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GENDER DIMENSIONS OF FARMERS' PERCEPTIONS AND KNOWLEDGE ON CLIMATE CHANGE IN TESO SUB-REGION, EASTERN UGANDA

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ABSTRACT

Perceptions and knowledge play a key role in shaping individual and collective response to climate change. Understanding gender dimensions of climate change perceptions and knowledge contributes to effective climate change adaptation. The purpose of this study was to evaluate male and female farmers' perceptions, knowledge as well as its (knowledge) determinants with respect to climate change in the Teso sub-region, eastern Uganda. Data from male- and female-headed households were analysed using descriptive statistics, Chi-Square, linear and multinomial logistic regression. Results showed that all farmers, men and women, were aware of climate change. Male and female farmers' perceptions of climate change did not differ significantly on all the parameters except on frequency of droughts with women more likely to perceive increased drought frequency compared with men. Further, sex of the household head was found to be the sole significant determinant of knowledge of the cause of climate change. Female-headed households were more likely either not to know the cause or to have erroneous information. Significant gender gaps in education levels and access to sources of information, namely, radio, extension and groups are cited as possible factors that could explain women's lower knowledge levels compared to men. Climate adaptation interventions should, therefore, put into consideration gender based variations in perceptions and knowledge for equitable and sustainable climate change adaptation.

Key Words: Agriculture, Africa, climate change adaptation, women

RÉSUMÉ

Les perfections et connaissances jouent un rôle clé dans l'orientation des réponses individuelles et collectives au changement climatique. La compréhension des dimensions genre en matière de des perceptions et connaissance sur le changement climatique contribue à une adaptation effective au changement climatique. L'objet de cette étude était d'évaluer les perceptions des fermiers sur base du genre (hommes et femmes) ainsi que les déterminants de leurs connaissances sur le changement climatique dans la Sous-région de teso à l'est de l'Ouganda. Les données issues des hommes et femmes chefs des ménages étaient analysées par la statistique descriptive, le K-Carré et la Régression logistique linéaire et multinomiale. Les résultats ont montré que tous les fermiers, homme et femmes étaient au courant du changement climatique. Les perceptions des hommes et femmes sur le changement climatique ne différaient pas significativement eu égard à tous les paramètres mesurés à l'exception de la fréquence de la sécheresse où plus des femmes que des hommes ont mentionné une augmentation de la fréquence de la sécheresse. En outre, le sexe du chef de ménage était trouvé le seul déterminant significatif de la connaissance de la cause du changement climatique. Les femmes responsables de ménages connaissaient ou pas la cause du changement climatique ou bien possédaient une information erronée. Des lacunes significatives en matière des niveaux d'éducation et l'accès aux sources d'information telles que la radio, la vulgarisation et les groupes sont ici cités comme des facteurs potentiels influençant les niveaux bas de connaissance chez les femmes en comparaison avec les hommes. Des interventions d'adaptation climatique pourraient, en conséquence, être mises en considération les variations dans les perceptions et connaissances sur base du genre, pour une adaptation équitable et durable au changement climatique.

Mots Clés: Agriculture, Afrique, adaptation au change climatique, femmes

INTRODUCTION

Perception refers to beliefs or opinions often held by many people based on how things seem to them. Knowledge, on the other hand, concerns the way people understand the world, and how they interpret and apply meaning to their experiences (Blaikie *et al.*, 1997). Both perception and knowledge guide decision making and consequently, farmers' action on climate change adaptation. In an inquiry into social limitations to climate change adaptation, Adger *et al*. (2008) argued that, in addition to limitations presented by availability of technology and the capacity for learning, other elements including perceptions and knowledge considerations within society fundamentally limit climate change adaptation. Leiserowitz (2005) also noted that public perceptions/opinions are critical components of the sociopolitical context within which policymakers operate, and can fundamentally compel or constrain political, economic, and social action to address a particular risk, such as climate change. Thus, a first step toward enabling more communities and individuals to adapt to climate change could be to make explicit the underlying values shaping preferences and decisions (Adger *et al*., 2008).

Developing countries are especially vulnerable to climate change because of several predisposing factors such as poverty, geographic exposure, heavy dependence on rain fed agriculture and issues of poor governance and social infrastructure (IPCC, 2001; Stern, 2006). The vulnerability of developing countries in Sub-Saharan Africa is further compounded by gender inequality, whereby agriculture which is the backbone of their economies is left predominantly in the hands of under-resourced, ill-informed, overworked women. However, while women farmers are disadvantaged with regard to access and control over resources, they have knowledge and experiences accumulated from years of working the environment that can be tapped for climate adaptation. Thus, climate change has specific gender characteristics emanating from women's social roles, discrimination and poverty. For instance, women often live in conditions of social exclusion, such as cultural limitations to mobilise outside their immediate environment; have less access to information on early warning systems in times of disasters, and to forecasts of climate variability; and have difficulties in participating in training processes (UNDP, 2009). Brody *et al*. (2008) further noted that due to differences in access to education, access to and control of resources and power to make decisions, men and women experience their social, economic and environmental reality in different ways. This leads to differences in capacities, knowledge, interests as well as needs (UNDP, 2009). Blaikie *et al.* (1997) also contend that knowledge is not homogeneous within a local population but varies according to respondents, due to gender, among others. This is likely to introduce gender based variations in climate change perceptions and knowledge among men and women farmers.

A scoping study by Brody *et al*. (2008) to identify knowledge gaps in linking gender and climate change noted that integration of a gender-sensitive perspective in climate change research and responses was a recent development. Unlike in other fields like environment, energy, water, conflict, disasters and agriculture, specific references to climate change were still few; hence, the need to further contribute towards filling this gender knowledge gap. In this regard, gender differentials in climate change perceptions and knowledge among farmers in Uganda as well as the underlying explanatory factors are not well understood. The objective of this study, therefore, was to evaluate male and female farmers' perceptions, knowledge as well as its (knowledge) determinants with respect to climate change in eastern Uganda.

METHODOLOGY

The study was undertaken in Soroti district, in Eastern Uganda. The district was purposively selected owing to its fragility and sensitivity to climate variability. Soroti district lies at 01^{o} 46N, 33^{o} 39E, in the Kioga plains. The terrain is generally flat, traversed by numerous swamps and other ravine wetlands. Mean annual rainfall is typically 1100-1200 mm, distributed between two seasons of March to July and September to November. Late November to late February/early March is traditionally the long dry season, and mid- June to late- July is the short one but this

has become variable with frequent drought spells causing famine (MWLE, 2007). The soils are of sandy sediments and sandy loams, well drained and highly friable with alluvium deposits in the bottomland. The farming system is predominantly annual cropping and cattle Teso system. Small scale farming has been predominant in the area for long, which has greatly reduced vegetation cover, and is suggested to be a likely trigger for negative environmental effects such as intensity of floods and droughts, soil nutrient and biodiversity loss due to habitat conversion (Egeru and Majaliwa, 2009).

The study was conducted in two phases. In the first phase, a stakeholders' workshop was conducted in September, 2010 in Soroti district, Gweri sub-county to determine the kind of climate changes perceived, farmers' adaptations and where they are located. The workshop had a total of 30 key informants selected with the assistance of the Soroti District NAADS Coordinator on the basis of their in depth knowledge and experience with the study site. Participants consisted of ten male ten and female farmers; five local leaders (including Local Council III official, parish chiefs); and five technical personnel in agriculture and the environment disciplines, from both Government and Non-Governmental Organisations (NGOs). The workshop yielded qualitative data that informed development of the follow up survey and guided selection of sites for in depth study.

Phase two consisted of a household survey conducted in the three parishes of *Aukot*, *Awoja* and *Dokolo* in Gweri sub-county in order to obtain an understanding of the gendered perceptions and knowledge on climate change. Data were collected in January 2011. A semi-structured questionnaire was designed, informed by a stakeholder consultative workshop and literature. Review of the questionnaire by experts ensured content validity while field testing in a neighbouring parish that was excluded from the main study addressed issues of clarity.

Data were collected on a number of variables including demographics, ownership of assets, social-economic variables, and perceptions and knowledge on climate change. Gweri Sub-County was selected in consultation with the district Agricultural Officer and National Agricultural Advisory Services (NAADS) coordinator, on the basis of representativeness of the characteristics of Soroti district and accessibility, among other things. The three parishes were selected based on prevalence of specific climate change events and adaptation practices as identified in the workshop. In each parish, a community based facilitator, identified by the sub-county NAADS coordinator, helped to construct a sampling frame that included all male and female headed households from which 50 farmers were selected. All female headed households in the sampling frame were considered because they were few compared to males, while the male headed households were randomly selected using random numbers. A total of 150 households for the three parishes was obtained. However, only 135 households were used in the analysis, 15 households having been dropped on account of incomplete and/or inconsistent data. Ninety households were male headed and 45 female headed. Data were entered in the Statistical Package for Social Scientists (SPSS) and analysed using SPSS and Excel.

Farmers' perceptions on climate change were analysed using descriptive statistics (percentages and averages) and Chi-Square tests were used to determine the relationship between farmers' perceptions and gender. Eleven parameters were used to measure farmers' perceptions on the climate change. These included farmers' views on whether; climate change had been generally noticed, temperature had increased, length of seasons had changed, rainfall had decreased; and severity and frequency of drought, floods, winds and storms had increased. Response options for perceptions on climate changes were adapted from Ishaya and Abaje (2008). Farmers' perceptions on change in temperature and rainfall were then compared with meteorological data on temperature and rainfall for Soroti district between 1980 and 2010 (see, for example, Gbetibouo, 2009). Temperature and rainfall data were graphed and their trend analysis over the 30 year period was done using linear regression (Remy *et al.*, 2005). Analysis of perceptions on the future of climate change was done using descriptive statistics and two-proportion *Z*-tests.

Determinants of climate change knowledge among male and female farmers were identified

using multinomial logistic regression. Prior to the regression analysis, multicollinearity among independent variables was tested (Leech *et al.* 2005). Four independent variables that had tolerance values greater than 1-R^2 (1-0.084 = 0.916) were included in the model. The resulting model significantly predicted knowledge of climate change cause (χ^2 = 18.455, df = 8, p = 0.018). The specification of the empirical model or reduced form that was estimated is as follows:

$$Y_i=\beta_0+\beta_1X_1+\beta_2X_2+\beta_3X_3+\beta_4X_4+\beta_5X_5 \ldots\ldots\ldots\ldots(1)$$

Where Y_i is a dependent variable, farmers' knowledge of the cause of climate change specified as: farmer has correct knowledge =3, farmer has wrong knowledge =2 and farmer does not know the cause = 1. β_0 is the Y- intercept; whereas β_{1-} β_5 is a set of coefficients to be estimated. X_1-X_5 are explanatory variables hypothesised, based on theory and related emperical work. Table 1 presents a description of explanatory variables, their expected sign and reason for the sign expectation.

RESULTS AND DISCUSSION

General perception of climate changes. Participants in the stakeholders' workshop concurred that the major climate change events in the past 10 years were floods, droughts and strong winds and storms. Major flood incidents were reported to have occurred in 1976, 1996 and 2007; with the 2007 being the most severe. On the other hand, drought was reported to have occurred in 1944, between 1992 and 1994, and between 2008 and 2009; with the 1944 drought being the driest. Furthermore, the 2008- 2009 drought was the longest, lasting four months. Higher temperatures had been observed overtime as well as incidents of strong winds and storms during dry seasons and following the floods.

Quantitative data from the survey revealed that the perceptions expressed in the workshop were widely distributed in the community. All male and female respondents agreed that the climate was changing (Table 2).

On examining the differences between the percentages of men and women who agreed to having perceived the respective climate changes, the proportion of men who perceived the changes was lower on all parameters, except increased severity of strong winds and floods. Generally, male respondents were less likely to perceive changes in drought frequency and severity, temperature increases and decreases, rainfall decreases, and change in seasons. However, the difference in perception was only statistically significant for increased frequency and severity of droughts. The proportion of women who perceived that there was an increase in frequency of droughts was significantly higher than their male counterparts, supporting a significance relationship between perception and gender (χ^2= 7.245, df = 1, P = 0.007).

These findings seem to indicate a link between perceptions and gender roles/activities. Men and women are more likely to perceive climate related changes that more directly affect their social roles/ activities probably due to their struggles to fulfil their responsibilities/obligations in society. In this regard, women's traditional role of ensuring food availability in the household make them keener on hindrances to achieving this goal. For instance, women are responsible for preserving (drying) of foodstuffs such as cassava and sweet

TABLE 1. Description of explanatory variables and the expected sign

Variable	Description	Expected sign	Reason
X_1	Sex of household head, 1 (female), 0 (male)	-	Female heads have less opportunities for exposure
X_2	Access to credit;1-yes, 0 otherwise	+	Indicator of empowerment to demand for services
X_3	Access to extension services; 1-yes, 0-otherwise	+	Facilitates access to information on weather/ climate
X_4	Age of household head	+	Older farmers have more experience and accumulation of knowledge
X_5	Education level (years of schooling)	+	More education favours faster knowledge acquisition

TABLE 2. Farmers' perceptions of climate changes over the past 30 years

Climate change parameters	Agree (%)		Don't know (%)	
	Women	Men	Women	Men
Climate changes generally noticed	100	100	0	0
Temperature increased	97.1	96.9	0	0
Temperature decreased	56.5	52.4	0	1.6
Rainfall decreased	92.6	92.2	0	0
Length of seasons changed	97.1	95.3	0	0
Floods more frequent	88.7	85	0	1.7
Floods more severe	93.7	94.7	1.6	3.5
Droughts more frequent*	97	83.3	0	1.7
Droughts more severe	95.1	91.4	1.6	1.7
Strong winds more frequent	76.7	75	8.3	3.6
Strong winds more severe	64.4	65.4	8.5	3.8

*Significant at P < .01 by Chi-square tests

potato. Decreases in temperature can portray their plight of having to dry foodstuffs for longer periods of time under the sun; while the consequences of increased temperature, flood frequency, changes in seasons, drought severity and frequency present multiple constraints to achieving their role as homemakers. In addition, men being major owners of livestock such as cattle normally kept out doors in kraals would be more affected by strong winds which reportedly stirred animals into stampedes leading to straying and death of animals.

Findings on farmers' perceived climate changes are in agreement with previous studies in Uganda and elsewhere. For instance, a Participatory Rural Appraisal (PRA) that led to the preparation of the Uganda National Programme of Action (NAPA) on climate change, established that the frequency of droughts had increased and seven droughts were experienced between 1991 and 2000. An increase in intensity and frequency of heavy rains and floods was also observed and confirmed by the PRA results (NAPA, 2007). A study by Oxfam (2008) in Bundibugyo and Kasese districts also revealed increased frequency and intensity of droughts, heavy rains, floods, and erratic rainfall. Other studies revealed similar perceptions in other countries around the world. For example, Ishaya and Abaje (2008)'s study in Nigeria found that a majority (86%) of the respondents perceived that the climate had been changing over the years. Similarly, Gbetibouo (2009) found that most of the farmers (91%) in the Limpopo basin, South Africa perceived the temperature to be increasing. Other studies include Nhemachena and Hassan (2007) in Southern Africa and Vedwan (2006) in northwestern India.

Farmers' perceptions versus meteorological data. Temperature and rainfall meteorological data are presented in Figures 1 and 2, and their trends and linear regressions in Tables 3 and 4. The missing data for annual mean and maximum temperatures between 1985 and 1990 were due to technical constraints experienced at the Soroti weather station. The average annual temperature data exhibited a positive trend, suggesting a 0.69 ^{o}C increase in temperature over the 30 year period. As seen in Table 2, equal proportions of men and women (97%) were in agreement with this trend. On the other hand, although the analysis for the rainfall data showed that the amount of rainfall received annually had reduced by about 20 mm over the period, the trend was not statistically significant at ($P<0.05$) and the R^2 was very low, meaning that variations in rainfall could not be explained by the time variable alone. This was in spite of the claim by about 92% of both men and women that rainfall in the area had declined. This provides further evidence that farmers tend to place more weight on recent information than

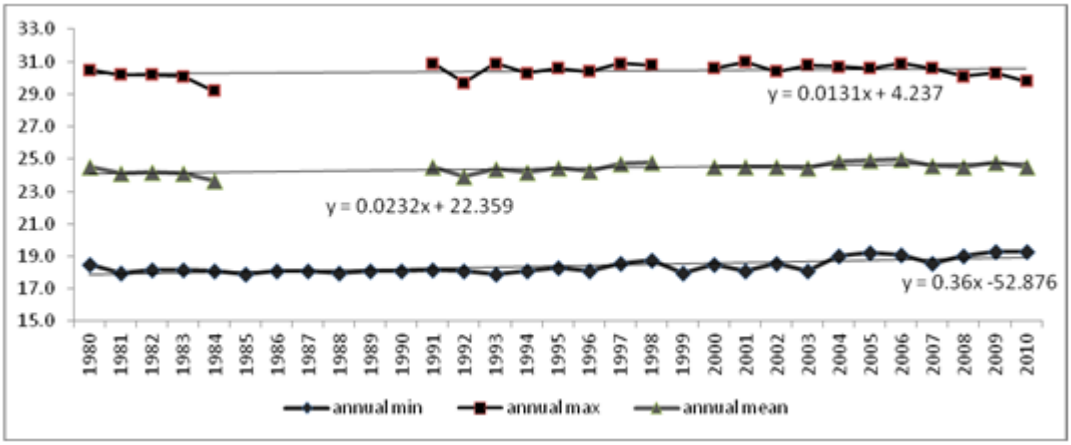


Figure 1. Trend of temperature data for Soroti district in Uganda between 1980 and 2010.

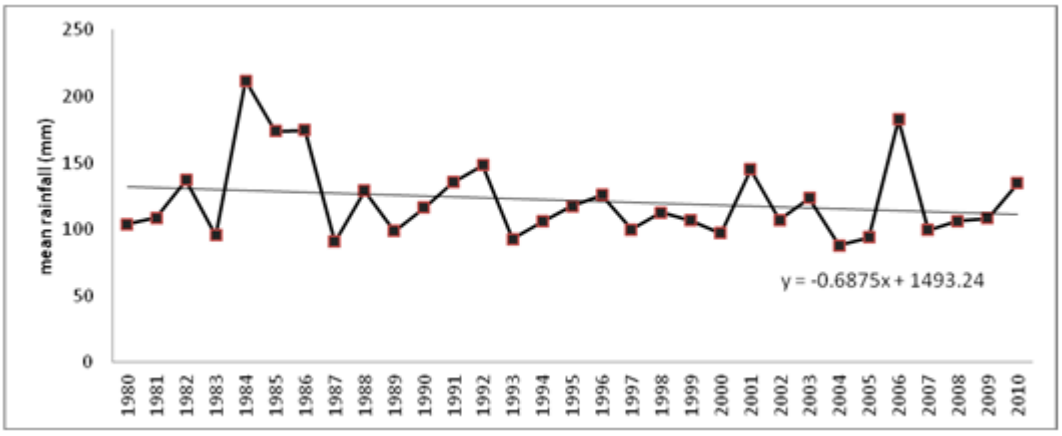


Figure 2. Trend of rainfall data for Soroti district in Uganda between 1980 and 2010.

TABLE 3. Analysis of temperature data from 1980 to 2010 for eastern Uganda

	Constant	R^2	Coefficients (B)	t-values	Std. Error
Temperature (maximum)	4.327	0.078	0.013	1.363	0.010
Temperature (mean)	-22.359	0.472	0.023	4.435**	0.005
Temperature (minimum)	-52.876	0.56	0.36	-5.967**	0.006

TABLE 4. Analysis of rainfall data from 1980 to 2010

	Constant	R^2	Coefficients (B)	t-values	Std. Error
Annual mean Rainfall (mm)	1493.24	0.043	-0.688	-1.138	0.604

might be appropriate as earlier reported by Maddison (2007). Also, farmer perceptions in this regard are more likely to be shaped by rainfall distribution rather than total amounts of rain received over the year given the low adoption of water harvesting technologies. Generally, the findings reveal that men and women's perceptions with regard to rainfall and temperature varied only marginally and may not necessarily agree with scientifically collected meterological data. This points to a need to harmonise farmers' perceptions with scientific data. Scientific meteorological data can be suitably packaged to sensitise farmers about climate change indices so as to dispel misconceptions arising from their subjective perceptions.

Farmers' perceptions on the future of climate change. The majority of respondents (63% of men and 53% women) expected climate change effects to become more severe, while about 23% were optimistic that things would get better. On the other hand, about 14% men and 24% women could not give an impression of what the future would be like. A two-proportion Z-test ($z(135)=\pm 4.72$, $P<.0001$) confirmed that respondents who thought things were bound to get worse were significantly more than those who either thought things would get better or those who could not tell what they expect the future to be like. Thus, there were more people who expected climatic change consequences to get worse. This view resonates with the recent scientific prediction of future climate change according to the IPCC (2007) synthesis report, which states that continued GHG emissions at or above current rates would cause further warming and induce many changes in the global climate system during the 21st century that would very likely be larger than those observed during the 20th century. However, the Chi-Square test to determine the relationship between gender and respondents' perceptions on whether in future the climate change situation would get better, worse or don't know, was not significant ($\chi^2= 3.634$, $df = 3$, $P = 0.304$) implying that both men and women held similar views on this.

On the other hand, although the majority of respondents expect worse climate change consequences in future, most of the farmers (81% men and 74% women), had hope that something could be done to reduce the future burden of climate change. Only 23% were pessimistic that something could be done. Also, a two-proportion Z-test ($z(135)=\pm 7.39$, $P<.0001$) confirmed statistically significant differences between the two proportions, implying that more farmers thought something could be done about the situation. This notion is also held in the science realm that societies can respond to climate change by adapting to its impacts, thereby reducing the rate and magnitude of change (IPCC, 2007). The Chi-Square test for the relationship between gender and perceptions regarding whether or not something could be done to avert climate change was also not significant ($\chi^2= 0.838$, $df = 1$, $P = 0.360$).

Furthermore, farmers who believed nothing could be done about the situation were tasked to explain their pessimistic stance. A summary of the explanations is provided in Table 5.

According to these results, most of the people (48%) view climate change as an external force against which they find themselves as helpless victims. On the other hand, the laxity to adopt better practices, corruption of leaders/officials and limited livelihood options are genuine challenges whose remedies lay in the hands of community members, government and other development agencies.

TABLE 5. Explanations for pessimistic views on the future of climate change in eastern Uganda

Response	Men (%)	Women (%)	Overall (%)
End of the world/God's wrath	50	46	48
No good will from people to change practice	33	38	36
Corruption of leaders/officials	8	15	12
Limited livelihood options	8	0	4

Findings on farmers' perceptions of the future of climate change assert that more people expect climatic change consequences to get worse but also a majority of farmers hold the belief that something can be done for the better. Both of these sentiments are also widely held in the scientific circles. Encouragingly, however, we find that the optimist group is larger than the pessimist group. The two groups represent both an opportunity and challenge for climate change adaptation programmes/initiatives. The opportunity represents the momentum within the community by the optimists to facilitate the adaptation process, for instance, by actively pursuing and seizing opportunities to get out of undesirable conditions. As Rosenstock *et al*. (1988) noted, people tend to act when they realise that their actions positively affect outcomes. This momentum should be practically tapped into, for instance, through improved service delivery, identifying and supporting early adopters to act as models for others and promoting rural entrepreneurship. Members of the optimistic group would be especially critical for leadership in steering climate change response.

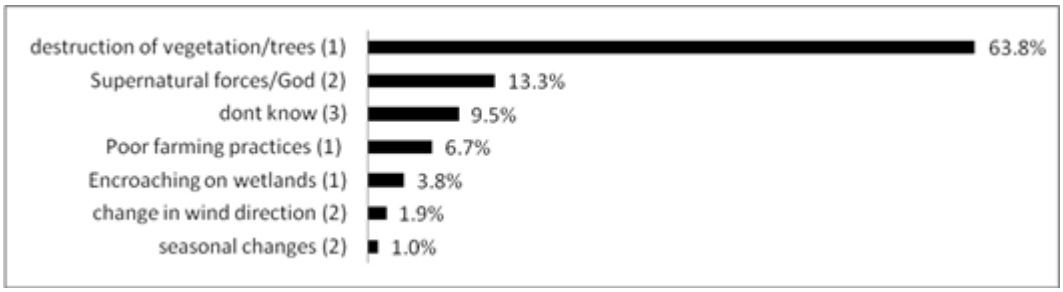
On the other hand, the pessimists who mainly manifested a helpless attitude in the face of climate change may continue to frustrate adaptation efforts and even weaken the community adaptation momentum. As Rosenstock *et al*. (1988) further noted, individual behaviour is also determined by self-efficacy; that is, one's own competence to perform the behaviour needed to influence outcomes. Therefore, if farmers continue to see that the locus of control on issues pertaining to climate change lies beyond them, they may retreat, sit and wait for their fate. For instance, Adger *et al.* (2008) noted that if the possibility of a threshold being reached, and the system changing to a different state as a result, is perceived as unattainable through a particular individual or societal lens, this perception would identify this threshold as a limit to adaptation.

In regard to optimism and pessimism in view of the future of climate change, we find that both men and women respondents held more or less the same outlook. Thus, adaptation interventions aimed at influencing farmer perceptions on the future of climate change can adopt the same message for men and women. However, such interventions need to take into account the existing optimist-pessimist dichotomy in perceptions and aim at empowering both men and women from both camps as active agents of climate change adaptation.

Farmers' knowledge of climate change

Causes of climate change. Farmers perceived the observed climate change to be caused by a range of factors. These were clustered into three categories, namely, those in agreement with scientific empirical understanding (category 1), those in contradiction to this (category 2) and those who didn't know the cause (category 3). Category 1 was regarded as correct according to the scientific world view (see for example Pidwirny, 2006; IPCC, 2007) while category 2 was wrong. Farmer responses in category 1 included destruction of vegetation/trees, poor farming practices and encroaching on wetlands while category 2 responses included super natural forces/God, seasonal changes and change in wind direction (Fig. 3).

Accordingly, about 74% of respondents knew the correct cause of climate change (that is, about 90% of men compared to only about 60% of women); while about 16% held a contradictory view (about 27% of women compared to only 6% of men). Further more, only about 4% of the men did not know the cause of climate change compared to about 14% of women. The findings show that, although the majority of the farmers were knowledgeable about the causes of climate change, men were more knowledgeable compared to women. This view is supported by the Chi-sqaure test, which showed a significant relationship between gender and climate change knowledge among respondents (χ^2= 12.761, *df* = 2, P = 0.002). However, the results also reveal a divide within the community regarding those who thought that climate change was due to destructive human activities and those who thought otherwise. Those who considered human activities to have little or no influence constituted a sizeable proportion. One implication is that people who know that climate change is caused by human actions are more likely to adopt climate change adaptations than those who feel otherwise. This points to the need for



Key: 1 = Correct; 2 = Wrong; and 3 = Don't know

Figure 3. Farmer perceived causes of climate changes in eastern Uganda (%) (n=105).

sensitisation of communities as to the causes of climate change and plausible remedies. This is especially so for the women who appear to be worse off than men.

Determinants of climate change knowledge. According to results from the multinomial logistic regression (Table 6), only sex of the household head significantly predicted farmers' knowledge on climate change causes. Female heads were close to eleven times more likely to not know the cause of climate change and they were also about three times more likely to be wrong about the cause of climate change than their male counterparts. This underlines the gap between male and female farmers' knowledge of causes of climate change.

This gender gap could be due to differences between men and women in education levels, access to agricultural information sources such as extension, radio and membership to farmer organisations. The survey established that female household heads were significantly less educated than male heads ($t(133)=5.607$, $P<.001$). The mean number of years of schooling of female heads ($\bar{x}=3.2$, $\sigma = 3.2$) was only half that of the male heads ($\bar{x}=6.7$, $\sigma = 3.4$). Wolfe and Haveman (2002) made a case for social and nonmarket benefits from education highlighting empirical evidence of positive contributions of more schooling. For instance, more schooling was seen to be helpful in reducing pain, suffering, mortality and anxiety in response to negative life events. It was also found to boost savings and social cohesion in addition to facilitating technological and social change. More, schooling also helps people to make more informed choices, participate more fully in their communities and it tends to increase the probability of nonviolent protests against government-sponsored repression. Consequently, education differences are likely to leave women disadvantaged and less influential in communal endeavours. Furthermore, access to extension by female headed households (40%) was significantly less than that by male headed households (60%) ($\chi^2=4.821$, $P = 0.028$). It is widely believed that limited mobility, access to resources especially land, excessive workloads and high illiteracy relative to men dampen women's opportunity to participate in extension programmes (World Bank, 2009).

In addition, access to farmers' organisations by female headed households (31%) was also significantly less than that for male headed households (52%) ($\chi^2 = 5.398$, $P = 0.02$). Female headed households, therefore, miss out on known opportunities of organised groups to access benefits such as savings and credit, enhancing common property management of natural resources, advancing claims to rights and resources, overcoming market failures in addition to providing an important forum for women to access and share information (World Bank, 2009). Access to radio was also significantly less for female headed households (35%) compared to male headed households (73%) ($\chi^2 =15.092$, $P <0.000$). Radio in particular is the main traditional medium used in disaster management. With a high level of illiteracy and low level of telephone coverage, radio remains the most frequently used, most publicly accessible to the poor, especially women and most effective medium (Yap, 2011). With radio being a key medium of

TABLE 6. Analysis of determinants of farmers' knowledge of the cause of climatic change

		B	Std. Error	Wald	Sig.	Exp(B)
Don't know	Intercept	-3.466	1.564	4.910	.027	
	sex_head	2.360	.797	8.764	.003*	10.588
	age_head	-.012	.030	.159	.690	.988
	access_extn	.760	.785	.939	.333	2.139
	access_credit	.838	.750	1.249	.264	2.311
Wrong	Intercept	-2.812	1.085	6.712	.010	
	sex_head	.976	.564	2.994	.084***	2.655
	age_head	.029	.020	2.039	.153	1.029
	access_extn	-.357	.555	.414	.520	.700
	access_credit	-.544	.637	.728	.393	.581

Model Fitting Information					Pseudo R-Square	
Model	Model Fitting Criteria -2 Log Likelihood	Likelihood Ratio Tests Chi-Square	df	Sig.	Cox and Snell	.161
					Nagelkerke	.207
Intercept Only	150.538				McFadden	.117
Final	132.083	18.455	8	.018		

a. The reference category is: correct. *Significant at $\alpha = 0.01$; ***Significant at $\alpha = 0.1$

information, especially to the poor, this unequal distribution of radio among male and female headed households suggests that women especially in female headed households are less likely to receive guidance on coping with climate change.

This particular result strongly highlights an important gender implication in charting the way forward on climate change response by men and women. Since men and women are at different levels of knowledge, at least in initial discourse, with women more likely to have either false knowledge or not to know the cause of climate change, a gender sensitive approach is essential. Moreover, with societies being largely patriarchal, where men dominate decision making (Moser, 1993), women's interests and ideas or concerns are more likely to be left outside the mainstream. In other words, Leiserowitz (2005) cautions that since negotiations are often an exercise of power, with the powerful having the upper hand to determine outcomes, taking care to embrace the multiple voices and perspectives in the community is necessary as the solution rests in the coordinated action of all.

CONCLUSION

Findings from this study show that a majority of male and female farmers are aware of climate change and their perceptions largely resonate with scientific meteorological data. Both male and female farmers had observed that the length of seasons had changed; temperatures had increased; rainfall had decreased; floods, droughts, and strong winds had become more frequent and severe. There was no significant difference in perceptions regarding changes on all climate parameters between men and women with the exception of perceived frequency and severity of droughts. Women were more likely to perceive increased drought frequency compared to men. Consequently, climate change response interventions need to engage both men and women so as to get a holistic understanding of community perceptions. Further, female headed

households were less knowledgeable about the cause of climate change. Sex was found to be the sole determinant of climate change knowledge. Women had significantly less education and access to sources of information, namely, radio, extension and groups undermining their capacity for climate change adaptation.

The findings make a strong case for gender consideration in climate change response policies and programmes. Addressing the variations in perceptions and knowledge of men and women sharpens climate change policies in their role of bringing about gender equitable and sustainable climate change adaptation. Climate change adaptation policy, therefore, should take into consideration the need to close gaps in access to information sources such as radio, agricultural extension and farmer organisations as well as education in general. Further still, interventions at all levels should involve both men and women. In doing so, specific climate change intervention policies, implementation strategies as well as wider government policies should aim to leverage equal opportunities for both men and women to enhance effective sharing of their views in light of harmonising climate change messages to elicit maximum positive response.

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REFERENCES

Adger, N.W., Arnell, N.W. and Tompkins, E.L. 2005. Successful adaptation to climate change across scales. *Global Environmental Change* 15: 77 - 86.

Adger, N.W., Dessai, S., Goulden, M., Hulme, M., Lorenzoni, I., Nelson, D. R., Naess, O. L., Wolf, J. and Wreford, A. 2008. Are there social limits to adaptation to climate change? Springer Science + Business Media B.V. *Climatic Change* 93:335 - 354.

Blaikie, P., Brown, K., Stocking, M., Tang, L., Dixon, P. and Sillitoe, P. 1997. Knowledge in Action: Local Knowledge as a Development Resource and Barriers to its Incorporation in Natural Resource Research and Development. Great Britain: Elsevier Science Ltd. *Agricultural Systems* 55(2): 217-237.

Brody, A., Demetriades, J. and Esplen, E. 2008.Gender and climate change: mapping the linkages (a scoping study on knowledge and gaps prepared for DFID). UK: BRIDGE, Institute of Development Studies (IDS). Available: http://uneca.org/acpc/publication/docs/DFID_Gender_Climate_Change.pdf.

Egeru, A. and Majaliwa, M.G.J. 2009. Landuse/ Cover Change Trend in Soroti District, Eastern Uganda. *Journal of Applied Science and Environmental Management* 13(4): 77 - 79. Available: www.bioline.org.br/ja.

Gbetibouo, G. A. 2009. Understanding farmers' perceptions and adaptations to climate change and variability: the case of the Limpopo basin, South Africa. IFPRI discussion paper 00849. Washington, DC: IFPRI. Available: www.fao.org/fileadmin/user_upload/.../docs/ifpri_limpopo_dp00849.pdf.

IPCC. 2007. Climate Change 2007: Synthesis Report. Contribution of Working Groups I, II and III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. Core Writing Team, Pachauri, R.K and Reisinger, A. (Eds.). IPCC, Geneva, Switzerland. 104 pp. available: http://www.ipcc.ch/publications_and_data/publications_ipcc_f ourth_assessment_report_synthesis_report.htm.

IPCC. 2001. Third Assessment Report - Climate Change. Available: http://www.grida.no/publications/other/ipcc_tar/.

Ishaya, S. and Abaje, I.B. 2008. Indigenous people's perception on climate change and adaptation strategies in Jema'a local government area of Kaduna State, Nigeria. *Journal of Geography and Regional Planning* 1(8):138-143, November, 2008. Academic Journals. Available: http://acadjourn.org/JGRP/PDF/Pdf2008/Nov/Ishaya%20and%20Abaje.pdf.

Leech, N.L., Barret, K.C. and Morgan, G.A. 2005. SPSS for intermediate statistics: use and interpretation. London: Lawrence Erlbaum Associates, UK.

Leiserowitz, A.A. 2005. American Risk Perceptions: Is Climate Change Dangerous? *Risk Analysis* 25(6): 1433-1442.

Maddison, D. 2007. The perception of and adaptation to climate change in Africa. The World Bank, Development Research Group Sustainable Rural and Urban Development Team. Policy Research Working Paper 4308. Available: http://www-wds.worldbank.org/servlet/WDSContentServer/WDSP/IB/2007/08/06/000158349_20070806150940/Rendered/PDF/wps4308.pdf

Moser, C.O.N. 1993. Gender planning and development: theory, practice and training. New York: Routledge, USA. 15pp.

MWLE, 2007. Report on State of the Environment 2007. Ministry of Water Lands and Environment. Republic of Uganda.

Nhemachena, C. and Hassan, R.M. 2008. Micro-level analysis of farmers' adaptation to climate change in Southern Africa. IFPRI and CEEPA. Available: http://www.ifpri.org/publication/micro-level-analysis-farmers-adaptation-climate-change-southern-africa-0.

Oxfam. 2008. Turning up the heat: Climate change and poverty in Uganda. Oxfam GB, online ISBN 978-1-84814-039-4. Available: www.oxfam.org.uk/.../policy/climate_change/.../ugandan_climate_change.pdf. Accessed: 10/03/10.

Pidwirny, M. 2006. Causes of Climate Change. Fundamentals of Physical Geography, 2nd Edition. http://www.physicalgeography.net/fundamentals/7y.html.

Remy, L.L., Clay, T. and Oliva, G. 2005. Do we have a linear trend? A beginner's approach to analysis of trends in community health indicators. Family Health Outcomes Project University of California, San Francisco. Available: http://fhop.ucsf.edu/fhop/docs/pdf/mcah/trend13b.pdf.

Rosenstock, I.M., Strecher, V.J. and Becker, M.H. 1988. Social Learning Theory and the Health Belief Model. Health Education Quarterly, SOPHE, John Wiley and Sons, Inc. 15 (2):175-183. Available: http://deepblue.lib.umich.edu/bitstream/2027.42/67783/2/10.1177_109019818801500203.pdf.

Stern, N. 2006. Stern review on the economics of climate change. Available: http://webarchive.nationalarchives.gov.uk/+/http:www.hm-treasury.gov.uk independent_reviews/stern_review_economics_climate_change/stern_review_report.cfm.

UNDP. 2009. Resource guide on gender and climate change. Available: http://www.uneca.org/acpc/about_acpc/docs/UNDP-GENDER-CLIMATE-CHANGE-RESOURCE-GUIDE.pdf.

Vedwan, N. 2006. Culture, Climate and the Environment: Local Knowledge and Perception of Climate Change among Apple Growers in Northwestern India. *Journal of Ecological Anthropology* 10: 4-18.

Wolfe, Barbara. L. and Haveman, R. H. 2002. Social and nonmarket benefits from education in an advanced economy. Available: http://bostonfed.org/economic/conf/conf47/conf47g.pdf.

World Bank. 2009. Gender in agriculture sourcebook. Washington, DC 20433: The International Bank for Reconstruction and Development /The World Bank, 1818 H Street, NW. Available: http://siteresources.worldbank.org/INTGENAGRLIVSOUBOOK/Resources/CompleteBook.pdf

Yap, N.T. 2011. Disaster Management, Developing Country Communities & Climate Change: The Role of ICTs. University of Guelph, Canada, IDRC. Available: http://www.niccd.org/YapDisaster Management DevelopmentICTs.pdf.