

REVIEW



## Review of gender and climate change adaptation among rural households: The cases of Ghana and the Gambia

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### ABSTRACT

The lives and livelihoods in Sub-Saharan Africa (SSA) have been negatively impacted by climate change, particularly those of rural Ghana and the Gambia households. Extreme weather phenomena like floods and droughts have made agriculture unsustainable for the rural communities in these two countries. These obstacles are particularly experienced by women, who are more likely to be disadvantaged and experience social inequality. This study examines how gender differences and gender-responsive adaption strategies, such as policies, laws, and regulations, are affected by climate change in rural families in Ghana and the Gambia. The study's methodology in this paper involves a thorough examination of recent empirical studies on how differently men and women are affected by climate change, how well they can adapt, and what factors influence how they respond to it. Researchers and policymakers in Ghana and the Gambia would particularly benefit from this review study since it highlights the necessity of gender-sensitive policies and programs for climate change adaptation to improve equality and resilience in these two countries' rural households.

### KEYWORDS

Gender; Climate change adaptation; Rural households; Ghana; Gambia

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### Introduction

In order to alleviate the impacts of climate change and the environmental issues associated with global warming, it is imperative that we transition from the utilization of fossil fuels to clean and sustainable energy sources [1]. Due to their greater reliance on ecologically delicate industries like forestry and agriculture, developing nations, especially the Least Developed Countries (LDCs), already face greater risks from any atypical shifts in climate phenomena. As a result, the majority of people in these countries will be significantly impacted by any adverse impacts on these sectors [2]. Agrawal and Perrin, rural communities that depend on natural resources are expected to bear a disproportionate amount of the consequences of climate change, including heat waves, fires, diseases, starvation, floods, storms, coastal flooding, and fluctuations in temperature and precipitation [3].

According to a 2017 estimate, about 3.4 billion individuals live in rural areas worldwide. Low and middle-income countries accounted for 15% and 79% of these populations, respectively. Fishing and cattle rearing comprised the main sources of income for many of these people. Approximately 570 million farms exist worldwide, with 500 million or more covering fewer than 2 hectares, or 12% of all agricultural land 51–77% of almost all nutrients are produced by small and medium-sized farms ( $\leq 50$  hectares). Compared to metropolitan regions, rural areas have higher rates of poverty. In 2013, 18.2% of rural and 5.5% of urban inhabitants experienced extreme poverty [4]. Sissoko et al., also pointed out that decreasing agricultural productivity is the primary way that predicted climate change is anticipated to affect farm household livelihoods in the West African Sahel [5].

Other biophysical factors that affect agricultural production besides weather patterns are the chemical and physical properties of the soil, the prevalence of pests and diseases, and socioeconomic factors like migration, low educational attainment, population growth rate, research and extension, market conditions, and the use of chemical fertilizers.

The main factor influencing climate adaptation disparities between men and women is gender inequalities in climate susceptibility. Women frequently face barriers to decision-making and resources that could help them enhance their standard of living [6]. The allocation of tasks between males and females, rigid gender norms, and inequitable availability of resources and financial resources all render women more susceptible and restrict their capacity to adjust and cope with the impacts of climate change. For instance, women's capacity to run or climb to escape a dangerous situation such as floods may be hampered by the clothing they wear or by their obligations to take care of little children [7]. It is becoming more apparent that socioeconomic inequality already exists and is being exacerbated by climate change. Long-standing control over or access rights to assets or capital ownership, as well as punishing practices and social norms, can all greatly amplify the socioeconomic gaps that exist between men and women [8].

Farmers' ability to adapt to changes in extreme weather events depends on institutional support for adaptation, which needs to be gender-sensitive and focused on capturing the preferences of both men and women farmers [9]. Furthermore, many development organizations are taking a

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holistic approach to their adaptation programming in light of the mounting evidence that shows how gender and numerous other socio-economic factors combine to create a complex matrix of vulnerability and risk, which in turn determines how individuals can adapt to climate change [10]. Attaining gender equality is crucial for social and economic progress and promotes other development objectives such as enhancing women's access to resources for production, improving their health and nutrition, and increasing agricultural productivity gains. Therefore, it is imperative to include gender considerations in policy as an initial and indispensable step [7].

Therefore, this review aims to thoroughly evaluate how gender affects rural households in Ghana and the Gambia's ability to adapt to climate change. Additionally, the review seeks to assess specific climate change challenges faced by rural households in these two West African countries particularly floods and droughts, gendered socioeconomic inequalities, and gendered differentiated impacts and vulnerability. In essence, the paper will enhance comprehension of the correlation between climate change and gender. Specifically targeting rural families, which are particularly susceptible to the impacts of climate change, this review aims to enlighten policymakers about the need to include gender considerations in national climate change policies. It does this by consolidating relevant literature and pinpointing areas where research is lacking.

### Factors responsible for climate change in Ghana and the Gambia

For the past decades, anthropogenic climate change has severely affected the lives and livelihoods of people especially rural households in these two countries. In Ghana, for instance, air pollution has been widely regarded as the primary environmental variable accountable for climate change [11]. The main source of household air pollution, accounting for 70% of emissions, is the domestic use of solid biomass, coal, and kerosene, which releases carbon monoxide (CO), nitrogen dioxide (NO<sub>2</sub>), sulfur dioxide (SO<sub>2</sub>), and particulate matter (PM) [12]. The transportation industry, especially on roadways, is a major source of air pollution and greenhouse gas emissions, constituting around 17% of the overall emissions and 48% of the energy sector in Ghana [13]. One significant portion of Ghana's unregulated and illicit mineral extraction and recovery operations is one of the elements causing climate change. The highest levels of mercury contamination in air, water, and land are experienced in communities and ecosystems located near illegal mining "galamsey" sites [14,15].

As to the second Nationally Determined Contribution of the Gambia, there is an anticipated rise in GHG emissions from 4,935 GgCO<sub>2</sub>e in 2020 to 6,617 GgCO<sub>2</sub>e in 2030, representing a 34.1% increase. Waste, industrial processes and product units (IPPU), energy, transportation, land use, land-use change and forest (LULUCF), and agricultural, forest, and other land use (AFOLU) are the industries that emit the greatest emissions (GoTG, 2021). Moreover, the loss of carbon sinks and carbon emissions are primarily caused by intensive farming and deforestation for agricultural growth. Significant greenhouse gas emissions result from relying on fossil fuels for energy demands. The development of the industrial sector and the methane emissions from landfills brought on by inappropriate waste disposal and management practices are the primary drivers of climate change in the Gambia [16,17].

### Impact of climate change on agricultural production in Ghana and the Gambia

Agricultural production is the primary means of livelihood for most people in Sub-Saharan Africa. However, starting from 2012, its productivity has shown signs of decline [18]. About 50% of the workforce in Ghana works in the agriculture sector, which has been severely damaged by climate change. Undoubtedly, crop production has emerged as one of the most vulnerable industries to climate change in the entire country. An estimated 1.0°C increase in temperature has occurred in Ghana within the past 60 years. This has greatly diminished agricultural output, especially in northern Ghana, a region that has been historically affected by marginalization and marked by severe poverty and malnutrition. Because of their excessive reliance on rainfall, farmers in northern Ghana face difficulties from fluctuating and ever-erratic rainy seasons [19]. Rainfall fluctuations have diminished agricultural output, posing a threat not only to farmers' livelihoods but also to the national food value chain [20].

The climate of Ghana is tropical, characterized by an average year-round warmth. The temperature rise has worsened the already tropical climate, resulting in a decrease in nutrient efficiency. Furthermore, it increases the amount of water crops require, lowers soil moisture content, and messes with the agricultural cycle by prolonging crop growth and reducing crop availability. For their agricultural operations, most farmers rely on irrigation or rainfall. Thus, due to the increasing warmth, irrigation dams become depleted, which has a detrimental impact on food consumption. Additionally, the rivers of Ghana are shallow and prone to temperature fluctuations, which creates obstacles for irrigation methods. Owing to these dynamics, crops in Ghana are susceptible to escalating temperature and water fluctuations, consequently compromising food output [21,22].

In addition, since the middle of the 1960s, The Gambia has seen erratic changes in its weather, such as erratic patterns of rainfall, heavy unexpected rains, storms, droughts that occur within a season, cold spells, and the widely acknowledged 21st-century phenomenon of climate change [23]. The ongoing series of floods and droughts severely harmed the nation's ability to produce key cereals, putting farm households at risk of food shortages. As a result of existing social, economic, and institutional limitations, the rural population of the country is more vulnerable to severe weather events and prolonged climate fluctuations [24]. The deterioration of vital natural resources is intimately related to the effects of climate change, such as rising sea levels. For instance, salt intrusion, also known as salinity, typically diminishes the arability, performance, and production of crops predominantly cultivated in marshy regions, such as rice [25,26]. For example, Bojang et al., noted that most farmers in Sapu and Kuntaur located in the Central River Region, indicated that rising temperatures brought on by climate change would have a significant negative impact on rice production [27]. Extreme temperatures have significant negative effects on rice productivity, particularly during flowering and heading.

### Impact of climate change on vegetation in Ghana and the Gambia

Numerous studies carried out in the SSA have examined how climate change is currently affecting and will continue to affect

flora and fauna, as well as how these consequences may affect the livelihoods of individuals who depend on these resources [28]. In Ghana, climate change has caused a disparity between the plant and animal life that defines tropical savanna communities [29]. The deforestation caused by agriculture, logging, mining, infrastructure development, and urban growth has reduced forest ecosystems by more than 60% within the last thirty years. This has endangered most people's sustainable means of subsistence, worsened by the growing climatic variability and its catastrophic events [30]. Ghana's yearly vegetation loss to climate change stands at 3.51%, resulting in annual losses of over 315,000 hectares (ha) and is projected to exceed 4.7 million (ha) by 2030 [30]. The repercussions of vegetation loss in the country are immensely detrimental to both the ecosystem and the long-term human welfare. The consequences of deforestation have affected the ability of both rural and urban residents to maintain sustainable lifestyles, by disturbing crucial natural processes and massively degrading forest ecosystems [31]. Changing climatic patterns and rising temperatures have led to increased soil degradation and erosion, species extinction, and a rapid decrease in river and stream water levels [32].

Furthermore, the influence of climate change on plant and animal life has been particularly evident in the Gambia for the past decades. Owing to the intense drought that hampers agricultural output, rural inhabitants have resorted to diversifying their livelihoods into hunting to enhance their economic stability. Indeed, the deterioration of habitats caused by agriculture, hunting, wildfires, and overgrazing has led to the local extinction of numerous species during the past century. However, little is known about the geographical range and ecological state of invertebrates in the Gambia, nor the possible impacts of climate change on them [33,34].

### Climate change's effects on Ghanaian Gambian rural households

Due to an increase in anthropogenic greenhouse gas (GHG) emissions in recent decades, West Africa has been more at the receiving end of climate change than contributing. There has been a slow and spatially varied warming that has reached 0.5°C each decade [35]. Ghana and the Gambia, however, are not exempted from the fluctuations and changes in the climate. The following chapters address the main climate change issues that these two nations have faced in recent years.

#### Effects of floods on rural households in Ghana

Flooding is one example of extreme weather events that have been shown to deplete household assets and make them more susceptible to shocks and poverty. Studies indicated that farmlands, people's health, houses, and financial resources were the household assets most vulnerable to flooding [36]. In Ghana, for example, flooding is largely caused by severe rainfall in Ghana's northeast and northern regions. It frequently results in dam failures or rivers spilling their natural bounds and swallowing the nearby dry areas. Flooding is a phenomenon that destroys farmlands, the main source of income for most communities, endangering food security [37]. In November 2010, Ghana had an unprecedented flood that caused 700,000 people to be resettled and damaged 55 communities. Additionally, 23,588 acres of farmland suffered flood damage and 3234 homes were destroyed. Based on a 2010 assessment by

Ghana's National Disaster Management Organization (NADMO), the flood incurred an estimated total cost of \$116,340.22. Moreover, a severe flood event on June 3, 2015, resulted in the loss of more than 150 lives. Empirical studies demonstrated significant property damage and financial losses (Figure 1) [38].



**Figure 1.** Illustrates cases of flash floods in rural communities in Ghana (Source: Ghana Business News).

#### Effects of floods on rural households in the Gambia

The Gambia National Disaster Management Agency (NDMA) has reported around 43,984 casualties in 2022. The effects include the destruction of homes, food supplies, sanitary facilities, and household items, in addition to a considerable number of lives that are still at risk. Of the affected population, 22% are children under five years old, and 51% are female, including 2,846 pregnant and nursing mothers. In addition, 1,200 sanitary facilities and over 392 water points were damaged by the floodwaters. Furthermore, overflowing septic tanks contaminate the water supply, endangering the public's health [39]. Floods typically occur in the Gambia during the rainy season, causing crop damage and subpar harvests. Since farmers make up the majority of those impacted, it is clear that agriculture is their main source of income and that they do not have enough money from other sources (Figure 2) [40].

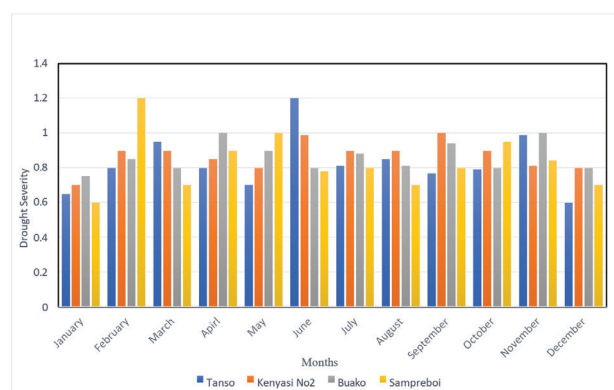


**Figure 2.** Flood incident in rural Gambia (Source: The Standard Newspaper).

#### Impact of drought on rural households in Ghana

One of the climate extremes that most hinder livelihoods is drought, especially in dryland areas [41]. It is frequently

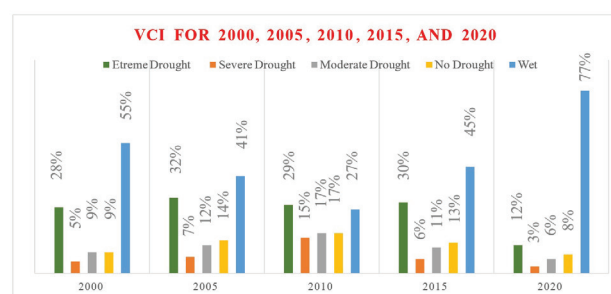
reported that the West African Sub-region saw notable variations in rainfall, particularly throughout the 20th century. [42]. West African populations have long endured a dry climate that fluctuates annually and over an extended period [43]. Dumba et al., noted that Ghana experiences frequent droughts, the worst and most damaging of which occurred in the nation's history in 1983 [44]. Drought conditions negatively impact crop productivity and food security. According to earlier reports, the nation's ongoing drought had an impact on all agriculture sector investments. Unpredictable rainfall, protracted droughts, and high temperatures have negatively impacted the nation's sustainable agriculture industry. Furthermore, when a drought strikes, farming—the primary source of income for many rural residents—ends abruptly since irrigation infrastructure is inaccessible for dry-season farming. Most residents in the area sell their assets to keep their diets in order, and those who are unable to do so suffer severe consequences to their means of subsistence (Figure 3) [45].



**Figure 3.** Severity of drought in provincial Ghana from 1982 to 2019  
Source: Modified after [46].

### Effects of drought on rural households in the Gambia

Due to climate change and variability, The Gambia has suffered and will continue to incur significant economic losses. The total annual rainfall decreased by over 30% between 1950 and 2000. This decrease is indicated by the shorter rainy season and the amount of rainfall that has been seen in August, especially between 1968, 1985, and 2002 [47]. This phenomenon has decreased the yield of crops like corn, groundnuts, and millet due to the little and uneven rainfall combined with rising temperatures, which further exacerbates food insecurity, rural poverty, and other problems [48]. Studies by Badjie et al., indicate that a sizable portion of the country is seeing an increase in the frequency and duration of dry spells paired with a drop in the amount and duration of rainfall [49]. He went on to say that the Northern Region of The Gambia had seen less rainfall than usual for at least 29 of the past 40 years. Kargbo et al., latest report also mentioned how cattle herds have been harmed by temperature and rainfall variations [50]. He further stated that farmers in rural Gambia claim that the consequences of reduced rainfall, particularly between 2016 and 2020, were severe enough to affect their livestock. Among other things, these consequences included decreased fertility, a lack of pasture, and the requirement for animals to travel long distances in search of pasture and water (Figure 4).



**Figure 4.** Drought intensity in the Gambia using the Vegetation Condition Index (VCI) on a five-year interval from 2000 to 2020  
Source: Modified after [47].

### Gendered socioeconomic inequalities

Inequalities in income and health that affect the most vulnerable groups in Sub-Saharan Africa are made worse by climate change. It is widely believed that women are mostly responsible for climate change challenges. The effects of climate change disproportionately impact them because of social injustices and assigned social and economic duties. Instruments and methods for climate protection and adaptation will also have varied effects on men and women in their various social positions [51]. The consequences of climate change exacerbate social variables such as poverty, education, and food security, which are crucial in determining the condition of human health and well-being [52]. According to McLeman et al., a study conducted in Ghana's upper west, rural residents said that while the start of the dry season remained mostly constant, the rainy season started later [53]. In addition, they noted that the frequency of extreme rainfall events throughout the wet season was rising along with the length of intra-seasonal dry spells. Social inequality and community vulnerability among women and men are further exacerbated by this condition. Furthermore, there has been no attempt to look into the knowledge and experiences of female farmers in The Gambia regarding the negative effects of heat on health and their adaptation plans related to reproductive health and pregnancy. It would be beneficial to investigate and include more information about how these factors affect Gambian women subsistence farmers' capacity to adjust to rising temperatures brought on by climate change, both during and outside of pregnancy [54].

Owing to resource scarcity and social norms that require women to handle multiple roles and duties within the house, women are more likely to work in low-wage, low-productivity jobs like small-scale farming. Gender inequalities in the utilization of time, access to productive resources, and market and institutional variables are the key causes of gender productivity discrepancies, which are not inherent [6]. Therefore, the effects of climate change have made it more difficult for rural residents of Ghana and the Gambia to make ends meet because their primary sources of income are related to climate-sensitive sectors including forestry, agriculture, and fishing. As a result, there is now more inequality and its effects are more pronounced for women, children, and individuals with disabilities.

### Impacts of climate change on different gender

An increasing amount of research is looking into the effects of

gender inequality in the context of climate change. It shows that there are gender differences in how people perceive and experience the effects of climate change, as well as in their capacity for adaptation and in terms of their priorities, needs, and preferences. Studies also show that men and women are affected differently by climate shocks and climate change [55]. Due to large differences in economic opportunities and access to productive resources as well as the fact that women are typically less educated, poorer, and excluded from family, community, and governmental decision-making processes that have a direct impact on their lives, women are more vulnerable to climate change. Generally speaking, women own less and rely more on natural resources for their subsistence [56]. For example, a study conducted in the Lawra district of Ghana's Upper West Region by Assan et al., found that a higher percentage of male farm household heads (16%) than female heads (1%), had access to formal credit [57]. Farmland was owned by almost 47% of the female heads of agricultural families. The remaining female heads obtained their farmland via renting or sharecropping (53%) or through their fathers, siblings, or husbands. Most male heads of agricultural households (96%) were landowners; the remaining 4% obtained their farmlands through sharecropping or allocation from their fathers. Olaniyan states that in addition to being affected by climate variations, Gambian women farmers—who are mainly known for growing poultry, small ruminants, horticulture, and food crops—also have limited access to resources and are less involved in policy and decision-making [58]. Women are generally viewed as a "marginalized group" in discussions about climate change, as previously mentioned. They are depicted as "victims" of development since they lack various resources. However, they fearlessly bear the burden of surviving as food suppliers, carriers of fuel and water, and guardians of household food security, especially in SSA [59].

### Gendered adaptation strategies in Ghana and the Gambia

#### Gendered adaptation strategies in Ghana

Ghana is a tropical country, and climate change has always had an impact on its agricultural sector. This is particularly noticeable in the countryside. These areas are agriculture-dependent communities. Farmers in northern Ghana (Upper East, Upper West, Northern, North-East, and parts of Bono, Ahafo, and Oti regions) are the most vulnerable to extreme weather conditions [60-63]. The agricultural planting season in northern Ghana has shifted from early April to late April or early May in recent years. This shift is mostly driven by unpredictable precipitation patterns and changing environmental conditions, particularly declining rainfall [64]. Ghanaian farmers and rural households are the most impacted by climate change because these farmers lack the resources needed to properly adapt to its impacts [65,66]. Despite the profound impact on rural households, farmers in rural Ghana employ mulching, farming on fallowed land, planting early maturing crop types, and fertilizer use as strategies to alleviate the effects of climate change on agriculture [67-69]. Bawakyillenou et al. assert that farmers raised their level of life by boosting irrigation, diversifying their livestock and crops, and venturing into non-farm businesses that provide income [70].

Since women are usually at the forefront of community-based and agricultural operations, they are essential to Ghana's efforts to adapt to gender and climate change. Ghanaian women are important contributors to agricultural diversification, which is necessary for a climate change adaptation strategy [6,14,20,71,72]. They keep household gardens and small farms where they grow a range of crops and vegetables. This positively affects food security, reduces risk, and improves nutrition [73]. They take part in revenue-generating activities that support adaptation to climate change [57,60]. Rural women are mostly engaged in processing agricultural produce. This adds value and serves as a revenue generation source [74,75]. Many women engage in handicrafts income streams, and this puts less reliance on mainstream agriculture, which depends on the weather conditions. Their involvement in savings organizations offers them financial assistance and ensures investment in adaptation initiatives [20,76].

However, gendered climate adaptation initiatives have contributed massively to minimizing climate change impacts in Ghana [78,79]. Through the introduction of drought-resistant crops, women have been equipped to challenge their male counterparts in farming to increase food security [14,57,79]. Women are now better able to invest in sustainable farming methods that support economic resilience because of increased financial accessibility [80-82]. Women and girls' understanding of and ability to adjust to the effects of climate change have increased dramatically as a result of targeted climate awareness programs [83-85]. These highlight the necessity of addressing the relevant issues that women face to create a resilient society. Contrary to this, is the fact that gender biases and limited access to finances for women have dominated over the years and are limiting their ability to fully achieve inclusivity in climate change adaptation [86,87]. To address this, there is a need to improve educational opportunities, financial support, and policy reforms.

#### Gendered adaptation strategies in the Gambia

The majority of smallholder farmers in the Gambia who follow the ideas and methods of sustainable agriculture use the current climate change adaption measures for farming practices [88]. Farmers employ adaptation measures, such as altering the farming calendar, utilizing crop diversification, and managing their crops, to transition to crop kinds and cultivars that are less susceptible to climatic pressures [89]. According to research by Fatou et al., over 85% of rice farmers use calendar modification as their primary on-farm adaption technique [90]. Some of them plant several crops or introduce innovative cropping methods to increase farm yield [91]. They apply soil and nutrient management strategies in their agricultural activities. They mulch the soil surface using organic materials, such as dead plants or crop wastes, to prevent weed seeds from sprouting and regulate temperature and evaporation [92].

Nonetheless, women are essential in the Gambia when it comes to climate change adaptation. They contribute greatly to crop diversification and income-generating activities. This has contributed to mitigating climate impact among rural households [54,93]. Their participation in agricultural activities demonstrates the noteworthy contributions they make to the production and security of food in households [94,95]. Women

in Gambia ensure crop diversification through mixed cropping and farming, which reduces the risk of drought, flooding, and pest infestations. Women's in-depth knowledge of traditional farming practices and local plants helps preserve and enhance traditional farming methods that are resistant to weather conditions. This enhances the protection of biodiversity, ecosystem resilience, and food security [93,96]. The women in Gambia engage in economic activities that benefit their families [25,97,98]. Their activities include microfinance, handicrafts, e-tourism, food processing, entrepreneurship, and reducing dependency on activities that worsen the effects of climate change [99]. Women modify their revenue-generating endeavors to become more climate-resilient in response to climate change. They diversify their sources of income, look into alternate livelihood possibilities, and implement sustainable business practices [24,25,100].

However, the implementation of gender-based adaptation strategies in the Gambia has made significant progress towards the fight against climate change. The women-led cooperative initiatives have increased food security through sustainable farm practices [101-103]. Training programs for women entrepreneurs have equipped them to economically diversify their income generation streams [25,104]. Initiatives like community-based water management, have increased clean water accessibility, thereby reducing its adverse effects on female-headed households [105,106]. These strategies have enhanced efforts to ensure gender equality and swift decision-making processes.

#### **Adaptation policies in Ghana and the Gambia**

In recent times, Ghana and the Gambia have endeavoured to incorporate gender equality with climate adaption into their policies and programs. This has led to the implementation of several gender adaptation measures, including policy reforms to enhance gender equality. These initiatives have led to the current state of both nations' efforts to mitigate and adapt to climate change. Gender issues are taken into account in the measures of the Ghana National Climate Change Policy (NCCP), which deals with climate change adaptation and mitigation [107]. It focuses on agriculture, energy, disaster preparedness, health, and water resource management to build a compatible economy targeting low carbon emissions for sustainable development [108]. This strategy acknowledges both the direct and indirect effects of climate change on men and women, as well as its role in contributing to the continuous widening of the gender inequality gap. The National Climate Change Policy is supported by the National Gender Policy, which was developed in 2015. This effort aims to promote gender equality and women's empowerment in all spheres of the economy [109].

This policy is relevant to Ghana's attempts to adapt to and lessen the effects of climate change because it highlights the fact that women are more susceptible than men to these effects. It also advocates for gender-based initiatives to support women's leadership, economic empowerment, access to resources, support for their livelihoods, health, social protection, and education and training. The National Reproductive Health Service Policy and Standard was implemented to offer support and guidelines to women and children in reproductive health [110]. Reproductive health care is supported by the Ghanaian

government as preventive, curative, and promotional services to enhance population health and well-being, especially for mothers, children, and young adults. This policy promoted reproductive health service delivery in the country as it offered pregnant women the opportunity to access free healthcare [111]. It eliminated the financial barrier and improved access to the increasing antenatal care uptake and facility delivery utilization among pregnant women and postnatal care services for nursing mothers with their newborn babies, free of charge for up to 90 days [112]. The Domestic Violence Act (Act 732) enacted in 2007 gave impetus which shield women against domestic abuse, protecting their rights and children. The act addresses domestic abuse, and by advancing gender equality, it has helped Ghana enhance its efforts to support socioeconomic growth and climate change adaptation. Women are protected from domestic abuse and given the tools they need to fully engage in the development of their communities according to this Act [113]. The involvement of women in local governance has had a significant impact on both climate change adaptation and gender equality [114]. Through this initiative, women were able to advocate for policies that were responsive to their needs, reflective of their requirements, and fairly represented women in government [115].

Moreover, the National Climate Change Policy (NCCP) of 2016 implemented by The Gambia is a direct reaction to the growing challenges posed by climate change. The 2012–2015 Programme for Accelerated Growth and Employment (PAGE) and the Government of The Gambia's Vision 2020 are two established frameworks that the country has embraced to address poverty reduction and promote development. These frameworks form the basis for the plan. By 2025, the Policy aims to include climate change into the processes of national budgeting, planning, decision-making, and program execution. Enhanced human resource capabilities, consolidated financial resources, and efficient institutional frameworks will facilitate this [116]. Additionally, in 2007, the Gambia National Adaptation Program of Action (NAPA) was created. This policy seeks to enhance communities' adaptive capacities and deliver timely adaptation benefits, and awareness creation. The priority intervention areas include agriculture and forest conservation, through infrastructure development, early warning systems, expansion of irrigation, bush fire control, agroforestry, rangeland, and wildlife management with a key focus on rural households [117].

The long-term, climate-neutral development plan, or LTS, for the Gambia was created very recently. According to the nation's acceptance of the Paris Agreement on April 25, 2016, the LTS aims to attain net-zero greenhouse gas emissions by 2050. The Long-Term Climate- Neutral Development Strategy 2050 (LTS) focuses on the five primary industries in the country that produce greenhouse gases: energy, agriculture, waste management, transportation, land use, and land use change and forest (LULUCF) (MECCN, 2022). Recognizing that the country's long-term economic and social success depends on the full and equal participation of women, men, girls, and boys, the Gambia government also developed the National Gender Policy (2010–2020). The goal of the policy is to coordinate and guide the design and execution of development programs at all levels, considering gender equality when allocating resources for fair national development [118]. The National Women Act

of 2010 was also passed to guarantee the rights of women with disabilities to be free from violence, including sexual abuse, to participate in decision-making, and to receive special treatment that is commensurate with their physical, economic, and social needs. These rights include facilitating their access to professional and vocational training, employment, and participation in society [119].

Therefore, gender equality and climate change adaptation have greatly benefited from women's engagement in local administration [114]. Through this initiative, women were able to advocate for policies that were responsive to their needs, reflective of their requirements, and fairly represented women in government [115]. Their inclusion in local governance gives them the urge to influence gender-sensitive policy initiatives for climate change adaptation.

### **Government initiatives to improve livelihoods of people affected by climate change in Ghana and the Gambia**

Ghana's government intends to implement 2 million highly efficient household cookstoves by 2030. This initiative is supported by a bilateral agreement with Switzerland, which aims to stimulate private sector financial commitment to clean cookstoves. This initiative aims to reduce the exposure of unclean cooking energy and its associated consequences [120]. Over the past decade, Ghana has allocated almost US\$ 670 million towards seven coastal protection projects next to its coastline [121]. Since 2016, over US\$ 100 million has been invested in the northern drylands to enhance smallholder farmers' ability to withstand challenges and support the delicate environment that sustains their livelihood [121]. A citywide resilient infrastructure design work is being led by the Ministry of Water Resources and Sanitation, and it includes a significant \$200 million investment in the Greater Accra Resilient Integrated Development Project. The project aims to enhance flood risk and solid waste management in the Odaw River. Government funding for this project is provided by the World Bank.

The Gambia government has been proactive in tackling the escalating consequences of climate change, disasters, and environmental deterioration. By working with organizations, it has significantly improved land degradation, conserved biodiversity, and sequestered carbon through initiatives including Green-Up 1 million Trees, Green Gambia Initiative for Sustainable Future, and Green Streets. These initiatives highlight a commitment to building a sustainable future despite the challenges posed by events associated with climate change [122]. Several laws have been passed by the Gambian government to administer protected places, including 66 forest parks, one Ramsar site, six national parks, and game reserves, which account for 4% of the country's total geographical area. These regulations are intended to assist in-situ conservation efforts, especially in regions that are very vulnerable to the effects of anthropogenic climate change [123,124]. In addition, the government of The Gambia is making an effort to restore degraded forests and agricultural landscapes using climate-resilient plants, establish companies based on natural resources, and strengthen capacity and policies to implement eco-based adaptation systems with support from the Green Climate Funds (GCF). This initiative aims to protect the

environment and encourage the development of a sustainable economy based on natural resources for the benefit of the local populace [125].

### **Discussions**

It is now widely acknowledged that climate change exists, and a growing body of research indicates that it poses a serious threat to development, especially in the Least Developed Countries (LDCs). Because of this, the vast majority of people in these countries have already felt the disproportionate effects of climate change, especially those who reside in rural areas where their primary sources of income are forestry, agriculture, and fisheries. The effects of climate change have significantly impacted people's lives and means of subsistence in rural SSA. Climate change disproportionately affects women, and its effects are more dire than those experienced by men. Women's heightened vulnerability to climate change is mostly caused by cultural and gender norms, the division of labour between men and women, and women's uneven access to finance and productive resources, notably in Sub-Saharan Africa, according to research. These factors influence women's capacity to respond to and adjust to the shocks and consequences of climate change. Ghana and the Gambia are two developing countries where climate change has had a major detrimental impact on agriculture, the primary source of income for many rural populations. According to the Consultative Group on International Agricultural Research (CGIAR), 75 percent of the 3.4 billion people who live in rural areas globally are in middle-income countries and 15% are in low-income countries. The data used to calculate these numbers came from Thornton and associates in 2019. Many of these people who made their livelihood from small-scale farming today confront numerous challenges as a result of climate change. Approximately 570 million farms exist worldwide, of which at least 500 million cover less than 2 hectares, or 12% of all agricultural land. These factors along with climate change have led to an increase in the rates of poverty and inequality in many rural communities.

A rise in anthropogenic greenhouse gas (GHG) emissions has changed the climate of West Africa in recent decades, with Ghana and the Gambia experiencing the most significant effects. Recent years have seen extreme weather events impact both countries, including droughts and floods. These events have had a detrimental effect on the lives and means of subsistence of the rural poor, especially women, children, and individuals with disabilities. According to the Ghana National Disaster Management Organisation, an exceptional flood in November 2010 caused the displacement of 700,000 people, the destruction of 55 communities, damage to 23,588 acres of farmland, and the destruction of 3234 homes. The total estimated financial losses were \$116,340.22. On June 3, 2015, there was another flood disaster in Ghana that claimed 150 lives. In addition, the Gambia's National Disaster Management Agency claimed 43,984 casualties. The agency added that a significant number of lives remain in danger due to flooding, which has also resulted in the loss of homes, food supply, sanitary conditions, and personal items. Of the individuals impacted, 22% are children under five, and 51% are female, comprising 2,846 expecting and nursing mothers. Rural communities experience the consequences of climate change more acutely than urban people do due to their higher susceptibility and less capacity for adaptation.

The negative effects of droughts can be severe on the rural households of both countries. For instance, the provinces of Tanoso, Kenyasi, Buako, and Sampreboi in Ghana have suffered greatly from the drought that lasted from 1982 to 2019. According to Figure 3, the worst droughts occur in Kenyasi throughout the year, peaking in March. While Buoko and Sampreboi experience fewer droughts than the other two areas, Tenso also encounters difficulties in the middle of the year. Between 1968 and 2002, The Gambia also had a decrease in yearly rainfall, particularly in August, which is typically the month with the highest rainfall in the entire country. According to a 2023 drought intensity study conducted in the Gambia by Bayo and Mahmood, the most severe drought conditions were recorded in 2005, with 32% [47]. The study used the Vegetation Condition Index (VCI) for five years from 2000 to 2020. But as 2020 approached, situations improved better, with a significant rise in rainy conditions to almost 77% (see Figure 4). The Vegetation Condition Index is a technique used to examine the health and condition of the vegetation especially about drought. Thus, people in these countries have been and still are impacted by extreme weather occurrences, with rural communities being more severely affected.

Finally, countries are attempting to achieve climate neutrality through policies and laws, especially about gender-based adaptation approaches in rural areas. Among other notable laws on gender, Ghana developed the National Climate Change Policy (NCCP), the Domestic Violence Act, the National Reproductive Health Service Policy, and the National Gender Policy of 2015. The National Women Act of 2010, the National Gender Policy (2010–2020), the National Climate Change Policy (NCCP) of 2016, and the long-term plan for climate-neutral development for 2050 were created in the Gambia, in contrast. Climate-smart agriculture techniques, such as crop diversification, drought-tolerant crop selection, and altering the farming calendar, have been taught to rural farmers as adaptation measures, with a special emphasis on women. Furthermore, the governments of both nations have started several projects to mitigate the effects of climate change in recent years. Two such projects are the Ghanaian government's clean, efficient household cooking stove project and the Gambia's ecosystem-based adaptation project, which aims to restore degraded forests and agricultural landscapes with climate-resilient plants. If these policies and regulations are properly put into practice, rural residents—men and women alike—will experience greater food security, a reduction in poverty and inequality, and a marked improvement in their capacity to adapt to the effects of climate change.

## Conclusions

This study examines the interconnected issues of gender inequality, economic problems, and climate change vulnerability in rural households in Ghana and Gambia. The findings highlight the increasing impact of climate change on these West African nations. Extreme weather events like floods, droughts, and unpredictable farming seasons pose serious threats to the survival of rural households, particularly women who are often disproportionately vulnerable to both climate change and gender inequality. Agriculture, which is crucial for food security and economic stability in rural areas, is highly susceptible to climate change. Addressing the challenges posed

by flooding and drought requires gender-sensitive adaptation strategies that empower women and build community resilience.

To effectively address the complex issues of gender dynamics and climate change in rural households, both countries need integrated approaches. Gender-responsive policies should be implemented at the national level, incorporating gender considerations into climate change policies. This will help to close the gender gap in decision-making, empowerment, and access to resources for climate adaptation. Governments and development partners should support rural farmers by providing technological resources, weather information, and adaptive strategies. This will help them better prepare for and cope with the devastating effects of climate change. Community-based adaptation strategies that involve both genders in decision-making can promote resilience and inclusivity. Utilizing indigenous knowledge can help communities develop strong and sustainable adaptation initiatives. Capacity building and education are also essential for enhancing local populations' ability to adapt to climate change.

Important adaptation strategies include education, farmer empowerment, and the introduction of drought-resistant crops. Continued research on gender and climate change in rural areas is necessary to inform evidence-based policy development. Monitoring and evaluation strategies can help assess the effectiveness of gender-sensitive adaptation projects. Collaboration among government agencies, academia, local communities, and NGOs is crucial for ensuring a holistic approach that is culturally relevant and effective in facilitating climate change adaptation.

## Disclosure Statement

No potential conflict of interest was reported by the authors.

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