

Comparing Farmers' Perception of Climate Change and Adaptation Strategies in the Transition and Savannah Zones of Ghana

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Abstract

The perceptions of agrarian communities about climate change; and its effect on their livelihoods in the face of multiple socioeconomic stressors has been widely studied. Using lenses like gender and intersectionality, and feminist political ecology, it has become apparent that several social locations intersect to shape peoples' vulnerability and adaptive capacity to climate change. In the face of limited resources, priority areas for building adaptive capacity must be identified. By comparing the ranking of livelihood challenges of communities in the transition zone (where rainfall has been relatively favourable in the past) and the savannah zone (where arid conditions have shaped the very culture of the people) of Ghana, this study reveals that, the historical climatic conditions of a place is a relevant determinant of the importance people attach to climate change, their vulnerability, and their capacity to adapt to it. Areas that have been historically arid have relatively less concern but superior adaptive capacity for climate change while communities that are used to relatively more precipitation have more concern but inadequate adaptive capacity for climate change. It is proposed that this phenomenon is appealed to in prioritizing where limited resources to boost adaptive capacity are directed. The paper highlights the importance of using extension workers to break adaptation knowledge transfer barriers, and also the importance of including possible adaptation techniques when building models that predict the effects of climate change on the growth of crops.

Keywords

Adaptation - Climate change - Gender - Intersectionality - Livelihoods

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1. Introduction

Rural agrarian communities are faced with several socioeconomic and political challenges that militate against the sustainable development of their livelihood activities and improvement in their well-being in general [1, 2, 3]. One of the major reasons for this inertia in sustainable livelihood development is that such communities form a major part of the primary production base of national economies and are directly dependent on natural resources, which themselves are dependent and subject to atmospheric and climatic disturbances. As a result, though the livelihoods of agrarian communities are stressed by multiple socioeconomic and political factors, it is usually construed that environmental challenges such as climate change and variability will be their most important and overarching concern [4, 5, and 6].

A large number of studies have therefore examined and predicted the effects of climate change on agrarian communities and their livelihoods [5, 7, 8, 9, 10, 11, and 12]. A few others have gone further to investigate the local dynamics of how climate change and variability will have differentiated effects on certain groups or categories of

people, and how this should be addressed in adaptation policy formulation and implementation [13, 14]. Gender is perhaps the single most studied issue as far as differentiated effects of climate change are concerned. Several studies have shown that due to gendered roles shaped mainly by culture, women are, and will continue to be disproportionately affected [15, 16, 17, 18, and 19]. Other studies that have examined this issue from intersectionality lens have evidently demonstrated that vulnerability is not shaped by the gender dichotomy only, but that gender intersects with other social identities such as age, class, and ethnicity to create more differentiated levels of vulnerability [20, 21, 22, and 23].

In the past, agricultural research that focused on issues like land tenure, access to credits facilities, marketing, and infrastructural challenges address them as though they were independent of climatic conditions. However, since climate change became the central agenda of environmental discourses over two decades ago, all these erstwhile climate independent agricultural challenges have been observed to have climate change connotations. This is because climate change and variability are seen as a security issue that threatens not only the natural and human capital, but also the already constrained social, physical and financial capitals of most agrarian communities [24, 25, 26, and 27]. In that line, other authors [28, 29, and 30] have studied the perceptions of local agrarian communities about climate change (in terms of whether they sense changes in their local climatic conditions) and investigated the coping or adaptation strategies in their livelihood activities as a response. The underlying thought in such studies is that climate change is an important concern for agrarian communities because of its predicted effect on the natural resources which they depend on.

That notwithstanding, a recent work that studied the relative importance of climate change in the context of multiple stressors in semi-arid Ghana found that even though climate data demonstrates that the climatic conditions there have changed and that farmers' local perceptions confirm it, many of the farmers do not worry about climate change [13]. Rather, their major concerns are about non-climatic factors. That indicates that in the Ghanaian context, the study of agrarian communities' perception of climate change should go beyond "sensory perception"- that is whether they see, hear or are aware of climate change [31, 1, 32], to a "contextual perception," that is, how they regard it in the face of other pressing socioeconomic needs. With regards to the latter, one question remains unanswered. That is, how do agrarian communities in different agro-ecological zones regard or contextualize climate change, given that the political ecology does not selectively favour any zone? The use of agro-ecological zones as a grouping variable

infers that there is a hypothesized underlying combined effect of rainfall history, temperature, soil and vegetation types, and planting history on the agrarian communities' contextual perception of climate change.

The main objective of this study is to compare the ranking of livelihood challenges of five agrarian communities: three in the transition zone of Ghana (this issue) and two in the semi-arid zone (i.e. Savannah) as presented by [13]. Using historical climatic data, history of farming practices and methods, a ranking of livelihood challenges, we analyzed the differences in perceptions of climate change and adaptation strategies across the two zones.

2. Methodology

2.1 Livelihood Challenges Ranking in the Transition Zone of Ghana

Three communities (i.e. Anyima, Nante, Krabonso) fringing the Bosomoa Forest Reserve, in the Kintampo South District, located in the Brong-Ahafo Region of Ghana (Fig. 1), were selected for this study. Key characteristics of these communities are presented in Table 1. The fieldwork was done between June and July 2015. In each community, focus group discussions were held with farmers to determine, inter alia, their livelihood challenges. First, through general invitation, a large group of individual farmers were brought together in a plenary discussion to list the key challenges that they face in their agricultural activities.

Each of them were then asked to give their perception on how much loss (in terms of standard measuring units of the produce from the predominate crop) the challenge they ranked 1 brought to them (i.e. normal yield under all favourable conditions (Y_n) - (Y_p) number of units harvested due to the challenged ranked 1). Data collected on livelihood challenge ranking was analysed across gender and generational groups (young and elderly) using the Scale Value Based Quotient (SBQ) [33]. The final rank of a particular challenge was calculated as:

$$SBQ = \left\{ \sum_{i=1}^n f_i \frac{n+1-i}{(N)(n)} \right\} (100)$$

Where, f_i = number of farmers reporting the particular scale value of a particular challenge (i.e. frequency of the i th scale value of the problem), N = total number of farmers, and n = the maximum scale value number (i.e. 5).

The adaptation measures that have been adopted by farmers for all types of crops were also identified and discussed during the plenary session.

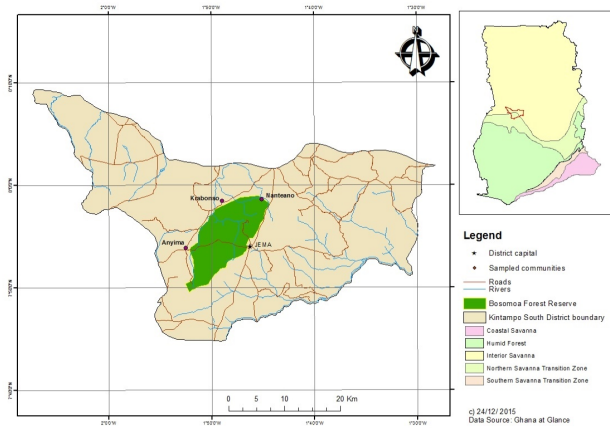


Figure 1. Map showing survey communities in the Kintampo South District, in the transition zone of Ghana. Source: author.

2.2 Livelihood Challenges Ranking in the Semi-arid Zone of Ghana

In 2012, Nyantakyi-Frimpong and Bezner-Kerr (2015) conducted a livelihood assessment study in two farming communities (Hemang and Jongorro) in the Upper West Region of Ghana which lies in the semi-arid ecological zone. Key characteristics of these communities are presented in Table 1. We present a brief summary of their methodology and results to provide a basis for the contrast with our study. Permission has been obtained from their publisher for their figures used.

By adopting a feminist political ecology framework, the study sought to determine, inter alia, how important climate change is to smallholder rural farmers, as compared to other factors, and how this differs by age, gender and kinship relations. The study surveyed 404 households which represented about 41% of all the households in the two villages for background information on household characteristics and other demographics. This was followed by 8 focus group discussions which involved a total of 75 participants from both villages. This was held with young men (9 in Hemang and 10 in Jongorro), young women (11 in Hemang and 10 in Jongorro), elderly men (10 in Hemang and 8 in Jongorro) and elderly women (8 in Hemang and 9 in Jongorro). During this focus group discussion, participants in each group were first asked to list the challenges facing their livelihood activities. Secondly, they were asked to rank the listed challenges in order of importance, and thirdly, to use different sizes of stones to depict how serious those challenges were to them.

Table 1. Key characteristics of study villages in the transitional and Semi-arid zone of Ghana.

Study village	Anyima, Nante, Krabonso	Hemang	Jongorro
District	Kintampo South District	Lawra District	Nadowli District
Zone	Transitional	Semi-arid	Semi-arid
Elevation	60-150 m	294m	262m
Population	4835/3175/2935	4041	494
Farming season period	~5months (Apr-Aug)	~5months (Apr-Aug)	~5months (Apr-Aug)
Mean annual rainfall	1400 mm-1800 mm	941 mm	Data not available
Timing of rainfall	Start: March/April End: August/September	Start: March/April End: August/September	Start: March/April End August/September

3. Results

3.1 Contextualized perception of climate change in the Transitional zone of Ghana

It can be observed from Tables 2, 3 and 4 that erratic rainfall (short duration of rain, unpredictable rainfall and delayed onset of rainfall) is the major issue of concern for all the three farming communities surveyed, irrespective of crop cultivated. This finding is further validated by the estimates that respondents made on the losses that erratic rainfall causes. Using erratic rainfall as the proxy for climate change, an average of about 40% of losses (across all crops) were attributed to climate change.

Table 2. Frequency of scale values assigned by farmers (n = 10) – Anyima. DCC = maize.

No.	Issues/ Problem	Scale Values					SBQ %
		1	2	3	4	5	
1	Pest/Diseases Infestation	-	2	2	1	3	38 ³
2	*Erratic Rainfall	9	-	1	-	-	96 ¹
3	Bush/Wild fires	-	-	2	-	1	14
4	Financial challenges	-	4	2	2	-	28
5	High Cost of farming inputs(fertilizer, agro-chemicals)	1	4	2	2	-	62 ²
6	Labour Issues	-	-	-	5	-	20
7	Poor extension services	-	-	1	-	6	18
8	Lack of farm implements/tools	-	-	-	-	-	-

DCC = Dominant crop cultivated. *causes an average of 42.2% loss in farm produce on an average farm size of 1.5 acres.

Table 3. Frequency of scale values assigned by farmers (n = 10) – Krabonso. DCC = Ginger.

No.	Issues/ Problem	Scale Values					SBQ %
		1	2	3	4	5	
1	Inadequate farmland for large-scale production	2	4	-	-	2	56 ³
2	Financial challenges	4	-	3	2	-	66 ²
3	Crop pests/diseases	-	-	-	1	-	4
4	High prices of tools	-	-	1	2	4	22
5	*Erratic rainfall	4	3	2	1	-	80 ¹
6	High prices of farm inputs/agro-chemicals	-	3	4	2	-	56 ³
7	Lack of buyers for farm products	-	-	-	-	2	4
8	Consumer price determination	-	-	-	2	2	12

DCC = dominant crop cultivated. *causes an average of 43.0% loss in farm produce on an average farm size of 1.1 acres.

Challenges relating to financing (access to credit facilities and high cost of inputs) was consistently ranked as

Table 4. Frequency of scale values assigned by farmers (n = 10) – Nante. DCC = Yam.

No.	Issues/ Problem	Scale Values					SBQ %
		1	2	3	4	5	
1	Erratic rainfall	7	2	1	-	-	881
2	Lack of buyers for produce / Market	-	-	-	3	1	14
3	Loss of soil fertility	-	2	1	-	2	26
4	Financial challenges	3	3	-	-	2	582
5	Consumer price determination	-	2	-	4	1	343
6	Bush/wild fires	-	-	2	-	1	18
7	Pest and disease infestation	-	-	3	3	1	32
8	Stubborn weeds	-	-	2	-	1	26
9	Lack of labour	-	1	1	-	1	18

DCC = Dominant crop cultivated. *causes an average of 33.5% loss. Data on farm sizes is missing.

the second most important challenges for all three communities. Perhaps, it would have gained the first position thirty years earlier. Though economic conditions have generally worsened at best remain the same, it is interesting that finance-related challenges have now gained second place. The conscious and consistent placement of climate change challenge above financial challenges for all three communities demonstrates an active contextualization of climate change as the topmost issue of concern, and a critical limiting factor affecting the lives of households in the transition zone.

3.2 Contextualized perception of climate change in the Semi-arid zone of Ghana

From Figure 2 and 3, it is clear that farmers in the semi-arid parts of Ghana are more concerned about other socioeconomic and cultural challenges rather than climatic change related issues. Three key issues can be seen from Fig 2 and 3 which are relevant to the argument we seek to make. First, it is noteworthy that drought conditions and flooding are of low importance to both young and elderly women as compared to issues like access to granaries, land appropriation by large multinational companies, and labour availability. Secondly, and on the contrary, drought conditions and flooding are of high importance to both young and elderly men which make a supporting case for shifting from the conventional women focused approach to “climate change and gender” studies, to the intersectionality paradigm (Osborne, 2015; Hankivsky, 2014). Thirdly, Fig. 3 shows that, overall, climate change and variability challenges are of low importance to farmers in the semi-arid regions.

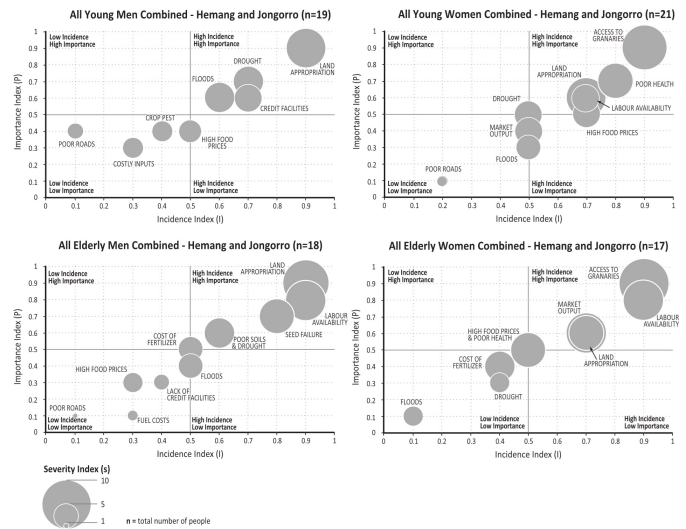


Figure 2. Participatory ranking and scoring of livelihood challenges by farmers in Hemang and Jongorro in the Upper West Region of Ghana: results by gender and age (Nyantakyi-Frimpong and Bezner-Kerr, 2015).

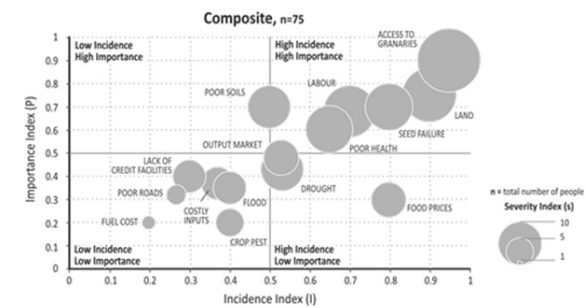


Figure 3. Participatory ranking and scoring of livelihood challenges by farmers in Hemang and Jongorro in the Upper West Region of Ghana: Composite results age (Nyantakyi-Frimpong and Bezner-Kerr, 2015).

3.3 Adaptation methods in the transition and semi-arid zones

As part of the elements embedded in agro-ecological zones, the study also sought to compare the farming methods and/or adaptation strategies used in the two zones. In terms of adaptation measures, it was clear that farmers in the transitional zone had a limited number of adaptation strategies for erratic rainfall conditions (low rainfall, droughts and high temperatures), given that the commonest method used in all the three communities is mulching (which is not an adaptation strategy per se, but a cultural practice) and irrigation (Table 5), which is rather expensive for farmers who mostly ranked financial challenges as the second most important challenge (Tables 2, 3 and 4), can be very labour intensive, and ultimately subject to erratic rainfall. Besides, mulching and irrigation, their only alternative is to change to vegetable cultivation.

Table 5. Adaptation strategies adopted by farmers in the transition zone

Challenge	Adaptation strategies
1 Low rainfall	Anyima (DCC = Maize) Cultivation of vegetables. Irrigation.
2 Drought	Krabonso (DCC = Ginger) Cultivation of vegetables. Irrigation. Zero tillage. Boundary clearing.
3 High temperatures	Nante (DCC = Yam) Cultivation of vegetables. Irrigation.
4 Strong winds	Farming near water bodies
5 Disease/pests	Mulching. Staking. Spreading of ash.

However, in the semi-arid zone, it was reported of four widely used adaptation measures viz: crop sequencing and biological pest control; tied and round ridging; Zai planting pits and trash lines; and application of manure and composting. These are more robust adaptation technologies that can effectively cushion production against low rainfall and drought conditions as compared to those used by farmers in the transition zone [13].

4. Discussion

There is usually the tendency to intuitively think that farmers, especially women farmers in the arid and semi-arid regions are the most vulnerable to climate change, due to expected conditions of severe drought and dry spells, and so must be given priority in allocating limited resources for supporting adaptation. Comparing the findings from both studies, it has become quite apparent, as noted by one respondent in Semi-arid zone that, drought and dry spells have been a normal part of the lives of farmers in the arid regions, and “it [climate] has been like this ever since.” These “normal” climatic conditions have shaped their lives, livelihood and very culture; they are well adapted to them, and climatic extremes are not major worries for them in the face of other socioeconomic stressors. Another study in the arid rural Sahel revealed that adaptation to climatic extremes is a traditional thing, and that, “change in land use and livelihood strategies is driven by adaptation to a range of factors of which climate appears not to be the most important” [25].

On the other hand, unlike farmers in the arid and semi-arid zone, farmers in the transition zone are used to relatively higher mean annual rainfall through the planting season period and the timing of rainfall have been the same for both zones in the past (Table 1). Popular adaptation methods in the semi-arid zone, like tied and round ridging; Zai planting pits and trash lines; and composting were completely absent in the study communities in the transition zone (Table 4). It is apparent that farmers in the transition zone have relatively fewer and less robust adaptation technologies and so is much distressed by climate change, and ill-prepared to handle its constraints on their livelihoods. A similar study in another historical rain favoured district in the Ashanti region of Ghana revealed that more than 55% of the respondents had no active adoption methods for increased temperature and reduced precipitation [32]. With up to about 40% of all types of crop produced being lost, as a result, it is no more an issue of adaptation challenge for a few groups of farmers, but an issue that threatens food security for the whole nation, and must be taken seriously. Knowledge and technology transfer is thus advocated for. Just as some farmers in the semi-arid zone learnt about Zai planting from neighbouring farmers in Burkina Faso [13] the distance and knowledge gap between the two

zones can and should be bridged, as a matter of urgency, by extension workers.

Our findings question some of the sweeping statements and recommendations made by analysts of climate change-related risks to “African” agriculture. For example, the authors assert that, coming warmer climates in tropical Africa will cause a decrease in production of most crops, and that “cropping systems will have to change”[34,35]. We note that first, such climate models usually do not include the various adaptation strategies by which food crops can be grown to maintain productivity even in limiting conditions. In addition, obviously, not all cropping systems need to necessarily change. On the contrary, some cropping methods as identified in semi-arid Ghana, which is more robust and effective adaptation strategies need to be perpetuated. In another study by which was based on “a large-scale survey of agriculturalists in 11 African countries (including Ghana),” the author noted that, out of about 9500 farmers surveyed, “few, if any, farmers mentioned lack of appropriate seed, security of tenure, or market accessibility as problems”[31]. Such assertions are misleading as they grossly overlook mediating inter and intra country-specific peculiarities, giving a false general impression about the needs of rural “African farmers”. For example, such challenges as claimed by the author [31] to be rarely mentioned by African farmers were mentioned by most respondents in this study, and in other local Ghanaian studies [13, 25, 32]. More policy-relevant insights will be gained when such studies are situated and discussed within subnational and national contexts.

Finally, we recommend that subsequent modelling of the regional effects of climate change and variability on various food crops in the study region should incorporate the range of prevalent, available or possible adaptation strategies and their relative robustness [9]. This also calls for research that compares the quantitative and qualitative effects of various adaptation methods for the same types of crops within and across ecological zones.

Unlike the authors [13] who situated and analysed their findings in the peculiar cultural and political economic context of their study area, our study and analysis took an apolitical approach. Notwithstanding, given that there are cultural (e.g. gender inequalities) and socioeconomic challenges everywhere, and that the political ecology across the country does not selectively favour any region or group of people, we hold that as a constant underlying factor. Comparing the differences in the place of climate change and variability in the ranking of livelihood challenges of farmers from the two zones, we argue that farmers' perception and adaptive capacity to climate change exhibits hysteresis (input from historical climatic and agro-ecological conditions), and this scenario must be appealed to in identifying priority areas for the pur-

pose of directing scarce resources for improving adaptive capacity.

5. Conclusion

This study compares climate change adaptation strategies for crop farmers in the transition zone to that of Savannah zone of Ghana. Our finding suggests that farmers in the savannah zone have more adaptation strategies and as such, arid conditions are not a priority concern for farmers in the face of other socioeconomic stressors. Knowledge transfer of adaptation strategies between the two zones needs to be catalyzed to improve the resilience of farmers in the transition zone.

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