Climate Change

Determinants for strategies to cope with climate-related flood hazards in Cameroon

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ABSTRACT

The increasing frequency of natural hazards and floods in particular as a consequence of climate change, and their impacts especially in developing countries cannot be overemphasized. The need for research to contribute to framing appropriate coping strategies in order to reduce downside effects especially on the poor is urgent. This paper empirically assesses the determinants for household coping decisions to climate-related flood hazards in Cameroon, fundamentally based on logistic regression analysis. The occupation of household head, livestock per capita, cash kept at household, group membership, leadership, marital status and the length of time living in the community are found to significantly influence household coping decisions. The research concludes by emphasizing the complimentarity between social community and market-based components before and after climate-related floods in order to reduce their downside effects.
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Key words: Climate change, determinants, coping strategies, Flood hazards, Cameroon

1. INTRODUCTION

Increasing climate-related hazards are causing insecurity, lowered quality of life, undesired displacement of victims, capital loss, deaths and psychological disorders. It is estimated for instance that by 2020, climate change will have exposed 6 million more people living in coastal areas to flooding, representing an unprecedented rise of 39% more than would have been the case if climate change was absent (Warren *et al.* 2006).

Floods are currently the most frequent climate-related hazards worldwide (CRED 2015, Rakib and Islam 2017). According to CRED (2015), floods alone accounted for over 47% of all weather-related global hazards between 1995 and 2014 worldwide, increasing from a mean of 127 to 171 per annum. Floods have serious direct and indirect effects on victims. The direct effects include destruction of houses, crops (Balgah *et al.* 2015, Rakib and Islam 2017) and the loss of lives. Indirect effects may include the spread of fecal and vector-borne diseases, mental disorders and psychosocial traumas (Ntungwe, 2015). The August 2011 floods in

Cambodia for instance killed 250 people and 1,675 livestock, leaving 1.7 million affected. Over 400,000 hectares of rice farms were destroyed. The total economic damage was estimated at US$ 625 million (Chantarat *et al.* 2015).

Rising climate-related floods and their huge impacts especially in developing countries have rendered hazard response strategies increasingly complex, as hitherto fore (Helgeson *et al.* 2013, Ferreira *et al.* 2013). Hazard response strategies, which are formal or informal, encompass all actions taken to respond to (potential) risks, shocks and adverse outcomes generated by hazards (Holzmann, 2001). *Formal* responses are state and market institutions that have evolved for the management of hazard risks or shocks, including for instance insurance contracts and banks savings. *Informal* responses are measures taken at individual, household or community levels to protect against risks or to fight against shocks, in the presence or absence of public or market based arrangements. Some examples include buying and selling of real assets, savings in real assets, marriage, savings and borrowing from informal social networks (Holzmann, 2001, Balgah *et al. 2012*). While formal responses dominate in developed countries, informal ones are mostly appropriated in developing countries where state and market based (formal) instruments are often dysfunctional or nonexistent. This is the case with many sub-Saharan countries.

Cameroon is one of the Sub-Saharan countries which currently witnesses an increasing rate of climate-related flood hazards, with are often accompanied by huge negative effects, usually range from the displacement of victims through the destruction of houses, land, crops, livelihoods, to increased disease prevalence and loss of human lives (Tanku 2012, Ntungwe, 2015). To cope with the aftermaths, victims often face a form of portfolio-choice problem which is very limited to the options available to them. Preventive and mitigating options are generally very limited especially to the vast majority of poor victims (Helgeson et al. 2013, Chantarat et al. 2015). This unfortunate situation often leads to the adopting of coping strategies that push victims deeper into poverty, where they remained trapped (Balgah, 2011, Barrett *et al.* 2006).

In spite of the limited options, households still have to choose. This article is interested in identifying the drivers for choice decisions amongst victims of a case study flood in Cameroon.

Several factors have been identified in the topical literature to influence household coping decisions. For instance, Berman et al (2014) report that high levels of poverty were partly responsible for household decisions to rely heavily on agriculture as well as on social support after floods in Uganda. Households with older aged household heads were more likely to rely on social support than households with younger household heads. Shitangsu and Joyant (2010) observe that begging by household members after climate-related hazards increased with the increase of household head's age in Bangladesh (p=0.000), as a result of increased physical incapability after the floods.

Bashiru et al (2014) and Berman et al (2014) working in Ghana and Uganda respectively further contend that the level of education affected the risk coping decisions among farmers and flood victims respectively. The more educated households relied mostly on savings, due to greater livelihood diversity options, while less educated households preferably relied on social support. The gender of the household head also affects flood coping decisions. Shitangsu and Joyant (2010) for instance found out that engaging family members for begging, selling of labor with advance payment and temporary migration were higher among female headed households than male headed households (23.3% and 7%; p=0.002, 56.7% and 32.9%; p=0.009 and 26.7% and 6%; p=0.01911 respectively). Thus the female-headed households mostly adopted passive coping measures that rather increased their vulnerability to (flood) hazards; compared to male-headed ones (see also Mobarak *et al.* 2012). This probably explains why GTZ (2010) suggests that gender aspects should be considered for a successful (flood) hazard management. Jakiela and Ozier (2012) working in rural villages in Kenya show that access to risk-sharing and reciprocal arrangements among members of social groups influence household coping decisions. In the same line, Shitangsu and Joyant (2010) observe that 87.6% of the victimized households in Bangladesh helped each other (through manual labor, food, money, house reconstruction, etc) during and in post-hazard periods. More to this, the perceptions, culture and beliefs of hazard victims have been identified as implicit community based determinants of household adoption of certain coping strategies against disaster impacts. Balgah et al (2015) for instance reported that disaster victims in rural Cameroon were unwillingness to move to new havens far away from the graves of their beloved ones because of their cultural beliefs, thereby opting to stay in the flood risk zones.

The above examples provide justification on why research on coping decisions amongst flood victims is crucial to understand, particularly in developing countries where flood effects are highest (CRED 2015). We contribute to this discourse with a case study from Cameroon.

2. MATERIALS AND METHODS

This section presents the methodological approaches applied to the case study in an attempt to examine the determinants for household coping decisions to a flood hazard in Cameroon. It presents the sampling approaches and the analytical procedures applied in the case study.

2.1. Methodology and sampling approaches

This paper examines the determinants for coping mechanisms with September 2012 Babessi floods in Cameroon. A developing country case study is justified based on the premise that countries suffer most from increasing frequency of flood hazards (IPCC 2014, CRED 2015). Both victims and non-victims were sampled. The sampling unit was the household. A structure questionnaire based on Henry et al (2003) was used in the survey.

2.2. Data collection and analysis

Data was collected by trained enumerators from 22nd to 25th October 2012 from flood victims in Babessi community, located in northwestern Cameroon. Interviews were done solely by trained enumerators irrespective of whether the household head could read and write. Interview and data recording was done at the homestead of the interviewees. The questionnaire was administered to a near census of 38 victims. Any flood victim who was not interviewed either declined or was not present in the community at the time of interview. This was complemented by observations and key informant interviews. Collected data was analyzed using SPSS (Statistical Package for Social Sciences), version 20.0. At 90% confidence interval (α = 0.1), both descriptive and statistical analyses have been performed. Additionally, a logistic regression was performed to ascertain which factors contribute to the decision of households to adopt specific (mainly informal) coping strategies after the floods. Results and discussions are presented in the following section. The asset portfolio of the Sustainable Livelihoods Framework (Scoones 1998, Oyekale and Gedion 2012) provided the basis for the analysis. Though data was collected from both victimized and non-victimized households, only the victimized households were included in the above mentioned analyses.

3. RESULTS

3.1. Descriptive Socio-economic analysis of the Sample

A majority of the flood victims (71.8%) have only primary school education and/or below (Table 1). Subsistence agriculture is also the main source of livelihoods for ≈70% of the entire sample (Table 2). Most flood victims (≈80%) are married and living with their spouses (Table 3). The mean age was 43years, with average household size of 8 persons (Table 4). Most flood victims (≈90%) belong to a group or network (Fig 1). However, only a very small proportion (less than 30%) is involved in leadership of these networks, probably as a consequence of their low levels of education (Fig 2).
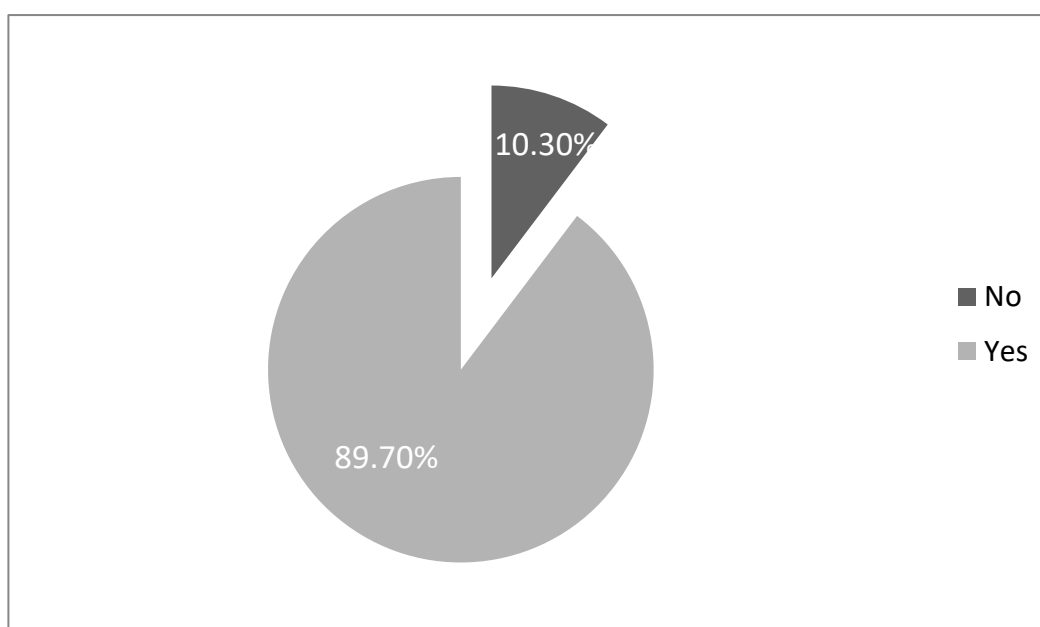

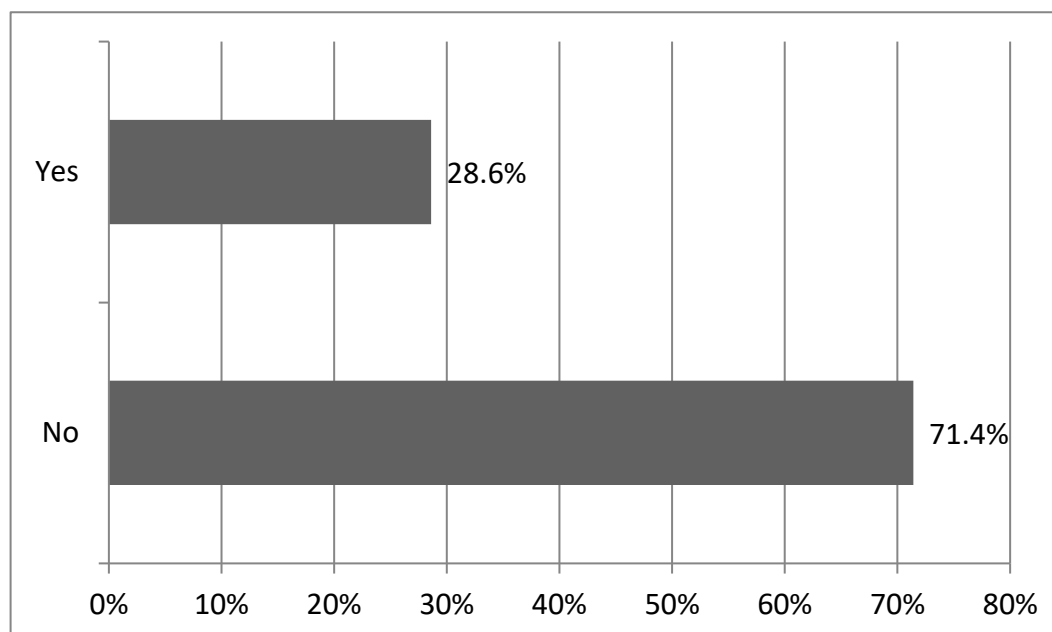**Figure 1** Membership in groups/networks

Figure 2 Percentage of interviewees holding leadership positions in groups or networks

3.2. Determinants for the adoption of risk/disaster coping mechanisms

After 20 iterations, 13 variables explaining over 67% of the household coping decisions were retained for the logistic regression analysis (see Tables 5 and 6 for the model summary and the omnibus tests respectively) The results of the regression analysis shows that the main occupation of household head (B = 2.109), livestock per capita (B = 0.001), cash kept at household (B = 0.004), group membership in groups/networks (B = 3.178),holding a leadership position in group (B = 9.226), marital status (B = 37.316) and the length of time living in the community (B = 0,121) were the key factors that influenced household coping decisions among the case study flood victims in Cameroon (Table 7).

Table 1 Educational attainment of flood household head

Highest Level of Education attained	Frequency	Percentage
No or did not complete primary school	11	28.2%
Completed primary school	17	43.6%
Some secondary education	3	7.7%
Completed secondary school	4	10.3%
Some high school	2	5.1%
Completed high school and above	2	5.1%

Table 2 Main occupation of flood household head

	Frequency	Percentage
Farm enterprise	27	69.2%
Non-farm enterprise	12	30.8%
Total	39	100%

Table 3 Marital status of flood household head

	Frequency	Percentage
Single	1	2.6%
Married and living with spouse	30	76.9%
widow(er)	8	20.5%
Total	39	100%

Table 4 More Descriptive Statistics

Variable	Minimum	Maximum	Mean	Std. Deviation
Age of household head	23	82	42.64	13.655
Household size	1	26	7.82	5.129
Estimated household monthly income	29,860	120,490	56,680	23,870
Clothing and footwear expenditure in the last 12 months	30,000	600,000	198,690	150,100
Number of groups to which household head belongs	0	5	2.13	1.472

Table 5 Regression Model Summary

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
	13.405[a]	0.423	0.676

Estimation terminated at iteration number 20 as maximum iterations had been reached.

Table 6 Omnibus test of model coefficients

		Chi-square	df	Sig.
Step 1	Step	17.057	13	0.0985
	Block	17.057	13	0.0985
	Model	17.057	13	0.0985

Table 7 Determinants for adopting coping strategies by flood victims

	Variable	B	S.E.	Wald	df	Sig.	Exp(B)
	Financial/Economic Capital Determinants						
Step 1ᵃ	Income	.000	.000	.027	1	.870	1.000
	Livestock per capita	.001	.000	1.259	1	.262	1.001
	Assets per capita	.000	.000	1.719	1	.095	1.000
	Cash held in the house	.004	1.085	.000	1	.998	1.000
	Human Capital Determinants						
	Age	-.418	.361	1.342	1	.247	.658
	Education	-2.825	2.987	.895	1	.344	.059
	Household size	-.438	.450	.596	1	.440	.706
	Main occupation	2.109	3.831	.303	1	.582	8.2421
	Social Capital Determinants						
	Marital status	37.316	8.302	.000	1	.996	1.607
	Belonging to a group/network	3.178	7.647	.173	1	.678	23.999
	Leadership in the group	9.226	6.927	1.774	1	.0915	10.153
	Sex	-34.377	8.303	.000	1	.997	.000
	Residence time	.212	.191	1.227	1	.247	.658
	Constant	-22.099	8.302	.000	1	.998	.000

4. DISCUSSION

From a socio-economic perspective, the majority of flood victims in the Cameroon case study have attained only primary school education and/or below (71.8%). This limits their ability to tap into formal hazard management options (e.g. off-farm income generating activities), and provides a plausible explanation of why a majority of them depended largely on subsistence agriculture for their livelihoods. Marriage seems to provide a cheap source of family labor, and may explain why over 75% of all victims are married and living together as a family at the time of the interview. Most hazard victims (≈90%) belong to at least one informal group or network. However, only 30% of them have leadership positions in at least one of the groups/networks they belong to (figure 2). While strong membership indicates the importance that social capital can play in flood hazard recovery and supports previous contentions (Shitangsu and Joyant 2010, Jakiela and Ozier 2012, Berman *et al.* 2014, Bastagli and Holmes 2014)., poor access to leadership may hinder full network appropriation. Table 4 provides more information on the descriptive statistics of our sample. The mean age for those interviewed was about 43years, 13years short of the life expectancy of 56years in Cameroon (Human Development Report, 2016). The mean household size of 8 resonates with previous research in the region (e.g. Ngwa *et al.* 2015), and may be indicative of the importance of family labor for subsistence farming. Other socioeconomic variables (e.g. estimated mean monthly income and the mean expenditures on clothing and foot wear) are slightly higher than the averages in the region.

A binary logistic regression analysis was employed to determine which household variables explain the adoption of coping mechanisms by the flood hazard victims in our case study. The binary variable, type of coping mechanism took 1 if the victim adopted predominantly informal mechanisms and 0 otherwise. The attributes of our regression model as presented in tables 5 and 6 showed that the variables retained in our model explain 67.6% of the factors affecting victimized household disaster coping

decisions. The results also show that there exist a significant relationship at the 10% level between the dependent and independent variables used in our model (X^2 = 17.057, p = 0.0985).

The discussions in this section have been presented in three sections (financial/economic capital, human capital and social capital determinants) based on the asset portfolio of the Sustainable Livelihoods Framework (Scoones 1998).

The financial/economic status assessed using household monthly income and household assets per capita had no influence on the decisions of the flood victims to adopt one form of disaster coping mechanisms over the other. On the other hand, their per capita livestock as well as the amount of money held at household before the floods weakly influenced the coping strategies of flood victims. This weak/no influence by financial/economic capital on disaster coping decisions may be explained by a normal distribution of incomes and assets among households at lower levels of development. However, the influence of livestock may be attributed to the socio-cultural perceptions of owning livestock by households as they are used in traditional ceremonies like traditional wedding and other celebrations and informal savings to be appropriated in times of need (Shitangsu and Joyant 2010, Helgeson *et al.* 2013, Berman *et al.* 2014). Berman et al (2014) for instance found out that 61% of the hazard-affected household in Uganda had their household were willing to sell their livestock as a strategy to cope with stresses. Helgeson et al (2013) on their part report almost% in a different case study.

From a human capital perspective, the age of the household head, level of education of household head and household size were non-influential in the decision to adopt mainly informal coping responses to the Babessi floods. These results however contradict the findings in the topical case studies (Njome *et al.* 2010, Jensen 2012, Bashiru *et al.* 2014, Berman *et al.* 2014). Jensen (2012) for instance in his work in India found education to be a very cost-effective strategy for influencing and implementing schooling decisions in poor households in India. A probable explanation for this is the generally low levels of education observed in the Cameroon case study. In an area where only ≈10% of the household heads had high school level of education, education may not appear to be of significant importance to the inhabitants of the area, especially with regards to socio-economic interactions. Because of this low level of education, most household have therefore engaged in agriculture for their livelihoods. This probably explains why close to 70% of the population relied on agriculture for their household livelihoods and as an important strategy to cope with the flood hazard. Since flood hazards often supersede endogenous household response mechanisms, interactions between internal capacities, vulnerabilities and the external environment often determine final coping strategies (Holzmann 2001). More so, in an area where people roughly share the same way of life, occupation and are subjected to similar shocks, they are likely to employ similar coping strategies when hazards strike as response opportunities and available coping mechanisms are relatively homogeneous (Buyinza *et al* 2008). This probably explains why in the research area, the main occupation of the household head affected their household coping strategies. Improving agricultural techniques can therefore enhance the coping capacities of our sampled households to future floods. Improving education to enhance access to off-farm income activities should also be contemplated.

At the social capital, the marital status of the household head, membership and holding leadership positions in groups or networks (B = 9.226, P=0.0915), longevity in the community affected the decisions of the victims to adopt informal coping strategies to the 2012 floods. The gender of the victim was negatively correlated with the decision to adopt coping strategies. Based on the above results, we can conclude that social capital is likely to play a key role in the decisions of flood victims to adopt mainly informal hazard management mechanisms at low levels of development. Similar contentions abound in the topical literature (Shitangsu and Joyant 2014, Bastagli and Holmes 2014).

5. CONCLUSIONS

In this study, we have attempted to identify the drivers for coping decisions to flood hazards based on a case study from Cameroon. We did this by examining how different household socio-economic characteristics based on the asset portfolio of the Sustainable Livelihoods Framework can influence coping decisions to flood hazards in a developing country context. By and large the accumulation of social capital seemed to have played a key role in shaping coping decisions in our case study. Whilst our findings are context-specific, they stimulate further research interest in understanding how different characteristics shape coping and adaptation decisions. Continuous research is needed to identify trends which can form the basis of wider policy prescriptions especially in developing countries, where climate-related hazards in general and floods in particular are, and will be having serious disruptive effects on livelihoods. This is primordial especially for flood-prone areas (Hutton and Haque 2004, Rakib and Islam 2017). Our findings indicate a dominance of community based response strategies, in line with the generally observed trend in developing countries, where state and market institutions for flood hazard management often fail, or function only partially. However, whenever possible, such informal coping strategies should be complemented by formal (state and market) mechanisms. This will drastically reduce the downside effects of flood hazards.

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