

Local Perspectives on the Causes of Climate Change in Rural Ghana: Implications for Development Planning

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Abstract

This paper explores local knowledge of the Sisaala on the causes of climate change and variability in rural north-western Ghana and the implications for development planning. While debates arising from western scientific research on the causes of climate change are clearer at the global and regional scales, knowledge of localized perspectives is often lacking to bring completeness to the diversity of understandings imperative for informing development planning at local levels, especially in Africa. This paper contributes to filling this gap and draws on data collected from in-depth interviews and focus group discussions from a cross section of people in the Sissala East District. From local perspectives, climate change is caused by multiple factors, including the felling of trees, bush burning, over grazing, use of modern agriculture machinery and agro-chemicals, breakdown in spirituality, traditional religion, and values for bio-diversity conservation. The paper argues that local knowledge on the causes of climate variability largely corroborates the anthropogenic view of the causes of climate change; and that perspectives on the spiritual cause of climate change is attributable to a holistic worldview of the indigenous Sissala. The paper underscores the relevance of Climate Change Mitigation and Adaptation Planning (CCMAP) in the context of decentralization and local governance. It emphasizes the importance of Endogenous Development (ED) and Behavioral Change Communication approaches to district development planning for maximizing local knowledge and resources for achieving sustainability.

Keywords: Climate change; anthropogenic; local knowledge; Mitigation; Adaptation; Planning.

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Introduction

The evidence on global climate change and the adverse implications for development across the globe and particularly, Africa is widely acknowledged (FAO et al., 2019; Zoundji et al, 2017). Africa is considered one of the most vulnerable continents to climate change and climate vulnerability (IPCC, 2014). For Africa, an estimated 75 million to 250 million people are projected to suffer from water stress arising from climate change by the year 2020 (IPCC, 2007). Further forecast estimates that about 350 million to 600 million people in Africa would suffer from water stress by the 2050s (IPCC, 2007). The overall climate change would impact negatively on many domains of life among local populations. These domains would include freshwater resources, food, fibre and forest products, coastal systems and low-lying areas, and human settlements and health (IPCC, 2007). These negative consequences present daunting challenges to Africa's development, particularly, in Sub-Saharan Africa (FAO et al., 2019; United Nations, 2018).

Ultimately, addressing climate change and climate vulnerability through research, policy and development is not only a priority, but an issue that requires urgent attention, concerted efforts, and innovations at local levels. This brings into the limelight the strategic importance of local knowledge systems and an Endogenous Development (ED) approach to community development. Local innovations and response to climate change and climate variability has become even more important in the light of little attention to climate change adaptation and or low state capacity to address the development challenges associated with climate change. For instance, while many countries are often signatories to international conventions on climate change, commitment to action and resource allocation is not illustrated towards meeting the goals and targets of these conventions. Despite the vulnerability of Sub-Saharan Africa to climate change, awareness on predicted impacts of climate change is limited and the preparedness to cope with climate

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challenges are lacking (Ifeanyi-Obi et al., 2017). Moving forward, complementarities in the roles between local communities and the state will enable better and improved capacity for responding to the challenges of climate change (UNFCCC, 2018).

An entry point for exploring the role and or potential role of local knowledge systems for addressing challenges of climate change through research and policy is to interrogate local understandings of the causes of climate variability. The role and or potential role of local knowledge or indigenous knowledge as a basis for interpreting and responding to climate variability and change is underscored by many researchers (Ayanlade et al., 2017; Audefroy & Sanchez, 2017; Nkomwa et al., 2014). According to Eguavoen (2012), although local populations may have difficulties in the right interpretation of the concept ‘climate change’ in local languages, they do have the capacity and knowledge systems for observing and describing changes in weather elements, especially rainfall and temperature. Therefore, climate change is not new to the traditional people of the African Sahel region since they have lived and coped with the changing climate (droughts) over the past century (Musarandega et al., 2018). Indeed, populations in the African Sahel region have over the past years coped and adapted to extreme climatic events, especially severe droughts through their indigenous knowledge systems (Musarandega et al., 2018; Ansah & Siaw, 2017; Nyong et al., 2007). The focus on local knowledge also underpins the relevance of Endogenous Development (ED) - both in research and development planning. Endogenous development here refers to development where the development options and processes are respectively determined and controlled by the local people and the benefits of the development retained within the local economy of the people (Slee, 1993). It also considers the social, material and spiritual well-being of the people, thus, integrating into the development process the values, beliefs and cultural norms of the local people which enhances sustainability

through ownership by the local people (Comparing and Supporting Endogenous Development [COMPAS], 2010). It is development that involves a continuous process of adaptation and innovation within local perspectives and primarily (but not exclusively) grounds on local strategies, knowledge, institutions and resources (Van't Hooft, 2006). Against this background therefore, ED offers a relevant framework for analyzing local knowledge of the causes of climate change and variability and the implications for adaptation planning.

This paper draws on the local knowledge of the Sisaala in north-western Ghana to analyze local perceptions and understanding of the causes of climate change and the policy implications for development planning. The paper is organized in eight parts. In the ensuing part, the incidence and causes of climate change and variability are presented with part three focusing on climate change and local knowledge. This is followed by a description of the study area and methodology. The results are presented and discussed in parts five and six respectively. Part seven presents the implications for development planning while part eight concludes of the paper.

Climate Change and Climate Variability: Incidence and Causes

The Third Assessment Report (TAR) of IPCC (2001a: 21) defines climate change as any change in climate over time due to natural variability or human activity. The IPCC further observes that climate change refers to a statistically significant variation in either the mean state of the climate or in its variability, persisting for an extended period, typically decades or longer. The United Nations Framework Convention on Climate Change (UNFCCC), Article 1 defines climate change as a change in climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and observed over comparable time periods (UNFCCC, 1992: 7). According to Chauhan (2010), climate change simply refers to the changes in climatic

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conditions over a period of time, usually decades or more and it is seen as the shift in weather patterns.

Climate variability is distinct from climate change mainly in relation to time or period of change. Climate variability refers to variations in the mean state of the climate on all temporal and spatial scales beyond that of individual weather events. Variability may be due to natural internal processes within the climate system (internal variability), or to variations in natural or anthropogenic external forcing (external variability) (IPCC, 2007:79). Usually, climate variability is used to mean variations on time scales of a few years to a few decades that is, shorter than a climatic averaging period. Variations in the two major climatic elements namely precipitation and temperatures in Africa and Sub-Saharan Africa in particular have accounted for frequent recurrent floods and droughts as well as increasing temperatures (Mulwa et al., 2017; Morton et al., 2017). Precipitation changes over the years in Sub-Saharan African countries including Ghana have demonstrated a decreasing trend in terms of frequency and amount of rainfall recorded (Derbile & File, 2016; Napogbong et al., 2021). In few cases where precipitation amounts are great, they result in devastating floods within the same year (Elum et al., 2017).

So far, the discourse on the causes of climate change and variability largely suggests that human activities are more responsible for climate change (Mase et al., 2017; Morton et al., 2017; Udmale, 2014; USEPA, 2018; Napogbong et al., 2021). According to the TAR of IPCC (2001b), climate change may be caused by natural processes or anthropogenic causes leading to changes in the composition of the atmosphere. There are multiple natural factors that are reported to cause climate change and climate variability. These natural factors include earthquakes, volcanic eruption and orbital variations. Many of these natural factors are considered as geological and meteorological in nature as climate change itself (Carter, 2007). Earthquakes and volcanic eruptions tend to release

large quantities of sulphur dioxide, dust, ash and water vapour into the atmosphere that has the potential of affecting the patterns of the world climate over decades. Also, orbital variations are reported to influence the severity of climate seasons such as winter, summer and harmattan (Kankam-Yeboah et al., 2010). In addition, earthquakes and volcanic eruptions are sudden and natural events that have the potential of emitting substances that can degrade the environment and pollute the atmosphere.

Several other scholars have noted that climate change is caused by human actions, leading to debates as well as scientific consensus about the causes of climate change over the past decades (Mase et al., 2017; Zoundji et al., 2017). Climate change became evident after the industrial revolution due to excessive emissions of Greenhouse Gases (GHGs) (UNFCCC, 2018). Emissions of GHGs such as carbon dioxide, methane and nitrous oxide into the atmosphere through industrial activities such as manufacturing and production, agriculture (crop and livestock production) and other land-use changes have contributed significantly to climate change (USEPA, 2018; Windham-Myers et al., 2018). Thus, the burning of fossil fuels for energy and transport, use of land for agricultural purposes, building of towns and cities (construction), deforestation, coal mining, oil and gas production, bush burning, and other activities significantly contribute to GHGs emissions and global warming (Ocko et al., 2018). These consequently lead to climate change, which affects human life, livelihoods and food security (Lipper et al., 2014).

In Africa however, climate change does not mainly concern the emission of gases and other environmental damages as have been emphasized by the IPCC (2007). Rather, it is more about the links between climate change and contemporary hazards such as droughts, desertification, floods, coastal storms and soil erosion – economic growth and social progress” (Lisk, 2009: 8). The conventional perspective on the causes of climate change reveals an interesting dimension, which

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shows how local farmers understand and interpret the causes of climate change. This perspective is rooted in indigenous knowledge systems of local communities that have attachment with the spiritual and cultural dimensions of society (Davies et al., 2019). Thus, smallholder farmers in sub-Saharan Africa (SSA), including Ghana, also perceive climate change from cultural and spiritual dimensions, which include perceiving floods, droughts and extreme temperatures and other forms of disasters including poor crop yields as forms of punishment from the Supreme God, ancestors for acts of disobedience by the living generation (Kupika et al., 2019; Zoundji et al., 2017; File, 2015). Therefore, there is an existence of a strong linkage between social beliefs, values and norms of local communities, smallholder farmers and climate change issues in SSA. This is because these beliefs and norms guide their behaviour and activities including agricultural practices. Farmers in SSA agree to significant changing pattern of rainfall, in terms of frequency, intensity, distribution and timing and increasing temperature (File & Derbile, 2020; Aniah et al., 2019; Zoundji et al., 2017). Farmers' perceptions reveal decreasing rainfall and rising temperatures with devastating effects on crop growth and yields (Alam et al., 2017). Recurrent delays in the onset and early cessation rains in SSA, including Ghana (Derbile & File, 2016) have led to droughts (dry spells) and floods which affect crop yields and food security (Derbile et al., 2016).

The manifestation of climate change in Ghana has been recurrence of floods and droughts, erratic rainfall pattern, rising temperatures and other extreme weather conditions that adversely affect human life and livelihood options especially agriculture (Ghana National Climate Change Policy, 2013). According to the GNCCP (2013), temperatures across Ghana demonstrate an increasing trend with higher increases for the agro-ecological zone in northern part of the country. This confirms projections that temperatures, if not checked, are rising towards more than 2 degrees Celsius by 2030 under current circumstances. Rainfall analysis also shows a decreasing trend in

all ecological zones of Ghana but with a much more decreasing trend for the northern savannah ecological zone (NCCP, 2013; World Bank Group, 2011). Low and erratic rainfall pattern in the northern part of the country results in dry conditions and droughts in most of the farming season and this severely affect food crop production and food security (Aniah et al., 2019; Donkoh et al., 2019; Alhassan et al., 2018; Buah et al., 2017;). Climate variability results in changes in farming seasons such as sowing and harvesting seasons due to changes in rainfall pattern. The uncertainty and unpredictability of rainfall-based seasons for farming activities affect the farming calendar leading to abandonment of the cultivation of some local food crops (File, 2015); a situation that is likely to aggravate food insecurity and malnutrition in Ghana and other sub-Sahara African countries (IPCC, 2007).

Local knowledge and Climate Change

Local knowledge as applied in this paper is synonymous with indigenous knowledge (IK), indigenous knowledge systems (IKS) and or traditional knowledge (TK) (Derbile et al., 2019). Local knowledge in this context refers to the unique knowledge systems associated with particular communities, indigenous people and their physical environment, accumulated over time through experimentation and learning, and largely transmitted orally from generation to generation for the purpose of supporting livelihoods and the totality of life.

Several authors have put forward different definitions that highlight the key issues that characterize local knowledge or traditional knowledge or indigenous knowledge. According to Mafongoya & Ajayi (2017:17), indigenous knowledge refers to the “knowledge and know-how that is accumulated over generations and guides human societies in their innumerable interactions with their surrounding environment”. The authors further noted that “these knowledge systems are transmitted and renewed by each succeeding generation, ensuring the wellbeing of people by

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providing food security, environmental conservation, and early warning systems for disaster risk management” (Mafongoya & Ajayi, 2017:18). Local knowledge can also refer to the cumulative body of knowledge, practice and belief, that evolves through adaptation processes and passed on to generations via culture and belief systems of the people within their environment (Berkes, 2012).

According to Hansen and Van Fleet (2003), traditional knowledge (TK) is the information that people in a given community, based on experience and adaptation to local culture and environment, have developed over time, and continue to develop. They noted that TK is collective in nature, regarded as communal property and often transmitted to selected few people within the community through specific cultural and traditional information exchange mechanisms. It also encompasses mental inventories of local biological resources, animal breeds, local plant, crop and tree species as well as belief systems that enhance the livelihood of the people, health and protection of the environment. Local knowledge systems, therefore, provide a vital lens for interpreting climate change and variability and making meaning of the world in which people live.

Literature show that local people draw on their indigenous knowledge systems to observe, interpret and respond to the consequences of climate variability and change in diverse ways (Bogale & Bikiko, 2017; Muyambo et al., 2017; Iloka, 2016; Egeru, 2012). According to Jiri et al. (2016), rural societies and people possess valuable knowledge for climate change assessment and adaptation and so, indigenous knowledge is an important social capital for rural people in food production under climate change. Local knowledge over the years has provided weather information to smallholder farmers and rural communities on seasonal and inter-annual activities through indigenous observations and interpretations of meteorological phenomena (Mafongoya & Ajayi, 2017). The authors observed that, local communities in SSA have well-developed

structures and wisdom for predicting, interpreting and dealing with common disasters such as droughts and floods. These hazards are predicted by observing the activities of birds, wind direction, the shape of the crescent moon, the behaviour and activities of certain animals and trees.

It has been found that local communities in SSA have, through indigenous knowledge, dealt with natural disasters and conserved the environment over the centuries to sustain their basic livelihoods (agriculture). These indigenous knowledge systems relate to enhancing the understanding of local communities on climatic risks, disaster prevention and mitigation, early warning, preparedness and response, and post disaster recovery strategies (Mafongoya et al., 2017). Indigenous peoples and local communities have been recognized as front liners in climate change adaptation discourse, who can share with stakeholders their invaluable insights and perspectives on the effects and coping mechanisms which can be shared with stakeholders on climate action platforms (UNFCCC, 2018).

Thus, local knowledge serves as a basis for interrogating local understanding or exploring the perspectives of local people on the causes of climate change. This is because the understanding of local people of the causes of climate change is essentially part of their local knowledge as long as such knowledge is primarily shaped by the local context, even if part of that knowledge is shaped by some external knowledge. Local knowledge in the study area is shaped by the worldview of indigenous communities, which has strong connections with culture and the traditions of the people. Hence, local knowledge may be distinct from western scientific knowledge because it draws on the worldview of indigenous communities in Africa.

Study area and methods

This study was conducted in the Sissala East District of the Upper West Region of Ghana. The district has a total land size of 4,744 sq km and is located in the north-eastern part of the region (Figure 1). The vegetation is Guinea Savannah, comprising a mix of grasses and scattered fire-resistant trees such as the Shea, Baobab and Dawadawa trees. It has a tropical continental climate. The mean monthly temperature ranges between 21°C and 32°C, but the lowest and highest monthly temperature may range from 12°C in December to 40°C in March or April. The district has a single rainy season from May/June to September/October during which crop production is done.

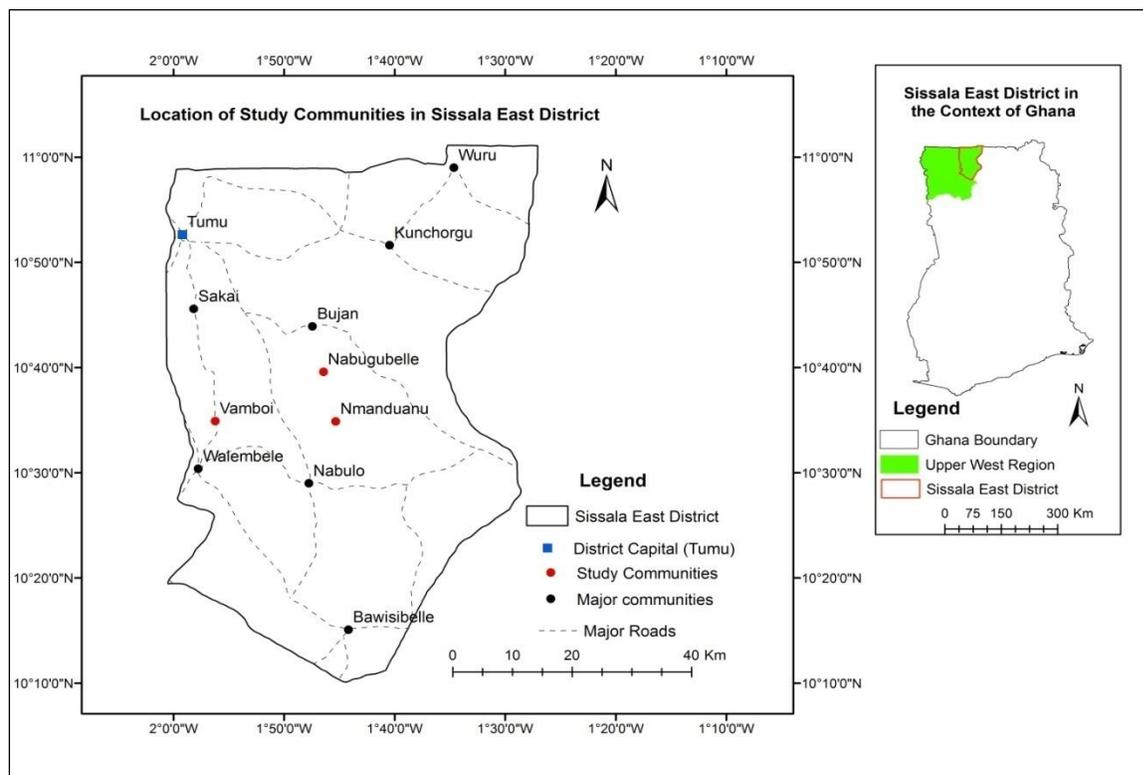


Figure 1: Map showing Sissala East District in national and regional context

Source: UNDP (2010:5)

The district has a population of 56,528 as at the 2010 population census (Ghana Statistical Survey, 2012) and the population is generally distributed in dispersed and predominantly rural settlements.

The district is primarily inhabited by a homogenous ethnic group, the Sissala ethnic group with a

few other ethnic minorities, the Kasena who are settled in one or two communities in the eastern boundary of the district. Rain-fed farming is the primary occupation of the people and most are involved in cereal, leguminous and root crop production. These crops specifically include maize, millet, guinea corn, rice, beans, soybeans, and yam.

This paper draws on primary data collected from three purposively sampled study sites in the Sissala East District, as part of a large study that was conducted on climate change and food security in the Upper West Region. These study sites were namely, *Vamboi*, *Nabugubelle* and *Nmanduanu* (Figure 1).

A qualitative exploratory approach was applied in collection and analysis of the data. In specific terms in-depth interviews and focus group discussions served as the main sources of data. In-depth interviews were applied in collecting data from two categories of participants; household heads and key informants, who include earth priests (locally called *Jantina*), women leaders (*magazia*), traditional chief farmers, and rainmakers. These participants were purposively sampled for two phases of in-depth interviews. The first phase of in-depth interviews involved 15 household heads who had over 15 years of practice or farming experience in the Sissala area. So, six (6) female and nine (9) male household heads were interviewed at the household level. The data collected centered on their own observations and experience of climate variability and their thoughts on its causes.

In the second category, a total of 33 key informant in-depth interviews were conducted. They specifically included the chiefs (3), earth priests (*Jantina*) (3), traditional chief farmers (3), rainmakers (2), male elders (6), and traditional women leaders including Muslim women leaders (*magazias*) (6). The others included leaders of women groups (4), male youth leaders (3) and female youth leaders (3). The study benefited significantly from their experiences and knowledge

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in farming, the important roles they play in the communities and above all, their in-depth knowledge and understanding of indigenous knowledge systems around climate patterns.

Furthermore, Focus Group Discussions (FGDs) were conducted among three categories of discussants in each community. These included the chiefs and council of elders (3), adult male farmers (3) and adult female farmers (3). The others included male youth (3) and female youth (3). Overall, 15 focus group discussion sessions were conducted with discussants ranging between 7 and 12 per session. An FGD guide was prepared and used for the discussions. The FGDs enabled in-depth discussions and analysis of local perspectives on the causes of climate variability in all study sites.

Results

The concept climate change is difficult to translate directly in many indigenous languages including Sisaali. Hence, the concept of climate change is often explained in Sisaali using local phrases such as *tinteng birima*, *orle birimia* to mean ‘land change’ or ‘environmental change’ respectively (see File, 2015). Farmers’ understanding or definition of climate change relate to their observation and experience of changes in local weather elements and the general environment including vegetation changes over the past years. Their definition and understanding of climate change also mirror the changes and variations in weather elements such as rainfall, temperature, sunshine and wind. Based on this perspective, they are able to attribute climate change and variability to some causes. Further to this background, local perspectives reveal that climate change and variability are caused by multiple factors. These include activities related to farming and other livelihoods. In more specific terms, they include tree felling, use of modern farm

implements and equipment, bush burning, over grazing, excessive use of agro-chemicals and lack of respect for spirituality and traditional values and norms.

First, tree felling was identified as a main cause of climate change. Farmers explained that there was an increased incidence of felling trees and or lumbering for purposes of charcoal production, export of lumber, roofing, and firewood. It was revealed that trees in the past were cut for roofing of houses (thatch roofing), construction of cattle kraals, construction of sheds and for farming purposes. The use of modern farm implements such as tractors, planters and bullocks for ploughing involves felling of trees to facilitate movement of the vehicles and implements. This also contributes to deforestation and environmental degradation.

It was further shown that people cut trees for purposes that were not practiced by the early generation. For example, felling trees for charcoal burning as an income generation activity was reported as a new phenomenon and that it never happened during the early generations of the communities. This has led to increased incidence of tree felling and deforestation in the area. Even economically valuable trees such as the Shea and dawadawa trees which were strictly protected in the past, are not spared these days. These trees were owned by family heads, landlords and farmers and no individual or group of individuals could go and cut down such trees for any purpose or activity.

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These and other trees of economic value were left undisturbed on farms and at homes (communities) and when they fruited permission was sought from the owners before any individual could harvest the fruits. An elderly woman in Nabugubelle noted during a focus group discussion that;

We are told trees and thick vegetation bring good rains, but trees are indiscriminately fell for individual purposes. - Charcoal production and other activities have caused the felling of trees and disappearance of the thick forests and many tree species that surrounded us in the past. The forests have disappeared and the trees around are not enough to bring us enough rainfall, as we are told. In the past, some trees were viewed as sacred deities which were worshipped; so, cutting them will result in poor rainfall pattern as a form of revenge by the deities. ...the cutting of shea, dawadawa, and other economically important trees is even affecting us (women). This is because one can hardly get two bags full of shea nuts and dawadawa seeds for sale or for processing into (respectively) shea butter and “chuaa” (local spice made from dawadawa seeds) for consumption and sale.

Another new phenomenon that was reported was the use of chainsaw machines popularly called ‘*dorma*’ for tree felling and lumbering in communities. Chainsaws were not used for any activity in the past by the people. However, chainsaws are now common and have become a source of income to owners and the operators of the machines. People either buy the machines or hire them for a period during the off-farm season for tree cutting. Chainsaw operators fell trees for production of wood and boards for roofing of houses and also for export. In fact, it was reported that most of the processed wood is exported to neighboring Burkina Faso for sale. More worrying was rosewood harvesting. This activity was considered very lucrative as Chinese merchants provided ready markets for harvested wood. Majority of the youth and landlords fell to this business and some abandoned farming for a year in place of rosewood harvesting. The averages prices quoted for a container of rosewood ranged between GH 12,000.00 to GHC 25,000.00, depending on the sizes of the logs. It was unraveled that a maximum of 40 logs per container sells at GHC 25,000 while maximum of 100 logs to a container sells at GHC 12,000, the least price. This has increased

deforestation because of the pace at which trees are being felled. Even though some people said they were aware of the consequences of the indiscriminate harvesting of rosewood and other tree species, they said they could not stop it because it was a lucrative source of household income to families. A young man in Nabugubelle remarked, during a discussion, that;

We know that this (rosewood harvesting) will affect us and that is why a youth group has been coming to our communities and ceasing some of the loaded trucks in order to deter us from it. We were told on Radford FM that it will affect rainfall pattern which will affect us as farmers too. ...but because there is money in it, we cannot stop, especially the case that rosewood trees do not bear fruits for us.

Another perceived cause of climate change is bush burning. Bush burning is an annual activity associated with the dry season. Bush burning reportedly destroys the vegetation cover. According to the people, early burning was practiced in the past and this reduced the damages caused to the vegetation and the environment. Young tree species were not completely burnt because the wet vegetation (grasses and shrubs) reduced the intensity of the fires. This enabled young tree species to grow. It also enhanced the flowering and fruiting of most economic trees. A respondent underscored this in observing that:

During the time of our fathers, bush fires never caused harm to farm produce or damage to wild trees or did they cause poor rainfall as it does today. We used to burn before, during and after harvesting and all these never affected us. Our rivers were there, wild trees yielded fruits abundantly, there were plenty of animals to hunt for meat and the environment (vegetation) was not affected much. Women and children could not move alone beyond one mile because the vegetation was thick. Today one can see beyond 2 miles as if it is a football park (in-depth interview with an earth priest in Nmanduanu).

From the above narrative, a situation of deforestation and environmental degradation is suggested in recent years due to the indiscriminate bush burning in the district. In contemporary times, both early and late burning are practiced, and the latter destroy the vegetation completely because of the dry conditions. The people also reported that smoke emitted from bush fires diffuses into the skies, pollutes atmospheric gases and disrupts formation of rain-bearing clouds. This then causes

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low rainfall and or rainfall variability. Traditionally, smoke was seen as a way of preventing or reducing rainfall in the past.

Another factor that was reported to cause climate change is over-grazing of vegetation by cattle, particularly, large herds of cattle shepherded by Fulani herdsmen who originate from Burkina Faso. Places that were considered forested and virgin lands have all been over-grazed by cattle. These herdsmen settle where there are many water bodies and thick vegetation for watering and grazing purposes, respectively. Their cattle graze on these lands both day and night. The Fulanis also cut down trees including economic trees such as shea, dawadawa, '*fufulaa*', *digalia*, *holo*, *butuma* and many others to feed the cattle. Shea, dawadawa and *fufulaa* were usually cut down when they were developing fresh fruits for the animals to feed on. Also, the animals feed on shea fruits and nuts as well as dried pollen of *fufulaa*; a situation that deprive rural women access to shea nuts and other wild fruits. This has resulted in massive deforestation and land degradation in many communities in the district. Such lands now appear like deserts and cannot support any plant growth well. In many communities, people have become resentful about the destructive activities of Fulani herdsmen, so that tensions and conflicts between them are common and widespread. Nonetheless, people claim Chiefs and earth priests (*Jantina*) have failed to apply sanctions on Fulani herdsmen because they have been bribed by the latter.

Excessive use of agro-chemicals in farming was also reported as a cause of climate change. The use of weedicides for weed control is common and widespread among farmers. The use of this chemical is excessive because of multiple spraying of farms by farmers. Farmers apply weedicides in the cultivation of groundnuts, beans, soybeans and other leafy crops before ploughing and after sowing. Simply put, farmers apply chemicals three or more times within a season. Farmers also reported the use of chemical fertilizer and pesticides. According to farmers, the use of these

chemicals has caused changes in local crop varieties and affected the ability of soil to retain water (or soil moisture) and nutrients for crop growth. These chemicals were believed to have killed many of the earth organisms such as the earthworms, millipedes, centipedes and other organisms that play central role in providing and sustaining soil fertility and the natural vegetation, which from their perspective is important for maintaining a good rainfall pattern. A man in Vamboi community noted during an in-depth interview that;

The use of 'condemn' (herbicides) among farmers these days is too much. Every farmer in this community (Vamboi) uses 'condemn' (herbicides) on his or her farm. ...and we usually spray a field about 3-4 times over the season. This has killed many soil organisms such as earthworms, millipedes, centipedes, snails, toads, etc which invite rains and maintain soil fertility. The chemicals also pollute our streams and other water bodies on our farms. That is why these days we carry drinking water from home to our farms. We no longer drink from farm streams.

From the narrative, it suggests that indiscriminate use of chemicals causes water and air pollution, which is a source of danger to the survival of species. The overdose of these chemicals does not also enhance the ability of the soil to maintain soil nutrients and water for plant growth.

Farmers also attributed climate change to lack of adherence to spirituality, traditional worship and curses arising from irregular performance of rituals and sacrifices to community gods and ancestors. It was reported that in the past sacrifices were made to the gods and ancestors of the land before farmers started farming activities at the beginning of the farming season to seek from the ancestors and gods, good harvest. The *Jantina* (earth priest), received sheep, goats and fowls from farmers to perform traditional worship and offer sacrifices to community gods and ancestors on behalf of the community. These sacrifices were to the *jang vene or boi veneng* (community god) to literally mean “begging for food from the ancestors and community gods, primarily, because the sacrifices were meant for appeasing community gods for ensuring good harvest. After harvest, farmers would further contribute food items, small ruminants and fowls for the *Jantina* to

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perform a thanksgiving sacrifice. This was termed *pa jang vene ling*, literally meaning “fetching water for the *jang vene* and ancestors” and thanking them for granting them successful farming season and good harvest. This sacrifice was also used to ask for good yields from economic trees such as shea and dawadawa trees. The sacrifice also ushered in a ban on harvesting the fruits of these economic trees until they were ripe and or dry for harvesting. Culprits of non-compliance were fined a ram, he goat (male goat), and fowls for sacrifices to be made to the gods and ancestors. These fines were enforced. Reportedly, communities were no more strictly adhering to the standard protocols of traditional worships associated with farming and this is part of the reason rains are not favorable for farming activities. In fact, most traditional sacrifices that supported social and economic lives have been reportedly relegated to the background by the youth.

Finally, the results on farmer perspectives also showed that climate change is a curse for widespread incidences of breaking traditional taboos among the youth and breakdown in social order and morality. According to respondents, sexual intercourse in inappropriate places such as farms and the bushes, stealing and pegging of wood from ebony tree (locally called *kali dang*) are taboos that attract curses from the gods and ancestors. In narration during an FGD:

It was a serious taboo in the past for people to engage in sexual intercourse in the bush and on the farm. It was also a serious traditional crime that incurred the wrath of the gods and ancestors if a farmer stole farm produce or any item from another farmer’s farm. These acts were/are considered as “dising” (dirt) to the gods, ancestors and the spirits of the land. This spoils the land for any farming and other activities. It was also a taboo for women to go the farms during their menstrual periods. Women who were in their menstrual periods were considered impure before the gods and were prohibited from going to the farms. Family heads who worshiped the family and farm gods did not eat food prepared by such women. Today, all these taboos have been broken, and as punishment for breaking them, , the gods and ancestors invoke droughts, floods, infestation of pests and diseases on communities (in-depth interview with an elder in Challu).

In modern times, these taboos have been disregarded and people even have sexual intercourse everywhere, in the bush or farm. Stealing from farms has become common. Many farmers' report of stolen bags of groundnuts, maize and tubers of yam from their farms during the harvest season annually. Women continue to violate the taboo which inhibits them from going to the farms during their menstrual periods. These acts that offend the gods are on the increase and widespread, thus, leading to multiple curses – drought, heavy rains and floods, pest and diseases.

Discussion

Two key issues underpin this discussion. First, it underscores that local perceptions corroborate the anthropogenic view of the causes of climate change. Second, we also argue that the local perspectives of farmers are essential parts of their local knowledge as shaped by their worldview and cosmovision.

First, local perspectives generally point to human activities as the primary causes and drivers of climate change. From the results, these human activities generally relate to the utilization of natural resources, including the vegetation and forest products, farming practices and the spiritual and religious domains of life. These activities have led to deforestation and loss of biodiversity, breakdown in spirituality, traditional values and norms for biodiversity conservation and curses from the gods. Such perceptions corroborate the anthropogenic view of the causes of climate change. Several scholars and authors contend that anthropogenic activities have been responsible for climate change since the industrial revolution (Olivier et al., 2017; USEPA, 2018). For instance, the felling of trees through increasing chainsaw activities and charcoal production were causing deforestation and degradation of forest lands in many parts of the country and other places (Djagbletey et al., 2012; Acquah, 2012). In the Afram Plains of Ghana, charcoal production has become prominent because it is a main livelihood option of the people (Codjoe et al., 2011). In

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northern Ghana, economic trees such as shea and dawadawa trees were preserved on farms as properties of chiefs and earth priests (Blench, 2006), but even these are no more spared in the act of cutting down trees for lumber and charcoal production. Another widely reported cause of climate change is bush burning and the negative implications of Greenhouse Gases (GHGs) in global warming. Some researches in Ghana have attributed climate variability and change to bush burning which has become an annual activity (Fosu-Mensah et al, 2010; Acquah, 2012; Ahenkan & Boon, 2010). According to the FAO (2009), bush burning is one of the activities that will accelerate environmental degradation and emissions of GHGs to cause climate change, which will consequently affect human livelihoods and food security. In general, climate change is attributed to bad farming practices and bush fires (Chauhan, 2010; Farauta et al., 2011).

Second, the anthropogenic view of the causes of climate change is reflective of the local knowledge of the people as derived from their worldview and cosmovision. While many aspects of the anthropogenic view largely corroborate the western scientific understanding of the causes of climate change, the point of departure is the spiritual cause of climate change. The breakdown in spirituality and non-adherence to customs, traditions, norms and values associated with good life according to the worldview of the people is cited as a cause of climate change. From the viewpoint of the Sisaala, climate variability and change is punishment from the gods and ancestors for non-adherence to many traditional norms, values and belief systems. Similar findings have been reported attributing climate change to acts of gods and ancestors due to breakdown in norms and belief systems in many African rural communities (Zoundji et al., 2017; Egeru, 2012; Bonye & Jasaw, 2011; Ogalleh et al., 2012; Eguavoen, 2012).

Some studies show that excessive use of weedicides and unsustainable agricultural production practices were adversely affecting ecosystems and ecosystems services which provides livelihoods

to the people in Africa (Dittoh & Akuriba, 2018). Local perceptions revealed that these chemicals drive away spirits of farm gods that avert or prevent climate hazards like droughts and floods from happening. In addition, social vices, stealing on farms has become very common, a situation that invokes the wrath of the gods and spirits of the land, ancestors and the almighty God. These findings corroborate those of Egeru (2012) that local people attributed floods and droughts to sexual intercourse among men and women in the bushes and stealing in Eastern Uganda. For local populations, the smaller gods and the almighty God invoke extreme climatic events on the people as punishment for deviant social behaviors.

The interpretation that climate change is caused by human activities, including spirituality reflects the holistic world view and cosmovision of the people in the Sisaali speaking areas (Figure 2). Climate change and variability is not interpreted as a standalone phenomenon; it is interpreted as a natural event (as in the physical climate), its occurrence as caused and shaped by the social and spiritual domains of life of the local people. This worldview and cosmovision integrate three main domains of life, namely, the human world, the natural world and the spiritual world (See Millar, 1999; Gonese, 1999).

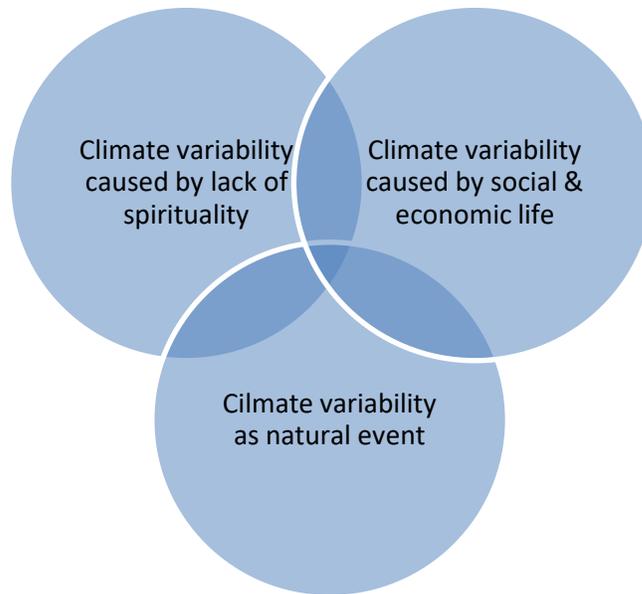


Figure 2: Worldview on causes of climate variability among the Sisaala
Source: Adapted from Millar (1999) and Gonese (1999).

Millar (1999) presents the cosmivision of the people in northern Ghana as an integrative worldview. He underscores that for the traditional people, gods, spirits, ancestors, spiritual and political leaders, sacred groves, lands and shrines, ritual crops and animals, food items and cash crops are all an integrated whole. Drawing on the traditional cosmivisions from Ghana and Zimbabwe, Millar (1999) asserts that the worldview of many indigenous communities in Africa associate spirituality with land, water, animals and plants.

Per the worldview of the Sissala (Figure 2), climate variability, particularly, rainfall variability is self-inflicted and caused by a wide range of factors partly underpinned by spirituality, religion and culture. These factors are multiple; non-adherence to rituals that help to bring good rains, breakdown in social order and violation of taboos that destroy the sanctity of the natural environment, especially, land, the lack of discipline among traditional spiritual leaders and their lack of purity, including rain ‘makers’ and above all, rainfall variability as punishment for societal

misconduct. According to Millar (n.d), rain is regarded by African people as one of the greatest blessings of God, who is often referred to as the rain – giver. Many of them make offerings and prayers to God in connection with rain. Rainmakers are reported in all parts of the continent. Their duties are to solicit God’s help in providing rain or in halting it if too much of it. Hence, they are engaged in the art of rainmaking and or stopping. There are rites to mark the onset of the rains, the first planting, the harvest, and the beginning of the hunting season. Rainmaking is one such rite, and rainmakers are amongst the most important spiritual leaders.

This positions traditional worldview in religion and philosophy, but also underscores the centrality of spirituality in traditional and or local knowledge systems. According to Harverkort and Hiemstra (1999), religious and philosophical concepts have their place within traditional worldviews. This is expressed as a hierarchy between divine beings, spiritual beings, especially the ancestors, men, women, and natural forces, such as climate, diseases, floods, soil, vegetation and animals. In the words of Goduka (2000), African knowledge is spiritually centered wisdom. This is because in the traditional African view, the universe is a spiritual whole in which all beings are organically interrelated and interdependent.

Implications for development planning

The paper underscores that such a holistic interpretation of the cause of climate change has profound implications for development planning towards achieving SDG 13 (Climate Action) which calls for urgent action towards combating climate change and its impact. In this regard, we argue that Climate Change Mitigation and Adaptation Planning (CCMAP) within the context of decentralization and local governance is the most appropriate policy framework in the study context, but also at national and continental levels where similar conditions prevail. Given that local knowledge on the causes of climate variability largely corroborates the anthropogenic view,

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the paper recommends the promotion of CCMAP that is anchored by an integrated approach to implementation at the local level. In more specific terms, the combination of an Endogenous Development (ED) approach with Behavioral Change Communication is imperative for achieving sustainability. Such an approach will essentially require predominant reliance on local resources and a central role for traditional institutions of governance in consonance with the traditional worldview and cosmovision of the people. Behavioral change communication and community action planning should be emphasized as an innovative strategy for achieving positive behavioral change that supports minimization of the human activities that destroy the natural environment but also contribute to environmental and or vegetative regeneration. Innovation for achieving behavioral change is important because past education programmes have not achieved the desired outcomes as unsustainable ways of utilizing natural resources continue to prevail.

Within the framework of CCMAP, the paper recommends the promotion of multiple strategies and interventions. These should span community education and the promotion of self-initiated community resource management schemes, conservation of natural resources, particularly, the vegetation, prevention and management of bush fires, and a vigorous promotion of agro-forestry and tree planting in tandem with sustainable development. Furthermore, we recommend the promotion of livelihood diversification that draws largely on local resources as an integrated part of climate change mitigation response and interventions. Farming can still be sustainable under climate variability if the right measures are taken. Education of farmers on sound farming practices and conservation can help maintain productivity of arable lands to support agricultural production under environmental change in rural areas.

Conclusion

In conclusion, local perspectives and knowledge of the causes of climate variability largely corroborate the anthropogenic view of the causes of climate change in the global climate change research community. The causes reflect multiple human activities that destroy the natural environment and or contribute to greenhouse gas emissions. They generally include forest resource extractive activities, agriculture mechanization and breakdown in spirituality, traditional values and norms. The paper underscores that spirituality as a cause of climate change is a departure from the western scientific worldview and that this view arises from a holistic and integrated worldview of the indigenous Sisaala. To support efforts towards achieving SDG 13, it is imperative to promote Climate Change Mitigation and Adaptation Planning (CCMAP) that is anchored on Endogenous Development and Behavioral Change Communication approaches to implementation.

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