Perceptions of drought among rural farmers in the Savelugu district in the northern Savannah of Ghana

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Abstract

Drought is one of the most constraining climate extremes to livelihoods particularly in dryland environments. Effective adaptation to drought is partly dependent on farmers' perceptions and how these are harmonised with scientific knowledge systems into local adaptation policies and strategies. This paper examined the perceptions of drought among farmers in five villages in the Savelugu district in northern Ghana using in-depth interviews and focus group discussions. Farmers perceived an increased drought risk over the last twenty to forty years, relating this to the frequency of drought occurrence which is considered to be on the rise. Some farmers perceived a reduction in drought intensity and changes in the time dimension of drought occurrence. In addition, some farmers expected the risk of drought to rise in the near future. These observations are partially consistent with the science of climate change. However, the explanations for these perceptions are largely sought in socio-cultural rather than scientific notions. Thus farmers' responses are not only derived from real experiences and rational explanations of climate experts but also from local non-scientific explanations. The paper therefore argues that effective adaptation to drought rests on the integration of both scientific notions and local perceptions of drought by farmers.

Keywords: Drought, Climate change, Perceptions, Farmers, Adaptation.

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Introduction

Changes in the pattern of drought attributable to climate change have drawn keen attention from climate change scholars and policy makers. Africa, however, has been the centre of attention, as the continent is the most drought-prone, yet much of its population is engaged in rain-fed agriculture (IPCC, 2001, 2007; Stern, 2007; Dalby, 2009; Yaro, 2013). The most immediate impacts of droughts on rural livelihoods are therefore felt in the agricultural sector. Drought exacts heavy and often unbearable consequences on agricultural productivity, with consequences for household and national food security (Devereux, 2000; Reynolds et al., 2007). Not only is the frequency and severity of drought on the rise, but also there is an emergence of near permanent drought conditions in the semi-arid and arid regions of the continent which is a great source of concern (IPCC, 2007), especially for small scale and subsistence farmers, largely located in the rural areas that dominate the agricultural sector (Morten, 2007; Reynolds et al., 2007).

Although African farmers are particularly accustomed to drought, the droughts of the 1970s and 1980s signified a key moment in the history of the continent due to their severity and outrageous defiance of local adaptation and coping strategies (Sen, 1981; Rain, 1999). These droughts resulted in profound economic and political changes and extensive international assistance (Batterbury & Warren, 2001). In the 1990s and 2000s, frequent but less intense droughts have had debilitating consequences on livelihoods on the continent (IPCC, 2007). Changes in the pattern of drought on the continent, coupled with the high dependence on rain-fed agriculture, have therefore led to an emphasis on more effective interventions aimed at increasing rural farmers' capacities to adapt.

Small scale rural farmers in Africa particularly have limited capacities to deal with the effects of climate change, partly due to high levels of poverty (IPCC, 2007; Morten, 2007; Golo & Yaro, 2013). Meanwhile, governments generally lack the resources to assist farmers to build their adaptive capacities (IPCC, 2007; Foresight, 2011). Unfortunately, scarce government resources and international grants dedicated to enabling farmers to deal with structural constraints of their environments and their ramifications, particularly in the second part of the last century, have largely been unsuccessful (Ellis, 2000). This has partly been a result of misapplication of funds due to a lack of clear understanding or total neglect of the 'worlds' or concerns of rural dwellers in favour of scientifically biased and top-down approaches (Chambers, 1983; Ellis, 2000; Byg & Salick, 2009). The perceptions, that is, the recognition and interpretation of environmental phenomena have an immense influence on people's decisions and choices of response (Adger, 1999; Patt & Schröter, 2008; Slegers, 2008; Byg & Salick, 2009). Several studies show that African farmers have the capability of understanding their climate and recognising changes, particularly those concerning rainfall (Eriksen, 2005; Thomas et al., 2007; Mertz et al., 2009). Indeed, studies on farmers' adaptation to environmental change have shown that perceptions of African farmers have guided innovation, choice and use of indigenous adaptation strategies with admirable success most of the time (Davies, 1996). Local perceptions of climate are therefore crucial inputs for adaptation policies (Danielsen et al., 2005; Slegers, 2008; Weber, 2010).

In spite of the value of local perceptions in adaptation to climate variability and change and therefore the need to mainstream these into adaptation policies, the area has attracted little, though growing attention in recent times (Bioversity, 2009; Yaro, 2013). Moreover, most of these studies have specifically focused on the changes in the pattern of climate which support the science of climate change rather than on a general approach which reveals not only perceived changes related to climate change, but also those pertaining to the other aspects of the climate phenomena such as causation which are imperative for adaptation. The mere recognition by farmers of the reality of climate change and the initially broad based explanation they have to offer, as depicted by many climate change studies, may therefore not be sufficient for appropriate policy formulation. Rather, it is the detailed but holistic perceptions of each of the climate parameters that can provide clearer or more precise inputs for policy. This paper examines the perceptions of drought among rural farmers in the Savelugu district of the Northern Region of Ghana. The study area is situated in the northern Savannah agro-ecological zone.

The northern Savannah agro-ecological zone is characterised by high unpredictable rainfall patterns with high incidence of droughts, yet its agriculture, the main source of livelihood, is largely dependent on rainfall (UNDP, 1997; CIDA, 1999; EPA, 2012). As a result, droughts often impact severely on livelihoods in the area (Dietz et al., 2004; Laube et al., 2008; Van de Giesen et al., 2010). The effects of drought on food production in the area are greater than anywhere else in the country (Ministry of Food and Agriculture (MoFA), 2007; EPA 2007, 2012). This spatial difference has generally been attributed to the seasonality of rainfall, intra-seasonal rainfall variability and climate change. The northern Savannah has a uni-modal rainfall regime, thus drought risks are concentrated in a single season instead of in two seasons as in the Transitional agro-ecological zone and the forest zones which cover much of the southern part of the country (Dietz et al., 2004). Intra-seasonal rainfall variability is also more pronounced in the northern Savannah, thereby increasing the risk of drought. According to the Environmental Protection Agency (EPA) of Ghana, rainfall variability in the region is exacerbated by climate change, resulting in a rise in the frequency of droughts (EPA, 2000). Rainfall in northern Ghana has become particularly more unreliable, precipitating several droughts with adverse consequences on livelihoods (Hesselberg & Yaro, 2006; Van der Geest, 2011). Adaptation policies with regard to drought in this region have, however, been insufficient (EPA, 2012; Yaro, 2013). This paper argues that the inclusion of local perceptions in adaptation policies is central to ensuring effective adaptation to drought in the area.

Methodology

The research examined the perceptions of drought among small holder farmers in five villages in the Savelugu district of the Northern Region of Ghana. As shown in figure 1, the study villages include kpalung, Laligu, Tunaayili, Libga and zaazi, all located in the Savelugu district, which was previously part of the Savelugu/Nantong District Assembly. According to the Savelugu/Nantong District Assembly (SNDA) (2010), over ninety percent of the people derive their livelihoods mainly from the agricultural sector, which is largely dependent on

rainfall. Agricultural productivity in the district is therefore highly climate-sensitive, particularly in relation to drought (SNDA, 2010). The district is one of the few in the Savannah classified as highly vulnerable in terms of crop vulnerability to drought (EPA, 2012). This characteristic primarily informed the decision to select the district for this study.

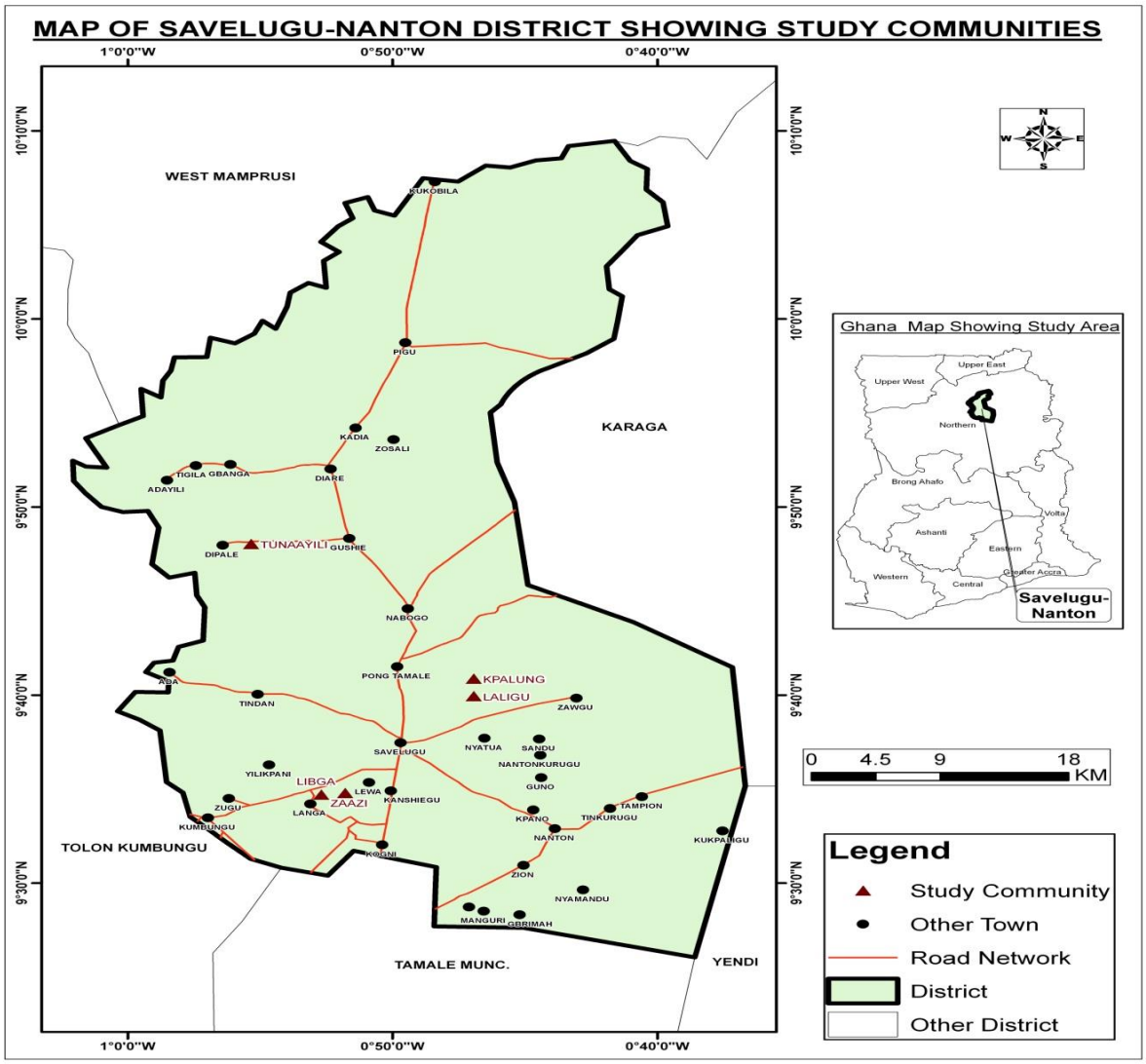

Fig. 1: Map of Study Site

Farmers in the study area have small and fragmented farms and mainly cultivate crops to satisfy their food needs, though they also have dedicated crops for the market. The land size cultivated by households ranges from two to twenty five acres. There is little usage of tractors and combine harvesters, with widespread use of rudimentary tools such as the hoe and the cutlass. Sowing and harvesting are still largely labour intensive. The farmers in the Savelugu district can therefore be referred to as small holder farmers.

The paper used qualitative methods in gathering primary data from 2012 to 2013. Individual in-depth interviews and focus group discussions were used. Twenty five in-depth interviews and five focus group discussions were conducted. Respondents for the individual interviews

consisted of fifteen males and ten females. In each village the *tindana* (custodian of the land) and four elderly farmers were interviewed. The *tindanas* were purposively selected because they are considered to be very knowledgeable about issues concerning climate and agriculture. They make sacrifices to the deities to ensure good rainfall and good harvest. Interviews with the *tindanas* therefore unsurprisingly were very useful in revealing and detailing perceptions of the patterns of drought over time and their spiritual connotations. Four other farmers were accidentally selected in each village and interviewed about their perceptions of the patterns of drought and the reasons for and challenges of these for agricultural livelihoods.

The focus group discussions brought together people of different characteristics to further discuss both general and individual opinions. Participatory approaches in research in rural Africa can be very useful in facilitating understanding and utilisation of uncertain climate information (Roncoli et al., 2009). The participants of the focus groups numbered from eleven to seventeen and were predominantly male in all the villages. The ages of the participants ranged from forty to ninety years. The focus group discussions were crucial in highlighting and enabling understanding of different perspectives.

Farmers' Perceptions of Drought

This section presents the perceptions of drought by farmers in the study villages. The discussion on the perceptions of drought is concentrated in four sections; the definition, patterns, identification and causes of drought.

Drought definition

This section presents the basic definition of drought as provided by the people. Drought (*sanzali*) occurs when the lack of rain is accompanied by deficiency in water and moisture that lasts long enough to adversely affect plant growth and yield. Focus group discussions and interviews clearly distinguished drought from short spells as they both had different names and descriptions. Such a distinction is necessary to ensure an unambiguous discussion of drought as an element of climate. One of the statements that stood up very strongly without any contradiction from focus groups and that helped to capture this definition of drought is cited below.

> *Look my son let me make this simpler. It is just like too much rain and flooding; there can be so much rain that we can't go to farm but it is not called flooding when the water is not so much high on the ground and usually does not last long enough to damage our crops. This one ...we call it Kochogu* (excess water) *and the one that eats* (destroys) *the crops we call kodili* (flood). *You see?* (Male, focus group).

The statement draws a contrast between excess water and flood to illuminate the difference between short dry spells and drought. Short dry spells are seen as a state of insufficient rainfall which is relatively short-lived and has little or no impact on crops, while drought is considered a dry period that lasts long enough to affect plant growth. The local understanding of drought

is therefore generally consistent with the scientific (conceptual) explanation of agricultural drought.

Farmers in the study area generally perceive drought as a common feature of the climate of the area. Rainfall data from 1961-2010, as shown in figure 2, show that the study area experienced many drought risk years. These are indicated by those years registering less than 800mm which is the average rainfall for the area. Figure 2 shows variations in total annual rainfall between years and does not tell whether there was a drought or not. Total rainfall only gives us an indication of drought risk. Rainfall amounts for Savelugu have gone through less variation between 1960 and 1970 to higher variations between 1970 and 2010. The period between 1970 and 1978 saw relatively favourable rainfall. This was followed by relatively unfavourable rainfall conditions from 1980 to1985. The poor rainfall in this period coincided with nationwide droughts from 1980 to1983. The drought of 1980-83 was one of the most devastating in the history of Ghana (Van der Geest, 2011).

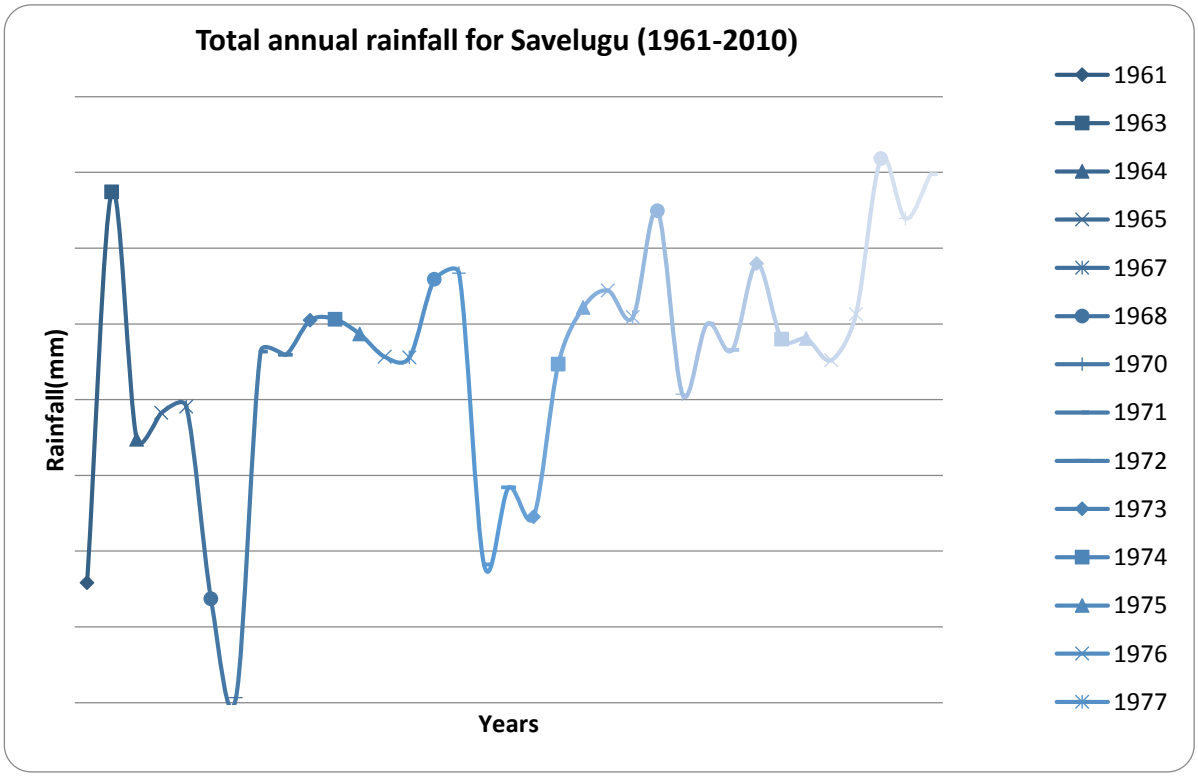

Fig. 2: Total annual rainfall for Savelugu (1961-2010)
Source: Compiled from Ghana Meteorological Services data sheets

The period 1996-2010 reflects relative recovery in rainfall, with all the yearly totals being above 800mm. The variable nature of the rainfall has implications for drought. Generally, rainfall below average is a potent condition for drought (Wilhite & Glantz, 1985; Burroughs, 2007). The study did not find any classification of drought years for the study area. The droughts of the 1970s and 1980-83 are exceptions as they are widely captured by literature mainly for their relatively extreme severity.

Patterns of drought

Focus groups and interviewees assert that the patterns of drought have changed remarkably within the last twenty to forty years, the general view expressed by focus groups being that the frequency of drought has risen while its intensity has reduced. Older people tended to refer to the droughts of the 1970's and 80's as the point of departure for assessing the current patterns of drought. These droughts were very devastating (Burroughs, 2007) and seem to have created a lasting and stark reminder among older farmers of the real and potential impacts of the phenomenon. Based on their drought experience dating from the 1970's and 80's, some older farmers explained that although the frequency of drought had increased over time, its intensity had generally declined. This corroborates Maddison's (2007) assertion that experience is a crucial factor in farmers' perception of climate. While the peoples' perceptions of the frequency of drought are consistent with the reports of the IPCC (2001, 2007) and the EPA (2007), their observations about its intensity are not. The reports in question here report a rising trend in the intensity of drought worldwide and countrywide. The contradiction is not much of a surprise, as global phenomena do not always manifest in the same ways all the time at the micro scale. However, this points to an important issue concerning adaptation to drought; that local policies must necessarily reflect local manifestations of the pattern of drought, especially as interpreted by local farmers. This way, policies will not only deal with specific realities but also resonate with local people, an inevitable condition for the acceptability and success of adaptation strategies.

Besides changes in the frequency and intensity of drought, farmers also perceive that expected droughts no longer occur at the time they used to. This is said to compromise their ability to plan their farming activities and in some cases predict other droughts and act accordingly. The two most feared droughts, being the *birigu sansali* ('sowing drought') and the *kpagla sansali* ('flowering drought') are said to have shifted forward and backward respectively. The 'sowing drought' refers to a particular drought that normally occurs at the beginning of the rainy season, specifically during the period of sowing. In this instance, farmers either wait for the period within which the drought is expected before planting their seeds or they sow at different times within the period in order to spread risk. The 'flowering drought' refers to drought that occurs in the 'second half' of the rainy season in the period when most crops are usually at their flowering stages. During this 'period', farmers usually weed their farms even if there were not enough weeds and also add layers of soil to help preserve moisture at the roots of plants in anticipation of the 'flowering drought'. The 'flowering drought' is said to be more destructive as it sometimes lasts close to or until the end of the rainy season. The changes in the time of occurrence of these droughts is said to compromise farmers' ability to respond appropriately, thereby rendering them more prone to losses from drought. For example, it is explained that those farmers who often wait for the 'sowing drought' to pass before they plant their seeds are increasingly running into trouble with the shortening of the rainy season. Focus groups easily concurred that the minority of farmers understood well the nature of the changes in these droughts and are building competences in dealing with them while the majority are still confused and reliant on old and inadequate measures.

What are farmers' expectations of drought risk within the next thirty years? Farmers base their expectations of drought largely on their experiences spanning several decades, often using the 1970's or 80's as a point of reference. This is not surprising, as experiences of major environmental events often influence future judgements regarding the occurrence of same events (Slegers, 2008; Weber, 2010). Generally, three opinions of the future of drought risk were obtained: drought risk will (1) increase, (2) decline and (3) remain the same. The first view is consistent with climate change scenarios for the region which generally present a drying thesis: less rainfall precipitating frequent droughts. Such scenarios, including those of the IPCC (2007) and the Environmental Protection Agency of Ghana (2007), also project an increase in farmers' vulnerability to drought due to high exposure and low adaptive capacities in the region. Similarly, farmers who perceived an increase in drought risk within the next thirty years also perceived an increase in drought vulnerability, largely based on expected increase in the frequency of occurrence of drought and on increasing soil degradation. Soil degradation is considered an important determinant of vulnerability to drought. Farmers explain that impoverished soils are prone to drought as they have less capability to hold water and little nutrients to offer to plants. Thus, generally, it is expected that an increase in drought occurrence will exacerbate the insecurity of agricultural livelihoods.

Future judgements of the occurrence of climate events can result in changes in people's adaptive behaviour (Davies, 1996; Adger, 1999; Patt & Schröter, 2008). Focus groups emphasized that the expectation of an increase in drought risk has resulted in an increasing trend towards livelihood diversification that includes both farm and non-farm strategies. Common among these strategies are migration and the increasing use of flood prone areas for the cultivation of maize. Flood prone areas tend to hold moisture for much longer periods and are therefore less vulnerable to droughts. Maize cultivation in these areas is done in the early part of the rainy season so as to avoid possible flooding in the middle of the season. Discerning the pattern of drought among farmers in the study area is not as much a difficulty as its identification. The next section examines the subject of drought identification in the study area.

The identification of drought

The identification of the commencement of drought is a subject laden with diverse opinions among farmers. While a section of the people claimed it was possible to identify the on-set of a drought, others asserted it was impossible and that the Supreme Being (God) and the deities strategically kept this away from humankind. Those who claimed to have the knowledge to identify the on-set of drought can generally be categorised into two groups. According to one group drought is said to have begun when rainfall deficiency accompanied by excess heat starts to have visible negative effects on crops. The visible negative effects include wilting and poor flowering or total failure to flower by crops. The farmers explained that it may take up to two weeks for a drought to set in after rainfall deficiency, depending on the type of soil and the type of crop. Local critics of this means of identifying drought using its physical effects on crops claim that it does not make for effective coping for those farmers who eventually become vulnerable because they are left with very little time to organise their coping strategies.

The second means of identifying drought is the presence of drought conditions: 'drought began at the time when the soil had no more moisture for plants in the presence of extreme heat'. Those who are of this opinion therefore hold that it is not the visible effects of drought on crops that signifies its beginning, but the commencement of conditions that bring those effects. They explained that one of the earliest signs of a drought is when the upper soil at the very root of a plant can be picked up by the hand and blown into dust by air from one's mouth. Those who put their faith in this 'dust method', however, point out that the existence of these conditions does not necessarily imply a drought has begun, as they may be short lived. Rather, it is the persistence of these conditions and the realisation of their effects that defines the existence of a drought. Farmers explained that the uncertainty that surrounds this method does not make it irrelevant, as measures, particularly agricultural cultural practices, can still be employed just in case the conditions resulted in a drought. It is also explained that having knowledge of the 'dust method' is very helpful as one begins to plan what to do when the fears of a drought became real, as a respondent explained:

> *Look, it is not all the time you see these signs and there actually will be drought but we old people begin to think of what to do...so if it actually happens you won't just raise your head and look at God but you will also by then have put something in your head about what to do. When you do like this you will be better than the household head who just sits there until it is here, just one time! And that is the time he begins to think of what to do. This kind of household head is like a boy who has no wife.* (Male, focus group).

The 'early identification' of drought and employment and or planning of strategies against its actual occurrence are somewhat consistent with the concept of insurance mechanisms. Insurance mechanisms comprise the mechanisms employed by households at the very beginning of coping with a contingency (Corbett, 1988) such as drought. But in this situation, the occurrence of the drought is uncertain, as the dry spell may be short lived. By acting early, as earlier explained, farmers are able to reduce the impacts of drought on crops. In his statement, the respondent cited above also demonstrates the main concern expressed by focus groups about the first method of identifying drought. 'Those who use this method just sit down and do nothing till the drought is here and then they go round begging others for food and money, but those who can see drought early can sell animals and buy food before the market women know that there will be a bad harvest and increase prices of food at a time that your animals are leaning and cannot sell at a good price' (Female, focus group discussion). Hikes in food prices constitute a nearly inevitable ramification of droughts (Devereux, 2000) which constrains food security among farmers in the northern Savannah who depend largely on own production to secure their food needs (Yaro, 2006). The 'early' identification of drought is therefore an important means of reducing the adverse consequences of drought on food security and livelihood in general.

Changes in the rainfall pattern is however said to pose serious challenges to the use of the 'dust method'. It is asserted that it is increasingly difficult to identify the on-set of drought due to the increasing incidence of short dry spells which is considered a deviation from the normal climate conditions. 'These days the old men easily confuse the increasing short dry spells for

drought' thus reducing the accuracy of the 'dust method'. *Even those who normally added more soil to their crops, thinking that there was a drought, are now tired of doing it many times in a season,* says a sixty year old male during an individual interview. It has been recognised that farmers on the African continent are increasingly aware of the inaccuracies of the signs of nature used to predict the weather and have reduced their dependency on them (Slegers, 2008). Some farmers were of the opinion that the reducing nature of the practice of adding layers of soil to crop roots in dry conditions has increased their vulnerability to drought over the last twenty to forty years. Some farmers postulated that their inability to perform the cultural practice when required would continue to increase their vulnerability to drought in the future as the 'rains are increasingly becoming erratic'. Generally, farmers' ability to identify the on-set of drought is poor and does not augur well for effective coping. Farmers are therefore in need of assistance from the meteorological services which provide more accurate information on rainfall and the on-set of extreme weather events.

The two methods used in the identification of the on-set of drought are said to be commonly constrained by changes in the time frame of the rainy season resulting from changes in the rainfall pattern over the last twenty to forty years. It was asserted that there is a shortening of the rainy season which makes it increasingly difficult to distinguish between drought and the end of the rain season, as noted by the 60 year old in the following words: ...*those who don't know how to read the changes* (in the rainfall pattern) *well often farm late and when the rainy season is finished they say it is drought but that is not drought, we call that one the shortening of the rainy season*. While there was no consensus on whether the rains started early or late, farmers easily agreed that the rains ended earlier than usual. The chief Fulani herdsman who had lived in the village of Kpalung for more than two decades had this to say about the matter:

> *Drought is when there is not enough rain for crops and grasses to grow their normal growth during the rainy-season. But the rainfall pattern is changing. The rains now start at the same period but stop early so the Dagombas confuse drought with the change in rainfall pattern...if you don't know this then you will always farm late and the rains will stop early...and you will say it is drought*. (Male, focus group discussion).

Besides the assertion that the rains started in the same period as before, the statement above by the Fulani man is a succinct summary of what focus groups and many interviews had to say about the rainfall pattern and drought identification. Also, it is generally asserted that older men were those better positioned to notice, understand and adjust to the changes in the rainfall pattern due to their range of experience.

On the contrary a section of the people claim that only God and the deities knew when drought actually started. This opinion also holds that farmers only realised the presence of drought when it had already started to have visible negative effects on crops. This is based on the premise that drought is a punishment from the God and the deities for the sins of the people. *If God is going to punish you, why would he let you know...so that you can find another way to get food for the year?...no, he wouldn't let you know* says the seventy year old female during an interview. It is also believed that it is impossible to identify the on-set of a drought because of the intention of God and the deities to make the future uncertain to humans. Thus one could

only prepare for the possibility of occurrence of drought. The statement below demonstrates this perception of drought identification.

> *We know that drought is something that will always come as long as the world is still there but you can't tell when it will come or when it has started...you just see it only when it is already there...with its effects already...you can only save some money, food or keep animals well and just wait to see what God decides...* (Male, individual interview).

As highlighted in the statement above, those who believed that it was impossible to identify the on-set of drought seemed to be more particular about adaptation than coping strategies. Saving money, keeping more animals and seasonal migration are considered key strategies for adapting to drought. The focus on adaptation by this group of people implies that they would be more willing to try out strategies for adapting to anticipated droughts than to adopt coping strategies which may be warranted by meteorological information. There will therefore be the need to engage farmers in participatory interactions that highlight the need for effective coping, amidst adaptation, as a means to reduce drought vulnerability. Perceptions of the existence of a phenomenon and its challenges often generate curiosity for causality. The next section examines famer's attribution of the causes of drought.

Causes of drought

Table 1 presents attributed causes of drought and the sources of the knowledge of these causes as mentioned by interviewees and participants of focus groups. The reasons for drought ranged from immorality to bush and charcoal burning, while the sources of knowledge included generational knowledge transfer, religious leaders, the radio, NGOs and government sources. Table 1 shows that farmers have generally two categories of attributed causes: those influenced from within and those influenced from without.

Table 1: Perceived causes of drought

Causes	Source(s) of knowledge
Immoral and irresponsible behaviours these days	Generational knowledge transfer, Muslim Imam, Fetish priest
Failure to give alms	Muslim Imam
Failure to perform final funeral rites of chiefs	Generational knowledge transfer Fetish priest
Failure to offer sacrifices to deities	Generational knowledge transfer, Fetish priest
As test of faith by God	Generational knowledge transfer, Christian leaders, Fetish priest, Muslim Imam

Substitution for even more hazardous events	Generational knowledge transfer, Fetish priest, Muslim Imam,
'Natural order' –(The world is always changing, good eras and bad eras alternate)	Generational knowledge
Distortion of nature by some magic men and Islamic priests (Magic men and Islamic priest calling for rains when drought is from God; God will bring the drought back at a later date)	Generational knowledge transfer, Muslim Imam, Fetish priest
Distortion of nature by some business men. (Some market men that possess witchcraft sometimes use their powers to bring drought so that they make more profits from the resulting shortage of food)	Generational knowledge transfer, Fetish priest
Deforestation – (Trees help to bring rain. Deforestation reduces rainfall)	Generational knowledge transfer, Radio, NGOs, Government
Too much manufacturing (This put plenty of smoke in the atmosphere that finds its way here to distort the rainfall pattern) Too many aeroplanes that fly in the white man's land all the time that add more smoke to the skies which finds its way here	Radio, NGOs, Government
Bush and charcoal burning (Put plenty of smoke in the skies which reduces rainfall)	Radio, NGOs, Government

Source: Compiled from field work (interviews and focus group)

However, these are not entirely distinguishable in the pattern of explanation, clearly indicating the existence of local and scientific *hybrid perceptions*. In this case, farmers' understanding of traditional attributed causes was extended by scientific knowledge and this situation seemed to be common among those with at least basic education. It also appeared that most of the farmers who emphasised scientific causes were community leaders or had been engaged directly in some NGO or government activities. Thus education and exposure to scientific views played a key role.

Explanations of the causes, however, generally had a strong leaning on social realms, particularly spiritual reasons and religious disobedience. God and the deities may bring drought upon the people for several reasons, including immoral conduct, failure to perform final funeral rites of dead chiefs and fetish priests, cutting of trees that belong to the deities and failure to give *Zakat*. *Zakat* is a muslim tradition of giving alms to the needy at least once a year. Weather has traditionally been viewed as a phenomenon determined by God (Golo & Yaro, 2013) and

deities (Byg & Salick, 2009). Adverse weather is generally seen as a punishment from these powers, including God.

Other reasons purported to cause drought as depicted in Table 1 include, the exploits of magic men, the desire for money by wizards, bush burning, charcoal burning, deforestation, air transport and the *natural order*. Magic men and wizards are said to possess powers which they use to prevent rainfall to cause drought for various gains, including creating a dry period for the performance of funerals and to induce shortage of food. Bush burning, charcoal burning, deforestation, manufacturing and air transport are said to release smoke into the atmosphere which does not augur well for rainfall. The smoke is said to dissipate *rain-clouds*, resulting in the lack of rain which causes drought. Deforestation is said to reduce the amount of moisture in the atmosphere that brings rain. This may then result in drought. Also, deforestation is said to expose the top soil to the sun which destroys its moisture holding capacity and makes it possible for drought to easily set in when the rains stop for some time. There are other notions that deforestation causes drought through the lack of trees that would capture atmospheric moisture to form rain clouds.

Perhaps the most intriguing cause of drought named by the people in table 3 is the *natural order*. By *Natural order* is meant natural changes that occur in the earth across time and space, including 'eras of good rainfall, eras of bad rainfall'. These changes are seen as inevitable and to represent permanent changes (for each era). *God...can't allow mankind to have an easy life...he has to challenge you by making the world such that things keep changing...everything has its time...* says the fifty year old *tindana* (the land chief) of the village of Laligu. Generally, the explanation of the natural order by the people is an indication that the local people do not only perceive climate change but also they are aware that climate change has occurred before in the history of humankind. The explanation of the natural order also indicates that local people perceive that natural factors can result in or contribute to climate change. Eras of good years are followed by eras of bad years and vice versa. Each era is associated with permanent changes. Accordingly, the years of a bad era could comprise extreme events such as drought, severe sunshine, flood and strong winds, while good years could comprise good rainfall, 'enough sunshine and enough wind'. Their idea of permanent change generally conforms to the science of climate change.

Farmers' explication of the causes of drought has a time element which distinguishes both short term and long term causes associated with temporal and permanent changes in the pattern of drought. While some of the causes were deemed to bring just temporal changes in the frequency and intensity of drought, others were seen as resulting in permanent changes to the pattern of drought. Focus groups asserted that long term causes that resulted in changes in the pattern of drought included deforestation, bush burning, charcoal burning, air transport and the *natural order*. On the other hand, short term causes included immoral conduct, the exploits of magic men, fetish and Islamic priests, and the zeal for money by wizards. These short term causes are thought to bring temporary drought effects. The statement below sheds some light on the time dimension of the causes of drought.

> *...when you sin God can punish you with a drought one time and that is it,...when you keep on sinning, God will continue to punish you and when you reduce sinning drought too will reduce...but when you cut trees it takes very long to bring droughts but those droughts will stay with you...like a scar from a hunting exercise. ...our great grandfathers told us already that where there are no plenty trees, there is less rainfall and drought occurs often at those places.... But the Tamale town people want to buy plenty of firewood and our women too need the money...When we were kids, the droughts were only severe but not often... (they were severe because of blood spillage in the wars of those days) now almost every year you can expect drought...* (Male, focus group).

The expression places particular attention on deforestation as a long term cause of drought. When asked how deforestation contributes to the long term changes in rainfall and drought, the respondent above answered:

> *Now you are asking me to say what I don't know, only God knows it, he made the world and knows how it should be, even if you sell most of your cattle your women won't have much cow dung for fire neither will you have enough milk for children, some people even cut the trees that belong to the deities for firewood, so you see people don't care, they do anything to the ground...as long as it brings money* (Male, focus group).

The elderly man, like other respondents, clearly had no exact explanation for how deforestation caused changes to the pattern of drought. However, he demonstrates a vivid understanding of the idea of environmental sustainability, in that, 'too much' deforestation could result in a reduction of the *rain-bringing* services rendered by forests. Others, however, explained that the effect of deforestation was a reduction of moisture in the atmosphere, as trees were responsible for holding this moisture to facilitate rainfall. The cutting of trees over time is therefore considered an important cause, not just of drought, but also of its rising frequency over time. Some very old respondents linked the on-going deforestation to what they described as a dwindling trend in environmental stewardship roles of people in their villages as well as in the surrounding villages.

Humankind is expected by God to exploit the resources of the earth with care. For example, it is not allowed to cut all the trees on one's farm land and even some trees such as the *dawadawa* and *shea* are not to be cut except for naming ceremonies of new born children. These are some of the ways of taking care of Gods' creation to ensure its continuous existence and usefulness and to keep the wrath of God at bay. This notion can be likened to the theological model of stewardship. This notion is neither inherently Christian nor religious and stresses the need to ensure the moderate use and protection of the environment as a God given duty. Thus it is contingent on every human person to pursue this moral obligation to ensure the sustainability of the environment for future generations (Wardekker et al., 2009). In their quest for development, humans must therefore seek to strike a balance between resource use and human welfare on the one hand and preservation on the other (Golo & Yaro, 2013). In the study area this perspective is observed to be dominant, particularly among older people and religious leaders, who do not tie the concept to religion but see it as a generic divine standard for human-

environment interaction, the disregard for which has resulted in the changing patterns of rainfall and drought.

Conclusions

The paper has sought to present the perceptions of drought by farmers in the northern Savannah. The definition of drought by famers is generally based on its effects on crops, which generally conform to the scientific notion of agricultural drought. Farmers relied largely on their experiences spanning several decades, particularly the 1970's and 80's, to describe the patterns of drought. They perceived marked and permanent changes in the pattern of drought which some of them linked with climate change. Perceived increase in the frequency of droughts is the commonest link to climate change. These perceptions conform to scientific knowledge on drought and climate change. There is rising evidence that the frequency of drought worldwide is on the rise and that African countries are experiencing the worst consequences due to high exposure and low adaptive capacity (IPCC, 2007; Burroughs, 2007; Dalby, 2009; Foresight, 2011).

The intensity of drought, however, was generally considered by the farmers to be on the decline. This is contrary to the IPCC (2007) report. In this report, drought intensity is recognised as rising in Africa. This is not surprising, as the manifestation of phenomena at local or micro levels does not always reflect that of the macro scale. Some farmers also recognised changes in the occurrence of expected droughts which were attributed to climate change. The recognition of a reduction in drought intensity and the changes in the occurrence of expected droughts over the last 30 to 40 years show that at the idiosyncratic level people's experiences can provide a more nuanced understanding of global environmental phenomena. This acts to provide area specific information suitable for adaptation policies, as opposed to macro analysis and projections of droughts such as those of the IPCC (2001, 2007) and the Stern Report (2007) that largely provide only regional or macro level information.

As opposed to scientific notions, drought is more closely linked to moral and spiritual factors, demonstrating the spiritual or religious inclination of local farmers in the area. As shown earlier, this has an immense influence on farmers' response strategies. The influence of spiritual notions on farmers' coping and adaptation strategies can either be enabling or constraining. In broader terms, the spiritual notions of drought could be exploited to promote environmentally sustainable practices which can act to reduce drought vulnerability at the local level. Thus this study strongly recommends that spiritual perspectives be considered in the formulation of drought adaptation strategies. This is corroborated by Golo and Yaro (2013) who argue that rural peoples can offer useful solutions to climate adaptation, not only because they are capable of recognising and interpreting the nature of changes, but also because they take up the roles of environmental stewards, based on the notion of theological stewardship, as a God given duty. But as spiritual notions do not normally conform to scientific explanations of drought, any attempts at enabling adaptation should be careful not to directly challenge spiritual views on drought and climate change, as this could jeopardise efforts. Such mutual respect is

important in obtaining an in-depth understanding of climate change and in tackling its multi-faceted impacts (Byg & Salick, 2009) including drought. This way, studies focusing on local adaptation to climate extremes like drought should not only seek to identify and analyse the effectiveness of local strategies, but also to identify practices that derive from or are influenced by traditional notions, rather than to merely assess the contrast between local traditional notions and scientific knowledge of climate variability and change. In this regard, there is the need for further studies into how specific local perspectives may be merged with scientific notions, especially where these are incongruent, into national and sub-national adaptation policies.

The perceptions of the farmers reflect not only their strengths but also their weaknesses in confronting and adapting to drought. Indeed, local knowledge of climate can be very useful in understanding the coping strategies and adaptive capacity of indigenous communities (McCarthy & Long, 2005; IPCC 2007). Although farmers clearly perceive the changes in the pattern of drought, they are generally struggling to adapt their livelihoods to these changes. The changes in the pattern of drought are said to result in the situation where some aspects of age old traditional knowledge of drought concerning its identification and expected periods of occurrence, causes and remedies, long used as a basis for coping and adaptation, are increasingly becoming less relevant.

It is therefore important to promote participatory programmes in a button-up approach that allows farmers to share their understandings and concerns with their colleagues and other stakeholders such as government and NGOs, while scientific explanations are introduced to extend their knowledge where applicable. Participatory approaches to drought adaptation should be favoured against top-down approaches where extension officers and various non-governmental organisations try to impose on local farmers various (alien) ideas and technologies which may have little acceptability, possibly resulting in failure. Local people are neither ignorant of, nor passive to changes in the patterns of rainfall and drought; rather, they understand and act on these according to their socio-cultural, economic and physical environments which have long aided local adaptation, and which have been considered to be impressive on many occasions. It is therefore imperative to address a combination of drought perceptions as these highlight local relevant solutions.

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