

RESEARCH ARTICLE

Effect of climate variability on gender roles among communities surrounding Lake Mburo National Park, Uganda [version 1; peer review: 2 approved, 2 approved with reservations]

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Abstract

Background: Climate change has been increasingly recognized as a global crisis with effects on gender roles. Recently, communities surrounding Lake Mburo national park, Uganda have been experiencing frequent severe droughts. It was against this background that this study was designed to understand effect of climate change on gender roles.

Methods: This cross sectional study reviewed the effect of climate change on men and women’s gender roles using a pragmatic research paradigm based on a thematic review model using participatory methods and a structured questionnaire.

Results: The study found that men and women’s gender roles were altered during extreme dryness. Men played their roles sequentially focusing on one single productive role, while women played their roles simultaneously, balancing the demands of each role with their limited available time. Effect of climate change variability affected productive roles more in Kiruhura district than Isingiro district. There was migration of both men and women in search for water and pasture livestock in Kiruhura district which distorted gender roles of women. Consequently, women and children had a heavier load and were the most people affected by climate change effects.

Conclusion: Gender roles of communities surrounding Lake Mburo National Park, Uganda were affected and altered by the effects of climate change variability. Therefore, institutions offering climate services to local communities should consider gender in decision making, access to resources, information and knowledge.

Keywords

Climate change, Climate variability, gender roles, communities

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Introduction

The climate change crisis is threatening the livelihoods the poor in society living in marginally productive rangelands in sub-Saharan Africa (Babugura *et al.*, 2010; IPCC, 2014; Sathaye *et al.*, 2006 and Quisumbing & Yamauchi, 2009). The frequency and intensity of droughts as indicators of climate change have increased. These droughts have caused devastating effects on biodiversity, community livelihoods, food security, and health (Djoudi & Brockhaus, 2011; Ekpo & Agu, 2014; IPCC, 2014 and Sathaye *et al.*, 2006). These effects, impact on gender differently including the gender roles and coping strategies (Barnett & Adger, 2007; Dankelman *et al.*, 2008; Guloba, 2014; Nampinge, 2008; Omolo, 2011 and Quisumbing *et al.*, 2011). It has been shown that climate change causes changes in normal gender (men, women and children) roles within a household (Henson, 2011; IPCC, 2007; IPCC, 2014). This study defines gender roles as activities ascribed to men and women on the basis of their perceived differences (ILO, 2008).

Uganda is experiencing greater weather disruptions including increased temperatures and changes in precipitations. As a result, communities surrounding Lake Mburo National Park (LMNP) have experienced frequent severe droughts in Kiruhura and Isingiro districts (Abraham, 2003; Kamugisha *et al.*, 1997; Ocaido *et al.*, 1996; Ocaido, 2003; Ocaido *et al.*, 2009b and UWA, 2015). The intensity of these droughts has affected gender roles among these communities and no studies had been done among these communities to determine the effect of climate change on gender roles of men and women. It is expected that the outputs of this study will play a vital role in designing adaptive community based sustainable mitigation measures for climate change around LMNP.

Methods

Ethical considerations and consent

This study obtained two ethical approvals from Makerere University School of Social Sciences Research Ethics Committee (MAKSS REC) under the protocol number MAKSS REC 06.17.063, and Uganda Council for Science and Technology (UNCST) with Research Registration Number SS 4383. Information regarding the role of each participant was explained and respondents signed consent forms.

Study design

A study was conducted between the months of October 2017 to June 2018 among communities surrounding Lake Mburo National Park (LMNP), in the districts of Kiruhura and Isingiro in Western Uganda. LMNP is a small park of about 260 square Km which lies in the cattle corridor stretching from Northern Tanzania in the south, to the south western shores of Lake Kyoga, and on to Karamoja in the north east of Uganda (Ocaido *et al.*, 2009a). The study area has a bimodal, pattern of rainfall. The average annual rainfall total is about 750-800 mm. The shorter rains fall between March to May, and the long rains from mid-September to early December. Normally short dry seasons occurred from late December to February and the long dry season from late May to September (G.o.U (2015); UWA, 2015). It has an altitude of 1, 220m-1,828m above sea level. The economies of Kiruhura and Isingiro district depend on agriculture

(crops and livestock production). However, there is more crop production in Isingiro District, and more livestock production in Kiruhura District.

A cross-sectional study was done in the two districts: Kiruhura representing pure pastoral and agro-pastoral farmers while Isingiro was for pure crop and smallholder crop-livestock farmers. The study was carried out in Sanga, Kanyaryeru and Nyakashashara sub counties in Kiruhura District, and Marsha and Rugaga Sub counties in Isingiro District. These study sites were purposively selected.

A reconnaissance survey was done as a preparatory phase, and it involved visiting the study area to get relevant information to guide the designing of the cross-sectional survey tools, selection of study sites and to sensitize relevant stakeholders about the upcoming research activities.

The study involved use of participatory methods and administration of a detailed structured questionnaire. For both participatory and questionnaire methods, purposive sampling was used to select 2 parishes per Sub County and from each parish 2 villages were selected. This was based on the availability of evidence of climate change affects, accessibility and limited research on gender roles and climate change.

The unit of analysis was a household from which a man or a woman was chosen. Equal number of men and women were chosen for each strata. Sampling frame strata of farmers were pure crop farmers, pure livestock keepers, pure crop farmers and agro-pastoralists. Households in each household were randomly selected (Kothari, 2004).

Focus Group Discussions (FGDs) were carried out in all the 20 villages by the (I.J.N). There were three FGDs per village which were stratified as women's group, men's group and mixed (women and men's) group living in the community. The selection of FGD participants was done through identifying men and women who had similar understanding of the effect of climate change on gender roles.

A minimum of 8 participants for each focus group discussion were held. All proceedings of the FGDs were recorded for transcription and analysis. This was used after informing participants why there was need to record their voices. The participants were informed that their recorded audios would be destroyed within the period of five years and who would have access to their recordings and where they would be stored. The number of FGDs was as shown in Table 1.

Focus group discussions comprised both sexes (male and female) and children; these were cluster sampled. The interview guides (Extended data (Nagasha, 2019)) for both FGDs and Key informants were pretested prior the study in order to determine systematic problems in the questions and improve the guide by revising the identified error (Creswell, 2013). Key informants were opinion leaders, district extension staff like District Production Officers, Agricultural Officers, Meteorologists, Veterinary Officers, Environmental Officers, Community

Table 1. A summary of distributions of Focus Group Discussions (FGDs).

Selected Focus Group Discussions		
	Selected Villages	Stratified FGDs Per Village
Kiruhura District	12	Mixed group Women group, Men group
Isingiro District	8	
Respondents	8-12 respondents in each group	

Development Officers, Community Wildlife Wardens and LMNP-Chief warden. They were purposively selected during reconnaissance, and then interviewed at their work places or homes. The selection was made based on the position, knowledge on climate change, history of the study area and other required information. An average of 45 minutes was spent on each FGD and a key informant. Field notes were made during the interviews and transcripts returned to participants for comments as recommend by Creswell (2013).

A questionnaire (Extended data, (Nagasha, 2019)) was administered to respondents in villages selected for the study as previously described. A minimum sample size of 384 households was determined using equation used by Dohoo *et al.* (2003).

$$n = \frac{Z^2 PQ}{D^2}$$

Where n = minimum sample size.

Z = 1.96 at 95% confidence interval

P = Estimated percentage prevalence of 50%

Q = 100-P

D= acceptable error of 5. However, to increase the precision, questionnaires were administered to 400 households.

Data was collected using participatory methods as described by Tadevosyan & Schoenhuth (1997). FGDs were held with men and women using a checklist of questions. In-depth interviews with purposively selected key informants were conducted. The discussions and interviews were recorded using a tape recorder. A detailed structured questionnaire was used to verify in detail the information given by participatory studies. The discussions and a detailed questionnaire captured information on the normal household gender roles, reproductive roles, productive roles and community roles, and how these were altered during prolonged drought. The study defined reproductive roles as childbearing and rearing responsibilities, and domestic tasks done by women, are required to guarantee the maintenance and reproduction of the labour force. This includes not only biological reproduction, but also the care and maintenance of the work force (male partner, oneself and working children), and the future work force (infants and school-going children). In this study, productive roles refer to work done by both men and

women for pay in cash or kind. It includes both market production with an exchange-value, and subsistence and home production with actual use-value, and also potential exchange-value. Community roles refer to activities undertaken at the community level to ensure the provision and maintenance of scarce resources of collective consumption, such as water, energy sources, health care and education. This is unpaid work, undertaken in 'free' time (FAO, 2012).

The magnitude of changes of the roles was ranked on a four point Likert scale ranging from (0–3): 0= don't agree to 1= slightly agree 2= Agree and 3=strongly agree which applied their response for men and women on the effect of climate change on gender roles. Qualitative data was subjected to interpretation through the systematic classification process of coding and identifying themes using MaxQDA 2018 software. This means that qualitative data was broken down into smallest meaningful units of information with respect to the objectives of the study. Quantitative data was analyzed using SPSS version 17.0 and Microsoft Excel 2013 into descriptive statistics. Gender differences of roles and altered roles were determined using Odds ratio and Chi-square test. The differences were determined across different farming systems and wealth rankings around LMNP.

Results

The details of land ownership by gender were as shown in Figure 1. Overall, in both districts of Kiruhura and Isingiro, more women (83%) did not own land compared to men (52%) ($p=0.003$). Isingiro district had significantly more landless women (98.7%; $X^2 = 52.6$, $p<0.001$) in Isingiro district than in Kiruhura (50.6%). Similarly in Isingiro there were significantly more men who were landless (67.5%; $X^2 = 52.6$, $p<0.001$) than in Kiruhura (41.8%). Men had power and authority over land in the two districts. Women made no decisions on how to use household land that was available.

Household age structure was as shown in Figure 2. Children (0–17 years) formed the majority in the two districts, followed by the youth (18–35 years). On the contrary, the elderly (65+ years) were the smallest population in all households of Isingiro and Kiruhura districts. Overall, children constituted 41.7%, youth 33.6%, adults (36–64 years) 21.5% and elderly 3.1%. Across age structure, there was no significant difference between males and females ($P>0.05$).

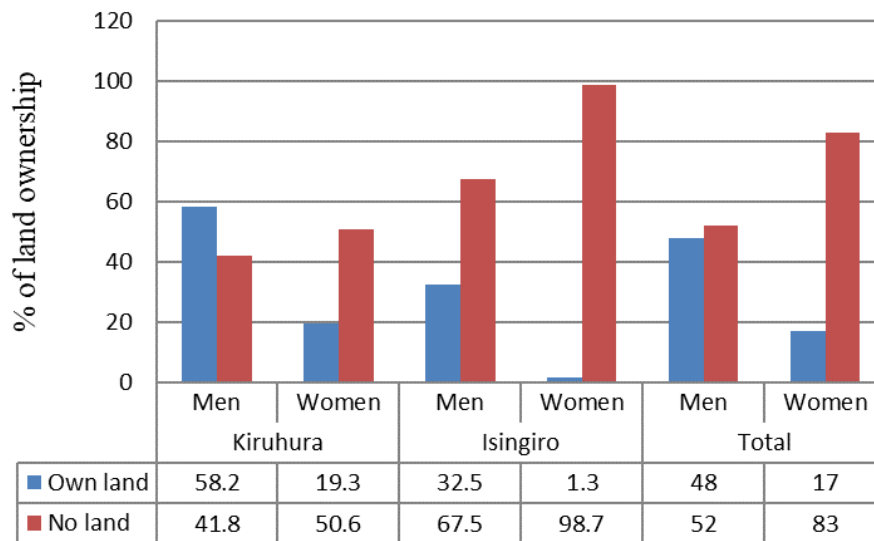


Figure 1. Land ownership by gender.

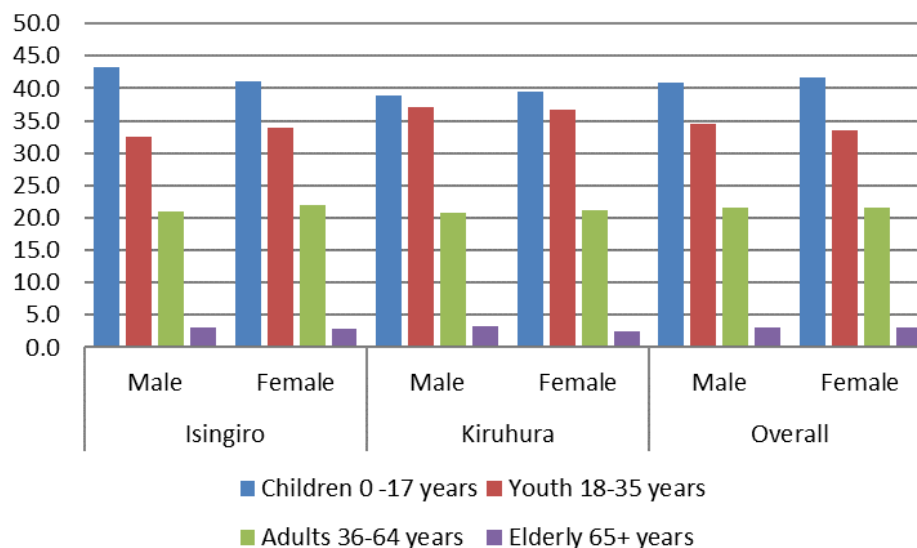


Figure 2. Household age structure.

The current gender roles were as shown in Table 2. Overall, children in Kiruhura district were less engaged in gender roles, whereas in Isingiro district, children were actively engaged in almost all the roles. 89.9% of children collected firewood; 45.5% of males and 41.4% of females paid their school fees; 53.4% of females cultivated; and 44% of females cooked. Female children in Isingiro district were more engaged than the males. Adult males were actively engaged in grazing (48.2%), spraying

cattle (53.8%), firewood collection (62.8%), building and fencing (53.2%), paying fees (48.6%), and fetching water (45.9%).

Male FGDs in Isingiro district reported that men changed their roles during drought, in order to search for water and collect firewood for their own and other households. They also earned monetary benefits. Water was fetched from far distances and was sold at a cost of 0.27\$ per a 20 liter container. This implied

Table 2. Current gender roles of children and adults in Isingiro and Kiruhura districts.

Role	Children				Adults			
	Isingiro		Kiruhura		Isingiro		Kiruhura	
	Male	Female	Male	Female	Male	Female	Male	Female
Grazing	17.2	40.5	0.4	1.3	48.2	30.3	26.3	19.7
Milking	37.1	38.5	0.4	4.4	21.9	5.8	22.8	13.5
Spraying cattle	19.3	38.8	0.4	2.1	53.8	14.1	22.3	20.2
Cultivation	37.5	53.4	2.1	3.8	41.1	37.0	25.2	36.6
Child raising	33.7	45.7	1.7	2.9	20.2	49.2	28.6	36.6
Cooking	37.4	44.0	2.1	2.9	29.0	43.3	15.5	39.5
Home hygiene	30.1	30.3	4.2	0.0	27.5	36.0	35.7	36.6
Firewood collection	48.0	89.9	4.6	1.3	62.8	25.4	30.7	31.9
Building and fencing	32.4	51.4	4.2	0.8	53.2	42.7	29.0	11.3
Paying school fees	45.5	41.4	4.6	5.5	48.6	23.0	36.1	18.9
Fetching water	41.6	52.6	3.8	1.3	45.9	12.3	40.3	36.1
Others	13.3	21.9	0.4	1.7	48.5	34.2	3.8	5.5

that due to climate change effects, regular roles changed where the burden of children working was more felt in Isingiro district, and the men decided to look for alternative sources of income through water fetching.

Reproductive roles affected by climate change in Isingiro and Kiruhura districts

Details of gender response of effect of climate variability on reproductive roles were as shown in Table 3. Reproductive roles were affected in both districts. The women in Isingiro district (33%) and Kiruhura district (21.7%) were affected through walking long distances to fetch water. This activity consumed time for other domestic work like cooking and firewood collection. These women also agreed that due to drought, walking long distances to fetch water was one of the contributors to preparation of only one meal per day. This limited time spent caring for the elderly and children. In Kiruhura district, 20.1% of males were mainly affected because of trekking long distances in search for water and pasture.

During FGDs with women, it was reported that during drought periods they spent much time walking looking for water and firewood which led them to prepare one meal per day. This also took away from time spent on caring for the elderly and the children. Women FGDs in Isingiro district in the villages of Kashwina A and Kashwina B, reported that they spent more time guarding their gardens from being destroyed by animals, like wild pigs and hippopotamus from LMNP, leaving children to do household chores. They also reported that due to scarcity of firewood, women had resorted to using banana combs “*enkonya*” for cooking. This implied that children were denied strategic needs like education since they missed out schooling

in order to fill for their mothers while she was away from the household.

In Isingiro and Kiruhura districts, women strongly agreed (mean ranking score of 3) that climate change affected reproductive roles by walking long distances looking for water and pasture. Women in Isingiro district agreed (mean ranking score of 2) that they had resorted to cooking one meal day, and spending less time taking care of the elderly. The rest of the respondents had a moderate slight agreement (mean score of 1) towards the effect of climate change on gender reproductive roles.

The effect of climate variability on gender productive roles

The key informants and FGDs in Isingiro district reported that in male headed households, the landless and men with small plots of land fled their homes to look for work elsewhere, leaving women and children to struggle in the extreme dryness. It was reported that their return to their homes depended on the conditions found where they had gone.

In Kiruhura district, key informants responded by stressing that men conducted illegal grazing in LMNP. Overall, women in both districts looked for alternative sources of income like chicken rearing and piggery. Children and youths engaged in rabbit keeping in Isingiro district.

With FGDs held in Kiruhura district women engaged in charcoal selling reported that: “*we give “loans” to youth male and adult men, hire them out to go to the forests to cut trees and burn charcoal for us. When they bring a finished product, we pay off their balance on their loan. We do the actual selling of charcoal and earn an income. We have actually taken over*

Table 3. Percentage gender response of effect of climate variability on reproductive roles.

Roles	Kiruhura (N=238)						Isingiro (N=158)					
	Youth		Adults		Elderly		Youth		Adults		Elderly	
	M	F	M	F	M	F	M	F	M	F	M	F
Walking long distances for domestic water & pasture	20.2	25.2	40.8	31.5	19.3	12.6	12.7	8.9	15.9	13.3	17.7	19
Children missing school	12.6	16.0	21.4	16.0	8.0	5.5	12.7	7.6	14.6	8.2	9.5	12.7
Cooking one meal a day	10.5	13.0	16.0	21.0	7.1	6.3	5.7	6.3	3.8	4.4	7.6	19.0
Difficult to take care of the elderly	9.7	8.4	9.2	17.6	5.5	4.6	13.9	11.4	15.2	13.9	10.1	16.5
Spending more time taking care of the malnourished children	8.0	8.4	19.3	9.2	6.3	5.9	6.3	6.3	5.7	3.8	3.2	10.1
Spending more time taking care of sick people due to hygiene related diseases	5.5	7.6	21.0	7.1	6.7	5.9	7.0	5.7	3.8	3.8	5.1	13.3
Others	4.2	3.4	6.7	1.7	3.8	2.5	8.9	1.9	1.9	0.0	0.6	0.6

household responsibilities such as paying school fees and scholastic materials for our children”.

Men in Kiruhura district strongly agreed (mean ranking score of 3) and youth agreed (mean ranking score of 2) that there was no crop planting during the extreme drought. Men and women in Kiruhura district agreed (mean ranking of 2) that they opted for alternative sources of income. Overall, in both districts, they slightly agreed (mean ranking score of 1) on the effect of climate change on productive roles.

Details of gender response of effect of climate variability on productive roles were as shown in Table 4. Male adults and youth, 22.7% and 12.2% respectively, from Kiruhura district responded that climate change affected their work because they would not plant anything productive in extreme dryness which affects the household income. 16.8% of men in Kiruhura district spent more time looking for water and pasture for their animals. Women (13.9%) in Kiruhura district opted for alternative sources of income and looking for work outside the household. Most of these women engaged in charcoal selling.

Respondents from FGDs reported that communal roles had been affected by climate change. Traditional gatherings like parties and burials were greatly affected in both districts, especially during prolonged dry spells. Traditionally, communities would collect food and provide labor for any community member for any traditional gathering. However, due to climate change effects, this norm ceased. Women FGDs in Isingiro district said that “they had inactive burial associations (*bataaka twezikye*), where men would provide firewood and women would provide food to sustain the ceremonies”. Both men and women in Kiruhura district agreed (mean ranking score of 2) that they spent long hours looking for water and pasture, and children’s routine school attendance was disrupted.

Discussion

The nature of household structure influenced reproductive, productive and community roles in the face of climate change. The household structure, in the study area showed that 41.7% were children, 55.2% were youth and adults, and 3.7% were elderly. Under normal circumstances, this meant that the children and elderly (44.8%) were supposed to depend on adults and youth as their labour force. This is the typical sub-Saharan Africa nature of households which is in agreement with observations in Rwanda (Taremwa *et al.*, 2016), Kenya (Omolo, 2010) and Tanzania (Swai *et al.*, 2012). This was contrary with what was observed in Jamaica (Ayesha, 2015) and in China (Wei *et al.*, 2014). There was no gender disparity according to sex across different age structures.

Most women did not own land in both Kiruhura and Isingiro districts (Figure 1). This implied that they had limited access to land for cultivation and keeping livestock. They depended on the decisions of men. This observation was similar to what has been observed elsewhere (FAO, 2011; Mukasa *et al.*, 2010; Shumba, 2011). Women own less than 2% of the world’s land, and they own only approximately 15% of land in Africa south of the Sahara. The women’s exclusion from land ownership puts them in a “state of dependence” and therefore were more vulnerable to the effects of climate change, hence distorting their gender roles (Doss *et al.*, 2013; Shumba, 2011). Women made no decisions on how to use the available household land. This agreed with the Unitary Model of household decision making process which is dominated by male headed households (Katz, 1997; Mader & Shneebaum, 2013).

Overall (see Table 2), children in Kiruhura district were less engaged in household activities, whereas in Isingiro district, children were actively engaged in almost all domestic chores. Almost 89.9% of female children in Isingiro collected firewood. Also contrary to the norms, 45.5% and 41.4% of male and female

Table 4. Gender response of effect of climate variability on productive roles by percentage.

Roles	Kiruhura (N=238)						Isingiro (N=158)					
	Youth		Adults		Elderly		Youth		Adults		Elderly	
	M	F	M	F	M	F	M	F	M	F	M	F
No planting crops during extreme dryness	12.2	8.0	22.7	8.0	6.7	2.9	1.9	0.6	3.2	3.8	6.3	5.1
Spending time looking for water and pasture during dryness	8.4	7.1	16.8	10.1	5.5	3.8	4.4	3.2	4.4	3.2	5.7	5.1
Looking for work outside household for pay	10.9	11.8	17.2	10.1	3.4	3.8	1.3	3.8	2.5	1.3	1.9	5.7
Alternative source of income like charcoal selling	7.6	11.8	8.0	13.9	2.9	2.5	3.8	4.4	7.0	5.7	6.3	7.6
Shop keeping	2.1	7.1	3.8	6.3	2.5	5.0	3.8	3.2	3.8	0.0	2.5	4.4
LMNP Employee	3.8	2.5	2.9	2.1	3.8	5.0	5.7	4.4	7.6	3.8	6.3	4.4
Others	5.5	5.0	4.6	1.7	2.9	2.5	1.3	2.5	1.9	0.0	1.9	3.8

children respectively paid their school fees. Overall, females cultivated and prepared meals. Female children in Isingiro district were more engaged than the male children. Adult males were actively engaged in grazing, spraying cattle, firewood collection, building, fencing, paying fees and fetching water. However, women in Isingiro district were more engaged in cultivation, child raising, cooking, building and fencing. In Kiruhura district, men were more active than women in grazing, home cleaning and hygiene, firewood collection, building, fencing, paying fees and fetching water. Women were active in cultivation, child raising, cooking and home hygiene.

Among the two districts (Table 2) it was shown that children in Isingiro district were more heavily engaged than children in Kiruhura district. The argument was that while men typically played their roles sequentially, focusing on a single productive roles, women played their roles simultaneously, balancing the demands of each with their limited available time (FAO, 2011). This forced women to engage children in order to balance their work load and available time. Regarding reproductive roles, which included not only biological reproduction but also the care and maintenance of the family (FAO, 2011), they were affected by climate change in both districts of Kiruhura and Isingiro (Table 3). The women in both districts were affected through walking long distances to fetch water. This agreed with what was earlier reported that women were more burdened with fetching water within a household (FAO, 2018, Mukasa *et al.*, 2010). Walking long distances affected their gender relations and forced them to engage children to fill in the gap while they were away. Similar observations had been experienced elsewhere in Africa in Tanzania (Van *et al.*, 2013), Nigeria (Ekpo & Agu, 2014), Kenya (Omolo, 2010), South Africa (Babugura *et al.*, 2010) and Zambia (Lwando, 2013). In Zambia, according to Lwando (2013) in-order to cope with effects of climate change variability, women walked long distances to fetch valuable natural resources for livelihoods making them have unable to engage in decision making, taking care of household

chores, looking after sick and elderly, engaging in income generating and participating in community activities.

An earlier study done on economic assessment of impacts of climate change in Uganda, it was projected that between 2010 and 2015 the demand for water in Uganda was expected to increase ten-fold from 408 million cubic meters to 3963 million cubic meters (FAO, 2018). Similarly, it was reported that women and girls walked long distances in search for water. In developing countries the world over, women and girls bear the burden of fetching water for their families, and spent significant amounts of their daily time hauling water from distant sources (FAO, 2008; FAO, 2018). To make matters worse, the water collected from distant sources was insufficient to meet household needs and was at most times also contaminated. Again this made women and girls pay the heaviest price for provision of unhygienic water for their households.

However, in Isingiro more men compared to women (Table 3) took up the role of fetching water due to the economic benefit attached to it. Water scarcity during the extreme dry periods, involved fetching water from distant source, contributing to the cost of USD 0.27 per 20 litre jerry can of water.

Women's lives were in danger in the communities of Isingiro district due to guarding their gardens from being destroyed by wild animals from LMNP. Due to the effect of climate change in LMNP, wild animals would leave the Park in search for water and pasture and they ended up destroying communities' gardens. Therefore women opted to guard their gardens in order to ensure future food security within their households. This altered their reproductive roles like preparing meals and looking after the sick and elderly which at times caused marital strife.

Women in Isingiro, during periods of extreme dryness there was less tranquility in the households as it was easy for women to become involved in quarrels with their male spouses over

food. There was also scarcity of firewood that led to women resort to the use of banana combs “enkonya” for cooking. In contrast, men became less burdened because they did not perform their gender roles during these periods, hence they often resorted to spending their time in bars leaving only women to engage in their reproductive tasks.

The effect of climate change variability affected productive roles more in Kiruhura than Isingiro (Table 4). Climate change due to high temperatures and low precipitation has posed greater risks to productive roles in Africa (FAO, 2018; Henson, 2011; Sivakumar *et al.*, 2005; Swai *et al.*, 2012). In Kiruhura district, there were increased migrations of both men and women in search for pasture. The roles of women were affected because they had to join men in grazing in search of pasture and water. This affected gender specific responsibilities of women as nurturers and community managers. These agreed with earlier findings made by Nhamo (2014).

Climate change also affected the productivity of livestock (FAO, 2018), hence affecting availability of milk for ghee production by women for sale. Women looked for alternative sources of income, especially charcoal selling that stabilized household security in the face of climate change variability. This was in agreement with Mukasa *et al.*, (2010) who found that extra income earned by women through charcoal selling had been used to meet household responsibilities such as paying school fees. In Kiruhura, both youth and adults of both sexes, sought employment outside their households. In Isingiro district, male headed households, the landless and men with small plots of land fled their homes to look for work outside, leaving women and children to survive in the tough conditions of extreme dryness.

The study was also underpinned by gender socialization and intra household bargaining theories. Gender socialization theory can be used to explain gender differences in coping climate change due to the different social roles between men and women. Folkman & Lazarus (1980) found that the different roles of men and women affect the stressors to which one is exposed and therefore constrained their coping behavior. Consequently, in this study climate change variability being the major stressor for both men and women it influenced their potential to respond to it, hence altered their gender roles. This is aggravated by the fact that as long as agriculture continued to be rain-fed, its gender role vulnerability to climate shocks will vary in short, medium and long-term basis resulting in increased food insecurity and high poverty levels (FAO, 2018).

The gender and intra household decision making process theories, suggest two models that work: unitary and bargaining models. With these two models, a household is the main focus of analysis on how decisions are made on how to use and control of household resources (Mader & Schneebaum, 2013). With a unitary model, allocation of resources is done by the head of a household. The model applies unequal distributions of resources (Katz, 1997). Men usually make decisions within the productive gender roles in resource control and allocation

which affects livelihoods within the households. This explains why over 70% of women in Kiruhura and Isingiro districts did not own land which limits their participation in productive roles. This was one of the reasons why they were limited in performing their reproductive roles.

While with the bargaining model the intra-household allocation of resources is an outcome of bargaining processes among the members of a household. Here individual members of a household act as separate agents with their own preferences and utility functions considered (Mader & Schneebaum, 2013). This model has worked on division of labor based on socially recognized gender roles within Isingiro households, where fetching of water during extreme droughts was done by men but at the same time earning an additional income during drought periods.

Conclusion and recommendations

Gender roles of communities surrounding LMNP were affected and altered by the effects of climate change variability. Reproductive, productive and community roles were the major roles of men and women in Isingiro and Kiruhura districts. The findings indicated that women walked long distances in search for water and firewood, yet all the core reproductive activities are loaded on a woman in every household. It was reported that women taking long hours guarding their gardens from LMNP wild animals, halted domestic chores like preparing meals and taking care of the elderly. Communities had to have one meal a day, which was a problem for the children. Consequently, men complained of not having meals on time and this disrupted gender relations in households. Findings also indicated that productive roles were affected too due to the unreliable weather. Communities could not predict the planting seasons as they used to do and this affected their levels of incomes especially the communities in Isingiro district since they depend mainly on agriculture. This pressured men and women to look for alternative sources of income, alternative sources of water and pasture and all these resulted into food insecurity and high levels of poverty among these households. Community roles were also highly affected because community education system for children and youth was distorted because of the effects of climate change, traditional ceremonies were not being honored as it used when climate was still favorable. Therefore, the findings indicated that women were the most affected gender regarding reproductive roles, and both men and women were greatly affected with their roles being altered regarding productive and community roles. However, since men played their roles sequentially focusing on productive roles, women played their roles simultaneously, balancing the demands of each within their limited time. Consequently, women had a heavier load and were the most affected by climate variations effects. This study recommends that institutions offering climate services to local communities should successfully mainstream gender in decision making, access to resources, information and knowledge. Therefore, communities around LMNP, the local government, LMNP management, NGOs and relevant institutions should work together to offer the climate services.

Data availability

Underlying data

Underlying data is available from figshare

figshare: Dataset 1. Codes.csv, <https://doi.org/10.6084/m9.figshare.7484945.v2> (Nagasha, 2018)

License: [CC by 4.0 attribution](#)

Extended data

figshare: Extended data. Extended data, <https://doi.org/10.6084/m9.figshare.7643183.v2> (Nagasha, 2019)

License: [CC by 4.0 attribution](#)

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The funders had no role in study design, data collection and analysis, decision to publish, or preparation of the manuscript.

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Open Peer Review

Current Peer Review Status: ? ✓ ✓ ?

Version 1

Reviewer Report 25 March 2019

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Chinekwu Obidoa

Department of International and Global Studies, Mercer University, Macon, GA, United States

This paper addresses a very pertinent issue in Africa. The impact of climate change on gender roles requires urgent attention and this paper provides very timely and useful information on this growing global health problem. The authors did a good job with the conceptualization of the study. The study introduction was good and straight to the point. I have the following suggestions:

1. I think the authors reported a lot of information on the roles of children. The title of the paper does not include children or demographic roles. I suggest that the authors re-visit the title of the paper to include gender and demographic roles since a sizable portion of the findings from the paper and the discussion focus on children.
2. I think the methods section is not very coherent. The methods used were not discussed in a manner that is easy to understand or follow. The authors should go step by step and report exactly what they did in chronologic order.
3. "The selection of FGD participants was done through identifying men and women who had similar understanding of the effect of climate change on gender roles." I do not understand what the authors meant by similar understanding - was this determined from previous studies?
4. The bar graphs of % ownership of land and household age structure are not necessary. Both graphs do not highlight the key findings from the study and do not necessarily contribute to the flow and rationale of the study in a meaningful way.
5. The discussion section is quite long and includes a lot of repetitions. It is also difficult to follow the points made. I strongly suggest that the discussion be sub-sectioned and that the authors discuss results under key findings.
6. The recommendations are quite vague and insufficient. Given the weight and implications for the findings made, I think the authors can be more explicit and specific about what really needs to be done to help these communities deal with climate change. Mainstreaming is a catch word that is used all across East Africa a lot to refers to what needs to be done with gender issues but most people hardly know what this means.

Is the work clearly and accurately presented and does it cite the current literature?

Partly

Is the study design appropriate and is the work technically sound?

Yes

Are sufficient details of methods and analysis provided to allow replication by others?

Partly

If applicable, is the statistical analysis and its interpretation appropriate?

Partly

Are all the source data underlying the results available to ensure full reproducibility?

No source data required

Are the conclusions drawn adequately supported by the results?

Yes

Is the argument information presented in such a way that it can be understood by a non-academic audience?

Yes

Does the piece present solutions to actual real world challenges?

Yes

Is real-world evidence provided to support any conclusions made?

Yes

Could any solutions being offered be effectively implemented in practice?

Yes

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Gloablization and health in Africa.

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however I have significant reservations, as outlined above.

Reviewer Report 19 March 2019

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**Joy Obando** 

Department of Geography, Kenyatta University, Nairobi, Kenya

The authors have clearly presented the effect of climate variability on gender roles using an appropriate research design. The discussion of the results and the conclusions can be enhanced to make the paper sound. The use of the terms 'climate change' and 'climate variability' should be differentiated.

Clarification is required on the land ownership - it is not clear if women only own land when they are single/unmarried/widowed or whether they co-own the land with the men at the household level.

Provide the distance to the water sources or the length of time taken to qualify 'walking long distances'

It will be important to discuss the effect of charcoal burning as a livelihood on the forest ecosystem as well as the human-wildlife conflicts as they affect the women.

Is the work clearly and accurately presented and does it cite the current literature?

Yes

Is the study design appropriate and is the work technically sound?

Yes

Are sufficient details of methods and analysis provided to allow replication by others?

Yes

If applicable, is the statistical analysis and its interpretation appropriate?

Yes

Are all the source data underlying the results available to ensure full reproducibility?

Yes

Are the conclusions drawn adequately supported by the results?

Yes

Is the argument information presented in such a way that it can be understood by a non-academic audience?

Yes

Does the piece present solutions to actual real world challenges?

Yes

Is real-world evidence provided to support any conclusions made?

Yes

Could any solutions being offered be effectively implemented in practice?

Yes

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Geomorphology, Integrated Watershed Management, Climate Change

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard.

Reviewer Report 12 March 2019

<https://doi.org/10.21956/emeraldopenres.14019.r26331>

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Sylvia Bawa

Department of Sociology, York University, Toronto, ON, Canada

This study examined the impact of climate change on gender roles in two communities around Lake Mburo national park, in Uganda. The authors reviewed relevant literature in the area and used relevant theories to ground their study. The methodology was well outlined, making it fairly easy to 'replicate' the study. Since studies involving communities and people are subject to various interfering variables (especially including the human element), replication in any such study has to be understood within a particular context.

I have a suggestion which may well fall outside the scope or disciplinary parameters of the current study for consideration in future studies. Given that communities in postcolonial studies have colonial legacies, it would help to provide some historical context to the two communities under study. In particular, around how land ownership and use are/have been traditionally understood and or conceptualized. For instance, do these communities still practice communal ownership of land and farming resources? How do these customs address gender equity or what changes occurred in the colonial era to tip the scales (if equitable practices existed prior to colonization for instance)? Given that climate change has always occurred (not on the scale as we are experiencing at the moment), what were the coping strategies involving how gender roles were affected in the past?

The study was well designed and executed and I look forward to reading from the authors in the future as they expand their study to include some of the suggestions.

I noted a few typos (see examples of sentences below) to help the authors in their final editorial review:

In the following sentence, "Adult males were actively engaged in grazing (48.2%), spraying cattle (53.8%). firewood collection (62.8%), building and fencing (53.2%), paying fees (48.6%), and fetching water (45.9%)", I assume the authors are referring to the act of taking cattle out to pasture (to graze). The sentence should be rephrased to reflect this as its current iteration is a bit

awkward.

"This implied that children were denied strategic needs like education since they missed out schooling in order to fill for their mothers while she was away from the household". Rephrase sentence

"This was contrary with what was observationed in Jamaica (Ayesha, 2015) and in China (Wei *et al.*, 2014). There was no gender disparity according to sex across different age structures." Observationed?

Is the work clearly and accurately presented and does it cite the current literature?

Yes

Is the study design appropriate and is the work technically sound?

Yes

Are sufficient details of methods and analysis provided to allow replication by others?

Yes

If applicable, is the statistical analysis and its interpretation appropriate?

I cannot comment. A qualified statistician is required.

Are all the source data underlying the results available to ensure full reproducibility?

Yes

Are the conclusions drawn adequately supported by the results?

Yes

Is the argument information presented in such a way that it can be understood by a non-academic audience?

Yes

Does the piece present solutions to actual real world challenges?

Yes

Is real-world evidence provided to support any conclusions made?

Yes

Could any solutions being offered be effectively implemented in practice?

Yes

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Globalization, Postcolonialism, Critical Development Studies and Human Rights

I confirm that I have read this submission and believe that I have an appropriate level of

expertise to confirm that it is of an acceptable scientific standard.

Author Response 18 Mar 2019

Judith Irene Nagasha, Makerere University, Kampala, Uganda

The comments are good and will be revised accordingly. More clarity on historical land ownership will be clearly reported regarding the two communities.

Competing Interests: No competing Interests

Reviewer Report 05 March 2019

<https://doi.org/10.21956/emeraldopenres.14019.r26342>

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Kathleen E. Colverson

International Center Associate Director of Program Development, University of Florida, Gainesville, FL, United States

The article is general well written, and very timely. The recommendations section needs to be expanded to build on the data that was collected, but the study included sufficient numbers of interviews and data that is rich on the changes in gender roles based on climate variability in this region of Uganda.

I have made a number of further comments and questions in the Word document which can be found [here](#).

Is the work clearly and accurately presented and does it cite the current literature?

Yes

Is the study design appropriate and is the work technically sound?

Yes

Are sufficient details of methods and analysis provided to allow replication by others?

Yes

If applicable, is the statistical analysis and its interpretation appropriate?

Yes

Are all the source data underlying the results available to ensure full reproducibility?

Yes

Are the conclusions drawn adequately supported by the results?

Partly

Is the argument information presented in such a way that it can be understood by a non-academic audience?

Partly

Does the piece present solutions to actual real world challenges?

Partly

Is real-world evidence provided to support any conclusions made?

Partly

Could any solutions being offered be effectively implemented in practice?

Partly

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Gender and agricultural systems research, capacity development in integrating gender and nutrition into agricultural research

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however I have significant reservations, as outlined above.

Author Response 06 Mar 2019

Judith Irene Nagasha, Makerere University, Kampala, Uganda

The reviewer's comments are highly appreciated. I will provide more collaborations where questions are asked and revise accordingly.

Competing Interests: No competing interests.