

# Farmers Perception Of Climate Change And Adaptation Of Indigenous Strategies In The Savanna Ecology Of Ghana

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**Abstract**— Climate change is increasingly becoming the major issue of concern when discussing various measures to address food security problems. This paper highlights existing knowledge of crop farmers, who depend heavily on agriculture for their livelihood, on the causes, indicators and adaptation strategies employed to sustain their livelihoods in the drought dominant savanna regions of Ghana. Three districts viz. Jirapa, Lawra-Nandom and Wa Municipality of the Upper West Region were selected for the study. Two hundred and forty farmers comprising 30 farmers each from 8 communities were interviewed in the study using semi-structured questionnaires. About sixty six percent of farmers (66.3%) were males while 33.8% were females. Majority of the farmers (86.7%) were aged between 20 years and 59 years. In addition 64.2% of farmers were educated whereas 35.8% were without formal education. Crops cultivated included: maize (37.5%), groundnut (25.4%), yam (10.4%), millet (8.33%), cowpea (5.42%), sorghum (5.0%), bambara beans (4.17%) and rice (3.75%). All farmers defined climate change differently but the general indicators stated included; high temperature (27.5%), changes in rainfall pattern (19.6%), low crop yields (18.8%), low humidity and sunshine (9.17%), spread of diseases (9.17%), changes in dry and wet seasons (8.33%), drying of leaves (3.75%) and sound of some birds (3.75%). Almost all farmers (96.7%) identified human activities (deforestation, bush burning, exhaust from vehicles, continuous cropping and bush burning) as the main causes of climate change. Attempts by farmers to adapt to the changing climate include; use of early maturing crop varieties (43.8%), supplementary irrigation (21.3%), use of organic manure (17.9%), studying the rainfall pattern to reduce crop losses (13.3%) and use of zero tillage (3.75%). The study confirmed concerted efforts by farmers to sustain livelihoods in the face of climate change through the deployment of low input techniques

**Keywords**— *climate change, adaptation, resilience, indicators, strategies*

## I. INTRODUCTION

Climate is an essential factor that has direct effects on all aspects of life and particularly, the impact on agricultural production are extremely unequivocal [1-4]. More so as scientific evidence becomes more convincing that increasing greenhouse emission will warm the planet [5], it has become ever more important to understand the impacts of global warming factors [6]. To this end, documented evidence show that the impacts of climate change are significant, based on a wide anticipation that between 5 million and 170 million additional people will be at risk of hunger by 2080 [7]. For that matter, the relationship between climate change and agriculture sector has continually been a major issue of discussion among various stakeholders to address food security problems. Additionally, there are different dimensions to climate change: environmental, social and economic [8]. Experts emphasize that to understand climate change, it is important to distinguish between the occurrences of weather events over long period and how the weather parameters (including temperature, precipitation) affect the aforementioned factors. Climate change can be largely attributed to increases in the concentration of greenhouse gases in the atmosphere [5] that trap in-coming solar radiation and thus warm the surface of the earth.

Globally, the increased effect of climate change on the agricultural sector remain the central point of discussion since the sector contributes to global climate change as well as can be affected by the changing climate [3]. Although the impacts will differ globally, the impacts of climate change on agriculture production are both positive as well as negative [3, 9]. Without doubt, agriculture sector rely strongly on favourable environmental conditions. Perhaps, farmers engaged in subsistence agriculture are those at the greatest risks to climate change impacts due to the following reasons (i) lack of capacity to exert influence and respond to alternations in their local environment, (ii) dependence on small land holdings that make them unable to withstand crop losses. The common occurrence of these scenarios in developing countries, position subsistence farmers not only as those at the greatest risk to climate change, but those who have the lowest means available to adjust to environmental change. The main factors that affect crop production are the same as those influencing

natural vegetation which include solar radiation, temperature and moisture.

Developing countries are more vulnerable to climate change due to the fact that majority of the populations rely on agricultural sector and furthermore lacks technical and financial capability to respond to increased variability [2, 10-12]. Additionally, the agricultural sector is not only vulnerable to climate change but also faces the problems of low returns from agricultural exports in developing countries.

Ghana is one of the developing countries with rich ethnic diversity and has varied geographical setting, where agriculture has plays essential role in maintaining status. Recent floods in Ghana has been devastating on the people of the three Northern Savannah Regions (Upper West, Upper Eats and Northern) affecting human life and other natural resources. Despite the improvement in poverty reduction and economic stability, poverty remains predominantly critical with the highest disparity in these three Northern Savannah Regions as confirmed by the Ghana Human Poverty Index in 2002/2003. Approximately, 60% of those engaged in economic activity fall below the poverty line, with the majority of the poor being women. Additionally, the Ghanaian economy is largely agrarian providing employment for over 60% of the population. According to Barber, et al. [13] the most at risk of climate change is this category of the population especially are women, children, youth who have very low education, often malnourished and as well as farmers with low technological know-how.

A confirmation in literature has indicated diverse and mix views about the causes and indicators of climate change across and within communities in Africa, despite the evidence of a general awareness. Presumably, at the local level it is considered that a wide range of indicators of climate change for predicting wet and drought seasons are preminent. In some instances, some farmers believe that cold winters indicate a drought, while hot summers signify good rains and also specific environmental changes. It is also evident that perceptions of climate change go complementary with adoption to climate change. Mendelsohn and Dinar [14] identified three broad strategies to reduce the impact of climate change on agricultural productivity. These include agronomic, agro-economic and the Ricardian modeling. The perspectives of the indigenous people, the way they think and behave in relation climate change, as well as their values and aspirations have a significant role to play in coping strategies of climate change [15]. Though scientific research make efforts towards identifiable indicators of and adaptation to climate change, some of the responses from the indigenous folks bring on-board sustainable mechanisms. These information may be based on traditional believes and customs that may be incorporated into mechanisms, which becomes useful to all stakeholders especially where collaboration between Research and indigenous knowledge is proactive [16].

The present study investigated farmers understanding on causes, indicators and perception of climate change and the attempts towards adaptation in four Districts of the Upper West region of Ghana. The documentation of such information would not only be useful for research but integrated into national policies directed towards issues and adaptation/coping measures.

## II. METHODOLOGY

**Study area:** The Upper West Region located at the North-Western corner of the country. It lies between longitudes 1°25'W and 2°50'W, and between latitudes 9°35'N. It has a total population of 576, 583 and this represents 3% of the national population. The region is geologically part of the high plains that cover most of the North-Western part of Ghana. The Upper West Region covers a geographical area of approximately 18, 478 square kilometers. This constitutes about 12.7 % of the total land area of Ghana. The region is bordered on the North by the Republic of Burkina Faso, on the East by Upper East Region, on the South by Northern Region and on the West by Cote d'Ivoire. The major ethnic groups are the Dagaba, Sisaala and Wala.

The Upper West Region has a unimodal rainfall between May and October, with the highest annual rainfall between 1000-1250mm. It also has mean monthly temperature ranges between 22.4°C and 34.5 °C with humidity of 65% and 30% during the wet and dry seasons respectively (Ghana Metrological Service Department). The vegetation is the guinea savanna woodland characterized by short trees and growing pasture. The common woody species found in the area include *Vitellaria paradoxa*, *Parkia biglobosa*, *Azalia africana*, *Pterocarpus spp*, *Tamarindus indica*, *Anogeissus leiocarpus*, *Diospyros mesopiliiformis*, *Adansonia digitata*, *Khaya senegalensis*, *Azandirata indica*, *Acaccia spp*. the tree are interspersed with ground flora of mainly grasses. The common grass species are *Adropogon gayanus*, *Pennistum spp*, *Iperata cylindrical* and *Loudetia togotensis*. Basically, the soil is lateritic developed from underlying birimian rock. The soil is coarse and dark in colour. Locations that have patches of stable vegetation have top soil usually compose of sandy-loam.

**Data collection and analysis:** The study was conducted in four Districts (Jirapa, Wa, Nadwoli and Lawra) of the Upper West Region. A total of 8 communities were selected for the study with 2 communities from each district. The communities selected are Bamahu, Busa, Kaleo, Nadwoli, Jirapa, Han, Nandom and Brutu. Thirty respondents were randomly selected in each community and a total of 240 farmers were interview using a semi-structured questionnaire. Group discussions were also conducted to validate the information from personal interviews.

## III. RESULTS AND DISCUSSION

In order to improve its adaptive capabilities of

farmers in Northern Ghana we must first examine their perception on likely impacts based on their observation of possible indicators of climate change. For the purposes of sustainability, adaptation to climate change requires that farmers using traditional techniques of agricultural production first notice that the climate has altered. Farmers then need to identify potentially useful adaptations and implement them.

This paper attempts to verify state of these issues among selected farmers. According to the results of the study, 66.25% and 33.75% were males and females respectively were reached. Their age distribution was as follows: 43.3% were between 40-59 years, 43.3% (20-39 years), 9.58% (60-79 years) and the least 3.75% were 70 years and above. Majority (35.8%) of the respondents had no formal education, primary education (16.3%), Secondary level (15.8%), middle school leaving certificate (15%), Junior high school (12.5%), and only 4.58% had obtained tertiary education.

Crop cultivated by respondents include: maize (37.5%), groundnut (25.4%), yam (10.4%), millet (8.33%), cowpea (5.42%), sorghum (5.0%), Bambara beans (4.17) and rice (3.75%). The choice of maize as the major crop is as a result of it being the main staple food crop for households throughout the year, which also confirm the continuous dependence on fertilizers to improve yields [17]. The other crops except rice do not require fertilizers although that could as well maximize yields. Cowpea and Bambara beans are nitrogen fixing crops [18] but are less grown for food and not for green manuring.

All (100%) respondents expressed positive understanding of climate change and defined it as changes in the weather condition (73.8%) and environment over time (26.3%). They were able to relate climate change to abnormalities in the weather and environmental conditions over a period of time and the following indicators were mentioned; high temperature (27.5%), changes in rainfall pattern (19.6%), low crop yields (18.8%), low humidity and more sunshine days (9.17%), spread of diseases (9.17%), changes in dry and wet seasons (8.33%), drying of leaves (3.75%) and sound of some birds (3.75%). According to Reidsma, et al. [19] the designing of innovative farming systems are also found to be good indicators of adaptive capacity to climate change. Significant proportion (96.7%) of farmers identified human activities (deforestation, bush burning, burning fumes from vehicles, continuous cropping and bush burning) as the main cause of climate change. Largely however, increasing number of hot days in the growing season contribute to decrease in crop yield [20, 21].

Attempts by farmers to adapt to the changing global climate include the following: use of early maturing crop varieties (43.8%) confirming a report by Ishaya and Abaje [17], supplementary irrigation (21.3%), use of organic manure (17.9%), studying the rainfall pattern to reduce crop losses (13.3%) and use of zero tillage (3.75%). The results clearly confirm concerted efforts

by farmers to deploy low input techniques to cope with the changing global climate. Farmers adopt soil and water management/ conservation techniques to improve yields. These techniques include the use bucket-kit-irrigation to deliver water to vegetable crops during the dry season, straw mulching, use of Farm yard manure (FYM), composted organic materials and extract from *Azadirata indica* to control crop pests. Most of the

#### IV. CONCLUSION

Findings of the study show that farmers recognize the changes in climate over the years and they attributed the incidence to human behaviors particularly inappropriate agriculture practices, which precisely lie within their domain. Appreciating the effect of climate change, some farmers are making various efforts, which also lead to low cost of inputs. The results from this study show that farmers are interested and willing to participate in issues related to mitigating climate change, which also emphasizes the need for continuous education on natural environmental conservation and necessarily resource to achieve the objectives of combating and/or coping with climate change.

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