© 2016 IJSRSET | Volume 2 | Issue 6 | Print ISSN: 2395-1990 | Online ISSN : 2394-4099
Themed Section: Engineering and Technology

The Influence of Community Participation in Management of Water Shed as a Flood Mitigation Strategy on Household Livelihood in Nyando Flood Plains, Kisumu County

Ombati Susan Moraa*[1], Raphael Nyonje[2], Dorothy Ndunge Kyalo[3]

[*1]PhD candidate, Department of Extra-Mural Studies, University of Nairobi, Box 30197-40100
[2]PhD, Senior Lecturer, Department of Extra-Mural Studies, University of Nairobi, 30197-40100, Nairobi-Kenya
[3]PhD, Senior Lecturer, Department of Extra-Mural Studies, University of Nairobi, 30197-40100, Nairobi-Kenya

ABSTRACT

The purpose of this study was to establish the extent to which community participation in management of water shed as a flood mitigation strategy influence household livelihood in Nyando flood plains, Kisumu County. The study used a descriptive survey design with a sample of 370 households obtained through random sampling and 15 key informants selected purposively who were administered with questionnaires and interviewed respectively. The questionnaire was tested for reliability using Cronbach alpha giving 0.929 as the alpha co-efficient thus considered reliable. Data was analysed using descriptive statistics: frequency, percentages, means and standard deviation as well as regression analysis as inferential statistics. The study found that there is a statistically significant relationship between Community participation in Management of Watershed and household livelihood ($r = 0.653$; $p = 0.000$). Further, the study established the Community Participation in Management of Watershed explains up to 42.7% ($R^2 = 0.427$) of variance in household livelihood for residents of flooding areas. The study concludes that communities should be encouraged to take part in management of watershed as flood mitigation strategy to improve their standard of living and mitigate the effects of floods.

Keywords : Community Participation, Management of Watershed, Household Livelihood, Flood Mitigation Strategy

I. INTRODUCTION

For many decades now, floods have been the most common natural disaster causing a lot of natural disaster fatalities in the world [1]. [2] Floods claim more lives and damage properties than any other natural disaster. Floods presently affect an estimated 520 million people per year in the whole world, resulting in estimates of up to 25,000 annual deaths, people left without homes, flood related diseases, crops and livestock damage [3]. Halving poverty by 2015 has not been achieved due to floods which take back years of development hence a challenge in the achievement of the Millenium Development Goal (MDGs) [4].

Flood in Kenya has been occurring every year, hence slowing down development and costing the government a lot of money in ensuring the communities are resettled and supported in terms of relief. However, although all East African countries have flood mitigation policies, their laws are still raw in terms of formulation and implementation [5].

A watershed is the land area drained by a river/ stream system. Rain falling from fields, forests, rooftops, parking lots and street flows towards a lake or river forms a watershed however human activities on land have a direct and cumulative impact on water and other natural resources within a watershed. A watershed is also called a drainage basin or a catchment area. An

area in which water flowing into, it goes to a common outlet [6].

Watershed management as a mitigation strategy in the flood plain involves construction of contour bunds, graded bunds, field bunds, terraces building and furrow practice. Also improving soil health, increasing soil structure, ground water recharge, construction of check dam, farm bond and gully control structure. Watershed determines social- political ecological entity which plays a crucial role in determining food, social and economical security and provides life support services to rural people. Watershed management is therefore an effective tool for addressing many of these problems in flood prone areas to improve livelihood. People and livestock are the integral part of watershed and their activities affect the productivity status at the same time affect the mitigation of floods in the watershed [6].

A study done in Kothapally watershed India shows that average crop yield was less than 1ton/ ha therefore Kothapally was characterized by low productivity, low income and low employment with high incidence of poverty in 1999 and before. After watershed management was applied crop yield increased by 2 to 5 times and irrigation potential increased from 13% to 31% as compared to 1999. Survey suggest that average household income in Kothapally watershed is greater than 50% compared to adjoining locations where watershed management were not made. It has increased crop productivity, reduced poverty and increased employment opportunities [6]. Therefore watershed management in the flood plain as a flood mitigation strategy is important in ensuring the livelihood is not in danger.

The main factors contributing to increased incidence of floods include; reduced flood carrying capacity of the rivers due to excessive siltation of their bed, uncontrolled and unregulated human activity, large scale deforestation, and no provision for routine maintenance of dykes [4]. Community participation in management of watershed is essential to the livelihoods of the people of Nyando plains. According to the Government of Kenya statistics, over 70% of the population living around the Nyando plains live below poverty level (< US$ 1.00). This raises questions whether the community really participates in watershed management to improve their livelihood [7].

Shelter is very important in the community. It was observed that a high proportion 449(89.0%) of the wall structures for shelters of the residents were made of mud. Nearly 47(8.9%) of walls were made of stone or brick, while a smaller proportion of 5 (1%) were of timber [8]. This shows how the livelihood is in danger in terms of shelter. Most of the community members are staying in structures which are not strongly built. Several areas in Nyando District like Kano plains suffer the effects of floods every year [8]. Five hundred and fifty children reported to be at risk of suffering from malaria and waterborne diseases every year [9].

Water as a result of floods needs to be utilized in different ways to improve livelihood of the Nyando community. Utilization of stored water in dams, reservoirs are indicators in management of the watershed hence help in mitigating floods. If the water stored is not utilized during the rainy season it overflows causing floods. In the process of utilizing water for domestic work, irrigation of crops and spraying of livestock the livelihood will improve by having enough food at the same time mitigate floods. Water is the key element in economic, social and cultural development of any society. Throughout history people have settled next to waterways and in flood plains because of the advantages they offer. In spite of all these water can also cause destruction and damage if not well utilized [10].

The continued loss of fertile soil and siltation of rivers in Nyando plains led to frequent flooding. There are a number of initiatives being implemented to control floods including river draining, construction of dykes, and construction of water pans for water harvesting. The programmes implemented are Nyando Flood Control Programme NFCP).The programme implemented by National Water Conservation and Pipeline Corporation(NWC and PC) has in the past five years seen the construction of 6km of Eastern dyke and 3km of Wester Dyke as well as the rehabilitation of the Wagai –Ombeyi dyke which is 3km long. Other activities to control floods were draining 2.2km of Nyando River, bush clearing, excavation and desilting have been done on several yeas to drain and unblock them. One of the proposed dams has been surveyed and is awaiting implementation [11].

II. METHODS AND MATERIAL

A. Objective

To establish the extent to which community participation in management of water shed as a flood mitigation strategy influence household livelihood in Nyando flood plains, Kisumu County.

B. Research Design

The study adopted descriptive survey design using both qualitative and quantitative research to solve the problem and to investigate consequences of action to the problem [12, 13]

C. Data collection

The instruments used to collect data include questionnaires, interviews, observations and experiments [12, 13]

1) Target Population: This study targeted; Households heads in Nyando plains, village elders and chiefs of the locations under study, local government authority representatives, District Disaster management officer representative in Nyando and the NGOs registered in the flood prone area. The study involved households from 4 locations involving Wawidhi, Kakola, Kikolo (East Kano) and Onjiko. The target population for the household heads was 11,050 [14].

2) Sample Size: A sample size of 385 was sufficient for a target population of 11,050 which was considered to be representative of the target population [15]. The sample size was distributed into 370 household heads plus 15 disaster management officers working in Nyando flood plains at the time of survey study, which is equal to 385.

3) Sampling Techniques: Multistage sampling was used to sample locations and sub locations. Multistage sampling selects progressively smaller areas until the individual members of the sample have been selected through a random procedure [16]. Proportional sampling was then used to sample the number of selected household where the households were grouped into different strata [17].

Systematic sampling was used to select the households which took part in the study. In systematic sampling every K^{th} case in the population frame is selected for inclusion in the sample [18]. Purposive sampling was used to identify the 4 village elders and 4 chiefs, 1 Sub-County Local Authority Management Officer who represented the government, 1 Disaster Management Officer, and 5 managers from the NGOs in the study area for the interview.

4) Data Collection: The research used both primary and secondary data. Secondary data was obtained from already documented findings in related contexts. Regarding primary data, questionnaires and interview schedules were used. The household head questionnaire was designed to accommodate all the essential indicators spelt out under each variable. The interview schedule was used to collect qualitative data from village elders and chiefs, Local Government Representatives, the Government representatives and the available NGOs in the area under study.

To ascertain content validity of the study instruments, experts from the area of project planning and management were asked to evaluate the validity of the instruments. In order to ensure reliability of the instrument, Cronbach's alpha was used. A measuring instrument is reliable if it provides consistent results [19]. Cronbach's alpha measure internal consistency of multiple LIKERT questions in a survey questionnaire that form a scale. Reliability coefficient => 0.70 was considered acceptable.

For the actual data collection, authorization was obtained from the University, Ministry of higher Education, and National Council of Science, Technology and Innovation as well as the local leadership. Four trained research assistants were used to administer the questionnaires to household heads while the researcher conducted the interviews.

D. Data Analysis

Quantitative data was analysed using descriptive statistics including mean, standard deviation and variance to describe the indicators of Management of Watershed and Household Livelihood [16]. Phenomenological approach was used to analyse qualitative data obtained from interviews with the key informants. [12] Phenomenological approach is an

approach which emphasizes deep understanding of the participation view. Significant statements were analysed to generate meaning from the units and the development essence description through theme analysis [13]. Inferential statistics, specifically regression analysis, was used to establish the relationship between Community participation in Management of Watershed and Household Livelihood. To obtain continuous data from the LIKERT scales of management of Watershed and Household Livelihood, the scores of the items in the scale were summated and used as values in each scale by each household. In the regression analysis, household livelihood was used as the dependent variable with management of watershed being the independent variable. The variables were modeled using the following linear equation:

$$Y = a + bX + \varepsilon$$

Where; Y=Household livelihood (dependent variable)

a = regression constant

X = Community participation in management of the watershed (Independent variable)

ε = the model error term

III. RESULTS AND DISCUSSION

A. Reliability

In order to establish the reliability of the household heads questionnaire, pilot testing was done using 10% of the expected respondents in the adjacent locations not included in the study area. Thus 37 samples collected were entered into SPSS v.20 and reliability analysis for Cronbach's alpha was run. Consequently, for the 10 items from the Management of Watershed scale Cronbach alpha = 0.929 was found while for the 10 items in the household livelihood scale, a reliability co-efficient of 0.739 was obtained with the overall instrument reliability coming to $\alpha = 0.923$. The instrument was therefore considered to be highly reliable in measuring the variables.

B. Demographic Characteristics for Households Heads

The key demographic information components obtained and which were regarded to be relevant and necessary for the study included: Gender, Age, marital status, household size, and level of education and location of the respondents.

The study found that majority of the respondents were female (Male = 42.4%; Female = 57.6%). This perhaps compromised the community participation in flood mitigation strategies given that women culturally are not supposed to participate in land management of the watershed. [21] Cultural constraints restrict women's mobility and that traditionally, women own less land, lack decision making power. In terms of age, the majority of the respondents who were 24 years and above (61.5%) thus lacked accountability as far as community participation in flood mitigation strategies are concerned.

The study found that majority of the respondents 160(44.1%) were married with another 113(31.1%) being widowed. This point to the fact that women, who were married, were mainly left at home as their spouses went to look for formal employment. As culture defines women role by restrict their participation in management of watershed, this restricts involvement of women making them vulnerable to flood disaster [22, 23]. In terms of household size, the study found that majority of the households in Nyando Plains (66.1%) had household sizes of between 3 and 7 persons with another 11% having average household size of 8 or more. This finding indicates extreme overdependence and vulnerability of the population to flood disaster. [24] There is a high consumption of poverty in Nyando flood plain of 66% compared to the neighboring regions where Kericho had a consumption poverty of 58% and Nandi Sub County had 63% poverty index.

As for level of education, the study found that majority of the household heads in Nyando plains have just basic education with 58.1% having secondary education while 33.9% having only basic primary education. In terms of income and livelihood, the study found that majority of the household heads were unemployed (58.7%) with even majority (46.3%) indicating that there average monthly earning was KES 1000 (approximately USD $10). This is an evidence of high poverty levels in Nyando flood plain which affects community participation in management of watershed. Similarly Islam, Hasan, Cowdhury, Rahaman and Tusher (2012)asserts that, vulnerability depends on several factors like flood and erosion characteristics, physical infrastructure, peoples culture, political and social economic condition where employment as a source of livelihood is inclusive.

C. Descriptive Analysis

1) Management of Watershed: The study sought to establish the extent to which community participation in Management of Water shed influence household livelihood in Nyando flood plains. A 10 item 5 point LIKERT scale was used to measure the level of community participation in management of watershed. Frequencies and percentage of each response was computed as well as the means and standard deviation. The details were as shown in table 1.

Table 1. Descriptive Statistics for Selected Indicators of Management of Watershed

Management of Watershed	SA	A	N	D	SD	Mean	STDev
1. I always remove silt to open channels of water ways	118 32.5%	129 35.5%	59 16.3%	56 15.4%	1 0.3%	3.85	1.053
2.I regularly plant trees to help in preventing floods	75 20.7%	121 33.3%	83 22.9%	77 21.2%	7 1.9%	3.50	1.098
3.I always control soil erosion by digging gulleys	33 9.1%	61 16.8%	129 35.5%	107 29.5%	33 9.1%	2.87	1.085
4.I utilize water stored in dams/reservoirs as a result of floods for irrigation and domestic use	58 16.0%	69 19.0%	97 26.7%	116 32.0%	23 6.3%	3.06	1.184
5.Idispose used materials/wastes at the right place to avoid blockage of channels during floods	56 15.4%	29 8.0%	101 27.8%	134 36.9%	43 11.8%	2.78	1.223
6. I always participate in maintenance of dams and reservoirs to avoid burst during floods	22 6.1%	50 13.8%	44 12.1%	182 50.1%	65 17.9%	2.40	1.114
7.I always participate in construction of farm ponds to mitigate floods in my farm	20 5.5%	59 16.3%	17 4.7%	157 43.3%	110 30.3%	2.23	1.202
8.I participate in establishing of permanent grass and vegetation in my farm	25 6.9%	49 13.5%	22 6.1%	188 51.8%	79 21.8%	2.32	1.157
9.I always participate in construction of diversion channels in my farm to mitigate floods	25 6.9%	108 29.8%	27 7.4%	109 30.0%	94 25.9%	2.62	1.329
10. I always participate in unblocking culverts and waterways due to massive chunks of litter to mitigate floods	32 8.8%	60 16.5%	20 5.5%	87 24.0%	164 45.2%	2.20	1.388
Mean of means						**2.78**	**1.183**

The study found that residents in Nyando plains do not take part in management of watershed as a flood mitigation strategy with mean = 2.78 and standard deviation = 1.183. This indicates that the respondents were generally ranging between disagree and neutral.

However, from the interviews with key informants, it emerged that there is considerable management of watershed activities going on in the community, although this is not targeted at flood management. Specifically, one of the village elders reported that:

> "*Removal of silt is not necessarily done to mitigate floods but to conserve the outside environment" [Village elder].*

This opinion was also shared by the Sub County Disaster Management Officer who commented as follows:

> *"Trees do well here in Nyando but the community has not maximized the opportunity as a strategy to mitigate floods and at the same time improve on their household livelihood. We can only plant trees to conserve the environment but not putting floods in mind. [Sub County Disaster Management Officer]*

The impact of lack of involvement in Management of Watershed by the community was articulated from the key informant interviews. During such interviews, one of the CBO chairpersons said that:

Most of the land is left bare because when floods occur, we are caught unprepared as a community in digging gulleys hence a lot of soil is swept to the river Nyando and eventually to the lake Victoria which in turn causes sedimentation hence the back flow of water from the lake to the homes endangering the lives of the household livelihood". [CBO Chairperson 1]

This position is in agreement with World Meteorological Organization that, utilization of stored water in dams and reservoirs are indicators in management of the watershed hence helping in mitigating floods [24].

2) Household Livelihood: Descriptive analysis of the indicators of household livelihood with close bearing on management of watershed was done. Three indicators were analysed to show frequency and percentages of various responses. Mean score and standard deviation was calculated for each indicator. Detailed findings on the indicators of household livelihood resulting from management of watershed are presented in table 2.

Table 2. Household livelihood

Practice	SA	A	N	D	SD	Mean	STDev
The water stored in dams, reservoirs as a result of floods is used for irrigating crops and therefore improve food security	66 18.2%	119 32.8%	72 19.8%	82 22.6%	24 6.6%	3.33	1.199
Managing the watershed has helped us increase crop yield	60 16.5%	119 32.8%	82 22.6%	82 22.6%	20 5.5%	3.32	1.155
Management of the watershed has helped us secure our houses from floods hence access to shelter	58 16.0%	121 33.3%	49 13.5%	85 23.4%	50 13.8%	3.14	1.320

On the water stored in dams and reservoirs as a result of floods being used to irrigate crops and improve food security, the study found this to be true (Mean = 3.33; Standard deviation = 1.199) as majority of the respondents (32.8%) agreed with another 18.2% strongly agreeing. The study also found that managing the watershed increases crop yield with mean 3.32 (standard deviation = 1.155). Specifically, majority of the respondents 119(32.8%) agreed with the statement while 82 (22.6%) were neutral. The respondents were neither disagreeing nor agreeing.

The study found that Management of the watershed has helped secure houses from floods hence access to shelter (mean = 3.14; standard deviation = 1.320) which was slightly above the neutral mark.

A. Regression Analysis

A simple linear regression analysis was conducted to determine the equation connecting community participation in Management of Watershed and Household Livelihood. The aggregate on Community participation in Management of Watershed was determined as a summation of the scores on individual

items in management of Watershed scale. Similarly, the score on the Household Livelihood scale were also determined. The regression output is presented in table 3 (Model summary), table 4 (ANOVA) and table 5 (Coefficients).

Table 3. Regression Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.653[a]	.427	.425	4.628

a. Predictors: (Constant), Community Participation in Management of Watershed

From the model summary, community participation in management of watershed explains up to 42.7% of variance in household livelihood (R2 = 0.427) which cannot occur by chance.

Table 4. ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	5763.938	1	5763.938	269.085	.000
	Residual	7732.795	361	21.420		
	Total	13496.733	362			

Dependent Variable: Household Livelihood
Predictors: (Constant), Community Participation in Management of Watershed

Further, the ANOVA table shows that linear regression model statistically fits the data with F (1, 361) = 269.085 at p<.05 (p = .000).Therefore this justifies the model, community participation in management of watershed influences household livelihood.

The coefficients table shows the equation which explains how community participation in management of the water shed influence household livelihood. The constant term (p = 0.000) and the coefficient of Management of Watershed (p = 0.000), are statistically significant as p < 0.05 as shown in table 5.

Table 5. Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	17.702	.876		20.209	.000
	Community Participation in Management of Watershed	.496	.030	.653	16.404	.000

a. Dependent Variable: Household Livelihood

The equation for modeling the variables was given as;

$$Y= a+ bX +\varepsilon$$

Where; Y=Household livelihood (dependent variable)

a = regression constant

X = Community participation in management of the water shed (Independent variable)

ε = the model error term

Thus, replacing the coefficients, the equation becomes;

$$Y=17.702 + 0.496X_1$$

The regression equation predicts household livelihood from community participation in management of watershed such that $y = 17.702+0.496\ X_1$ with the constant being statistically significant. Therefore there is a significant relationship between community participation in management of the watershed and household livelihood. Consequently, a unit change in community participation through management of watershed will improve household livelihood by 0.496.

IV. CONCLUSION

From the findings, the study concludes that there is low community participation in Management of Watershed as a flood mitigation strategy among residents of Nyando Plains in Nyando Sub County. The level of education among residents needs to increase if the residents are to take up management of watershed as their responsibility in mitigating floods. As a major finding, the study found that there is a statistically significant linear relationship between community participation in management of watershed and household livelihood. An increase in community participation in management of watershed corresponds to improved livelihood. Therefore, efforts should be put in place to increase community participation in management of watershed.

V. REFERENCES

[1] Doocy. S., Daniels, A., Murray, S., & Kirsch. T.C. (2013). The Human Impact of Floods: A Historical Review of Events 1980-2009 and Systematic Literature Review.

[2] Etuonorbe, A. K (2011).The Devastating effect of flooding in Nigeria

[3] Wallingford, H., (2005) Source Book for Sustainable Flood Mitigation Strategies. Department for International Development. Published by HR Wallingford Limited.

[4] UNDP (2002) Kenya Natural Disaster Profile. Enhance Security Unit.

[5] Bikibinga-Ibembe, J.D.,Vuai, A.S.,& Mungai, N.W. (2011).Environmental laws and Policies Related to periodic flooding and sedimentation in the Lake Victoria Basin (LVB) of East Africa. Africa journal of Environment Science and Technology.

[6] Wani, P. S. and Garg, K. K. (2007) Watershed Management concept and principles. International-Crops Research Institute for the semi-Arid Tropic ICR/Patancheru 502324, Andhra Pradesh, India

[7] Raburu, P.O., Okeyo-Owuo,J.B., and Kwena,F.,(2012)Community Based Approach to the management of Nyando Wetland, Lake Victoria Basin. Kenya.

[8] Yitambe, A., Mwanzo .I., Mogere S.,& Nyakundi ,H.(2010). Community perceptions and Response to flood risks in Nyando District, Western Kenya. J.MB. Journal of Disaster Risk Studies.Vol.3.No1 2010.

[9] Red Cross (2006). Red Cross Red Crescent Guide. Case study Indonesia. The Recent flood were very Unusual.

[10] World Meteorological Organization, Ministry of Water Resources Management and Development, Kenya and Associated Programme on Flood Management, (2004), 'Strategy for Flood Management for Lake Victoria Basin, Kenya', Available at http://www.apfm.info/pdf/strategy_kenya_e.pdf

[11] The County Government of Kisumu (2013). Kenya Vision 2030: First County Integrated Development Plan 2013-2017.Towards a Globally Competitive and prosperous Nation

[12] Mertens, D. M. (2005). Research methods in education and psychology: Integrating diversity With quantitative and qualitative approaches.2nd ed.Thousands Oaks:Sage.

[13] Creswell. J.W. (2003) Research Design: Qualitative, Quantitative and Mixed Methods Approaches. London: Sage. 2nd ed.

[14] KNBS (2010). Basic Report on well-being in Kenya. Nairobi. Ministry of planning and National Development.

[15] Krejcie, R. V. & Morgan, D. W. (1970). Determining sample size for research activities. Educational and Psychological Measurement.1970 pp607-610.

[16] Oso, W. O. and Onen, D. (2009). A General Guide to Writing Research and Proposal and Report: A Handbook for Beginning Researchers Revised Edition Jomo Kenyatta Foundation.

[17] Castillo J, C., (2009). Probability Sampling and Randomization. Retrieved April 26 from Explorable.com:http//explorable.com/probability-sampling.

[18] Mugenda, M. and Mugenda, A.G (I999). Research Methods. Quantitative and Qualitative approaches Nairobi. Acts press.

[19] Kothari, C. R., (2004). Research Methodology. Methods and Techniques (Second Revised Edition).New Age International (P) Limited Publishers.

[20] Creswell, J.W., (2009). Research Design: Qualitative, Quantitative and Mixed Method Approaches. Third Edition. University of Nebraska-Lincoln. SAGE Publications LTD.

[21] Oxfam (2012) Gender Equality in Emergencies Restoring Livelihoods after floods. Gender Sensitive Response and community Owned Recovery in Pakistan.

[22] Few, R., Ahern, M., Matthies, F. & Kovats, S. (2004). Floods health and climate change: A strategic review, Tyndall Centre. Working Paper 63Unity.We are in this together

[23] Bhatti A. (2001). Risk perception, culture and communication: South Asian Experience. (Paper presented at the Fifth Conference of the European Sociological Association.

[24] Ongor, O. (2007) Integrating Water Resource Management and Flood Management: A community participatory approach. A case study of Nyando river water shade in Kenya Moi Institute of Technology. Department of Agriculture.