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Women, Climate Change and Cross-border Informal Agricultural Food Trade between Ghana and Burkina Faso

Lydia Kwoyiga[1*]

Abstract
While artificial colonial boundaries grouped Ghana and Burkina Faso into two independent countries, Informal Cross Border Trade (ICBT) continues to link these two countries, specifically through women selling agricultural produce. However, climate change is already affecting agriculture in Africa, and evidence shows that some countries may experience a production deficit while others may experience a surplus. Nonetheless, trade flows through food redistribution may boost resilience among countries. However, a scan through the existing literature about trade and climate change shows that the focus is largely on international trade and its contribution to climate change. In fact, studies between Ghana and Burkina Faso about climate change are mostly biophysical, with limited attention on trade. Furthermore, women are the majority of people engaging in ICBT and are more vulnerable to climate impacts, but are conspicuously missing in climate change discourses. Existing studies that explore women's food trade between Ghana and Burkina Faso mainly focus on vegetables such as tomatoes, thereby neglecting cereals and legumes, the staples of the people in northern Ghana, a zone that is noted to be experiencing severe climate impacts. As the first of its kind, the study adopted a qualitative approach and was guided by ecofeminist theory to interrogate the impacts of climate change on ICBT in agriculture engaged by some Ghanaian and Burkinabe women traders. Specifically, it focuses on the following: (i) women traders' perceptions of climate change, (ii) causes of climate change, (iii) ways by which climate change is affecting ICBT in agriculture and (v) navigating through the impacts. Interviews, informal discussions, and personal conversations with women traders and visits to the shops of these trades provided data for the discussion. The study revealed that women traders observed climate change occurrences in the form of changes in temperature and rainfall. The results further showed that human activities are causing climate change. The study thus suggested that irrigation, tree planting and introducing improved varieties of socio-culturally acceptable crops could boost adaptation and promote trade.

Keywords
traders, food crops, climate, adaptation, impacts

[1]Department of Environment, Water and Waste Engineering, University for Development Studies, Tamale, Ghana
***Corresponding author:** lkwoyiga@uds.edu.gh
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1. Introduction

Artificial colonial boundaries (Lentz, 2000) resulting from the Berlin conference of 1883 have separated and grouped Ghana and Burkina Faso into two distinct political and administrative countries even though these countries have common ethnic groupings and values, share local resources as well as engage in trade. It was, therefore, not surprising that immediately after both countries gained indepen-

dence, the then presidents in a ceremony in Paga, Ghana restored and strengthened the ties between them by symbolically destroying the artificial boundaries separating them (Hagberg and Tengan, 2000). Subsequent leaders of these countries such as Flight Lieutenant John Jerry Rawlings of Ghana and Thomas Sankara further strengthened these ties. In fact, the populist Coup d'état by President Sankara staged in 1983 in Burkina Faso was inspired by two successful ones by President Rawlings of Ghana in 1979 and 1981 (Rothchild and Gyimah-Boadi, 1989).

Apart from socio-cultural and political ties, Informal Cross Border Trade (ICBT) also binds together most African countries as is also the case between Ghana and Burkina Faso. According to Koroma et al. (2017) and Bensassi et al. (2016), this activity is profound as Kahiya and Kadirov (2020) asserted that it predates modern Africa. Karkare et al. (2021) noted that this activity significantly supports the livelihoods of about 43% of the African population and contributes to offsetting food security. Noteworthy, however, trade generally has been threatened by global environmental challenges such as climate change (even though trade also contributes to greenhouse gas emissions resulting in climate change). For instance, it is noted that, climate change damages trade infrastructure and lowers growth and productivity of factors of production (Martinez-Martinez et al., 2023; Dellink et al., 2017). While African countries according to Keane et al. (2021) contribute less to greenhouse gas emissions, with almost Africa's share of total emissions being unchanged in the past 30 years (around 3.5% in 2017), current and future climate scenarios show that the continent is already and will continue to experience climate change manifestations in the form of changes in precipitation level, extreme temperatures and rising sea levels. This consequently impacts agricultural production, specifically food trade. As Sawadogo and Fofana (2021) noted, the agricultural sector of African countries is vulnerable to climate change. This, Muller et al. (2011) explained to be as result of the fact that the sector is largely tied to weather. For instance, Haile et al. (2017) asserted that climate change will not only affect yields but also the pattern of production (changing countries' comparative advantage in the production of certain crops). Mahofa (2021) cited that while climate change will favour the production and export of maize from countries such as Burundi, Tanzania, Zambia and Ghana, there will be a maize deficit in countries such as Sudan. This implies that though climate change may affect agricultural production in some African countries, trade flows will boost the resilience of other countries' food systems from shocks associated with climate change. While there is a corpus of literature that documents the nexus between trade and climate change at the global level, a sift through it shows that the focus is more on the impacts of climate change on international/global trade (Dellink et al., 2017; Martínez-Martínez et al., 2023), trade as an adaptive strategy to climate change impacts (World Trade Organisation, 2022; Dekens et al. 2021; Brenton & Chemutai, 2021) and the impacts of trade on climate change through emissions (Gao et al., 2021). Also, studies on cross-border informal trade between Ghana and Burkina Faso, still focus more on its nature (Nkendah, 2010; Ayilu et al., 2016; Bensassi et al., 2016; Ama et al., 2014; Bout et al., 2017) rather than how such activity is being impacted by climate change. As such, transboundary and regional level studies of climate change impact on informal agriculture food trade are almost absent in Africa. Furthermore, climate change studies between Ghana and Burkina Faso are largely biophysical (Jung, 2006; Mul et al., 2015; Obuobie, 2008; Oyebande & Odunuga, 2010), neglecting the nexus between climate change and trade in agricultural food. As noted, "the traditional approaches to climate change action tend to maintain the natural science community as the primary authority, and thus global climate agendas are dominated by highly scientific, elitist, and patriarchal discourses which prioritize emissions reductions over equally as important social implications" (Johnson 2022 p. 48).

Moreover, ICBT in Africa is driven by women. According to Afrika and Ajumbo (2012), women constitute the majority of those who engage in ICBT because of their active role in the distribution of food and smaller consumer goods; the bulk of items constituting such a trade. This is evident in the East of the Democratic Republic of Congo, where women constitute 85% of cross-border small-scale trade while in West Africa their share in this activity is between 70% and 90% (Trade Facilitation West Africa Programme, 2020). This is also the case of Ghana and Burkina Faso. However, women and their economic activities tend to be impacted more by climate change. Adzawla et al. (2019) findings in Ghana concluded that the impacts of climate change on female's livelihoods were more severe than males. Similarly, Sawadogo and Fofana's (2021) study of Burkina Faso revealed that climate change is unfavourable towards women's economic activities compared to men. Apart from climate change impacts on women and their trade, women traders engaged in ICBT trade between Ghana and Burkina Faso are at risk of violent extremism and political instability (characterising Burkina Faso, Niger, and Mali). Nonetheless, it is noted that women generally possess knowledge and experiences that are vital for tackling climate change (Senja, 2021). Yet, women are underrepresented in climate change decision-making and policy (Gaard, 2015). The literature, particularly on women traders' contributions to climate change discourses, remains incomplete. For instance, existing studies such as Arku et al. (2017) were limited to Accra with a focus on traders who engage in manufacturing goods and neglecting the gender component of it.

Furthermore, evidence shows that women in ICBT in Africa trade in agricultural products (Koroma et al., 2017; Bouet et al., 2020), including cereals and legumes. Cereals and legumes are not only the staples of the people located in the border communities of northern Ghana and southern Burkina Faso, but their production is also sensitive to changes in climate parameters. These crops are grown in northern Ghana, an agroecological zone that is characterised by unimodal rainfall pattern and high temperatures and decreased rainfall in the past 30 years (Ministry of Environment Science, Technology and Innovation, 2013). These crops are not easily cultivated through irrigation, as is the case of tomatoes and other vegetables. Yet the existing studies about women's engagement in informal agriculture food trade between Ghana and Burkina Faso one-sidedly focus on tomatoes and other vegetables (see Amikuzunu 2011; Kaba et al., 2020). Informal trade involving cereals and legumes by women is hardly studied particularly with regards to climate change. It is, therefore, important to assess the performance of the agriculture food trade of cereals and legumes under climate impacts between the two countries.

The article thus examines the impacts of climate change on cross-border informal food trade engaged by women. Specifically, it focuses on the following: (i) women traders' perceptions of climate change in the two countries; (ii) causes of climate change (iii) ways by which climate change impacts agricultural food trade and (iv) navigating through the impacts.

The study's decision to focus on women's engagement in ICBT agricultural food trade and climate change is because of the following. Firstly, the study would offer insights that could be applied in a variety of ways to the current literature and ongoing discussions on climate change and adaptation in West Africa. Furthermore, the results of the analyses of cross-border informal trade in agricultural food contribute to a better understanding of the impact of climate change on the flow and distribution of agricultural food between Ghana and Burkina Faso, thus contributing to the literature on climate change and trade. The study contributes to highlighting the perspectives of women who are not only vulnerable to climate impacts, but also whose voices are mostly missing in climate change solutions. In other words, the application of the ecofeminist theory contributes to advancing the gender discourses on climate change as it focuses on women and their agriculture food trade which are vulnerable to climate impacts. The study for the first time illuminates the often overlooked but age-long practice and important contribution of cereal food trade between Ghana and Burkina Faso. It adds to the literature on the Sustainable Development Goals 5 and 13.

1.1 Climate change scenarios in Ghana and Burkina Faso

In Ghana, the National Climate Change Policy indicates that climate change and its impacts are already evident in the form of an increase in temperature and a decrease in mean annual rainfall in all the country's ecological zones. The average rate of increase in temperature has been 0.21°C per decade, with a more rapid increase in the northern regions of the country. The value estimates show increases of 1.7°C to 2.04°C by 2030 in the northern Savannah regions, with average temperatures rising as high as 41°C (Ministry of Environment, Science, Technology and Innovation, 2013). On the part of rainfall, the policy states that rainfall in the country has decreased from the south to north over the past 40 years with rainfall patterns becoming more erratic in all the ecological zones in Ghana. On trends of annual rainfall in Ghana between the periods 1951-2000, Owusu and Waylen (2009) observed that mean annual rainfall totals within all four agro-ecological zones in the country have decreased. Using historical rainfall data, future scenarios of climate change show that rainfall across the country will decrease by 2.9% in the near future (2040), with a slight increase of 1.1% in the mid future (2060) and later decrease in the far future (2080) by 1.7%. Throughout the country, projected mean temperatures will increase by 3.8% by 2040, 5.6% by 2060, and further increase by 6.9% (Ministry of Environment, Science, Technology and Innovation, 2015).

On the part of Burkina Faso, the Ministry of Environment and Fishery Resources (2015) documented a downward trend in total annual rainfall across the entire country; with the number of rainy days decreasing while the number of consecutive dry days increasing. On the part of temperature, the analysis shows an overall upward trend in the number of hot days and nights with few exceptions in the southwestern regions. Extreme annual temperatures are increasing, especially in the Sudanian and Sahelian Zones. While these trends have brought droughts, floods, heat waves, dust storms among others, agriculture and natural resources have been heavily affected. The Ministry of Environment and Fishery Resources, (2015) further explained that long-term data on extreme temperatures indicated an overall upward trend in the number of hot days and hot nights, except in the southwestern regions, where there has been a downward trend in the number of hot nights. Detailed analysis indicates that there is an upward trend in extreme annual temperatures (minimum annual temperatures and maximum annual temperatures) in both the Sudanian and the Sahelian zones.

1.2 Women and Informal Cross Border Trade in Africa

There is difficulty in defining ICBT (Koroma et al., 2017). Nonetheless, Afrika and Ajumbo (2012, p.2) define ICBT as "trade in processed or non-processed merchandise which may be legal imports or exports on one side of

the border and illicit on the other side and vice-versa, on account of not having been subjected to statutory border formalities such as customs clearance". ICBT refers to trade in goods/merchandise and services that may be legally imported or exported on one side of the border and illegally on the other side and vice-versa, on account of neither having been recorded in the official trade statistics nor subjected to statutory border formalities such as customs clearance." (Koroma et al., 2017, p. 5).

Bouet et al. (2020) noted that most informal cross border traders in Africa are women. They cited that 80 percent of cross-border traders in the Great Lakes region are women, with 75 percent of them engaged in this between Malawi and Zambia. Citing Botswana and Rwanda, they further noted that of all the informal traders, 61 percent and 74 percent are women in these respective countries. They explained that the participation of these women in informal cross-border trade reflects their broader presence in the informal sector activities in general. Koroma et al. (2017) added that ICBT is depicted in Africa by the women crossing the borders with their heads and backs laden and arms overloaded with goods for sale blended with the sight of male traders transporting heavy loads on bicycles, trucks, buses, and pushcarts for sale across borders.

1.3 Ecofeminist theory

The study draws from Ecofeminist Theory which examines the links between women and nature and the implications of these links for environmental protection and management. Thompson (2017) explained that historically, women and nature have been tied together, hence the oppression of women and the exploitation of the earth are connected, in this case, climate impacts on the environment and women's livelihoods. This theory, Singh (2023) explained, represents not only a humanity and nature connection but also the role of patriarchy in aiding the use of science and technology to cause violent behaviour towards women and nature (hence causing of climate change). In other words, it looks at the domination/oppression of women and the domination/oppression of nature as connected and mutually reinforcing through systems of oppression.

The Ecofeminist Theory is traced to ecofeminism, a term that was first formally used by French feminist Françoise D'Eaubonne in her 1974 work Le Féminisme ou La Mort (Johnson 2022). Nonetheless, Federici (2022) noted that before the emergence of the term, some women's works such as Rachel Carson's seminal work Silent Spring brought to the fore the idea of ecofeminism as some women began to document the impacts of human activities on the environment. In fact, she mentioned that Carson's work perhaps qualifies her as a 'mother' of ecofeminism as her contributions continue to shape the gender and environmental perspectives and thoughts of other ecofeminists such as Vandana Shiva, Val Plumwood, Carolyn Merchant and recently in Africa's youth such as Ruth Nyambura and Oladosu Adenike. According to Campbell (1994), women historically acted on their ecological concerns, an indication of ecofeminism as seen in the Green Belt Movement in Kenya (led by Mathai Wangari), the Chipko movement in India (documented by Vandana Shiva and others), and the Women's Pentagon Actions in the United States (activities organised mostly by Ynestra King). According to Batrićević and Paunović (2019), ecofeminism embodies both an ecological philosophy and a social movement that draws on environmental studies, critiques of modernity and science, and feminist critical analyses and activism that are aimed to explicate the links that exist between women and nature. The application of the Ecofeminist Theory would thus help analyse and unpack the case of the research study in the following ways: firstly, a feminist perspective of ICBT and climate change is important as it helps to understand and unearth among women traders the manifestations of climate change and its impacts. As Thompson (2017) noted, ecofeminists insist that women innately have a stronger connection to the earth than men which is why they can lead the movement of earth healing. Secondly, this theory will contribute to understanding how climate impacts the agricultural food that these women engage in. Jin (2023) noted that appreciating and centering the voices and experiences of women is crucial for not only understanding the range of climate impacts but also for identifying the most effective climate justice solutions. Thirdly, the application of the theory will contribute to understanding ways of adapting to climate impacts, especially in the agriculture sector. Ecofeminism insists that gender aspects be considered in climate change policies because gender mainstreaming in this area has the potential to enhance the results of climate change combating process and accelerate progress towards reaching gender equity (Batrićević & Paunović, 2019). Ecofeminism argues that since patriarchal powers enable the exploitation of nature and the oppression of women, then it is prudent that nature and women must be examined together for better understanding. The theory thus proposes that the promotion of diversity, equity and relationship and cooperation, should be considered as strategies that states can adopt to respond to climate impacts (Samandari, 2016). An ecofeminist perspective is important to understand why gender should be considered in climate change analysis, policy and action. This is because feminism and environmentalism are not mutually exclusive and hence need to be discussed along with each other to get a full grasp of the underlying economic, social, and political factors that drive global warming and the consequences on marginalised groups such as women (Johnson 2022).

2. Materials and Methods

The study interrogates women traders from Po (Burkinabe) and women traders from Paga and Navrongo (Ghana) who engage in trading in 2 border community markets of Navrongo and Paga in Ghana (Figure 1). Po, Paga and Navrongo were purposively selected for the study. Po was selected because most of the Burkinabe women trading in these food crops originate from there. Po also lies in close proximity with Paga and Navrongo with a good road network that allows for the easy movement of traders and their goods and services. It is important to mention that Burkinabe women cross a border to trade in these food crops, Ghanaian women only remain in their various markets of Paga and Navrongo to purchase legumes and cereals in large quantities and then resell them to local buyers in these two Ghanaian markets. This situation is largely a result of the political instability and violent extremism that characterise the Sahel regions including Burkina Faso. Paga and Navrongo markets/traders were chosen for the following reasons. Firstly, these markets are the net-receivers of Burkinabe women who sell cereals and legumes. Also, these cereals and legumes are cultivated in both Paga and Navrongo and could help explain why there is limited local production of them, hence the reliance on traders from Burkina Faso for supply. In addition, as noted in the introduction, staples of the people of Paga and Navrongo are prepared from cereals and legumes. Moreover, most of the people of Navrongo, Paga and Po are of the Kasem descent but separated through colonialism. So, the people share socio-cultural ties that may contribute to fostering the ICBT, hence the choice of these markets.

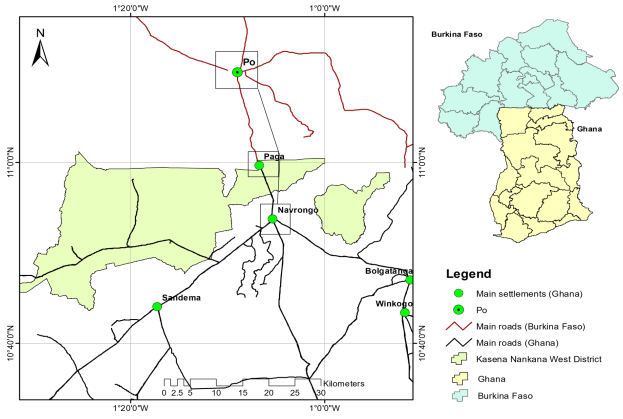

Figure 1. Map of study areas. Source: Author

2.1 Navrongo and Paga in Ghana

Ghana is a country located in West Africa with geographical boundaries between latitudes 4.5°N and 11.5°N and longitude 3.5°W and 1.5°E and bordered by Ivory Coast (West), Togo (East), Burkina Faso (North) and the Gulf of Guinea (South). While Paga is a border town near Burkina Faso, Navrongo is 8 km away from Paga, with both places noted for their active engagements and interactions with the people of Burkina Faso. Apart from the modern political system, the two towns practice the twin traditional political systems made of chiefs and earth priests. Most of the people here are Kasena and speak the Kasem language. Navrongo and Paga were once part of the then Kasena Nankana District until 2008 when the towns became district capitals of the Kasena Nankana East Municipality and Kasena Nankana West Districts. Navrongo is the capital of Kasena Nankana East Municipality while Paga remains the capital of Kasena Nankana West District. The two towns have similar geographic features. The climatic conditions of both places are characterized by the dry and wet seasons, which are influenced by two (2) air masses – the North-East Trade winds and the South-Westerly (Tropical Maritime). The Harmattan air mass (North-East Trade Winds) is usually dry and dusty as it originates from the Sahara Desert. Day temperatures are high recording 42° Celsius (especially between February and March) and night temperatures could be as low as 18° Celsius. There is only one rainy season which runs from May to October. The total rainfall averages 950 mm per annum for both towns. In terms of vegetation, Navrongo lies within the Guinea Savannah woodlands while Paga is found in the Sahel Savannah. Agriculture is the dominant economic activity of the two towns. The major crops grown are millet, sorghum, rice, groundnuts, leafy vegetables, cowpea, Bambara beans, okro, cotton, tomatoes, and onion. Trading and commercial activities in these places are mainly in foodstuffs, semi-processed food, and crafts. These commodities are sold in the local markets and outside the towns. The two towns practice the 3-day market cycle.

2.2 Pô, in Burkina Faso

Burkina Faso is a landlocked country in West Africa. It is located between 9°20' and 15°05' of North latitude, 5°20' of West latitude and 2°03'in East longitude; It is shares boundaries with Ghana, Benin, Togo, Ivory Coast, Niger, and Mali. Pô, a border town, is located in the southern part of Burkina Faso, in the Nahouri Province. Covering an area of 1,642 km2, it is bordered to the north by the Kaboré Tambi National Park, to the east by the communes of Tiébélé and Gombousgou, to the west by the commune of Guiaro, and to the south by the Republic of Ghana. It is located between 11° and 11°30 north latitude and between 1°30 and 0°40 west longitude. It is distant respectively from Ouagadougou (the political capital of the country) by 145km; from Manga (the capital of the administrative region of Centre-Sud) by 90km and from Ghana by 19km. The economy of the commune is based on agriculture and trade (Ouedraogo, 2022). Three eco-climate zones exist in Burkina Faso: the Sahel area in the North, the north-Sudanese area in the center and the south-Sudanese area in the South-West. Po is found in

the north-Sudanese area in the center.

2.3 Participants, data collection and analysis

A qualitative approach was employed to gain insights into the study topic. This is premised on the fact that it is one of the first studies to explore in-depth and offer insights into ICBT in agricultural food crops, particularly cereals and legumes under the impacts of climate change between Ghana and Burkina Faso. The study was conducted between June 2021 to November 2023. Considering the focus of the study, participants were recruited based specifically on their trade engagement in cereals, and legumes and their willingness and availability to participate in the study. A total of 38 women traders from Burkina Faso and Ghana were selected through purposive and snowball sampling. Purposive sampling was used to select the Ghanaian traders based on their trade engagement in cereals and legumes. However, it was difficult to identify the Burkinabe women who engaged in this trade in Ghana hence snowball sampling was used. A total of 15 Burkinabe women (6 interviewed in Paga and 9 interviewed in Navrongo) and 23 Ghanaian traders (8 interviewed in Paga and 15 interviewed in Navrongo) volunteered to participate in the study. Data collection methods comprised interviews, informal discussions, and personal conversations with women traders. The interview questions were semi-structured as De Jonckheere and Vaughn (2019) noted that this allows the researcher to gather information from key informants who have firsthand experiences, attitudes, perceptions, and beliefs related to the topic of interest. The questions focused on the following key points:

- Characteristics of the women traders and food crops
- Perceptions of climate change occurrence
- Causes of climate change
- Impacts of climate change
- Adaptation measures

The questions were open-ended. With the help of a research assistant, all interviews were conducted in the markets of Paga and Navrongo. Interviews were conducted in Kasem since Kasem is the language spoken by the people of Paga and Navrongo in Ghana and Po in Burkina Faso. Visits to these women's shops to ascertain the kind of cereals they sold provided additional information for the study. The visits also provided data about the types of market structures that accommodate the women and their items, the packaging of the food and how they undertake transactions. To analyse the content of the data generated, the thematic analysis by Braun and Clarke (2006) was adopted, who proposed a six-step process: familiarizing with the data, coding the data, searching for themes among the codes, reviewing the identified themes, defining the themes, and writing the reports.

3. Results

3.1 Characteristics of women traders and agricultural food involved in the ICBT between Ghana and Burkina Faso

Women who engaged in ICBT involving cereals and legumes between Ghana and Burkina Faso were both young and middle-aged women within the age bracket of 20 and 55 years. Their level of education is low, as some had basic education while others never had any formal education. Most of the traders are married women. Women who have families and friends in either country or who have sojourned there, engaged more in this because of the support from their acquaintances in either country. The traders have been active in this trade for at least 7 years. The Burkinabe women traders bring cereals and legumes such as millet, sorghum, beans and cowpea to markets in Paga and Navrongo and sell to Ghanaian traders at wholesale prices (in sacks/bags). However, the Burkinabe traders also directly sell in smaller quantities (bowls and baskets) to their Ghanaian non-commercial customers. Burkinabe women crossing the Ghanaian border must produce evidence of citizenship of their country. However, since Ghanaian women are unable enter into Burkina Faso to buy these food crops, they rather meet their counterparts in the markets of Paga and Navrongo and buy commercial quantities to resell. Paga and Navrongo markets take place every three days with Paga market taking place first, usually a day before Navrongo market day. Almost all the food items are packaged in sacks and transported to the market for sale. From the interviews, trade transactions involved the use of the Ghanaian currency, Cedi (GHS). Kasem, a local language spoken both in Navrongo, Paga and southern Burkina Faso serves a medium of communication during transactions. The sale of cereals and legumes is throughout the year as some are processed (dried) and stored for sale during the lean season. The trade activities are not formally registered or formalised. Nonetheless, Burkinabe women traders use approved routes, the Paga/Dakola route to enter and depart from Ghana. The traders cover a travel distance of about 200 km from Po to Paga and Navrongo. Traders from both countries are not members of any formal organisations or associations. The activity serves as a source of livelihood for these women as they are able to meet the basic needs of their families. The traders' initial source of income for the activity comes from savings and loans from families. The mode of transportation to these markets involves the use of vehicles (buses and trucks) to cross the borders but the movement of the goods and traders within each country consists of trucks, motorbikes and tricycles.

3.2 Women traders' perceptions of climate change in the two countries

The women traders from both countries have some knowledge of climate change. This is evident in their perceptions related to the changes in the two climate parameters namely temperature and rainfall. The interview responses of the women traders depicted that there had been changes, though some did not notice any changes.

3.3 Burkinabe women traders

3.3.1 Temperature

According to the Burkinabe women, though their country is landlocked and generally characterised by high temperatures, the past 30 years have been associated with even higher temperatures. This is evident when 73% (N=15) of these traders mentioned that temperatures had increased over the past 30 years. Their responses further revealed that the number of hot days had increased with April to May being the extremely hot months. A Burkinabe trader said this:

> Growing up, I would say temperatures were cooler than now. What we are seeing now is the sun just roasting people both day and night especially immediately after the harmattan period. It is just too hot. When you think tomorrow will be better, tomorrow comes and is even hotter than yesterday. During those hot days, it is always unbearable to sleep inside our rooms, even cooling systems are not supportive enough again. It becomes difficult to preserve fresh vegetables and other foodstuff. Travelling in buses that ply our roads can be uncomfortable because of the heat. Temperatures are just increasing throughout the year with the worst being in the dry season.

This notwithstanding, 20% noticed no change with 7% indicating that temperatures had rather decreased. Figure 2 summarises the responses of these women's perceptions.

3.3.2 Rainfall

The traders' perceptions of rainfall over the years showed that there had been some changes in pattern, time, duration and volume of rainfall over the past 30 years. Out of the total, 60% (N=15) of them perceived rainfall to have decreased (Figure 2). They cited the past years to have been better than the current years as those years in the past were associated with reliable rainfall during the 5-month rainy season. The respondents further revealed that the rainy season is now protracted but torrential, and sometimes accompanied by storms that caused damage to their lives and properties. That notwithstanding, 27% of them perceived rainfall to have increased over the years. Lamenting about the situation, a Burkinabe trader said this:

> I do not know where we have gone wrong as a country. We have picked arms against one another, and nature is attacking us too.

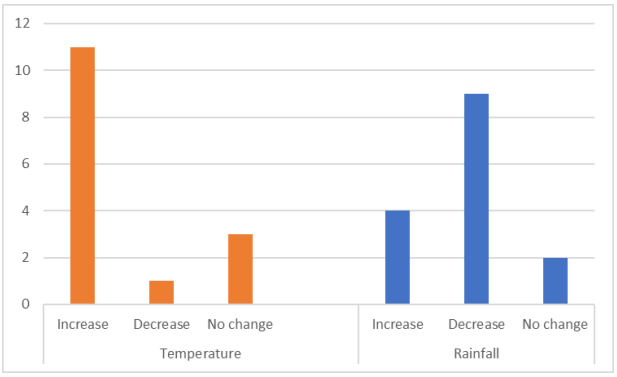

Figure 2. Burkinabe women's perceptions of climate change Source: Author

3.4 Ghanaian women traders

3.4.1 Temperature

According to the Ghanaian traders, generally speaking, temperatures up north are noted to be higher than those in southern Ghana due to the different agro-climate conditions that characterised these two zones. Nonetheless, they mentioned that over the years temperatures had increased throughout the country with northern Ghana being the worst. Of the 23 respondents, 96% of them mentioned that temperatures had increased in the past 30 years.

They noted that higher temperatures that were recorded in March are now being recorded as early as January with April which used to be mild in terms of temperature now also being as hot as March. Their responses further revealed that the number of hot days and nights had increased especially after the rainy season; ends in September. According to them, warm air associated makes both the day and night temperatures high and uncomfortable. However, 4% mentioned that they did not see any changes. A summary of their responses in shown in Figure 3.

A Ghanaian trader said this

> As for the heat that we are experiencing in recent years, it is something beyond description. It is just unbearable. Unlike in the past when the harmattan was colder, higher temperatures experienced these days do not permit us to enjoy the cool aspect of the harmattan; the air is dry and warm. Daytime temperatures are almost the same as night. The whole place

> is always hot. Those of us in northern Ghana are being grilled like fish by hot temperatures in the dry season.

3.4.2 Rainfall

According to the Ghanaian traders, even though they are aware that the southern part of the country experiences two rainy season while the northern part has only one rainy season, rainfall in the northern part of the country years ago was better than now. Their responses however differed as 61% observed that rainfall had decreased. These respondents hinted that in the past, the rainy season started in February and ended in October/November. However, in recent times, rains set in late June and stop by October. They stressed that the starting and ending of the rainy season is now uncertain. The volume and pattern of rainfall are also unpredictable. The traders thus added that apart from farmers now being unable to know when to sow their seeds, they are also unsure of what to grow. In fact, some concluded that the amount of rainfall had reduced in recent times. Rains are also accompanied by havoc such as floods and storms and this causes damage to human lives and properties. Nonetheless, 30% mentioned an increase in rainfall while 9% did not see any change (Figure 3).

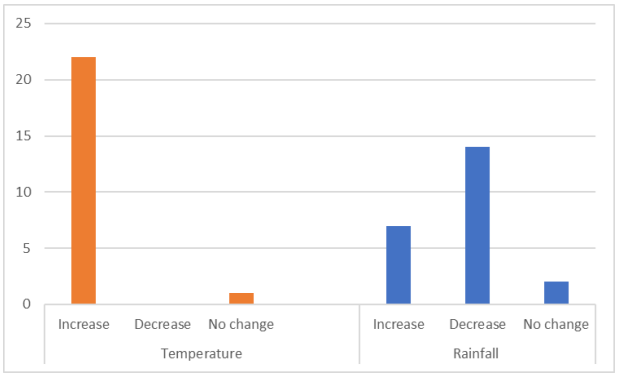

Figure 3. Ghanaian traders' perceptions of climate change. Source: Author

3.5 Causes of climate change

The responses of the women revealed that climate change is largely caused by human beings, even though some mentioned that nature is also contributing to climate change, and some had no idea about the causes of climate change. Regarding the ways by which human activities cause climate change, most of the women mentioned that man, in the quest to develop, is using science and technology to cause a lot of destruction to the earth thus resulting in climate change. They further mentioned that man's constant drive to exploit the environment to meet his insatiable needs and dominate or exercise control over his fellow human beings is harming the environment and thus the planet Earth.

Specifically, Burkinabe women, while attributing human activities (Figure 4) as a number one cause of climate change, explained that the cutting down of trees, for charcoals, farming and urbanisation, is degrading the environment and causing climate change. They further noted that the presence of political instability, in which militiamen destroy the vegetation cover and human property, does not only negatively impact the environment, but it also diverts government attention and resources meant to protect the environment.

A Burkinabe woman said this

> Po, my place is located in the Sahel characterised by grasses and stunted trees, yet we keep cutting down trees to farm, and construct things without planting trees again. We even cut down trees for fuelwood (firewood and use logs to burn charcoal). This further degrades the environment. It is more terrifying these days with the political instability where militia men set houses and bushes ablaze all in the name of fighting and trying to secure political power and authority. Our men are physically fighting one another. This negatively affects human lives and the environment. These men also do not have time to protect and conserve the environment, this is the situation in my country.

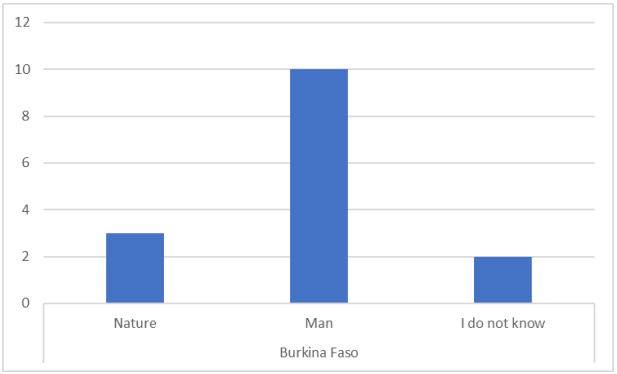

Figure 4. Burkinabe women's perceptions about causes of climate change. Source: Author

The Ghanaian traders equally identified human activities as the leading cause of climate change (Figure 5). They noted that apart from the cutting down of trees, some socio-cultural practices bring curses in the form of increasing temperatures and no rainfall. For instance, the women believe that the celebration of funerals around May and June now, which was not the case in the past, delays the onset of the rains. They further mention that the presence of cheaper chemicals for destroying grasses and trees is what degrades the environment and causes climate change.

A Ghanaian trader said this

> Years ago, Paga was a beautiful place with trees and grasses. The environment was friendly but now, it is extremely hot and hostile. People still cut down trees indiscriminately, as they simply buy a chemical that they apply to the roots of the trees and spray the grasses and within no time, everything is dead. Charcoal burning near the border is still common. Men are always finding ways of taking from the environment without conserving or protecting it. Women physically are not able to cut down trees, it is always the men.

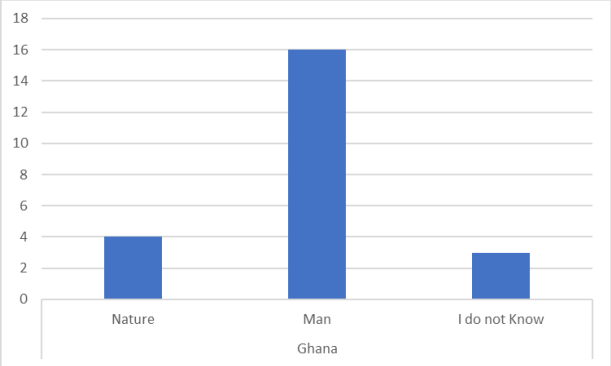

Figure 5. Ghanaian traders' perceptions about the causes of climate change. Source: Author

This notwithstanding, some respondents also think that nature is causing climate change, as what is being experienced now has happened before. They mentioned that temperature and rainfall cannot be changed by human beings, but only by nature (God). Nonetheless, other respondents said they did not have any idea about the causes of climate change.

3.6 Perceived climate change impacts on ICBT in cereal/legumes trade

3.6.1 Quality of food supplies

According to the traders, the quality of sorghum and millet produced in recent times is low when compared to the past. According to them, physically, good quality sorghum or millet is ascertained in terms of appearance: colour and texture, taste, size of the grain and even the aroma. For instance, the colour of sorghum (the seed coat) is important in defining the final product to which it is put to use. Sorghum that is used to brew local alcohol (Pito) is supposed to be red while the one that is commonly needed for preparing porridge appears white. Regarding millet seeds, such have a pleasant smell, are firm and their texture is consistent. Good millet tastes mild and sweet. The colour of the preferred millet is nearly white, pale, yellow, brown, and grey. According to the women traders, unfortunately, with climate impacts the supposed colours of cereals such as sorghum have changed. They attributed this to the erratic rainfall pattern coupled with insufficient rainfall. According to them, the crops are not able to get sufficient water for their growth. Crops such as the white sorghum, which is in high demand because it is used for preparing food and the red one used in brewing local beer commonly called Pito, are difficult to cultivate in recent times and becoming uncommon. They revealed that the early millet which takes 3 months to mature and is considered a hunger-offsetting food crop (farmers consume that as the rainy season unfolds) is not being cultivated again, because it performs poorly due to the late and uncertain onset of rains. Thus, farmers now endure hunger which was not the case in the past. As a way of adapting, farmers tend to replace the cultivation of the early millet with maize. However, maize cannot meet their food needs as the early millet does. The traders thus concluded that the poor performance of these crops due to climate change has affected their availability for household consumption and trade.

A Burkinabe trader said this

> Sorghum in the past was easy to cultivate because of better rainfall which yielded quality seeds. We could easily get this from farmers in large quantities and of quality. I could stock a lot and sell throughout the year both in Burkina Faso and Ghana. Now it is difficult to get this to buy from the farmers and when I even it, it is not of quality as compared to the past.

Ghanaian traders indicated that the quality of sorghum, beans and groundnuts had also reduced. They mentioned that years ago, a lot of varieties of these crops were locally cultivated and sold on the market. However, as a result of poor rainfall, a few varieties are now cultivated and these current varieties are not of the same quality as when compared to the past. These were also brought in from Burkina Faso and sold in the market. Overall, this has affected the demand by Ghanaian buyers for these crops and varieties.

A Ghanaian trader said this

> What we are getting from Burkina as sorghum these days is not sorghum compared to the past. We used to get quality produce which when used to brew our local drink commonly called Pito gave great taste. Now Pito brewers I supply bags of sorghum to complain about its poor-quality nature. In fact, they admitted the current type of sorghum looks like one that did not mature properly due to insufficient rains.

3.6.2 Market supply of food items

All Burkinabe respondents asserted that as a result of climate change which is affecting rainfall, crops failures are now being recorded, resulting in poor crop yield. Therefore, farmers are not able to get enough to feed their families as most of them are subsistent farmers. According to the Burkinabe women, in the past where crop yields were good and resulted in a bumper harvest, farmers had a lot of surpluses to supply the market with. However, in recent times, because of poor yields, traders now had to chase farmers to their farms, and yet ended up with no supplies. The perceived impacts of climate change on the market supply of food items by Ghanaian women traders corroborated what the Burkinabe women said about the situation in their country. The Ghanaian women mentioned that in the past, there was a readily available supply of groundnut and beans as some traders bought a lot during the harvesting season, stored them, and released them onto the market during the lean season.

A Ghanaian trader said this

> Getting quality cereals years ago was not a problem at all. I could sit in Navrongo (Ghana) and get my distributors (Burkinabe suppliers) put these in trucks to bring. Nowadays, these Burkinabe women bring the product themselves which is not even enough

3.6.3 Destruction of transport infrastructure and increasing cost of transportation

Apart from poor crop yields affecting market supply of food crops, climate change manifestations such as severe floods destroy transport infrastructure which makes access to farms challenging. According to the Burkinabe traders, some bridges linking farms and remote areas to markets in Burkina Faso where women traders are located got destroyed by floods. Also, considering the nature of farm roads, floods easily eroded these roads which impeded Burkinabe farmers from conveying their food produce to the markets for sale. The destruction of these structures hindered the timely delivery of farm produce by farmers to these traders in Burkina Faso. This situation resulted in the rotting of some produce on farms and affecting its quality. Limited quality produce ended up getting to the market too late, thereby creating an artificial shortage of produce supply. Coupled with this is the increase in the cost of transportation of the food as some suppliers had to find alternative means of transporting their food items. In the long run, the increase in the cost of transportation is absorbed in the farm prices of the produce by the farmers/suppliers. The traders in turn increased their prices which affected the market demand for these cereals and legumes. Traders thus ended up making less profits.

3.6.4 Destruction of market structures and degradation of the market environment

According to the women traders, market structures both in Burkina Faso (Po) and Ghana (Navrongo and Paga) get destroyed by floods and storms yearly. As noted already, women traders in Burkina Faso receive their supplies from Burkinabe farmers at the market squares. They then transport the produce to their final markets in Paga and Navrongo. Sacks containing the food items are stored or displayed in stores, sheds and stalls. Unfortunately, heavy storms usually rip off the roofs and sometimes pull down the walls of these structures. Market drainage systems, which are usually poorly constructed, get choked and flooded whenever there are floods. As a result, the traders do not only suffer from the floods and rains but their food items get soaked by the flood water. According to the Burkinabe women, they suffer more because they experience this in the three marketplaces.

3.6.5 The overall impact on traders' finances and social livelihoods

The traders bemoaned the overall impact of climate change on their finances and social livelihoods which are supported by the benefits/proceeds of this trade. The traders mentioned that low-quality food crops are less demanded by consumers and this affects the daily sales made thus the overall profit. Also, shortages of some of the crops resulting from poor farm yields render traders unable to meet the market demand which consequently affects their market gains. Furthermore, the destruction of market structures due to floods and storms exposes food crops stored in the market to water and other weather conditions. This affects the state and quality of these crops as some get soaked in flood water which culminates in low demand hence low sales and profits. Traders thus, end up making losses. Associated with the destruction of market structures is the inability of traders to display their items for sale with potential buyers on the other hand being unable to physically access market stalls (as some get flooded/destroyed by winds) in the market to purchase the crops. Overall, income generated from the sales of food crops is negatively affected hence less available finance to continue with the trade. It is further noted that some traders save the profits that they make from the trade. These savings are then used to start and sustain some other livelihood activities such as farming and operating provisions/grocery stores as a way of generating more income to maintain their families. Unfortunately, poor returns from this trade in recent times consequently affect the start or the sustainability of these livelihood activities.

A Burkinabe trader said this:

> I used to get much profit from this business. I could bring at least 35 bags of sorghum and 20 bags of millet to the Navrongo market and

> sell everything in cash on that same market day. Nowadays, I only bring a few bags as demand is low because some customers are not satisfied with the quality of sorghum that we sell on the market. The few consumers who patronise the produce even buy them on credit. As a result, I cannot return to Po and immediately get supplies from farmers.

A Ghanaian trader said this:

> Trade in cereals these days is risky. We are not able to get quality cereals hence unable to attract customers. Sometimes you display these items on the market and for the whole day, no potential buyer asks for the price. The few who ask about the prices after assessing their quality walk away without buying. Sometimes, buyers come around but due to a shortage in supply from Burkina Faso, we are not able to sell anything to them. In fact, some of us are thinking of switching to trading in other food crops because it makes no sense to continue engaging in this as there is no demand for hence no profit from the sales.

3.7 Women traders perceived adaptative strategies to navigate climate impacts

3.7.1 Tree planting

The women traders mentioned that as human activities destroy the environment and accelerate climate change, human beings must consciously promote reforestation and afforestation since increased vegetation is associated with rainfall. They therefore suggested that tree planting should be promoted in both countries. According to the Burkinabe traders, tree-planting activities are gaining momentum in the country as governments and non-governmental organisations are engaging in these, even though the political situation continues to affect the country's development activities. According to the Ghanaian traders, tree planting has also received attention from various governments of the country, however, this is not yielding the necessary results due to the lack of commitment by the citizens and governments to such projects. These traders therefore suggested that tree seedlings should be made easily accessible to individuals, households and local communities. Also, community-owned plantations should be promoted.

3.7.2 New improved varieties of food crops that are locally acceptable

The respondents identified that since the protracted nature of the rainy season has affected the cultivation of certain traditional varieties of crops such as the early millet, efforts should be made to get improved varieties of seeds that are adaptable to the weather and socially accepted by the people. This is because, even though some varieties of cereals like beans have been introduced and cultivated based on the current pattern of rainfall, the demand for such remains low due to poor palatability. They therefore suggested that research into the cultivation of food crops that meet the taste and socio-cultural needs of the people should be conducted.

3.7.3 Improved transportation and market infrastructure

According to the traders, it is important that governments of the various countries prioritise infrastructure development, especially under climate change. The Burkinabe women mentioned that both the local and central government ought to devote some resources to putting up market stalls that can withstand storms and floods. The Ghanaian traders mentioned that revenue that is being collected by the Municipal Assemblies where the Navrongo and Paga market are located, should be used to construct better stores/stalls and maintain the existing ones.

3.7.4 Addressing political and socio-cultural issues as a way of promoting better rains

The Burkinabe traders revealed that instead of people taking arms to fight one another, the Burkinabe should rather use science, technology and indigenous practices to improve the natural environment. The women mentioned that it is important for all Burkinabe to promote peace so that resources used in conflicts would be used to identify other adaptative measures.

3.7.5 Better storage facilities

The traders revealed that to secure food to sustainably supply the market, it is also important to have in place facilities that allow for the storage of food supplies, especially in the dry season. According to them, the dry season in both countries spans at least 5 months and this comes with shortages of some food items on the market. However, during the rainy season when producers harvest produce, gluts or surplus sometimes occur. Markets in both countries at such a time get flooded with farm produce. Therefore, they suggested that both individuals and governments should continue to promote the constructions of food warehouses where surplus food could be stored, which is currently underway, especially in Ghana.

3.7.6 Water harvesting technologies for irrigation

During the interviews, respondents from both Ghana and Burkina Faso mentioned that one of the ways of navigating through the impacts that climate change is having on ICBT food trade is by adopting technologies that allow for the harvest and storage of flood water for irrigation in the dry season. This was emphasised by the Ghanaian traders who noted that yearly, floods have become frequent in the Upper East Region including Paga and Navrongo as a result of rainfall and excess water from the Bagre Dam in Burkina Faso which is

ejected downstream to Ghana. Therefore, since the erratic rainfalls do not favour the rainy season cultivation of such crops, the excess water could be harvested and stored either on the surface or subsurface of the ground for later uses like irrigation.

4. Discussion

Informal cross-border food trade engaged by women of Ghana and Burkina involves the entry of Burkinabe women into local markets in Paga and Navrongo in Ghana and the sale of goods there. As cereals and legumes such as sorghum, millet, beans and cowpea are traded in, this study is similar to the informal trade that Nkendah (2010) studied in Cameroun with its neighbouring countries. Similar to how Kahiya et al. (2017) note that informal trade provides access to goods that are unavailable domestically, informal cross-border trade by Burkinabe women in the study area allows people to cope with climate change occurrences that affect the cultivation of some staple food crops such as cereals and legumes in northern Ghana (hence creating food shortages). The women traders who constituted the focus of this study, guided by their experiential or local knowledge and ability to narrate past incidence as also noted by Party et al. (2020), were able to perceive climate change coupled with the current practices or events in their respective countries. In line with studies from elsewhere (Kumar et al., 2023; Partey et al., 2020; Kwoyiga, 2019; Gbetibouo, 2008) the women traders noted that climate change is occurring in the form of changes in temperature and rainfall. The study results indicated a decrease in rainfall and an increase in temperature in both countries which resonates with the perceptions of farmers studied by Gbetibouo (2008) at the Limpopo Basin (South Africa) and Diiro et al. (2016) in the Mopti region of Mali. The perceived changes in temperature and rainfall are further confirmed by the study results of the Ministry of Environment and Fishery Resources (2015) of Burkina Faso and the Ministry of Environment, Science Technology and Information (2013) of Ghana. The significant level of climate knowledge held by the respondents implied that even though the women traders are not farmers, their experiences of engaging in agricultural food trade coupled with their natural environment have shaped their awareness and level of knowledge about changes in the climate. This reinforces Thompson (2017) ecofeminist perspective that women, due to their stronger connection with the earth, know such matters better. What also emerges from this study is that though both countries are trapped under climate change impacts (with northern Ghana receiving more rainfall than Po), cereals and legumes cultivation is still on an increase in Po which catalyses the cross-border trade. The explanation for the limited availability of cereals and legumes in Ghana and their abundance for trade in Burkina Faso could be the different adaptation strategies, priorities and methods that each country has adopted, and the local adaptive practices adopted by farmers.

From an Ecofeminist Theory perspective, the results revealed that climate change is largely attributed to human activities. The women traders identified man's use of science and technology in the quest to develop and exercise dominance in society to be the cause of climate change. This resonates with Singh (2023) perspective about ecofeminism where men continue to portray violent behaviour towards nature and women as a result of patriarchy. Elaborating on man's role in climate change, the results further identified different causes that go beyond deforestation to include socio-cultural practices and political activities. The women traders identified socio-cultural and political activities that do not only bring curses on the environment but also degrade and divert attention for environmental protection and conservation. This is consistent with the findings of Diiro et al. (2016) whose study identified the cause of poor rainfall in Mali as being the wrath of God and political conflict.

Considering how climate change affects ICBT, the study aligns with Thompson's (2017) assertion of ecofeminism, that the oppression of nature is linked with women. This is because the results showed that human activities cause climate change, which consequently impacts the production, availability and quality of crops, a situation that has also been noted in Senegal (Kumar et al., 2022) and Mali (Diiro et al., 2016). These impacts can be attributed to the already environmentally degraded nature of the northern part of Ghana and southern part of Burkinabe coupled with the monomodal rainfall pattern experienced in these parts of Africa. Also as noted in the literature already, these areas are already characterised by high temperatures and low rainfall when compared to southern Ghana, thus climate change has come to exacerbate these conditions. The outcomes of climate impacts on agricultural food trade are that, apart from the Burkinabe women making little gains in the trade, Ghanaian women often are unable to meet the demands of their local customers. This affects the overall benefits that these women make from ICBT and hence the need to promote adaptation.

Similar to how Jin (2023) noted the importance of recognising women's voices and experiences in addressing climate change, the study has also explored how certain measures, when adopted, could promote adaption which will subsequently contribute to the sustainability of ICBT food trade and women's livelihoods. Similar to the findings of Bessah et al. (2021), this study suggested that farmers could adopt measures such as the introduction of new varieties of crops that can adapt to the changes in rainfall and temperature and are socially and culturally accepted by consumers. This will ensure that there is quality and available legumes and cereals on the market with corresponding demand. In line with Hertel (2018), this

study further proposed the need for better institutions and governance systems that ensure that the environment is protected and sustained. This is because, for adaptive measures to be fully adopted there is the need for effective monitoring and regulation. Also, to secure water for farming purposes throughout the year, water harvesting technologies that support irrigation have long been practised in these countries, with Burkina Faso already making giant strides in recent times. It is therefore not surprising that the study further proposed that growing crops such as cowpea, especially in the dry season through irrigation, can boost its availability throughout the year. The practice of irrigation in Burkina Faso should, therefore. motivate Ghanaians to embrace irrigation as an adaptation strategy. These empirical findings imply that effective adaptive measures can boost the resilience of agricultural food trade under climate change impacts.

5. Conclusion

The paper set out to examine the impact of climate change on cross-border informal food commodities trade between Ghana and Burkina Faso which is hardly given attention. Though women are more vulnerable to the impacts of climate change, their voices are missing in climate change discourses, as there is a paucity of literature in that regard, hence the onus of this paper.

The study showed that climate change is manifesting in the form of a decrease in rainfall and an increase in temperature. Guided by their experiences, past events and their natural connection with nature, women traders lamented the role of human activities, including sociocultural practices and political activities, that directly and indirectly affect nature and cause climate change. ICBT involving cereals and legumes is impacted by climate change as climate impacts do not only affect the quality and availability of legumes and cereals for trade but also trade and its supporting facilities and infrastructure in both countries.

To adapt to climate impacts in both countries, the study recommends taking into consideration the changes in the pattern of rainfall with new and improved varieties of crops that may contribute to increasing agricultural production and market supply of cereals and legumes. Also, irrigation could promote better adaptation of farmers and the continuous supply of quality legumes and cereals. The study therefore suggests that irrigational practices which are already ongoing in both countries should be promoted. The study further recognises the importance of better human practices towards the natural environment, effective institutions and political stability in securing a better planet for humanity.

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