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Original Research Article

The Nexus between Socio-economic Factors and Coping with Effects of Climate Change Related Disasters on the Environment in Kisumu County

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Abstract

Floods and drought affect households in lower Nyando river basin in a cyclical pattern almost every year. Each flood event is almost always followed by a drought event whose impacts include not only loss of lives, displacement of people and infrastructural damage, but also erode the soils' and waters sources' potential to sustainably supply goods and services to the households. This study explored the influence of social factors on coping with effects of Climate Change Related Disasters (CCRDs) namely Floods and Drought on the environment (soils and water sources). Data for the study was collected through a survey of 374 households, Key informant interviews and observations. The target population was 64,103 and sampling unit were the household Heads. Data on socio-economic factors and coping mechanisms of the households was collected. Data processing and analysis was conducted using descriptive and inferential statistics. T-test and Multiple regression tested at alpha p < 0.5% were used to correlate socio-economic factors with coping of households. Most households were found to engage in multiple coping activities at different levels of intensity. Coping mechanisms that constitute Conservation Agriculture scored lower means. Further, coping mechanisms on common (shared) natural assets also ranked lower than those on individual assets. Gender (sex) (t = -2.299, p = .022) and age 56 – 65 years (t = -3.910, p = .000) and 66 years (t = -2.473, p = .014) and above age groups significantly influenced coping of households. However the level of education and farm size had no significant influence on coping. Coping capacity of households was significantly different across wards (p = .027). The study recommends location specific interventions and enhanced extension services to the community to create awareness on the impact of CCRDs on the environment and disseminate information on sustainable coping options. Socio-economic factors need to be given due consideration when designing policy which would resilient-proof the natural assets and households.

Keywords: Resilience Climate Change Related Disasters (Floods and Drought), Coping, Impacts, Influence

INTRODUCTION

Studies have shown that about 90% of all natural disasters that afflict the world are related to severe weather and extreme climate events. GoK (2007); IPPC (2007) and IGAD (2007) amongst others recognize the increased risk of floods due to climate change and increased climate variability such as El Niño in poor developing countries. Rojas *et al.* (2014) and Mabe, Sarpong and Osei-Asare (2012), reiterate that the increase in the frequency of climate change extreme events such as droughts and floods has increased the pressure on water and arable land, two critical inputs in agricultural production. If not mitigated, floods and drought can have devastating effects on the environment with subsequent undesired impacts on the livelihood of

the indigenous population and also undermine development efforts in the region (Bosque, 2008). Mitigation comprises coping mechanisms, which even though described as short-term responses to survive the immediate prevailing challenging situations, could as well be demonstrated as adaptation strategies when they become the normal way of sorting out the problem at hand (Mutekwa, 2009). The impact of climate change depends as much on socioeconomic vulnerability as on biophysical exposure. (Tubiello and Fischer, 2007) report that biophysical impacts are superimposed on existing vulnerabilities determined by socioeconomic factors such as an individual's age, gender which work in concert with other factors that will help build local resilience.

The problem

In the lower river Nyando basin, it is suspected, the traditional nature-based livelihoods are under threat from effects of CCRDs. Weak coping mechanisms, poor adaptive capacity, inadequate preparedness, and cultural attributes could be contributors of reduced resilience to CCRDs. Few studies have been conducted to determine how socio-economic factors influence the coping mechanisms employed by households in dealing with impacts of floods and drought on soils and water sources which are the bedrock of their livelihoods. This paper identifies the interventions households use to mitigate impacts of floods and drought on the soils and water sources and goes on to explain how the socio-economic factors influence the coping interventions.

Objectives

The broad objective of this study is to examine the how socioeconomic factors influence coping with the effects of Climate Change Related Disasters namely floods and drought on the environment (soils and water sources) in Lower Nyando river basin, Kisumu County, Kenya. This objective was addressed through two specific objectives:

1. To establish how households cope with impacts of CCRDs on the environment in Nyando and Lower Nyakach Sub Counties, Kisumu County.
2. To explain the influence of Socio-economic factors on coping with effects of CCRDs on the environment by households in Nyando and Lower Nyakach Sub Counties, Kisumu County

Literature Review

The observed changes in climatic conditions over the past 30 years are clear on every continent. All the key indicators of climate change, including sea-level rise, temperature and drought days, are expanding outside the normal ranges of frequency, intensity and location (Nolan and Smith, 2015). Recent extreme weather events such as hurricanes in the United States, floods and storms in Europe, typhoons in Asia, droughts in Africa, and bushfires in Australia have served to remind us of the impacts of climate change and in many cases, highlighted shortcomings in preparedness and disaster response (Ibid). Locally in Kenya, climate change has manifested variously with resultant negative effects on community livelihoods. The communities affected resort to local solutions to cope. In the Lake Victoria basin there has been a major flood annually or biannually since 1982, suggesting that the flood situation is worsening (Ongwenyi et al., 1993). Drought on the other hand is a slow onset phenomenon which manifests in water deficit both for agricultural and for domestic use (Obiayo, Stanley and Charles, 2016). The need to resilient-proof livelihoods in the face of climate change is therefore a reality. This section highlights the effects of floods and drought in the study area, coping mechanisms and social factors influencing coping.

Effects of Floods and Drought in the Study Area

Effects of CCRDs range from socio-economic, environmental, physical and ecological. In 1997/1998, the El Niñ o-associated floods affected many parts of Kenya, causing destruction to property, loss of lives, famine and waterborne disease epidemics. In recent years, floods in the Nyando river basin have resulted in negative impacts, ranging from loss of human lives and livestock to widespread destruction of crops, houses, public utilities and disruption of various economic activities (Nyakundi *et al*., 2010). Obiayo *et al*., (2016) reported that floods wrecked havoc on the maize and bean crops leading to food insecurity, school children were unable to go to school as they schools were flooded and hence inaccessible, more people accessed water from open sources posing health risks and inadequacy of sanitation facilities and most were rendered homeless as their shelters were destroyed. A study conducted by Masese, Neyole and Ombachi, (2016) on the impacts of floods on education, sanitation and flood induced health problems in lower Nyando river basin, revealed that floods interfere with education systems and cause overwhelming psycho-social effects, water-borne and respiratory illnesses. Sanitation facilities became unusable during and after floods. The focus of these studies have largely been on effects of floods on crops and shelters but few if any have addressed the influence of floods on soils on water sources, which is the bedrock of the livelihoods. A soil survey carried out in Kenya revealed that in Nyando Sub County the soil organic matter content ranges from low (1.16% Total Organic Carbon (TOC)) to adequate (3.66% TOC) (NAAIAP, 2014). 92% of farms have TOC below adequate level and, therefore, low soil organic carbon

matter content. The report further states that the low soil organic matter content results in low water holding capacity and may lead to soil erosion by runoff water during the rains(Ibid).

Drought on the other hand manifests as a deficiency in precipitation over an extended period, usually a season or more, resulting in water shortage causing adverse impacts on vegetation, soils, water sources, animals and/or people (NCCRS, 2010). Below normal precipitation has resulted in drought in Nyando river basin leading to immense negative effects in the basin such as decreased water volume in rivers, dry wells, death of livestock and loss of livelihoods dependent on water (Nyakundi *et al.,* 2010). Soil moisture essential for microbial activities and crop production, is reduced in drought conditions (Mabe *et al.,*2012) and consequently there is minimized organic activity and continued dry spell which kills soil organisms. The end result is dry and cracked soil and it even becomes easier for desertification to set in. Drought also makes it unsuitable for plants and vegetation cover to survive leading to bare soils susceptible to both wind and water erosion. Badly eroded soils lose all topsoil and some subsoil rendering the farmlands unproductive (Smith, Eldon and Bradley, 2000). Water access and quality issues have remained a thorn in the flesh to residents of Nyando district especially during the long spells of drought (Nyakundi,2010). The situation is not abating soon with Recha, Gachene and Lieven (2017) projecting that in the years 2030-2050, there will be an increase in soil moisture stress in Nyando due to high evaporation as a result of increase in daytime temperatures. The dilemma of which is a better evil of the two could not have been captured better in the words of one old lady in Kombura location.

"When the floods come, it's fury is great: there is water all over, you can hardly find dry wood to cook with. It carries all and sundry in its path, soaks and destroys stored grains, renders people homeless, washes away toilets and gives way to diseases. But the drought is no better; it heats up the core of your head to the point of cooking your brain and not an iota of green blades to assuage the vast dry, dusty and cracked soils".

It is therefore imperative that, the impacts of CCRDs on the environment, if not addressed adequately could compromise the productivity and health of the productive assets with subsequent impacts on the users.

Coping with effects of Floods and Drought

Daniel (2011) attempts to formalize the theory of resilience and ascertained that resilience is dependent on a coping strategy. However, not all coping mechanisms are productive. Some coping practices could also be erosive with consequent serious implications on community livelihood security (Opondo, 2013).The coping strategies employed by flood prone communities in Budalangi district of western were potentially counter-erosive in nature destroying household assets base and ultimately leading to increased vulnerability to future floods. Such strategies included sale of property, extra income-generating activities, modified food consumption, and reduced expenditure on household requirements, migration and temporary relocation. Masese *et al.* (2016) found out that the strategies adopted by communities in flood prone areas of Nyando basin were short term and could lead to unsustainable present and future livelihoods for residents of flood-prone areas. Nyakundi *et al.* (2010), observes that at present, most of the efforts of those concerned with disaster management in the then Nyando district were focused either on emergency health preparedness or post-emergency relief. Little has been done to embed sustainable practices into the communities with a view to building resilience. They recommended a shift in the national and international mindset, from reaction and charity to anticipation and pre-emption. She further notes that the community should be encouraged to understand the importance of global climate and improve their indigenous coping strategies since climate change is likely to exacerbate the impacts of floods and increase the vulnerability of communities.

Coping therefore requires an intricate balance of choices versus the outcome. This can only be achieved by in-depth scrutiny of how socio-economic factors influence coping strategies. Even though much work has been done on effects of floods and the coping interventions engaged in the study area, the focus has largely been on effects on the built infrastructure and less on the natural capital (soils and water sources). This has attracted technological and behavioural solutions with little attention being paid to interventions on soils and water sources and how social factors influence coping.

Socio-economic factors and Coping with effects of Climate Change Related Disasters

Social factors can be described as those factors that relate to the individual by virtue of gender, location, livelihood and day-to-day interactions with his/her environment. Social characteristics have been found to influence coping to a great extent (Béné *et al*., 2016). Whereas socioeconomic variables, such as income, education, and age, will not influence the occurrence of climate extremes, they can impact the way populations are able to prepare for, withstand, and recover from the impacts (IPCC 2012a). Existing socio-economic conditions vary from one person to the other and therefore a disaster can lead to different outcomes even for demographically similar communities.

Gender is not merely a variable that assesses the differences between men and women in the wake of

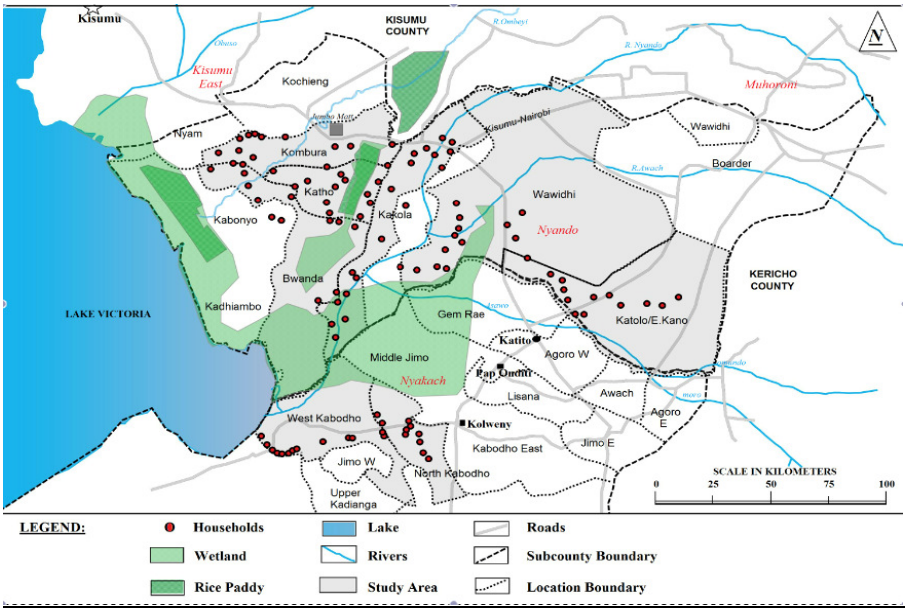

Figure 1. Map of the study area: Source: Author.

disasters. It also refers to how living conditions, demographic and economic attributes, behaviors and beliefs reflect gender power relations (Cvetkovic´ *et al.* 2018). In order to test the central hypothesis of which gender is a predicting variable in all the stages of the disaster cycle in Serbia, Cvetkovic´ *et al.* (2018) reported that gender (β = –0.143) was the most important predictor of individual preparedness. On the other hand, a multivariate regression with flood risk map knowledge information showed that the most important predictor was educational level (β = –0.078).

Béné *et al.* (2016) concluded that wealth is an important factor in the recovery process of households affected by shocks and stressors because wealth confers households indirect consequences of improved income/assets e.g. more travel and exposure to ideas and information, better social status and a more influential voice in the community, or even more self-confidence. Gender and religion shape access to different sources of information and therefore affect men and women differently in their abilities to adapt to climate change while investigating the role that gender plays in adaptation actions in Africa (Twyman *et al. (*2014). Thus, the study of climate change and its impacts on natural systems is inadequate in the face of questions about societal capabilities to cope with or adapt to these effects, their vulnerability, resilience, and adaptive capacity (Malone, 2009).

The study area

The study area is located in lower Nyando river basin that traverses both Nyando and lower Nyakach sub-counties of Kisumu County. The Nyando River Basin covers an area of 3,500 square kilometers in Kisumu County. The Nyando River catchment straddles the equator bound by longitudes 34°45' 0"E and 35° 21"E. It borders the Winam Gulf, a protruding part of Lake Victoria, at the end of which is Kisumu Town. The Nyando river catchment empties its water into Lake Victoria. It is notorious for frequent flooding. Available data suggest that progressively greater flooding is being caused by smaller flow in the rivers concerned (Opere, 2013). The Nyando river basin experiences a bimodal rainfall pattern with long rains in March-May and short rains in September-October. The annual rainfall varies from more than 1,100 mm to 1600mm with a minimum and maximum mean monthly rainfall of 72mm and 243 mm respectively (JICA, 1992 in Raburu., *et al.,* 2010). Vertisols are the dominant soil types (Ocholla, 2010). Households display a high degree of poverty and low incomes. The main occupation of a majority, is subsistence farming (Nyakundi *et al.,* 2010). A map of the study area is shown in figure 1.

METHODOLOGY

The study adopted a descriptive survey research design, targeting a population of 64,031 and an accessible population of 14,675 households with a sample size of 374 households. The sample unit was the household heads (HHHs). Stratified sampling was used to select two divisions that are prone to both floods and drought from Nyando and Nyakach Sub-counties. Proportionate sampling was then used to ensure appropriate sample size from each division. Finally systematic sampling was used to select households where a household was picked

after every 3 households. A census method was used to sample all the 13 key informants who were identified were. Observations made and were necessary photographs were taken.

Data Analysis

Data processing and analysis was done using Statistical Package for Social Sciences (SPSS version 20) computer system. Descriptive statistics and inferential statistics were used to analyze the data.

RESULTS AND DISCUSSIONS

Objective 1 sought to establish how households in Nyando and Lower Nyakach Sub Counties, Kisumu County, Kenya cope with impacts of CCRDs (floods and drought) on the environment (soils and water sources). Households were found to engage in a number of coping mechanisms to deal with impacts of CCRDs on soils and water sources. The mechanisms range from simple day to day activities like treating drinking water, draining waterlogged soils, mulching, paddocking, moving to wetlands to graze, deep ploughing, planting cover crops, planting drought resistant varieties to more complex and long term initiatives like construction of check dams, agroforestry, protecting water sources, rehabilitating damaged river banks and building gabions. All the initiatives are applied at different levels dependent on resource availability and prior experience of their success levels. The means for coping with impact of floods on soils, floods on water sources, drought on soils and drought on water sources were 2.98, 3.01, 2.87, 3.07 respectively. These means were then compounded to form a coping index which was found to be M=2.84 (table 1).

The study also revealed that interventions that stand to benefit individual households by virtue of ownership or proximity to the water source and where failure to take action would render them more vulnerable were more popular as opposed to interventions that would potentially benefit communal interests e.g. rehabilitating damaged river banks, restricted abstraction and restricted grazing in wetland. A possible explanation to this is that individual interests supersedes communal interests and therefore individuals perceive common property as collective responsibility hence few people would be moved to protect an asset for the common good. From the findings, households engage a portfolio of responses in the face of CCRDs, similar to the findings of Béné *et al.* (2016). The availability and capacity to engage a variety of coping options in the face of disturbances, is a positive indicator of resilience. This has been proven by to be true from other studies (Masese *et al*., 2016).

From the results, mean coping value of drought on water sources was highest followed by that of floods on water sources, floods on soil sources and least was drought on soil sources. It can also be inferred that coping with impacts of CCRDs on water sources (M=3.07 and M=3.01) is better than coping with impacts of CCRDs on soils (M=2.98 and M=2.87). This implies that the households' options of coping with impacts of CCRDs on water sources are more elaborate or intensive than those for coping with impacts of CCRDs on soils. Extension services targeting soil health therefore need to be intensified. Surprisingly, a respondent in Wawidhi location was of the view that they are better placed to deal with floods than with drought.

"we are used to the floods and have devised ways of coping, but drought is still a mountain to climb".At least with floods, water is there in plenty and food is not scarce but with drought, neither food nor water is available".

Probably the subjective perception that floods are manageable has been reinforced by experience(Parsons *et al.,* 2015) and the short-term gains of cultivating riverbanks is illusionary. Besides, drought unlike floods has not received as much attention in this study area since the magnitude is incomparable to drought incidences that ravage the Arid and Semi-Arid Lands of Kenya. From the findings, households engage a portfolio of responses in the face of CCRDs, similar to the findings of Béné *et al*., (2016). The availability of and capacity to engage a variety of coping options in the face of changes is a positive indicator of moderate resilience. This has been proven to be true from other studies (Masese *et al.,* 2016). However, it will be noted that Soil and water conservation strategies, despite their potential effectiveness in addressing some of the challenges of climate change, require much labour and appropriate training of extension workers and farmers (Mutekwa, 2009). For instance, building gabions is both labour intensive and expensive and so is irrigation. Households in the study area may therefore not be in a position to adopt these. The effectiveness of the mitigation measures varies depending on soil and weather conditions as well as according to specific characteristics of the different productive systems (Rojas *et al.,* 2014).

Further analysis of data revealed a significant effect in coping between divisions/wards ($p = .027$) as in table 2. According to key informants, extension services are weak and therefore people tend to copy what others are doing not taking cognizance of the locational disparities. This could explain the disparity in coping capacity between divisions/wards. Efforts therefore need to be made to ensure that location specific interventions are adopted based on the perceptions and ability of the targets to adopt them. Extension services need to be strengthened and riparian law enforced.

Table 1. Coping with impact of CCRDs on the environment Index

Scale	N	Mean	SD
Coping with effect of floods on soils index	327	2.98	0.94
Coping with effect of floods on water sources index	323	3.01	0.81
Coping with effect of drought on soils index	326	2.87	1.01
Coping with effect of drought on water sources index	326	3.07	1.00
Coping with impact of CCRDs on the environment index	342	2.84	0.90

Table 2. Differences in Coping with Impact of CCRDs in the Environment by division

Scale	Sum of Squares	Df	Mean Square	F-ratio	p-value
Between Groups	5.869	2	2.935	3.643	.027
Within Groups	273.112	339	.806		
Total	278.982	341			

Table 3. Multiple regressions between socioeconomic factors and Capacity of Households to Cope with Impact of CCRDs

Model	Unstandardized Coefficients		Standardized Coefficients	t-value	p-value
	B	Std. Error	Beta		
(Constant)	2.962	.134		22.088	.000
Gender dummy	.239	.104	.131	2.299	.022
35 years and below dummy	-.182	.172	-.063	-1.058	.291
36 - 45 years dummy	-.135	.130	-.066	-1.033	.302
56 - 65 years dummy	-.587	.150	-.242	-3.910	.000
66 years and above dummy	-.390	.158	-.165	-2.473	.014
Did not go to school dummy	-.175	.273	-.037	-.640	.523
Lower primary school level of education dummy	-.211	.183	-.065	-1.149	.251
Secondary school level of education dummy	.144	.116	.073	1.245	.214
Tertiary level of education dummy	.067	.169	.023	.398	.691
Farm size	-.007	.033	-.012	-.216	.829
$r = .286$, $R^2 = .082$, $F(10, 327) = 2.922$, $p = .002$					

Objective 2 sought to explain the influence of socioeconomic factors on Coping with effects of CCRDs on the environment by households in Nyando and Lower Nyakach Sub Counties.

The social factors considered in addressing this objective were gender (sex), age, level of education and the farm size owned by the respondents. Out of 347 household heads, 58.2% were of the male gender and 41.8% female. The sample had more men household heads compared to women. This community is polygamous and by the social construction, one household could have many women married to one man. Most households are therefore headed by men unless in situations of widowhood and rare cases of divorce (personal observation). The majority of the household heads (54.1 %) were between the ages 36-55 which is age at which most men have moved out of their fathers' homes and established their own homesteads as per tradition (personal observation). Most of the respondents had a minimum upper primary level of education, (46.7%) followed by 29% who had minimum secondary education. In terms of farm sizes, majority (61.3%) of the household heads had farm sizes of 2 acres and below.

In order to determine the influence of socioeconomic factors on coping capacity of households to effects of CCRDs, multiple regression analysis was done. The results are displayed in table 3.

The results displayed a positive relationship ($r = .286$) between the socioeconomic factors and capacity of households to cope with impact of CCRDs. All the factors had no significant influence on the outcome except gender ($t = -2.299$, $p = .022$), 56 – 65 years ($t = -3.910$, $p = .000$) and 66 years ($t = -2.473$, $p = .014$) and above age groups. The social factors accounted for 8.2% ($R^2 = .082$) variation in capacity of households to cope with impacts of CCRDs. The explanatory variables had a statistically significant effect on capacity of households to cope with impact of CCRDs. $F(10, 327) = 2.2.922$, $p = .022$. These findings resonate with those of Twymann *et al.* (2014)insinuating that women in Nyando, are more likely to have learned and adopted coping mechanisms through experience compared to men due to more engagement on farm agricultural activities hence higher coping capacity. Béné *et al.* (2016) cited experience as one of the subjective factors that influence responses to impacts of particular events at the individual, community and

societal levels in communities. Their study concluded that resilience is socially constructed and as such gender would play a big role. Negative correlation between age and resilience was also reported by Béné *et al.* (2016) who argued that being young might be an advantage in adapting and in this case coping with CCRDs since young people have less social, familial and financial commitments than older households, a factor which can be decisive in the context of adaptation/transformation to change. In the case of Nyando river basin, the older the farmers, the less their capacity to cope hence the negative coefficients. This is practical given that the more elderly people may lack the energy and agility to try out many coping strategies unlike the younger people. These findings contradicted those of Mardy *et al.* (2018) who found a positive correlation between age and drought coping strategies imputing that as farmers age, they were more likely to practice drought coping strategies. They opined that the older farmers possess a higher level of knowledge regarding CC and drought through their own dealings and experience.

Farm size had no significant influence on coping capacity. These results contrast with other studies. For instance Mardy *et al.* (2018), found out that farm size amongst other variables was significantly associated with the choice of coping strategy that the farmers employed. They argued that that some crop-based coping strategies require a larger farm size hence farm size influenced farmers' choice of which drought coping strategies to use. Oluoko-Odingo (2004) on the other hand, found a negative correlation between farm sizes and food crop production. She attributed this to land fragmentation. According to her, small farm sizes are uneconomical since so much effort is put in it in terms of labor and inputs and yet the harvests are minimal.

This study, just like that of Béné *et al*., (2016) found no significant relationship between the education level of the household head and household resilience. Education level did not have a significant effect on coping capacity. This could be attributed to the fact that education does not necessarily translate into assets that can be mobilized to cope with floods or drought. In any case, the majority of household heads interviewed had primary level of education. Key informants admitted conducting very little education on management of effects of floods and drought on soils and water sources. This is exacerbated by the fact that, the line Ministries of Agriculture, water, irrigation and health at the ward level are grossly underfunded since the promulgation of the new constitution in 2013, which saw devolution of services to county level take root. Since then, extension services have been totally crippled. Adult education and learning is therefore not provided for in the study area and dissemination and uptake of new techniques and technology that would mitigate the CCRDs are wanting. Okayo *et al*. (2015) also established that educational level did not influence high uptake of precautionary measures against floods in Nyando Sub-county. They attributed this to complacency of the community to flooding and its effects as long as they get relief food distributed to them. Extension services need to be revived and soil and water management should be given prominence.

CONCLUSIONS

This paper investigated the influence of socioeconomic factors on coping of households with effects of CCRDs (floods and water sources) on the environment (soils and water sources) in lower Nyando river basin, Kisumu County. From the findings, households in the study area engage multiple interventions to cope with floods and drought impacts on the soils and water sources. The study also established that coping interventions that can be undertaken by households directly are more popular compared to coping interventions that require collective responsibility or communal effort. This means that policy targeting climate change adaptation should promote both individualism and collectivism. Communal approach should be enhanced, as this is likely to have a greater impact on the shared resources. Considering that land, though individually owned and managed, is contiguous, practices on neighbouring parcels would impact on the larger landscape. The same applies to water sources that are communally owned. Further, individual interventions are carried out at small scales depending on individual biases and capacity. There is need to upscale the coping interventions in order to realize community adaptation to impacts of CCRDs. The coping capacity is also affected by poor extension services. Extension service are not prioritized by the county government and hence no funding given to the line ministries for this activity. Consequently, households are not equipped with the requisite current information, knowledge, skills and technology to surmount climate related challenges facing their environment. This may compromise livelihoods and health of the community members. Law enforcement on observation of the riparian boundaries is also weak and therefore riparian lands are not protected from human activity rendering them more vulnerable to CCRDs.

Age and gender (sex) influence coping. Women seem to be more flexible in terms of enacting interventions as opposed to men yet men mostly own land. The study also revealed that the older the respondents, the less their capacity to cope hence the negative coefficients. This is practical given that the more elderly people may lack the energy and agility to try out many coping strategies unlike the younger people. Coping mechanisms therefore ought to be gender sensitive. Policy should provide for gender differences.

RECOMMENDATIONS

1. Socioeconomic factors should be considered when formulating policies that aim to build resilience in the community to impacts of CCRDs on the environment.
2. The coping mechanisms should be upscaled to embrace collectivism in management of disasters that affect common resources like water bodies and sometimes land.
3. Extension services need to be revived and soil and water management should be given prominence in a bid to enhance the coping mechanisms.
4. Initiate Payment for Environmental Services (PES) Scheme in the upper catchment where upstream users (catchment) are given incentives to engage conservation activities that would in turn benefit downstream users
5. Enhance law enforcement to comply with observation of the riparian land limits.
6. Conservation Agriculture should be promoted as an adaptation to climate change.
7. Further studies could explore the impact of the other socio capitals dimensions for example income, type of landuse, social organizations amongst other in resilience studies in this area.

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