



RESEARCH ARTICLE

REVISED **Effect of climate change on gender roles among communities surrounding Lake Mburo National Park, Uganda [version 2; peer review: 3 approved, 1 approved with reservations]**

Previously titled: Effect of climate variability on gender roles among communities surrounding Lake Mburo National Park, Uganda

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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 the study was designed to understand the 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 affected productive roles more in Kiruhura district than Isingiro district. There was migration of both men and women in search of water and pasture for livestock in Kiruhura district which distorted gender roles of women. Consequently, women and girl children had a heavier load and were the most people affected by climate change effects in these districts.

Conclusion: Gender roles of communities surrounding Lake Mburo National Park were affected and altered by the effects of climate

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change. Therefore, institutions offering climate services to local communities should consider gender in decision making, access to resources, information and knowledge during participation in climate change mitigation and adaptation.

Any reports and responses or comments on the article can be found at the end of the article.

Keywords

Climate change, Climate variability, gender roles, communities



This article is included in the [Sustainable Food Systems gateway](#).

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REVISED Amendments from Version 1

The following corrections have been done:

1. Title changed to 'Climate change' not 'climate variability'.
2. Most typographical, spelling and grammatical errors have been corrected.
3. Methodology sampling of FDGs was by random sampling.
4. Repetitions in some sections of methodology has been removed.
5. Redundant and repeated results were removed.
6. Discussion was cleaned up.
7. Clear conclusions were itemized and explicit recommendation has been made.

Removal of results for land ownership and household age structure is not possible. This is because it will make argument of recommending promotion of good household gender relations in order to mainstream gender roles difficult if the reader does not have this information. Reviewer just took it for granted that readers of this article would be from sub-Saharan Africa.

See referee reports

Introduction

The climate change crisis is threatening the livelihoods of the poor in societies 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 have differential impacts on gender 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, boys and girls) 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). These differences are frequently influenced by culture and other international factors such as religion, social economic, education and environment.

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. It is expected that the outputs of this study will play a vital role in designing gender based adaptive community strategies centered on 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 occur from late December to February and the long dry season from late May to September (GoU, 2015; UWA, 2015). It has an altitude of 1, 220m-1,828m above sea level. The economies of Kiruhura and Isingiro district depend on rain fed agriculture for 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, then 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 the 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 in these counties.

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 stratum. 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. There were three FGDs per village which were stratified as a women’s group, men’s group and mixed (women and men’s) group living in the community. The selection of FGD participants was randomly done.

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 a need to record their voices. The participants were informed that their recorded audios would be destroyed within the period of five years; who would have access to their recordings and where they would be stored. The number of FGDs carried were as shown in [Table 1](#).

Focus group discussions that were comprised of both sexes (male and female) and children were cluster sampled. Data was collected using participatory methods as described by [Tadevosyan & Schoenhuth \(1997\)](#). The interview guides (Extended data ([Nagasha, 2019](#))) for both FGDs and key informants were pretested prior to the study in order to determine systematic problems in the questions and improve the guide by revising the identified errors ([Creswell, 2013](#)). Key informants were opinion leaders, district extension staff like district production officers, agricultural officers, meteorologists, veterinary officers, environmental officers, community development officers, community wildlife wardens and LMNP-chief warden. They were purposively selected during reconnaissance survey. 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 the equation used by [Dohoo et al. \(2003\)](#).

$$n = \frac{Z^2}{PQD^2}$$

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 0.05. However, to increase the precision, questionnaires were administered to 400 households.

A detailed structured questionnaire was used to verify information given by participatory studies. The questionnaire captured information on: the normal household gender roles that are reproductive, productive roles and community roles and how these roles were altered during prolonged drought. Reproductive roles were defined as child bearing and rearing responsibilities, and domestic tasks done by women that are required to guarantee the maintenance and reproduction of the labor force. This included biological reproduction role, care and maintenance of the household work force (male partner, oneself and working children), and the future work force (infants and school-going children). In this study, productive roles were taken as work done by both men and women for pay in cash or kind. It includes: market production with an exchange-value, home production with actual use-value and also with potential exchange-value. Community roles were referred to be 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; 1= slightly agree; 2= Agree and 3=strongly agree. 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

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	

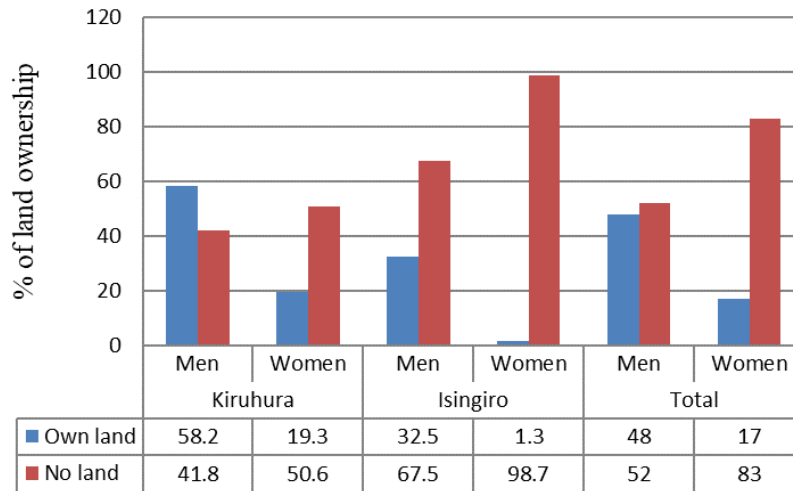


Figure 1. Land ownership by gender.

women (98.7%; $X^2 = 52.6$, $p < 0.001$) 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 both 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 the 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 number of males and females ($P > 0.05$).

The current gender roles were as shown in Table 2. Male FGDs in Isingiro district reported that men changed their roles during drought. They searched for water and collected firewood for their own and other households. They earned monetary benefits for doing these roles. Water was fetched from far distances and was sold at a cost of 0.27\$ per a 20 liter container.

Reproductive roles affected by climate change in Isingiro and Kiruhura districts

Details on the gender responses to the effects of climate change on reproductive roles were as shown in Table 3. Reproductive roles were affected in both districts. During FGDs with women, it was reported that during drought periods they spent more time walking looking for water and firewood which led them to prepare one meal per day. This also took away time spent on caring for the elderly and the children. During women FGDs in Isingiro district in the villages of Kashwina A and Kashwina B, they 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 the scarcity of firewood,

women had resorted to using banana combs “*enkonya*” for cooking. Women also reported that children missed out school in order to do their household work while they away.

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 spent 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 change on gender productive roles was as shown in Table 4. 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 face this tough periods. In Kiruhura district, key informants reported 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 youth 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 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

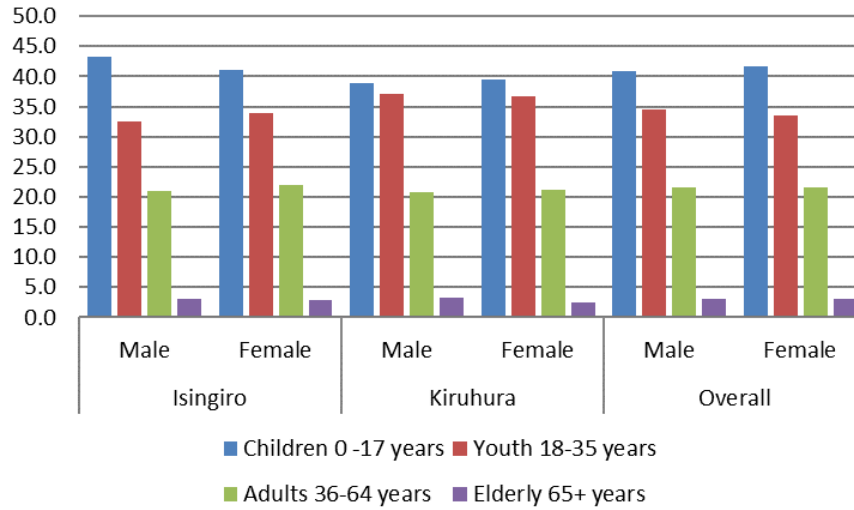


Figure 2. Household age structure.

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

for alternative sources of income. Overall, in both districts, they slightly agreed (mean ranking score of 1) on the effect of climate change having significant effects on productive roles.

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 longer hours looking for water and pasture, and children’s routine school attendance was disrupted.

Discussion

The nature of the 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%

Table 3. Percentage gender response of effect of climate change 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

Table 4. Percentage gender response of effect of climate change on productive 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
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

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 labor 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 proportion 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 in sub-Saharan Africa (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.

Most female children in Isingiro collected firewood and fetched water. Also contrary to the norms, 45.5% and 41.4% of male and female 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 in Kiruhura.

In this study it was shown 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. This forced women to engage children in order to balance their work load and available time. This was in agreement to what was earlier observed by [FAO \(2011\)](#). Regarding reproductive roles 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 ([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 the effects of climate change, women walked longer distances to fetch valuable natural resources for livelihoods making them unable to take care of household chores, looking after sick and elderly, engaging in income generating activities and participating in community activities.

An earlier study done on the 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 envisaged that women and girls would walk longer distances in search for water. Elsewhere in developing countries, 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 contaminated. This made women and girls pay the heaviest price for provision of unhygienic water for their households.

However, in Isingiro during these challenging periods more men than women ([Table 3](#)) took up the role of fetching firewood and water. These roles were switched due to income gain associated with these activities. For example, water was sold at USD 0.27 per 20 liter 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 pasture and ended up in their 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. Also children had to stand in for their mothers during this periods.

During periods of extreme dryness in Isingiro district there was less tranquility in the households as it was easier for women to become engaged in quarrels with their male spouses over food. There was also scarcity of firewood that led to women resorting to use 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 affected productive roles more in Kiruhura than Isingiro ([Table 4](#)). Elsewhere in sub Saharan Africa climate change has posed greater risks to productive roles ([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. 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 their communities leaving behind women and children to survive in the tough conditions of extreme dryness.

In this study, gender socialization and intra household bargaining theories could be used to explain changes in gender roles as coping strategy brought about by climate change ([Folkman & Lazrus, 1980](#)). Gender socialization theory and unitary model could explain gender differences in coping with climate change seen in Isingiro where women were overburdened than men ([Katz, 1997](#); [Mader & Shneebaun, 2013](#)). This situation was made worse because the women decision making process on how to use household resources to cope up with climate was limited ([Katz, 1997](#)). On the other hand, the bargaining model

seems to have worked well in Isingiro, where roles such as fetching water and firewood collection were switched over to men in order for the household to earn income during extreme droughts.

It therefore becomes apparent that for successful tackling of effects of climate change around Lake Mbuoro National Park, good household gender relations needed to be established so that adaptive gender roles in tackling climate change are mainstreamed. This will require support of formal and informal institutions. Elsewhere, it has been shown that households that have been institutionally supported easily adapt sustainable gender based measures of mitigating effects of climate change (FAO, 2018). Therefore government institutions, the local government, LMNP management, NGOs and relevant institutions should work together with communities around LMNP to ensure that adaptive gender roles to adverse effects of climate change are successfully mainstreamed. Gender roles should be mainstreamed in decision making, access to resources, information sharing and knowledge acquisition.

Conclusion and recommendations

Gender roles of communities surrounding LMNP were affected and altered by the effects of climate change. Women were more affected than men in the two districts. In Isingiro district, women were overburdened. They had to walk longer distances to fetch water and guard their gardens from invading wild animals. Children had to step in to take over responsibilities of their mothers where girl children were most affected. They were more involved in fire wood collection and fetching water. In Isingiro, men switched over their roles to fetching water and collecting firewood in order to make money. In Kiruhura, climate change affected productive roles, where there was migration of both men and women in search for water and pasture for livestock which distorted gender roles of women. Consequently, women in

Kiruhura district resorted to charcoal burning as alternative source of income instead of ghee making.

From this study, it becomes clear that good household gender relations needed to be established whereby responsive positive adaptive gender roles in mitigating climate change effects need to be mainstreamed with institutional support. Formal and informal institutions offering services in mitigation of climate change to local communities should actively be involved in this exercise.

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](#)

Grant information

This research was funded by the Swedish International Development Agency (SIDA), Makerere -Sweden Bilateral Research Cooperation under grant No: 2391. Further appreciation goes to College of Mentors-Council for the Development of Social Science Research in Africa (CODESRIA) for the Mentorship trainings.

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 2

Reviewer Report 21 June 2019

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Chinekwu Obidoa

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

This is a better version of the paper. The authors made important revisions based on reviewer comments. However, one section that still needs work is the conclusion. The last paragraph in that section needs to be rewritten. It is too long and not very clear. Also, I suggested earlier that the authors itemize or state specifically actions they would like to see taken in response to the findings they made in their research. The word mainstream is used but without clarification of what it means in practical terms.

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 14 June 2019

<https://doi.org/10.21956/emeraldopenres.14202.r26419>

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Kathleen E. Colverson 

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

The authors addressed my previous concerns in this revised version.

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.

Version 1

Reviewer Report 25 March 2019

<https://doi.org/10.21956/emeraldopenres.14019.r26339>

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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

<https://doi.org/10.21956/emeraldopenres.14019.r26343>

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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.