR) and climate change adaptation (Habitat, U.N., 2019).

The risks posed by climate change are further intensified by sea level rise, which increases flooding, erosion, and salinization of freshwater resources, threatening coastal towns (Roy et al., 2023). Urban drainage systems also struggle with excessive rainfall, leading to flash floods that damage property and infrastructure (De Oliverra et al., 2022). These direct impacts are compounded by indirect effects, such as impaired sanitation and food insecurity resulting from disruptions to essential services (Guide to Climate Change Adaptation in Cities, 2011). Vulnerable groups, especially those in informal settlements, face heightened risks due to inadequate infrastructure and resources for adaptation, leading to health hazards, socioeconomic instability, and displacement (Guide to Climate Change Adaptation in Cities, 2011).

In response, cities can enhance urban resilience by updating master plans to account for climate risks like sea level rise and flooding, and investing in infrastructure improvements such as levees, sea walls, and better drainage systems (Guide to Climate Change Adaptation in Cities, 2011). Energy efficiency, renewable energy investments, and water management strategies can also serve

as win-win adaptation measures (Guide to Climate Change Adaptation in Cities, 2011). Green infrastructure and urban agriculture can reduce energy demand and prepare cities for food shortages, while climate-resilient transportation planning can prevent damage to infrastructure in flood-prone areas (Guide to Climate Change Adaptation in Cities, 2011). Additionally, incorporating natural systems like wetlands and urban woods enhances resilience and mitigates flooding (Lamond et al., 2015).

Socioeconomic factors also play a critical role in vulnerability, with low-income neighborhoods often lacking the resources necessary for adaptation, exacerbating climate risks (Wamsler, 2017). Disadvantaged groups, including women, children, and indigenous populations, are disproportionately affected by climate change, experiencing increased health risks, loss of livelihood, and disruption of cultural practices (Guide to Climate Change Adaptation in Cities, 2011). Without action, the economic and infrastructural costs of climate change are projected to rise significantly, as seen with Hurricane Harvey and Hurricane Katrina, which caused billions in damages (Amadeo, 2019).

Inadequate action to address climate risks can result in severe long-term consequences, including increased mortality from heat-related illnesses, water shortages, and the spread of vector-borne diseases (Guide to Climate Change Adaptation in Cities, 2011). Land degradation, food insecurity, and the rising costs of coastal protection or relocation further exacerbate vulnerabilities (Guide to Climate Change Adaptation in Cities, 2011). Furthermore, urbanization itself generates additional risks like heat islands and flooding, making vulnerability assessments and adaptation plans crucial (Guide to Climate Change Adaptation in Cities, 2011). Global partnerships and improved governance can enhance climate resilience, but limited funding and technical expertise remain significant barriers (UN-Habitat, 2019).





5. POLICY AND INSTITUTIONAL FRAMEWORK FOR THE CITIES/ DRR SECTOR

5.1. Institutional arrangements for the Implementation of the Sectoral Plan

This section provides a comprehensive overview of the key actors involved in the implementation of adaptation plans for the Cities and Disaster Risk Reduction (DRR) sector in Ghana. It categorizes stakeholders into sectors, including national government ministries, agencies, non-governmental organizations (NGOs), civil society organizations (CSOs), and development partners, highlighting their respective roles and responsibilities. It emphasizes the need for collaboration across national ministries, agencies, NGOs, and CSOs to ensure inclusive, effective, and sustainable outcomes.

Table 4: Roles and responsibilities of key actors and stakeholders in Cities & DRR Sector

Actor Sector	Implementation Responsibility
National Government Ministries Institutions: Ministry of Environment, Science, and Technology; Ministry of Sanitation and Water Resources; Ministry of Local Government and Rural Development; Ministry of Food and Agriculture; Ministry of Lands and Natural Resources; Ministry of Works and Housing; Ministry of Roads and Highways; Ministry of Health.; Ministry of Finance; Ministry of Information (MOI)	- Develop and monitor national adaptation frameworks and policies. - Coordinate funding and inter-ministerial collaboration for climate resilience. - Ensure decentralization of adaptation plans and support MMDAs in local implementation. - Promote climate-smart agriculture, sustainable urban development, and resilient housing policies. - Improve sanitation, flood management, and access to clean water.

Actor Sector	Implementation Responsibility
National Agencies Institutions: National Disaster Management Organization (NADMO); Environmental Protection Agency (EPA); Ghana Meteorological Agency; National Development Planning Commission (NDPC); Hydrological Services Department; Department of Urban Roads; Department of Town and Country Planning; Department of Gender; Forestry Commission; Ghana Statistical Service (GSS); Water Resources Commission (WRC); Ghana National Fire Service (GNFS); National Commission of Civic Education (NCCE); Metropolitan, Municipal and District Assembly (MMDA); Land Use and Spatial Planning Authority (LUSPA); Volta Basin Authority (VBA)	- Lead disaster response, preparedness, and recovery in urban areas. - Regulate environmental standards and oversee climate adaptation strategies. - Provide weather data and early warning systems for disaster risk reduction. - Monitor water flow, manage drainage systems, and design flood control measures. - Oversee urban planning and ensure proper land-use zoning. - Protect urban forests and green spaces to enhance climate resilience. - Provide early warning information on disasters - Provide data to inform adaptation planning and vulnerability assessments.
Non-Governmental Organizations (NGOs) Institutions: Ghana Red Cross Society; CARE International; Friends of the Earth Ghana; SEND Ghana; WaterAid Ghana; ActionAid Ghana; World Vision Ghana	- Support disaster response and community-level preparedness. - Lead resilience-building initiatives for vulnerable populations. - Advocate for sustainable environmental management and equitable resource distribution. - Enhance access to clean water and sanitation in disaster-prone areas.



Actor Sector	Implementation Responsibility
Civil Society Organizations (CSOs)	- Advocate for climate adaptation policies and ensure inclusivity in DRR strategies. Build awareness and support community-based adaptation projects.
Institutions: Civil Society Platform on Climate Change; Disaster Volunteer Groups; Youth Climate Council Ghana;	
Development Partners and Donors	Provide technical expertise and financial support for adaptation planning. Strengthen institutional capacities and fund urban resilience projects.
Institutions: United Nations Development Programme (UNDP); World Bank; African Development Bank; International NGOs.	- Facilitate investments in infrastructure and disaster management initiatives.

5.2. Proposed Coordination Institutional Arrangements

This section outlines the institutional framework and specific roles of key stakeholders involved in the implementation and will play pivotal roles in coordinating of adaptation plans for the Cities and Disaster Risk Reduction (DRR) sector in Ghana. It highlights the specific coordination responsibilities of each institution, emphasizing their contributions to fostering collaboration, ensuring effective implementation, and ensuring that adaptation strategies are integrated across different governance levels.

Table 5: Proposed Coordination Roles in the Cities & DRR Sector

Actor Sector	Institution	Specific Coordination Role
National Government Ministries	Ministry of Environment, Science, Technology and Innovation	Lead the development of national adaptation frameworks and policies; ensure inter-ministerial coordination.
	Ministry of Sanitation and Water Resources	Coordinate water resource management and urban sanitation efforts in adaptation planning.
	Ministry of Local Government and Rural Development	Ensure decentralized implementation of adaptation plans through MMDAs.
	Ministry of Food and Agriculture	Oversee climate-smart agricultural practices and food security in urban and peri-urban areas.
	Ministry of Lands and Natural Resources	Guide sustainable land use and resource management for climate resilience.
	Ministry of Works and Housing	Coordinate resilient housing policies and flood management systems.
	Ministry of Roads and Highways	Ensure climate-resilient road infrastructure and urban connectivity.
	Ministry of Health	Manage health systems' preparedness and response to climate-induced urban disasters.
	Ministry of Finance	Mobilize financial resources and coordinate budget allocations for adaptation projects.
	Ministry of Information (MOI)	Lead awareness campaigns and public communication on adaptation initiatives.





National Agencies	National Disaster Management Organization (NADMO)	Lead disaster response coordination and preparedness at the national and local levels.
	Environmental Protection Agency (EPA)	Oversee environmental impact assessments and climate adaptation strategy implementation.
	Ghana Meteorological Agency	Provide climate data, weather forecasts, and early warning systems for disaster risk reduction.
	National Development Planning Commission (NDPC)	Integrate adaptation planning into national and regional development frameworks.
	Hydrological Services Department	Coordinate flood control and drainage system design for urban areas.
	Department of Urban Roads	Ensure resilient urban road design and maintenance.
	Department of Town and Country Planning	Oversee urban land use planning and zoning for disaster mitigation.
	Department of Gender	Promote gender-sensitive adaptation measures to address vulnerabilities.
	Forestry Commission	Protect urban green spaces and promote reforestation to enhance resilience.
	Ghana Statistical Service (GSS)	Provide data and indicators for vulnerability assessments and adaptation monitoring.
	Water Resources Commission (WRC)	Coordinate water resource management and flood prevention measures.

	Ghana National Fire Service (GNFS)	Coordinate fire response and prevention measures in urban DRR plans.
	National Commission of Civic Education (NCCE)	Lead public education and awareness on climate resilience and disaster preparedness.
	Land Use and Spatial Planning Authority (LUSPA)	Ensure climate-sensitive spatial planning and urban design.
	Volta Basin Authority (VBA)	Oversee cross-border water resource management and climate adaptation in urban settings.
Non-Governmental Organizations	Ghana Red Cross Society	Coordinate community-level disaster response and resilience-building initiatives.
	CARE International	Support local adaptation programs and build capacities of vulnerable communities.
	Friends of the Earth Ghana	Advocate for sustainable environmental management and urban resilience.
	SEND Ghana	Promote equitable resource allocation and support marginalized groups in urban adaptation plans.
	WaterAid Ghana	Coordinate water access and sanitation projects in vulnerable urban communities.
	ActionAid Ghana	Lead women-focused climate resilience initiatives and community-based adaptation programs.
	World Vision Ghana	Support disaster preparedness and child-focused resilience programs.
Civil Society Organizations (CSOs)	Civil Society Platform on Climate Change	Advocate for inclusive climate policies and community-based adaptation initiatives.

	Disaster Volunteer Groups	Provide community-based support for disaster preparedness and response efforts.
	Youth Climate Council Ghana	Mobilize youth engagement and leadership in urban adaptation and climate resilience strategies.
Development Partners and Donors	United Nations Development Programme (UNDP)	Provide technical expertise, funding, and policy advice for adaptation planning and capacity building.
	World Bank	Fund urban resilience projects and support institutional strengthening.
	African Development Bank	Invest in infrastructure and disaster risk reduction initiatives.
	International NGOs	Support technical assistance, capacity building, and knowledge sharing for urban adaptation and DRR.

5.3. Policy Framework for the Sector

The Cities and Disaster Risk Reduction (DRR) sector in Ghana benefits from a broad and evolving legal and policy framework that aims to integrate climate change adaptation and disaster risk management into urban development planning. As extreme weather events become more frequent and intense, the Ghanaian government has recognized the need for proactive measures to address risks such as floods, fires, and droughts. This awareness has led to the development of comprehensive plans at national, regional, and district levels to ensure efficient disaster response. These plans enable key agencies and organizations to carry out effective and coordinated responses to natural disasters, covering preparedness for floods, droughts, earthquakes, and various conflicts. This section outlines the key policies and frameworks that

provide the necessary foundation for the successful implementation of adaptation actions within the sector. Key initiatives include:

1. **National Climate Change Policy (2013):** The National Climate Change Policy (NCCP) establishes a comprehensive approach to addressing climate change in Ghana, emphasizing the need for climate adaptation and disaster risk management at all levels of governance. It highlights the importance of building climate resilience in urban areas, especially in the context of growing populations and rapid urbanisation and encourages the integration of climate considerations into development planning.
2. **National Climate Change Master Plan (2015):** The Master Plan provides detailed strategies for climate change mitigation and adaptation, focusing on sectors such as water, agriculture, energy, and urban development. The Master Plan includes specific actions for enhancing disaster risk reduction, strengthening climate resilience in cities, and improving the capacity of local governments and communities to manage climate risks.
3. **Nationally Determined Contributions (2015):** Ghana's Nationally Determined Contributions (NDCs) highlight the country's commitment to reducing greenhouse gas emissions and enhancing climate resilience. The NDCs include specific targets for adaptation actions, particularly in vulnerable urban areas. These contributions emphasize the need for coordinated efforts across sectors, including disaster risk reduction and urban resilience planning.
4. **National Climate Change Adaptation Strategy (2012):** This strategy outlines key areas for adaptation, with an emphasis on building resilience in communities, protecting vulnerable populations, and ensuring sustainable development practices. The adaptation strategy calls for the implementation of climate-resilient infrastructure in urban settings and



the development of disaster management systems that integrate climate change considerations.

5. **National Climate Change and Green Economy Learning Strategy (2016):** The Green Economy Learning Strategy supports the transition towards a climate-resilient and low-carbon economy. It advocates for the incorporation of climate change and sustainability principles into economic planning, urban development, and infrastructure design, making it crucial for integrating DRR and climate adaptation strategies in cities.
6. **National Gender Policy (2015):** The National Gender Policy recognizes the disproportionate impact of climate change and disasters on women and marginalized groups, particularly in urban areas. It provides guidelines for ensuring gender-sensitive approaches to adaptation planning, ensuring that disaster risk reduction strategies address the needs of women and other vulnerable groups in urban settings.
7. **Updated Nationally Determined Contributions (2021):** Ghana's Updated NDC (2021) strengthens its commitment to climate action by outlining more ambitious goals for both mitigation and adaptation. It emphasizes the integration of climate risk into urban development, prioritizing the enhancement of resilience in cities and local communities, with a focus on reducing disaster risk and improving adaptive capacity.
8. **National Disaster Management Plan (NDMP):** Initially drafted in 1997 and reviewed in 2007, this plan provides a comprehensive framework for disaster management and outlines strategies for effective disaster preparedness, response, and recovery.
9. **National Standard Operating Procedures for Emergency Response (NSOP) 2010:** These procedures provide standardized guidelines to ensure coordinated and efficient emergency response across the country.



10. **Ghana Plan of Action on Disaster Risk Reduction and Climate Change Adaptation (2011-2015):** This strategy integrates disaster risk reduction with climate change adaptation, ensuring a cohesive approach to managing risks.
11. **National Contingency Plan (NCP):** This plan focuses on emergency preparedness and response, detailing the roles and responsibilities of various agencies during a disaster.

5.4. Funding Arrangements for the Sector Plan

In the context of the Cities/DRR Sector, the implementation of the proposed actions in this plan will require substantial investments from sector ministries, departments, and agencies. Relevant institutions are encouraged to integrate this action plan into their annual institutional plans and budgets, ensuring the allocation of resources by the Government of Ghana for its execution. Additionally, securing financial support from international donors, development partners, and private sector stakeholders will be crucial to complement government funding. Institutions should explore innovative financing mechanisms, such as public-private partnerships (PPPs), green bonds, and climate adaptation funds. To ensure transparency and accountability, regular monitoring and reporting on financial allocations and expenditures should be implemented, fostering stakeholder confidence and ensuring the successful and sustained execution of this action plan.



6. SECTOR ADAPTATION ACTIONS

The adaptation plans for the Cities and Disaster Risk Reduction (DRR) sector in Ghana aim to build resilience and address climate vulnerabilities in both urban and rural settings. These plans encompass a range of targeted interventions which prioritize inclusive approaches that address the vulnerabilities of women, youth, and marginalized groups while aligning with national policies and frameworks.

The overarching focus of the sector adaptation options is to build resilience through targeted interventions. Additionally, these strategies emphasize the importance of inclusivity, with particular attention to gender considerations, ensuring that the needs of vulnerable groups and marginalized communities are integrated into decision-making and implementation.

The sector adaptation options are grounded in the principles of the Sendai Framework (UNISDR, 2015). The sector's adaptation options thus encompasses four key priorities for action to enhance urbanisation, prevent new and reduce existing disaster risks:

- i. Understanding disaster risk
- ii. Strengthening disaster risk governance to manage disaster risk.
- iii. Investing in disaster reduction for resilience and
- iv. Enhancing disaster preparedness for effective response, and to “Build Back Better” in recovery, rehabilitation and reconstruction.

The proposed adaptation options for the Cities and Disaster Risk Reduction (DRR) sector in Ghana bordered around the following based on the categories of cities and disaster risk sectors earlier highlighted (that is housing - comprising issues surrounding informal settlements; infrastructure - comprising issues surrounding transportation, drainage, and energy systems; public health - comprising health

care and sanitation facilities; and waste management - comprising waste disposal, segregation and recycling):

1. Urban and Rural Flood Risk Management and Resilience Enhancement.
2. Improved Water Supply and Sanitation Systems
3. Drought-Resistant Agricultural Practices and Urban Food Security.
4. Strengthened Disaster Preparedness and Emergency Response
5. Climate-Resilient Housing and Infrastructure.
6. Sustainable Urban and Rural Transport Systems.
7. Ecosystem-Based Adaptation (EbA) for Urban and Rural Areas.
8. Coastal Resilience Against Sea-Level Rise and Erosion.

6.1. Urban and Rural Flood Risk Management and Resilience Enhancement

Flooding poses a significant threat to urban and rural communities in Ghana, disrupting livelihoods, infrastructure, and ecosystems. To address these risks, implementing flood management measures that align with the Sendai Framework priorities is critical. These actions emphasize the importance of understanding flood dynamics, enhancing governance frameworks, and investing in infrastructure to reduce vulnerabilities. Gender considerations are essential, as women, children, and marginalized groups often face the brunt of flood impacts due to limited access to resources and decision-making platforms. Ensuring inclusivity in planning and implementation will empower vulnerable groups and create equitable resilience outcomes. Special attention should be given to flood-prone rural communities along the Volta River Basin and urbanised centres in the Greater Accra, Ashanti and Eastern regions, where flooding often leads to significant loss of lives and property.



Table 6: Adaptation Option 1 - Flood Risk Management and Resilience

Adaptation Actions	Objectives	Action Steps	Indicators of Success	Time Frame	Resources	Lead	Implementing Partners	Estimated Cost
Conduct community-based flood risk mapping to identify high-risk zones	Identify and prioritize vulnerable areas for targeted interventions	- Organize workshops with local communities to gather flood history data.	- Completed flood risk maps.	Short-term	Human, GIS software, community participation	EPA,MMDAs and NADMO	Universities and academia, development partners, CSOs, NGOs, Community Leaders,	
		- Conduct participatory mapping sessions.	- Community engagement in mapping exercises.					
		- Train community members in flood risk data collection.	- High participation of women and youth.					
		- Create risk maps using GIS technology.	- Use of maps in local planning meetings.					
		- Validate risk maps with local stakeholders.	- Increased awareness of flood risk zones.					
Develop hydrological models to predict flood-prone areas in urban and rural settings	Enhance early flood detection and planning capabilities	- Collect hydrological and meteorological data.	- Functioning flood prediction models.	Medium-term	Data collection equipment, software, technical experts	Meteorological Agency	Ghana Hydrological Authority, Water resources Commission, Universities, Research Institutions, International Research Organisations,	
		- Digitize and analyse historical flood data.	- Accurate forecasts disseminated.					
		- Build and validate predictive models.	- Integration of models into decision-making.					
		- Partner with academic institutions for technical support.	- Increased forecast accuracy during the rainy season.					
		- Train local stakeholders on model usage.						



Adaptation Actions	Objectives	Action Steps	Indicators of Success	Time Frame	Resources	Lead	Implementing Partners	Estimated Cost
Establish flood risk management committees involving local governments and community representatives	Foster collaboration and inclusive decision-making for flood management	- Form committees with diverse representation.	- Active committees with regular participation.	Short-term	Meeting spaces, training materials	MMDAs	Community Groups, Traditional Authorities	
		- Define roles and responsibilities.	- Documented action plans.					
		- Develop a clear governance structure.	- High representation of marginalized groups.					
		- Hold regular meetings to discuss flood risks and solutions.	- Successful implementation of recommendations.					
		- Monitor and evaluate committee activities.	- Consistent meeting attendance.					
Enforce zoning regulations to prevent construction in flood-prone areas and waterways	Minimize risks by ensuring development aligns with flood risk data	- Review and revise zoning regulations.	- Reduced construction in high-risk zones.	Medium-term	Legal frameworks, inspection teams, Human, Logistics	MMDAs	NADMO, Law Enforcement	
		- Train local planners and developers.	- Increased compliance rates.				Authorities (Ghana Police), EPA, Forestry Commission, Real Estate Associations, Community, Ministry of Works and Housing, Wildlife Division	
		- Conduct regular inspections of new developments.	- High awareness of zoning laws.					
		- Monitor and penalize violations.	- Lower frequency of flood-related damages.					
		- Educate the public on zoning laws.	- Enforcement mechanisms in place.					



Adaptation Actions	Objectives	Action Steps	Indicators of Success	Time Frame	Resources	Lead	Implementing Partners	Estimated Cost
Upgrade drainage systems to handle increased rainfall intensity	Prevent urban flooding and improve water flow during heavy rains	- Assess existing drainage systems.	- Improved drainage capacity.	Long-term	Human, funding, construction materials	Ministry of Roads and Highways,	MMDAs, Private Contractors, Engineering Firms, Development partners such as the World Bank,	
		- Conduct community consultations to identify bottlenecks.	- Reduced urban flooding incidents.					
		- Design upgrades using sustainable materials.	- Positive community feedback.					
		- Regularly maintain drainage systems.	- Decreased stagnation of floodwater.					
		- Incorporate nature-based solutions.	- Timely maintenance schedules adhered to.					
Construct flood retention basins and green infrastructure like wetlands to absorb excess water	Mitigate flood impacts by enhancing water retention and natural absorption	- Identify strategic locations for basins and wetlands.	- Functioning retention basins and wetlands.	Long-term	Land, construction materials, ecological expertise	Environmental Protection Agency	Forestry Commission, MMDAs, NGOs, Community Groups, Wildlife Division, Development Partners	
		- Consult environmental experts.	- Reduced flood intensity.					
		- Construct and maintain the infrastructure.	- Enhanced local biodiversity.					
		- Engage communities in preservation efforts.	- Positive environmental impact reports.					
		- Monitor water retention levels.	- High local participation in preservation.					



Adaptation Actions	Objectives	Action Steps	Indicators of Success	Time Frame	Resources	Lead	Implementing Partners	Estimated Cost
Implement early warning systems for floods, integrating real-time data with community alerts	Enhance disaster preparedness and minimize flood impacts through timely information sharing	- Set up monitoring systems.	- Operational early warning systems.	Medium-term	Technology, communication tools, local monitors	NADMO	Telecommunication Companies, Meteorological Agency, EPA, Media, Information Service department, National Commission for Civic Education, Forestry Commission, Coastal Development Authority,	
		- Develop mobile-based alert platforms.	- High community awareness and response.					
		- Integrate alerts with radio and SMS systems.	- High accuracy of real-time alerts.					
		- Conduct awareness campaigns on the system.	- Reduced response times during emergencies.					
		- Regularly update early warning protocols.	- System integration with national disaster agencies.					
Train local communities in flood evacuation drills and emergency response	Build local capacity to respond effectively during flood events	- Conduct training workshops.	- Increased community preparedness.	Short-term	Training materials, facilitators,	NADMO	NGOs, MMDAs,	
		- Simulate evacuation drills.	- High participation in drills.					
		- Train women and youth in emergency leadership roles.	- Positive feedback on emergency response training.		logistical support			
		- Provide evacuation kits and guidelines.	- Community response teams active.					
		- Establish community response teams.	- Reduced casualties during floods.					



6.2. Improved Water Supply and Sanitation systems

Access to clean water and sanitation is fundamental for public health and resilience, yet many Ghanaian communities face inadequate infrastructure, exacerbating vulnerabilities to disasters. Adaptation measures for improving Water Supply and Sanitation should prioritize understanding water resource risks, strengthening governance, ensuring water sustainability and investing in resilient systems to ensure reliable water and sanitation access. For example, in urban areas, specific challenges such as inadequate sanitation facilities in areas prone to roadside dumping (markets bus stops, etc.), require immediate action. Additionally, measures to curb illegal alluvial mining (galamsey) activities are crucial, as these practices pollute water sources and exacerbate environmental degradation.

Gender considerations are critical, as women and girls often bear the responsibility of fetching water, exposing them to risks such as health issues and reduced educational opportunities. Including women in decision-making and implementation ensures sustainable and inclusive outcomes.



Table 7: Adaptation Option 2 - Improving Water Supply and Sanitation in Communities

Adaptation Actions	Objectives	Action Steps	Indicators of Success	Time Frame	Resources	Lead	Implementing Partners	Estimated Cost
Assess and document water resource vulnerability under changing climate conditions for urban communities	Identify water resource risks to support targeted interventions	- Conduct vulnerability assessments.	- Vulnerability reports published.	Short-term	Human, GIS tools, technical resources	MMDAs	Research Institutions (e.g., Universities, CSIR-WRI), NGOs (e.g., WaterAid), and Donor Agencies (e.g., USAID, World Bank), International Research Organisations,	
		- Use GIS mapping to identify at-risk areas.	- Integration of data into city planning.					
		- Collaborate with academia for technical expertise.	- High adoption of findings in policy actions.					
		- Publish findings in accessible formats.						
Upgrade and expand urban water distribution networks to ensure reliable access in underserved areas	Provide equitable water access, particularly to slums and informal settlements	- Survey underserved areas.	- Improved water access.	Medium-term	Engineering expertise, funding	Ghana Water Company Limited	Water resources commission, Ghana Hydrological Authority, Private Sector (e.g., Borehole Contractors, PPPs), MMDAs, and Community-Based Organizations (CBOs)	
		- Install pipelines and improve pressure management.	- Positive user satisfaction in target areas.					
		- Conduct regular system maintenance.	- Reduced complaints about water shortages.					
		- Engage communities for feedback.						





Adaptation Actions	Objectives	Action Steps	Indicators of Success	Time Frame	Resources	Lead	Implementing Partners	Estimated Cost
Strengthen monitoring and enforcement mechanisms to curb illegal alluvial mining (galamsey) activities	Reduce water source pollution and environmental degradation	- Set up monitoring teams. - Train enforcement agencies.	- Decrease in galamsey activities. - Improved water quality in affected areas.	Short-term	Monitoring tools, enforcement agencies	Ministry of Lands and Natural Resources	NADMO, Environmental Protection Agency (EPA), Community Leaders, Traditional Authorities, NGOs, Law enforcement (Ghana Army, Ghana Police)	
		- Strengthen penalties for violations.	- High community support for anti-galamsey measures.					
		- Promote alternative livelihoods for affected communities.						
Promote community-led initiatives to protect water sources from pollution and degradation	Empower communities to actively engage in protecting water sources	- Organize capacity-building workshops.	- Active community groups.	Medium-term	Training materials, community funds	MMDAs	Water resources commission, Ghana Hydrological Authority, NGOs (e.g., Global Water Partnership), Traditional Authorities, Faith-Based Organizations (FBOs), and Youth Groups	
		- Establish local water protection groups.	- Positive environmental outcomes reported.					
		- Create incentive programs for best practices.	- High participation rates among women and youth.					
		- Facilitate peer learning exchanges.						

Adaptation Actions	Objectives	Action Steps	Indicators of Success	Time Frame	Resources	Lead	Implementing Partners	Estimated Cost
Rehabilitate degraded watersheds and protect critical water Sources through reforestation and conservation initiatives	Enhance ecosystem health and ensure sustainable water availability	- Identify priority areas for rehabilitation.	- Increased forest cover.	Long-term	Tree seedlings, ecological expertise	Environmental Protection Agency	Forestry Commission, Wildlife department, International NGOs (e.g., IUCN,	
		- Engage local communities in planting activities.	- High local participation.				Conservation International), and Local Community Groups	
		- Monitor watershed health.	- Positive biodiversity outcomes.					
Conduct public awareness campaigns on the impacts of galamsey and the importance of proper sanitation practices	Foster behavioral change to support water and sanitation improvements	- Design culturally appropriate materials.	- High community awareness.	Short-term	Media partnerships, education materials	NADMO	Local Media (e.g., Joy FM, GBC), Educational Institutions, and NGOs (e.g., WASH Ghana)	
		- Partner with local radio and TV stations.	- Reduction in pollution incidents.					
		- Organize community forums.	- High engagement in public forums.					
		- Target schools for education programs.	- Positive feedback on campaigns.					



Adaptation Actions	Objectives	Action Steps	Indicators of Success	Time Frame	Resources	Lead	Implementing Partners	Estimated Cost
Enforce housing laws requiring the inclusion of toilets in all building projects to eliminate open defecation, establish more public toilets	Improve sanitation and eliminate public health risks	- Amend building codes.	- Increased compliance with housing laws.	Medium-term	Construction materials, inspection teams	MMDAs	Private Developers, NGOs (e.g., Sanitation Solutions Ghana), and Traditional Authorities	
		- Train building inspectors.	- Reduction in open defecation incidents.					
		- Conduct routine inspections.	- High usage of public toilets.					
		- Build public toilets in strategic locations.	- Improved hygiene indicators.					
		- Penalize violations.						
Develop robust water supply infrastructure, including emergency water storage and distribution systems	Ensure reliable water access during droughts and disasters	- Build emergency reservoirs.	- Reliable water supply during crises.	Long-term	Engineering expertise, storage materials	Ghana Water Company Limited	NADMO, Private Sector (e.g., Water Tank Suppliers), and Donor Agencies (e.g., AfDB, UNDP)	
		- Strengthen existing pipelines.	- Positive feedback on water availability.					
		- Integrate water storage into urban planning.	- High efficiency in emergency response systems.					
		- Develop maintenance schedules.						



Adaptation Actions	Objectives	Action Steps	Indicators of Success	Time Frame	Resources	Lead	Implementing Partners	Estimated Cost
Develop partnerships with private sector actors to invest in sustainable water and sanitation infrastructure	Leverage private investment to support long-term sustainability in water and sanitation systems	- Host investment forums.	- Increased private sector involvement.	Long-term	Investment incentives, partnership frameworks	Ministry of Water and Sanitation	Private Sector (e.g. water bottling companies), Donor Agencies (e.g., World Bank, USAID), NGOs	
		- Develop public-private partnerships (PPPs).	- High funding levels for water projects.					
		- Offer incentives for green projects.	- Completion of green infrastructure projects.					
		- Align investments with national priorities.						



6.3. Strengthened Disaster Preparedness and Emergency Response

Disaster preparedness and response systems in Ghana must address the varying needs of urban communities to reduce loss of life and property. Enhancing disaster preparedness and response by strengthening local emergency, strengthening climate information systems and early warning systems in both urban areas and rural communities. Especially those in flood-prone and drought-prone areas, need timely and localized climate information to take preventive actions against extreme weather events, including floods, storms, and droughts. Urban centers like Accra, Kumasi, and Takoradi are particularly vulnerable to flooding, fire outbreaks, and health-related emergencies, while rural areas often face risks such as droughts and limited access to emergency services. Coastal cities are additionally exposed to rising sea levels and coastal erosion, necessitating specialized measures for coastal disaster risk reduction (DRR).

Strengthening urban communities' ability to prepare for and respond to climate-induced disasters will help reduce vulnerabilities, while a well-equipped and adequately funded disaster response system will ensure timely and effective action in both urban and rural settings.



Table 8: Adaptation Option 4 - Strengthening disaster preparedness and response

Adaptation Actions	Objectives	Action Steps	Indicators of Success	Time Frame	Resources	Lead	Implementing Partners	Estimated Cost
Conduct vulnerability assessments for critical infrastructure and populations.	Identify high-risk areas and prioritize interventions to reduce disaster impacts.	- Map vulnerable communities and infrastructure.	- Comprehensive vulnerability maps developed.	Short-term	GIS tools, survey equipment, data collection	EPA	MMDAs, NADMO, Universities, Donors (e.g., UNDP), International Research Organisations,	
		- Assess risks for various hazards (floods, fires, storms).	- Targeted risk reduction interventions implemented.					
		- Use GIS tools for analysis.						
Develop hazard and risk profiles for urban and rural areas.	Enhance understanding of local disaster risks and prioritize	- Collect historical disaster data.	- Published hazard profiles.	Medium-term	Research tools, data analysts	EPA	NADMO, Universities, Academia, International Research Organisations,	
		- Conduct hazard-specific risk assessments.	- Integration of profiles into development planning.					
	mitigation strategies.	- Collaborate with local communities to validate findings.					NGO/CSOs, Community Groups	
Build resilient shelters for evacuation during emergencies.	Provide safe havens for populations during disasters.	Identify sites for shelters. Construct disaster-resilient structures. Ensure shelters are equipped with basic amenities.	Functional and accessible shelters available. Increased community satisfaction with safety measures.	Long-term	Construction materials, funding	NADMO	MMDAs, Ministry of Finance, Donor Agencies, Construction Firms	



Adaptation Actions	Objectives	Action Steps	Indicators of Success	Time Frame	Resources	Lead	Implementing Partners	Estimated Cost
Equip the Ghana National Fire Service (GNFS) with modern fire tenders and other firefighting equipment.	Improve the capacity to respond to fire emergencies effectively.	Procure modern fire tenders. Train fire personnel on new equipment Upgrade fire stations for better service delivery.	Faster response times. Reduced fire-related damages and casualties.	Medium-term	Equipment procurement, training resources	GNFS	Ministry of Interior, Private Sector (e.g., Fire Equipment Suppliers), Donors,	
Regular maintenance of and/or building more hydrants to improve fire response capacity.	Enhance access to water for firefighting in critical locations.	Identify areas with limited hydrant access. Repair or replace dysfunctional hydrants. Monitor and maintain hydrants regularly.	Increased availability of functioning hydrants. Improved fire response efficiency.	Medium-term	Construction resources, technical expertise	GNFS	MMDAs, Ghana Water Company Limited, NGOs	
Expand ambulance services across districts for rapid medical response during disasters.	Ensure timely medical assistance for affected populations.	Procure additional ambulances. Train emergency medical teams. Establish ambulance stations in underserved areas.	Shorter medical response times. Increased survival rates during disasters.	Medium-term	Ambulance vehicles, medical training resources	Ministry of Health	Ghana Ambulance Service, Ghana Police Service, Ghana National Fire Service MMDAs, NGOs, Donors	



Adaptation Actions	Objectives	Action Steps	Indicators of Success	Time Frame	Resources	Lead	Implementing Partners	Estimated Cost
Establish a dedicated fund to support DRR initiatives and emergency responses.	Provide sustainable financing for disaster management and risk reduction efforts.	Develop fund governance structures. Secure contributions from public, private, and donor sources. Establish transparent disbursement processes.	Functional DRR fund. Increased financing for disaster management initiatives.	Short-term	Financial resources, governance expertise	Ministry of Finance	Private Sector, Donor Agencies (e.g., World Bank, AfDB), NADMO	
Create local disaster management committees for response coordination.	Strengthen community-based disaster response and coordination.	Form committees with diverse stakeholders. Provide targeted training on disaster response strategies. Implement community-based early warning systems.	Established and active committees. Improved coordination during emergencies. Regular community drills conducted.	Short-term	Human resources, training modules	NADMO	MMDAs, Law Enforcement Agencies (Police, Fire Service, Army), Ghana Ambulance Service, NGOs, Community Disaster Volunteer groups, Traditional leaders,	



Adaptation Actions	Objectives	Action Steps	Indicators of Success	Time Frame	Resources	Lead	Implementing Partners	Estimated Cost
Implement coastal protection measures such as mangrove restoration and seawalls to mitigate sea-level rise.	Reduce the impact of sea-level rise and storm surges on coastal communities.	Restore mangroves in degraded areas. Build seawalls in high-risk locations. Conduct awareness campaigns for coastal DRR.	Reduced storm surge impacts. Increased mangrove coverage. Enhanced community awareness of coastal resilience.	Long-term	Construction materials, ecological expertise	Ministry of Works and Housing	NADMO, Coastal Development Authority, MMDAs, NGOs	
Strengthen coastal DRR through the installation of advanced meteorological and tidal monitoring systems.	Improve early warning systems for coastal disasters.	Install advanced meteorological stations. Train local personnel to operate systems. Disseminate real-time warnings to vulnerable communities.	Operational monitoring systems. Improved response times for coastal hazards.	Medium-term	Monitoring systems, training resources	Ghana Meteorological Agency	NADMO, Coastal MMDAs, UNDP, Private Sector	



6.4. Climate-Resilient Housing and Infrastructure

Climate-smart housing and infrastructure reduce vulnerabilities to extreme weather while promoting sustainable development. Adaptation measures focus on integrating resilient materials, enforcing building codes, and supporting inclusive housing policies.



Table 9: Adaptation Option 5 - Promote resilient housing and infrastructure

Adaptation Actions	Objectives	Action Steps	Indicators of Success	Time Frame	Resources	Lead	Implementing Partners	Estimated Cost
Assess the vulnerability of existing housing and infrastructure to extreme weather events.	Identify and prioritize housing and infrastructure at risk for targeted interventions.	- Conduct detailed vulnerability assessments.	- Comprehensive vulnerability maps developed.	Short-term	GIS tools, survey equipment, technical expertise	Ministry of Works and Housing	MMDAs, EPA, Universities, Community-Based Organizations (CBOs), NGOs	
		- Map high-risk areas.	- Prioritized intervention plans in place.					
		- Engage local communities in data collection.						
Enforce building codes that mandate climate-resilient construction techniques.	Ensure that new infrastructure can withstand climate impacts.	- Review and update building codes.	- High compliance with building codes.	Medium-term	Legal frameworks, training modules	Ministry of Works and Housing	MMDAs, Ministry of Local Government and Rural Development, Construction Firms, Private Developers	
		- Train building inspectors.	- Reduction in climate-related structural damages.					
		- Conduct compliance checks regularly.						
Retrofit public buildings, such as schools and hospitals, to withstand climate impacts.	Strengthen the resilience of critical public infrastructure.	- Conduct assessments of existing public buildings.	- Retrofitted buildings operational.	Long-term	Construction materials, technical expertise	Ministry of Education, Ministry of Health	Ministry of Local Government and Rural Development, MMDAs, Private sector (eg, Telecommunication organisations through corporate social responsibility) Development Partners	
		- Develop retrofit plans.	- Improved safety during extreme weather events.					
		- Implement retrofitting projects in phases.						



Adaptation Actions	Objectives	Action Steps	Indicators of Success	Time Frame	Resources	Lead	Implementing Partners	Estimated Cost
Rebuild housing destroyed by disasters using sustainable and resilient designs.	Provide safe and durable housing for disaster-affected communities.	- Develop resilient housing designs.	- Reconstructed homes that meet resilient standards.	Long-term	Construction materials, funding	Ministry of Works and Housing	MMDAs, NGOs, Community Leaders, Donor Agencies	
		- Train local builders in climate-resilient construction methods.	- Increased satisfaction among disaster-affected populations.					
		- Support reconstruction with subsidies.						
Enforce proper zoning regulations and prevent construction in waterways to mitigate flood risks in cities.	Reduce flood risks and improve urban resilience.	- Review and strengthen zoning regulations.	- Increased adherence to zoning regulations.	Medium-term	Legal frameworks, technical expertise, human resources	Ministry of Works and Housing	MMDAs, Law enforcement officers (Police), Ghana Water Company, NADMO, Water resources Commission, Ghana Hydrological Authority	
		- Identify and clear illegal structures in waterways.	- Reduced flooding incidents in urban areas.					
		- Conduct public awareness campaigns on zoning laws.						



6.5. Sustainable Transport Systems for Urban and Rural Mobility

Reliable and sustainable transport systems are essential for connecting communities and supporting economic activities. Adaptation measures prioritize resilient infrastructure, planning for climate impacts, and promoting energy-efficient mobility solutions. Gender considerations should address barriers women and marginalized groups face in accessing safe and reliable transportation, ensuring inclusive mobility systems.



Table 10: Adaptation Option 6 – Promoting sustainable transport systems

Adaptation Actions	Objectives	Action Steps	Indicators of Success	Time Frame	Resources	Lead	Implementing Partners	Estimated Cost
Assess the vulnerability of transport networks to climate-related hazards.	Identify climate vulnerabilities in transport infrastructure for proactive adaptation.	- Conduct climate vulnerability assessments on roads and bridges.	- Vulnerability assessment reports completed.	Short-term	Human (technical) climate data, financial, logistical	Ministry of Transport	MMDAs, Ghana Highway Authority, Universities, Climate Researchers, International Research Organisations, Development Partners,	
		- Identify high-risk areas for extreme weather impacts.	- High-risk zones identified for intervention.					
		- Collect local climate data for accurate analysis.						
Build elevated roads and bridges in flood-prone areas.	Ensure transport infrastructure remains functional during flood events.	- Identify flood-prone zones along major transport corridors.	- Completed elevated infrastructure.	Medium-term	Construction materials, engineering expertise	Ministry of Roads and Highways	MMDAs, Ghana Highway Authority, Private Contractors, Environmental NGOs	
		- Design elevated roads and bridges.	- Reduced transport disruptions during floods.					
		- Start construction with flood resilience in mind.						
Reconstruct damaged roads using sustainable and resilient materials.	Repair and upgrade damaged roads to withstand future climate impacts.	- Identify roads most affected by climate events.	- Roads reconstructed with resilient materials.	Medium-term	Sustainable construction materials, technical expertise	Ministry of Roads and Highways	MMDAs, Contractors,	
		- Select appropriate resilient materials for reconstruction.	- Fewer road closures during extreme weather.					
		- Begin phased reconstruction projects.						



Adaptation Actions	Objectives	Action Steps	Indicators of Success	Time Frame	Resources	Lead	Implementing Partners	Estimated Cost
Enhance transport systems to improve mobility and resilience to climate impacts, particularly in urban and rural areas.	Improve mobility by ensuring roads, bridges, and public transport systems remain operational during extreme weather.	- Assess the current transport system's resilience.	- Improved mobility during extreme weather events.	Medium-term	Transport infrastructure, technical expertise	Ministry of Roads and Highways	Ministry of Transport , MMDAs, Physical Planners, Traffic Management Agencies,	
		- Develop projects to improve key routes.	- Increased public satisfaction with transport reliability.					
		- Implement traffic management plans to avoid disruptions.						
Upgrading and expanding public (bus) transport access and alternative options (train system).	Increase the resilience and capacity of public transport networks to meet growing urban and climate challenges.	- Assess gaps in existing public transport systems.	- Increased public transport ridership.	Long-term	Funding for infrastructure, energy-efficient vehicles	Ministry of Transport	MMDAs, Ministry of Railway Development, Train Operators, Private Sector, Ministry of Energy, EPA, MESTI	
		- Plan routes for expanded bus and train systems.	- Expanded routes and stations.					
		- Promote use of climate-resilient vehicles.						



Adaptation Actions	Objectives	Action Steps	Indicators of Success	Time Frame	Resources	Lead	Implementing Partners	Estimated Cost
Ensure regular removal of debris from road drainage systems to prevent flooding and improve traffic flow.	Prevent flooding and ensure smooth traffic flow during and after heavy rains.	- Regularly clean and maintain drainage systems along major roads.	- Reduced flooding in urban and rural transport corridors.	Short-term	Equipment for cleaning, human resources	MMDAs	Ministry of Roads and Highways, Local Contractors, Waste Management Companies, Private Road Transport Union, NGO/CSOs	
		- Implement a debris collection schedule.	- Improved traffic flow during heavy rains.					
		- Install waste-trapping technologies.						
Develop public transport systems that are energy-efficient and resilient to climate impacts (e.g., introduction of electric buses).	Ensure long-term sustainability and reduce carbon emissions from public transport systems.	- Promote the use of electric buses and other low-emission vehicles.	- Increased number of electric buses in service.	Medium-term	Electric buses, charging infrastructure, funding	Ministry of Transport	MMDAs, Ghana Private Road Transport Union, Private Sector (Electric Vehicle Manufacturers), Ministry of Energy, Ministry of Roads and Highways	
		- Upgrade bus depots to support electric vehicle fleets.	- Reduction in carbon emissions from public transport.					
		- Implement policies to encourage clean transport options.						



6.6. Drought Resilient Agricultural Practices and Urban Food Security

Droughts severely affect agriculture, water availability, and livelihoods, particularly in rural Ghana. Adaptation strategies focus on understanding drought patterns, improving governance, and building infrastructure to support water and agricultural systems during dry periods. Promote drought-resistant agricultural practices in rural areas, particularly in the Upper East, Northern, and Upper West Regions, where extended dry seasons and water scarcity pose significant risks to livelihoods. In these drought-prone areas, encourage the adoption of water-saving irrigation techniques, drought-resistant crop varieties, and rainwater harvesting systems to improve agricultural productivity and food security. In urban areas, such as Accra and Kumasi, ensure that water management practices are optimized to support the rural hinterlands, especially by creating sustainable systems for water storage and distribution during droughts.

Food security is a critical issue in Ghana, where climate change impacts agricultural productivity. Adaptation measures focus on resilient farming practices, improved irrigation and access to climate-smart technologies. A major challenge to food security is food loss, which occurs at various stages in the supply chain. Ghana loses an estimated 20-30% of cereals and legumes, and 20-50% of fruits, vegetables, tubers, and roots due to inadequate storage, transport, and market infrastructure. Additionally, the agricultural sector needs to adapt to a changing climate marked by unpredictable rainfall, prolonged dry spells, and high temperatures, which threaten food production.

Gender-sensitive interventions should be introduced, providing women and youth with the tools and skills to engage in these practices and benefit from the improved infrastructure. Additionally, strengthening local markets and building public-private partnerships will help create a more resilient food system, reducing post-harvest losses and enhancing food security.



Table 11: Adaptation Option 7 – Enhancing Rural Food Security through Climate-Resilient Agriculture.

Adaptation Actions	Objectives	Action Steps	Indicators of Success	Time Frame	Resources	Lead	Implementing Partners	Estimated Cost
Provide access to irrigation systems, improved seeds, and weather-resistant storage facilities.	Ensure reliable crop production and storage even in adverse climatic conditions.	- Install irrigation systems in water-scarce areas.	- Increased crop yields in drought-prone areas.	Short-term	Irrigation technology, improved seeds, storage facilities	Ministry of Food and Agriculture	MMDAs, Agricultural Extension Services, NGOs, Seed Companies, Private Sector	
		- Provide farmers with access to high-quality, drought-resistant seeds.	- Reduced post-harvest losses.					
		- Support the establishment of weather-resistant storage solutions.	- Improved storage facilities.					
Develop a drought vulnerability assessment map, early warning systems, and monitoring systems using satellite imagery and local data to predict water shortages	Improve proactive drought response and resource allocation	- Identify vulnerable regions using GIS.	- Comprehensive drought maps available.	Medium-term	Satellite technology, GIS tools, training materials	EPA	Research Institutions (e.g., CSIR), Donor Agencies (e.g., UNDP), NADMO, NGOs (e.g., IWMI), Ministry of Environment, Science,	
		- Integrate satellite imagery and ground data.	- Functioning early warning systems.					
		- Set up a centralized data analysis unit.	- Faster response to predicted water shortages.					
		- Train local stakeholders on using early warning systems.					Technology and Innovation (MESTI), International Research Organisations	



Adaptation Actions	Objectives	Action Steps	Indicators of Success	Time Frame	Resources	Lead	Implementing Partners	Estimated Cost
Establish drought contingency funds to support recovery efforts	Ensure financial readiness to mitigate and recover from the impacts of drought	- Set up a drought relief fund.	- Functional drought contingency fund.	Short-term	Financial contributions, governance structures	Ministry of Finance	Private Sector (e.g., Banks), Donor Agencies (e.g., World Bank, USAID), NGOs	
		- Define criteria for fund access.	- Reduced time to provide drought relief.					
		- Secure contributions from donors and the private sector.	- High transparency in fund management.					
		- Develop transparent fund allocation systems.						
Enhance water storage infrastructure, including reservoirs and underground tanks, to store water for agricultural and domestic use during dry spells	Ensure reliable water supply for multiple uses during prolonged dry periods	- Identify priority sites for water storage.	- Increased water storage capacity.	Long-term	Construction materials, technical expertise	Ghana Water Company Limited	Water resources commission, Ghana Hydrological Authority, MMDAs, Private Sector (e.g., Water Tank Manufacturers), Donor Agencies (e.g., AfDB), and Community Groups	
		- Construct reservoirs and underground tanks.	- High functionality of reservoirs and tanks.					
		- Train communities on proper water storage management.	- Enhanced community satisfaction with water availability.					
		- Monitor infrastructure regularly.						



Adaptation Actions	Objectives	Action Steps	Indicators of Success	Time Frame	Resources	Lead	Implementing Partners	Estimated Cost
Introduce affordable, solar-powered cold storage systems for perishable goods in urban market centres and rural farmgate.	Minimize food wastage and enhance food availability during climate-related disruptions.	- Install solar-powered cold storage units in rural and urban market centres.	- Reduction in post-harvest food loss.	Medium-term	Solar-powered cold storage units, training resources	Ministry of Energy	Ministry of Food and Agriculture, MMDAs, Agricultural Extension Services, Private Sector (solar companies)	
		- Train farmers and market vendors on usage and maintenance.	- Increased income for farmers from preserved goods.					
		- Ensure affordable access for small-scale farmers.	- Wider adoption of cold storage.					
Establish urban food banks and distribution hubs to enhance food access during disruptions caused by climate-related shocks.	Improve food security in urban areas during climate-related crises and disruptions.	- Develop food banks and distribution hubs in high-risk urban areas.	- Increased availability of food during climate events.	Long-term	Infrastructure, food supply, community engagement	Ministry of Food and Agriculture (MoFA)	MMDAs, Local Food Producers, NGOs, NADMO, Ministry of Local Government and Rural Development,	
		- Stockpile essential food supplies in anticipation of climate shocks.	- Number of households supported through food distribution.					
		- Establish partnerships with local organizations.						
Support agroforestry and soil conservation programs.	Enhance land productivity, biodiversity, and ecosystem services through sustainable farming practices.	- Promote the establishment of agroforestry systems on farms. - Provide training on agroforestry techniques.	- Area of land under agroforestry. -- Enhanced biodiversity and ecosystem services.	Medium-term	Technical expertise, funding for conservation programs	Ministry of Food and Agriculture	MMDAs, NGOs, Farmer Cooperatives, Local Communities, Farmer Based Organisations,	





Adaptation Actions	Objectives	Action Steps	Indicators of Success	Time Frame	Resources	Lead	Implementing Partners	Estimated Cost
Train farmers in climate-smart agricultural practices.	Build the capacity of farmers to adapt to climate change and improve food security.	- Organize workshops on climate-smart agriculture.	- Number of farmers trained.	Short-term	Training resources, expert facilitators, demonstration farms	Ministry of Food and Agriculture	MMDAs, Agricultural Extension Services, Universities, NGOs, Farmer Based Organisations,	
		- Provide hands-on training on new farming techniques.	- Increased adoption of climate-smart practices.					
		- Set up demonstration farms for practical learning.	- Improved crop and livestock productivity.					
Rehabilitate damaged farmlands and infrastructure after disasters using sustainable methods.	Restore agricultural productivity and minimize the impact of disasters on food production.	- Assess damage to farmlands and infrastructure after climate-related disasters.	- Number of farmlands and infrastructure rehabilitated.	Short-term	Rebuilding materials, financial resources	Ministry of Food and Agriculture	MMDAs, Disaster Management Agencies, NGOs, Local Communities, Forestry commission	
		- Promote sustainable rebuilding methods.	- Improved agricultural productivity after rehabilitation.					
		- Provide financial support for farmers to recover.						
Promote farmer cooperatives and farmer-based organizations to strengthen collective risk management.	Empower farmers to collectively manage climate risks and share resources and knowledge.	- Encourage the formation of cooperatives in rural areas.	-Number of active cooperatives.	Medium-term			MMDAs, Farmer Groups, NGOs,	

Adaptation Actions	Objectives	Action Steps	Indicators of Success	Time Frame	Resources	Lead	Implementing Partners	Estimated Cost
		-Facilitate training on collective risk management strategies. -Provide financial support for cooperative-led initiatives.	-Enhanced risk management capacity of cooperatives. -Improved group coordination.		Organizational support, training, funding	Ministry of Food and Agriculture	Farmer Cooperatives, Farmer Based Organisations, Financial Institutions	
Develop early warning systems for agricultural pests and diseases that contribute to post-harvest losses.	Reduce agricultural losses due to pests and diseases, particularly in regions prone to climate variability.	- Set up early warning systems for pest and disease outbreaks. - Train farmers on pest and disease management. - Coordinate with meteorological agencies for timely alerts.	- Number of early warnings issued. - Reduction in pest and disease-related losses. - Increased farmer adoption of prevention measures.	Medium-term	Early warning technology, training materials, technical expertise	Ministry of Food and Agriculture	MMDAs, NADMO, NCCE, Information Service Department Meteorological Services, Universities, Agricultural Extension Services, Development partners, media	
Promote climate insurance schemes to protect farmers against losses caused by unpredictable weather conditions.	Provide financial protection to farmers facing climate-related risks and uncertainties.	- Develop and promote affordable climate insurance products. - Educate farmers about the benefits of insurance.	- Number of farmers insured. - Reduction in financial losses due to extreme weather events.	Long-term	Insurance products, awareness campaigns, financial support	Ministry of Food and Agriculture	MMDAs, Insurance Companies, Financial Institutions (banks), Farmer	



Adaptation Actions	Objectives	Action Steps	Indicators of Success	Time Frame	Resources	Lead	Implementing Partners	Estimated Cost
		- Create a partnership with insurers and financial institutions.	- Increased insurance coverage.				Cooperatives, Farmer Based Organisations, NGOs	



6.7. Ecosystem-Based Adaptation (EbA) for Urban and Rural Communities

Ecosystem-based adaptation (EbA) offers a natural and cost-effective approach to building resilience against climate change impacts. This adaptation plan focuses on using ecosystems to help communities in both urban and rural areas adapt to climate risks such as flooding, droughts, and heat stress. In urban centers such as Tema, EbA can include the restoration of mangroves, wetlands and urban forests to provide flood protection, improve air quality and reduce urban heat island effects. In rural areas, particularly in the Northern and Volta Regions, EbA strategies should focus on restoring degraded landscapes, protecting watersheds, and planting trees to reduce soil erosion and enhance water retention. By incorporating biodiversity conservation and ecosystem management into urban planning and rural development, communities can better adapt to climate stressors while safeguarding natural resources. Key actions should include the establishment of community-led conservation initiatives, integrating EbA into local development plans, and empowering women and youth in environmental stewardship roles. This approach will strengthen the resilience of both urban and rural communities by leveraging nature's solutions to reduce climate risks.



Table 12: Adaptation Option 8 - Enhancing Ecosystem-Based Adaptation (EbA)

Adaptation Actions	Objectives	Action Steps	Indicators of Success	Time Frame	Resources	Lead	Implementing Partners	Estimated Cost
Conduct ecosystem vulnerability assessments and map critical ecosystems to guide adaptation efforts.	Identify at-risk ecosystems and guide targeted restoration and protection measures.	- Identify and assess ecosystems at risk of degradation due to climate impacts.	- Completion of vulnerability assessments.	Short-term	Research, technical expertise	Environmental Protection Agency	MMDAs, NGOs, Research Institutions, Local Communities, Research and academia, International research organisations, development partners	
		- Create a map of critical ecosystems to prioritize actions.	- Availability of ecosystem maps for guiding action.					
		- Use data to guide planning and decision-making.	- Reduced ecosystem degradation.					
Conduct awareness campaigns on the importance of ecosystem restoration in urban and rural areas.	Increase public awareness of the value of ecosystems and the need for their protection and restoration.	- Develop targeted awareness campaigns for different regions.	- Increased public knowledge and participation.	Short-term	Media, educational materials, facilitators	Environmental Protection Agency	MMDAs, NGOs, Local Communities, Schools, Media. NCCE, Research and academia, International research organisations, development partners,	
		- Utilize media, workshops, and community forums to reach diverse groups.	- Improved community engagement in ecosystem restoration activities.					
		- Promote benefits of ecosystem restoration.						



Adaptation Actions	Objectives	Action Steps	Indicators of Success	Time Frame	Resources	Lead	Implementing Partners	Estimated Cost
Integrate ecosystem-based approaches into local and national planning frameworks.	Ensure that ecosystem protection and restoration are incorporated into policy and development plans.	- Review and revise local and national planning frameworks to include ecosystem-based approaches.	- Inclusion of ecosystem-based approaches in planning frameworks.	Medium-term	Legal frameworks	Ministry of Environment, Science and Technology	MMDAs, NGOs, Environmental Protection Agencies, NDPC	
		- Provide technical support to MMDAs for policy integration.	- Stronger policy enforcement for ecosystem protection.					
		- Establish legal frameworks for protection.						
Restore degraded ecosystems, such as wetlands, forests, and mangroves, to enhance natural defences.	Rehabilitate ecosystems to restore their capacity to protect communities from climate impacts.	- Identify degraded ecosystems and prioritize restoration activities.	- Area of degraded ecosystems restored.	Medium-term	Restoration programs, technical expertise	Forestry Commission (Wildlife Department)	MMDAs, NADMO, NGOs, Local Communities, Environmental Restoration Agencies, EPA, Ministry of Environment, Science and Technology, Forestry Commission, Development Partners, Water Resources Commission, Ghana Hydrological Authority,	
		- Implement reforestation, wetland restoration, and mangrove planting.	- Improved ecosystem function and biodiversity.					
		- Monitor the effectiveness of restoration efforts.	- Increased resilience to climate impacts.					



Adaptation Actions	Objectives	Action Steps	Indicators of Success	Time Frame	Resources	Lead	Implementing Partners	Estimated Cost
Support community-led conservation initiatives through financial incentives.	Empower local communities to actively engage in	- Provide financial incentives for community-led conservation programs.	- Number of community-led initiatives.	Long-term	Financial incentives, capacity building programs	MMDAs	Financial Institutions, Telecommunication institutions through corporate social responsibility,	
	conservation and restoration activities.	- Offer training on sustainable conservation practices.	- Increased community participation in conservation activities.				Ministry of Environment, Science and Technology, Ministry of Gender, Children and Social Protection, National Youth Authority, Local Communities, NGOs, Environmental Organizations	
		- Monitor and evaluate the success of community initiatives.	- Improved local ecosystem health.					



6.8. Coastal Resilience Against Sea-Level Rise and Erosion

To address the increasing threat of sea erosion, particularly in coastal cities and communities such as those in the Greater Accra Region, Volta Region, and Western Region, a comprehensive approach is necessary. This includes implementing coastal protection measures like sea walls, mangrove restoration, and the creation of buffer zones to reduce erosion and protect vital infrastructure. Additionally, the construction of resilient buildings and infrastructure that can withstand flooding and rising sea levels should be promoted. Relocating vulnerable communities in high-risk coastal areas also require securing land tenure and integrating local knowledge in planning and management processes to ensure the long-term safety of residents.

Efforts should include the increased construction and maintenance of sea defence infrastructure, such as coastal barriers, to protect against tidal surges and erosion. Furthermore, investing in research on sustainable, nature-based solutions like coastal wetlands and mangroves is crucial, as these offer multiple benefits, including carbon sequestration, biodiversity conservation, and further protection against sea-level rise. Local communities should be engaged through awareness programs that educate the public about the causes and effects of sea erosion, and about preventive measures to mitigate risks. Public-private partnerships can be explored to fund large-scale coastal protection projects and the relocation of communities. Strengthening Coastal Resilience Against Sea Erosion should be coordinated across local governments, ministries, and relevant stakeholders to ensure effective execution, integration of local knowledge, and sustainability.



Table 13: Adaptation Option 9 - Strengthening Coastal Resilience Against Sea Erosion

Adaptation Actions	Objectives	Action Steps	Indicators of Success	Time Frame	Resources	Lead	Implementing Partners	Estimated Cost
Implement coastal protection measures, including sea walls, mangrove restoration, and buffer zones to reduce erosion.	Protect vulnerable coastal areas from erosion and sea-level rise, safeguarding infrastructure.	- Construct sea walls and coastal barriers.	- Reduced coastal erosion rates.	Medium-term	Construction materials, ecological restoration funds	Coastal development authority	MMDAs, EPA, NADMO, NGOs, Environmental Restoration Agencies, Local Communities, Ministry of Environment, Science, and Technology	
		- Initiate mangrove restoration projects.	- Improved infrastructure resilience against tidal surges.					
		- Designate and maintain buffer zones.	- Increased area of restored mangroves.					
Promote resilient building and infrastructure designs that withstand flooding and rising sea levels.	Ensure that new infrastructure in coastal areas is built to withstand extreme weather conditions.	- Integrate climate resilience into building codes for coastal regions.	- Number of new resilient buildings.	Medium-term	Technical expertise, construction materials	Ministry of Works and Housing	MMDAs, Private sector contractors, Housing developers	
		- Provide incentives for building resilient structures.	- Reduction in flood-related damage. - Increased compliance with resilient building standards.					



Adaptation Actions	Objectives	Action Steps	Indicators of Success	Time Frame	Resources	Lead	Implementing Partners	Estimated Cost
Relocate vulnerable communities in high-risk coastal areas, ensuring secure land tenure and community engagement.	Reduce the risk of displacement and loss of life due to sea-level rise by resettling vulnerable populations.	- Identify vulnerable communities and prioritize relocation.	- Number of communities relocated.	Long-term	Land, relocation infrastructure, community engagement	MMDA	MMDAs, NGOs, Local Communities, Private sector (for relocation infrastructure), Ministry of Local Government and Rural Development, Development Partners	
		- Secure land tenure for relocated communities.	- Successful integration of communities into new locations.					
		- Engage communities in planning.	- Increased local participation in relocation planning.					



Adaptation Actions	Objectives	Action Steps	Indicators of Success	Time Frame	Resources	Lead	Implementing Partners	Estimated Cost
Increase the construction and maintenance of coastal defence infrastructure, including tidal barriers and sea walls.	Protect critical infrastructure and communities from sea erosion and tidal surges.	- Conduct feasibility studies for new coastal defence projects.	- Completed coastal defence projects.	Short-term	Funding, construction materials, engineering expertise	Ministry of Works and Housing	Ghana Hydrological Authority , Water Resources Commission, MMDAs, Private sector contractors, Local Communities, Coastal Development Authority, Ministry of Lands and Natural Resources,	
		- Expand and maintain existing barriers and sea walls.	- Improved protection against storm surges.					
			- Reduction in infrastructure damage due to sea erosion.					



Adaptation Actions	Objectives	Action Steps	Indicators of Success	Time Frame	Resources	Lead	Implementing Partners	Estimated Cost
Promote research into nature-based solutions for coastal resilience, such as wetlands and mangroves.	Enhance coastal resilience using sustainable, nature-based solutions to mitigate erosion and flooding.	- Conduct research on coastal wetlands and mangroves.	- Number of research projects.	Medium-term	Research grants, environmental experts	Ministry of Environment, Science, and Technology	Universities, NGOs, Research Institutions, Development Partners (e.g. GIZ, USAID), Forestry Commission, International Research Organisations	
		- Implement pilot projects to restore and protect wetlands and mangroves.	- Increased area of wetlands and mangroves restored. - Improved biodiversity and carbon sequestration rates.					



Adaptation Actions	Objectives	Action Steps	Indicators of Success	Time Frame	Resources	Lead	Implementing Partners	Estimated Cost
Engage local communities in awareness programs about the causes, effects, and preventive measures for sea erosion.	Increase local knowledge and community involvement in reducing sea erosion impacts and mitigating risks.	- Organize public education campaigns.	- Increased public awareness of sea erosion risks.	Short-term	Logistics (Awareness materials), Human, media	MMDAs	, Ministry of Environment, Science, and Technology, NGOs, Local Communities, Media, NCCE, Information Service Department, Ministry of Communication, Research and Academia	
		- Develop informational materials about sea erosion and mitigation strategies.	- Greater community participation in protective activities.					
		- Set up community workshops.	- Reduced incidences of illegal coastal activities.					





7. ANTICIPATED IMPLEMENTED CHALLENGES AND PROPOSED ADAPTATION SOLUTIONS FOR THE CITIES/DRR SECTOR

Implementing climate adaptation and disaster risk reduction (DRR) measures in Ghana's Cities/DRR sector presents numerous challenges that could hinder progress toward resilience and sustainability. The assessment forecasts several challenges ranging from limited financial resources and weak institutional capacity to insufficient public awareness, poor infrastructure, and resistance to change. Addressing these barriers requires targeted solutions that prioritize resource mobilization, capacity-building, public engagement, and infrastructure development, while fostering strong collaboration among stakeholders. This subsection outlines key thematic challenges and proposes actionable solutions to ensure the effective implementation of adaptation strategies in Ghana's urban and rural areas.

By addressing these challenges and implementing the proposed solutions, Ghana's Cities/DRR sector can build greater resilience to climate change and reduce disaster risks, ultimately enhancing the well-being of cities, towns and communities across Ghana.

7.1. Limited Financial Resources:

A major challenge in implementing adaptation strategies within Ghana's Cities/DRR sector is the scarcity of financial resources. Public sector funding often falls short of the substantial investments needed for infrastructure development, disaster risk reduction measures, and climate adaptation initiatives. This financial gap poses significant risks to the timely execution of critical projects.

To address this, institutions must integrate climate-resilient actions into their annual budgets and planning frameworks to ensure consistent funding allocation. Furthermore, leveraging international financial support from donors, development partners, and global climate-focused funds, such as the Green Climate Fund and Adaptation Fund, is critical. Innovative financing mechanisms, including green bonds, climate adaptation funds, and public-private partnerships (PPPs), should also be explored to supplement government resources and address funding shortfalls.

7.2. Institutional Capacity and Coordination:

The successful execution of climate adaptation and disaster risk reduction measures requires robust institutional capacity and coordination. However, many Metropolitan, Municipal, and District Assemblies (MMDAs) face challenges such as limited technical expertise, logistical constraints, overlapping responsibilities, and insufficient staffing, all of which undermine effective implementation.

Strengthening human resources through targeted capacity-building programs can equip personnel with the necessary skills to manage climate resilience initiatives. Additionally, fostering better coordination among other ministries, departments and agencies, MMDAs and other relevant stakeholders is essential. Establishing dedicated units within MMDAs to oversee climate resilience projects can further enhance accountability and streamline decision-making processes.

7.3. Inadequate Public Awareness and Participation:

In both urban and rural areas, limited public awareness of climate risks and disaster preparedness poses a barrier to adaptation efforts. Many communities, especially in marginalized regions, are unaware of the importance of disaster risk reduction and climate adaptation measures.

To overcome this challenge, community-based education programs should be implemented to raise awareness about climate risks, adaptation options, and



disaster preparedness strategies. Engaging local communities in participatory planning processes ensures that their knowledge and priorities are incorporated into adaptation strategies. Additionally, media campaigns, local radio broadcasts, and community meetings can be used to disseminate information and mobilize communities to actively participate in resilience-building efforts.

7.4. Climate and Environmental Data Gaps:

The lack of reliable and up-to-date climate and environmental data presents a significant challenge to effective planning and implementation of adaptation measures. Many regions in Ghana, particularly rural areas, lack adequate data on climate variability, disaster risks, and environmental degradation. To address this, investments should be made in collecting, analysing, and sharing climate and environmental data. Integrated data management systems can enhance informed decision-making by combining weather forecasting, early warning systems, and disaster impact assessments. Partnerships with academic institutions, research organizations, and international agencies should also be strengthened to improve data availability and promote knowledge sharing across sectors.

7.5. Poor Infrastructure and Unplanned Urbanization:

Rapid urbanization in Ghana has led to the proliferation of unplanned settlements, particularly in flood-prone areas, increasing the vulnerability of urban populations to climate impacts. Insufficient infrastructure, such as drainage systems, waste management facilities, and climate-resilient housing, exacerbates these risks.

To address this, climate-resilient infrastructure development should be prioritized, with a focus on flood control systems, drainage, and waste management in urban and peri-urban areas. Disaster risk reduction measures must also be integrated into urban planning and zoning regulations to prevent construction in high-risk zones. Promoting sustainable urban development practices, such as the

incorporation of green infrastructure like urban forests and rainwater harvesting systems, can further enhance urban resilience to climate impacts.





8. GENDER CONSIDERATIONS FOR THE SECTOR ADAPTATION PLAN

8.1. Gender dimensions in cities and DRR sector

Gender plays a critical role in Ghana's urban development and disaster risk reduction (DRR) efforts as it influences the vulnerability, resilience, and adaptive capacity of communities, particularly women. Women make up a significant portion of Ghana's urban population but often face systemic inequalities and barriers that limit their ability to prepare for, respond to, and recover from disasters. For instance, women are more likely to live in informal settlements, where infrastructure is inadequate, making them disproportionately vulnerable to hazards such as floods and fires (UN-Habitat, 2020).

Access to land and secure housing is a key factor in urban resilience, yet women in Ghana face significant challenges in owning property due to patriarchal norms and discriminatory practices. In many urban areas, women rely on informal rental markets or live in overcrowded conditions, limiting their ability to implement risk-reducing measures, such as building flood-resistant structures or accessing early warning systems (Antwi-Agyei et al., 2015). Studies show that in Accra for instance, only 20% of women have secure land tenure compared to 80% of men, highlighting significant gender disparities in urban property rights (UNDP, 2022).

Additionally, women often lack access to credit, insurance, and social safety nets, further compounding their vulnerability to urban disasters. Limited financial resources prevent many women from investing in risk reduction measures, such as elevating homes in flood-prone areas or accessing technologies like solar-powered lighting during power outages. If women had equal access to resources and decision-making opportunities, it could significantly enhance urban resilience, reduce disaster impacts, and improve community well-being (World Bank Group, 2017).

Women's participation in DRR decision-making and policy formulation is also limited. Despite being disproportionately affected by disasters, women are often excluded from key governance processes at both the community and municipal levels. For example, local disaster management committees in Ghana's cities often lack adequate representation of women, reducing the effectiveness of gender-responsive planning (SEND Ghana, 2014). This exclusion results in DRR strategies that fail to address women's specific needs, such as access to safe shelters or services for pregnant women and nursing mothers during emergencies.

8.2. Other key gender issues in cities and DRR sector(UNDP, 2022):

- Women are often overrepresented in informal settlements, where disaster risks are higher due to inadequate infrastructure and services.
- Women have limited access to technical knowledge and training in DRR, making it harder for them to adopt risk reduction practices or benefit from early warning systems.
- Customary laws and discriminatory practices restrict women's access to land and secure housing, reducing their resilience to urban disasters.
- Women's participation and representation in urban governance and DRR planning remain insufficient, leading to policies that fail to address their specific needs.
- Gender considerations in DRR policies are often treated as an afterthought rather than being integrated into core strategies.

Other different socioeconomic groups (including women, men, children, the elderly and the disabled) experience varying degrees of climate change vulnerability. It is widely acknowledged that women are more vulnerable to the threats of climate



change due largely to their oftentimes limited control over the productive assets that could help them to address the threats posed by climate change. To address these challenges, Ghana must adopt gender-responsive urban planning and DRR strategies. Building the capacity of women and other vulnerable groups to actively participate in urban governance and disaster preparedness can improve resilient outcomes. Additionally, integrating gender-sensitive approaches into urban policies and ensuring equitable access to resources, training, and technologies are critical steps toward sustainable and inclusive urban development.

Adopting a gender lens for the adaptation plan will provide a better understanding of the different experiences of the threats posed by climate change between men and women but also between individuals within those groups based on age, educational levels, ethnic origins and marital status. Therefore, integrating gender considerations into cities and disaster risk reduction (DRR) sectoral adaptation strategies is critical to ensuring equitable outcomes, fostering inclusion, and addressing the unique needs of all societal groups. A gender-responsive approach will not only enhance adaptation outcomes but also strengthen community resilience by leveraging the contributions of diverse groups. The following themes outline the key considerations for integrating gender into the Cities and DRR sector.

8.3. Gender considerations for National Adaptation Planning for cities and DRR sector

8.3.1. Gender-Sensitive Approach

Adopting a gender-sensitive approach ensures that disaster risk reduction (DRR) strategies address the distinct vulnerabilities and contributions of women, youth, and marginalized groups. This includes integrating gender perspectives into all stages of urban and rural DRR planning to create inclusive and equitable solutions.



8.3.2. Gender Analysis

Comprehensive gender analyses should be conducted to identify how disasters and climate risks affect women and men differently. This will help uncover gaps in access to resources, participation in decision-making, and the impact of disasters on livelihoods, particularly for women in informal sectors and rural communities.

8.3.3. Stakeholder Consultations on Gender-Responsive Actions

Engaging the local communities, relevant actors, women, youth, and other marginalized groups in stakeholder consultations ensures that their voices are heard in developing gender-responsive DRR interventions. Community-level dialogues should prioritize input from women's groups, cooperatives, and youth organizations to align actions with their specific needs.

8.3.4. Planning Gender Interventions

Gender-responsive planning must include targeted interventions such as designing safe emergency shelters for women and children, training women as first responders, and supporting women-led initiatives in climate-resilient livelihoods. These interventions should be integrated into broader urban and rural DRR frameworks.

8.3.5. Resource Allocation to Address Specific Gender Adaptation Actions

Dedicated resources must be allocated to fund gender-specific actions such as establishing women's safety networks, creating economic opportunities for women in disaster-prone areas, and improving access to health and sanitation facilities during emergencies.

8.3.6. Monitoring Performance of Gender Interventions

Establishing gender-sensitive monitoring frameworks ensures accountability and tracks the effectiveness of gender-specific actions. Regular reviews and feedback mechanisms should assess how well interventions are addressing the needs of women, youth, and vulnerable populations in both urban and rural settings.

The following provides a guide to address gender vulnerability in the sector.

Table 14: Gender Sensitivity Approach

Gender Approach	Description
Gender analysis	Identify gender sensitive issues through desk review of sector reports and documents.
Stakeholder consultations on gender responsive actions	Gender stakeholder consultations is required to identify interventions which address the vulnerabilities identified in the gender analysis. When prioritizing, gender interventions should not be left out. Along with the interventions, the stakeholders should identify specific gender vulnerable groups and assign specific roles from planning through to implementation and monitoring.
Planning gender interventions	The gender actions identified must be integrated into the respective sector plans. This will increase visibility of interest and needs of gender vulnerable groups. When gender interventions are included in the sector plans, it is easy to allocate resource and monitor performance.

Resource allocation to address specific gender adaptation actions	The gender vulnerability interventions identified must be budgeted. Where possible, it must be incorporated into existing structures. Gender focal desks in the various sectors should be trained and provided with the necessary tools to oversee the implementation of the gender interventions. The gender team should include management to ensure to help prioritize gender interventions.
Monitoring performance of gender interventions	Data on adaptation interventions should be segregated by gender groups identified in the gender analysis. In addition, specific gender indicators should be included to help evaluate the effectiveness of the gender interventions.





9. FRAMEWORK FOR ADAPTATION MONITORING AND EVALUATION

The Monitoring, Evaluation, and Learning (MEL) framework for the Cities and DRR sector aims to provide a comprehensive system for tracking the progress and assessing the impact of adaptation actions. It is to be designed to ensure that adaptation measures contribute to increasing resilience in urban areas while integrating gender-sensitive strategies. This framework will provide insights into the effectiveness of interventions, guide future planning, and ensure accountability and transparency in the management of adaptation efforts.

9.1. Objectives of the MEL Framework

The primary goal of the MEL framework is to monitor and evaluate the outcomes of adaptation actions in cities, focusing on reducing disaster risks and enhancing resilience. Specifically, the framework will

- Track the implementation of adaptation activities to ensure alignment with planned outputs and outcomes.
- Evaluate the effectiveness of gender-sensitive adaptation actions in reducing vulnerabilities and enhancing resilience.
- Facilitate learning to improve future adaptation strategies and policies.
- Ensure accountability to stakeholders, including women, youth, and marginalized groups.

9.2. MEL Components for the Cities & DRR Sector

9.2.1. Indicators for Adaptation Outcomes

The MEL framework should incorporate indicators at different levels to measure progress in adaptation across the Cities and DRR sector. These indicators will include input, process, output, outcome, and impact indicators, with specific attention to gender-responsive outcomes.

1. Input indicators will track the allocation of resources for DRR actions and gender-focused interventions, while process indicators will measure how well gender considerations are integrated into planning and implementation.
2. Output indicators will assess the delivery of gender-responsive adaptation actions such as the construction of flood-resilient infrastructure and inclusive early warning systems.
3. Outcome indicators will focus on the reduction of disaster risks and improved resilience among women, youth, and marginalized groups in urban areas.
4. Impact indicators will evaluate the long-term changes in resilience, livelihood improvement, and disaster preparedness within vulnerable communities.

9.2.2. Data Collection and Analysis

Data collection in the Cities and DRR sector should be continuous, robust and gender sensitive.

1. Establish benchmarks to assess progress against initial conditions.



2. Disaggregated data by gender, age, and socioeconomic status should be prioritized to assess the differential impacts of climate risks on various population groups.
3. Additionally, the use of both qualitative and quantitative data collection methods, such as surveys, focus group discussions, and participatory approaches, will be employed to ensure inclusivity.
4. Local communities, particularly women's groups and youth organizations, will be engaged in data collection processes to validate and ensure that data accurately reflects their realities.
5. The integration of digital tools and technologies, such as mobile-based surveys and GIS mapping, will also improve the efficiency and transparency of data collection.

9.2.3. Gender-Responsive Indicators

Gender-responsive indicators will be central to monitoring the impact of the Cities and DRR sector's adaptation efforts. These indicators will include the extent to which women and marginalized groups have access to and benefit from adaptation measures, such as climate-resilient infrastructure, disaster preparedness programs, and early warning systems. The framework will also assess the participation of women and youth in decision-making processes, their access to climate-resilient livelihoods, and the availability of gender-responsive emergency services. By tracking these indicators, the MEL framework will ensure that the adaptation efforts in the Cities and DRR sector are inclusive and equitable.

9.2.4. Institutional Arrangements for MEL

Effective implementation of the MEL framework will require strong institutional arrangements across multiple levels of government and civil

society. The EPA will play a central role in overseeing the implementation of the MEL framework, ensuring that gender-sensitive adaptation actions are effectively tracked and evaluated. Stakeholders, including women's groups, youth organizations, and NGOs, will be involved in the planning, monitoring, and evaluation processes to ensure that the needs and perspectives of vulnerable groups are prioritized. The District Assemblies should be conducted to implement and monitor MEL processes at the community level. The MEL should allow for collaboration with external assessments for objectivity and accountability. These evaluators will work alongside the relevant ministries and local authorities to assess the impact of adaptation actions on disaster risk reduction and gender equality.

9.2.5. Implementation and Reporting Mechanisms

Transparency in reporting will be critical, and regular updates on progress will be made available to stakeholders through public dashboards, online platforms, and community consultations.

a. Reporting Structures

- Develop periodic reports to assess progress on adaptation plans and gender outcomes.
- Use simplified reporting templates to ensure accessibility for all stakeholders.

b. Learning and Feedback Loops

- Host workshops and knowledge-sharing events to discuss lessons learned.
- Update adaptation strategies based on MEL findings to enhance effectiveness.



c. Accountability

- Publish MEL reports and progress updates to ensure public accountability.
- Use real-time dashboards to track implementation and provide visual feedback to stakeholders.

9.2.6. Learning and Adaptation

The MEL framework should not only focus on monitoring and evaluation but will also facilitate adaptive learning. Regular assessments of adaptation interventions will provide insights into what is working and what needs to be adjusted. This information will inform future programming and policy adjustments. Adaptive learning will involve refining strategies based on the evaluation of gender-sensitive outcomes, ensuring that the Cities and DRR sector continues to evolve to meet the needs of women, youth, and marginalized groups. Key lessons learned from the MEL process should be shared with relevant stakeholders, including policymakers, local authorities, and communities. These lessons will help inform best practices for future adaptation initiatives, improving the resilience of cities and communities in the face of climate change.





10. CONCLUSION AND RECOMMENDATIONS

10.1. Conclusion

The methodological guide for developing the Sectoral Adaptation Plan for the Cities and Disaster Risk Reduction (DRR) sector in Ghana, aims to strengthen urban resilience and address the impacts of climate change. The guide emphasizes a systematic, participatory approach, ensuring inclusivity and relevance in adaptation planning processes. It offers structured guidance for sectoral experts, ensuring consistency in approach, while also recognizing the critical importance of aligning these plans with national frameworks and policies.

Climate change poses a serious threat to both urban and rural populations in Ghana, especially in rapidly growing cities, which face increasing risks such as heat stress, flooding, and public health challenges. The proposed adaptation strategies are designed to mitigate these risks, focusing on enhancing infrastructure, improving water supply, sanitation, and disaster preparedness, and ensuring that vulnerable groups, including women, youth, and marginalized communities, are considered in the planning and implementation stages.

The institutional arrangements proposed for the effective implementation of the sectoral adaptation plan call for collaboration among national ministries, local governments, non-governmental organizations, civil society organizations, and development partners. This multi-stakeholder approach is essential for the integration of climate adaptation and disaster risk reduction into urban development, ensuring that all sectors work in concert towards achieving sustainable, climate-resilient cities.

The identified key areas for adaptation—flood risk management, disaster preparedness, sustainable water systems, resilient housing, and climate-smart

agriculture—offer actionable solutions that are adaptable to the unique needs of both urban and rural communities. By adopting ecosystem-based adaptation (EbA) practices and promoting coastal resilience, Ghana will better protect its natural resources and urban infrastructure, ensuring that the country's urban areas are better equipped to withstand the challenges posed by climate change. The proposed adaptation options for the Cities and Disaster Risk Reduction (DRR) sector in Ghana bordered around:

1. Urban and Rural Flood Risk Management and Resilience Enhancement.
2. Improved Water Supply and Sanitation Systems
3. Drought-Resistant Agricultural Practices and Urban Food Security.
4. Strengthened Disaster Preparedness and Emergency Response
5. Climate-Resilient Housing and Infrastructure.
6. Sustainable Urban and Rural Transport Systems.
7. Ecosystem-Based Adaptation (EbA) for Urban and Rural Areas.
8. Coastal Resilience Against Sea-Level Rise and Erosion.

The ongoing collaboration and feedback from stakeholders will be crucial for refining and prioritizing the adaptation strategies, ensuring that they are both actionable and sustainable in the long term.

Stakeholder engagements and workshops offer a platform to present the findings of the stocktaking exercise and discuss each of the proposed adaptation measures. Allowing for feedback from stakeholders and ensuring the integration of context-specific measures. This should include participatory approaches and inclusive identification and prioritization of risks to the Cities and DRR Sector in Ghana.



Additionally, integrating gender considerations into the Cities and DRR sector's adaptation strategies is vital for ensuring equitable outcomes and fostering inclusion. By addressing the unique needs of diverse societal groups, a gender-responsive approach will not only enhance adaptation outcomes but also strengthen community resilience.

Finally, the Monitoring, Evaluation, and Learning (MEL) framework for the Cities and DRR sector will provide a comprehensive system for tracking the progress and assessing the impact of adaptation actions. It will ensure that adaptation measures contribute to resilience in urban areas, integrate gender-sensitive strategies, and offer insights to guide future planning. This framework will ensure accountability and transparency in managing adaptation efforts and contribute to effective decision-making.

10.2. Recommendations

In order to ensure the effective implementation and sustainability of the proposed adaptation measures for the Cities and Disaster Risk Reduction (DRR) sector, it is critical to adopt a comprehensive, inclusive approach. This approach should prioritize stakeholder engagement, gender integration, capacity-building, and robust monitoring systems. Furthermore, urban planning and climate adaptation efforts should be closely linked, ensuring that long-term resilience is built through both infrastructural investments and policy reforms. The following recommendations provide actionable steps to enhance the success of these adaptation strategies.

1. Strengthen Stakeholder Engagement in Cities and DRR Adaptation Planning

Engage stakeholders from all sectors—government, private sector, civil society, and community members—in regular consultations throughout the adaptation planning and implementation phases. These consultations

should focus on refining sectoral adaptation strategies, ensuring that feedback is incorporated into the final action plans. A participatory approach will enhance local ownership of adaptation efforts and improve the relevance and effectiveness of proposed measures.

2. Integrate Gender-Responsive Approaches into Cities and DRR Strategies

Ensure that adaptation strategies within the Cities and DRR sector explicitly address gender inequalities and integrate gender-sensitive planning. Gender-responsive interventions will ensure equitable access to resources, opportunities, and decision-making processes for women, youth, and other marginalized groups in urban and rural settings. Gender considerations should be embedded in disaster risk management plans and urban resilience frameworks to enhance inclusivity and ensure that the unique needs of different groups are met.

3. Promote Capacity Building for Local Communities and Decision-Makers

Develop and implement capacity-building programs for local authorities, communities, and relevant stakeholders to enhance their understanding of climate risks and adaptation measures. These programs should prioritize training in disaster risk reduction, climate resilience, and gender integration. Building local expertise to promote community-based adaptation (CBA) will ensure more effective implementation and long-term sustainability of adaptation strategies.

4. Design and Implement a Comprehensive MEL Framework for Cities and DRR

A Monitoring, Evaluation, and Learning (MEL) framework should be established to track the implementation and impact of adaptation measures in the Cities and DRR sector. The MEL system should include gender-sensitive indicators to assess the effectiveness of adaptation efforts for



different societal groups. The framework will help guide future adaptation planning, ensure transparency in the management of resources, and improve accountability.

5. Enhance Disaster Risk Reduction and Early Warning Systems in Urban and Rural Areas

Strengthen early warning systems and disaster risk reduction mechanisms tailored to both urban and rural settings in Ghana. This includes investing in localized weather forecasting and early alert systems, particularly for vulnerable communities. Ensuring that communities are prepared and equipped to respond to disasters will reduce risks and minimize losses in the event of climate-related disasters.

6. Integrate Climate Change into Urban Planning and Development Policies

Ensure that climate change considerations are integrated into all urban development and planning policies in Ghana's cities. This includes promoting climate-resilient infrastructure, such as flood management systems, water conservation technologies, and climate-smart urban designs. Urban planning should actively reflect the need to address disaster risks while fostering sustainable development.

7. Integrate Climate Change into Urban Planning and Infrastructure Development

Integrate climate change considerations into all urban development and infrastructure policies. This includes promoting climate-resilient infrastructure such as flood management systems, climate-responsive building codes, and sustainable urban drainage systems. Infrastructure planning should prioritize climate adaptation by ensuring the protection and upgrading of existing infrastructure, including roads, water supply systems,

and electricity grids, to withstand climate impacts such as flooding, storms, and heatwaves.

8. Ensure Long-Term Financing for Cities and DRR Adaptation by Promoting Public-Private Partnerships

Encourage collaboration between the public and private sectors to finance and implement climate adaptation projects in urban areas. Public-private partnerships (PPPs) can mobilize additional resources, expertise, and technology, enabling more effective and scalable adaptation solutions. Secure consistent, long-term funding to support adaptation initiatives in the Cities and DRR sector. This can be achieved through international climate finance and innovative financing mechanisms like green bonds. A reliable financing framework will ensure the sustainability and continued implementation of adaptation measures.



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