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# Gendered perception and vulnerability to climate change in urban slum communities in Accra, Ghana

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## Abstract

Climate change is known to have differential impacts in the Global South, with gender and poverty being determining factors. In Ghana, both these factors come into play as women living in slums bear the brunt of the impacts. In spite of this, the majority of research in gender and climate change adaptation has focused on rural communities to the detriment of their poor urban counterparts. Using a critical feminist intersectional approach, this study investigates how the interplay between gender, socio-economic, institutional and place-based factors shapes vulnerability to climate change in three slums in urban Accra, Ghana. The results demonstrate that while climate change poses serious environmental hazards to all residents of slums, their perceptions and knowledge regarding the causes and impacts of these hazards are differentiated by gender, age, educational status and place-based variables, with women generally showing a lower level of awareness about climate change than their male counterparts. The results indicate further that irrespective of age, educational attainment and where people live, women were found to be overall more vulnerable, despite experiencing similar levels of exposure as the men, by virtue of their limited access to productive resources, poor conditions of housing, low participation in adaptation decision-making, as well as the heavy domestic responsibilities placed on them. We conclude that it is imperative for adaptation policy makers to formulate and implement appropriate adaptive measures in a gender-sensitive and context-specific manner to respond to the different vulnerabilities faced by different categories of social groups and communities in cities of the Global South.

**Keywords** Gender · Urban slum · Climate risk perception · Intersectionality · Vulnerability to climate change · Accra · Ghana

## Introduction

Climate change remains one of the key development challenges confronting developing countries in the twenty-first century. Its impacts will be distributed differently among regions, across ages, income groups and genders (Cardona et al. 2012). Both physical and social factors influence a group's or individual's susceptibility to climate extremes. The former

involves exposure to risks, such as floods, storm surge, hurricanes and cyclones, while the latter involves factors, such as social, economic, institutional and political arrangements, that limit or enhance their capacity to cope with and adapt to climate hazard or external stress placed on their livelihood and well-being (Adger and Kelly 1999; Djoudi et al. 2016; Frick-Trzebitzky et al. 2017). Social vulnerability theory asserts that vulnerability is influenced by social differentiation inherent in gender, class, culture, race, age and other power structures, coupled with situational variables such as where people live, their physical and mental health, household composition and size, literacy status, and resources available to them to cope with crises (Cannon and Müller-Mahn 2010; Alston 2013). Gender is thus a crucial determinant of vulnerability to climate change as it interacts with socio-economic, institutional and situational variables to produce different degrees of vulnerability for different categories of men and women (Djoudi et al. 2016; Van Aelst and Holvoet 2016).

In Ghana, the National Climate Change Adaptation Strategy (NCCAS) specifically identifies that women,

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(especially those living in vulnerable locations as a group) are particularly susceptible to the impacts of climate change (MEST 2010). Nonetheless, there have not been any systematic attempts to understand how the interplay between gender, socio-economic status, institutional arrangements and place-based factors shape the vulnerability for different categories of men and women, or how their perceptions and knowledge of climate hazards match or differ. While some studies have focussed on gender and climate change adaptation, the majority have tended to focus on the conventional binary gender categorisation and pay insufficient attention to the interplay between gender and other forms of social differentiations, such as age, education, income, ethnicity and location, in determining vulnerability for different categories of men and women. For example, Dankelman (2008) in a study of gender, climate change and human security in Ghana, Bangladesh and Senegal, finds that in Ghana, women are constructed as a homogenous group susceptible to climate change impacts. Further, most existing studies concentrate exclusively on the livelihoods of rural residents (e.g. Dasgupta and Baschieri 2010; Glazebrook 2011; Naab and Koranteng 2012), thus largely ignoring the experiences and perceptions of their poor urban counterparts occupying hazardous locations.

A common feature of existing work is the fact that they pay insufficient attention to the ways in which gender interacts with other socio-economic, institutional and place-based factors to shape vulnerability for different categories of men and women living in poor urban communities, particularly slums. As Vinyeta et al. (2016) have argued, gender can be married with climate change impacts in ways that interact with other forms of oppression, such as economic, class and marginalisation, to create unique climate change vulnerabilities. In this context, some critical feminist scholars (e.g. Nightingale 2006; Lykke 2009; Osborne 2015) have suggested the need for intersectional approach as a means for analysing how power differentials work together to produce differentiated vulnerabilities for different categories of men and women. There is a need for more studies into the social aspects of vulnerability from an intersectional perspective that will develop in-depth understanding of the nature of differentiated vulnerability and adaptation resulting from the interplay between gender and multiple dimensions of social, economic and institutional power relations. The assessment of vulnerability in urban slums using an intersectional approach will be crucial to the development of participatory adaptation policy measures for cities in developing countries. This study used an intersectional approach to examine the role of gender and its interactions with socio-economic, institutional and place-based factors in shaping vulnerability to climate change for different categories of men and women living in three urban slums in Accra, Ghana. Specifically, the study aimed to (i) identify the main climate hazards prevalent

in slums, (ii) explore men's and women's knowledge of climate change and (iii) analyse the socio-economic, institutional and place-based factors that shape their vulnerability to climate change hazards.

The paper is structured as follows. Section one introduces the study and provides an overview of the gender dimensions of climate impacts in the Global South, with a specific focus on Ghana. This is followed by an examination of the linkages between gender, slums and vulnerability to climate change using intersectionality as the conceptual lens. Section three presents the methodology and case study brief profiles. Section four presents project results and concludes with a discussion on the implications of this project for climate change adaptation research and policy making in Ghana and the developing world in general.

### **Conceptualising gender and vulnerability to climate change in slums: an intersectional approach**

This section frames the issue of gender and vulnerability to climate change within the current theoretical debates and literature. In particular, it analyses the drivers or causes of gender vulnerability to climate change through the lenses of the feminist intersectional framework. It further examines how the term slum has been conceptualised and operationally defined in the development literature.

Gender refers to the socially constructed roles, identities, norms, relations, responsibilities and opportunities associated with being a man or woman in a given society (WHO 2011; Alston 2013). A distinction must be made between gender and sex as both concepts are not synonymous. The latter refers to biological differences between women and men. Thus, while gender is socially constructed and culturally specific, sex, on the other hand, is biologically determined. In the same vein, it must be emphasised that gender is not synonymous with women. Gender must be understood as a relational concept because it is structured in the context of female and male interactions (Nightingale 2006; Alston 2013).

In the Fourth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC), Parry et al. (2007, p. 27) define vulnerability to climate change as the “degree to which geophysical, biological and socio-economic systems are susceptible to, and unable to cope with, adverse impacts of climate change”. As such, vulnerability is conceptualised as a function of three elements: exposure, sensitivity, and adaptive capacity (Adger 2006). Exposure and sensitivity refer to the presence of and the degree to which a system is affected by or is responsive to changing climatic conditions or hazard (Kelly and Adger 2000). Based on this conceptualisation, vulnerability is related to the “susceptibility, sensitivity, and lack of resilience or capacities of the exposed system to cope with

and adapt to extremes and non-extremes” (Cardona et al. 2012, p.70). However, this conceptualisation has been criticised for its inability to explain how political and structural dynamics interact to determine the vulnerability outcomes of poor and marginalised groups in society (Bohle et al. 1994; Adger 2006). Instead, some scholars have sought to define vulnerability from a social perspective. The United Nations Office for Disaster Risk Reduction (UNISDR 2009) has defined vulnerability as the conditions shaped by physical, social, economic and environmental factors or processes, which accentuate the susceptibility of a community, system or asset to the damaging effects of a hazard. This definition highlights the need to move beyond analysing biophysical vulnerability, and to simultaneously incorporate socio-economic, institutional and cultural dynamics that shape climate impacts and adaptation (Sugden et al. 2014; Buechler 2016). For instance, Aboagye (2012) finds that the social, economic and political factors within society are implicated in the impacts of flood disasters in Accra, Ghana.

Gender is an important social variable that interacts with other economic, institutional and place-based factors to influence people’s ability to mitigate and adapt to climate change impacts (Below et al. 2012; Nyantakyi-Frimpong and Bezner-Kerr 2015; Ahmed et al. 2016). In Africa, a significant body of literature on gender and climate change suggests that women and men perceive and experience climate change differently and that women usually are more vulnerable due to their dependence on natural resources and structural inequalities in their access to and control of such resources (Dankelman and Jansen 2010; Carr and Thompson 2014). For example, Pérez et al. (2015) working in nine countries in East and West Africa report that women have less access than men to common property resources and goods and services. Women control less land than men, and the land they control is often of poor quality and characterised by insecure tenure. However, the validity of this conventional binary male-female conceptualisation of gender in climate change vulnerability research has been criticised as too simplistic as it does not pay sufficient attention to the power relations that are shaped by these social contexts (Tschakert 2012; Carr and Thompson 2014; Nyantakyi-Frimpong and Bezner-Kerr 2015). Many scholars (e.g. Tschakert 2012; Bee 2013; Djoudi et al. 2016) have made the case that individuals and groups are found within broader socio-cultural, economic and political relations and that the capacity to adapt and respond to climate change is influenced by power relations that mediate access to resources, information and availability of choices.

Asserting the need for a more nuanced understanding and in-depth analysis of gender in climate change research, some critical feminist scholars (e.g. Nightingale 2011; Kaijser and Kronsell 2014) argue the importance of using the intersectionality approach. Intersectionality has been defined as the “interaction between gender, race, and other categories

of difference in individual lives, social practices, institutional arrangements, and cultural ideologies and the outcomes of these interactions in terms of power” (Davis 2008, p. 68). In the context of climate change, intersectional analysis focuses on how different individuals and groups adapt differently to climate change, by virtue of their situatedness in power structures based on context-specific and dynamic social categorisations (Kaijser and Kronsell 2014). A growing body of literature from critical feminist political ecology has highlighted the joint effects of gender, access to land, education and credit as significant determinants of the capacity to adapt to climate change and variability in Africa (Below et al. 2012; Fosu-Mensah et al. 2012; Ahmed et al. 2016). For example, Codjoe et al. (2012) working in Ghana demonstrate that preferences for adaptation projects emerge at the intersection of gender and livelihoods. They show that when deciding preferences for adaptation to drought, women fishers preferred options addressing post-harvest technology and seasonal forecasts, while their male counterparts preferred constructing fish ponds, crop insurance and fish culture technologies. Similarly, Nielsen and Reenberg (2010) demonstrate that variable gender expectations associated with particular ethnicities in Burkina Faso produce different adaptive capacities in similar agrarian settings. Moreover, Ajibade et al. (2013) find that vulnerability to flood impacts in Lagos, Nigeria, is shaped by gender roles intersecting with place, class and household structure. These studies show that when assessing the vulnerability of individuals and households to climate change and variability in the Global South, especially in Africa, it is essential to look beyond a simple binary categorisation of men/women and utilise a broader framework to analyse the intersectionality of gender and other social determinants. In this context, Kaijser and Kronsell (2014) suggest that adopting an intersectional approach can assist in avoiding the ‘traps’ of essentialisation, and enable solidarity and agency to occur across and beyond social categories. Others (e.g. Adger and Kelly 1999; Nightingale 2011) also consider intersectionality as a potential analytical tool to help comprehend how the interplay among multiple social dimensions of power can shape the development of adaptation strategies to climate change and other associated drivers of change. This paper uses the intersectional approach to investigate the role of gender and its interactions with social, economic, institutional and place-based factors in determining vulnerability to climate change in urban slums. As such, we do not assume the notion of homogeneity in the use of the terms ‘women’ and ‘men’ and we recognise that there are differences among women and men in terms of age, income, education, ethnicity and other social, economic and place-based factors which interact to influence their vulnerability to climate change.

Although slums have become an important aspect of urbanisation process in the Global South, there is no consensus

on what constitutes a universally accepted definition of a slum (UN-HABITAT 2003a). Nonetheless, the most widely used definition is the one provided by the UN-HABITAT (2003a, p.12) which defines a slum as:

“an area that combines, to various extents, the following characteristics: inadequate access to safe water; inadequate access to sanitation and other infrastructure; poor structural quality of housing; overcrowding; and insecure residential status”.

However they are defined, slums have become a permanent feature of cities, particularly those in the Global South due to rapid urbanisation and globalisation (UN-HABITAT 2003b; Ovenseri-Ogbomo et al. 2011). Additionally, the implementation of neoliberal economic policies, pursued under the Structural Adjustment Programme (SAP) as well as rural-urban migration, have been drivers contributing to the growth of slums in Ghana, and its capital, Accra in particular (Okyere et al. 2013). Although the SAP caused significant economic growth of the Ghanaian economy, the housing needs of the urban poor were less addressed (Okyere et al. 2013). Currently, it is estimated that one in three urban residents reside in slums globally, with that number increasing to three out of four in sub-Saharan Africa (UN-HABITAT 2006; UN-HABITAT 2008). In Ghana, estimates suggest that more than 5.5 million Ghanaians reside in slums and the majority live in the Greater Accra Region (Paller 2012). It is generally agreed that slums are places characterised by overcrowding, poverty, social disadvantages, harmful environmental exposure, insecurity and lack of access to amenities (UN-HABITAT 2006; Jankowska et al. 2011). These characteristics have been linked to increased risk and vulnerability to natural and human-induced hazards (Satterthwaite 2008; Jankowska et al. 2011). Thus, slums are considered to be vulnerable places and are prime targets for adaptation efforts.

## Methodology

For this study, we applied a mixed methods approach (Greene et al. 2005; Bryman 2012) based on a study of three slums in Accra: Old Fadama, Glefe and Faana. Data was collected from 350 men and women aged 18 years and above within a period of 6 months (December 2014–May 2015) through a survey. This sample comprised equal proportions of men and women. A multistage cluster sampling technique was employed to select both the communities and respondents for the survey. In the first stage, proportionate samples were allocated to each of the community because of variations in their populations. In stage 2, each community was divided into wards based on the existing boundaries. Houses in each ward were then numbered. In each ward, we selected every 2nd house to administer the questionnaires, and then a male and a female were purposively selected for the interview. Of the total 350

respondents surveyed, 150 lived in Old Fadama, with the rest distributed equally between Glefe and Faana. It must be stressed that individuals rather than households were selected for the interviews in order to achieve the study’s overall aim of understanding how different categories of men and women differently experience and perceive climate change (Barbour 2005). Given that males generally tend to be the heads of most households in Ghanaian society, we considered it imperative to collect information from individuals rather than households in order to ensure that women were represented and to prevent the likelihood of males dominating the interviewing process.

In addition to the survey, six focus group discussions (FGDs) were organised (separately for men and women) to solicit their views. To ensure that information provided by participants represented the views and concerns of the entire population, individuals were purposively selected from different areas and occupational groups within the communities to participate in the FGDs. Consistent with Bryman (2012), participants for each FGD session numbered no more than seven and each FGD lasted about an hour. Data collected from the survey were summarised, coded and analysed using the Statistical Package for Social Sciences (SPSS) version 21. Content analysis was employed to analyse transcripts of the FGDs. In the statistical analyses, chi-square was used to test for the inter-relationships among variables with a  $p$  value of < 0.05 considered to be statistically significant.

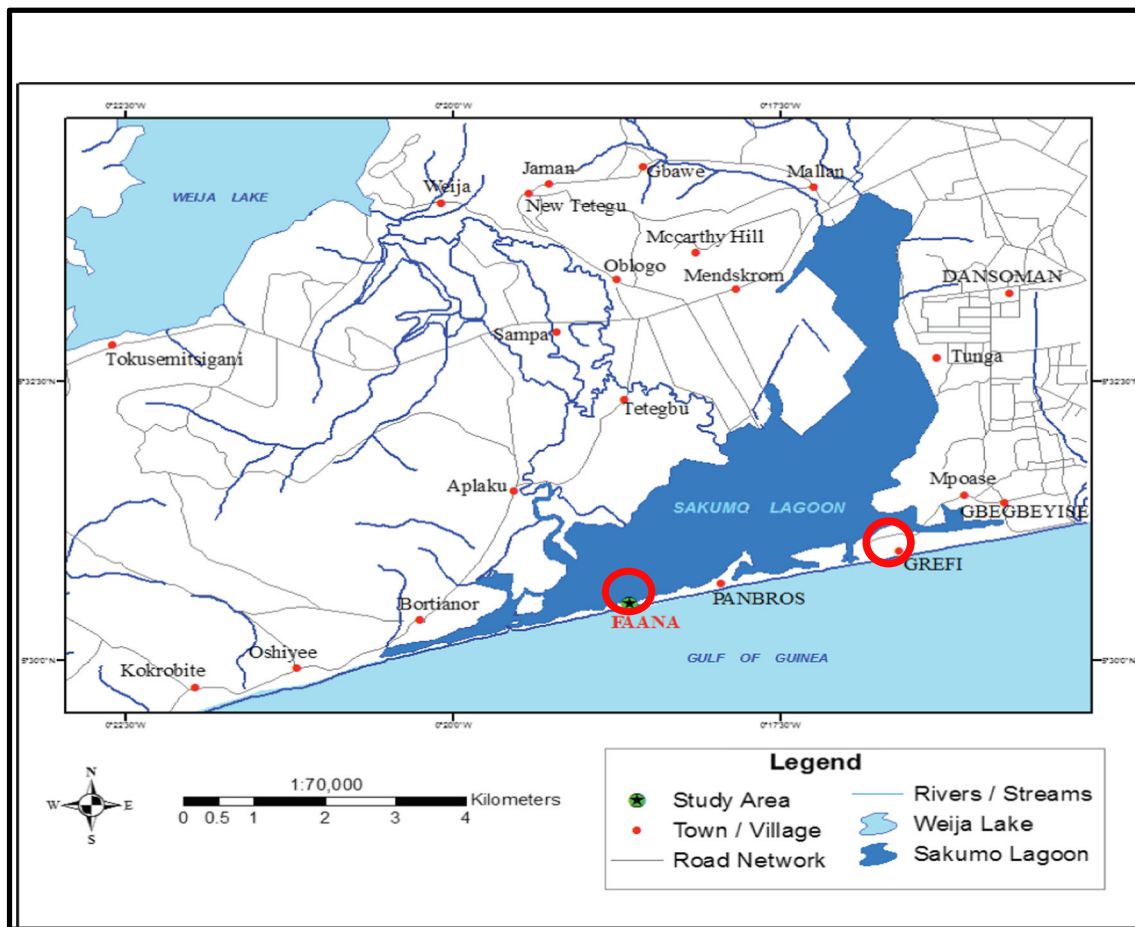
## Profiles of study communities

### Old Fadama

The Old Fadama community (also called Sodom and Gomorra) is located in the northwest of Accra’s Central Business District (CBD) and occupies about 31.3 ha of land along the Odaw River and the Korle Lagoon. The settlement’s population is estimated at 78,684 (People’s Dialogue Ghana (PDG) 2009). This translates to a population density of 2424.18 persons per hectare making the community one of Accra’s highly densely populated neighbourhoods. Most of the residents in this community do not hold official legal title to the land they occupy (PDG 2009). About 85% of the settlement’s population are believed to be employed in the informal sector of Accra’s economy of which 56% operate their business activities within the settlement (Afenah 2012).

### Glefe

Glefe is a coastal community which lies in the south-western corner of Accra. It is locked in between a lagoon and the ocean (see Fig. 1). The settlement has an estimated population of 7178 (Accra Metropolitan Assembly (AMA) 2010), and it is characterised by relatively open coastline that enables



Source: Oteng-Ababio et al. (2011, p. 433)

**Fig. 1** A map of Accra with locations of Faana and Glefe shown in circles. Source: Oteng-Ababio and Owusu (2011 p. 433)

considerably strong, unimpeded swell waves to reach the coast. The community is considered one of Accra's most densely populated and most vulnerable to flooding (AMA 2010). It is almost cut off from the rest of the Accra Metropolis by Lake Bebu and hence lacks basic infrastructure, such as proper drainage, access roads, potable water, and sanitation (Kudiator 2012; Andoh 2013). Artisanal fishing and salt production are the two major sources of livelihood for residents of Glefe.

### Faana

Faana is a fishing community located along the Gulf of Guinea (see Fig. 1). It is bounded on the north by the Sakumo Lagoon and on the south by the Gulf of Guinea (Oteng-Ababio and Owusu 2011). The population of the community is estimated to be between 800 and 1200 (Oteng-Ababio and Owusu 2011). The coastline of Faana is characterised by a gently sloping shoreline. The settlement is deprived of all forms of basic infrastructure, such as electricity, potable drinking water, waste management services,

educational and health facilities. Artisanal fishing is the dominant economic activity in this community.

### Socio-demographic characteristics of respondents

Table 1 shows the socio-demographic characteristics of the survey respondents and it is evident that they are predominantly young, with 72% aged below 40 years. The majority of respondents (43%) in this category were aged 18–29 years and comprised equal proportions of men and women. This is consistent with the results of the 2010 Population and Housing Census Report of Ghana which depicts a broad base of the population pyramid consisting of large numbers of children and youth with a conical top comprising a small elderly population (Ghana Statistical Service (GSS) 2013). Overall, 69% of the respondents had lived in their communities for more than 6 years. Additionally, 63% of respondents had attained some formal education up to the secondary or middle school level, with 36% not having any formal education at all. For the respondents with no formal education, about 46% were women compared to 26% of men. These results compare

**Table 1** Socio-demographic characteristics of survey respondents

Variable	Male (%)	Female (%)	Total (%)
Age			
18–29	39	47	43
30–39	31	27	29
40–49	14	18	16
50+	16	8	12
Education			
Basic	19	28	23
JHS/MSLC	31	19	25
Secondary	23	6	15
Tertiary	1	1	1
None	26	46	36
Ethnicity			
Akan	15	17	16
Ga-Adangbe	8	15	13
Ewe	29	30	30
Dagomba	36	27	31
Others	8	11	10
Duration of residence			
1–5 years	26	36	31
6–13 years	42	30	36
> 14 years	32	34	33

Source: Field survey 2015

favourably with the broader national situation. The 2010 Population and Housing Census found that of the population 11 years and older, 74% are literate while 26% are illiterate, with literacy found to be higher for males (80%) than for females (69%) (GSS 2013). In relation to ethnic affiliations, the majority of respondents (31%) are Dagombas, 18% of men and 13% of women, respectively.

## Results

### A wide range of environmental hazards are experienced in slum communities

By nature of their vulnerable locations, slum residents are exposed to a myriad of environmental hazards often associated with climate change. The study results revealed that flooding, heatwaves, fire outbreaks, windstorm/rainstorm, sea erosion and salinity intrusion were the most common climate hazards experienced by the respondents. Flooding which was regarded as the most common climate hazard was experienced by almost equal proportions of men and women (78% compared to 77%). This was followed by heatwaves, with 78% of women compared to 75% of men claiming to have been exposed. However, about 62% of men compared to 49% of women were exposed to fire outbreaks. Moreover, while

53% of women considered sea erosion as a concern, the proportion that did so, was 43% for men. Similarly, salinity intrusion was regarded as a hazard by a slightly higher proportion of women than men (39% compared to 33%). It is likely that the reason for this is that the women in slums and other marginalised communities in Ghana are responsible for collecting and storing water for domestic use. In focus group discussions, women intimated that they often walk farther to collect water due to contamination of local water sources from sea erosion and salinity intrusion and are therefore more exposed to the impacts of these hazards compared to their male counterparts.

Furthermore, the results indicated that age was an important factor in the perception of exposure to climate hazards in the study communities. Table 2 shows the relationship between age and exposure to climate hazards and it is evident that flooding, for example, was considered as a major concern by men and women in all age groups, except those aged 30–39 and 40–49 years. In the same way, 94% of women compared to 79% of men aged 40–49 years regarded heatwaves as a concern. Conversely, fire outbreak was regarded as a concern by a higher proportion of men than women across the different age categories. The high exposure of men to fire outbreaks was attributed to the ‘protective role’ they perform with respect to fire emergency in slum communities. The male participants in focus groups argued that the lack of emergency responses from city authorities in times of fire outbreaks within slum communities has meant that they are often compelled to handle fire emergencies by organising their own evacuation and reconstruction activities. This situation is compounded by and reflects the traditional gender power structure in the Ghanaian household: the men are ‘protectors’ of families in times of disaster emergencies.

Some place-based factors also account for differences in exposure to climate hazards between the study areas. As can be seen in Table 3, the majority of respondents in Glefe and Faana considered flooding as a major concern whereas those in Old Fadama were concerned more about fire outbreak. Interestingly, there were no significant differences between the responses of men and women in Faana and Glefe regarding exposure to flooding; however, there was a significant difference reported in Old Fadama where 85% of men compared to 72% of women considered fire outbreak as a concern. Focus group participants attributed the high prevalence of flooding in Glefe and Faana to tidal waves and the overflow of the Weija Dam. The two communities are located in the downstream side of the Weija Dam in Accra, which makes them more vulnerable to dam spillage in times of heavy rainfall at the upstream side of the Densu River. The low-lying nature of these communities also facilitates their exposure to flooding associated with tidal waves. The flooding problem in these communities has been compounded by the lack of basic drainage infrastructure, as well as an indiscriminate siting of

**Table 2** Type of climate hazards experienced by male and female survey respondents by age (multiple response)

Age	Climate hazards	Male (% yes)	Female (% yes)	Number	Total (%)
18–29	Flooding	69.6	64.6	101	66.9
	Heatwaves	72.5	69.5	107	70.9
	Fire outbreaks	75.4	54.9	97	64.2
30–39	Flooding	74.1	83.3	80	78.4
	Heatwaves	74.1	79.2	78	76.5
	Fire outbreaks	59.3	47.9	55	53.9
40–49	Flooding	87.5	93.5	50	90.9
	Heatwaves	79.2	93.5	48	87.3
	Fire outbreaks	41.7	38.7	22	40.0
50+	Flooding	96.4	92.9	40	95.2
	Heatwaves	82.1	85.7	35	83.3
	Fire outbreaks	53.6	42.9	21	50.0

Source: Gender and climate change vulnerability survey, 2015

structures or building along waterways, which together interact to make flooding from heavy rainfall and dam spilling a perennial challenge.

### Influence of socio-demographic factors on climate change knowledge and perception

Socio-demographic factors such as gender, age, education, income and ethnicity can greatly influence the individual's awareness, attitude, risk perception and knowledge of climate change issues (Masud et al. 2017). In this section, we analyse how the interplay between gender, age, education and

religious affiliations influences slum residents' knowledge and perception of climate change. Survey results indicated that overall, 46% of the respondents across all three communities, claimed to have knowledge of climate change, albeit with significant differences between men and women. Whereas 52% of men claimed to have knowledge about climate change, only 41% of women did so. Female participants in focus groups reflected that their male counterparts had much better access to information outlets, such as the radio, public media and information technology. They also asserted that men were more often able to attend community meetings where climate change issues were discussed and hence were

**Table 3** Type of climate hazards experienced by male and female survey respondents by study area (multiple response)

Community	Climate hazard	Male (% yes)	Female (% yes)	Total (% yes)
Glefe	Flooding	95.6	96.4	96.0
	Heatwaves	71.1	85.5	79.0
	Fire outbreaks	4.4	7.3	6.0
	Sea erosion	68.9	76.4	73.0
	Salinity intrusion	53.3	60.0	57.0
	Windstorm/rainstorm	60.0	70.9	66.0
Faana	Flooding	100.0	96.2	98.0
	Heatwaves	81.3	86.5	84.0
	Fire outbreaks	71.1	63.5	70.0
	Sea erosion	91.7	96.2	94.0
	Salinity intrusion	64.6	67.3	66.0
	Windstorm/rainstorm	75.0	67.3	71.0
Old Fadama	Flooding	54.9	47.1	51.3
	Heatwaves	74.4	64.7	70.0
	Fire outbreaks	85.4	72.1	79.3
	Sea erosion	1.2	1.2	1.3
	Salinity intrusion	2.4	1.5	2.0
	Windstorm/rainstorm	43.9	23.5	34.7

Source: Field survey 2015



better informed about the issue of climate change. This finding is consistent with other studies carried out in slums and marginalised communities in other parts of Africa. Ishaya and Abaje (2008) find that among the indigenous people of Kaduna, Nigeria, males are more likely to perceive climate change compared with females, because they have better education and awareness about climate change.

Synthesis of the results also show that there is a relationship between age and climate change knowledge, with about 61% of men compared to 34% of women aged 18–29 years claiming to have knowledge of climate change. A high and equal level of awareness about climate change was found among men and women aged 30–39 years (48%). Interestingly, a higher proportion of women aged 50 years and above had knowledge of climate change than men in the same age group. Focus group discussions also revealed that younger men and women had better exposure and access to mass media and other modern communication technologies—sources where information about climate is mostly disseminated. The ability to read, assimilate and interpret climate-related information is critical in helping men and women to adapt to climate change. Our survey results show that respondents who had achieved higher educational status also appeared to be more aware of climate change, with more men than women more knowledgeable about climate change at all levels of educational attainment.

Apart from awareness of climate change, understanding how people perceive climate change is important as it largely determines the forms of actions taken to cope with its impacts. The results indicated that a higher proportion of men than women (83% compared to 72%) perceived climate change to be ‘changes in rainfall and temperature patterns’. This finding is consistent with the results of other studies. For instance, Oloukoi et al. (2014) report in their gender-related study that both men and women in the Nigerian woodland savannah perceived climate change by recounting recent changes in rainfall and temperature patterns. A higher proportion of women than men (22% compared to 7%) claimed to have heard about climate change but maintained that they did not understand what it meant.

### **Socio-economic, institutional and place-based factors produce different and gender based vulnerabilities across the three slums**

The analysis of the factors underlying vulnerability to climate change revealed the important role of gender interacting with other socio-economic, institutional and place-based factors in shaping vulnerability for different groups of men and women in the three slums. These factors are related to social roles, housing, infrastructure and service provision, participation in decision-making, and ownership and control of resources for adaptation. In this study, we found some differences in

vulnerability between different categories of men and women based on social roles. For example, focus group discussions revealed that men were generally responsible for handling home finances whereas women generally performed home management roles. The women, however, were found to be overburdened with domestic responsibilities as they performed the bulk of the routine domestic duties, such as collecting and storing water, bathing children, cleaning and cooking. Performance of these domestic duties often reduced the time available to women to engage in income generating activities and to build their adaptive capacities. As McKinley et al. (2016) have argued, the social role of women in many countries can limit their abilities to adapt to climate change and that their responsibilities relating to childcare, water collection, and cooking fuel collection often enhance their sensitivity to climate change. We also found that most of women’s domestic roles depended largely on the availability of natural resources, such as water and fuel wood, which acted as a constraint on their adaptive capacity. The longer the women spend searching for water and fuel wood, the less time and energy they have for performing other domestic responsibilities, suggesting an increase in time poverty. As expressed by a female participant in Glefe:

‘We [the women] do much of the domestic activities such as cooking, cleaning of dishes, fetching of water, bathing of children and washing. Doing these things [domestic activities] often delay us from going to work early and this negatively affects our profits from businesses as we tend to lose our customers’.

However, results also indicated that performance of these roles differed amongst age groups: bathing and feeding of children was performed by 85% of women aged 18–29 years and 30–39, compared to only 52% of men within the same age cohorts. This is not surprising given that these respondents are within the childbearing age. Additionally, collection of water was done mostly by women aged 40 years and above. Given that the responsibility for collecting water mainly falls on children and young adults in Ghanaian society, one would expect that this activity would be performed by respondents aged below 40 years. It appears that the heavy involvement of these respondents in other routine domestic duties, including bathing or feeding of children, may have reduced their involvement in water collection. With climate change expected to negatively affect the availability and reliability of fresh water supplies (Arnell 2004), it can be concluded that women, especially those 40 years and above will experience an increased workload associated with a water collection and storage.

In terms of housing, although generally housing was of poor quality in the three slums, men were better off than women. The survey results showed that while 46% of women occupied compound houses, only 29% of men did so. In compound houses, a number of families or households share a large house and a common compound and other facilities,

such as toilet, kitchen and bathroom. These houses are either wooden shacks or concrete structures with no electricity connections and have deep cracks and holes in the walls. Their roofs also leak and the foundations are slightly or largely exposed to erosion with decaying or inadequate windows for proper ventilation. Overcrowding and unsanitary conditions predominate in such houses. This trend may be attributed to the heightened poverty among women as well as the gender inequalities in traditional land ownership system in Ghanaian society where men are privileged in terms of access to land for housing development. The high concentration of women in compound houses heightens their exposure to flooding and other climate change-related hazards. Further, focus group discussions revealed that residence in compound houses exposes their occupants (mostly women) to waterborne diseases often associated with flooding.

The survey results also revealed a huge infrastructure deficit across the three communities, although men were found to have better access than women. For instance, while 71% of men claimed to have access to electricity, only 67% of women had access. Similarly, 28% of women compared to 25% of men trekked over 2 km daily to collect water from nearby communities due to lack of in-yard water connections. The results also reveal some differences between the study areas, with Faana emerging as the most deprived community. None of the respondents in this community had access to water, electricity and toilets. This situation certainly posed some serious challenges to the respondents, especially women. Focus group meetings revealed that the lack of domestic toilet facilities has forced many of the respondents to defecate in the open, with women subsequently being more vulnerable to physical attacks and embarrassment. This problem was particularly acute for respondents aged 30–39 years followed by those aged 50 years and above.

In coping with climate shocks and the longer terms impacts of climate hazards, the provision and ownership of adequate resources are of critical importance. Nevertheless, we found across all three slum areas, that ownership of resources or assets is gendered in favour of men, with about 60% of men compared to only 40% of women owning assets, such as the house, a bank account, machinery etc. Similarly, control of communal resources is structured along gender lines. Female participants in focus groups raised the fact that although they may have the rights to use certain communal assets, the decisions regarding their utilisation are mostly taken by men. As a female participant from Old Fadama notes:

‘Even though we [women] are more than the men at the Kokomba Yam Market, we don’t have any say when they [men] are taking decisions about how to allocate stores or space. They make decisions on sanitation issues in the market as well. The men usually decide and inform us about it’.

Apart from physical assets, social capital plays an important role in assisting slum residents to cope with impacts of climate

hazards. A number of civic associations were found to have played a crucial role in addressing community vulnerabilities. For instance, there are the Old Fadama Development Association (OFADA) and the Ghana Federation of the Urban Poor (GHAFUP) in Old Fadama which have been in charge of organising and executing measures to address the community’s vulnerability to flooding and fire outbreaks. There is also the Glefe Community Development Association which oversees the general development needs of the residents including vulnerability reduction. However, it became clear that the leadership structures of these informal governance institutions are controlled by men, thereby making it difficult for women to participate equally in their decision-making processes. Again, as another female participant from Old Fadama states:

‘There is an informal leadership structure in this community represented by Old Fadama Development Association (OLDFADA) and the Kaya Youth Association. We [women] are involved in the activities of OLDFADA but it is totally controlled and managed by the men. This makes it difficult for us to participate equally in the affairs of the association. We just play organizing role in this association and attend community durbars and forums’.

## Discussion

Understanding what local knowledge and perceptions exist about climate change is essential not only for formulating climate change education and communication interventions but also for effectively implementing risk reduction strategies (Danielsen et al. 2005; Masud et al. 2017). Notwithstanding this, Wolf and Moser (2011) have argued that local people’s knowledge and perceptions are often embedded in the local cultural and social contexts and therefore cannot be said to be gender-neutral. However, some authors, such as Greenberg and Schneider (1995), have argued that males and females who actually confront environmental hazards in stressed neighbourhoods will have the same level of concern. Do differences actually exist between women and men who live in slum communities with multiple hazards? The results of this study have demonstrated that even though men and women in this study live in vulnerable communities with exposure to multiple climate hazards, their knowledge and perceptions regarding these hazards differ. The results show that individuals’ socio-demographic factors such as gender, age and education have a great influence on their knowledge and perception of climate change. The younger adults and those with high educational attainments exhibited higher levels of awareness about climate change compared to other categories of respondents. The high awareness among the younger adults was found to be associated with their exposure to the mass media and other modern communication technology where information about climate change is often disseminated. This

confirms the important role of information and technology in determining adaptive capacity among different age categories and has implications for climate change communication. There is a need for policy makers to develop and implement climate change communication strategies to target different age cohorts to address their diverse information needs.

A person's proximity to the perceived manifestation of climate change also plays an important role in how people feel about it and how threatening it may be for them (Bateman and Edwards 2002; Etkin and Ho 2007). These interpretative processes are determined largely by social factors, cultural biases and gender (Bateman and Edwards 2002). The results of this study demonstrate that perceptions of climate hazards were significantly related not only to gender but also to which area people lived in, and to the differences in levels of exposure among the study areas. Collectively, these results imply that perception of climate risks can be gendered and spatially differentiated and that if care is not taken, women's risk perceptions can be given less attention than those of their male counterparts in social vulnerability research. This highlights the fundamental need for vulnerability researchers to adopt gender-sensitive and context-specific assessment methodologies to be able to account for the spatial and social differentiations in risk perceptions and vulnerability among different groups of men and women living in slum communities in cities of Africa.

Additionally, the relationship between gender and environmental knowledge has engaged the attention of sociological gender theorists (McCright 2010) resulting in the development of the gender socialisation and social role perspectives to explain this nexus. Gender socialisation theory asserts that the different values and social expectations conferred to boys and girls through socialisation continue and replayed into society's dominant culture. Women's place is often limited to the private sphere whilst men's place, on the other hand, lies in the public or cultural sphere (Davidson and Freudenburg 1996). The gender role perspective, on the other hand, attributes the gender differences in environmental knowledge to the influence of the social roles performed by men and women in society, and argues that a woman's decision to be a homemaker triggers her values of nurturance, compassion, and empathy in such a way as to increase environmental concern (Blocker and Eckberg 1997). By extending these theories to the realms of climate change, one would expect that women will demonstrate a high level of awareness about climate change given their nurturing and caregiving roles. However, the results of this study did not support an extension of these theories to show that women are more knowledgeable about environmental problems, such as climate change. In fact, women in this study demonstrated a lower level of awareness about climate change compared to their male counterparts partly due to their low level of education and involvement in adaptation governance, which

are underpinned by the unequal power relations between men and women in slum communities and the Ghanaian society in general.

Kaijser and Kronsell (2014) suggest that scrutinising the representation in decision-making about climate change is one way of undertaking institutional analysis within an intersectional framework. Our analysis of institutional representation in localised adaptation decision-making unearths unequal power relations in community adaptation governance, which constrained the adaptive capacity of women. Overall, women were found to have played a minimal role in decision-making in climate change adaptation governance structures. Röhr and Hemmati (2008) have argued that the degree to which women participate in decision-making on climate change is small. The interplay between gender and climate change decision-making processes suggests that power structures and relations in slum communities are manifested not only materially but also normatively as sociocultural norms are reproduced in practices of political, economic, and social institutions. Gender and place-based differences in institutional, political, and economic processes are clearly evident in access to both tangible (land, house, bank account) and intangible (information, time, social capital) assets in slums and this differential access affected the adaptive capacities and hence vulnerabilities of different groups of men and women. This finding provides some useful insights into understanding how approaches to adaptation planning in Africa may have different impacts on power structures. For example, the traditional approach to adaptation planning, which often revolves around offering aid interventions to individuals to enhance asset bases, may become counterproductive in the long run as they may fail to address gender-differentiated vulnerabilities in the promotion of climate change adaptation among males than females (Nabikolo et al. 2012). Therefore, it is imperative that policy makers in Africa adopt an intersectional approach in policy formulation and implementation process to prevent the risk of producing and reinforcing unequal power relations relating to the access to resources and decision-making structures in slums and other marginalised neighbourhoods in their cities.

## Conclusion

This paper explores the social dimensions of vulnerability to climate change by focussing on how the interplay between gender, socio-economic, institutional and place-based factors shape the vulnerability of slum residents to climate hazards in Accra, Ghana. This study contributes to an important gap in the gender and environment literature, by enhancing our understanding of social differentiation and vulnerability in poor urban communities in the Global South. Taken together, our results demonstrate that the differential vulnerabilities faced

by slum residents are closely linked to the interplay between gender and sociocultural norms or institutional arrangements prevailing in slums and Ghanaian society in general. By virtue of their roles as caregivers, social expectations of what is acceptable for women and a lack of access to decision-making power, women tend to be more vulnerable relative to men in facing the impacts of climate hazards. The utilisation of an intersectional approach enhanced our understanding of the interplay between gender and other forms of social differentiation providing nuance in the determination of the knowledge, perception and adaptation to climate change of slum residents in Accra, Ghana. By adopting an intersectional approach, this study also avoided the danger of focusing on simplistic gender dichotomies.

We acknowledge that this study focussed mainly on understanding the experiences and perceptions of individuals (i.e. men and women) regarding climate change. As such, it does not adequately yield data on households or families. Data could not be disaggregated to determine the differences in vulnerability between male-headed and female-headed households and how other demographic characteristics of respondents, such as marital status, relationship to the head of household and family situation may have contributed to influence vulnerability. We suggest this as an area of future research. Notwithstanding, the findings of this study have contributed to the debate on gendered environmental relations in urban slums by highlighting the vulnerabilities faced by different residents based on gender, age, education, location and institutional arrangements and the kinds of measures that are needed to address these vulnerabilities. We find that there is the need for policy makers in charge of African cities to formulate and implement climate change policies and programmes in a gender-sensitive manner so as to adequately respond to the circumstances of different categories of men and women. The gendered nature of ownership and control of resources in urban slums and Ghanaian society in general will have consequences for the development of power relationships between men and women in local adaptation governance. It is therefore recommended that gender-blind adaptation policies and programmes should be avoided.

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### Compliance with ethical standards

This study was conducted in line with the Australian Code for the Responsible Conduct of Research. Ethics approval for this study was obtained from the Human Research Ethics Committee (HREC) of the University of Adelaide, with Project Approval No. H-2014-170.

**Conflict of interest** The authors declare that they have no conflict of interest.

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