

AFRICA DEVELOPMENT AND RESOURCES RESEARCH INSTITUTE (ADRRRI) JOURNAL



ADRRRI JOURNALS (www.adrri.org)

E-ISSN: 2343-6662 VOL. 29, No. 1 (6), October, 2020-December, 2020

Survival Strategies of Women Smallholder Farmers in Response to the Effects of Climate Change: A Case Study of the Kpachelo Community of Savelugu Municipality

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Available Online: 31st December, 2020

URL: <https://www.journals.adrri.org/>

Abstract

This study was carried out within the context of heightening concerns that climate change is imposing difficulties on the livelihoods of rural people in Sub-Saharan Africa. The study examined the effects of climate change on rural smallholder women farmers in the Kpachelo community of northern Ghana. Data was collected using focus group discussions, in-depth interviews, and direct observations. The empirical results reveal agriculture to be the principal economic activity of the women of Kpachelo community, focusing on crop production and animals rearing, with sole dependence on natural rainfall. The study also unravels household food insecurity as the substantive consequence of climatic change in the area. The most important survival strategies adopted by women rural smallholders to reduce the effects of climate change include rationing of meals, consumption of seed stock, and reducing the quantity of food eaten per day. Consequently, there is the need for adaptation efforts to address the sources of vulnerability and poverty for rural women. There must be a deliberate attempt to institutionalize, re-equip and strengthen district level agricultural extension agents and climate information services to serve vulnerable communities, including women.

Keywords: climate change, Women, food security, smallholder farmers, strategies, agriculture.

[Cite article as: Mohammed, K. D. and Ishawu, A. (2020). **Survival Strategies of Women Smallholder Farmers in Response to the Effects of Climate Change: A Case Study of the Kpachelo Community of Savelugu Municipality.** Africa Development and Resources Research Institute Journal, Ghana: Vol. 29, No. 1(6), Pp. 1-29, E-ISSN: 2343-6662, 31st December, 2020.]

Received: (August 27, 2020)

Accepted: (December 31, 2020)

INTRODUCTION

Climate change is found to be a menace to global food production. This is according to the United Nations Food and Agriculture Organization (FAO). The effects of climate change throughout the world are lessening the strength of natural resources including biodiversity, soil, and water to maintain the food demand of the world's doubling population (FAO, 2019). The Intergovernmental Panel on Climate Change (IPCC) have predicted that there will be an increase with global warming of 1.5°C on climate-related risk to health, livelihoods, food security, water supply, human security, and economic growth. They further emphasize that this could further increase with 2°C (IPCC, 2018). It has been emphasized that populations at disproportionately higher risk of adverse consequences with global warming of 1.5°C and beyond include disadvantaged and marginalized populations i.e., indigenous traditional societies and rural communities whose livelihoods are dependent on agricultural or coastal livelihood (FAO, 2019). Evidently, climate change is happening, with several studies showing negative effects of climate change on crop yields and food production. The impacts observed have been far more common than positive impacts. Very few studies do show positive impacts of hot temperatures on food production at higher latitudes. IPCC have however said that it is still not clear whether the balance has been positive or negative (IPCC, 2014).

Unfavorable effects of climate change on food production and food security are happening within the framework of growing crop demands. This has been demonstrated in FAO's recommendation that global food production world food production in 2050 must be 60% further than that of 2005/2007 to reflect the increasing food demands of more than nine (9) billion people (Bruinsma, 2012; IPCC, 2014). Food production systems in Africa can be considered the most vulnerable due to overdependence of crop production on rainwater, heightened intra and inter-seasonal climate variability, reoccurring drought and floods affecting crops and livestock, and persisting poverty that hinder capacity to adapt (Boko et al., 2007). In the interim, capacity to better manage risk related to climate variability may help to strengthen adaptive capacities for climate change (Washington et al., 2006; Cooper et al., 2008; Funk et al., 2008). Importantly, the agriculture sector in Africa will face difficulties in adapting to climate change. This is anticipated to happen by mid-century, as negative effects of high temperatures become

increasingly prominent under A1B - (a balance across all sources; where balanced is defined as not relying too heavily on one particular energy source, on the assumption that similar improvement rates apply to all energy supply and end-use technologies) scenario (Battisti and Naylor, 2009; Burke et al., 2009a), increasing the possibility of reduced yield potential of main crops in Africa (Schlenker and Lobell, 2010; Sultan et al., 2013). As highlighted by United Nations Development Programme (UNDP), women in Africa are particularly vulnerable to climate change because their livelihoods are directly dependent on the natural environment (UNDP, 2009). Many women, for instance, the ones residing in poor African communities are at the center engaged in agriculture production and collecting water for household consumption and agriculture purposes (UNDP, 2009). As water collectors Denton (2002) postulate that, water related diseases such cholera and dysentery are the most high-risk diseases encountered by women. In many parts of Africa, an assessment of shifts in rainfall pattern by the IPCC show decline in water resources as well as agriculture production (IPCC, 2007). In IPCC's view, the changes will affect the livelihoods of women directly and further worsen their predicaments. Analysis of both national and regional level of vulnerability in Ghana demonstrates vulnerability particularly to drought impacts has physical/geographic patterns and socioeconomic relationships. The assessment found that the three northern regions (now five regions) are the most vulnerable. Also significant is that the adaptive capacity of these regions is the least nationwide following socioeconomic development and over reliance of indigenous economies and livelihoods on rain-fed systems such as agriculture and forestry. Increasingly erratic rainfall and reducing annual rainfall patterns, often because of climate change, are seriously impacting livelihoods of rural populaces of these areas. It has been observed that in dealing with extreme weather events (drought and flooding), communities within the region are facing challenges. In the context of development priorities and cross-cutting issues, water is highly relevant but is increasingly becoming a scares resource in northern Ghana largely because of climate variability/change (UNDP, 2009). This paper examines climate change impacts on smallholder women farmers in the northern region of Ghana using Kpachelo community as a case study. The study is guided by the following research questions:

- i. How does climate change affect smallholder women farmers in the study area?

- ii. What strategies does smallholder women farmers adopt to cope with climate change impacts?

LITERATURE REVIEW

Effects of climate change on women

There has been an upward growth in exploring climate change impacts on men and women in recent times; most of which have acknowledged that women and men have experienced differently impacts of climate change, and often at national, regional, or global with limited findings at the local level. Consequently, this paper intends to share findings of an assessment of the effects of climate change on smallholder women farmers in the northern region of Ghana. Significantly, climate variability is observed to have caused a reduction in agriculture productivity and consequently lower incomes and reduced crop yields. It is believed that subsistence agriculture suffers the most where reduced food intake could have implications for gendered human capital outcomes. Drought as an extreme event of climate could cause food insecurity and malnutrition in households however with diverse human capital impacts for men, women, and children. Within the vulnerability context, these impacts relate to different user characteristics and how they interact with sociocultural norms. Climate change will likely give rise to risk of food insecurity throughout the world, most importantly for individuals in the Global South (Porter et. al, 2014), Wheeler and Von Braun (2013). There is growing evidence of how food insecurity will likely overstress women and girls disproportionately in many settings. McIntyre et. al 2011, Ali and Nieh of 2007, Deaton and Drèze 2009) have said, for example, that, in India and Bangladesh a pervasive fact of life for women and girls is food insecurity; where one out of three young girls are stunted (Black, et al. 2013). It is further proven that women and girls found in these regions are more likely to experience hunger because of climate change disasters. A study by Andhra Pradesh, India, Williams, (2016) has suggested that twice as many women as men reported eating less in response to drought. Women and girls are mostly the first to skip meals if there is a shortage of food, as often occurs during drought, floods, or storms (Alston, 2015). Furthermore, Datar, et. al. (2013) found in India that underweight and stunted issues were more likely to be prevalent among young girls than boys after disasters. Researchers from Asia have documented evidence of food insecurity on women and girls induced by climate change.

A study in the Philippines found an increase in infant mortality of girls but not boys after a disaster. Anttila et al. (2013) has said that, the situation is mainly due to competition for limited resources within families. Also, girls and women are more likely to starve during drought in Iran (Keshavarz et al. 2013).

Similarly, because of sociocultural norms regarding the importance of men's physical labour, women and girls in Vietnam are more likely not to eat three times daily than men during periods of food scarcity (UN Oxfam International, 2009). In sub-Saharan Africa evidence exist of how food insecurity linked to climate change is disproportionately affecting women and girls. Tibesigwa et al. (2015) in south Africa observed that unmarried female household heads who may not receive income support from a migrant husband are more susceptible to food shortages than female headed households who are married. Kakota (2011) discovered in Malawi that households headed by females reported reducing more than twice as likely as their male counterparts' quantity of meals they eat as a coping measure to climate risk. Research conducted by Zakari et al. (2014) suggests female household heads are significantly likely to be food insecure than male household heads following climate change impacts on crop yields. An empirical study by Nyantakyi et al. (2015) in rural Ghana show unequal food distribution occasionally by men who control food distribution, thus causing food insecurity for children and women. Similarly, Segnestam (2009) in Nicaragua found more women are prone to reducing their food consumption as a coping strategy to drought. But Silvestri et. al (2015) demonstrates with evidence from East Africa and contrary to Segnestam (2009) findings suggest that female headed households are not predisposed or even less likely (Amwata, et. al. 2016) to suffer from food insecurity, in the face of drought within the region. Although speculative, researchers have said that female headed households prioritize food and other household essentials by spending judiciously as compared to male headed households, to promote household welfare (Amwata et. al. (2016). Again, research has proven that food insecurity and other exposures relative to climate change are connected to risk of depression with evidence of the impacts linked to women. Hadley and Patil (2006) discovered in Tanzania women could suffer anxiety and depression from food insecurity, especially during periods of acute food scarcity (Hadley et al. 2008). Literature from Ethiopia confirms the connection of findings on women and food security (Hadley, et. al. 2008). In Uganda and among women living with HIV, food insecurity is linked to

depression but not men (Tsai, et. al. 2012). Similarly, water scarcity has been found to be highly significant with emotional distress in the Cochabamba, Bolivia. This finding is very common among female headed households as they bear the brunt of fetching water tend to experience greater risk of collecting (Wutich, 2009; Wutich and Ragsdale, 2008). Stevenson et. al. (2016) and Stevenson et. al (2012) demonstrate that consistent research in rural Ethiopia noted a high correlation between water scarcity and psychosocial distress at household level among women. In Chiapas, Mexico, an assessment on the impacts of hurricanes Mitch and Stan causing flood discovered that while men lost income from remunerated work on farms, women lost the fruits, vegetables, chickens, and ducks from their home yards (Jungehülsing, 2010). Consequences of the losses posed challenges on women's capacity to feed their families, mainly since their daily food comes from backyard gardening. Furthermore, research has demonstrated that effects of droughts in Namibia has consequences on women. As highlighted in Angula (2010), droughts and out of women respect for husbands, first explore alternative ways of maintaining food security within the household before discussing matters of food shortages with their partners. Through basketry, sale of chicken, pigs, or goats and processing of nuts and oil were foremost explored by women as a livelihood diversification strategy and to raise money to buy food. Heat waves according the Smith et. al (2014), Kovats and Hajat (2008) is projected to become severe due to climate change. But the effects of climate change will more likely worsen as cities continue to develop the world over; producing heat that are associated with death related to extreme heat (Wong et al., 2013). Literature abounds that impacts of heat waves are health related. This available data uses past events about mortality and temperature, that is connecting mortality during periods of hot temperature to periods of typical weather. Gamble et al. (2013), Kuzuya (2013) have said regardless of sex, particularly in advanced countries heat waves often disproportionately affect aged population, as these are more sedentary and unlikely to escape very hot environs during prolonged period of hot weather. In global south an assessment of male and female differences in deaths from heat waves show the absence of any disparities between male and female in deaths or increase in risk related deaths because of hot temperatures. Studies in Latin America have similar research findings (Bell et al. 2008), Shanghai, China (Huang et. al, 2010), Nairobi, Kenya (Egondi et al., 2012), and northern Ghana (Azongo et. al, 2012). Conversely, similar studies have

discovered that differential impacts of heat waves on women. For example, Ahmedabad, India, Azhar et al. (2014) discovered the rate of deaths within females and perhaps linked to heat was vividly above that of males during a 2010 heat wave.

Coping strategies of women to climate change impacts

In sub-Saharan Africa most farmers redefine their farm management strategies to variations in the local climate and other factors; mainly unavailable markets, increased cost of agriculture farm inputs and limited infrastructure as a way of safeguarding critical livelihoods (Assan et al., 2018). The following session reviews literature on coping strategies of women during climate change impacts.

In a study to examine coping strategies of smallholder farmers in rural Ghana, Assan et. al (2018) found 45% of respondents borrowed loans from a Village Savings and Loans Scheme (VSLA) to be able to cope with the effects of climate change, 29% engaged in the sale of wild fruits and vegetables; 19% also sold firewood with the sale of livestock being 18%. It is important to highlight also that female headed farm households undertook these coping strategies during the dry season; a period of off-farm activities and was often due limited alternative livelihood options. Female farmers were equally into these activities because they needed to raise income to support other livelihood activities including apiculture (Assan et al., 2018). Poulsen et. al (2015) and Hovorka et. al. (2009) observed the development of non-rural gardens and farms to ensure continues food supply was a gradual but strong coping mechanism for climate change within urban communities. Between 10%-70% of households in urban areas across the globe gain income from agricultural activities but mostly in small amounts (Zezza and Tasciotti, 2010). Poorer households mostly linked to females has been observed to depend on non-rural agriculture as a coping strategy at the household level (Mkwambisi et al., 2011, Hovorka, 2006; Soto et, al. 2009). For instance, approximately, 55% of households headed by females compared to just 4% of households headed by males in Malawi obtain their livelihood from agriculture. Majority of the 4% rely on employment considered informal within industries that are inaccessible to women. In communities that are agro-pastoralist and experience widespread food deficits in northeast Kenya, women have a common strategy to reduce meals inlets (Serna, 2011). Regrettably, the situation worsened health conditions of women, children, and lactating mothers, while men turn to the option of

hunting and selling wild products including resin and gum. Another income generating activity for men during this time was also the felling of trees for firewood and charcoal (Serna, 2011). However, associated with felling of trees for firewood and charcoal were reports of men being weak because of reduced quantities of food consumption whilst doing manual labour.

The broad selection of literature thus demonstrate that climate change could affect men, women, and children food security needs in different ways. Clearly, the literature (Katoka, 2011; Zakari et. al 2014; Tibesigwa et. al; UN Oxfam International 2009; Assan et. al 2018) confirms women and children experience more negative health implication such growth and development which constitute human capital. In summary, women who have the primary responsibility to ensure household food security and provide meals for their families are often face difficulties during climate change impacts. As noted above, women reduced their food consumption to allow other household members eat more especially children and their husbands. Similarly, women would sell off a few of their belongings i.e., jewelry and small livestock or undertake additional work during climate change risks.

METHODOLOGY

Study Location

Kpachelo community is in the eastern part of the Savelugu-Nanton Municipality, a district located in the southern part of the Northern Region of Ghana. Kpachelo is surrounded by Kpano and Gbungbun communities to the North and Tumahi to the West. The major occupation of the people of Kpachelo is crop farming with women doubling as Shea butter processors and farmers. The study district Savelugu lies on 167m above sea level and the climate is classified as tropical. In Savelugu, the average annual temperature is 27.9 °C | 82.2 °F. The annual rainfall is 1077 mm | 42.4 inch. Between the driest and wettest months, the difference in precipitation is 225 mm | 9 inches. Throughout the year, temperatures vary by 5.0 °C | 41.0 °F.

Sampling and data collection

Tashakkori and Creswell (2007a), and Creswell and Clark (2011) have emphasized that a combination of methodological approaches further strengthens the research design. The

strength of a singular approach counterpoises the weakness of the other and can provide more comprehensive and convincing evidence than just a single method or approach. Probability and non-probability sampling techniques were used for the study. Under probability sampling, the study used the simple random sampling technique to sample 100 households in the study area. The technique involved the writing of house numbers of all the houses in the study community on pieces of paper through key informants, and putting the pieces of paper into a bowl, mixed thoroughly and then picked from the bowl without looking into it until the sample size for the community was obtained. Purposive sampling, which is a non-probability sampling technique was then used for the selection of individual respondents from the sampled households for the individual interviews. This involved the engagement of a household head (a man) to consent to interviewing a female spouse whose livelihood is mainly agriculture. Similarly, purposive sampling procedure was used to select the study community. The use of this sampling techniques was because available literature indicate Northern region of Ghana is vulnerable to climate change. By extension, the Kpachelo community which is found in Savelugu Municipality in northern Ghana. The sampling process followed the approach based on Taro's (1970) theorem and mathematically presented as:

$$s = \frac{N}{1+N*e^2} \dots\dots\dots (1)$$

Where:

s = sample size

N = Study population

e = Margin of error at 90% (0.10)

The population of smallholder women farmers (N) was obtained from the Assemblyperson of the area and double checked at the district assembly as 537. By computation therefore, the sample size for the study was obtained as approximately 85. This was however, adjusted to 100 to cater for design effect/sampling errors. Questionnaire administration, interviews and focused group discussions were the main data collection techniques adopted by the study. Questionnaires were administered to smallholder women farmers; to generate quantitative and qualitative data from the study population. Interviews were administered to 3 different non-governmental organization

working in the study area. For purposes of triangulation, the study also used focused group discussion involving 10 smallholder women farmers in the study area. This was intended to solicit information that otherwise was not revealed during the individual interviews.

Data Analysis

Data from the study was processed using Statistical Package for Social Sciences (SPSS), with the results presented in graphs. The study adopted a mixed method design which was a combination of appropriate qualitative and quantitative procedures to provide a better understanding of the research problem (Forsyth, 2007; Johnson et al., 2007; and Creswell & Clark, 2011). By this, the results of various focus group discussions were transcribed and discussed along the few quantitative data that were collected.

RESULTS AND DISCUSSIONS

Perceive effects of climate change stated by smallholder women farmers in the Kpachelo community

To further understand the how climate change has impacted the livelihoods of smallholder farmers, the study examined changes experienced by smallholder farmers specific to crop yields, crop type or varieties, crop pest and disease, rainfall, and household food availability.

Table 1: Perceived effects of climate change in the Kpachelo community

Measurement	Crop Yields	Crop type/varieties	Crop pest and disease	Rainfall	Household food availability	Farm Income
Increased	34%	69%	71%	6%	6%	7%
Declined	58%	6%	21%	82%	84%	62%
Same	8%	25%	8%	12%	10%	31%

Source: Field Survey (2019)

Rainfall is essential to activities of smallholder farmers. In effect, smallholder farming may not succeed if water availability is affected by climate change. Erratic rainfall can impact negatively on productivity and incomes of smallholder farmers. Significantly, rainfall was found to have declined over the last decade and more according to women

respondents. Overwhelming 82% of respondents agreed that rainfall has declined thus affecting agricultural livelihoods. Clearly, studies have shown that in Northern Ghana, the dry season is increasing in length and becoming more severe. Farmers and rural dwellers are conscious of the fact that temperatures are escalating. It is highly emphasized that rainfall has become erratic following frequent droughts. Also, 12% of respondents observed that rainfall had remained the same with no change at all. However, conservation agriculture practices such as zero or minimum tillage, contour ploughing etc. are often adopted by smallholder women farmers to enhance crop production. The least representing (6%) of respondents observed an increase in rainfall. The above findings according to smallholder women farmers reflects in crop yields. We found 58% of smallholder women farmers who observed that crop yields have reduced over the last decade and more. In a focus group discussion, it was discovered frequent drought is causing crop yields to decline. This according to respondents affects food availability and consequently household food security as well as efforts of women towards realizing food sovereignty. Nutritional status of vulnerable women and children could be influenced negatively as most smallholder women farmers are into legumes cultivation e.g., cowpea; soybean and Bambara beans which are high in nutritional values.

The study further discovered that 34% of women respondents reported that crop yield has rather increased. This number (34%) of respondents could have more knowledge in crop production as we discovered in a focus group discussion that a cross-section of smallholder women farmers has had training from Canadian Feed the Children (CFTC) on conservation agriculture. Furthermore, 8% observed that their crop yields have remained the same, thus there has not been any reduction or increase in crop yield over the last decade. It is important to highlight that we found in a focus group discussion that women farmers have held on to the use of indigenous crop varieties which are drought tolerant, early maturing and meet the dietary needs of smallholder farmers. This practice according to literature may constitute a sustainable practice capable of conserving natural soils.

Household food availability in the context of this study refers to the presence of food stock for consumption. The study revealed an overwhelming 84% of respondents observed a decrease in food availability for household consumption. This finding was further affirmed in a focus group discussion where smallholder women farmers

highlighted that the consequences of a reduction in household food availability are crop pest and disease infestation which likely could affect crop yields negatively, may equally impact household food availability. This finding very much aligns with the findings of Arnell et al., 2002; Devereux and Edwards, 2004. The researchers postulate that tropical and subtropical regions could suffer losses related to agriculture because of climate change and most likely affect food availability negatively. Also, another 10% reported that household food availability remained the same over the last decade, with just 6% reporting an increase in food availability for household consumption. The study further discovered that the 6% who reported an increase in household food availability may have participated in a training programme seeking to increase women farmers capacity in conservation agriculture. It was also discovered that an international nongovernmental organization by name CFTC in partnership with a local nongovernmental organization undertook development interventions in the study area with the objective of enhancing resilience of smallholder farmers to climate change impacts. It will not be inappropriate for the study to support the statement that food insecurity and climate change may have been a challenge for the Kpachelo community which necessitated the intervention by the two nongovernmental organization.

Studies have shown how climate change may influence the type of crops that communities and farmers grow. The effects of climate change especially drought might affect farmer's choice of crops to cultivate. Majority of the respondents (69%) reported that they have diversified the type of crop varieties they cultivate. In effect crop type and varieties for cultivation have increased over the last decade. According to respondents this is a strategy to improve their yields following effect of climate change on their agriculture livelihoods. In a focus group discussion, the characteristics of these varieties include early maturing varieties, drought tolerant and disease resistant crops. It is important to highlight that such crop varieties can strengthen crop production, increase yields, and withstand the effects of the changing climate. Therefore, smallholder women farmers decision to diversify crop varieties is a reasonable decision to make amid the changing climate. Additionally, 25% of the respondents said their crop type/varieties have neither increased nor decreased but has remained the same. The decision to increase or diversify crops amid climate change is influenced by finances of the individual farmer, as discovered in a focus group discussion. Following the above statement, we could deduce that this 25% of respondents could not afford to diversify their crop varieties or type. The least, representing 6% of respondents observed that varieties have rather

decreased. We found in a focus group discussion that this category of women were smallholder farmers who cultivate indigenous crop varieties. Significantly, women farmers observed that communities including the study community have lost most of their indigenous crop varieties, mainly due to the introduction of improved or hybrid seeds by international seed companies occasioned by the changing climate.

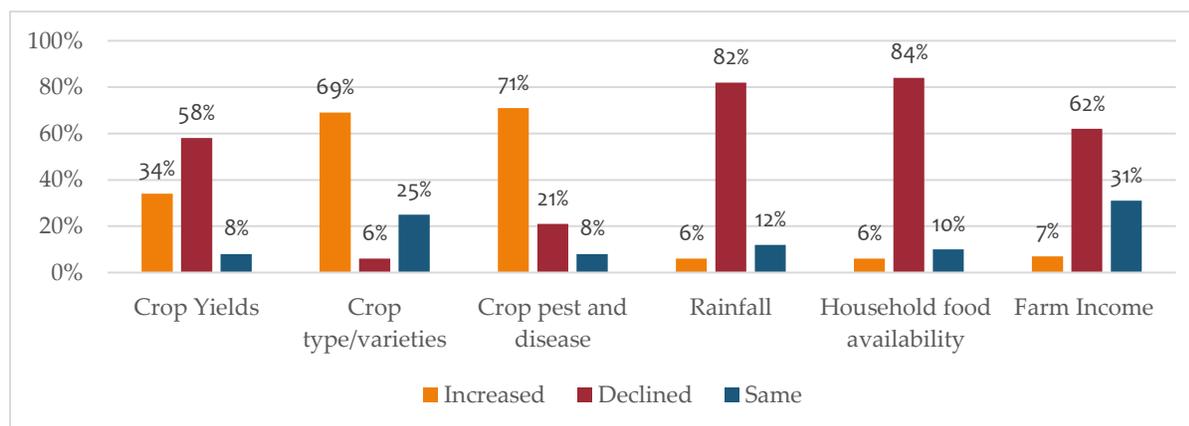
Literature has shown that climate change will pose greater risk of pest and disease to smallholder farmers and agriculture communities. Climate change will bring greater risk of pests and diseases to African agricultural systems, affecting crop, livestock, and fisheries productivity (Dinesh et al., 2015). In line with the above findings, the study discovered that majority of smallholder farmers representing 71% observed an increase in crop pest and disease. The effects of pest and diseases may be a major factor influencing farm productivity in Africa. Smallholder farmers have said that they are often saddled with crop losses because of crop pest and diseases especially in leguminous crops—a crop associated with smallholder farmers in the study community. Researchers have estimated that, globally about one-sixth of field production is lost to pests, with further losses in storage.

In an interview with agricultural extension agents at the department of food and agriculture, Savelugu we found common pests and diseases affecting crops in northern region. According to the extension officer maize crop is affected by the following diseases: cutworms during the young growing stage of maize; locusts; army worms and wire worms; stem borer attacking at the mature stage. Nematodes was also mentioned as pest for groundnuts. Insect pest associated with cowpea was mentioned as legume pods borer; cowpea seed moths e.g., *cydia ptychoraa*; pod sucking bugs for example, *clavigralia spp.*

However, 21% of the respondents said pest and diseases has not increased. This number of farmers emphasized that they control pest and disease with the use of pesticides and insecticides. A further analysis points to 8% of respondents' who argue that crop pest and diseases have rather decreased. This according to them has been possible because of their participation in agronomic trainings especially on integrated pest management.

Importantly, the continuous existence of an entrepreneur or a business is dependent on available capital. Farm income is thus essential to the continuous existence of a smallholder farmer and related farm activities. On the contrary, the study found 62% of smallholder women farmers reporting a reduction in their farm income. This phenomenon according to smallholder women farmers in a focus group discussion is

influenced by several factors including reduced crop yields, crop pest and disease and erratic rainfall. Farm income is obtained from yearly harvest from the farm according to smallholder women farmers. In effect, the occurrence of any of the above influencing factors will have dire ramifications on farm income of women farmers. It is highly recommended that the 62% of respondents are supported to improve upon their agricultural practices through training on conservation agriculture. This will likely improve crop production and by extension improve crop yields. Consequently, improved yields could translate to improve farm income. Also, the study found 31% who reported that their farm income has increased. Availability and access to farm inputs including fertilizer, improved seeds etc. accompanied with technical knowhow in crop farming can facilitate an increase in crop yields and subsequently farm income. The least representing 7% of respondents said their farm income has remained the same. It is possible that these set of respondents perhaps keep track of expenditures before and after cultivation. The study discovered through a focus group discussion that a cross section of smallholder farmers did not understand the concept of bookkeeping-a process very vital to improving farm income and productivity.



Source: Field Survey (2019)

Figure 1: Perceive effects of climate change in the Kpachelo community.

Coping strategies of smallholder women farmers

The study further looked at the coping strategies of smallholder women farmers in the study community. It observed from the study that smallholder women farmers have

developed strategies to manage with the effects of climate change. These strategies are at household level, where smallholder women farmers manage household food supply until another cropping season.

Table 2: Coping strategies of smallholder women farmers during climate change effects in the study location.

<i>Perceived effects of climate change</i>	<i>Yes</i>	<i>No</i>
<i>Sale of livestock</i>	83%	17%
<i>Consume seed stock</i>	84%	16%
<i>Reduce amount of food eaten</i>	95%	5%
<i>Ate fewer meals per day</i>	94%	6%
<i>Sought daily work outside</i>	62%	38%
<i>Migrate</i>	22%	78%
<i>Sold firewood</i>	89%	11%

Source: Field Survey (2019)

In the Kpachelo community smallholder women farmers cope with climate change by engaging in the sale of small ruminants or animals including goats, sheep, and fowls. We found that 83% of smallholder women farmers in the Kpachelo community sold their livestock. Livestock for the community refers to farm animals regarded as assets for most women.

The study established in a focus group discussion that the effects of climate change such as crop failure and decrease in crop yields often compel women to sell small animals (livestock) as a way of raising money to support household food needs. Key findings from the focus group discussions show women engage in sale of livestock due to spread of infectious diseases often because of climate change variations. Changes in climate change could compromise small ruminant's health; thus, compromising the safety of animals and the availability of animal fodder. Arguably, frequency of severe weather events (because of climate change/variability) may limit availability of fodder and water for livestock. This could also affect smallholder women farmers especially those who rely on exchange of grains for animal products. Biskup and Boellstorff (1995) confirms this when they found that extended drought caused a maximum economic stress for the unmarried and widowed women with children who were harshly resource constrained. Under these serious circumstances, some of these women resorted to the sale of their small livestock, which eventually reduced their own financial equity. Furthermore, as

little as 17% indicated they do not engage in the sale of livestock. It is important to highlight that in a focus group discussion, very few women did not keep livestock and may come from the 17% who responded no to sale of livestock. It could also imply that the effects of climate change or variability are minimal on the 17% of smallholder women farmers who do not sell their livestock. This could be connected to the findings of Kristjanson et al. (2010) when he discovered that the occurrence of drought in Niger further enhanced women control over livestock. This he explained was because they invoked a cultural norm; that require men to sell their livestock before women during periods of food insecurity.

Furthermore, the study found eating of fewer meals per day as a strategy to cope with climate change/variability. Majority of respondents (94%) said they eat fewer meals per day anytime they are unable to adapt to climate change. Serna (2011) equally found in a study that when food shortage was widespread, during climate change, a common practice, especially among women, was to reduce meal inlets. Eating fewer meals per day by smallholder women farmers could suggest women not receiving the optimal nutritional content from food. Women underscored in a focus group discussion that the phenomenon has dire consequences on their health and human development generally. Serna (2011) again puts it well when he said eating fewer meals per day by women “increased women’s health issue as well as that of children and lactating mothers”. Significantly, agricultural growth or productivity is very much dependent on the health of farmers including women (who constitute majority in smallholder farming). If the health of the majority in smallholder farming (women) is hampered due to climate change, this might impact agriculture productivity in the study area and the study district. We also discovered 6% of respondents have however indicated they do not eat fewer meals per day. Respondents emphasized that they are fairly coping with the changing climate.

Most smallholder women farmers representing 62% move out of the study location to seek for work as a measure or strategy to cope with the effects of climate change or variability. During a focus group discussion, it was highlighted that the type of work women undertake is mostly within construction sector, work as sales representatives for other market women and cleaning services. In the construction sector women are employed as laborer’s often engaged in carrying of concrete, sand etc. This kind of work is usually undertaken to earn income to support acquisition of daily household food

needs according to smallholder women farmers. Cleaning services on the other hand is usually through working with food vendors, government institutions and waste management institutions (both private and government). Conversely, 38% said they do not move outside of their community to look for work. According to this category of women, they engage in small businesses in and around the study area. The nature of business is mainly on selling of small wares, spices as well as locally manufactured beads, necklaces and Sheabutter processing.

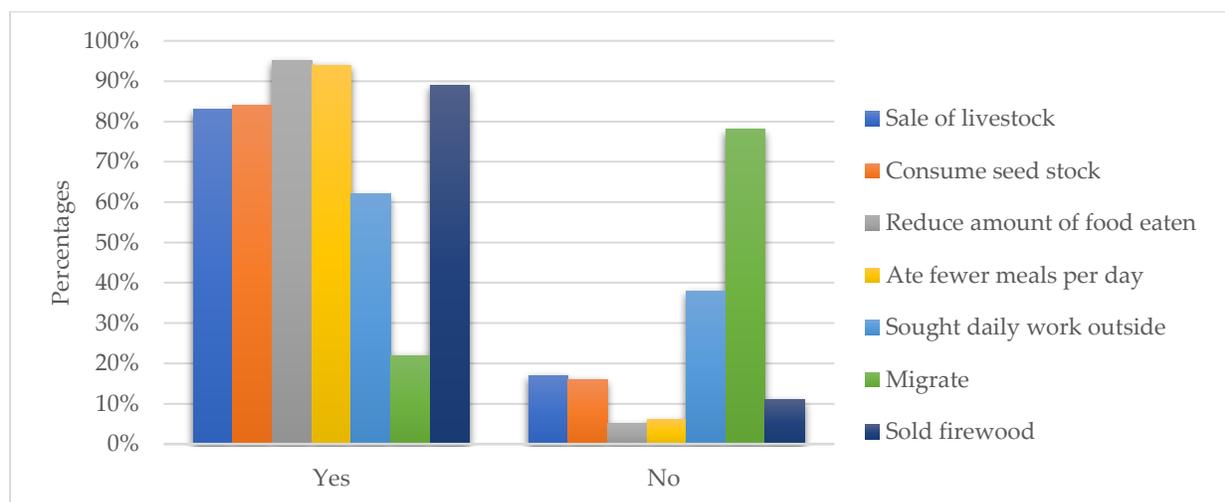
Overwhelming 95% of respondents said they reduce the amount of food eaten as a strategy to cope with climate change effects on their livelihood. Smallholder women farmers were very emphatic that climate change contributes to crop failure often because of erratic rains, increase in temperatures etc. This argument is reinforced in *figure 1* above where we see 82% of respondents indicating that rainfall has declined over the decade. We equally learn from a focus group discussion that crop failure most often affects food security in households and eventually puts a burden on the amount of food available for consumption. Thus, pushing families to reduce the amount of food eaten in households. It is important to remark that women in the study area depend largely on farm produce. Therefore, a negative shift in crop production could affect vulnerable women farmers and their households greatly and bring about food insecurity. However, 5% of respondents said they do not reduce amount of food eaten. We equally found in a Focus Group Discussion (FDG) with women that coping strategies could vary depending on capacity of individual households and the impact of climate change experienced by the household. The above import may explain why 5% of smallholder women farmers did not reduce amount of food eaten. Also, it was further emphasized that the extended household systems (which promotes inter-dependence of individual households) allows struggling households to depend on the extended household system to survive in times of climate change. This situation explains why this category of women (5%) have indicated they do not reduce amount of food eaten. This seats well with the findings of Hoddinott and Kinsey (2000) in rural Zimbabwe. They discovered that the 1994-1995 drought had serious implications on women body mass and not men. Daughters-in-law of household's head did not experience the effects of the drought but rather wives and daughters were severely impacted. In their opinion, daughters-in-law may have additional support or resource outside the household; mainly remittance income that helped to reduce the impact of the drought.

Seed is vital to the livelihoods of farming communities. Essentially, seed is the source of natural potential of biological species and their varieties resulting from the continual improvement and selection process over time. There is potential benefit from use of quality seed of diverse range of crop varieties by farmers. This is common knowledge to farmers as it increases food security through improved crop productivity (FAO, 2009). Unfortunately, the study noticed a worrying situation of 84% of respondents consuming their seed stock as a strategy to cope with climate change impacts. Consuming seed stock could present undesirable consequences on crop production as noted by the FAO. Highlights from a FGDs seem to confirm this assertion; where respondents said that often they are compelled to use rather poor-quality seeds for crop production (after consuming seed stock) often characterized by pest and diseases infestations thus contributing to crop failure. The use of quality seed, fertilizer, and right amount of moisture present in the soil could increase crop yields. Agrawal estimate that, holding other things constant, the use of quality seed of high yielding varieties increases crop yield by 15-20% (Agrawal, 2011). We found as little as 16% of respondent's indicating that they have did not consume seed stock during climate change effects. Perhaps the 16% of respondents has enough seed stocked for future cultivation or did not harvest enough and thus could not keep seed for future cultivation.

There exists enough literature highlighting migration as a strategy to coping with climate change impacts in some agrarian societies. However, this study found majority (representing 78%) who averred that migration was not a coping strategy to climate change impacts. It was further clarified in a focus group discussion that the 78% of respondents did not migrate because of their marital responsibilities and most importantly because of their role as primary care givers to children. It was emphasized that migrating in their view would bring difficulties upon that specific household. This finding seat very well with the findings of Agwu and Okhimambe (2009); where they found in Nigeria that during flood periods and the dry season, the interim migration of men to urban areas result in women being left alone taking care of the household. Women play a pivotal role in traditional household setting where they are responsible for almost every household need including providing for their husband's needs. As a result, migrating in times of climate change could be dire for the entire households especially vulnerable children. On the contrary, 22% chose migration as a coping strategy during climate change. In a focus group discussion, the study found that this 22% were respondents who perhaps are not married or married to men who have second wives,

making it easy for them to migrate. It is important to point out that women who migrate would require their husband's permission to do so. The study similarly established from this 22% of respondents that migration becomes an option when they experience low harvest from previous cultivation. According to respondent's migration was often in search of alternative livelihoods in southern Ghana so they can remit to family. The remittances according to them are used for basic needs such as food, clothing, and payment of school fees. Women however return home during farming.

Another coping strategy to climate change for smallholder women farmers in the study area is the sale of firewood. Overwhelming 89% said they engage in the sale of firewood as an alternative to adjust to the effects of the changing climate. This act which constitutes an environmental problem could have serious implications on the natural environment and further exacerbate women situation as being vulnerable to climate change impacts. Perhaps this explains why northern region is considered the most vulnerable to climate change impacts. It is because of activities such as tree felling for charcoal processing that contribute to maximizing effects of climate change; and making it difficult for families and households to cope. Natural resources like trees could serve as carbon sink and windbreaks during windstorm (which is an effect of climate change). Windstorm could damage food crops of smallholder women farmers leading to reduced crop yields. The absence of trees to protect crops and facilitate crop production can jeopardize smallholder women farmer's efforts to cope with climate change impacts, especially on agriculture. As low as 11% indicated they did not engage in sale of firewood because it has on the natural environment-a learning they have acquired from non-governmental organization operating in the study area.



Source: Field Survey (2019)

Figure 2: Coping strategies of smallholder women farmers during climate change effects.

Cause of perceived climate change effects; perspectives of smallholder women farmers

The study needed to establish the views of respondents about what could have caused the perceived changes observed. As such three parameters were proposed by the study to determine these phenomena. The parameters were climate variability/change, limited access to weather information and limited access to capacity building opportunities. The study is confident that either of the three parameters can influence the situation of respondents positively and negatively. Researchers in the field of climate change have demonstrated sufficiently how climate change affects vulnerable populations including women and girls, especially in Africa.

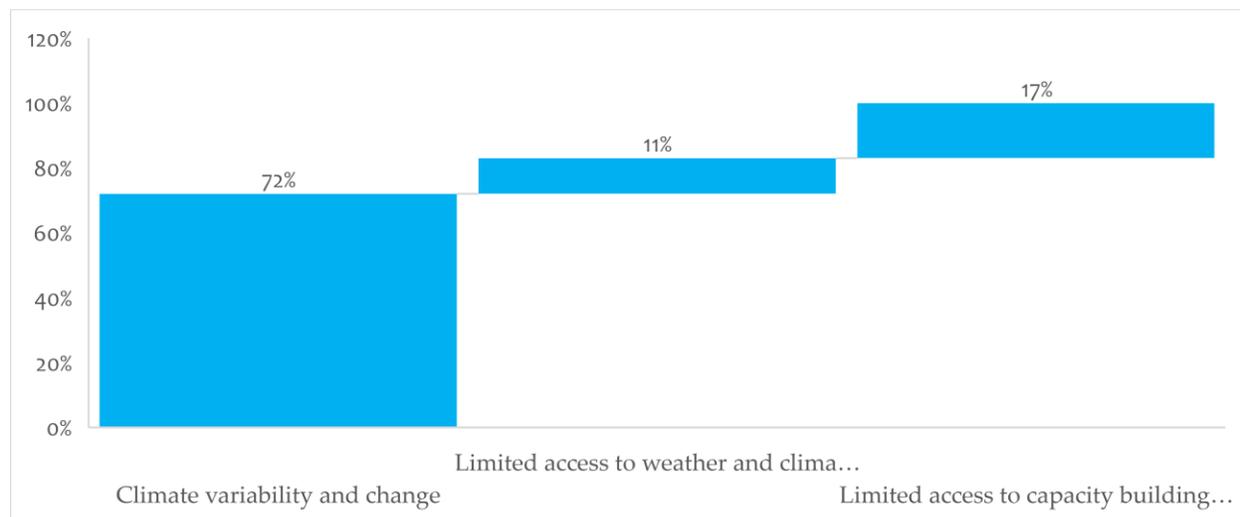
Table 3: Reasons assigned to the changes observed by smallholder women farmers

Responses	Percent
Climate variability and change	72%
Limited access to weather and climate information	11%
Limited access to capacity building opportunities	17%

Source: Field Survey (2019)

Women smallholder farmers may be right when majority of them pointed to climate change and variability as a cause to the perceived changes observed. Majority of

respondents representing 72% alleged that climate change/variability is the cause of the changes observed in their agricultural livelihoods. Although this assertion has not been scientifically proven, the study is of the view that juxtaposing the perspectives of respondents to available science and literature on climate change and variability, women may be right. Verna (2011) agrees with this finding as he state that climate change impacts (negative) has become increasingly evident, both long term changes in average temperature and rainfall. Climate change impacts according to Nelson et. al, (2010) will have serious impacts on agricultural livelihoods and biodiversity. The frequent occurrence of increased temperatures, drought, and erratic rainfall according to women has reduced productivity, increased crop pest and diseases and reduced household food availability. Seventeen (17%) were of the view that limited access to weather and climate information has contributed to the changes observed in their livelihoods over the last decade. Access to weather and climate information is critical to enhancing adaptation of smallholder farmers as well as increasing agriculture productivity. Consequently, limited access to weather and climate information would seriously affect activities of smallholder women farmers capacity to adapt to change and crop yields. Capacity building or training opportunities could empowerment smallholder farmers to improve their production and adapt to climate change. Nelson et. al (2010) agrees with this statement when he said that the marginalized, vulnerable and the poor in developing countries have the least capacity plan or prepare towards the impacts of the changing climate due to their limited resources. However, 11% of the respondents indicated that the observed changes in their livelihood activities may have been cause by limited access to capacity building opportunities or training. Our study equally found how useful training opportunities has helped some smallholder women farmers to improve upon their farming activities.



Source: Field Survey (2019)

Figure 3: Perceived cause of the changes observed by smallholder women farmers

CONCLUSIONS AND POLICY RECOMMENDATIONS

The study was conducted to assess the coping strategies of smallholder women farmers to climate change in the Kpachelo community in the northern region of Ghana. It further examined the extent to which climate change affect smallholder women farmers and their agriculture livelihoods. The study concludes that sale of firewood, sale of livestock, consumption of seed stock, reduce amount of food eaten, eating of fewer meals and search for work outside of the study location constitute coping strategies of women smallholder farmers in the Kpachelo community of northern region of Ghana. Furthermore, crop yields, crop type or varieties, crop pests and diseases, rainfall, household food availability and farm income are the changes observed by respondents during climate change impact on smallholder women farmers livelihood. The study recommends the support of government and non-governmental organizations to institutionalize, re-equip and strengthen district level agricultural extension offices to address sources of gender- issues on climate change.

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