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Adaptation to climate change or non-climatic stressors in semi-arid regions? Evidence of gender differentiation in three agrarian districts of Ghana

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ABSTRACT

With the increasing impacts of climate change in Africa, a relationship between rainfall and yields in semi-arid Ghana has been observed. Drawing insights from three agrarian societies in the semi-arid region of Ghana using qualitative research methods, the study reports how people currently deal with climate variability as insight on how they will deal with climate change in the future. The findings indicate wide gender inequality in decision making processes and land access resulting from patriarchal local customs and institutions that shape adaptation responses of different vulnerable social groups to climatic or non-climatic stressors. Different adaptation practices of groups indicate that both climatic and non-climatic stressors shape the kind of responses that groups adopt. From the current adaptation practices, efforts to improve adaptation to future climate change at local levels must give attention to the nexus of both climatic and non-climatic stressors, gender, differential vulnerabilities and other subjectivities that produce a particular adaptation practice in a given place.

1. Introduction

Across Africa, warming over land and rise in annual temperature is likely to exceed 2 °C by the end of the 21st century (IPCC, 2014). Reduction in precipitation and rise in annual temperature are more likely, thereby increasing stress on water availability, food production, health, and ecosystems across the continent (IPCC, 2014). The impacts of climate change on livelihoods are increasingly becoming pronounced in African countries. Within agrarian communities, these impacts interlace with and exacerbate existing uncertainties surrounding food security and water resources, spheres where challenges are experienced differently by different vulnerable groups. A growing body of literature on gender and climate change adaptation recognizes that one must examine intersecting capabilities, responsibilities and roles among different groups experiencing particular climate stressors (Carr and Thompson, 2014; Paavola and Adger, 2006). Further, one must also recognize that exposure of any group to climate change impacts does not happen in a vacuum, but rather is a part of a broader vulnerability context in which those groups are living and of which they are a part of (Carr, 2011). This context

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encompasses both climatic and non-climatic stressors, all of which feed into shaping the adaptation strategies of the people experiencing them. In this paper, we look more closely at the specific context of semi-arid Ghana and critically examine the ways in which conventional binary representations of both the stressors and those adapting are serving to hinder rather than enable relevant and effective adaptation planning in this area.

Gender inequalities in climate variability adaptation remain a challenge despite decades of efforts toward gender mainstreaming in development theory, policy and practice (Bhattarai et al., 2015). The gender inequality in adaptation is worse in semi-arid regions given the breadth and rapidity of projected climate impacts and variability there and the implications for agrarian societies (IPCC, 2013; Padgham et al., 2015; Traoré et al., 2013). A recent review found that despite over 40 years of aid that has gone toward gender and environment, inequalities still persist with only small, marginal effects on the ground (Arora-Jonsson, 2014). There is a plethora of research on gender and climate change (eg. Alston, 2014; Djoudi and Brockhaus, 2011), and the majority of these studies have given due consideration to the linkages between gender and climate impacts (Alston, 2014; Arora-Jonsson, 2011). In the poor areas of semi-arid regions, studies have shown that adaptation to climate variability is often associated with other socioeconomic stressors (eg. Nyantakyi-Frimpong and Bezner-Kerr, 2015) though those associations have not always been linked empirically. To date, there are only limited examples from the literature where gendered adaptation experiences in semi-arid regions are isolated as specific to climate change rather than in combination with non-climatic stressors (Benjaminsen et al., 2012; Nyantakyi-Frimpong and Bezner-Kerr, 2015; Sugden et al., 2014).

While gender is one important variable that can shape adaptation outcomes in agrarian societies, scholarship on gender and climate change practices and policies that rely on binary gender analysis of 'men and women' does not reflect contemporary understandings of gender- one of many important social factors intersecting within the vulnerability landscape[1] (Carr and Thompson, 2014). At the community scale, extreme focus on 'men-women' can improve adaptation at the individual level but serve as a potential source of maladaptation at the community scale given the existence of other groups (see, Carr and Thompson, 2014). In this paper, we move from this contrasting duality (men-women dichotomy) to a landscape of vulnerability where diverse social descriptors including disability, social class, ethnicity and value systems create heterogeneous conditions that shape gender relations in adaptation practice. The paper incorporates the heterogeneity of social structure principle (Rocheleau et al., 1996) and argues that such heterogeneity comes with differential interests and powers that need to be the basis for any examination of adaptation practice. In adopting a broader gender lens, we see gender as a critical variable in shaping resource access and control, often interacting with class, race and culture to shape ecological change, as well as the struggle by men and women to sustain ecologically viable livelihoods (Rocheleau et al., 1996). We differentiate how groups such as women, men and the disabled from three agrarian societies have adapted differently to similar or identical climate vulnerabilities. We trace the differences through a reflection of the narratives surrounding semi-arid environments, the north-south divide in Ghana, and differential adaptive capacities.

This paper aims to report on how people currently deal with climate variability, which provides evidence for how they will deal with climate change in the future. The paper uses qualitative perspectives from different social groups on adaptation practices in semi-arid regions to illustrate how gender binary conceptualizations[2] of what motivates adaptation strategies (i.e. climate or non-climate stressors), and what gendered factors shape those strategies (i.e. aligned with men or women) are no longer the most effective framings to use to understand adaptation and plan relevant policies and interventions in West Africa.

1.1. Historical context of inequality in semi-arid Ghana

In this section, we address two issues that affect gender relations in agrarian communities in Ghana. The first relates to the current agrarian and socioeconomic development dynamics associated with the climate change semi-arid of Ghana. The second traces the underdevelopment of semi-arid Ghana to colonial and postcolonial policies that created the north-south divide. It seeks to explore the historical context of inequality in semi-arid Ghana and how such policies have mediated gender inequality in relation to climate impacts as well as other stressors.

The semi-arid region of Ghana (Northern, Upper West and Upper East Regions), is the most deeply agrarian part of the country. In this area, much labor is invested in agriculture yet there are fewer returns, higher insecure agricultural livelihoods and prevalent malnutrition among children under five (Ghana Statistical Service, 2014a). It is also the part of the country where access to social services is limited as a result of various socioeconomic and environmental constraints leading to increased vulnerability compared to other ecological zones (Ghana Statistical Service, 2014b). This is also the part of the country where both climate impacts and structural underdevelopment are acute realities.

In semi-arid Ghana, 74.3% of the area is rural (Ghana Statistical Service, 2013a), with as many as 90.7% of rural households practicing agriculture (Ministry of Food and Agriculture, 2013; Ghana Statistical Service, 2013a). In the semi-arid areas, *women's secure* rights to *land* are limited, as less than 20% of women own land but over 80% depend on natural resources such as shea, fuelwood and other non-timber forest products for their daily livelihood (FAO, 2012a; Ghana Statistical Service, 2013b). The majority of these households are also food insecure (Ghana Statistical Service, 2013b). In terms of gender

[1] Vulnerability landscape used per this paper means the wider classes or groups of vulnerable people.
[2] Gender binary used in this context refers to classification of gender roles, identities and ideologies into two categories of male and female.

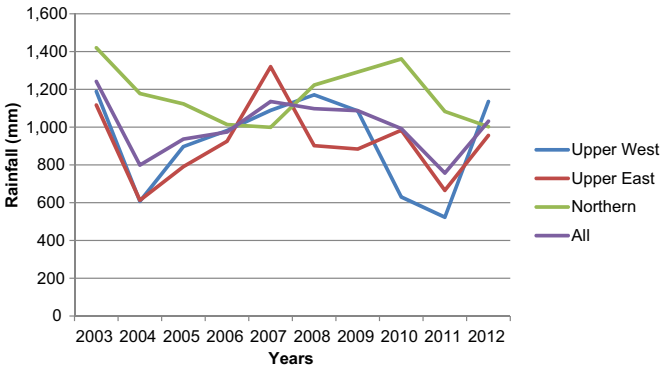


Fig. 1. Trend of rainfall in semi-arid Ghana.
Source: Data from Ministry of Food and Agriculture (2013).

inequalities, 59.7% of male are literate compared to 26.4% for females (Ghana Statistical Service, 2014a). Despite the fact that men have more working hours in on-farm activities, women in semi-arid Ghana have higher participation in all agricultural activities ranging from planting, harvesting, marketing and storage than men (FAO, 2012a). The incidence of poverty for the agriculture sector is about 39% with male-headed households having higher rates at 25.9% and 19% for female-headed households (Ghana Statistical Service, 2014b). These figures contradict the ongoing feminization of poverty discourse that assumes that female-headed households and women are poorest of the poor (Chant, 1997).

Within Ghana, the semi-arid regions have the highest rates of extreme poverty (FAO, 2012a). Although these rates have fallen over the years, today it remains as high as 55% compared to 64% in 2006 (Ghana Statistical Service, 2014b). The FAO (2012b) notes that rural women face many challenges in translating their labor into paid work, from paid work to higher incomes and in moving towards secured income. Among other factors, limited access to land and credit impedes this process for women (FAO, 2012a). In other categories of vulnerability, 47.1% and 78.7% of employed youth and children participate in agricultural work (Ghana Statistical Service, 2014a).

Agriculture is generally rainfed and the average rainfall for the last 30 years is 1030 mm, although with high inter-annual variability characteristic of this region (Fig. 1).

Climate variability and other socioeconomic factors affect agricultural production in terms of area cultivated as well as production quantities. Using a dataset from the Ministry of Food and Agriculture (MoFA), the trends in area cultivated show a relative increase in maize production, stable production of millet and a decline in sorghum (Figs. 2 and 3). Much higher land areas are used for sorghum than other crops. On the contrary, with similar crop area for maize and sorghum in 2010 for example, the quantity of maize harvested is far greater than that of sorghum. These variations are as a result of difference in inputs levels, nutrients requirements and climatic conditions. The major observation from Figs. 1, 2 and 3 indicate that as rainfall patterns change, the area of land cultivated as well as yield levels change proportionally to it. For example, between 2003–2004, when rainfall patterns decreased, the land areas of all type of sample crops decreased as well as their corresponding yields. Such a pattern makes it difficult to separate the effects of climate change from the pre-existing impacts of poverty in the semi-arid Ghana.

In terms of gender issues, an extensive study in Ghana shows that crops cannot simply be categorized as men or women's crops due simply to the numbers of men and women planting these crops (Doss, 2001). Hence, others have suggested that gendered agriculture can be assessed by looking at who produces for market or subsistence (Carr, 2008). In Ghana, female-led agriculture production is becoming more market oriented than men-led agriculture because women cultivate crops such as vegetables which are immediately sent to market after harvest (Ghana Statistical Service, 2014b). The disproportional growing of crops by gender is a reflection of gendered patterns in agriculture but this does not provide a basis

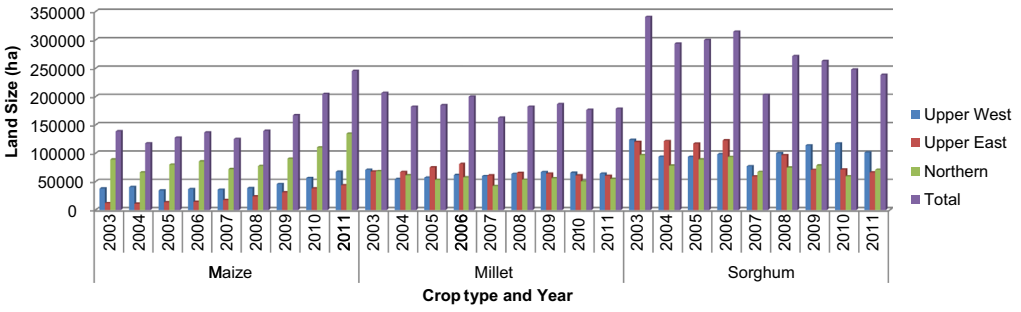


Fig. 2. Trends of cultivation of staple crops in semi-arid Ghana.
Source: Dataset obtained from Ghana Statistical Service.

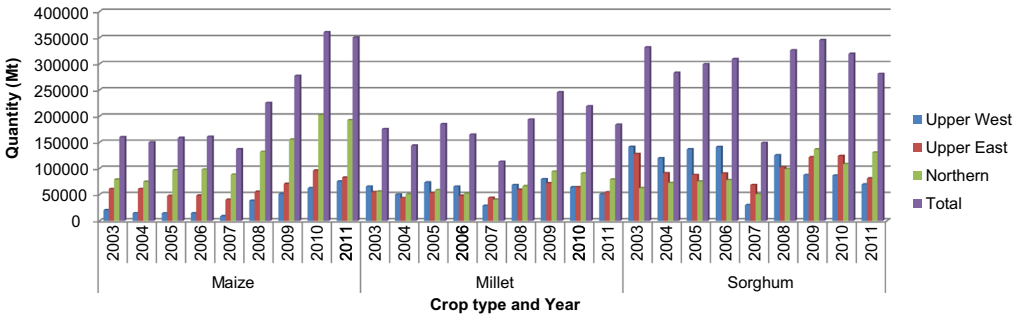


Fig. 3. Quantities harvested for staple crops (Mt).
Source: Dataset obtained from Ghana Statistical Service.

on which to categorize them as men or women's crops.

All the development dynamics of semi-arid Ghana which stated above are often explained in literature with two major narratives including geographic inequality (north-south divide in Ghana) and food insecurity resulting from climate variability. Firstly, colonial rule especially by the British shaped the development trajectories of semi-arid Ghana because the Northern Territories were not included in the British development plans until 1901 (Songsore, 2003). Much of the development interventions of British rule were located in southern Ghana, while the semi-arid Northern Territories were neglected due to limited opportunities to exploit natural resources (Songsore, 2003). Immediate post-colonial policies also favored natural resource and mineral exploitation for development and as such, the semi-arid region was not given due attention (Nyantakyi-Frimpong and Bezner-Kerr, 2015). Further, the semi-arid region of Ghana falls within the West Africa Sahel region with high climatic variability and severe droughts. Major drought events occurred in the 1980s with severe impacts on agriculture and food security (Rademacher-Schulz et al., 2014). The severe droughts, climate variability, excessive government borrowing, increasing budget deficits coupled with slow economic growth and high inflation compelled Ghana to go in for the Structural Adjustment Program (SAP) by the Bretton Woods Institutions (Konadu-Agyemang, 2000; Hutchful, 2002). The SAP was a loan package with severe conditionalities mostly affecting the agriculture sector and socioeconomic transformation of agrarian societies because of the removal of agricultural subsidies and retrenchment of some agricultural staff (Konadu-Agyemang, 2000). Farmers in semi-arid Ghana were affected the worst because of pre-existing levels of poverty, vulnerability and limited opportunities for non-agriculture income (Songsore, 2003; Nyantakyi-Frimpong and Bezner-Kerr, 2015). Despite this, although there is ongoing decentralisation, issues of decentralised climate adaptation planning are still limited and hence, little funding is allocated to local governments for climate adaptation (Ahmed and Puppim de Oliviera, 2016).

Over 80% of land is owned customarily (Campion and Acheampong, 2014) with three overlays of different interests: allodial, usufructuary, share tenancy and licenses. Chiefs, clan or family heads hold the allodial interest in customary land as trustees (Abubakari et al., 2016). Usufructuary interests are individual land ownerships, held by members of a particular family perpetually. They devolve through inheritance, thereby allowing owners to use land for food production and settlements (Yaro, 2009). Ownership through inheritance is the most important factor that shapes gender inequality in land ownership and access in the semi-arid Ghana (Yaro, 2009). Culturally, women cannot inherit family lands especially when there are male family members. The post-colonial administrations currently have about 168 land related laws that are fragmented, with duplication of mandate thereby making it difficult to address the cultural barriers in land ownership and emerging challenges (Biitir and Nara, 2016).

The current emphasis on agricultural intensification and liberalization of the sector have also favored large-scale developments. This has reinforced radical land fragmentation, land grabbing, and marginalization of smallholder farmers in the semi-arid Ghana (Nyantakyi-Frimpong and Bezner-Kerr, 2015). This can be observed in the proliferation of foreign direct investment in biofuels in northern Ghana thereby affecting land rights. As a consequence, smallholder farmers are increasingly losing their livelihoods, land rights, and the competition for land for food crops in the semi-arid region (Yaro, 2013). Farmers have therefore adopted many strategies to cope with these consequences in terms of migration, dry season farming, changing gender roles, livelihood diversification, use of improved crop varieties, sustainable land management, skipping meals, social networking, remittances, and keeping livestock (Yaro, 2013; Nyantakyi-Frimpong and Bezner-Kerr, 2015; Rademacher-Schulz et al., 2014; Bugri, 2008; Wossen and Berger, 2015; Wossen et al., 2014).

The literature points to the fact that gender relations are affected by development dynamics in agrarian settings through changing gender roles (see Carr and Thompson, 2014). In semi-arid Ghana, there are observed trends of increasing numbers of female-headed households, women's agriculture working hours, and changing roles in the family system (Ghana Statistical Service, 2013c; FAO, 2012a, 2012b). Within these dynamics, we assess the gender inequality in adaptation as whether groups are adapting to climatic or to non-climatic factors of three agrarian districts.

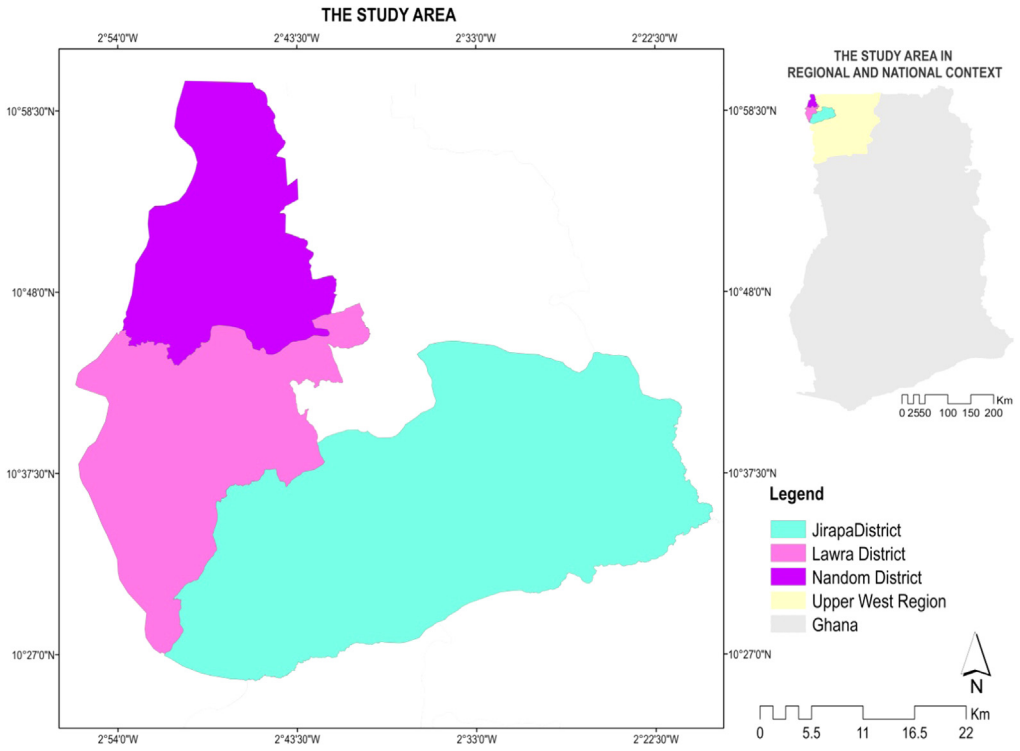


Fig. 4. Location of the three study districts in Ghana.

2. Methodology

2.1. Study area

Semi-arid Ghana covers 40.9% of land mass of Ghana with mean rainfall ranging 1000–1100 mm (Ministry of Food and Agriculture, 2013). It has a population density of 192 per/km^2 with increasing fragmentation of landholdings, especially among genders (Ministry of Food and Agriculture, 2013). The study is undertaken in the Upper West Region, which is a good representation of the whole of semi-arid Ghana. Nationally, the Upper West Region (UWR) has the highest poverty rate (70.7%) and an extreme poverty of 45.1% (Ghana Statistical Service, 2014b). It also has the highest income inequality rate (48.5%), greater than the average for the semi-arid region (41%) (Ghana Statistical Service, 2014b).

Upper West Region has a single rainfall season (April–September) followed by dry harmattan which is characterized by hazy and cold weather. Mean temperatures range from 21 °C to 32 °C and sometimes higher than 40 °C. The region falls within Latitude 9.8 – 11.0° North and Longitude 1.6 – 3.0° West (Fig. 4). The region is generally agrarian with districts closer to southern Burkina Faso and more vulnerable because of the location within the aridity gradient. The districts in this region include Lawra, Nandom, Jirapa, Nadowli, and Kaleo. Relative to other districts in the semi-arid part of Upper West Region, Lawra, Nandom and Jirapa are generally rural, agrarian and characterized by high illiteracy rates, infant mortality and increasing numbers of female headed households as well as high population density. Within the aridity gradient, these three districts are more arid and vulnerable because of their closeness to the West African dry region (see Traoré et al., 2013). The districts, therefore, offer the best representation of the semi-arid region of Ghana, following the assumption that poverty and climate vulnerability is inextricably linked to the dry-wet gradient (Traoré et al., 2013). Lawra, Nandom and Jirapa districts were selected as the case study areas for this research. Table 1 summarizes the characteristics of the study districts.

2.2. Data collection methods

The purpose of the study is to illustrate how different social groups adapt differently to multiple stressors of climate change in semi-arid areas. Qualitative data on adaptation response by different groups offers insights into localized gendered perspectives of climate adaptation in semi-arid areas that are often lost with quantitative data. Hence we adopted a more qualitative research approach using Focus Group Discussions (FGDs) and key informant interviews to collate qualitative data on adaptation. The purpose was to gather information on sectors within which vulnerabilities are observed, how farmers adapt to these vulnerabilities, who are most affected, what needs to be done differently, communication strategies about adaptation, and the gender dimensions of adaptation. Participants of the FGDs were selected from an existing local

Table 1
Demographic and basic characteristics of three study sites in the semi-arid region of Ghana.Source: Ghana Statistical Service (2013c), Ghana Statistical Service, 2014c, 2014d

Variable	Lawra and Nandom[a]	Jirapa	Upper West Region[b]
Total Population	100,929	88,402	702,110
• Male	48,641	41,592	341,182
• Female	52,288	46,810	360,928
Land Size (Km²)	1051.2	1667	18,476
Agriculture (%)	80.7	70.8	72.8
• Male (%)	84.1	81.8	77.8
• Female (%)	77.6	62.0	68.3
Women with secured land (%)	10	8	18
Employment	44,121	35,069	275,606
• Male (%)	47.0	44.9	47.0
• Female (%)	53.0	55.1	43
Poverty incidence (%)	66.9	68.9	70.7%
Rural (%)	86.7	85.6	83.7
Urban (%)	13.3	14.4	16.3
Disability (All forms)	4084	3390	25,746
Female Headed HH (%)	23.9	29.4	24.7
Literacy (%)	41.8	38	40.5
• Male (%)	49.3	46.2	48.5
• Female (%)	35.4	31.7	33.5
Infant Mortality (per 1000)	81	79	81
Under−5 Mortality (per 1000)	129	119	128

[a] As at 2010 Population census, Nandom was under Lawra until 2012 when Nandom was created as a new district. Major census information regarding Nandom as still aggregated under Lawra district.
[b] Upper West is the region where all the selected communities are located.

Table 2
Characteristics of focus group participants in the three study areas.

District	Sex		No. of people who could not read or write English	No. of FGDS	Composition
	Male	Female			
Lawra	10	1	5	1	7 traditional council members, 1 farmer based organization, and 3 government employees
Nandom	11	5	1	2	5 Community Based Organizations (CBOs), 10 government employees and 1 private sector
Jirapa	10	6	2	2	5 farmer based organizations, 3 CBOs, 1 traditional council member and 7 government employees
Total	**31**	**12**	**8**	**5**	–

adaptation platform called the Climate Change, Agriculture, and Food Security (CCAFS[3]) platform comprising of traditional authorities, leaders of farmers groups, women groups, NGOs, and representative heads of decentralized government departments. Without consciously selecting desired participants or influencing the choice of participants, this existing platform was used as a lens to understand gender inequality within the efforts towards climate adaptation in the study areas. Participants of the FGDs were the core members of the CCAFS platform which comprises of 11–16 members per platform (see Table 2). Whilst using a pre-existing platform allowed for the understanding of gender inequality starting from the decision-making process, it limited the researchers' ability to select participants of their own choice. Other groups such as the disabled and the Fulaani pastoralists were determined following the FGDs, where it emerged that they were among the most vulnerable groups in the districts. Follow-up interviews were thus conducted with some Fulaani pastoralists.

Each FGD comprised of 6-11 people. In all, 5 FGDs were conducted. Participants were first asked questions about their strategies related to climate variability. This was followed by questions on who is impacted by climate variability, how they

[3] CCAFS is a global project on food security implemented by the Consortium of International Agricultural Research (CGIAR) with one of its national focal points in Ghana (CGIAR, 2016). The Ghana projects sites are located in the semi-arid areas which include Jirapa, Lawra and Nandom also used for this study.

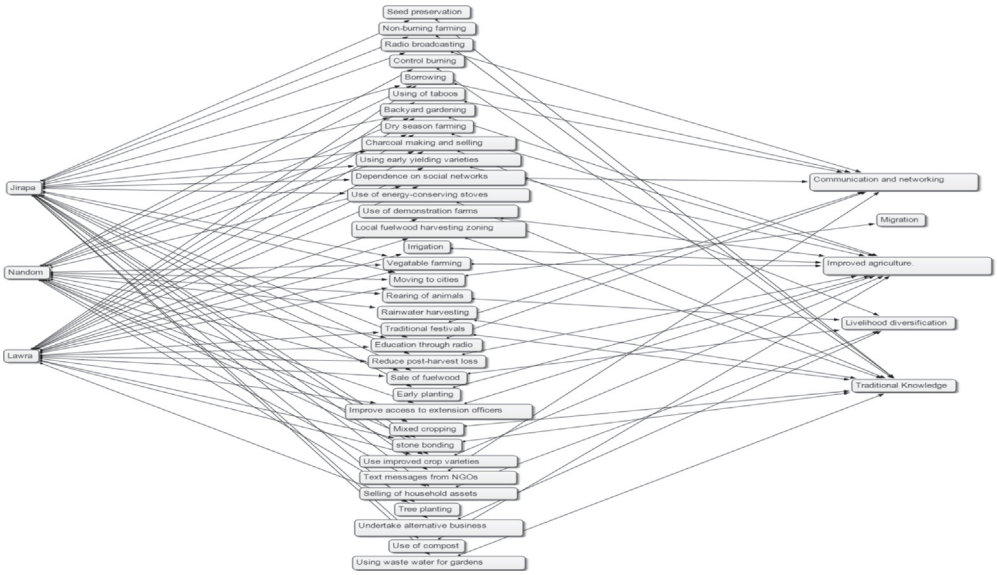
Note: In each community respondents mentioned several current vulnerabilities of their environment (in the middle). With each vulnerability, they prioritize the category of people who are most affected by (in far right).

Fig. 5. Current vulnerabilities in semi-arid Ghana, Note: In each community respondents mentioned several current vulnerabilities of their environment (in the middle). With each vulnerability, they prioritize the category of people who are most affected by (in far right).

are impacted and which groups are most vulnerable and why. The next set of questions was on current planned and autonomous adaptation practices. For planned adaptation, discussions focused on the planning process and implementation. The last set of questions was on local barriers and enablers for climate change adaptation, planning and implementation. To elaborate on issues that were raised in the FGDs, individual interviews were conducted with heads of decentralized district government departments, including the gender desk officers, the district director of agriculture, health directors and planning officers. These respondents were purposively selected.

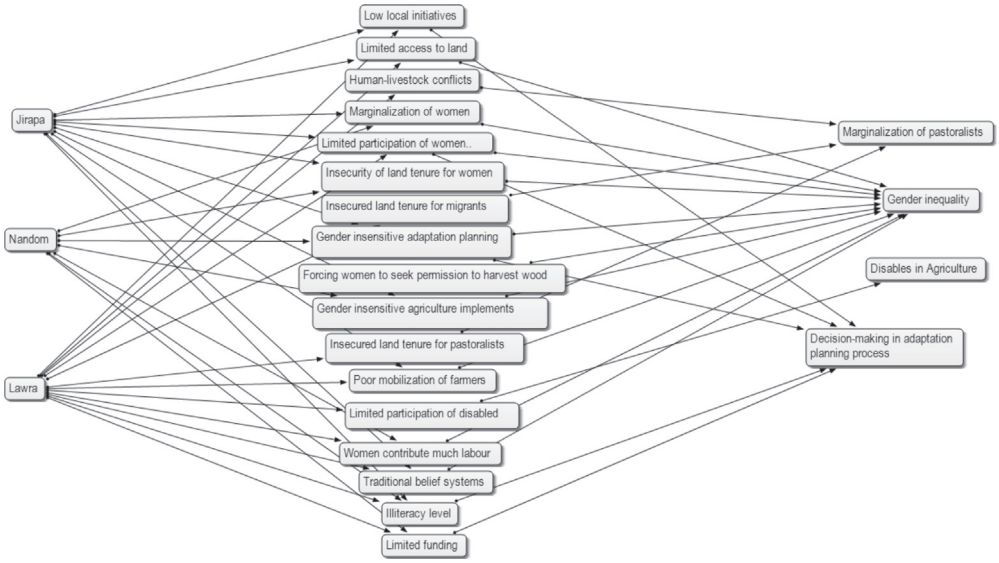
2.3. Data analysis

A qualitative software (Atlast ti) was used in the analysis of the results of the various FGDs. The analysis was done for three major issues (see Figs. 5, 6 and 7). Firstly, current vulnerabilities were analyzed according to the three cases (Fig. 5). Different codes were assigned to different vulnerabilities in each community and these were then aggregated on the basis of who is most affected by these vulnerabilities in the semi-arid region of Ghana. From the 'Atlast ti' results, the frequencies of



Note: in each community, different adaptation practices are mentioned (in middle), we categorize them based on our understanding of the current literature.

Fig. 6. Current adaptation practices and categories in semi-arid Ghana, Note: in each community, different adaptation practices are mentioned (in middle), we categorize them based on our understanding of the current literature.



Note: In each community, the different barriers (in middle) mentioned linked to the communities (on left). The barriers are then aggregated into four themes based on the authors understanding of barriers.

Fig. 7. Gender inequalities and barriers to adaptation in semi-arid Ghana, Note: In each community, the different barriers (in middle) mentioned linked to the communities (on left). The barriers are then aggregated into four themes based on the authors understanding of barriers.

different vulnerabilities and affected groups were there derived.

In Fig. 6, we coded the different current adaptation practices of the three communities and then broadly categorized them into five major themes. The frequencies of each adaptation relative to others were then obtained at district level and also for the different thematic categories. Fig. 7 addresses the barriers of adaptation using different codes and then categorizes them into broad areas of inequalities in adaptation observed in the semi-arid region of Ghana.

3. Results

3.1. Current vulnerabilities and affected groups

From the case study areas, Nandom and Lawra each reported six vulnerabilities as compared to Jirapa (five cases). In total, ten different vulnerabilities were reported for the semi-arid region of Ghana (as shown in Fig. 5). Of these, human-livestock conflict, bush burning and deforestation were non-climatic stressors. The others were direct climatic stressors. Whereas some of the vulnerabilities cut across all the districts, others were only pertinent to specific districts. For example, flooding was only mentioned in Nandom, which recorded its worst flood in decades due to heavy rainfall of 80.6 mm on 20th February 2015. Among the ten different vulnerabilities mentioned by participants, water scarcity, human livestock conflicts, flood and outbreak of meningitis are the major vulnerabilities in semi-arid Ghana, (Fig. 5). Water scarcity and drought emerged as the most serious issues because of the limited amounts of surface water due to high temperatures resulting in the drying up of rivers. Farmers were most affected by extreme events such as droughts. The water scarcity mostly affects women as they have to walk several distances and spend more time in fetching water. This has implications on time allocation for other activities such as farming. Related to this, meningitis remains one of the most serious threats in semi-arid Ghana, as incidences are higher during dry, hot, and dusty seasons (Codjoe and Nabie, 2014) and contribute to a large proportion (50%) of Ghana's health burden (UNDP, 2010). As much as 47% of the reported vulnerabilities affect farmers and 24% affect women in various ways.

3.2. Current adaptation practices (the narratives)

In terms of current adaptation practices, there are 33 different adaptation strategies adopted in the semi-arid Ghana (Fig. 6). These are also summarized in Table 3. Jirapa reported more adaptation strategies in addressing the vulnerabilities in Fig. 5. As much as 73% of the strategies in semi-arid Ghana shown in Fig. 6 are currently practiced in Jirapa. Similarly, adaptation practices of Nandom and Lawra individually account for 61% and 67% of the different strategies in the semi-arid region, respectively. Out of the 33 adaptation practices, 5 major categories are observed (Fig. 6).

The first relates to strategies that fall under communication and social networking for adaptation. This is observed from the reliance of local communities on communication of climate information, education and awareness raising through

Table 3
Summary of responses: climate change vulnerability and adaptation in semi-arid Ghana.Source: Focus group discussions in Lawra, Nandom and Jirapa in the Upper West Region of Ghana (2015).

Issue	Response		
	Lawra	**Nandom**	**Jirapa**
Areas of vulnerability	Natural resource (deforestation, bush burning)	Floods and droughts; health (Meningitis) natural resource (deforestation, bush burning); farming	Farming (soil infertility and bush burning); livestock (dry grasses and diseases); water scarcity
Who most is vulnerable	Women and farmers	Women and farmers	Women, children and the aged
Current adaptation	Soil management; tree planting; improved crop varieties; indigenous practices (seed preservation); selling of household assets; migration	Improved crop varieties; non-burning method; energy-conserving stoves; migration	Early yielding varieties; none-burning farming; use compost; stone bonding; sales of household assets, rearing of animals, dependence on social networks
Future direction	Sustainable exit strategy of NGOs; blend of culture and modernity; use of demonstrated farms; institutionalization of land tenure at community level	Intensification of agriculture and irrigation; livelihood diversification; improved post-harvest lost management; climate change in basic school curricula ; rainwater harvesting	Education and funding; behavioral change; access to Land by Women
Communication	Traditional festivals; radio broadcasting; stakeholder meetings	Extension officers; traditional festivals education through radio	Text messages from NGOs
Gender	Insecurity of land tenure for women and making women play soft roles	Marginalization of women; access to land	Limited participation of women and disabled in decision making process
Local barriers	Illiteracy level; lack of respect for local protocols and structures; failure to deliver when promised by NGOs	Marginalization of women; small scale farming ; traditional belief systems chiefs, the elders and politicians are barriers	Women not allowed; poor mobilization of farmers; funding ; low local initiatives
Local enablers	Cultural believe systems	Existence of gender strategies; existence of traditional authorities	Existence of local groups

various forms. For examples, in Jirapa, radios and mobile texting with support from local NGOs are used to build capacity for adaptation (Table 3). Similar instances of radio use and festivals for climate awareness are observed in Lawra and Nandom. In addition to this, social networking to build safety nets is also common in these areas for adaptation.

The other area of adaptation is migration. In the districts considered, climate change induced migration was a concern raised in Nandom and Jirapa. However, in Lawra, migration was said to be induced by socioeconomic factors. During the dry season, young people migrate from the semi-arid areas to the southern parts of Ghana to engage in other forms of income generation activities. Whereas development literature traces the pattern of north-south migration to the geographic inequality created by the British colonial annexation of semi-arid Ghana (Songsore, 2003), the evidence from Nandom and Jirapa shows that seasonal climate variability has motivated recent patterns of migration. This pattern reflects movement of both males and females.

The third category relates to issues that are geared towards improvement in agriculture. In recent times, such strategies broadly fall under climate resilient agriculture. This category is the dominant area in which most strategies are used largely because of the agrarian nature of the semi-arid Ghana. In the drylands, farmers and household are able to adapt to the climate stressors by shifting agricultural strategies for land use management, water conservation, and food security. For example, in most districts, backyard gardening is widely adopted including others such as mixed cropping, stone bonding, irrigation and dry season farming. However, the extent to which these strategies are normalized in semi-arid areas of Ghana is still unclear given that motivation to adopt them might be driven by the climate change discourse. However, the vulnerabilities which they are meant to address may be induced by both climatic and non-climatic stressors.

The next category is livelihood diversification, diversification of farming system into other livelihood options (risk spreading). For example, some households in all districts are diversifying from over reliance on farm income, rainfed and climate sensitive crops to non-farm income based activities, irrigation, dry season farming and used of improved varieties. However, the extent to which climate change is driving these adaptation practices is unclear. Although participants attribute these practices to climate change, it can be inferred that the inextricable relationship between climate change and socioeconomic stressors in semi-arid Ghana makes it difficult to draw separation (see Section 2).

The last category is factors that relates to the use of traditional knowledge for climate change adaptation. In all the districts, this component has come out clearly in terms of seed preservation, water conservation, land management, and post-harvest loss management. These strategies, according to local communities, are cheap and convenient. Whereas local communities are confident of the different traditional knowledge practices available, there is a general concern of lack of continuity among youth with migration as one of the key factors.

3.3. Evidence of inequalities among groups (counter narratives)

From the adaptation practices in Fig. 7 four counter narratives emerge from the barriers of adaptation. The first relates to marginalization of migrant farmers and pastoralists. Whereas the people of the three districts are considered to be of similar ethnic backgrounds, immigrants, especially pastoralists (mostly of the Fulaani tribe), are confronted with different challenges in climate adaptation. The first concern relates to access to rangeland and agriculture land. As settlers, having secured access to land for farming is difficult. Without secured tenure on rangeland, it becomes difficult to put in proactive measures against bush burning because there are no incentives for investing in lands that are not tenure secured. From another perspective, participants were concerned about the challenges that Fulaani pastoralists might create regarding adaptation. These include destruction of farm lands, pollution of water bodies, and sexual abuse of women. From the FGD in Lawra, there was a general concern that small water reservoirs (hand dugouts) used for dry season farming are shared with livestock of pastoralists thereby creating a critical challenge for adaptation because of pollution and over-use of water. The activities of pastoralists have also created concerns regarding human-livestock conflicts resulting from the destruction of farms lands by pastoralists.

The second counter narrative is gender inequality. In recent times, agricultural intensification has been viewed as a way of addressing climate effects in agriculture. In the agrarian setting, small-scale intensive farming requires innovation and appropriate technology to increase yield, which has a number of implications for gender relations. The first gender concern relates to the use of machinery and fertilizers. Focus group discussion in Jirapa shows that most modern agricultural implements (tractors, etc.) are not user friendly because they are difficult, heavy, and health-wise, risky for women, children, the aged and disabled to use. This concern is a limiting factor for most vulnerable groups wishing to engage in small-scale intensive farming. Modern agricultural initiatives can create preconditions for gender inequalities given that some are not user friendly to some vulnerable groups. The central point therefore is whether different groups are adapting to the impacts of climate change or to the impacts of reinforced gender inequalities. The second gender-related concern is labor working hours. Literature shows that women are increasingly spending more time in agricultural activities (FAO, 2012a, 2012b). This is particularly true in the case of Nandom where it was reported that climate change has reinforced gender roles in agriculture and as such women work 'like donkeys' in farms but remain the poorest in Nandom. The third relates to secured land tenure. Generally, women do not have secure rights to land because they cannot own lands culturally. However, in instances when women can have access to land for cultivation, such lands are mostly in valleys and only suitable for rice cultivation. When women have a bumper harvest in the valleys, the lands are taken over by the male counterparts who either sell the land or cultivate it for themselves.

The other local counter narrative is discrimination against people living with disability. The impact of physical disability on food security is increasingly gaining attention because of the unique concerns and the increasing numbers in agriculturally related activities (Coleman-Jensen and Nord, 2013; She and Livermore, 2009). The Lawra district has specific mechanisms of addressing the concerns of people living with disabilities in agriculture, while Nandom and Jirapa do not. In Lawra, the disabled through their networks and associations, are allocated a unique parcel of land where each is given a portion to farm. They have secured land titles and are economically powerful because of the creation of the disability fund which is under ongoing decentralisation in Ghana. This title is a customary lease agreement between the chief and the association of the disabled people. With reference to agricultural intensification, the disabled face particular challenges in terms of efforts required per unit land area. These efforts include fertilizer application, use of some implements or machinery, and time. With over 4089 and 3390 people living with disabilities in Lawra and Jirapa, respectively (Ghana Statistical Service, 2013c), it presents peculiar threats to agricultural investments and food security in the semi-arid region given that in places like Jirapa, the disabled do not have the same opportunities as in Lawra.

In the study districts, decision making is culturally allocated to different groups on the basis of social status and power in society, which is counterproductive to adaptation planning. Major decisions regarding crop type, variety, and amount of land to cultivate are generally taken by men. Decisions for planned adaptation at the community are also made by men since they are often the heads of the families. Whatever decisions are made by the men are transferred to the entire family. Women and children do not have a voice in decision making. This confirms the general assumption (if not a consensus) in the literature that women are often neglected in climate adaptation decision-making processes (Dankelman and Jansen, 2010; Damisa and Yohanna, 2007). The limited number of women's groups further reinforces their marginalization in adaptation planning processes. With increasing numbers of females in leadership roles (Table 1), the choice of men as the main agents for decision-making in agriculture presents an important gap, as majority of female-headed households are also farmers. In Lawra for instance, only one female was part of the FGD because of her social status as a sub-queen mother, but was not allowed to speak equivocally in front of the paramount chief. Whereas this trend is a cultural issue, it is increasingly becoming formalized, not only for seeking permission to speak but also to access natural resources such as non-timber forest products. Such new waves of restriction reflect the institutionalization of women's activities and livelihoods.

4. Discussion

The findings of this study raise a number of issues regarding gender and climate change adaptation in the semi-arid region of Ghana. Inequality in decision-making only results from more than a limited representation of different vulnerable

groups in the process, as argued in some earlier studies (Arora-Jonsson, 2011; Arora-Jonsson, 2010; Kronsell, 2013; Paavola and Adger, 2006; Salehi et al., 2015). The cultural system of the three agrarian districts in this study give power to different groups based on social class and gender. Such power, we argue, brings social differentiation among groups. For example, men often have the power to decide who migrates and who stays in semi-arid Ghana. Parallel to other studies that show local politics and power dynamics shape gendered adaptation inequalities (Huynh and Resurreccion, 2014; Djoudi and Brockhaus, 2011; Carr, 2008), the results of this study show that social differentiation (e.g., the disabled, pastoralists) requires significant attention in agrarian communities of semi-arid regions. For a meaningful gender integration in climate adaptation to be achieved in semi-arid Ghana, attention must be given to the interplay between social differentiation, climate impacts and differentiated vulnerabilities (Nyantakyi-Frimpong and Bezner-Kerr, 2015). In this study, social differentiations such as household headship, disability, migrant status and pastoralism are key issues that need to be integrated into the gender discourse as each has different implications for adaptation. Narratives of semi-arid areas generally show that climate change and variability are the key drivers of vulnerability and food insecurity. However, this study shows that in addition social class and culture are equally important factors that influence vulnerability and food insecurity due to the limitation they put on access to land and decision-making.

The second issue highlights multiple stressors in the semi-arid region including migration and extensification. Whereas the unequal distribution and access to land and resource about groups is largely acknowledged in the literature (Coulibaly-Lingani et al., 2009; O'Shaughnessy and Krogman, 2011), the findings of this study show a new dimension of extensification; that of women moving into non-fertile lands and pastoralists traveling longer distances in search of grazing land. By virtue of women's limited decision-making power, the majority of women have limited access to fertile lands as women cannot own land. A recent study shows that the few women who do own fertile lands in the semi-arid areas are mostly elderly and have inherited the land (FAO, 2012a).

Evidence from the FGDs indicates that socioeconomic factors are equally as important as migration as an adaptation, as are climate-related factors. What is unclear is at what stage is migration an adaptation to climate change or to socioeconomic vulnerabilities? From the FGDs, major trends of migration are observed during the dry season but, according to participants, this pattern is induced by the limited socioeconomic opportunities in the semi-arid areas during the dry season. From the early literature, current migration patterns of both males and females in semi-arid Ghana, irrespective of seasonality, are induced by the historical north-south divide in Ghana and the poverty situation in semi-arid Ghana (Songsore, 2003; Yaro, 2013). On the contrary, recent studies suggest that seasonal migration of males is climate induced (Rademacher-Schulz et al., 2014). This evidence suggests that for a meaningful gender analysis in adaptation to be done, due consideration must be given to the nexus between climatic and non-climatic factors. This historical pattern, though still common in the study area (Abdul-Korah, 2011), prompts a re-thinking of methodologies on the assessment of climate-induced migration in semi-arid Ghana. The historical socioeconomic-induced migration and the recent wave of climate-induced migration is evidence that support the need to assess gendered adaptation through the lens of a gender, climate and socioeconomic intersect. How individuals and groups are impacted by climate change depends on their positions in context-specific power structures based on social categorizations (Kaijser and Kronsell, 2014). A move towards gendered agricultural intensification in the semi-arid region requires deliberate policies which address labor shortages and the extensification of women into unproductive lands.

The third issue relates to institutionalization of women's livelihood. One phenomenon that clearly stood out was the need for women to seek permission through bureaucratic processes from the forest service division before harvesting of fuelwood, as was in the case of Lawra. With concerns of desertification and degradation in semi-arid regions, a number of policy interventions and research have called for community-based natural resource management (Kellert et al., 2000). This has created a socio-legal environment that favors the decision makers (with women often excluded) at the expense of those whose livelihoods depend on natural resources. This presents critical concerns. Given the high rate of illiteracy among women, most do not feel able to engage with formal institutions but rather prefer the traditional system. Most people have also lost confidence in the traditional system, given that when rules are set, belonging to networks places limitation on the ability of chiefs to sanction defaulters. The central concern is how women can mediate institutions that affect their livelihood given their limited power and role in agrarian communities. We argue that the strict controlling of natural resources in semi-arid areas brings an additional burden to adaptation efforts given that the livelihoods of women in the area are directly based on natural resources. With the existing unfavorable customs affecting women's efforts in adaptation, especially access to land, the formal institutionalization of fuelwood collection through institutional bureaucracies at the forestry division brings a serious livelihood concern. Our argument is not an advocacy for degradation of the environment, but the reconsideration of women's land rights, access to pastoral corridors and participation of women within the same local context that guarantee sustainable use of natural resources (Ostrom, 1990).

The fourth issue relates to the relevance of current adaptation strategies to climate variability to future climate adaptation efforts. We found an intersection between climatic and non-climatic factors that shape adaptation to climate variability in the three districts. This finding confirms the conclusions of other studies on the need for future adaptation planning through a nexus of climatic and non-climatic stressors (Carr, 2011; IPCC, 2014; Tschakert and Machado, 2012). Our findings show that the existing levels of poverty, culture and socioeconomic dynamics are major determinants of inequality in adaptation between groups exposed to similar climate variability. In several agrarian communities, these are evidence, providing insights into future adaptation strategies to climate change. From this study and others, two issues arise which act as barriers to the strengthening of current adaptation to climate variability and towards long term adaptation to climate

change in agrarian settings. Firstly, in the case of Lawra and other studies, women are presented as individual actors who are victims and vulnerable to climate change without considering the broader social relations that shape adaptation practices (Arora-Jonsson, 2011; Dankelman, 2010). Secondly, the intersect between how non-climatic factors influence adaptation and gender stereotypes are not clearly drawn in agrarian dynamics (Carr and Thompson, 2014). Overcoming these issues in the context of agrarian communities in semi-arid West Africa, creates an opportunity for more comprehensive understanding of how climate and non-climate stressors weave together to motivate adaptation strategies in these areas.

5. Conclusion

In this paper, we draw attention to a wider perspective of gender and climate change using qualitative data. In the review, we shared perspectives on why the gender-adaptation nexus is complex and inextricably linked to the wider institutional context, origin (i.e. Fulaani herders) and gender. It shows that gendered adaptation practices cannot be achieved without considering the socioeconomic context within which the adaptation takes place. By drawing insights from the narratives of gender and adaptation in agrarian societies as well as the development dynamics in semi-arid Ghana, the paper gives a qualitative description of the current situation of gender inequalities in adaptation practice in three agrarian districts. Our findings indicate an asymmetry of power among different social groups (men, women, disabled and pastoralists) resulting from patriarchal local customs and institutions that shape adaptation responses by different vulnerable social groups. Whereas each of the differential social groups have unique concerns, women are particularly vulnerable. However, an analysis of their vulnerability and adaptation cannot be assessed without consideration of the wider socioeconomic and political contexts, and development dynamics of the semi-arid environment. Assets like land, necessary for adaptation are unequally distributed amongst groups and individuals, with many cultural and socioeconomic factors placing restrictions on secured land tenure.

There are also observed marginalizations of vulnerable groups in the adaptation decision-making process, and the main driver of migration is the limited amount of socioeconomic opportunities in semi-arid regions during the dry season. Within the districts, there are many similarities in terms of vulnerability, future directions, enablers and barriers of adaptation which could suggest a movement towards a landscape approach of adaptation strategy in semi-arid Ghana. Proper planned adaptation can best be achieved, or make significant impact, if adaptation planning is considered at the landscape level (semi-arid Ghana). Such an approach makes it easy to overcome the barriers of pastoral corridors which are trans-boundary. Within the current ongoing decentralisation, funding and other support from national government for implementation can collectively be obtained. The historical development context of the semi-arid region in terms of effects of colonialism and structural adjustment policies makes it difficult to assess gender relations in climate adaptation without engaging the non-climatic factors that have given rise to vulnerability. However, future predictions show increasing climatic variability in the semi-arid area (Traoré et al., 2013) which will require more socio-cultural transformation to adapt to increasing vulnerabilities. Transformations are expected in the land tenure system such as, access to pastoral corridors, wider participation of women and other social groups in the adaptation planning processes. The National Land Policy of 1999 therefore requires significant revision to overcome local cultural barriers to guarantee women ownership and creation of pastoral corridors.

In the semi-arid areas considered, vulnerability arising from climatic and non-climatic factors are inextricably linked. The findings suggest that efforts to improve adaptation at local levels must give attention to the nexus of gender, differential vulnerabilities, cultural, political, socioeconomic context, and other subjectivities that produce a particular adaptation practice in a given place. Further studies should explore a mixed method analysis of adaptation experiences in the agrarian communities of semi-arid regions given that our current study is descriptive and highly contextualized to a single ethnic area.

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