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Household resilience to climate change hazards in Uganda

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Abstract

Purpose – As climate change shocks and stresses increasingly affect urban areas in developing countries, resilience is imperative for the purposes of preparation, recovery and adaptation. This study aims to investigate demographic characteristics and social networks that influence the household capacity to prepare, recover and adapt when faced with prolonged droughts or erratic rainfall events in Mbale municipality in Eastern Uganda.

Design/methodology/approach – A cross-sectional research design was used to elicit subjective opinions. Previous studies indicate the importance of subjective approaches for measuring social resilience but their use has not been well explored in the context of quantifying urban resilience to climate change shocks and stresses. This study uses 389 structured household interviews to capture demographic characteristics, social networks and resilience capacities. Descriptive and inferential statistics were used for analysis.

Findings – The ability of low-income households to meet their daily expenditure needs, household size, and networks with relatives and non government organizations (NGOs) were significant determinants of preparedness, recovery and adaptation to prolonged droughts or erratic rainfall events.

Practical implications – The results imply that policymakers and practitioners have an important role *vis-à-vis* encouraging activities that boost the ability of households to meet their daily expenditure needs, promoting small household size and reinforcing social networks that enhance household resilience.

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Originality/value – Even the low-income households are substantially more likely to prepare for and recover from prolonged droughts or erratic rainfall events if they can meet their daily expenditure needs. This finding is noteworthy because the poorest in society are generally the most vulnerable to hazards.

Keywords Resilience, Drought, Urban, Networks, Rainfall, Demographic

Paper type Research paper

1. Introduction

Urban resilience against climate change shocks and stresses has become an important issue in the contemporary world (Bozza *et al.*, 2015). As climate change is increasingly manifesting through prolonged droughts, erratic rainfall events, storms and floods threatening to severely affect developing countries (Walshe *et al.*, 2018), urban households are likely to suffer most because people and infrastructure are concentrated in urban areas (Bozza *et al.*, 2015; Taedong and Taehwa, 2016). Thus, the determinants of household resilience in urban areas warrant investigation to guide suitable interventions (Boyd and Juhola, 2014). In this study, household resilience is defined as the capacity of a household to prepare, recover and adapt or change its source of income or livelihood if needed when faced with climate change shocks and stresses (Jones and Tanner, 2015).

Several studies have indicated the importance of demographic characteristics and social networks in influencing household resilience to shocks and stresses (D'Errico and Di Giuseppe, 2018; IPCC, 2015; Jones and Samman, 2016). In its Fifth Assessment Report, the Intergovernmental Panel on Climate Change (IPCC, 2015) highlighted demographic characteristics such as age, gender, income and health status to shape the resilience capacities of urban households. In the context of resilience to food insecurity in Uganda, D'Errico and Di Giuseppe (2018) found that highly educated households are more resilient than low educated households while female headed households are less resilient compared to male headed households. Jones and Samman (2016) assessed resilience capacities and demographic factors that influence resilience to floods in Tanzania and reported that knowledge of previous floods, believing floods to be a serious problem and age were more important than other factors.

Social networks with relatives, friends, non government organizations (NGOs) and the government act as first responders during times of shocks and stresses (Aldrich and Meyer, 2014; Tawodzera, 2012; Tippens, 2016). This is because social networks can help in terms of the provision of loans, gifts, emotional support and early warnings, which are important for enhancing resilience (Aldrich and Meyer, 2014). To elaborate, Tawodzera (2012) reported that networks with friends and relatives were significant in enhancing household resilience to food insecurity in Harare. Similarly, Tippens (2016) revealed that the resilience of urban refugees to psychological stress in Nairobi was enhanced by establishing networks with NGOs.

Overall, the extant literature provides a wealth of knowledge on salient factors, which may enhance resilience to different types of shocks and stresses e.g. floods (Jones and Samman, 2016), food insecurity (D'Errico and Di Giuseppe, 2018; Tawodzera, 2012) and psychological stress (Tippens, 2016). However, studies have generally restricted predictors to objective demographic and economic factors (D'Errico and Di Giuseppe, 2018) or focused solely on the role of social networks (Aldrich and Meyer, 2014; Sadri *et al.*, 2017; Tawodzera, 2012; Tippens, 2016). This study endeavors to fill this gap by using a broad subjective approach that simultaneously explores multiple potential predictors in the context of climate-related shocks and stresses. Therefore, in line with Jones and Samman (2016), it is assumed herein that subjectively perceived resilience capacities are essential for understanding resilience.

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The study investigates demographic characteristics and social networks that may influence the household capacity to prepare, recover and adapt or change their source of income or livelihood if needed when faced with prolonged droughts or erratic rainfall events in Mbale municipality in Eastern Uganda. In line with the global call by the United Nations International Strategy for Disaster Reduction (UNISDR, 2015), this work is framed in terms of the following research question:

RQ1. Which demographic characteristics and social networks influence household resilience capacities when faced with prolonged droughts or erratic rainfall events?

In the past four decades, the globe has experienced unprecedented warming with average temperatures rising from 0.65°C to 1.06°C above pre-industrial levels (IPCC, 2015). This has exacerbated several climate change shocks and stresses such as prolonged droughts, heavy precipitation events, and floods, which have threatened to severely affect urban areas especially those in Sub-Saharan Africa (Boyd and Juhola, 2014). In the context of Uganda, Nsubuga and Rautenbach (2018) indicated a significant rise in air temperatures, increased droughts and dry spells, increased intensity of precipitation events and floods in October, November, December and January. The negative effects of these climate change shocks and stresses are particularly apparent in Uganda's urban areas located on the lower slopes of high mountains (UNDP, 2013). This illuminates the need for empirical assessments in the urban areas of Uganda to ascertain important determinants of household resilience to climate change shocks and stresses. Hitherto, only a few resilience studies have been conducted in Uganda with a focus on the urban context (Dobson *et al.*, 2015; D'Errico and Di Giuseppe, 2018). Moreover, there has been a dearth of attention to how demographic characteristics and social networks influence household resilience to climate change shocks and stresses. Therefore, this study presents an important research agenda that may have a potential policy impact by helping to provide knowledge that can improve Uganda's level of resilience to climate change shocks and stresses – this country was ranked 147 out of 178 countries in terms of resilience by Warner *et al.* (2015).

Herein, climate change shocks refer to sudden and rapid disturbances caused by extreme weather conditions (The Rockefeller Foundation/Arup, 2016), while climate change stresses refer to slow processes whose cumulative effects are felt after a long time (The Rockefeller Foundation/Arup, 2016).

The remainder of the paper proceeds as follows. The theoretical framework is presented in Section 2. In Section 3, the data and methods are described before the exploration of the results in Section 4. Conclusions and recommendations are provided in Section 5. Information concerning the survey instrument is relegated to the Appendix.

2. Theoretical framework

The concept of resilience emanates from the ecological stability theory proposed by Holling (1973, p. 14), who in his seminal work defined resilience as "the measure of the persistence of systems and of their ability to absorb change and disturbance and still maintain the same relationships between populations or state variables." Beyond ecology, resilience has also been conceptualized in other research domains e.g. engineering and materials science (Holling, 1996) and climate change disasters (Bozza *et al.*, 2015). Resilience generally means the capacity of a system or community that is exposed to hazards to resist, accommodate, and recover in a timely and efficient way, and the capacity to adapt or change its essential basic structures and functions (UNISDR, 2015). However, debates and disagreements do exist to the extent that the resilience concept is sometimes contested not only between different fields of study but also within frameworks and indices of the same field of study. Notwithstanding, the socio-ecological

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frameworks and indices developed to measure urban resilience to climate change shocks and stresses measure common capacities although not limited to the capacity to prepare, recover, and adapt or change (Lindsey *et al.*, 2018).

The capacity to prepare describes the ability of households to anticipate and lessen the effects of climate change shocks and stresses; the capacity to recover describes the ability to absorb and continue thriving; while the capacity to adapt or change describes the ability of a household to adjust and modify its sources of income or livelihoods if needed and take advantage of new opportunities presented by prolonged droughts or erratic rainfall events (Aldrich and Meyer, 2014; Jones and Tanner, 2015).

Most of the extant urban resilience frameworks and indices use objective approaches that make use of secondary socioeconomic and biophysical data sets as proxies for understanding resilience factors (Chun *et al.*, 2017). However, such data sets are often lacking in developing countries (Jones and Tanner, 2015). Thus, operationalizing objective resilience approaches is currently not possible in much of the world. To circumvent this challenge, subjective resilience approaches that obtain data using surveys to elicit local knowledge for measuring social resilience have recently been suggested (Jones and Tanner, 2015). Subjective resilience approaches capture context-specific issues by using cognitive self-evaluation of resilience capacities, following a bottom-up approach (Jones and Tanner, 2015). However, as much as subjective approaches may complement objective methods, their use has not been well explored particularly in quantifying the resilience capacities of urban households to climate change shocks and stresses. Thus, in assessing the resilience of households to prolonged droughts or erratic rainfall events in Mbale municipality, this study adopts a subjective resilience framework proposed by Jones and Tanner (2015) and used by Lindsey *et al.* (2018). This framework is premised on a bottom-up process, which relies on peoples' cognitive self-evaluation of the factors that are most important in contributing to household resilience (Lindsey *et al.*, 2018). Moreover, focus is placed on context-specific issues such as social networks (with friends, relatives, NGOs and government), demographic characteristics (gender, age, household size, gender of household head, education, income and the ability of a household to meet its daily expenditure needs) and perceived capacity to prepare, recover and adapt or change, which are significant in determining household resilience (Aldrich and Meyer, 2014; Lindsey *et al.*, 2018). While subjective resilience assessments have particular weaknesses, they can provide valuable insights, which need to be considered alongside objective resilience approaches (Jones and Tanner, 2015).

3. Data and methods

3.1 Study area

The study was conducted in Mbale municipality in Eastern Uganda (Figure 1) between August-September 2017. Mbale municipality was selected based on its location in a mountainous disaster prone area characterized by erratic rainfall events, flash floods in low lying areas and high rates of urban population growth imposing pressure on land and social service provision (Kansiime *et al.*, 2013; UBOS, 2016; UNDP, 2013). Reports also indicate that several droughts have affected the area e.g. in 1979/1980, 1993/1994, 1996, 1999, 2011/2012, 2013 and 2016/2017 (NEMA, 2010; OXFAM, 2017). These droughts exacerbate problems of water access, quality and affect crop yields leading to increased food prices. To further hamper the resilience capacities of households, Mbale municipality is located in a region of Uganda characterized by low social economic status, high poverty levels and vulnerability to climate-related shocks (Dobson *et al.*, 2015). Understanding which demographic factors and social networks are important in enhancing preparedness, recovery and adaptation is thus urgent to build requisite resilience (Kansiime *et al.*, 2013).

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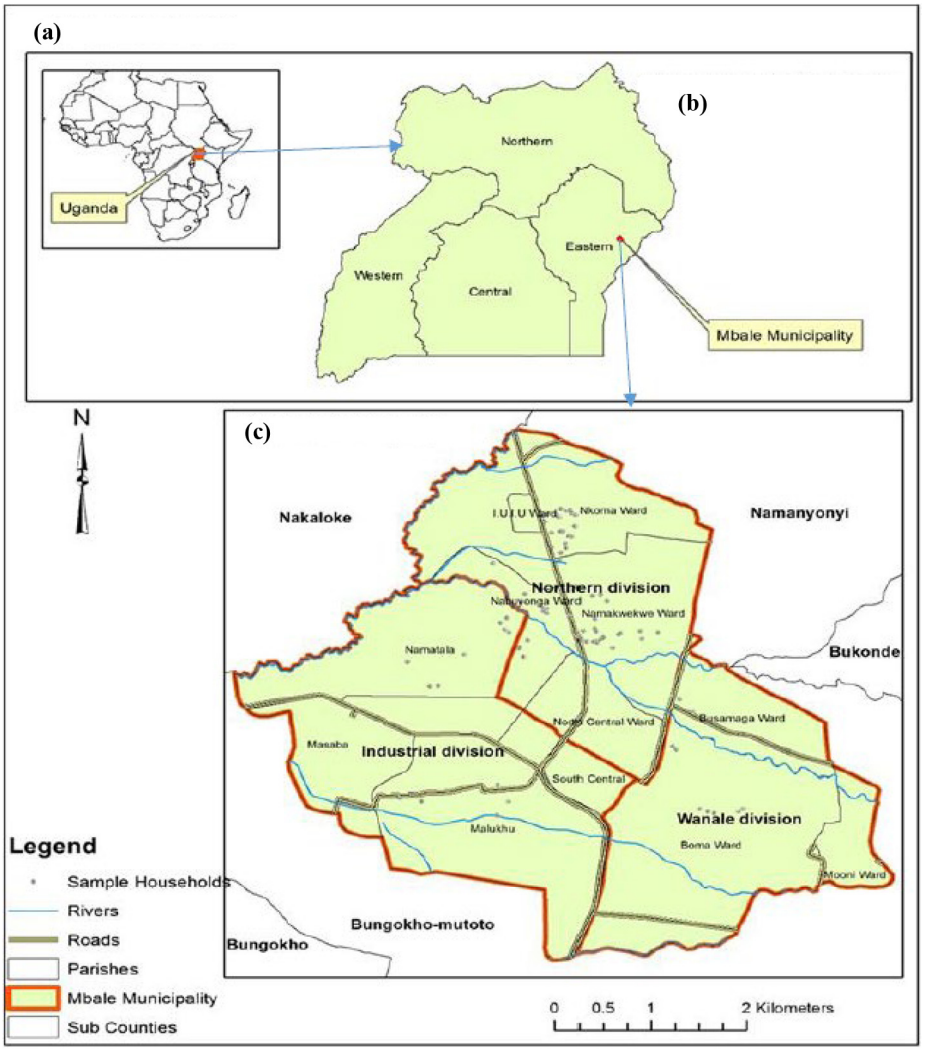

Figure 1. Study area location in Eastern Uganda

Notes: Map generated using geographical information systems with data from UBOS (2014); (a) Uganda in Africa; (b) Mbale Municipality in Uganda; (c) Mbale Municipality

Mbale municipality comprises three divisions i.e. Wanale, Industrial and Northern divisions with a total population of 92,857 in the year 2014 (UBOS, 2016). These three divisions are further demarcated into 14 wards. The municipality experiences a humid tropical climate with bimodal rainfall from March to June and from September to November, while dry seasons occur from December to February and in July (UNDP, 2013). For the period between 1960 and 2009, the average annual rainfall was 1,500 mm and the average annual temperature was 23°C (Mbale District Local Government Statistical Abstract, 2012).

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3.2 Data collection

A cross-sectional survey research design was used with a multi-stage sampling procedure. Multi-stage sampling was instituted because of its flexibility, cost-effectiveness and comprehensiveness (Bennett and Iiyanagec, 1988). The first stage involved a purposive selection of seven of the 14 wards spanning the three divisions in Mbale municipality. These wards were selected taking into consideration sensitivity and fragility to prolonged droughts, erratic rainfall events that often cause flash floods and population characteristics (UNDP, 2013; UBOS, 2016). The second stage involved random sampling of households to identify respondents to a structured household interview questionnaire (n = 389). Random sampling was deemed appropriate at this stage because every household in the selected wards is likely to be affected by prolonged droughts or erratic rainfall events. The sample size was statistically determined following Yamane (1967) at a 5 per cent level of precision [equation (1)].

$$n = \frac{N}{1 + N\ (e)^2} \tag{1}$$

Where:
n = sample size;
N = total population of households based on census data (UBOS, 2016); and
e = the level of precision.

The number of households sampled from each ward was proportionately determined based on census data (UBOS, 2016). Consequently, 129 households were sampled in Namatala ward, 79 in Namakwekwe, 58 in Nkoma, 50 in Nabuyonga, 46 in Malukhu, 11 in Boma and 19 in Busamaga west. Closed-ended questions were used because they provide an expeditious instrument for data collection, coding, interpretation, quantification and comparison of outcomes across space (Jones and Tanner, 2015). The data collection tool (Appendix) was pre-tested and consent from the participants was obtained before engaging them in the study. The data collected consisted of perceptions on the severity of prolonged droughts or erratic rainfall events; perceptions on household resilience capacities when faced with prolonged droughts or erratic rainfall events; and household demographic characteristics and social networks.

3.3 Data analysis

Descriptive statistics were used to explore perceptions on the severity of prolonged droughts or erratic rainfall events, resilience capacities and perceived spatial distributions of resilience capacities in the three divisions of Mbale municipality[1]. In terms of inferential statistics, linear regression was used to investigate, which demographic characteristics and social networks are significant predictors of household capacity to prepare, recover and adapt or change when faced with prolonged droughts or erratic rainfall events. This type of regression model was used because the predictor and outcome variables are linearly related[2].

In linear regression Models 1-3 (Table II) the outcome variables were, respectively, the ability of households to prepare, recover and adapt or change their source of income or livelihood if a prolonged drought or erratic rainfall event occurred. The predictor variables were demographic characteristics (i.e. gender and age of the respondent, monthly income of household head, household size, the gender of household head, the ability of a household to meet its daily expenditure needs and education level of the respondent). An interaction effect between income and the capacity of a household to meet its daily expenditure needs is also included. The effect of meeting daily expenditure needs on the ability to prepare, recover and adapt is expected to depend on household income.

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In linear regression Models 4-6 (Table II), the outcome variables were, respectively, the household capacity to prepare, recover and adapt or change while social networks (i.e. networks with friends, relatives, NGO's and government) were added to the set of predictor variables, alongside the demographic characteristics[3].

3.4 Sample characteristics

Households constituted the unit of analysis while the respondents were adult members of the household. The average age of respondents was 34 years of age with a range between 18 to 80 years of age. A slim majority of respondents were male (55 per cent). Next, 45 per cent of respondents had completed secondary education; 21 and 14 per cent had completed primary and tertiary education, respectively; 18 per cent had completed university studies. In terms of occupation, 45 per cent of the respondents were traders, 26 per cent were public servants, 18 per cent were farmers and 18 per cent had no form of occupation. Most households were headed by men (76 per cent). The average household size was five members with a range between 1 to 24 members. In terms of income, 37.5 per cent of respondents earned between $27 and $79 per month, 32.1 per cent earned less than $26, 16.2 per cent earned above $132 and 14 per cent earned $80 to $131. In the industrial division of Mbale municipality, 44 per cent of respondents earned less than $26 per month. Most households in the municipality survive on a daily expenditure of less than $2.6 (59 per cent), 28 per cent spent $2.9-$5, 9 per cent spent $5.5-$8, while only 4 per cent spent above $8.

4. Results and discussion

4.1 Perceptions of households regarding the severity of prolonged droughts or erratic rainfall events

Households were asked to report how serious the problem of prolonged droughts or erratic rainfall events are to their households (Table I). Overall, 63 per cent of respondents reported that prolonged droughts or erratic rainfall events have been a serious problem to their households, while 37 per cent reported that this is not likely to be a serious problem. This finding is likely to reflect the impacts of recent prolonged droughts in 2013 and 2016/2017, which were associated with water scarcity and high temperatures with deleterious impacts on crop yields, and consequently, leading to high prices of agricultural-related commodities (OXFAM, 2017). Similarly, Mohammed *et al.* (2018) reported an increase in prolonged droughts in Ethiopia in the past two decades.

4.2 Perceived capacity of households to prepare, recover and adapt or change

Most respondents perceived their households to be unlikely to prepare (59 per cent), unlikely to recover (53 per cent) and unlikely to adapt or change (56 per cent) their source of income or livelihood when faced with prolonged droughts or erratic rainfall events (Figure 2). This is

Table I. Household perceptions of the severity of prolonged droughts or erratic rainfall events in Mbale municipality from 2013 to 2017 (n = 389)

Response	(%)
Likely to be a serious problem	63
Unlikely to be a serious problem	37
Total	100

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likely to be because of the low socio-economic status of residents in the region and low social service provision (Dobson *et al.*, 2015), which increases the vulnerability of the population. Similarly, Lindsey *et al.* (2018) reported that most of the population in Tanzania was less likely to prepare, recover and adapt to flood events.

4.3 Demographic characteristics and social networks influencing the household capacity to prepare, recover and adapt or change

Linear regressions of demographic characteristics that could be determinants of households' resilience revealed that as household size increases, the household's capacity to prepare decreases (−0.0319**; Table II, Model 4). This finding corroborates with a report by D'Errico and Di Giuseppe (2018), who found that household size is inversely related to household resilience to food insecurity in Northern, Eastern and Central Uganda.

In terms of the interactive effect between income and households' ability to meet their daily expenditure needs and how this influences households' resilience capacities (Table II, Models 1-3), this needs to be interpreted through marginal effects, in this case, the effect of a household's ability to meet its daily expenditure needs on resilience capacities for the different categories of income. Figure 3 illustrates how the marginal effect of a household's ability to meet daily expenditure needs changes with increasing income. The effect is significantly different from zero for low household incomes *vis-à-vis* the capacity to prepare and recover. This implies that the lowest income households are substantially more likely to prepare for and recover from prolonged droughts or erratic rainfall events if the household is able to meet daily expenditure needs[4]. This finding is particularly relevant in this context as the poorest in society are generally the most vulnerable (Eriksen and O'Brien, 2007). Thus, this suggests a more nuanced approach may be warranted concerning arguments that would assume income alone determines the extent of resilience. It is possible that low-income households may be engaged in alternative non-cash activities such as subsistence livestock rearing, subsistence crop farming and other activities, which do not directly translate to income but help the household to satisfactorily meet its daily expenditure needs[5].

Moving on, the results also suggest that gender has a significant effect on households' ability to adapt or change (0.242**) its source of income or livelihood if needed when faced with prolonged droughts or erratic rainfall events (Table II, Model 6). This finding implies that men are more capable of adapting or changing compared to their female counterparts who are in most cases more vulnerable because of their socio-economic and political confines (Shabib and Khan, 2014). In many African traditions, women have less access to

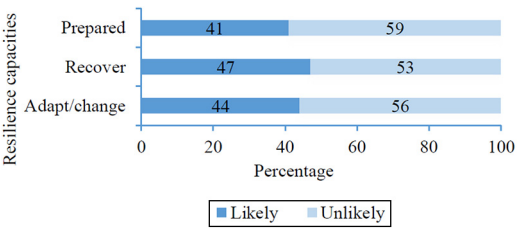

Figure 2.
Household capacities to prepare, recover and adapt or change their source of income or livelihood if needed when faced with prolonged droughts or erratic rainfall events in Mbale municipality in Eastern Uganda (n = 389)

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Table II. Linear regressions exploring demographic characteristics and social networks as determinants of household's capacity to prepare, recover and adapt or change when faced with prolonged droughts or erratic rainfall events in Mbale municipality

	Model					
	1	2	3	4	5	6
Variable	Prepare	Recover	Adapt/change	Prepare	Recover	Adapt/change
Gender	0.0477 (0.0877)	0.133 (0.0993)	0.265** (0.112)	0.0243 (0.0882)	0.0950 (0.100)	0.242** (0.113)
Age	−0.00293 (0.00322)	−0.00530 (0.00361)	−0.00419 (0.00412)	−0.00210 (0.00324)	−0.00413 (0.00363)	−0.00260 (0.00413)
Household size	−0.0342** (0.0140)	−0.0304* (0.0159)	−0.00884 (0.0179)	−0.0319** (0.0141)	−0.0270* (0.0159)	−0.00211 (0.0180)
Household head	−0.0593 (0.0954)	−0.0283 (0.108)	−0.182 (0.122)	−0.0578 (0.0953)	−0.0146 (0.108)	−0.192 (0.121)
Education	0.0374 (0.0422)	0.00928 (0.0477)	0.0103 (0.0544)	0.0396 (0.0423)	0.0181 (0.0478)	0.0255 (0.0543)
Expenditure	0.584*** (0.144)	0.323** (0.161)	0.320* (0.185)	0.552*** (0.145)	0.266 (0.163)	0.243 (0.186)
Income = 1	0.186 (0.124)	0.0481 (0.140)	0.0589 (0.159)	0.205 (0.125)	0.0501 (0.140)	0.0225 (0.159)
Income = 2	0.337* (0.202)	0.0644 (0.224)	−0.00166 (0.256)	0.336* (0.203)	0.0248 (0.226)	−0.0758 (0.256)
Income = 3	0.460 (0.312)	0.286 (0.348)	0.431 (0.424)	0.458 (0.311)	0.308 (0.347)	0.406 (0.421)
Exp × income = 1	−0.386** (0.193)	−0.0362 (0.216)	−0.308 (0.247)	−0.406** (0.193)	−0.0320 (0.216)	−0.241 (0.247)
Exp × income = 2	−0.348 (0.263)	0.150 (0.297)	−0.124 (0.336)	−0.367 (0.267)	0.188 (0.300)	−0.0594 (0.339)
Exp × income = 3	−0.499 (0.344)	−0.148 (0.385)	−0.802* (0.464)	−0.472 (0.344)	−0.149 (0.384)	−0.790* (0.463)
Nets_Friends				−0.0104 (0.0878)	0.00419 (0.0983)	0.0810 (0.112)
Nets_Relatives				0.178** (0.0884)	0.248** (0.0994)	0.147 (0.113)
Nets_NGO				−0.0106 (0.119)	0.0109 (0.134)	0.346** (0.153)
Government				0.179 (0.121)	−0.0348 (0.137)	−0.183 (0.157)
Constant	1.327*** (0.185)	1.457*** (0.209)	1.362*** (0.237)	1.177*** (0.198)	1.265*** (0.225)	1.143*** (0.253)
Observations	383	377	378	383	377	378
R^2	0.107	0.082	0.033	0.125	0.100	0.058

Note: Unstandardized coefficients are reported with standard errors in brackets: ***$p < 0.01$, **$p < 0.05$ and *$p < 0.1$

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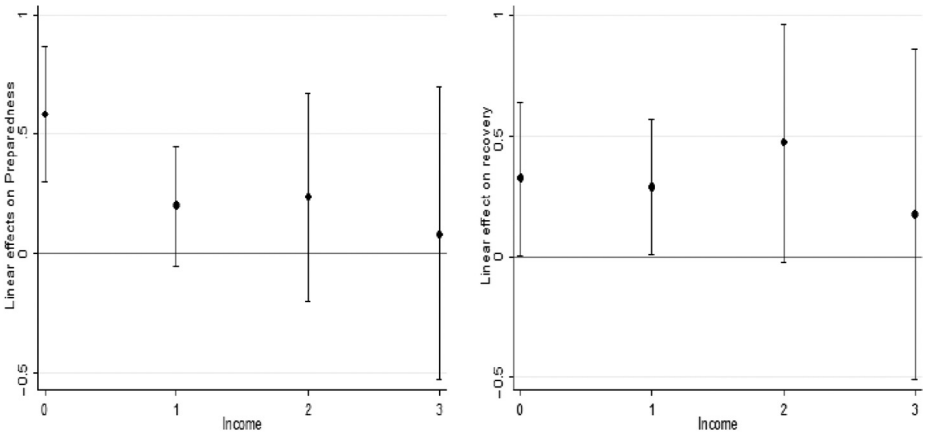
socioeconomic resources, which constrains their ability to adapt. Meinzen *et al.* (2010) reported unequal distribution of assets in developing countries, biased toward men. This renders women less capable of adapting or changing (Resurrección, 2013). This finding is in line with the work by Nabikolo *et al.* (2012), carried out in Eastern Uganda, who revealed a significant influence of gender on adaptation to climate change shocks and stresses.

The age of the respondent, the type/gender of the household head and respondents' level of education had no significant effects on resilience capacities. The insignificance of age deviates from the findings of Bandura (1977), who reported that younger people have a higher level of motivation to act on perceived shocks and stresses and can easily diversify their livelihood activities, and thus, are more capable of adapting compared to older people. Similarly, insignificance in terms of the gender of the household head and respondents' education deviates from the findings of D'Errico and Di Giuseppe (2018), who reported that male headed households and more educated people were relatively more resilient to food insecurity.

Moreover, results show that social networks with relatives have a significant positive effect on the household capacity to prepare (0.178**) and recover (0.248**) (Table II, Models 4 and 5). Aldrich and Meyer (2014) reported that relatives can speed up or improve recovery with financial and non-financial support.

Furthermore, social networks with NGOs (Table II, Model 6) have a significant positive effect on the capacity to adapt or change the source of income or livelihood if needed when faced with climate change shocks and stresses (0.346**). The significant positive influence of networks with NGOs on the household capacity to adapt or change testifies to the positive impact of these organizations in Mbale municipality. Several NGOs operating in the municipality including but not limited to World Vision (which builds schools, toilets, water sources and provides food and education for the vulnerable), Compassion International (which provides school fees, shelter and other basic needs) and Child Restoration Outreach (which helps the vulnerable with meeting basic needs, lends money to women for business purposes, provides art and craft training for women and promotes games and sports). The importance of NGOs suggested by the results resonates with Sadri *et al.* (2017) in Indonesia, who indicated that stronger personal networks with NGOs and relatives positively influence people's resilience capacities[6]. Networks with friends and government did not have a significant effect



Note: No significant effect for capacity to adapt or change

Figure 3.
Marginal effect of household's capacity to meet daily expenditures with increasing income (no significant effect for capacity to adapt or change)

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on household capacity to prepare, recover and adapt. In sum, the results imply that tight horizontal networks (with relatives) are a very important resource for households, while looser horizontal networks (with friends) do not appear to affect resilience significantly in Mbale municipality. Vertical ties that link households to NGOs can contribute positively to household resilience, particularly when it comes to assisting households to adapt to climate-related hazards, as they may not be capable to do so by themselves. In contrast, networks with the government do not appear to have been beneficial to household resilience in the present case. This could be due to an overall lack of ties with the government, but cannot be fully explained given the nature of the survey instrument and the questions included therein.

4.4 Spatial distribution of perceived household resilience capacities in the three divisions of Mbale municipality

Assessment of resilience capacities in the three divisions (Figure 4) revealed that most households in Wanale division perceived themselves to be likely to be well prepared (73 per cent), compared to 43 per cent of households in Northern division and 34 per cent of households in the industrial division. In total, 80 per cent of households in Wanale division perceived themselves to be likely to recover compared to 48 per cent of households in Northern division and 40 per cent of households in industrial division. In total, 50 per cent of households in Wanale division were likely to adapt or change their source of income or livelihood compared to 46 per cent of households in Northern division and 41 per cent of households in industrial division. Therefore, a greater proportion of households in industrial division perceived themselves to be unlikely to prepare, recover and adapt compared to their counterparts in Wanale and Northern divisions. This indicates a spatial differentiation of resilience capacities across Mbale municipality. This could be because the majority of households in industrial division are of low-income and composed of a high number of in-migrants driven by aridity from Karamoja sub-region in the North-Eastern part of Uganda. The fact that a greater proportion of households from Wanale division perceived themselves to be likely to prepare, recover, and adapt or change could be because a high proportion of households in Wanale division are high-income earners, and hence, likely to have the resources needed for preparedness, response and recovery.

5. Conclusions and recommendations

Findings suggest that prolonged droughts and erratic rainfall events are a serious problem for households in Mbale municipality. Indeed, most households perceived themselves to be

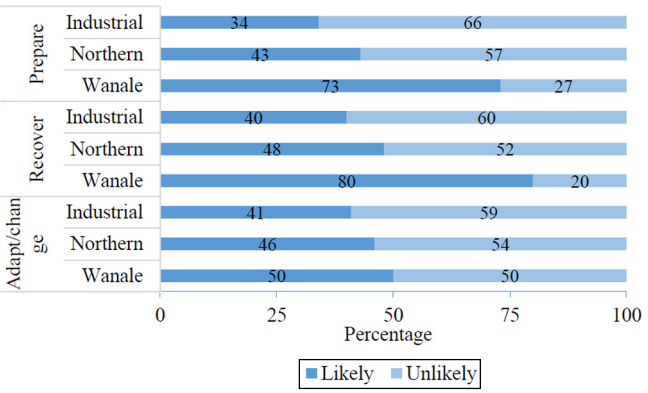

Figure 4. Spatial distribution of perceived household resilience capacities in the three divisions of Mbale municipality in Eastern Uganda (n = 389)

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unlikely to prepare, recover and adapt or change in the face of prolonged droughts or erratic rainfall events. This finding is inextricably linked to the low socioeconomic status and low level of development in the region and there is thus a need for government and households to scale up strategies to enhance resilience capacities.

Results imply that a mixture of demographic and social factors can explain the variance in household resilience capacities when faced with prolonged droughts or erratic rainfall events. Gender has a significant effect on the household's ability to adapt or change, whilst household size better explains the capacity to prepare. The ability of households to meet their daily expenditure is particularly important for low-income households (below $80/month for recovery and below $26/month for preparedness) and can have a substantial effect on household capacity to prepare and recover, which thus offers a more nuanced approach to arguments that would assume income alone decides over the degree of resilience. Social networks with relatives had a significant effect on the capacity to prepare and recover, while networks with NGOs exhibited a significant effect on household capacity to adapt or change.

Furthermore, households in the industrial division perceived themselves to be the least resilient compared to households in Northern and Wanale divisions. Thus, there is spatial heterogeneity across the municipality in terms of likelihood to be resilient.

Based on the findings in their totality, salient recommendations for policymakers and practitioners include encouraging small household size and activities that can boost households' abilities to meet their daily expenditure needs so as to increase their resilience capacities. Furthermore, the importance of social networks implies that policymakers and practitioners should promote social networks that shape household resilience to enhance preparedness, recovery and adaptation. In addition, the spatial heterogeneities in resilience capacities revealed by the results suggest a need for policymakers to direct more resources to parts of the municipality with low resilience.

Finally, the study tested the demographic and social factors that influence household resilience capacities. It provides insight into what factors may be most relevant to investigate further in future research. Future work needs to continue using multi-dimensional approaches to systematically investigate and understand household resilience to climate-related shocks and stresses in Uganda and in other developing countries that are exposed to similar climate-related hazards.

Notes

1. Pearson's correlation was used to quantify relationships between capacities to prepare, recover and adapt or change. Positive, but not strong, associations were revealed in all cases ranging from 0.465 between the capacity to prepare and recover through to 0.136 between the capacity to recover and adapt or change.
2. Where applicable, baselines in all models are formed by the lowest value of the variable scales.
3. To test the robustness of the linear regression results, a logistic regression model was estimated with a dichotomous variable (unlikely/likely) for all three resilience capacities. This is because the logistic regression model circumvents potential restrictions of linear regression with scales that are not metric. Additionally, other regression models were estimated without households' ability to meet their daily expenditure included as a predictor variable. This was undertaken to explore whether monthly income is significant in influencing resilience capacities.
4. For higher income categories, the household's ability to meet its daily expenditure needs has an insignificant effect. This could be explained by the fact that prices increase dramatically during droughts, implying that households may not be able to meet their daily expenditures needs when faced with such events, but they are able to do so under normal conditions. This complication could not be

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taken further into account in this study, but future research along those lines would be interesting and fruitful.

5. When households' ability to meet their daily expenditure is not considered in the model, monthly income has a significant positive effect on household capacity to prepare (0.120***) and recover (0.116***). This suggests that high income households have more capacity in these respects than low-income households.

6. Logistic regression of demographic characteristics and social networks that influence resilience capacities showed similar findings except for the significance of gender in household capacity to adapt or change and networks with relatives for household capacity to recover.

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Appendix. Household interviews: preamble and questions

Dear respondent,

This questionnaire is designed to generate information for a study on demographic characteristics and social networks as determinants of household resilience to prolonged drought or erratic rainfall in Mbale Municipality in Eastern Uganda. It will be used strictly for research purposes and the information gathered will be kept confidential. We kindly request your time to answer the questions that follow and thank you for you cooperation.

1. Locational/Spatial Information: Division……, Parish ……
Ward …….
GPS coordinates: Northing…… Easting……,
Elevation…….

Section A: Household characteristics

2. Household type (1) Male headed (0) Female headed
3. In which monthly income category do you fall (in UGX)? (0) Less than 100,000 (1) 101,000-300,000 (2) 301,000-500,000 (3) 501,000 and above.
4. Is your household able to meet all the daily expenditure needs of its members? (1) Yes (0) No.
5(a). How many people are in your household? ..... (b) What is your age? .....
(c) What is your gender[2]? ....., marital status[2]? ....., highest education level[4]? ……

Section B: Household resilience capacities against prolonged droughts and erratic rainfall events.

6. If a prolonged drought or erratic rainfall event occurred, how likely is it that your household would be well prepared in advance? (0) Not at all likely, (1) Not very likely, (2) Very likely, (3) Extremely likely.
7. If a prolonged drought or erratic rainfall event occurred, how likely is it that your household could recover fully within 6 months? (0) Not at all likely, (1) Not very likely, (2) Very likely, (3) Extremely likely.
8. If prolonged droughts or erratic rainfall events became more frequent, how likely is it that your household could change its source of income or livelihood if needed? (0) Not at all likely, (1) Not very likely, (2) Very likely, (3) Extremely likely.
9. In the past 5 years, how likely a problem has prolonged droughts or erratic rainfall events been to your household? (0) Not at all likely, (1) Not very likely, (2) Very likely, (3) Extremely likely.
10. Which of the following are sources of help to your household during times of hardship caused by prolonged droughts or erratic rainfall events? (a) NGOs, (b) Friends, (c) Relatives, (d) Government (local, regional, and/or central government)

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