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Farmers' Perception of and Coping Strategies to Climate Change: Evidence From Six Agro-Ecological Zones of Uganda

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Abstract

In Uganda, weather-related events such as prolonged dry seasons, floods, storms, mudslides, extreme rainfall, and delayed/early rains have become more frequent and/or intense. This has left most of the rural poor farmers' food insecure and their livelihoods threatened. A total of 192 sweetpotato farmer households distributed in six agro-ecological zones were interviewed to assess how farmers perceive the effects of changes in climatic variables, and how they have adjusted their farming practices to cope with the changes in climate. Gender of the household head and size of land owned significantly affected adaptation. Ninety nine percent of all households interviewed had observed a change in the climate in the last 10 years. Drought and floods had the highest impact on crop production across agro-ecological zones. Coping strategies towards extreme events included storing food, income diversification and digging drainage channels. Other strategies were planting trees; high-yielding, early-maturing, drought-tolerant, disease and/or pest-resistant varieties; planting at onset of rains; increased pesticide/fungicide application among others. The smallholder farmer households studied have a high awareness of changes in rainfall and temperature and have taken measures to cope with effects of a changing climate.

Keywords: climate variability, agriculture, farm-level adaptation, smallholder farmers, Uganda

1. Introduction

Global climate change is one of the most critical challenges facing the international community today. Climate change is threatening to undo decades of development efforts due to its negative impacts on agriculture, health, environment, roads, and buildings especially in developing countries (GoU, 2007; IPCC, 2007; Mendelsohn et al., 2006; Stern, 2007). From a food security perspective, sub-Saharan Africa (SSA) is arguably the most vulnerable region to many adverse effects of climate change due to a very high reliance on rainfed agriculture for basic food security and economic growth, and entrenched poverty (Dixon et al., 2001; IPCC, 2007; Cooper et al., 2008). Climate change is certain to amplify these vulnerabilities given projections of warming temperatures, potential for increased activity attributable to the El Niño Southern Oscillation and trends of increased aridity in southern Africa and other regions within Africa (Christensen et al., 2007; IPCC, 2007).

In countries like Senegal, China, Ghana, Nepal, Bangladesh, Nigeria, United States of America, farmers have been mentioned to perceive and even adapt to changes in the climate (Mertz et al., 2009; Byg & Salick, 2009; Fosu-Mensah et al., 2010; Maharjan et al., 2011; Haque et al., 2011; Salau, 2012; Arbuckle et al., 2013). Socioeconomic and environmental factors have been demonstrated in various studies to influence farmers' perception and adaptation to changes in the climate (Deressa et al., 2011), those include education, household size, livestock ownership, agro-ecological zone, farm size and access to credit among others. However, Gukurume (2013) reported that peasant farmers in Bikita district, Zimbabwe, had no adaptive capacity due to extreme poverty levels and reliance on basic technologies.

Coping strategies that have been recommended for instance in Ethiopia to lessen the negative impacts of climate change include encouraging livestock ownership, planting early-maturing and drought-tolerant crop varieties, investment in irrigation, and strengthening research institutions (Deressa & Hassan, 2009). In Ghana, Fosu-Mensah et al. (2010) identified crop diversification and changing planting dates for crop plants as the two most common adaptation strategies used by farmers. In Zimbabwe, crop and livelihood diversification were the main coping strategies used to reduce the risk of crop failure and livelihood vulnerability (Gukurume, 2013).

Despite Uganda being highly vulnerable to rainfall variability and climatic shocks like droughts and floods (MoWE, 2002; GoU, 2007; GoU, 2010; MoWE, 2010), micro-level studies at the farm-level on how rural smallholder farmers perceive these changes are limited. Most studies assessing the potential effects of climate change on African agriculture are regional or national and yet adaptation is place-based and needs the use of place-specific strategies (Fischer et al., 2002; Hassan & Nhemachena, 2008; Kurukulasuriya & Mendelsohn, 2008; Lobell et al., 2008; Seo et al., 2009; Deressa et al., 2011). There is also limited knowledge on whether farmers perceive climate change and how they are responding to the effects of a changing climate. It is also important to note that local perceptions cannot be estimated by models and the need to document how the lives of the local people are affected by the recent changes in climate.

This study therefore examined how rural smallholder farmers in different agro-ecological zones in Uganda perceive the effects of changes in climatic variables, and how they have adjusted their farming practices to cope with the changes in climate. Place-based perceptions and farm-level coping strategies of resource-constrained peasant farmers in Uganda are not documented. Specifically, we identified the major factors and quantified the extent to which these factors influence perceptions of climate change; further, we investigated actual farm-level coping strategies and documented how changes in climate affect crop production in six different agro-ecological zones of Uganda. We hypothesized that perceptions of and adaptation to climate change is highly influenced by the socioeconomic and environmental factors under which farmers live.

2. Materials and Methods

2.1 Survey Design and Study Area

A cross sectional household survey was carried out using a standard structured questionnaire applying both qualitative and quantitative methods of data collection and analysis. The questionnaire assessed demographic characteristics, perceptions of changes in rainfall, temperature and extreme weather events in the last 10 years, how changes in climate have affected crop production in the last 10 years and the changes made by farmers on their farms within the last 10 years because of changes in climate. The questionnaire was pre-tested on five households in Zirobwe, Luwero district and accordingly revised to produce the final questionnaire that was used in the study.

Interviews were conducted in six districts distributed among six agro-ecological zones of Uganda (Table 1). At least two sub-counties were covered in each district. District selection was based on a representation of the different agro-ecological zones of Uganda. Based on the above criteria a multi-stage, purposive sampling method was used to select the districts and the sub-counties. Selection of the villages and parishes to be surveyed was further guided by knowledge of local leaders and ease of accessibility. Respondents were distributed in 180 villages, 59 parishes, 17 sub-counties and six districts. Enumerators were first trained on the study tools and questionnaires prior to the data collection exercise. One respondent per household and per village or a distance of 5-10 km apart were considered for the study. People who were about 30 years of age or more and had lived in that village for the past 10 years or more were only considered in the study to ensure that respondents make meaningful comparisons between the past and the present. Interviews of the selected respondents were conducted in their homes. The number of respondents interviewed per district was 32 and included male, female, elderly and young farmers. A total of 192 farmer households were interviewed individually between August and October 2011.

Table 1. Characteristics of the six agro-ecological zones (AEZ) under study

AEZ (district)	Description of AEZ	Agricultural practices
Eastern Savannah (Soroti)	Rainfall from 800-1500 mm, 1,200-1,340 m asl., generally flat with undulating hills, moderate to good soils.	Rainfed agriculture, consisting of cereals, oil crops and pulses with moderate livestock rearing. Paddy rice grown in drained swamps.
Lake Albert Crescent (Masindi)	Rainfall from 800-1,400 mm, 620-1,585 m asl., generally flat with undulating hills. Soils are good to moderate.	Rainfed mixed farming of maize *Zea mays* L., pulses, root crops, coffee and livestock rearing.
Lake Victoria Crescent (Wakiso)	Rainfall of 1,200-1,450 mm, 1,000-1,800 m asl., hilly and flat areas, some with wetlands and forest. Soils good to moderate.	Mixed cropping of bananas, Robusta coffee *Coffea robusta* Pierre ex A.Froehner, vegetables, maize and moderate dairy farming. Mostly rainfed.
Northern Farming System (Gulu)	Average rainfall 1200 mm, 975-1,520 m asl., generally flat with isolated hills, fairly heavy fertile soils.	Rainfed crop cultivation, consisting of sorghum *Sorghum* sp., pearl millet *Eleusine coracana* Gaertn., cassava, sesame *Sesamum indicum* L. and pulses. Some rearing of cattle and small ruminants.
South Western Highlands (Kabale)	Rainfall >1400 mm, altitude 1,300-3,960 m mountainous areas of Mt. Muhavura with mostly volcanic rich soils.	Rainfed mixed farming involving mostly stall fed cattle, small ruminants, and vegetables, tubercrops such as potato.
Western Range Lands (Kasese)	Rainfall 915-1020 mm, altitude 600-1,524 m, rolling hills with some flat areas, soils are moderate to poor	Cattle rearing is predominant mixed in places with banana *Musa* sp. production

Source: http://www.fao.org/agriculture/seed/cropcalendar/aezones.do?isocode=UGA.

Table 2. Description of model variables of the selection equation for the Heckman probit selection model

1. Dependent variable **Description**	**Farmers who perceived climate change (%)**	**Farmers who did not perceive climate change (%)**
Perception of climate change (dummy: takes the value of 1 if farmer has perceived a change in the last 10 years and 0 otherwise)	99.0	1.0
2. Independent variables		
Description	Mean	S.D.
Level of education of household head (dummy: takes the value of 1 if above A level and 0 otherwise)	0.06	0.2
Age of the household head (years; continuous)	43.3	12.7
Social capital (dummy: 1 if member of a farmers group and otherwise 0)	0.4	0.5
Off-farm income source (dummy: 1 if present otherwise 0)	0.4	0.5
Weather forecast and climate information (dummy: 1 if received otherwise 0)	0.5	0.5
Traditional knowledge of local early warning signs (dummy: 1 if uses local signs to predict seasons and 0 if otherwise)	0.6	0.5
Extension information on sweetpotato crop (dummy: 1 if received otherwise 0)	0.1	0.3
Farming experience (continuous)	22.3	12.6
Elevation (m above sea level; continuous)	1261.6	380.8
AEZ is Northern farming system (dummy: 1 if Gulu otherwise 0)	0.2	0.4
AEZ is South Western Highlands (dummy: 1 if Kabale otherwise 0)	0.2	0.4
AEZ is Western Range Lands (dummy: 1 if Kasese 0 if otherwise)	0.2	0.4
AEZ is Lake albert Crescent (dummy: 1 if Masindi and 0 if otherwise)	0.2	0.4
AEZ is Eastern Savannah (dummy: 1 if Soroti, 0 if otherwise)	0.2	0.4
AEZ is Lake Victoria Crescent (dummy: 1 if Wakiso and 0 if otherwise)	0.2	0.4

2.2 Statistical Analysis

Data was entered using MS Excel and exported to STATA for basic descriptive statistical analyses. Frequencies and means were the major statistical tools that were used to enable the description of farmers' perceptions about changes in climatic variables and plant health as well the coping strategies being practiced to mitigate the effects of a changing climate.

2.3 Empirical Model

As previous authors have found, perception and coping strategies to climate change are influenced by a number of socioeconomic and environmental factors (Nhemachena & Hassan, 2007; Deressa et al., 2009; Nhemachena, 2009; Deressa et al., 2010). We therefore hypothesized that factors which affect perception and the development of strategies to cope with changes in climate will include agroecology, gender, age, household size, land holding, farm labor, ability to pay/hire labor, ownership of livestock, non-farm income source, access to credit, social capital, farming experience, practice of irrigation, use of farm inputs such as fertilizers and pesticides, receiving weather forecast, intercropping on the farm and the use of local signs to predict seasons. A two-step regression model (Heckman selection model) was used for this study because farmers first perceive and then develop strategies to cope with climate change.

2.4 Dependent and Independent Variables

Dependent variables are:

i) whether a farmer has or has not perceived climate change (Table 3);

ii) whether a farmer has or has not developed coping strategies to climate change (Table 4).

Independent variables include agro-ecological zone and altitude, age and education of the head of the household, household size, land holding, farmlabor, ability to pay/hire labor, ownership of livestock, non-farm income source, access to credit, social capital, farming experience, practice of irrigation, receiving weather forecast, intercropping on the farm, and the use of local signs to predict seasons.

Table 3. Description of model variables of the outcome equation for the Heckman probit selection model

1. Dependent variable		
Description	**Farmers who adapted (%)**	**Farmers who did not adapt (%)**
Adaptation to climate change (dummy: takes the value of 1 if farmer has adapted and 0 otherwise)	85.4	14.6
2. Independent variables		
Description	**Mean**	**S.D.**
Level of education of household head (dummy: takes the value of 1 if above A level and 0 otherwise)	0.06	0.2
Household size (continuous)	7.5	4.3
Gender of household head (dummy: 1 if male otherwise 0)	0.7	0.4
Off-farm income source (dummy: 1 if present otherwise 0)	0.4	0.5
Livestock ownership (dummy: 1 if livestock owned otherwise 0)	0.6	0.5
Extension information on sweetpotato crop (dummy: 1 if received otherwise 0)	0.1	0.3
Total land holding (ha; continuous))	19.8	190.3
Credit (dummy: 1 if there is access otherwise 0)	0.8	0.4
Intercropping (dummy: 1 if farmer intercrops and 0 if otherwise)	0.9	0.3
Irrigation (dummy: 1 if farmer irrigates and 0 if otherwise)	0.1	0.3
Number of farm workers (continuous)	4.5	3.6
Ability to hire farm labor (dummy: 1 if hires labor and 0 otherwise)	0.6	0.5

Table 4. Results of the Heckman probit selection model (two-step)

Independent variables	Regression values for adaptation model		Regression values for perception model	
	Coefficients	**P value**	**Coefficients**	**P value**
House hold size	0.0073	0.8620		
Livestock ownership	0.4894	0.0670		
Total land holding	-0.0261	0.0060		
Access to Credit	0.4977	0.0700		
Intercropping	-0.0558	0.8470		
Irrigation	0.1259	0.7640		
Ability to hire farm labor	0.2482	0.3720		
Number of farm workers	-0.0440	0.4450		
Education	0.0759	0.9020	-0.0233	0.4950
Extension information on sweetpotato	-0.0065	0.9890	-0.0044	0.8910
Off-farm income	0.3850	0.1620	0.0294	0.0117
Gender of household head	0.5734	0.0340	1.1592	0.0000
Age			0.0027	0.0030
Social capital			0.2055	0.1910
Climate information			-0.0044	0.8910
Local knowledge of early warning signs			0.0115	0.4910
Farming experience			-0.0016	0.1010
Elevation			0.0008	0.0000
AEZ is Northern farming system			0.0006	0.9820
AEZ is South Western Highlands			-0.7574	0.0000
AEZ is Western Range Lands			0.0844	0.0010
AEZ is Lake albert Crescent			-0.0241	0.3220
AEZ is Eastern Savannah			0.1324	0.0000
AEZ is Lake Victoria Crescent			-0.0779	0.0180
lambda	0.1036	0.0170		
Number of observations	179			
Censored observations	28			
Uncensored observations	151			
Wald chi^2 3643.88, p=0.000				

3. Results

3.1 Farmers' Perceptions about Changes in Climatic Variables

Nearly all the households (99%) interviewed had observed a change in the climate in the last 10 years. The percentage of households reporting that rain came late (47.6%) were nearly equal to those reporting rain to be coming early (47.1%). Forty three percent reported that rain increased in amount and intensity while 36% perceive rain to be extreme (Figure 1). The highest proportion of farmers (39% households) perceived an increase in temperature in the last 10 years, while 27% of the households did not observe any change in temperature (Figure 2). Extreme climatic events like floods, drought/prolonged dry seasons, and storms were reported to have increased in the last 10 years (Figure 3). Perception to climate change was indeed influenced by the agro-ecological zone; farmers in the northern farming system (Gulu), western range lands (Kasese), and eastern savannah (Soroti) perceiving more changes in climate variables than their counterparts in south western highlands (Kabale), Lake Victoria crescent (Wakiso), and Lake Albert crescent (Masindi).

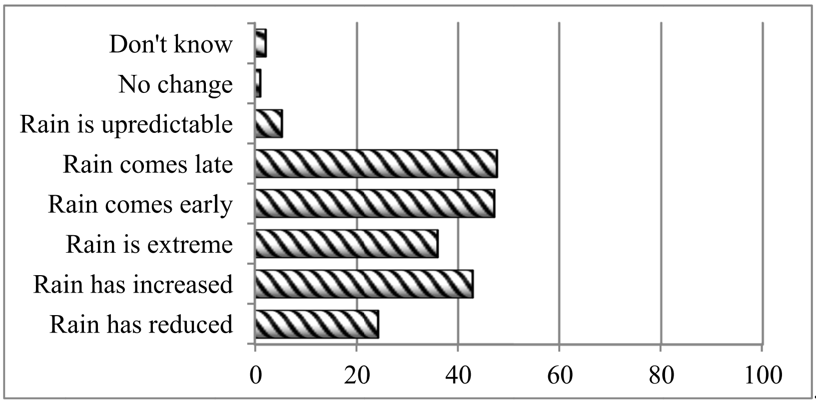

Figure 1. Farmer perception of changes in rainfall in the last 10 years (% households)

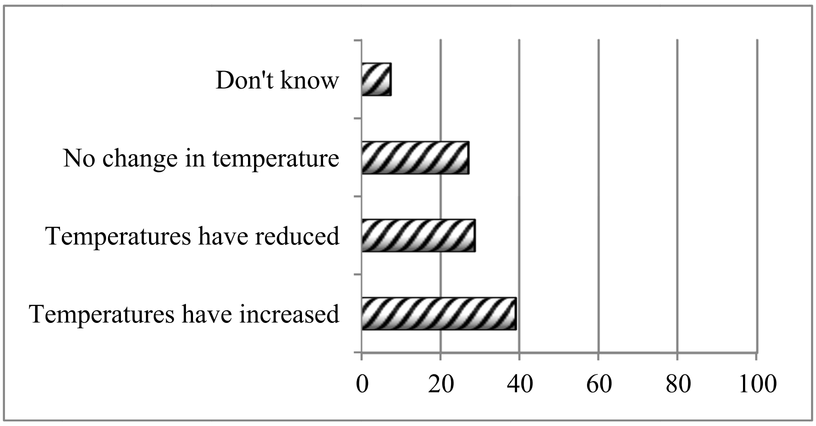

Figure 2. Farmer perception of changes in temperature (% households)

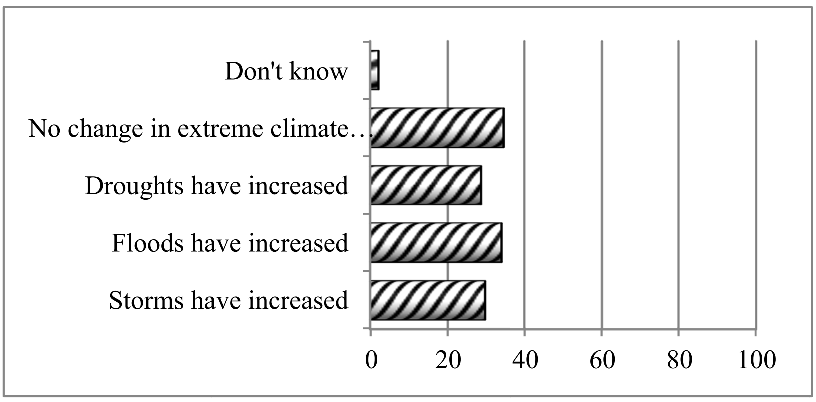

Figure 3. Change in the occurrence of extreme climatic events in the last 10 years (% households)

3.2 Factors Affecting Farmers' Strategies to Cope With Climate Change

Only one variable, gender of the household head, positively and significantly influenced adaptation to climate change (Table 5); i.e., male headed households responded faster developing coping strategies. Other factors that positively affected the development of coping strategies were household size, livestock ownership, access to credit, irrigation practice, ability to hire farm labor at peak seasons, education of household head, and access to an off-farm income source. Larger size of land owned negatively and significantly affected adaptation. Other factors that had a negative relationship to adaptation to climate change included intercropping practice, higher number of farm workers, and access to extension information.

Table 5. How changes in climate affected crop production

Climate change event	Effect on crop production	Crop affected	% households
Floods	rotting of tubers and roots, increased fungal diseases, loss of gardens, reduced yields, soil erosion, premature harvest of grain crops, reduced farm land	sweetpotato, potato, cassava, garden pea *Pisum sativum* L., bean *Phaseolus vulgaris* L., greengram *Vigna radiate* (L.) R. Wilczek, groundnut *Arachis hypogaea* L., tomato, eggplant *Solanum melongena* L., cabbage *Brassica oleracea* L., maize, rice, sorghum, sesame, watermelon *Citrullus lanatus* (Thunb.) Matsum. & Nakai, coffee, Taro *Colocasia esculenta* (L.) Schott , orange *Citrus* spp.	20
Mud slides/land slides	takes away fertile soils, soil erosion, washes away gardens	beans, potato, all crops	1
Drought/ prolonged dry season	complete crop failure, reduced yields, drying up of crops, increased pest damage	sweetpotato, cassava, garden pea, common bean, green gram, groundnut, soya bean *Glycine max* (L.) Merr. , cowpea *Vigna unguiculata* (L.) Walp., sorghum, sesame, maize, millet, red pepper	37
Longer and more rain	longer growing time and increased yields	sweetpotato, cassava, beans, groundnuts, maize	5
Changed onset and cessation of rain season)	poor grain quality at harvest, late planting, reduced yields,	potato, cassava, bean, groundnut, maize, sorghum,	11
Extreme/intensive/ heavy rainfall	rotting of bean pods and tubers, reduced yields, cut-off roads, soil erosion, reduced labor	sweetpotato, potato, bean, groundnut, sorghum	19
Storms (strong winds and/or hailstones)	destroyed leaves, broke shoots and flowers, broke house, reduce leaf quality	sweetpotato, cassava, bean, tomato, maize, sorghum, sesame, banana, pawpaw *Carica papaya* L., tobacco *Nicotiana* spp.	11

3.3 Effect of Climate Change on Crop Production

Changes in climate had already started to impact on farmers' crop production. On average, drought had the highest (37% of the households) impact on crop production followed by floods (20% of the households) across agro-ecological zones (Table 6). For instance, floods caused rotting of potato (*Solanum tuberosum* L.) tubers and sweetpotato (*Ipomoea batatas* (L.) Lam.) and cassava (*Manihot esculenta* Crantz) roots, increased fungal diseases in potato, coffee (*Coffea* spp.) and tomato (*Solanum lycopersicum* L.) crops, reduced crop yields, soil erosion, and premature harvest of grain crops and reduced farm land.

Table 6. Changes made in crop, soil and water management practices in the last 10 years

Change made (adaptation strategy)	Households (%)
Planted trees and/or hedges	45.8
Planted quick-maturing crop variety	35.4
Started or increased use of pesticides or fungicides	33.3
Planted new and/or high-yielding varieties of a crop	26.0
Planted drought-tolerant crop or variety	23.4
Applied mulch in a crop garden	22.9
Planted early or late in the season	19.3
Diversified income source to a non-farm income source	18.2
Planted disease-resistant crop variety	18.2
Practiced soil erosion protection methods	17.7
Stopped planting a crop or variety	12.0
Planted pest-resistant crop or variety	11.5
Practiced zero or no tillage	9.4
Increased irrigation	1.0

Total is more than 100 because of multiple responses, n=192.

3.4 Changes Made with Respect to Crop Varieties and in the Management of Crops, Soils and Water

Farmers were asked for the changes which their households had made over the last 10 years following changes in the climate. Survey findings show that 45.8% of households had planted trees in the last 10 years (Table 7). Fruit trees were mostly planted for commercial sale of fruits and as a source of fuel (charcoal and/or firewood). Trees like pine, *Pinus patula* (Schiede ex Schltdl. & Cham.), and *Eucalyptus* species were planted for their timber, building poles, fuel, and for soil erosion protection on the steep slopes of Kabale. *Pinus* species and *Ficus* species were planted mainly for improving soil fertility due to their association with soil fungus.

3.5 Changes Made in Non-Farm Income Sources

We examined the non-farm activities which farmers had taken on to diversify their income sources and therefore spread the risks associated with farming like total crop failure. A number of activities had been started to increase household cash income and included handcraft making, stone quarrying, retail business, working as a casual worker at another farm and securing salaried employment. No household had any new additional cash income activity in Gulu district (Figure 4). Retail business was the most common type of activity started by households (16%) across the six districts.

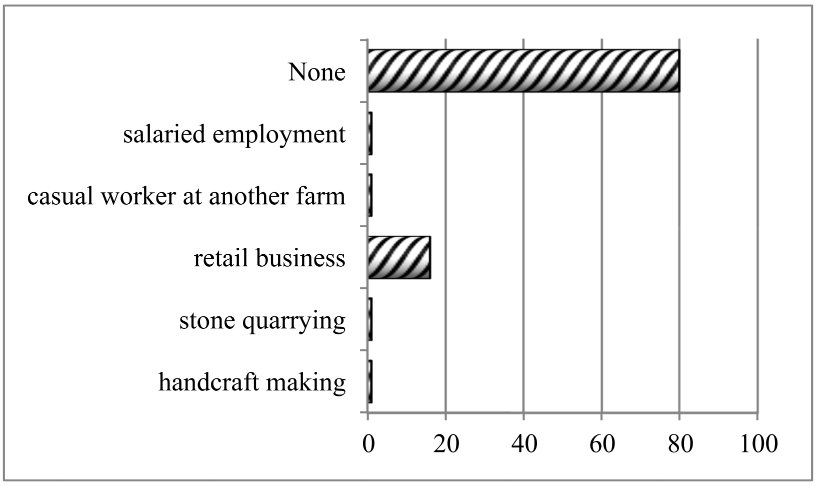

Figure 4. Changes made to diversifying from farm to non-farm activities

4. Discussion

Most of the farmers admitted to observing an increase in the amount and intensity of precipitation and an increase in temperature in the last 10 years. An increase in temperature in the last decades has been recorded in Uganda (MoWE, 2002; Nsubuga et al., 2011) and elsewhere in Africa, e.g., in Ethiopia (Mengistu, 2011), Ghana (Fosu-Mensah et al., 2010), and South Africa (Gbetibouo, 2009). Increased temperatures are said to be responsible for the increased floods reported for instance in Kasese district where the ice cap on Mt. Rwenzori has melted (Masereka & Tenywa, 2000; Kaggwa et al., 2009). In Uganda, higher temperatures have already been reported to reduce crop yields in cereals and coffee reducing the area for coffee cultivation (MoWE, 2002; GoU, 2007; GoU, 2010; MoWE, 2010). Temperature increases have been reported to be responsible for extending the geographic range of some insects (pests and vectors) currently limited by temperature like mosquitoes (*Anopheles* spp.) in highland areas that were historically malaria-free, such as in Kabale, Kisoro and Rukungiri districts of Uganda now also experiencing epidemics (MoFPED, 2009) and the sorghum chafer (*Pachnoda interrupta* Olivier; Coleoptera: Scarabaeidae) which has now extended to the northeastern highlands of Ethiopia including the Afar regions (Demessie, 2004).

Rainfall across the country has been noted to be unreliable and highly variable in terms of its onset, cessation, amount, and distribution, leading to either low crop yields or total crop failure (MoWE, 2002; Mubiru et al., 2012). The increase in rainfall over the years in Uganda agrees with the prediction by the IPCC report of a likely increase in the annual mean rainfall in East Africa (Christensen et al., 2007). If deviations of such magnitude persist a little longer, they could affect the overall physiological activities of plants and result in crop failures and reduced yields. As a result, rainfed agriculture is quite sensitive to even small changes in temperature and rainfall (IPCC, 2007).

Extreme weather events that had been experienced include drought and prolonged dry seasons, floods, storms/extreme rain and mud/landslides in order of decreasing occurrence. It is interesting to point out that extreme weather events have also had positive effects on agriculture like allowing for longer growing times due to plenty of rain hence resulting in increased crop yields especially in the Masindi district, while flooding created new opportunities for growing lowland rice (*Oryza* spp.).

Farmers manage risks, including those related to climate, regularly as part of their everyday lives. However, there is a need for farmers not only to cope with the impacts of a changing climate but rather to adapt in order to reduce the negative impact of climate change. Socioeconomic and environmental factors have a big role to play in the way farmers perceive and later adapt to impacts of a changing climate (Deressa et al., 2011). Coping strategies to protect farmers against climate related hazards included storing food, planting early and digging drainage channels. Other strategies included planting early-maturing varieties, high-yielding varieties, drought-tolerant varieties, disease- and/or pest-resistant varieties, income diversification, tree planting, increased pesticide/fungicide application, among others. Similar coping strategies were reported from various studies conducted in different parts of Africa like Ethiopia, South Africa and Nigeria (Giorgis et al., 2006; Hassan & Nhemachena, 2008; Deressa et al., 2009; Salau, 2012). Adaptive capacity of smallholder farmers to changes in climatic events is usually low due to dependence on natural resources, constraints in human and physical capital, and poor infrastructure (Shewmake, 2008; Salau, 2012; Gukurume, 2013). In this survey, factors that hindered adaptation included poverty (inability to pay for farm inputs, equipment and services like labor), unreliable weather forecasts, and shortage of food to store, among others.

5. Conclusions, Recommendations and Policy Implications

Small-holder farmers need to be supported by government and civil society organizations in the adaptation process to use water resources more efficient in agriculture since rain has becoming more erratic and with delayed onsets of rainfall.

Government institutions need to put more efforts into providing farmers with accurate weather forecasts as most farmers have no confidence in the weather forecasts received. This will enable farmers to fully exploit seasonal rainfall distribution to improve and stabilize crop yields.

There is need for the government of Uganda to facilitate the development and dissemination of agricultural technologies such as integrated pest management (IPM) to substitute the use of pesticides as well as drought-tolerant and early-maturing varieties by research institutions through increased funding to the agricultural sector.

The development and application/use of modeling tools that support adaptation planning and decision making need to be supported and disseminated to scientists and policy makers as this will help in forecasting extreme climatic events like floods, mudslides, disease and pest outbreaks rather than responding to these serious events or outbreaks as is the case in Uganda.

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