Climate and Development

ISSN: 1756-5529 (Print) 1756-5537 (Online) Journal homepage: http://www.tandfonline.com/loi/tcld20

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To cite this article: Joseph Awetori Yaro, Joseph Teye & Simon Bawakyillenuo (2015) Local institutions and adaptive capacity to climate change/variability in the northern savannah of Ghana, Climate and Development, 7:3, 235-245, DOI: 10.1080/17565529.2014.951018

To link to this article: https://doi.org/10.1080/17565529.2014.951018

Climate and Development, 2015
Vol. 7, No. 3, 235–245, http://dx.doi.org/10.1080/17565529.2014.951018

climate and development

RESEARCH ARTICLE

Local institutions and adaptive capacity to climate change/variability in the northern savannah of Ghana

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(*Received 27 November 2013; final version received 24 June 2014*)

Ghana faces several challenges from climate change/variability. Local institutions provide the framework within which idiosyncratic capacities of local people can be exercised in their adaptation to climate change. This paper examines the importance of formal and informal institutions for building adaptive capacity. Both formal and informal institutions play different but complementary roles in enabling or preventing the ability to cope, benefit and adapt to climate change. Responses to climate change in northern Ghana are dependent on the nature of institutions that grant people access to resources; define their exposure to climate threats; and dictate the rate of recovery from debilitating disasters. The effectiveness of institutions is constrained by their limited spatial and temporal reach, limited financial and human resources, and sometimes the faulty strategy designs and implementation procedures. Traditional institutions may malfunction when modern interpretations of tradition are in the interests of custodians of tradition rather than the ordinary poor. We emphasize the need for synergy between institutions that support adaptive capacities of the poor, and request corrective measures to institutions that lead to maladaptation.

Keywords: local institutions; climate change; adaptive capacity; northern Ghana; savannah

1. Introduction

Local institutions provide the framework within which idiosyncratic capacities of local people can be exercised in adapting to climate change. Traditional informal institutions are important in distant rural Ghana, where traditional leaders interpreting African customary laws, rules and norms regulate the political economy. This paper examines the institutions at the local level of six communities in terms of their role in facilitating or constraining capacity to adapt to climate change. Institutions are defined as the 'rules of conduct in organizations, routines and repertoires of procedures' (Koelble, 1995, p. 233). Institutions refer to the rules that are used in relationships between individuals (Ostrom, 2000), rather than merely interpreting them as organizations. Institutions are the rules, norms and strategies, which shape individual and organizational behaviour, while organizations are the social structures that embody agency (Koelble, 1995). Institutions are seen by North (1990) as the 'rules of the game' and the 'players of the game'. The rules of the game can be either de jure or de facto associated with formal state institutions and traditional informal institutions, respectively. This paper argues that both formal and informal institutions play synergistic roles in enabling people to adapt to climate change only when they function well with minimal bias and conflict of interest. It will discuss how both institutions are complementary at the local level in providing the building blocks for livelihoods and how their failure through lack of resources or changes in institutional structures affect the adaptive capacities of members of their communities. How have local institutions facilitated household and individual capacities and reactions to climate challenges?

Broadly, we distinguish between formal and informal traditional institutions. Organizations are classified as state/public, private/market and civic/civil society (Agrawal, 2008). The state/public organizations include local governments and local state agencies. The private/market organizations include service organizations and private businesses, while the civic/civil society includes membership of organizations, cooperatives and other informal groups. All these institutions are important as they complement each other in the differential roles they play and in their ability to reach specific people at particular points in time.

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Adaptation and adaptive capacities relate to the ability of people enabled by some conditioning factors (Eriksen & Brown, 2011; Vincent, 2007) embedded in institutions. Institutional arrangements are known to account for the success or failure of people to adapt to debilitating or even favourable conditions and the state of vulnerability (Christoplos et al., 2009; International Panel on Climate Change (IPCC), 2007; Perrin, Kononen, & Agrawal, 2008). Informal institutions are the social cement that binds society together and are manifested in traditional governance systems, norms and cultural practices, social capital and networks that enable different livelihood arrangements.

The role of institutions is paramount because they legitimize practices, rules of conduct, and norms, which are critical in defining access forms to resources, and therefore different capacities of people as enabled by the configuration of power relations. The contours of these power relations are important in defining the sustainability of adaptive capacity, adaptation strategies and actions of both individuals and organizations themselves. Local institutions shape climate hazards in three important ways: (1) they influence how households are affected by climate impacts; (2) they shape the ability and manner of households to respond to climate impacts and pursue different adaptation practices (3) and they mediate the flow of external interventions in the context of adaptation (Agrawal, Chhatre, & Hardin 2008).

The institutional framework conditions the transactions between individuals, groups and states through a deterministic structuring of options, opportunities and constraints (Dovers & Hezri, 2010; Whitehead, 2002). They create the space within which households and collectives choose specific adaptation practices (Perrin et al., 2008). Institutions define and coordinate access patterns to resources (including knowledge) actions, development of capacity, and structures. The paper argues that the role of individual agency is important, but this agency is given outlet by the interaction of formal and informal institutions, which provide the building blocks. Agency is important in bringing about changes in institutions as society evolves. This is important in defining the agency–structure relationships in the social sciences (Giddens, 1979).

A focus on institutions details northern Ghana's potential for adjustment to the future climate challenges and the development actions needed to build adaptive capacities. In the policy world, the results point to policy entry-points and many 'bad' entry-points for dry areas with poor populations.

1.1. *Climate change and variability in northern Ghana*

Northern Ghana is located in a difficult natural environment with a history of colonial and post-colonial neglect of development activity, which has increased the development gap between the north and the south. Poverty in rural areas of northern Ghana remains significantly more widespread and more persistent than in rural southern areas – this observation, and the factors explaining it have been the focus of much research over the years (Bening, 1975; Dickson, 1968; Konings, 1984). The socio-economic condition of northern Ghana is attributable to a range of factors including changing climate, policy neglect, political marginalization, poor infrastructure, localized conflict, rapid population growth, markets, low investments, natural disasters and technological-bottlenecks. The impacts of climate change in northern Ghana includes water stress, reduced food security, increased impacts from extreme weather events, displacement of people (due to floods) and an increase in the transmission of vector borne diseases (Codjoe, Atidoh, & Burkett, 2012; Dietz, David, Saa, Francis, & Ofori-Sarpong, 2004; Eguavoen, 2012; EPA, 2000; Mendelsohn, Dinar, & Williams, 2006).

Northern Ghana is facing challenges posed by changing climate and weather variability. In the semiarid and subhumid zones of West Africa, rainfall during the period 1968– 1997 has been on average some 15–40% lower than during the period 1931–1960 (Nicholson, Some, & Kone, 1999). It is predicted that the north will bear the brunt of climate change effects (Minia, 2004; Oguntunde, 2006). Based on future scenarios, it is projected that annual rainfall total will decrease by 9–27% by the year 2100, with the range representing spatial variations (Minia, 2004). The climate change scenarios for West Africa agree on a trend of increased temperatures, but fail to agree on the nature of precipitation, as a few show increases (Haarsmaa, Selten, Weber, & Kliphuis, 2005; Tschakert, Sagoe, Gifty, & Samuel Nii, 2010) while others indicated decreases (Held, Delworth, Lu, Findell, & Knutson, 2005; Laux, Kunstmann, & Bárdossy, 2008). This complicates the already unreliable agrarian economy and calls into focus the role of non-farm activities in making a living within the rapidly modernizing institutional conditions.

Synergistic relations exist between climate change and social, ecological, political and economic factors. In recent times, there is a difficulty of singling out climate as a driver of local livelihood change thereby suggesting that livelihood changes in human–environmental systems may be best understood by looking at co-evolution of different driving forces over time (Nielsen & Reenberg, 2009). The ability to survive and respond appropriately to climate change impacts is contingent on people's and community's strengths and weaknesses as defined by idiosyncratic and wider processes. Adaptation is difficult and impossible to separate from 'development' (Cannon & Muller-Mahn, 2010).

Adaptation to climate change means actions targeted at the vulnerable system in response to actual or expected

climate stimuli with the objective of moderating harm from climate change or exploiting opportunities (McCarthy, Canziani, Leary, Dokken, & White, 2001). Davies (1996) and Chambers (1989) argue that strategies pursued by households hitherto described as coping strategies, should be distinguished from adaptation strategies, which are geared towards maintaining a continuous flow of food and income for household consumption. These strategies include efforts in agricultural and non-agricultural areas including, agronomic/cultivation practices, marketing, new jobs and changes in social relations aimed at increasing their livelihoods resilience.

1.2. *Description of the study area*

The research was conducted in six communities, two each in the Savelugu-Nanton District (Kanshegu and Nyoglo) and the West Mamprusi District (Wungu and Gbeduri) of the Northern Region; and the Kassena-Nankani East District of the Upper East Region (Pungu-Bavugnia and Nyangua) (see Figure 1).

The communities of Wungu and Gbeduri are inhabited mainly by Mamprusis. Islam is the main religion followed by African traditional religion and then a few Christians. The landscape is gently undulating with a few isolated hills around Wulugu thereby resulting in frequent flooding of crops and settlements. Land is relatively more abundant than the other two districts. Also, the availability of several valleys has led to the cultivation of vegetables and watermelons as commercial crops. Outmigration of young girls to the major cities of Ghana is a common phenomenon in the district.

The people in Kanshegu and Nyoglo are Dagomba and are mostly Muslim with a few Christians and African traditionalists. The landscape is mostly flat and gently sloping. Outmigration of young girls to the major cities of Ghana is common. Kanshegu is located on the main trunk road and therefore more exposed to the forces of modernity, than Nyoglo which is an interior community with more access to land and some irrigation potential.

The inhabitants of Pungu-Bavugnia and Nyangua are Kasenas with the highest population density of 91 persons per km^2. There exists a mix of traditional African religion and Christianity with a few Muslims. The water table is very high in the district and enables the sinking of shallow wells for dry season irrigation gardens. This has gained it the reputation of the tomato district during the dry season.

2. The research methods

The paper uses participatory qualitative methods because institutions are better captured as relations between people in terms of behaviours, attitudes and rules. Participatory approaches in African rural communities can facilitate understanding and use of uncertain climate information (Roncoli, Crane, & Orlove, 2009). Group discussions of weather and climate especially scientific forecasts often result in higher levels of farmer response (Marx et al., 2007). The six communities were chosen because they represent micro-ecological zones with significant differences in climatic, hydrological, governance and socio-economic conditions.

We investigated the various local institutions which act as gatekeepers to resource access and social determination, showing how these are important to effective adaptation to climate change. Generally, expert interviews and discussions with groups and the vulnerable in the villages aim at mapping these institutions and showing their potential roles in adaptation and 'maladaptation'. Maladaptation refers to the negative changes and practices resorted to by households and individuals in reaction to climate stressors that are inimical to the their welfare or that of the community as a whole.

In each community two focus group discussions with sizes of 12 people were held. The first was normally with the chief, sub-chiefs and ordinary men. The choice of elders and young men enabled us capture the structure of power and access forms to resources for building adaptive capacity; the different aspirations and perceptions by the elderly and the young; the androcentric positions still held; the changes in traditional processes and structures; and responses to climate variability by different segments of the population. The second focus group discussion was with a group of 10 women composed three poor petty traders, three wealthy farmers and four non-poor women with mixed occupations.

We purposefully selected 10 people from each community composed of 5 men and 5 women for in-depth interviews. A grounded understanding of the role of institutions and livelihood resources was gained from these interviews. Expert interviews were held with the district planning officers to elicit the state institutional capacities in helping build adaptive capacities.

3. The role of formal institutions

The formal institutional architecture in Ghana is based on multi-level government and policies. At the national level, policy frameworks and the institutional architecture are designed to consider the risk of climate change through key sectoral areas such as governance, disaster management, water and agriculture. The important state organizations found in the area include the district assemblies, agents of ministries and the national disaster mobilization organization (NADMO). Non-state organizations included non-governmental organizations (NGOs), financial organizations and civil society groups. Interviewees mentioned the district assemblies, the extension services department of the ministry for food and agriculture,

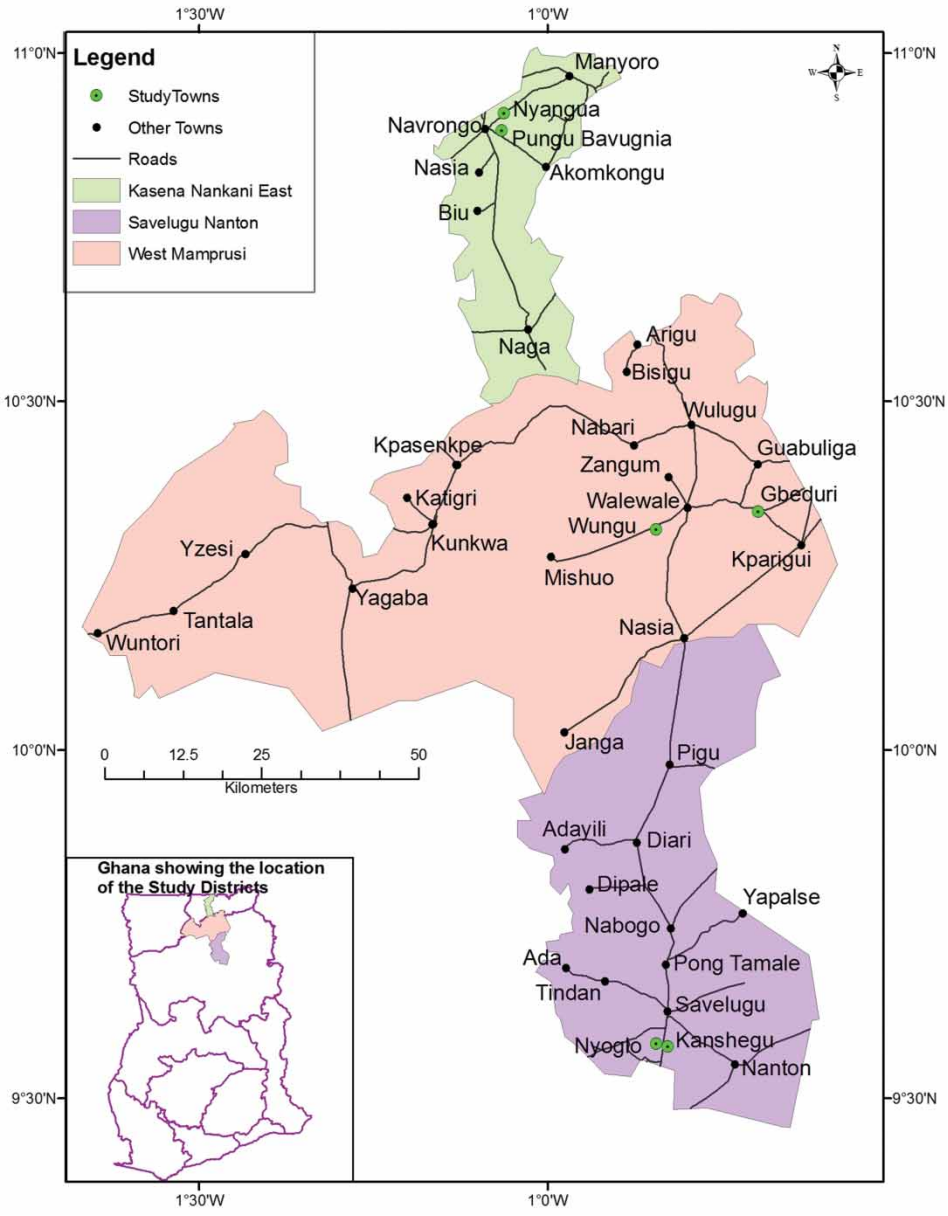

Figure 1. Map showing location of study communities in northern Ghana.

NADMO, NGOs, Micro finance organizations, the community health nurses of the ministry of health and religious organizations, as important in putting in conditions that enabled them adapt to climate change and other contingencies. Formal institutions in Ghana over the years have the responsibility of developing the nation through infrastructure provision, social services provision, economic growth, technology transfer, skills and knowledge development, security and protection of rights (collated from interviews and focus group discussions (FGDs)).

The Ministry for Food and Agriculture through its extension services department was acclaimed as the best (all male focus groups) in interventions addressing climate change through the provision of fertilizers to deal with declining soil fertility and meeting the nutrient needs of new crop cultivars, the introduction of new high yielding crop varieties, the teaching of skills and provision of information on climate change and other stressors. Important programs mentioned included the fertilizer subsidy program, the mechanization of cultivation with tractors and bullock ploughs and the facilitation of farmer cooperatives or networks. The role of innovation in adaptation to climate change is of paramount importance. This requires appropriate technology, skills, knowledge, change in social attitudes and behaviours, and the right political, market and cultural adjustments. The extension services

translate policies that address these dimensions of social and economic change directed at building climate resilience and achieving general socio-economic development. The adaptive strategies enabled by these interventions included the intensification of crop cultivation, use of tractors and adoption of new crop cultivars. The capacities are enhanced because of the knowledge and skills acquired in intensive cultivation practices and machinery use. Reducing prices of fertilizers and targeting the poor makes the adoption of high yielding and short maturing crops possible due to the endemic poverty which excludes poor farmers from adopting/adapting their farming practices. Most farmers combined these modern skills and knowledge with their traditional ecological farming practices of mulching, use of animal manure and mixed cropping in order to abate the negative impacts of climate stressors (individual interviews in all communities). The participants at the focus groups in Gbeduri for instance estimated that about 90% of the community used fertilizers, but for selective crops only due to poverty, while the same number adopted hybrid maize seeds, and yet another half have diversified crops into cowpea, soybeans and watermelons. All these were attributed to the fertilizer subsidy, introduction and advertisement of hybrid maize, cowpea and soybeans. Even though some of these programmes are no longer running, they certainly had sustainability effects.

The district assemblies played more indirect roles by their concentration on infrastructure, sanitation, information and governance. The importance of feeder roads, culverts, schools and clinics were acknowledged in all the focus group discussions as relevant in building community level adaptive capacity. The district assemblies incorporate climate change into their development plans and activities. The Savelugu-Nanton district for instance was collaborating with the Environmental Protection Agency (EPA) in implementing an orchard scheme using mangoes planted at the banks of rivers to both protect the river from siltation and offer villagers an alternative/complementary source of income. Small dams or dug-outs have been constructed by the district assemblies to provide a source of water for livestock and domestic use especially in the dry season. The assembly in Savelugu and Navrongo collaborated with NGOs and the Information Services Department to disseminate information on climate change impacts and the need for proactive adaptation and mitigation. The Community Water And Sanitation Division is now more active than before in the provision of water, dissemination of information on poor sanitation practices, and ensuring best phytosanitary practices (district planner, Savelugu and Navrongo). Also, five communities are being assisted under the Africa Adaptation Project with seedling to plant along the river banks as both mitigation and adaptation measures. All the communities visited had one or more boreholes. The feeder roads to all villages were in good condition enabled by the provision of graders to the assemblies by the Ministry of Local Government. Communities therefore have an adequate amount of physical/economic capital necessary in carving their livelihoods, which involves the freedom to make choices and changes to livelihood portfolios. The conditioning effects of these interventions are necessary for building community adaptive capacities, which in turn enables individual agency. The poor provision of economic infrastructure leads to maladaptation as a 35-year-old woman in Pungu-Bavugnia stated 'the politicians come and promise to expand our dam to enable us engage in all-season gardening, but it never materializes, so many of us merely cope with activities that don't enable us to feed our families'. Outmigration of able-bodied household members and the resort to excessive 'environmental mining' are negative coping activities occurring in all three districts, and confirmed by recent evidence for northern Ghana (Rademacher-Schulz, Schraven, & Mahama, 2013).

When climate-related disasters strike, communities are often not able to support each other because of the devastation caused to all categories of people (uniform exposure). Disaster management has become an important intervention that remedies the short-term shocks and enables people to bounce back to previous levels. The NADMO works with District Assemblies in assisting climate-disaster-stricken communities. In all the communities, respondents acknowledged the vital role that was played by NADMO and the district assembly during the floods of 2007, even though all the communities complained of inadequate relief supplies. Disasters are critical periods in the lives of poor communities. This is because their savings are in household assets, livestock and natural assets, which are most vulnerable to these disasters. The responses to droughts by state institutions were not as visible as responses to floods, which are disasters whose onslaught occurs within moments with visible damage (all focus groups). Droughts translate into lower harvest, poor nutrition and increased health problems in much slower conditions (40-year-old woman in Pungu-Bavugnia). Food aid, which is often the most appropriate response, was reported in all the villages. Reports of discrimination and favouritism in sharing out relief items of roofing sheets, cement, blankets and food was made by all communities which certainly leads to maladaptation by the very poor whose voices are weak and have no social and political connections. Hence, NADMO has been useful in helping in the short-term coping of disaster victims, but unfortunately have not been prominent in rebuilding adaptive capacities. Helping people get back to their previous welfare levels is important. Certainly, the contribution to adaptive capacity lies in the prevention of community members from lapsing into destitution by propping them when all is lost, which enables them mobilize and strategize to rebound to their previous levels.

As seen from the contributions of the three state organizations above, the critical point is the interwoven nature of their roles in building adaptive capacities of communities and individuals. An old lady in Gbeduri in response to a question on ranking institutions said that:

> it is impossible to say that one is more important than the other because while the extension agents help us feed the next year, the assembly helps put value and reduce drudgery of life and also build the lives of our children through educational facilities; the health agents support us now and prevent future sicknesses which will make useless all other investments.

Clearly, the integrated nature of the roles of these institutions is important in capacity building and charting the course of adaptation.

4. The role of NGOs in building adaptive capacities

This section provides a holistic view of NGOs since our participants had difficulty identifying them by name. The roles of NGOs vary a great deal just as their capacity to impact society. Residents of Kassena-Nankani Nankana East district had a smaller NGO presence than Savelugu-Nantong District and the West Mamprusi District Assembly. Most NGOs are located in Tamale and tend to operate within the Northern Region. In Nyoglo and Kanshegu people recount coming into contact with so many NGOs assisting in the development of their capacities not necessarily geared towards adapting to climate change, but meeting the challenges of their livelihood activities. However, none of the organizations have operated over a long time period in one village as they end projects according to their project timelines and resource availability (assemblyman of Kanshegu).

NGOs are actively engaged in awareness creation and dialoguing with local communities on the impacts of climate change and how to deal with them. In all villages residents confirmed that NGOs have provided them with information on climate change. Most adverts, talk shows and call-ins on radio about climate-related threats are paid for by NGOs. Community-based radio stations therefore also play important roles in broadcasting discussions on many risks and measures to overcome hazards.

In the West Mamprusi District the farmers have been introduced to a weather-index insurance scheme by an NGO specifically in reaction to climate variability. Premiums were low and this enabled mass participation even though the compensation formula and amounts received for weather-related losses were not satisfactory (men's discussion, Gbeduri). It is no longer in operation probably due to challenges that need re-strategizing.

The majority of NGOs are said to concentrate on women by supporting them in both farm and non-farm activities. They help women with technical and financial capacities to carry out their livelihood activities. Through this positive discrimination, they have been able to empower women who now cultivate their own plots of land, modernize the extraction of shea butter, increase investment in trading and local manufacturing (women's focus groups, all communities). Emphasis on girl-child education in these androcentric societies is useful in complementing the government's policy of free and compulsory primary education.

Financial assistance especially to women was common in all communities. The group loan schemes whereby farmers are put into a single group and granted a loan, which is then split among them, was the most cited. In this arrangement all farmers bear responsibility for failure of members to repay loans. This therefore provides the motivation and communal check on those unwilling to pay. It also helps the vulnerable who cannot pay as the others act as a form of insurance. Some of the farmers who received the loans were not able to pay back and as a result all group members were refused loans for the second time. A woman in Pungu-Bavogunia asserted that 'I am always afraid of such monies (loans)'. A 26-year-old man in Wungu indicated that he received a loan but it was not beneficial because he was not able to recoup even the initial capital investments as a result of the weather-related crop failure. He stressed that some members of the group were not able to pay the loan and there were some problems in the groups that made him opt out and has decided never to apply for any loan again. Several villagers indicated that they failed miserably in their investments to the extent that they had to borrow money or sell assets to pay for the loans and interest (male group interview, Wungu). They emphasized the need for loans because their personal resources were not enough to meet the spiralling cost of farming and other businesses, but decried the group loan strategy as inappropriate.

NGOs therefore provide direct and indirect adaptive capacity building activities. They lay the foundations for individuals to build various capitals, and directly assist in coping and adaptive livelihood activities. Awareness of climate impacts is an important step in strategizing to counter its negative impacts. Skills and knowledge enable people respond adequately to climate stressors. Financial resources are key to building livelihood capitals and engaging in strategies meant to offset the impacts of climate change. Targeting women is an appropriate response to the social inequalities that shape climate impacts on men and women. NGO activities help build both community and individual adaptive capacities, but poor conceptualization and strategies may also lead to maladaptation by specific groups. On the whole, the intentions and activities of NGOs, which change the rules, resources and relations between actors, are positive in building adaptive capacity.

5. The role of informal institutions

In rural Ghana, traditional governance systems define the life trajectories of its inhabitants as access to crucial natural resources and social networks are immersed in the functions, norms, rules and obligations of these institutions. The traditional informal institutions are particularly important in defining relations of power, which are reinforced by formal institutions of the state. We shall discuss the governance systems in the communities, rules of access to natural resources and social support systems which all combine to define a person's adaptive capacity in rural Ghana. Due to the different traditional governance systems the discussion is in two parts – chieftaincy systems and the tendana/family systems.

5.1. *Chieftaincy and adaptive capacity in Gbeduri, Wungu, Kanshegu and Nyoglo*

In the Savelugu-Nantong and the West Mamprusi Districts the main governance institution is the chieftaincy, which has a hierarchical system. The chieftaincy institution has command and control over natural resources crucially needed in this agrarian society. Each community has a chief who is supported by various sectoral sub-chiefs. The sub-chiefs are given different sections of the village lands to govern; so all families whose lands fall in those sectors are accountable to these sub-chiefs. However, the sub-chiefs have no dictatorial powers over the land use, but can arbitrate conflicts that arise, caution families misusing land, sanction individuals flouting traditional rules of resource use. In addition, they have a community development chairman, assemblyman and the *magazia* (women's leader).

In response to the question 'Who has control over natural resources including land for farming in this community, the chief of Kanshegu responded as follows:

> It is the chief who has control over land and all natural resources. In terms of access however, every household has its own farmland (kagsogu) which is absolutely under their control. Women can only pick sheanuts and fuelwood from their husbands' farm. , Irrespective of whose farm the dawadawa is found, it does not belong to them but to the chiefs. With access to herbs for treatment of ailments, anybody can harvest anywhere without prior notification to anybody. Land for residential purposes is sold by the Savelugu-Naa and Nyoglo-Naa (chiefs). When farmlands are converted to residential land only the chief can transact in them but with smaller shares going to the farmland owner.

In Kanshegu the chieftaincy institution using traditional rules disenfranchises families by selling out most roadside farms. These practices expose individuals to insecurity, which is an important determinant of vulnerability. Land tenure insecurity is an eroding factor of adaptive capacity. On the other hand, family heads in Wungu, Gbeduri and Nyoglo rent out farmland such as valleys with income flows ensuring some equity. The chiefs have no hand in these transactions unless a dispute erupts (focus groups with men in Gbeduri and Wungu). These institutions enable all in the communities fair access and usage of natural capital. However, the sale of periurban land for residential purposes disenfranchises families of their lands and causes maladaptation for those without resources to adapt successfully.

The extended family system is an important traditional institution. This system is still much more stronger in the northern region as a result of family resource sharing and residential arrangements of Islam, where many nuclear households stay in a large compound and feed from a common resource pool. Each member contributes labour and food for the welfare of all. Male members are assisted to marry at the expense of all through sale of family resources. All males resident in the compound cultivate the landlords' farm. The women take turns to cook for all using their own resources of ingredients, firewood and time. Health and education expenses are catered for by those with more resources and from general family resources of livestock and other assets (FGDs with men and women). Extended family systems enable individual adaptive capacities through the power of the collective. However, many were not happy with its dynamics due the commercialization of every aspect of life which therefore means that some members could keep resources outside the family due to perceived inequalities in contribution to the pool. Where this dissatisfaction is deep, extended family structures tend to prevent the building of adaptive capacities. Modernization was blamed by all in the focus groups- by this they meant, changing cultural norms influenced by television and education, rising cost of living, availability of too many foreign products and lower reliance on local products.

5.2. *Decentralized land systems and adaptive capacity in Pungu- Bavugnia and Nyangua (Earth priest/family systems)*

In the Navrongo district, the various families and earth priest (Tigatuu) control their own landed resources. There is an atomized system of governance whereby family heads play prominent roles in every aspect of life of their families, but collaborate with 'chiefs' and the Tigatuu in dealing with wider community matters. The chief of Pungu-Bavugnia for instance has no control over resource access in his community. The Tigatuu (earth priest) who deals with the land deity has control of common access natural resources, which are limited in the two villages as a result of population growth. According to the earth priest of Pungu-Bavugnia who administers all land in Pungu:

> The earth priest owns the land, and the chief owns the people. But we help each other take care of the community. If you want to build on the land, you have to see the earth priest. If you do not have a place to farm and wants a plot of land to farm, it is the earth priest you have to see. If someone is murdered in the community it is the earth priest you have to report to. But where another person injures a person, it is not our responsibility to arbitrate, but that of the chief.

He goes on to complain that things have changed and the institution is under threat by the forces of modernization, as in:

> But because the world has changed, some of the people no longer come to the earth priest. They sell land without notifying us, and the buyer begins building on it without first seeing the earth priest. If we try to find out how it was sold, they begin quarrelling with us. Because we want peace, we no longer talk of most of these things. Punyuro used not to have an earth priest but now they do, by creating one. They also now perform rituals and give land out to people. Is it now a money world?. (Earth priest of Pungu)

While we see the institution of chieftaincy ascertain more powers in the northern region over land, the earth priest is losing control to families and newly created earth priest. The nuclear family is very strong which makes ownership of family land a prerogative. Both husbands and wives have access rights to their nuclear family allocations from the compound family head.

In the communities in the Kassena-Nankani district, the nuclear family system is stronger but with important links to the wider extended family. Even though nuclear families consisting of husband, wife and children provide their food and other material needs for themselves, it is the responsibility of the landlord to assist those in distress. The extended family heads (landlord) owns the compound farm, except where he dies and they decide to share it among each nuclear family. Usually they also have two other farms for the landlord in the bush for millet and groundnuts. Cattle are jointly owned and cared for by the landlord, which is used in solving problems of the whole family. An elderly landlord in Nyangua told us his three acres of compound farm, 10 cows and about 20 guinea fowls theoretically belong to him, but he uses these to solve the problems of his sons and grandsons even though they have their own nuclear families with own farms and small livestock. They in turn provide his meals, water to bath, and run errands for him. He is their spiritual caretaker as he sacrifices to the ancestry on their behalf and teaches them traditional ways of life. Having a good security over nuclear household land is important for adaptive capacity as households cannot be disenfranchised and can decide on landuse, sale and mortgage. The support mechanisms enable people survive climate stresses and build on their livelihood strategies.

5.3. *Friendship and reciprocity*

The social networks of assistance are based on friendships. Assistance from friends now constitutes trusted channels of support to many in the community than among families when they are under stress, claimed women in both focus group discussions. Friends build a reciprocal system of exchange of material and moral supports which are important when there is harvest failure, when people are sick, when they need moral support and when they need small loans and grants for alternative investments (both focus group discussions). An old man in Pungu however distinguished between 'the friends of "yesterday" and "today" saying that in the past friends did not look at what they got from each other, but considered the joy of being there for each other. "Today's" friends maintain a debit and credit account so that they don't lose to their friends.'

However, 'today's friendship is based on pure reciprocity of material gain and sometimes exploitation which interviewees considered to be a deterioration of the concept of friendship/comradeship. Mohamed says:

> Usually we get assistance from each other through friendship and acquaintances. If you see that your friend is better than you, you will probably fall on him first before you approach any other person. Or your friend can even seek assistance from his friend for you so that you can pay back when you harvest your crops. The better off normally provide assistance to the very poor. Sometimes we fall on women for loans. Traditionally women don't provide food (cereals) for the upkeep of the household. So whatever they get from their farms is saved. In times of hardship, they are more resilient than men' (Mohammed 50 year old farmer at Kanshegu).

Both vertical and horizontal relations exist in the communities as resource needs differ among different socio-economic groups. Patron–client relations of old are mutating into vertical relations that may have exploitative consequences. Bigger land owners in Nyoglo and valley owners of Wungu and Gbeduri have several poorer individuals forming alliances of assistance with them in order to gain favours in the granting of landed resources (Men's focus groups). Hence, social capital is still high in the Walewale area than in the Kanshegu and Nyoglo.

Friendships and other forms of relationships involve mutual assistance of money, food, farm equipment and emotional comfort, which are critical components of ones ability to cope and adapt to climate and other stressors. The role of these relationships is mixed as they get influenced by monetary concerns and what each actor expects in return rather than merely on altruistic grounds. These forms of social capital constitute the access for coping with stress, and the ability to command other livelihood capital for effective adaptation to climate change stressors.

5.4. *Labour pooling groups*

Labour parties prevent farms from being destroyed by weeds; enables people build destroyed buildings; and the community to collectively repair roads and other economic assets.

Labour groups are still strong in Wungu and Gbeduri among the Mamprusi tribe, which is more 'traditional' than the Dagomba communities. In Nyoglo and Kanshegu, the commercialization of labour in the form of 'by day labour' involving payments of three Ghana cedis has led to the near death of labour groups. Labour groups are important under scenarios of climate change due to limited rainy days and the need to cultivate as fast as possible to deal with weeds. The social atmosphere created by group labour makes the work move faster and enjoyable (as claimed by the youth in Gbeduri). In-law farming was reported in Wungu and Gbeduri where over fifty people are organized to weed their in-laws' farm. Labour groups are an integral part of the culture of the savannah people with different systems in use. Horizontal labour networks are among peers or similar social status in which members circulate among the farms, construction and harvesting of the commons for each member. Vertical networks involve relations of dependence where patrons assist poorer households and in return receive labour/allegiance for performing activities. Given the labour constrains in an era of migration and high market demand, labour groups become an important determinant of adaptive capacity to climate induced stress. Social capital has direct links with adaptive capacity as they enable people access labour resources for coping and adapting to climate stressors.

6. Discussion and conclusions

The results show that institutional arrangements are important in creating the conditions under which people produce creative solutions to the impacts of climate change. The results concur with the view that institutions account for the success or failure of people to adapt to debilitating or even favourable conditions (Christoplos et al., 2009). Both formal and informal institutions play synergistic roles in defining the condition of the individual and the conditions of his/her environment. These are teased out under the four themes below:

1. *Institutions create enabling conditions for livelihood strategies*: the rules, norms and practices of organizations lay the foundation for the realization of livelihood strategies that ameliorate or take advantage of climate stressors. These conditions such as skills and knowledge, good health, markets, better seeds and new livelihood activities enable people to adopt and adapt to the changing physico-economic landscape. Institutions at the local level are important conduits for building adaptive capacity by structuring the conditions under which people adapt to climate change and variability (Agrawal, 2008; Yaro, 2010). State institutions and NGOs played this conditioning role in several areas very well. Communities close to major roads and district capitals tend to enjoy more benefits from these organizations than those that are less accessible. Field workers prefer accessible areas where success can easily be measured.

2. *Building livelihood capital – tangible and intangible*: The resilience of a household is measured to a large extent by the amount of its disposal assets, which can be used to mediate livelihood threats such as drought and floods. Institutional arrangements have tended to assist communities build these tangible and intangible assets via awareness creation, loan schemes, protection of natural assets, food aid, material aid, subsidies and starter packs. Institutional arrangements that enable farmers to adopt new improved varieties increase their incomes and welfare with ripple effects. Also, aid given during disasters prevents people from lapsing into destitution as the case was with the 2007 flooding in all three districts. Building and protecting assets is important in enhancing adaptive capacities as communities and households become ready to deal with future contingencies (Perrin et al., 2008).

3. Institutions define social relations of production: Institutions as social processes mediate resource access and are relevant in defining how assets can act as buffers to the challenges of climate change. Social vulnerability is directly linked to the efficient functioning of informal institutions which control landed property and social relations at the village levels where tradition triumphs. Access forms to the resources vary by governance type with more autonomy in earth priest systems than under the chieftain systems. Also, extended family systems constrained individual freedoms but guaranteed collective benefits than nuclear family systems. Where informal institutions functioned without modernized interpretations imbued with favouritism (Platteau, 2009), then different classes had access to resources, which defines a person's chances of crafting innovative mechanisms to deal with climate change impacts.

4. *Institutions as social cement with reciprocal and mutual benefits*: Kinship networks are important for coping especially where food scarcities and other contingencies emerge. The findings agree with Agrawal's (2008) examples of informal institutions involving those around labour sharing, indigenous information exchanges, savings societies, commons institutions and indigenous knowledge institutions around migration and storage. Being part of networks of assistance is a crucial determinant of adaptive capacity, because it is difficult to deal with the multitude of contingencies all alone. The effectiveness of these networks and institutions of mutual support is spatially disaggregated, with less urbanized areas having stronger networks than those close to urban modern influence. The principle of reciprocity has differential

consequences for the poor and the rich, though it enables them leverage their livelihoods. There is much scope for informal institutions to be adapted to reduce vulnerability to climate change (Vincent, 2008).

However, many institutional rules, practices and norms can cause maladaptation. These practices increased vulnerability by preventing people with less power and access patterns from using social and economic resources. Some informal institutions constrain adaptation by exclusionary tendencies such as poor access by women to land and inherited property. This potentially excludes women from agrarian decision-making and the capacity of women to actively contribute to economic diversification and food security (Quisumbing et al., 2001; Toulmin, 2009; Vincent, 2008). Maladaptation by women through the destruction the woodlands for firewood and inefficient charcoal burning methods are therefore consequential of traditional norms. Discrimination in the allocation of relief, subsidized fertilizers and in the provision of socio-economic infrastructure increases vulnerability of those affected.

The effectiveness of formal institutions is constrained by fundamental problems. The inability of state institutions and NGOs to upscale their activities spatially and in-depth creates short-lived capacity building initiatives which can easily be reversed. Many poor people have started growing traditional varieties of maize due to reduction of fertilizer subsidies, which spurred the initial adoption rates. These are often the result of resource constraints, mainly financial and faulty designs and strategies on the part of organizations. The state's inability to construct more roads into the interior, to hire more extension workers, to continue to subsidize important inputs and to maintain existing good initiatives, results from inadequate financial resources. Similarly, NGOs with a project focus have limited spatial and temporal effects. Though these are good initiatives, the sustainability of the efforts and practices when projects fold up is difficult.

A case for the collaborative effort of formal and informal institutions can be built from the forgoing. Each institutional arrangement is important as they provide complementary roles and sometimes affect different social groups differently. Given the poor financial position of the state, it will be useful to revamp some of the norms and practices associated with old African traditions. Modernizing these in ways that benefit the poor for whom adaptive capacities are already low should be an important policy goal. Custom should be interpreted through the lenses of opportunities and possibilities for all rather than for the selfish custodians of traditions and local elites (Yaro, 2012). Because adaptation to climate change is scale related (Johnston, Gregory, Pratt, & Watts, 2000; Osbahr, Twyman, Adger, David, & Thomas, 2008), the influence of institutions is therefore graded. The state and bigger organizations with more resources and scientific knowledge systems are best placed to perform certain roles than informal institutions. Since climate shocks and stressors affect people in all aspects of life (Laube, Schraven, & Awo, 2012), they demand institutional collaboration and interventions.

The lives of people in the study areas are regulated not only by circumstances in the area but also by the permeating actions of policies and practices of external institutions. Therefore, the institutional framework conditions the transactions between individuals, groups and states (Dovers & Hezri, 2010). The role of the individual agency is important, but this agency is given outlet by the interaction of formal and informal institutions, which provide the building blocks for adaptive capacity. *We emphasize the need for a focus on multilevel institutions that support adaptive capacities tailored to the risks, needs, priorities and particularities of different vulnerable groups and communities*.

Acknowledgements

We deeply appreciate the support of the Office of Research Innovation and Development (ORID), University of Ghana for the funding this project. Thanks to the two reviewers for very useful comments that shaped the final version.

Funding

This research was funded by ORID, University of Ghana [grant number URF/4/008/2011-2012].

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