



FINAL RESEARCH REPORT

HOUSEHOLD AND COMMUNITY EXPERIENCES AND PERCEPTIONS ON CLIMATE CHANGE IMPACTS DUE TO FLOODS, AND EXPECTATIONS ON POLICY IN BUNYALA SUB-COUNTY, WESTERN KENYA

MARCH 2014

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The research team was comprised of four Kenyan professionals with backgrounds in sociology, hydrology, gender, statistics and community development. The team was led by Denis Opondo, Principal Investigator, George Anyona, Co-Principal Investigator, Tupege Kasonwa, Project Manager, and Mark Odhimabo Osiyo, Project Accountant. They were assisted by seven consultants, including: Denis Masika, Joyce Otieno, Cyrilla Luvega, Michael Pundo, Dr. Omondi Ahawo, Dr. Benson Ojwang and Daniel Anyumba. The data collection team was comprised of two field supervisors, Jacinta Osiema and Sospeter Buluma, and six enumerators, namely: Harriet Akinyi Wandera, Nariari Namuye Alexander, Wanzala Odaye Denis, Robert Mudibo Ogutu, George Angira Omogi and Edwin Onyango.

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Cover Photo: View of River Nzoia in Bunyala flood plain from Nahasiongo Hill, July 23, 2012. By Denis Opondo.

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ACRONYMS AND ABBREVIATIONS

ARCC	African & Latin American Resilience to Climate Change
BUCODEV	Busia Community Development Organization
Co-PI	Assistant Principal Investigator
CBO	Community Based Organization
CDF	Constituency Development Fund
DDMC	District Disaster Management Committee
FBO	Faith Based Organization
FGD	Focus Group Discussion
GDP	Gross Domestic Product
GIS	Geographic Information System
GoK	Government of Kenya
HIV/AIDS	Human Immunodeficiency Virus/Acquired Immune Deficiency Syndrome
KII	Key Informant Interview
KNBS	Kenya National Bureau of Statistics
KMD	Kenya Meteorological Department
MRDC	Multiface Research and Development Centre
NAPA	National Adaptation Program of Action
NGO	Non-Governmental Organization
IGAD	Intergovernmental Authority on Drought
IPAC	Intergovernmental Climate Prediction and Applications Centre
IPCC	Intergovernmental Panel on Climate Change
ITK	Indigenous Traditional Knowledge
PI	Principal Investigator
SPSS	Statistical Package for Social Science
STI	Sexually Transmitted Infections
UN	United Nations
UNECA-ACPC	United Nations Economic Commission for Africa-Africa Climate Policy Centre
UNEP	United Nations Environment Program

UNFCCC	United Nations Framework Convention on Climate Change
UNICEF	United Nations Children Emergency Fund
USAID	United States Agency for International Development
WFP	World Food Program
WKCDD/FM	Western Kenya Community Driven Development and Flood Mitigation Project

EXECUTIVE SUMMARY

INTRODUCTION

This one-year small grant on “Household and Community Experiences and Perceptions on Climate Change Impacts Due to Floods, and Expectations on Policy in Bunyala Sub-county, Western Kenya” began in April 2013. The grant was awarded to Multifac Research and Development Centre (MRDC) by the African and Latin American Resilience to Climate Change (ARCC) project, a USAID-funded task order implemented by Tetra Tech ARD under the Prosperity, Livelihoods, and Conserving Ecosystems (PLACE) Indefinite Quantity Contract. The grant was implemented by MRDC, a non-governmental organization based in Kisumu, Kenya, with guidance from the United Nations Economic Commission for Africa - African Climate Policy Center (UNECA-ACPC) situated in Addis Ababa, Ethiopia.

The aim of this study is to contribute to strengthening Kenyan disaster risk management policy and planning by increasing awareness of local and institutional practices in response to floods. The research questions that guided this study are: (i) How can indigenous traditional knowledge be integrated into interventions to enhance household and community resilience to flood impacts? (ii) What are the gender-related implications of floods? and (iii) How do existing institutions help households and communities deal with flood risks?

This study looks at the frequent flooding in the Budalangi plains on the shores of Lake Victoria in Kenya in Bunyala Sub-county, and is justified by research findings that indicate current coping strategies are ineffective despite interventions by NGOs and the government. An understanding of local governance structures and institutional presence is particularly important because under the new constitution in Kenya the devolution of authorities to local government structures will have important ramifications. For example, there will be an increase in community participation in decision-making to address challenges to social and economic development in the context of climate change and climate variability. The research study area is Bunyala, Western Kenya, and the paper produces a compelling story that depicts real-life impacts of flooding on households.

RESEARCH METHODOLOGY

Methods used consist of a combination of qualitative methods (focus group discussions and key informant interviews) and more quantitative methods (household questionnaire survey). Household questionnaires were administered to 418 respondents. Seven focus group discussions (FGDs) were conducted with 65 community members consisting of youth, women, and men. Key Informant Interviews (KIIs) were conducted with 12 individuals.

SUMMARY OF FINDINGS

The study looked at households in Bunyala Sub-county. It analyzed how they were adapting to flooding in the long-term, and what coping mechanisms they were using to respond to flooding in the short term. Because the majority of respondents in the study engage in subsistence crop production/farming as their main occupation, flooding is a particular concern for them and has a significant impact on household day-to-day livelihoods. The study found that a majority of respondents recognize changes in flood regimes

and also experience severe impacts from floods. Furthermore, households experience food shortages caused by floods for about six months of each year, particularly during periods that correlate with rainy seasons.

Respondents use both coping and adaptation strategies/practices to deal with flood impacts. Short-term coping strategies often involve quick responses to the onset of floods and do not provide long-term solutions for household resilience to the negative impacts of floods. Furthermore, many of the coping practices used are often detrimental to household livelihoods by reducing their short-term and long-term resilience.

Households also report that wealthier households are better able to cope with the impacts of flooding, suggesting that poor households bear the brunt of flooding. Examples of coping practices used include temporary migration; relocation to camps and to homes of relatives and neighbors living outside of the flooded areas; spending less money on household requirements such as food, clothes and medication; rationing of food by reducing the quantity and number of meals for both children and adults; sale of household assets such as mobile phones and bicycles; and withdrawing children from school to help with domestic chores. It is clear that all of these practices leave households more vulnerable and are not sustainable solutions for household resilience to climate change. Since poorer households are more prone to the negative effects of yearly flooding, long-term, sustainable solutions need to be further explored and promoted by government and institutions.

Households have also been adopting long-term adaptation strategies and practices to combat the impacts of flooding. Many of the adaptation practices have involved using mechanisms to make household assets, such as homes, more resistant to flood damage. There has also been an effort to diversify livelihoods, in order to decrease dependence on farming. However, it should be noted that many of the practices are viable only for economically well-off households. Some of the adaptation practices households report using include planting trees around homesteads to keep out water; construction of houses with raised foundations to prevent damage to houses and household goods; improving food storage using Indigenous Traditional Knowledge (ITK); formation of women's and community groups for sharing of skills and resources; leasing farm land in the Migingo area for growing maize and sorghum; purchase of land on higher grounds; diversification from farming into other areas such as fishing and business; and permanent migration. The last three options are examples of those practices only available to households that are economically well-off. Again, it is clear that the less economically well-off a household is, the fewer resources they will be able to use to prepare for floods. As such, coping mechanisms, such as reliance on assistance, become important for many individuals in the study area.

The findings on ITK indicate there is a high-level awareness by individuals and community members of the use of ITK for predicting rainfall and flood onset. ITK on flood and rainfall prediction include sighting of a type of migratory stork (*magungu*) and a type of eagle (*lkhwasi*) that indicate the onset of the rainy season; wind patterns; coloration of water in the river, including foam and floating debris; the behavior of animals such as frogs and toads; dark clouds in the direction of Mt. Elgon, which indicates rainfall and flood onset; appearance of safari ants in homesteads and riverbanks/dyke, which indicates flood onset; and shedding of leaves by the *Omulodo* tree, which heralds rain. ITK commonly used after flood events include fishing in flood waters by men, women, youth, and children using traditional traps made of reeds and sticks; the use of traditional herbs and cow-dung burnt in open fireplaces to deal with mosquitoes that affect both humans and livestock; use of herbs to purify drinking water and cure water borne diseases; methods for food storage and preservation; relocation of households using traditional migratory routes; using alternative natural material for constructing shelters; and safety and security (this relates to informal arrangements by men and boys to patrol homesteads using boats and canoes). In many cases men remain behind in homesteads to guard household assets stored on the rooftops and in the eaves of houses, while women and children temporarily relocate.

It was hoped that ITK would prove to make a positive contribution to disaster management strategies. The paper has identified ways in which ITK can be promoted and should be used in planning. However, the study found that there are many obstacles to the use of ITK. Primarily, the current use of ITK among households is limited due to a lack of access and trust in the viability of ITK. The study also found that individuals perceived that modern western education and technology denied ITK experts the chance to exercise their skills. Furthermore, they also perceived that modern education actually increased distrust and disrespect for elders by younger community members, limiting the intergenerational transfer of ITK.

Findings on general flood impacts show that women, men, and youth are affected by displacement from homesteads, destruction of crops and loss of income, food shortages, and increased incidence of waterborne diseases such as cholera, typhoid, and malaria. Women and men both face unique flood impacts. However, this study focused on some of the particular impacts and vulnerabilities faced by women. It was found that after flooding, households are often relocated to camps, or seek other temporary shelter. This primary coping strategy has specific implications for women, including pregnant mothers who cannot access maternal health clinics; lack of food leading to poor diet for pregnant and lactating mothers; loss of income-generating activities for women; increased risk of sexual harassment and exploitation at camps and risk of contracting sexually transmitted diseases; greater school drop-out rate; and a greater prevalence of early marriage of young girls. Furthermore, there is greater stress on the females' domestic responsibilities and ability to provide food, water, and fuel for their children, since men often relocate outside of the camps.

There were strong perceptions of the negative impacts floods have on youth, particularly due to the negative behavior that reported to become more prevalent when families were relocated to camps during times of floods. Perceptions of the flood impacts on youth behavior include increased substance abuse, promiscuity of youth at camps, resulting in teenage pregnancies; increased sexual harassment of youth; early marriages among teenage girls; increased exposure/risk of HIV/AIDS and STIs; and inaccessible public facilities such as schools and village polytechnics, further leading to school drop-outs, as young girls are married and boys go into fishing and *boda-boda* (informal public transport business using motorcycles).

There are public and private institutions that work in Bunyala to provide assistance during flood events. These include government departments and agencies, NGO/CBOs, FBOs and international organizations. Private institutions are perceived as more effective in provision of assistance compared with public institutions. However, the effectiveness of public institutions is associated with structural interventions such as construction of dykes and dams. Generally, the main beneficiaries of assistance by institutions are women, the elderly, and children. Private and public institutions could be more effective by providing sustainable support rather than handouts. There are several recommendations geared towards institutions, both to strengthen coping mechanisms of households and increase adaptive measures.

RECOMMENDATIONS

The findings of this study have implications for policy makers and planners at both the county and national government levels. Several recommendations are presented below.

Indigenous Traditional Knowledge and Floods

There is potential for greater use of ITK in climate information and it is proposed that:

- Flood management should integrate modern scientific forecasting and climate modeling with ITK to strengthen understanding, dissemination, and use of climate information in the study area.
- ITK be integrated into current approaches (i.e., integration of ITK on flood prediction into *Early Warning Systems* for preparedness);
- ITK experts can be tapped as a means to disseminate climate information; and
- ITK on climate should be documented for posterity.

Gender and Floods

The gender dynamics of flood impacts represent a complex situation. Dealing with the gender issues of flood impacts requires a multi-pronged approach which combines public interventions, cultural/attitude changes, and community action. It is proposed that:

- Local communities be empowered through trainings/skills programs (new technology for farming) to improve small-scale agricultural productivity (small-scale irrigation for food production and income generation can be promoted);
- Education (adult and regular education) and vocational training to diversify livelihoods should be provided, along with other informal education and knowledge sharing; groups should be formed for the empowerment of women and youth;
- Women, as crucial contributors to food production and income generation, should be empowered to access resources such as money and land, and trained to develop decision-making skills. This can be achieved through training for women groups, and credit schemes to promote petty trade and small-scale businesses. Creating awareness of programs, such as the government's Women Enterprise Fund, should be promoted; and
- Community education and attitude change towards women's empowerment, violence against women, and sexual exploitation should be promoted.

Institutions and Floods

Households and communities in Bunyala Sub-county have limited capacity to deal with the negative impacts of floods. Improving their livelihoods requires interventions to address their coping and adaptation practices. Short-term coping practices, such as sale of land and household property, decreased expenditure on household requirements, and temporary relocation, make households more vulnerable to future flood events. Institutional investment in interventions to enhance household adaptation and resilience through long-term measures to improve the sustainability of livelihoods is crucial. However, as it currently stands, adaptation practices are not enough for households to adequately respond to floods. Therefore, coping practices also need to continue to be promoted while simultaneously strengthening long-term, sustainable institutional responses to help households adapt to climate change.

Recommendations for short-term institutional interventions to improve household coping with immediate impacts of floods, include:

- Collaboration among institutions to set up emergency relief facilities for accommodating households displaced by floods, taking into account sleeping quarters/dormitories, and sanitary and medical facilities;

- Provision of learning facilities in camps or relocation settlement in order to ensure learning in primary, secondary, and tertiary institutions is not disrupted to the disadvantage of learners;
- Partnerships with communities to develop water storage facilities for domestic purposes to reduce incidence of waterborne diseases;
- Promotion of participation and decision-making by women in income generating activities such as small-scale agriculture and trade for income generation and livelihood diversification; and
- Training of farmer groups and women's groups in modern farming techniques to not only improve agricultural productivity but also to enhance post-harvest conservation of food stocks.

Recommendations for institutional interventions that seek to address adaptation strategies for long-term household resilience to flood impacts include:

- Develop mechanisms for collaboration between ITK experts and climate scientists to promote dissemination of viable ITK information related to floods, and to develop local flood prediction and early warning instruments for application to emergency preparation that take into account local resources and community participation;
- Strengthen potential of agricultural production in the Mingingo area of Bunyala Sub-county through land adjudication and issuance of titles. This will provide incentive for modern commercial farming;
- Promote livelihood diversification initiatives to reduce reliance on subsistence agriculture and fishing -which are vulnerable to climate change and climate variability--in order to improve household food security and incomes;
- Promote flood-proof housing technology using locally available resources to reduce flood damage in homesteads;
- Build the capacity of relevant national and county government institutions to mainstream gender and climate change policies into institutional policies and activities;
- Implement integrated catchment management initiatives of the River Nzoia basin watershed to provide mechanisms for environmental conservation and management, as well as flood control, in order to limit the exposure of households and communities in low lying areas and floodplains to adverse flood effects. This could be achieved through public/private and community initiatives to address deforestation, soil erosion, and ecosystem conservation;
- Invest in structural flood control measures such as dams and dykes. This could be achieved through public/private investment in multipurpose dams for water harvesting, storage and production of electricity. This can be exploited for fish farming and small-scale irrigation projects that target local communities in the study area; and
- Conduct floodplain mapping, land use planning, and enforcement of laws on land use, agriculture, and settlement. For example, homesteads should not be constructed in the flood plains, near dykes, or along river banks.

I.0 INTRODUCTION

I.1 STUDY BACKGROUND

This paper is the result of a grant awarded to Multifaceted Research and Development Centre (MRDC) by the African and Latin American Resilience to Climate Change (ARCC) program, a USAID-funded project implemented by Tetra Tech ARD. Under the ARCC project, grants were awarded to United Nations Economic Commission for Africa - African Climate Policy Centre (UNECA-ACPC) partner organizations in Kenya, Ghana and Burkina Faso. MRDC was selected as one grantee to conduct a one-year research project on “Household and Community Experiences and Perceptions on Climate Change Impacts Due to Floods, and Expectations on Policy in Bunyala Sub-county, Western Kenya.”

I.2 GLOBAL CLIMATE CHANGE AND IMPACTS

Climate change has become evident worldwide through, for example, temperature and rainfall variations, as have climate change-related impacts, such as prolonged flooding, increased heat waves, increased length and frequency of droughts, sea level rise, and increased salinity (Rahman et al., 2007). In the context of climate change, the risk of floods will increase with increased frequency of extreme precipitation (Kundzewicz and Matta, 2007).

The Fourth Assessment Report (AR4) of the Intergovernmental Panel on Climate Change (IPCC, 2007) noted that a warmer climate coupled with increased climate variability in rainfall patterns, such those induced by the El Niño phenomenon, will significantly increase the risk of floods in the poor countries of the world (IPCC, 2007; IGAD and ICPAC, 2007). The *El Niño* and *La Niña* phenomena are weather patterns that affect the major currents in the Pacific Ocean and also the southern Pacific and Indian Oceans, causing changes in normal weather patterns (GoK 2009; Mogaka et al., 2006). Neither developed nor developing countries are immune to the effects of climate change. Globally, natural disasters including drought, landslides, and floods occur with increasing frequency and intensity (IPCC, 2007).

According to The World Bank (2009), the last two decades have recorded six years with the warmest temperatures and highest rainfall variability in sub-Saharan Africa. Consequently, climate-related disasters such as floods and droughts have doubled in East and Central African regions within the last 25 years. Sub-Saharan African countries like Mozambique, Malawi, Kenya, Madagascar, and Ethiopia are more likely to experience unexpected extreme climatic events.

Floods in less developed countries, like Kenya, are likely to have a large negative impact on social and economic development, and in fact already have. The 1997/98 *El Niño* flood in Western Kenya was associated with one of the largest flood losses in the country in the last 50 years (Mogaka et al, 2006). The economic and financial losses associated with the *El Niño* floods were estimated to be in the range of up to US\$800 million in Kenya (Karanja et al., 2002).

I.3 CLIMATE CHANGE IMPACTS IN KENYA

Kenya is highly vulnerable to climate variability, specifically drought, flooding (Mogaka et al, 2006), and sea-level rise (GoK 2012b). Research suggests that precipitation is expected to increase in some areas, with the largest rise in rainfall occurring in the highland and coastal regions. However, the arid and semi-arid parts of the county are projected to become significantly drier (GoK 2012b, Mango et. al., 2007).

This trend is mainly attributed to an increase in surface temperature and potential evapotranspiration (GoK, 2012c).

Climate change and increases of atmospheric carbon dioxide may have a positive impact on agricultural production in western Kenya. This is mainly attributed to increased temperatures in medium- and high-altitude areas. This will expand the area with crop production potential, increase cropping intensity potential, and increase CO₂ fertilization. However, negative impacts may also occur due to pest and disease damage and the worsening of workable conditions due to increased wetness (Fischer and van Velthuisen 1996, Kabubo-Mariara and Karanja, 2007). The medium and low potential agro-ecological zones in Kenya will bear the brunt of the negative effects of global warming. The high potential zones are located at altitudes above 2050 meters above sea level; medium potential zones are found at altitudes ranging from 1000 – 2050 metres above sea level; and the low potential zones are located at altitudes below 1000 metres above sea level. The agricultural losses in the medium- and low-potential zones due to global warming are estimated at about US\$178 per hectare (ha) by the year 2030, compared to losses of only US\$32 per hectare in the high potential zones (Kabubo-Mariara and Karanja, 2007).

The Lake Victoria Basin in Western Kenya is the most flood-prone region in the country (GoK, 2007). The basin covers an area of about 194,000Km² and is bordered by the east African countries of Burundi, Kenya, Rwanda, Tanzania, and Uganda. On the Kenyan side, the catchment has an area of 46,229 Km² and receives inflows from five major rivers: Nyando, Nzoia, Sio, Sondu, and Yala. All of these rivers rise from the Rift Valley and western highlands. Rivers Nzoia and Yala experience yearly floods in their lower reaches, which affect the Bunyala plains in western Kenya. This area is located within Bunyala Sub-county, the study area for this research.

Many parts of the country also experience unexpectedly heavy rainfall in mid-April. This continues through the end of May (the “long rains”) and from September to November (the “short rains”) (Nyakundi et al., 2010).

The study area (Bunyala Sub-county, Western Kenya) is affected by two main natural hazards – floods and drought – which pose numerous challenges to livelihood support systems, especially health and food security. The first recorded flood incidence was in 1937. Subsequently flood incidences were recorded in 1947, 1951, 1957/58, 1961/62, 1963, 1975, 1977/78, 2002, 2003, 2006 and 2007 (Bunyala District Report, 2008). The government of Kenya has, therefore, recognized climate change as one of the most serious threats to its sustainable development and poverty reduction programs (GoK, 2012).

It can therefore be argued that in Kenya, floods have the potential to significantly disrupt the country’s social and economic development due to the high costs associated with flood impacts. This study aims to highlight insights about real-life experiences of climate change impacts. Presently, there are substantial knowledge gaps on the impacts of extreme climate events facing communities. Most of these communities are not yet able to cope with or adapt to climate change impacts in a feasible way. This study looks at communities and their experiences in Bunyala Sub-county, Kenya, how climate change – through increased flooding--has affected their livelihoods, and what mechanisms they are adopting due to the latter.

1.4 CLIMATE TRENDS AND IMPACTS IN THE STUDY AREA

The climate trends in Kenya, particularly the Western parts of the country, will have a bearing on impacts of flood frequency and intensity. A study by Kenya Meteorological Department (KMD) on temperature and rainfall trends in Bunyala Sub-county showed that climate change has an effect on temperature and rainfall. This was based on analysis of temperature and rainfall collected over a period of 42 years (KMD). The results showed that this has led to increased stream flow, causing River Nzoia to overtop its banks and dykes, causing floods in the plains. The Water Evaluation and Planning (WEAP)

model was used to simulate river flow with acceptable accuracy during the reference period from 2001 and 2006.

The River Nzoia catchment is the wettest in Kenya, and the flow duration curve is typical of a catchment that suffers from rain-induced floods (Immerzeel and Droogers, 2009). The river discharge is lowest from January to March and relatively constant throughout the other months of the year, with a peak in May. Rain-fed agriculture is the largest water consumer (52% of total rainfall) in the catchment and urban water use is negligible. In total, 27% of total rainfall is discharged into Lake Victoria. Under the current climate, a total area of 18,943 ha is inundated with an average inundation depth of 4.9m. The current climate trend has for several years resulted in perennial floods in Bunyala, and this area presently experiences floods with increasing frequency and magnitude. This will result in destruction of livelihood activities and displacement of people (Immerzeel and Droogers, 2009).

The high flood discharge and excess of the carrying capacity of the river channel, naturally spills over the banks. In the flood plains (lower reaches) of River Nzoia, floods are often aggravated by high-water levels in Lake Victoria, and the back water effect from the lake causes widespread inundation for long durations (GoK, 2009a).

IMAGE 1: EDGE OF NOTHERN DYKE FROM NAKHASIONGO HILL, DECEMBER 2008



Credit: BUCODEV

The dykes in Bunyala Sub-county were constructed in the period between 1977 and 1984, with a return period of about 25 years. However, there are no routine maintenance arrangements, except occasional repairs of breached or severely damaged sections. Other complementary non-structural measures can be considered, including flood forecasting and warning, as effective methods of reducing risk to life and property. However, it is a complex process that requires proper awareness creation and education of both the forecasters and communities at risk of floods (GoK, 2009a).

1.5 FUTURE CLIMATE PROJECTIONS IN THE STUDY AREA

Climate change projections in the study area related to 2030 water resources show that the spatial distribution of rainfall will be almost unchanged compared with the present situation, but the northern part of both the Rift Valley and Ewaso Ng'iro North Catchment Area will be drier. As for the seasonal variation, more water resources will be expected in the rainy season and less water resources in the long dry season (June to August) in most of the country (GoK, 2012). The region extending from Lake Victoria to the Central highlands East of the Rift Valley will experience increases in annual rainfall (ICPAC, 2007). Therefore, if these projections are accurate, then there will be higher likelihood of increased intensity and frequency of floods in the region (Mango *et. al.*, 2007; GoK, 2009). Based on a study by Immerzeel and Droogers, (2009) very significant increases in peak discharges are to be expected. It is further estimated that a flood that occurs once every 10 years will now occur once every two years by 2050; and a flood that occurs every 25 years will now occur once every two years by 2090. Both the flood extent and inundation depth are likely to increase (Immerzeel and Droogers, 2009). It is estimated that in 2050 a total area of 21335 ha will be inundated once every five years with an average inundation depth of 5.4 m.

Flooding is the greatest threat of climate change in the Bunyala plains. Flooding causes dyke breaks resulting in loss of infrastructure and displacement of thousands of people. Consequently, thousands of people living in the flood prone lowlands will be forced to move to higher ground and to adopt various coping and adaptation strategies to survive (GoK, 2009). While coping strategies, in particular, may be successful in the short term, they often have severe implications for longer-term livelihood sustainability when people are unable to recover from flood impacts. The resulting negative impacts due to inadequate and unsustainable coping mechanisms will worsen the poverty situation.

I.6 CHARACTERISTICS OF THE STUDY AREA: BUNYALA SUB-COUNTY

The study area is known as Bunyala Sub-county; formerly named Budalangi division of Bunyala District. The former Budalangi Division was made a district by the president of Kenya in 2007 and was named Bunyala District and retained the name until 2013. However, under the new Kenyan constitution promulgated in 2010 and after the first general election under the new constitution, the name was changed to Bunyala Sub-county and is now one of the seven sub-counties of Busia County. Bunyala Sub-county is the region in Kenya that has experienced the most intense floods in recent decades.

It is a low-lying area with a generally flat landscape that predisposes it to frequent flood events when river Nzoia overflows. The area's physical setting and increased runoff from degraded catchments are contributory factors to the recurrent flood hazards (GoK, 2009).

FIGURE 1: THREE DIMENSION DIAGRAM SHOWING TOPOGRAPHY OF BUNYALA SUB-COUNTY

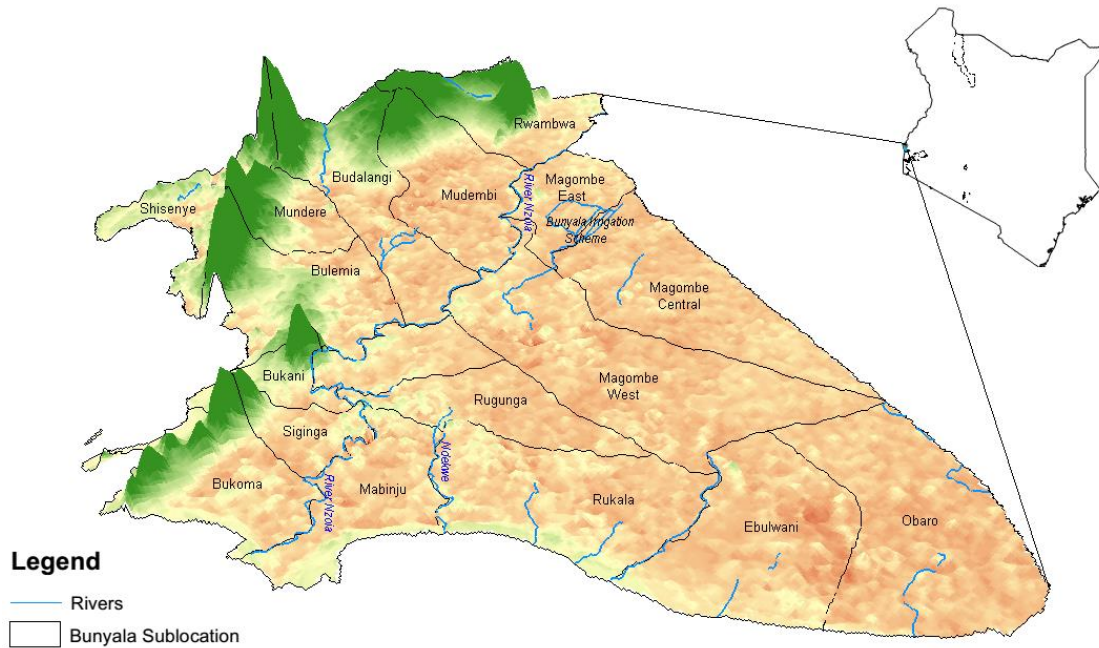
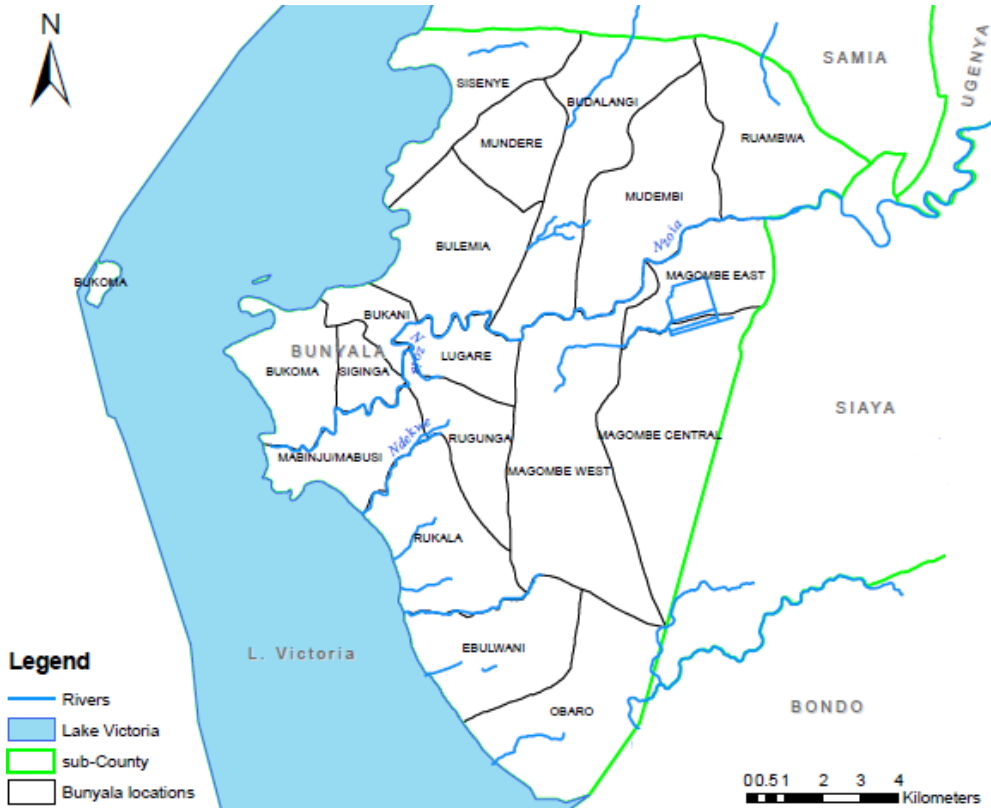


Diagram generated by Denis Masika using GIS

Bunyala Sub-county borders Samia to the North, Siaya to the East, Bondo to the South, and Lake Victoria to the West. It has six administrative locations: Bunyala Central, Khajula and Bunyala to the South of river Nzoia; and Bunyala East, Bunyala North and Bunyala West to the North side of river Nzoia. It has 18 sub-locations (Bunyala District Report, 2008). Data from the Kenya National Bureau of Statistics (KNBS) (2010) indicates the study area has an estimated population of 66,723, of which 31,718 are male and 35,005 are female, living in 15,245 households. In addition, it covers about 188.3 Km² and has a mean population density of 354 people per Km². The data also indicate that the study area is inhabited predominantly by the Manyala, a sub-tribe of the Luhya, who practice subsistence farming, fishing, and non-farm activities such as petty trade (Bunyala District Report, 2008; KNBS, 2010). The study area has high levels of rural poverty, affecting approximately 46.5% of the population (KNBS, 2008).

FIGURE 2: LOCATION OF RIVER NZOIA IN BUNYALA SUB-COUNTY



The alluvial soils and annual rainfall of between 750 and 1,015 mm support small-scale agriculture as well as livestock keeping (Bunyala District Report, 2008). The area is a host to the Bunyala Irrigation Scheme, which cuts across the boundaries of Busia and Siaya counties and covers about 1,734 acres. The irrigation zone within Bunyala covers about 1,031 acres and is managed by the National Irrigation Board, which provides local farmers with water and other farm inputs for rice production. The irrigation scheme is intermittently affected by floods, which destroy paddies, stored rice, and irrigation infrastructure (GoK, 2009b; Opondo, 2013).

River Nzoia drains through the Bunyala plains into Lake Victoria and has a length of about 334 km, and a catchment area of about 12,900 km². It has a mean annual discharge of 1777×10^6 m³/year. As its last 20 kilometers reach the mouth on the lake, the bed flattens to a slope of just 1-in-3400, and the river meanders through a wide flood plain. Here, the channel width increases to 70m and the height of the banks reduces considerably. This causes spilling of floodwaters over the banks and consequent flooding of large areas on either side (Nzoia River Basin Management Initiative (NRBMI), 2006).

The basin has the potential for growing a wide variety of crops and producing livestock, due to its good soil and gently sloping terrain. However, the high water table in the floodplain renders the area uninhabitable during much of the wet season. Population growth and pressure for land however, continues to push people to these flood-prone areas. The search for more agricultural land also spurs encroachment into Nzoia River wetlands. By settling in the flood plain areas, more people and households in Bunyala are at risk of flood hazards (Onywere et. al. 2011; Bunyala District Report, 2008).

1.7 OBJECTIVES OF THE STUDY

Vulnerable populations in developing countries suffer disproportionately from the adverse impacts of climate change, as their capacity to cope with extreme weather events and adapt to climate change is often limited. Today, there is increasing awareness in academic and policy circles that not all impacts of climate change can be addressed by mitigation and adaptation efforts by local people alone. The vulnerability of the households and communities at risk from floods is caused by a combination of physical factors, including exposure to floods, degree of protection from flood hazards, quality of infrastructure available, degree of access to resources, and ability or inability to avoid, withstand, or recover from the flood hazards. Socio-economic factors, such as acute poverty, high population density, lack of education, poor planning and management of agricultural and farm land, poor quality of agricultural inputs and technology and the absence of access to modern technological options to cope with the climate change and climate variability, increase the vulnerability of the population to floods. Occupation and livelihood activities also play a role. For example, fishermen, whose occupation requires them to live close to rivers and other water bodies, are more at risk than others and therefore, more vulnerable. Generally, communities also lack knowledge and access to adaptation measures that can help long-term resilience to floods (GoK, 2009).

In addition to climate change-exacerbated flood hazards described above, there is a complex interaction between social, economic, political, and environmental processes that impedes the capacity of households and communities to cope with and adapt to the impacts of floods. While a strategy for flood management in the study area must address the flood hazards themselves, it must also take into account other related national and local social, economic, and development policies. Flood prevention and mitigation efforts should be multi-dimensional and involve all stakeholders, but more particularly, the affected local communities, non-governmental organizations (NGOs), community-based organizations (CBOs), and public officials in government departments such as land, water, meteorology, fisheries, agriculture, and environment.

This study will therefore provide important information on how the respondents in the Bunyala Sub-county area perceive climate-related impacts, what adaptation and coping practices they undertake, what ITK exists and is applied, the gender dimensions of flood impacts, and the local institutional mechanisms that increase individual and community participation in decision-making.

This study seeks to help households, communities, and local level county authorities develop sustainable strategies for households to deal with the long term effects of floods due to climate change in Bunyala Sub-county, where 46.5% of individuals live below the poverty line (Kenya National Bureau of Statistics, 2008). This study also seeks to help relevant government departments, such as the Ministries of Land, Water, Agriculture, Fisheries, Environment, and Special Programmes, to design participatory policies and programs aimed at addressing the negative climate change impacts of perennial floods in Bunyala Sub-county. Such policies will need to consider sustainability of livelihoods for poor and vulnerable households and communities.

The aim of this study is to contribute to strengthening Kenyan disaster risk-management policy and planning by increasing awareness of local and institutional practices in response to floods.

1.8 RESEARCH QUESTIONS

The research questions that guided this study are:

- How can indigenous traditional knowledge be integrated into interventions to enhance household and community resilience to flood impacts?
- What are the gender-related implications of floods?

- How do existing institutions help households and communities deal with flood risks?

I.9 ORGANIZATION OF THE REPORT

This report consists of five sections, excluding the executive summary: (1) introduction, (2) literature review, (3) research methodology, (4) study findings (parts 1 and 2) and (5) conclusions. The introduction comprises background information on the study area, including climate change impacts. The second section presents relevant literature exploring the three main topics covered by this study: indigenous traditional knowledge (ITK); Gender and Floods; and Institutions and Floods. Section three describes the research methodology while chapter four describes findings that answer the research questions. The final section discusses key findings, conclusions, and recommendations.

2.0 LITERATURE REVIEW

This chapter includes important information on the use of indigenous traditional knowledge for predicting and responding to floods, the gender-related implications of flood impacts, and the institutions that play a critical role in determining how communities and households respond to the impacts of extreme climate change-related floods.

2.1 INDIGENOUS TRADITIONAL KNOWLEDGE AND FLOODS

Indigenous traditional knowledge has been used historically by communities in Africa to deal with climate-related disasters such as floods and drought (Opere and Ogalo, 2006; UNEP, 2008). ITK is typically not universal within a community, but is rather confined to a few experts, such as elderly people, women, or 'progressive' farmers (McCally, 1995). The ITK on disaster prediction and early warning is based on keen observation of the behavior of animals, birds, insects, vegetation, trees, winds, air and water temperatures, and clouds. These are “home-grown” indicators within the communities (Opere and Ogalo, 2006; UNEP, 2008).

For example, the Nganyi Clan of Bunyore in western Kenya has a century-long history of predicting rains. Some of the practices they use include observing wind patterns, air temperatures, and clouds. Other practices involve observation of animal behavior, particularly that of birds and reptiles. In the Lake Victoria region, the arrival in large numbers of the common swallows (*Hirundo angolensis*) circling the sky is a sign of the onset of rains. The behavior of frogs (*Africana spp.*) and toads (*Bufo spp.*) indicate a change in seasons. The croaking of the amphibians indicates the onset of rains, while their absence signals the onset of a dry season (UNEP, 2008).

In many communities, elders, both male and female, traditionally have had the responsibility of predicting disasters and guiding individuals on the use of preventive and mitigating actions. For instance, elders in Kenya's communities in Rusinga, Mfangano, Kano, Budalang'i, Lamu, Kwale, and Makueni monitored the progression of hazards and gave advice, which governed the behavior of their communities (UNEP, 2008).

Indigenous traditional knowledge includes elements of preparedness for dealing with natural disasters (Opere and Ogalo, 2006). For instance, an assessment of ITK in Budalang'i community of western Kenya provides insights into some of the strategies for preparedness (UNEP, 2008). For example, homesteads had to have a dugout canoe for transport in case of heavy flooding; men dug trenches to control the water around homesteads and around farmland; and ploughing/cultivation was not permitted along the river banks and lake shore when heavy flooding was predicted.

To ensure food security during droughts and times of scarcity, ITK and “know-how” guided post-harvest processing, preservation, and storage of farm produce and other food products gathered from the wild. The role of elders, particularly in western Kenya, to advise and direct community members on the types of crops to plant, when to plant them, and where and how to plant, was crucial.

Below are further insights into some of the strategies espoused by elders and ITK experts:

- Land preparation should start in November-January when it is dry, based on observation winds and changes in fauna and flora;

- Harvesting maize, millet, beans, and peas should be done between July-August, when dry winds are experienced;
- After harvesting, cassava and sweet potatoes (which only need a little rain) should be planted for food reserve;
- Households should stockpile fuel wood for cooking and preserving food during the rainy season in April-August;
- Households should catch and preserve fish by drying and smoking during the April-August rainy season (UNEP, 2008); and
- Small-scale farmers in the Sahel conserve carbon in soils through ITK of zero tilling practices and cultivation. Similarly, agroforestry is effective in carbon sequestration, and agroforestry projects benefit from traditional knowledge of plants (Osunade, 1994; Nyong, *et. al.*, 2006).

In the area of adaptation to climate change, indigenous knowledge systems have been applied in weather forecasting, vulnerability assessments, and implementation of adaptation strategies. As was seen from the above example, the knowledge-base of farmers follows a specific language, belief system, and process, through which the local weather and climate is assessed, predicted, and interpreted (Kipkorir, *et al.*, 2011). Understanding the local people's perception of climate and the relevant ITK is critical for effective communication of scientific forecasts and the implementation of development/adaptation interventions in general.

ITK can add value to climate change studies in several ways. First, ITK creates a "moral economy" by identifying persons within a community's cultural context who provide decision-making processes to be followed based on observed indicators or relationships within climatic and environmental events (Adugna, 1996; Woodley, 1991). Second, ITK improves local level acceptance of scientific methods, as much indigenous knowledge that was once regarded as primitive and misguided is now seen as appropriate and sophisticated. Finally, ITK provides mechanisms for participatory approaches—a major requirement for the success and sustainability of any community intervention.

However, in contemporary society, the use of ITK faces many challenges. In particular, there is a lack of recognition of the need for indigenous knowledge in climate change mitigation and adaptation strategies. There is also a lack of understanding concerning how to integrate ITK into western scientific techniques.

At the same time, indigenous practices should not be seen as substitutes for modern techniques. Rather, the two should complement each other in order to produce "best practices" for mitigation and adaptation options. The interaction between these two different systems of knowledge can further create a mechanism of dialogue between local populations and climate change professionals, which can meaningfully contribute to the design of projects that reflect people's real aspirations as well as actively involve communities (Nyong, *et. al.*, 2006).

2.2 GENDER AND FLOODS

Studies show that the impacts of flooding affect women more than men. For example, Hussein and Husain (2006) observed that women are disproportionately affected by floods as a result of economic and social dislocation of households, as they often have to cope with social and emotional upheavals resulting from flood effects, including death, disease, and food shortages, in the absence of men.

According to Brody, *et. al.*, (2008), in rural areas, women generally assume the primary responsibility for the subsistence of their families. However, women are often engaged in unpaid work and are excluded from household decision-making. Girls are expected to help their mothers with household tasks and with caring for younger siblings. As a result, heavy rains and frequent floods (resulting from climate

change) increase women's workloads, because they have to spend more time looking for food, collecting water, and cleaning and maintaining their houses after flooding. All these leave women more vulnerable to changes due to external phenomena, including climate change. Furthermore, women are sometimes left alone in rural communities during flooding, while their husbands or male household heads work in urban areas or outside the community. This means that women are left to deal with the impacts of floods without support, causing an even greater burden. Hussein and Husain (2006) argue that sustainable flood mitigation can succeed only with the involvement of local communities and disaggregation of the specific roles of men and women in flood protection and mitigation strategies.

As they are often among the most vulnerable group in a community, women bear most of the burden of climate change impacts. Otiende (2009) attributed this to the lack of inclusion/involvement of women in decision-making processes and in flood risk reduction planning and implementation of activities. In addition, the patriarchal system of the communities in Bunyala means that decision making on matters that affect the community, like flood risk management, is mostly vested in elders, who are often older men in the community (Onywere, *et. al.*, 2011). Finally, women are faced with unique challenges such as limited access to resources (e.g., land, livestock, tools, and credit), lack of access to information, limited mobility, and limited roles in decision-making (Ngenwi, *et. al.*, 2011).

Adaptation initiatives that do not take gender aspects into consideration could unintentionally replicate or even perpetuate gender inequalities (Hussein and Husain, 2006). In the Bunyala Sub-county, for example, dykes have frequently been used as a mechanism to control flood waters. However, the unintended impacts of such measures on women have not been comprehensively assessed. It is therefore necessary to understand how such measures impact women, for example, how increased distances to fresh water sources affect productivity and the lives of women.

Otiende (2009) argues that the participation of women and other disadvantaged groups in the community in decision-making processes, including flood risk-reduction measures, is a critical part of ensuring the effectiveness of the strategies. The study suggests that public education and awareness campaigns should target women as key stakeholders in flood risk reduction measures. Community education programs on awareness and behavioral change have the potential to reduce human vulnerability to floods through understanding the nature of flood risks and how to minimize individual and household risk.

The UNDP (2012) emphasized that effective gender mainstreaming starts with a comprehensive analysis of the effects of climate change from both men's and women's perspectives. This helps ensure disaggregation of qualitative and quantitative data by sex, and encourages stocktaking and incorporating women's perspectives in project design and implementation. Additionally, the UNDP notes that it is important that women are adequately represented at all levels in the decision making process and that gender differences in capabilities to cope with climate change are addressed.

2.3 INSTITUTIONS AND FLOODS

Institutions play a critical role in determining how communities and households respond to the impacts of climate change. According to Argawal *et al.* (2008) the activities of local institutions influence the impact of external interventions in shaping adaptation and improving the capacities of the most vulnerable social groups. This is fundamental to the success of adaptation programs. Similarly, national institutions are important as they provide the policy framework within which local institutions operate. The national institutions are instrumental in mobilizing capacity to intervene when extreme climate related events occur. Coordination between national and local level institutions is critical in this respect. Warner and Zakelideen (2012) argue that many studies show that strong collaboration between national and local institutions is crucial in disaster management, especially with regard to communication and disaster preparedness.

In Kenya, the new constitutional dispensation has introduced a two-tier government--national and county level governments. This will influence the institutional environment with regard to climate change impacts. The county governments will play a crucial role in dealing with challenges to development, poverty, resource mobilization, policy formulation, and implementation (GoK, 2013). They will be responsible for responding to the challenges of climate change and to its impacts on local level development and local community livelihoods.

Local public institutions include local government and higher level government offices operating at local levels. Local civil society institutions include rural producer organizations, cooperatives, and savings and loan groups, among others. Private institutions include service organizations such as NGOs and charities, and private businesses that provide insurance or loans (Argawal, *et. al.*, 2008). These local institutions shape the effects of climate hazards in three important ways: they influence how households are affected by climate change impacts; they shape the ability of the households to respond to climate impacts and pursue different adaptation practices; and they mediate the flow of external interventions in the context of adaptation (Argawal, *et. al.*, 2008).

However, institutional interventions need to be cognizant of local circumstances. Socio-economic and cultural perspectives are best captured when local communities and households are fully engaged in decision making. Inadequate and incoherent external support and inappropriate government policies limit the livelihoods outcomes and resilience of vulnerable households (Argawal, *et. al.*, 2008).

The experience in Bunyala appears to indicate weak institutional coordination that has failed to inspire appropriate adaptation responses to the perennial problem of flooding. Onywere, *et. al.*, (2011) noted that dysfunctional investments by the government in agriculture in the area—for example, the Bunyala Rice Irrigation Scheme (initiated in 1972)—is a clear manifestation of how inadequate institutional arrangements results in maladaptation, or inappropriate responses, to the impacts of climate change. The scheme was intended to provide employment opportunities, provide parcels of land where households could grow crops, and enable them to access markets for their produce. While Onywere, *et. al.* (2011) cites this as an illustration of weak institutional coordination, myriad factors may indeed be responsible for the failure of the scheme. In addition, no studies have been conducted on how local institutions access knowledge and information, capital and markets, and how these factors have influenced responses to the perennial floods in the study area.

3.0 RESEARCH METHODOLOGY

The research methodology consisted of a mixed method approach which entailed a combination of a quantitative method (household survey) and qualitative methods (focus group discussions and key informant interviews). The qualitative methods yielded narratives (in quotes and story boxes) about peoples' perceptions of flood impacts, while the quantitative method attempted to measure use and perception of coping and adaptation practices, ITK, gender dimensions and institutional dynamics in the study area.

3.1 HOUSEHOLD SURVEY METHODOLOGY

The study area of Bunyala Sub-county has about 15,245 households in six locations that are further divided into eighteen sub-locations, as indicated in Table I. Stratified random sampling was used to select the required number of respondents. The stratification was based on the populations of 18 sub-locations (KNBS, 2010). A total of 418 households were randomly selected and sampled from the selected sub-locations. There was provision of 18 households that were specifically set aside in case some of the households refused to participate in the household survey; however all households agreed to participate. The sample size of 418 provides a 5% margin of error at 96% confidence level. Within the sub locations, households were randomly selected using spatial randomization tools in a geographic information system. The required sample was calculated using a formula by Watson (2010).

In Kenya, the smallest administrative zones are named “locations,” followed by smaller “sub-locations.” The location is headed by a chief, and the sub-locations are headed by assistant chiefs. In Kenya, what are known as “locations” are held within Sub-counties.

Bunyala is the Sub-county of this study and the six locations for the study are: Bunyala West, Bunyala North, Bunyala East, Bunyala Central, Khajula, and Bunyala South. Each of the above locations consists of three sub-locations. Each sub-location was surveyed. Please refer to Table I below for details of sample size within each location and sub-location. Households in these sub-locations are under the jurisdiction of an assistant chief who works with several village elders (locally called *Liguru*). A standard technique of random sampling was used to select the households, having the *Liguru* generate lists of households in their specific area. The lists were entered into an Excel program and random numbers applied to select the predetermined numbers of households. Questionnaires were administered to the households identified through this process.

ADMINISTRATIVE ZONES IN STUDY AREA:

SUB-COUNTY: BUNYALA

Locations (each headed by chief): Bunyala West, Bunyala North, Bunyala East, Bunyala Central, Khajula, and Bunyala South

Sub-locations (each headed by assistant chiefs): Bukani, Siging, Bukoma, Bulemia, Mundere, Sisenye, Budalangi, Mudembi, Rwabwa, Magombe W, Magombe E, Mabinju, Mabusi, Lugare, Rugunga, Magombe C, Rukala, Ebulwani, and Obaro.

**TABLE 1: THE SELECTED LOCATION, SUB-LOCATIONS, AND SAMPLE SIZE
WITHIN BUNYALA SUB-COUNTY**

Selected Sampling in Bunyala Sub-County		
Locations	Sub-Locations	Sample size
Bunyala West		103
	Bukani	50
	Sigingi	22
	Bukoma	31
Bunyala North		52
	Bulemia	43
	Mundere	9
	Sisenye	0
Bunyala East		97
	Budalangi	37
	Mudembi	27
	Rwabwa	33
Bunyala Central		72
	Magombe W	31
	Magombe E	18
	Magombe C	23
Khajula		51
	Mabinju Mabusi	22
	Lugare	15
	Rugunga	14
Bunyala South		43
	Rukala	43
	Ebulwani	20
	Obaro	8
		15
	Total	418

3.2 HOUSEHOLD QUESTIONNAIRE

The household questionnaire consisted of four sections that had both closed and open-ended questions. The closed-ended questions aimed to prompt responses within a given range of choices to enhance standardization, while the open-ended questions were used to capture people's views and perceptions. The first part included the preliminary section, which dealt with consent and record information. The second section dealt with household livelihood activities, assets, and food security. The third section focused on flood impacts, and coping and adaptation practices. The fourth section explored the three main study themes: indigenous traditional knowledge, gender and floods, and institutions and floods.

3.3 PRE-TEST AND TRAINING

Prior to initiating the field work, both enumerators and supervisors were trained on their duties and roles. A two day training workshop was conducted for the enumerators and field supervisors. The training schedule had sessions on gender dimensions, questionnaire administration, and practical use of handheld global positioning system (GPS) receivers.

The process of quality control began with piloting (pre-testing) of the research instruments. The pilot study was carried out on August 21, 2013, at Lugare A and Lugare B villages in Lugare sub-location. The objective was to assess the adequacy of the household questionnaire tool, and sampling and data collection procedures. The pilot study (or pre-test) was used to identify errors and omissions, and to familiarize the enumerators and supervisors with the process and tools. Prior to the piloting exercise, the Principal Investigator (PI), Co- Principal Investigator (Co-PI) and one consultant (trainer on household survey administration and GPS receivers) recapped the training sessions and emphasized the importance of accurately recording responses.

3.4 FIELD WORK AND QUALITY CONTROL

The research team spent 19 days in the field between September 11, 2013, and October 4, 2013. During parts of October and November, the PI and two consultants, Denis Masika and Cyrilla Luvega, were involved in data collection using Focus Group Discussions (FGDs) and Key Informant Interviews (KIIs).

During field data collection, the data collection team was divided into two groups. Each group was headed by a supervisor. The PI and Co-PI visited the study sites to observe how the enumerators administered questionnaires and the supervisors performed their tasks. The data collection team reported their observations and experiences during end-of-day feedback sessions. This information included discussion of any errors made during questionnaire administration and the time required for the administration of each questionnaire. The pilot data was entered into an SPSS pre-coded screen. Preliminary data analysis was carried out and the results indicated that the quality of data collected was good. The issues highlighted above and the results of the pilot study were used to modify the household survey tool, which was then submitted to ARCC for approval before commencement of full-scale data collection.

The process described above was used during full-scale data collection. During this exercise, measures to ensure quality control included the following: all the questionnaires had serial numbers and the supervisors kept daily records of the questionnaires issued to the enumerators each day, including records of the completed and incomplete tools. This allowed room for follow-up visits to households in case mistakes were noted. The supervisors then went through all the questionnaires before handing them to the technical team, who went to the field to collect them every week until the work was completed.

Anonymity was ensured in data collection, data entry, and analysis. Information on the identity of individuals was not included in the household survey data set. The household survey questionnaire included an introduction that clarified consent and confidentiality. The enumerators were under instruction to inform respondents that participation in the study was optional, and only those willing to participate were engaged. Any respondent not keen to participate was allowed to opt out. In such cases, the enumerators immediately terminated the interview, thanked the individual, and proceeded to the next household. Similarly, FGD and KII respondents were assured that only anonymous data would be used in the research report.

The enumerators did not encounter any refusals by households to participate in the household survey. However, in a few cases, the enumerators had to make call-backs to households. When they found no one at home, the enumerators marked the particular questionnaire and notified the supervisors. The supervisors then ensured that the households concerned were visited at a later date and time so that the required number of questionnaires was attained.

3.5 FOCUS GROUP DISCUSSIONS

The FGD method of data collection was used to pose questions to a group of individuals selected for this specific purpose. A total of seven FGDs with 65 participants were conducted. Some of the

participants were identified based on the observations of the enumerators and supervisors, while others were identified in consultation with village elders, chiefs, and their assistants. As indicated in Figure 2 (study area), River Nzoia split the study area into two zones—the North and South. Three FGDs were conducted on the Southern side; two with women and men and the third with a mixed group of male and female youth. Three similar types of FGDs were also conducted on the Northern side. The exception was the fourth FGD conducted with a mixed group of male and female ITK experts on the Northern side. However, the participants were drawn from both sides of River Nzoia and were identified from the membership of an informal association of community elders in the study area. On the whole, the various categories of participants in FGDs were purposively selected based on their different roles and experiences with floods and weather-related events.

The research team took no direct role in the discussion, but presented topics and moderated the discussion, helping prompt participants to state their views and draw out the views of all group members. Each FGD had between seven and twelve participants.

3.6 KEY INFORMANT INTERVIEWS

The key informant interview (KII) method was used for more in-depth data collection from community members, and in particular, institutional representatives, who had diverse experiences with floods. The aim was to obtain information that would not easily be obtained from the other data collection methods. The KIIs were conducted with selected community members based on their experience in the subject matter and experts from selected organizations. The community respondents were identified based on the recommendations of the fieldwork research supervisors. The government and NGO officials were identified based on the work of their respective institutions in relation to floods in the study area. This method was used to obtain information from respondents who, by virtue of their positions, were deemed to have specific information on community coping and adaptation strategies, flood impacts and operations of the local county government.

A total of 11 key informant interviews were conducted with the following individuals: two KIIs with community elders (one male and one female); two KIIs with youth (one male and one female); six KIIs with government officials from the Ministries of Agriculture, Livestock, Public Health; National Irrigation Board, Water Resources Management Authority and Bulala FM (community radio), WKCDD-FM; and one KII with an NGO official from Busia Community Development Organization (BUCODEV).

3.7 RESEARCH CHALLENGES

The pre-test revealed errors and omissions in the instrument, uncertainty on the definitions of some terminologies, and time-related challenges inherent in both conducting the interviews and using the GPS units. Fortunately, discovering these issues during the pre-test allowed them to be resolved satisfactorily prior to initiating the field collection.

One enumerator resigned to go to college after the pilot study. Fortunately, another enumerator from the pool of those already interviewed for the position was still available to take her place. This individual was quickly trained and assisted by a supervisor during the initial days of data collection.

With 82 questions on 10 pages, the household survey tool was long. In some cases, this resulted in impatience from respondents. The enumerators sometimes sped up the administration of the survey. On the South side of River Nzoia in Magombe East, Magombe West, and Magombe Central (Bunyala Central) the enumerators found that respondents could only be reached after 11 AM. Most respondents were farmers and their farms were located far away from the homesteads, where the survey was being administered. In these cases, enumerators made several call-backs to administer the questionnaire. The challenges described in this paragraph contributed to delays in completion of the field work.

Several enumerators observed issues with cooperation – respondents claimed that much other research work had taken place with little or no feedback provided to the locals. This concern was noted and they were assured that some selected households and other relevant stakeholders would be invited to a community dissemination workshop before the end of the project. A two-day dissemination took place in February 2014. Participants were also informed that both the county and national governments were aware of the study.

Some households were located in inaccessible and swampy areas, particularly those in Bukhuma, Maduwa, and Iyanga in Obaro, and in the Ebulwani sub-locations of Bunyala South. To reach the households in these places, the supervisors and enumerators had to wade in water and take boat rides. The research team was provided with gumboots and other necessary equipment for safety.

Finally, a few respondents especially, the aged, could not identify the specific organizations (public or private) or distinguish between NGOs/CBOs and government agencies involved in flood-related activities. To deal with this, enumerators were trained on how to ask questions in order to get the most accurate responses.

3.8 DATA ANALYSIS

Data Entry and Validity Checking

For the household survey, data entry was done using the Statistical Package for Social Science (SPSS) software and pre-coded screens. Data cleaning was carried out simultaneously as the data collection progressed. Data entry clerks entered the initial data and the co-investigator and two consultants ran quick statistical checks for consistency. This quick checking of the validity of the data collected enabled the data collection teams to rapidly conduct repeat surveys and promote accuracy of data.

Qualitative data was collected through FGDs and KIs. Thus the data was in the form of notes only for KIs, but data from FGDs included both notes and voice recordings. The voice recordings of all the group discussions were transcribed for consistency and validity of information.

Data Cleaning and Analysis

Data cleaning and analysis of the household survey data was conducted by a team of data experts under the guidance of the PI and Co-PI. Data were first coded for ease of pattern recognition, then analyzed to generate the information required for the key research objectives. Information on closed-ended questions was analyzed while open-ended questions were coded and then analyzed. Continuous data were grouped for ease of analysis. Frequency analysis and cross tabulations were carried out in SPSS. The statistics generated were frequencies and percentages of respondents and responses (cases) in regard to multiple options. The result of the analysis was presented in the form of graphs and tables.

The FGD method was used to obtain qualitative data. The perceptions of participants on various questions were recorded by note takers during group discussions. Digital voice recording was used to provide back-up data. The FGD notes were read by the PI and Co-PI to glean relevant information. In addition, two consultants were hired to transcribe the voice recordings of all the seven FGDs. The transcriptions provided back up for field notes and were then used to provide information for the research report.

4.0 RESEARCH FINDINGS PART I

This chapter describes the survey results on household and community experiences and perceptions on climate change impacts due to floods, and expectations on policy in Bunyala, Western Kenya. It is organized into five sections: the first section describes the general characteristics of the respondents; the second section details the household livelihood activities and demonstrates household vulnerability to floods--particularly in terms of food insecurity. The third section presents findings on crop production and food shortages. the use of indigenous traditional knowledge practices as a means to cope with floods; the fourth section describes findings on the perceptions of flooding in Bunyala; the fifth section details coping and adaptation measures used. The following chapter, “5.0 Research Findings Part 2” discusses the uses of ITK with regards to floods, the impacts of floods on men and women; and the findings on the current institutional response to floods in Bunyala.

4.1 CHARACTERISTICS OF RESPONDENTS

Age, Gender and Religion

The ages of respondents were divided into seven categories, with the youngest category being 18 to 30 years and the oldest category being individuals above 80 years old. The majority of respondents were in the 51 to 60 years of age category, followed by 18% of respondents who were in the youngest category. Only 4% (15) of the respondents were above 80 years old. Most respondents were female (62%, 261), partially because, in many cases, men were engaged in work away from home, while in some cases some households were women-headed households. Christianity was reported as the main religion by 99% (417) of respondents, with several Christian denominations in the study area.

Marital Status

About half of the respondents 51% (214) reported that they were in monogamous unions. A sizeable number were widowed (26%, 110), while a smaller number reported to be in polygamous marriages (15%,61). (See Table 2). The remaining respondents were either single or separated/divorced.

TABLE 2: MARITAL STATUS

Marital status	Number of Respondents	Percent
Single	21	5
Monogamous	214	51
Polygamous	61	15
Widowed	110	26
Separated/divorced	11	3
Total	418	100

Education

Most respondents generally had low levels of educational attainment; only about half reported having had some form of formal education. Of those receiving formal education, the majority reported having only received a primary education. Although those receiving no formal education were significant, they were for the most part still literate.

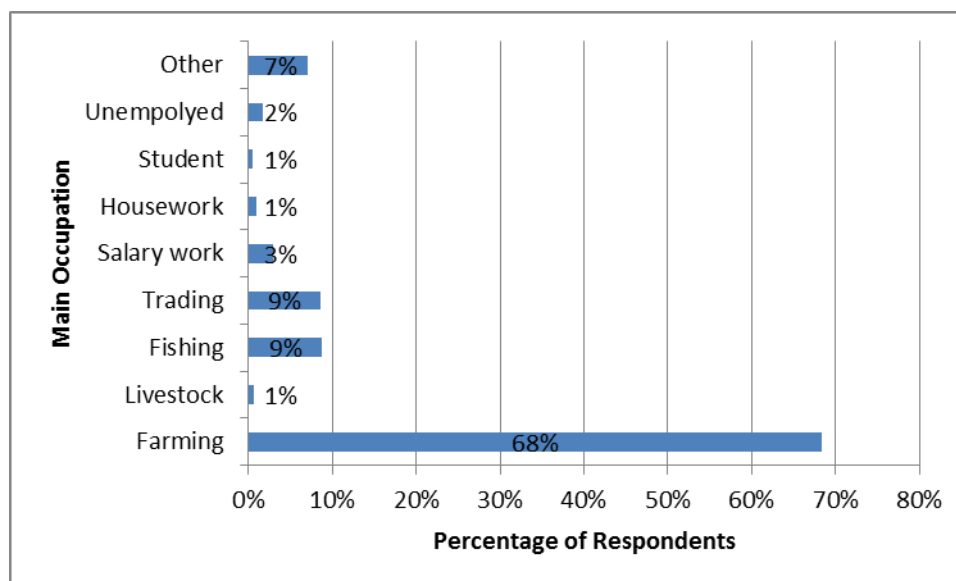
Land Use and Housing

In Bunyala, most households (94%, 394) own the land on which they live. The land use activities reported by respondents included construction of homesteads, crop production, grazing for livestock, renting it out to other users, and fallowing.

Similarly, almost all of the respondents 97% (405) reported owning the houses in which they live. The vast majority of houses in Bunyala are built with iron sheet roofs and earth/cement walls and floors. These materials make these households highly susceptible to flooding, as they are damaged and destroyed easily. A very small number of houses had walls made of stone blocks, or sun-dried and baked bricks, which build more permanent structures that can endure flooding more easily. The type of dwelling units is a good indicator of the socio-economic status of respondents, indicating that the majority of respondents were resource poor. Most respondents (90%, 375) reported that their houses do not have electricity; only a small number of households (9%, 37) reported having electricity. The common sanitary facilities in the area are pit latrines. Households without pit latrines use the bushes.

4.2 LIVELIHOODS

FIGURE 3: MAIN OCCUPATIONS



Farming/Crop Production

Seven out of ten respondents engage in farming. Of all female respondents, 75% engage in farming. Of all male respondents, 53% engage in farming. Farming was the dominant primary occupation of respondents, with 68% reporting it as such. All other occupations were practiced by much smaller numbers of respondents, as can be seen in Figure 2.

In an open-ended question, respondents were asked to list the main crops cultivated. (Respondents were allowed to list more than one crop, which is why the percentages exceed 100 percent.) During data analysis, the crops mentioned were organized into the following categories: cereals, legumes, root crops, vegetables, and sugarcane. Multiple responses show that cereals, particularly maize, dominate (94%, 359), followed by beans (79%, 302), sorghum (35% 133), millet (24%, 91); root crops, (15%, 54) and vegetables (6%, 24). The root crops consisted of sweet potatoes (8%, 28) and cassava (7%, 26). The main vegetables planted were kale (4%, 16), tomatoes (1.3%, 5), and cabbage (0.8%, 3).

Livestock

Livestock keeping is a livelihood activity practiced alongside crop production. Most respondents (80%, 336) reported owning livestock. The main livestock breeds include cattle, goats, sheep, pigs, and poultry. Almost half of the respondents who own livestock indicated the main purpose as home consumption. Around one third of respondents indicated sale as the main reason for livestock keeping. This would explain why, despite 80% of households keeping livestock, only 1% of respondents reported it as their main occupation.

Fishing

Fishing was identified as another source of income. Some 40% (169) respondents reported that they, or members of their households, engage in fishing and related activities. Fishing is concentrated among the younger age groups with over 60% of fisher folk falling between the ages of 18 to 50 years.

Off-farm Activities

More than half of respondents (63%, 264) reported that they, or members of their households, derive some income from non-farm activities, while about one third (36%, 152) did not obtain income from non-farm activities. White and blue collar jobs were the main non-farm (off-farm) activities reported by respondents. Some respondents (3%, 12) reported participation in salaried work, for example, as teachers, laboratory technicians, and assistant chiefs. A small number of respondents (1%, 5) reported engagement in blue collar jobs including carpentry, driving public service vehicles, sand harvesting, and cobbling.

4.3 CROP PRODUCTION AND FOOD SHORTAGES

Most households (89%, 365) indicated that there were months during which they experienced food shortages. The survey results further showed that majority of respondents (90%, 244) whose main occupation is farming are affected by food shortages. The most affected age groups are 51-60 (19%, 52); 41-50 (16%, 44); 61-70 (15%, 40) which are also the most active in farming as an occupation. A majority (89%) of the fisher folk also reported that they have experienced months of food shortages.

The respondents (65%, 220) attributed the main cause of food shortage to floods. The respondents also identified drought, lack of money to buy food, poor harvests, sickness or ill health, infertile soils, small agricultural land sizes, change in rainfall patterns, and wild animals/pests as other factors that contribute to food shortages.

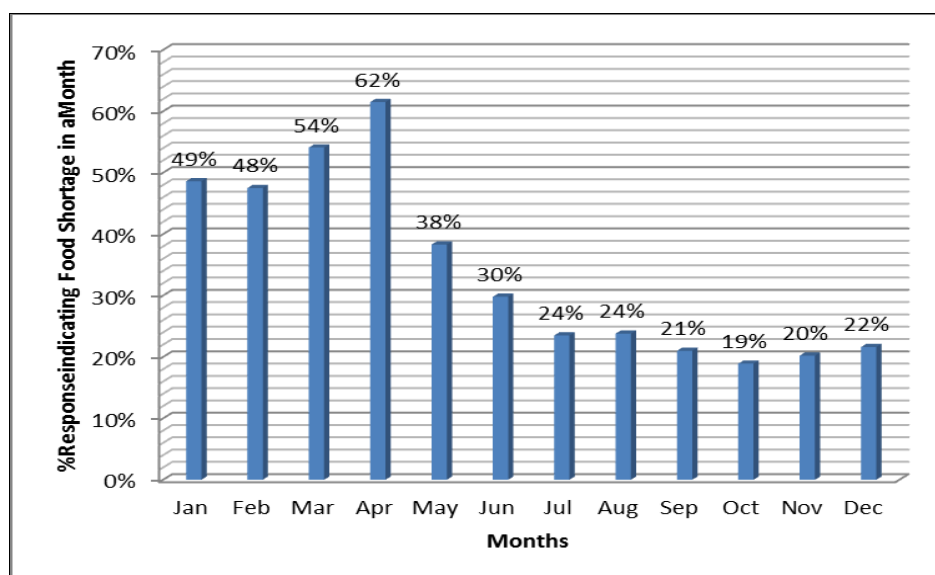
Generally, farming is the major socio-economic activity for the residents of Bunyala. However, the main purpose of crop production was found to be household consumption. About 84% of crop yields were reported as being for household consumption. Very little, approximately 11%, was reported to be sold. The staple food eaten during most meals was a maize meal (locally called *ugali*) – which is eaten with a variety of sauces and vegetables. Traditional vegetables are usually grown by women in their private gardens and are used for household consumption.

Additionally, during one KII with the Ministry of Agriculture the informant attributed food shortages to annual floods since 2008 in which farmers lose up to 60% of their crops and produce. More so, waterlogging after floods leads to further loss of crops and consequently, “the diminished resource base by recurrent loss of crops and land lead to loss of morale-people give up because why farm when one cannot harvest anything” (KII from Ministry of Agriculture).

With regard to crop production, respondents were asked about their perceptions of the decrease or increase in productivity over the last five years. A majority of respondents (62%, 259) involved in farming stated that crop productivity has decreased “a lot” mainly due to floods associated with too much rainfall and drought from low and unreliable rainfall (resulting from aridity caused by proximity to Lake Victoria); while for 28% (117) respondents, crop productivity decreased “a little.” In comparison a small number (3%,12) respondents indicated that there was a small increase in crop productivity.

The link between crop production and food shortage was made by one key informant who stated that, at the beginning of the year, planting begins in the middle of February to March, weeding is in April, and harvesting of beans starts in early May when flooding does not occur. It takes about three months from planting to harvesting. Ideally, the crop is harvested before the ideal time to avoid flood damage and supplement the diminishing food stock. As such, farmers were harvesting some crops earlier that they would have liked, in order to at least guarantee some harvest. However, food shortages may be experienced between the months of January to April due to the floods that happen regularly in the months of November or December (Figure 4).

FIGURE 4: PERCEPTIONS OF MONTHLY FOOD SHORTAGE



4.4 FLOODING IN BUNYALA

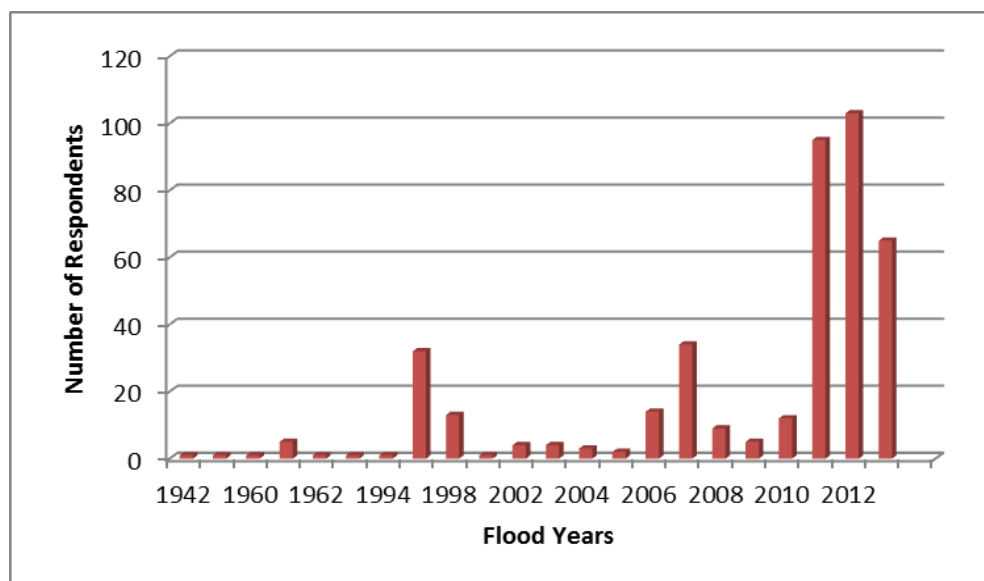
Household Perceptions of Flooding in Bunyala

Generally, when floods occur in Bunyala, the first alarm is usually raised by the people living near the river and dykes as they observe the rapid increase in the volume of water in the river channel or within the expanse between the northern and southern dykes. The alarm consists of ululations (shouts/cries)

called "*chinduru*" to convey danger from floods) by women and by men from the point of danger to other homesteads and villages in the area. Usually, there are no false alarms as floods are a matter of life and death not to be joked with. Available information shows no false alarm. Forewarned households move to gather children, livestock and household property in preparation for relocation to higher areas. The zone between the northern and southern dykes in Bunyala may be flooded without water overtopping into the adjacent floodplains. However, the dykes themselves are still considered as a viable option for temporary relocation because their height provides room for construction of temporary shelter and also allows movement of people and animals to move outside flooded areas. As events unfold, local government systems made up of the sub-county commissioner, chiefs and village elders liaise with other government officials to identify areas in which camps should be set up to accommodate households displaced by floods.

Since 2006, the patterns of floods have reflected the annual occurrence of severe floods. When asked about their perceptions of the most recent and severe flood, many respondents 25% (103) identified the flood of December 2012 as the most destructive, followed by 23% (95) and 16% (65) who mentioned the floods of 2011 and 2013, respectively (Figure: 5).

FIGURE 5: YEARS OF REPORTED RECENT AND SEVERE FLOODS



With regard to flood impacts, most respondents 92% (385) reported adverse flood impacts on their households. The response on the degree of flood impacts varied from severe 51% (213) to very severe 30% (126) to not severe 7% (29). A small number of households 7% (30) reported being unaffected by floods. Comments from the FGD with youth on the Southern side of River Nzoia shed light on the unaffected or less affected households.

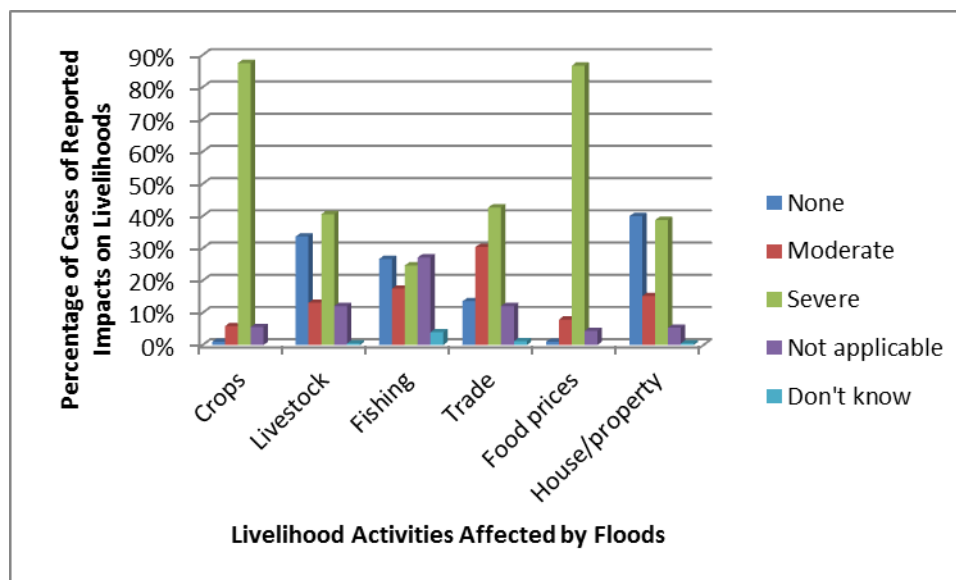
Participants were unanimous that unaffected households were:

- Economically well-off;
- Their children went to school wearing shoes;
- Live in permanent houses (made of brick, stone or sand blocks with iron sheet or tiled roofs);
- Those whose homesteads are located on raised grounds (untouched by flood waters); and

- Those who own boats/canoes (it costs about Ksh 50,000: USD 588 to build one).

The extent of flood impacts on livelihoods is presented in Figure 6.

FIGURE 6: FLOOD IMPACTS ON LIVELIHOOD ACTIVITIES



Flooding Frequency

In order to identify coping and adaption measures used to deal with flood impacts, respondents were first asked whether they had experienced changes in the frequency and intensity of floods. Most respondents 94% (39) recognized such changes. For example, one ITK expert stated that historically, floods occurred every five years but today, flood events are more frequent. In the period between 1938 and 1952, floods occurred but people were never displaced from their homesteads. The most severe floods in Bunyala occurred in 1961/1962 and led to the construction of the existing dykes. From that time until now, floods have become more frequent, occurring twice a year during the long and short rains (long rains season is between April and June while short rains are expected between September and November).

Vulnerability to Floods

The respondents were also asked about their perceptions on their current vulnerability to floods compared to previous years. A majority 63% (263) observed that they were now better able to cope, some 17% (71) reported about the same ability to cope, while others 17% (71), reported being less able and only 2% (8) reported having no difference in their capabilities to deal with floods. As mentioned above, participants in the FGDs were also emphatic about some of the reasons as to why some households were better able to cope versus others.

IMAGE 2: SUBMERGED HOMESTEAD IN IGIGO VILLAGE, BUDALANGI SUB-LOCATION, DECEMBER, 2008.



Credit: BUCODEV

Some of the reported characteristic of households that were able to cope were:

- Those with farms in flood prone areas where crops will be destroyed
- Those whose homesteads are located in flood prone areas
- Those who move temporarily to camps during floods
- Those who are illiterate and uninformed (for example households which use mosquito nets to fence off kitchen gardens against chicken reared under free range method rather than for use at night as protection against mosquitoes).

Flood Assistance

The respondents were asked about the assistance they received to deal with flood impacts. Most 74% (310) reported that they did not receive assistance from other people. However, some 26% (107) relied on assistance from other people. Of the latter group, assistance took the form of money 34% (33), shelter 30% (33), and materials 20% (22), and food items (one, 1%). In addition, many respondents 65% (271) received assistance from organizations. A significant number 30% (125) reported that they did not benefit from organizations. The main organizations that provide assistance during flood events were identified as NGO/CBOs 41% (236), government agencies and departments 38% (219), and religious organizations 20% (115).

The findings on floods in Bunyala in relation to household perceptions on increased intensity and frequency of floods, the reasons for vulnerability, and assistance provided to residents by other people and institutions indicated are indicative of the coping and adaptation practices to deal with flood impacts.

4.5 COPING AND ADAPTATION MEASURES

Generally, in dealing with vulnerability issues, reference is often made to coping and adaptation. The two terms appear similar but mean different things. Warner, *et. al.*, (2007) defines coping as short-term actions to respond to immediate risk, rather than adjustment to permanent threats. While the UNFCCC (2007) defines adaptation as processes by which communities or societies make themselves better able to deal with uncertain features on more long-term basis. In general, coping strategies, while addressing short-term situations, are less likely to be sustainable than adaptation strategies, which are longer term strategies.

Coping and Adaptation Practices

As discussed above, some respondents reported receiving assistance from public and private organizations in order to cope with flood impacts. Besides this coping mechanism, respondents also identified other coping and adaptation measures. Coping versus adaptation strategies that were adopted are listed below. They reflect a combination of information obtained from the household surveys, FGDs and KIIS.

Women reported adopted the following coping strategies to deal with the impacts of floods:

- Engaging in manual labor such as at construction sites and weeding other peoples' farms;
- Engaging in petty trade (retail buying and selling of food and non-food items such as cereals, tea leaves, sugar, salt, cooking fat and second hand clothes);
- Engaging in activities to earn extra income, such as manual labor and petty trade, were reported by 59 percent (211) of household survey respondents;
- Migration, defined as temporary relocation, to camps and to the homes of relatives and neighbors (29%, 104) living in safer areas;
- Spending less money on household requirements 22% (78) such as spending less money on food due to relief rations received from public and private organizations;
- Rationing of food by reducing the quantity and number of meals for both children and adults;
- Sale of household assets (5%, 17) such as mobile phones;
- Withdrawing children from school to help with domestic chores (in any case during flood events schools remain closed) and income-earning activities such as fishing in flood waters; and
- As previously discussed, the reliance on assistance from public and private organizations was also part of the short-term coping strategies of households.

The adaptation strategies highlighted in the FGDs and KIIs included:

- Planting trees around homesteads which helped with keep out water to protect houses;
- Construction of houses with raised foundations, preventing damage to household and household goods and decreasing chances of relocation;

Coping vs. Adaptation

Coping: Short-term actions to respond to immediate risk, rather than adjustment to permanent threats. Coping strategies more often than not have long-term negative effects.

Adaptation: processes by which communities or societies make themselves better able to deal with uncertain features on more long-term. Adaptation strategies have long-term positive effects.

- Purchase of land on higher grounds or, if do not own land, migration to land on higher grounds but this option was viable only for economically well-off households;
- Changing income sources by entry into small-scale trade and fishing;
- Planting early maturing crops such as vegetables for food and income immediately after floods;
- Strengthening food storage by use of traditional pots and gourds;
- In the FGD with the youth on the North, participants expressed a different position and identified the formation of groups (youth groups and community groups) that promote sharing of resources as critical; and
- Other important adaptation measure involved leasing of farm land in the Migingo area for growing maize and sorghum.

As mentioned above, the *Migingo* area in Bunyala has high potential for agricultural production as it is not perennially affected by floods compared to other parts of the study area. According to the KII informant from the Ministry of Agriculture, it is the only area where large-scale agricultural production is possible with the potential for surplus food production to reduce food shortages and generate incomes for households. However, exploiting the land which borders Siaya County is complicated by lack of adjudication.

Although already highlighted above, the FGDs showed that households understood that there were clear reasons for adopting certain long-term adaptation strategies that helped household adapt to the effects of floods, and could identify some of the strategies very clearly. For example:

- In the FGD with women on the Southern side, participants thought that community members thought it was more effective to respond to floods with long term measures such as planting trees around homesteads and construction of houses with raised foundations;
- In the FGD with women on the North, participants emphasized the construction of houses on raised ground within homesteads, purchase of land and migration to higher grounds
- In the FGD with men on the Northern side, participants considered changing income sources and food storage important; and
- In the FGD with the youth on the North, participants expressed a different position and identified the formation of groups (youth groups and community groups) that promote sharing of resources as critical.

Similarly, in a KII, the informant from the Ministry of Agriculture observed that people may report or talk about their ability (including individuals and communities) to cope and/or adapt based on information in the public domain, including: Radio bulletins, stories in newspapers, chief's barazas, community meetings, and public and NGO initiatives. This can happen by information trickling down to households through projects being implemented in the area. For example, at the time of this writing there was a project on tree planting in the upper catchment of River Nzoia and in the Bunyala Hills to deal with soil erosion being implemented by WKCD&FMP. There is information in the public domain on dyke management and construction of a new set of dykes (in a World Bank/Government of Kenya funded project). The presence of these projects has created awareness among households that these are measures that could help them deal with the impacts of floods, or help prevent the severity of floods.

In addition, the key informant from WKCD&FMP also argued that the implementation of the two measures would effectively reduce the severity of floods--particularly the construction of dykes which is

beyond the capacity of households and communities in the study area. However, if dykes are not constructed, the pattern of negative impacts of floods would continue or worsen. Thus the implementation of the structural flood management measures (particularly dams/ water reservoirs and dykes) by either public or private institutions would help strengthen existing adaptation practices by households in Bunyala and enhance their resilience to flood impacts.

Perception of Effectiveness of Coping and Adaptation Measures to Deal with Flood Impacts

The respondents were also asked about whether the coping and adaptation practices they used were effective in helping them deal with the effects of floods. A significant proportion (84%, 347) reported that the coping (engagement in extra income earning activities, sale of household property, spent less money on household expenses, and modified food consumption) and adaptation measures particularly permanent migration were inadequate (non-effective) while 15% (63) acknowledged some level of adequacy (effectiveness). However, even for the respondents to whom the coping and adaptation measures were effective, 98% (298) noted that the measures were still not enough to deal with the impacts of floods. In addition, 1% (3) reported that the measures had cost implications.

Some of the strategies perceived as most effective included:

- Engagement in extra income earning activities beside farming;
- Location of homesteads and farms in raised areas 18% (66);
- Shifting/ diversifying from farming to small-scale farming to fishing and small-scale businesses; and
- Early planting of certain crops such as vegetables, beans and sweet potatoes.

These useful strategies are indicative of viable adaptation practices used by some households. While some of the strategies perceived as least effective included:

- Sale of household property such as mobile phones and bicycles;
- Spending less money on household expenses;
- Modified food consumption by reducing quantities and number of meals per day for both children and adults; and
- Permanent migration) which requires huge sums of money for purchasing land and constructing houses.

In regard to the coping and adaptation practices of households, participants in the men only FGD on the Northern side reported that some households are better equipped and well prepared to deal with the impacts of floods. The characteristics of such households include:

- Households living in raised areas far from the river and dykes;
- Households who own boats for fishing and transport;
- Those who live near roads;
- Households that are economically well off and can afford to migrate or buy land and settle elsewhere;
- Small size households with up to four members; and
- Households with able bodied members.

They also identified households that are ill-equipped and poorly prepared to deal with floods including:

- Families with elderly members;
- Families with disabled members;
- Poor families and those with many disabled members;
- Orphan-headed households;
- Female-headed households;
- Households living near the river banks and low-lying areas such as *Sigingga*;
- Families with large numbers of people, many houses and livestock – they will experience more destruction and recovering is expensive;
- The poor whose houses are mud-walled and roofs made of reeds or grass thatched; and
- Households in which elders live alone.

5.0 RESEARCH FINDINGS PART 2

5.1 INDIGENOUS TRADITIONAL KNOWLEDGE (ITK) AND FLOODS

The study focused on ITK in the context of communities with high poverty levels. As was pointed out in previous sections, many coping strategies are currently being used – and are often erosive (long-term negative effects) further increasing household vulnerability. Local knowledge on rainfall and flood patterns can provide insights into traditional coping and adaptation strategies and opportunities for integration into interventions by public and private institutions for long-term livelihood sustainability. Therefore, it was necessary to identify the ITK – which resides in people’s memories and is transmitted orally to deal with natural disasters, such as floods. ITK can also provide and promote understanding of potential channels for communicating climate related information and adaptation options.

Custodians of ITK

The custodians of the ITK on rainfall and floods were reported as being mainly elderly men 64% (348) and elderly women 31% (166). In addition, it was noted in all the FGDs that elders, both male and female, possess ITK. The more youthful community members who engage in fishing were recognized to possess ITK on fishing and wind (wind patterns/direction and its influence on the availability of fish).

ITK Techniques

The ITK techniques noted are divided into two categories: those used prior to flood onset, and those used after floods to cope with flood impacts. People in Bunyala appeared to be highly knowledgeable or at least aware of ITK techniques used to predict rainfall. Participants in all FGDs identified examples of how ITK was used to predict rainfall and floods. Regarding use of ITK after floods, the household surveys results showed that, of those who used ITK, it was primarily used for food storage.

Some of the ITK techniques identified during the FGDs are listed below:

ITK Techniques Used Prior to Flood Onset

- The sighting of certain migratory birds (*magungu*) indicate onset of the rainy season
- The sighting of a type of eagle (*Ikhwasi*) indicates onset of rainfall
- Wind direction was indicative of various predictions, including:
 - *Agundu* blows from North to South and indicates a dry spell
 - *Ikhoma* blows from East to West and indicates a dry spell
 - *Imbalaha, Nyauganda, Luingo* blows from South to West and indicates rainfall onset
 - *Imbuga* blows from East to West in December signaling a dry spell
- Change in the color of water in the river, including foam and floating debris, indicates flood onset
- The behavior of animals such as frogs (croaking at night in November) indicates flood onset
- Dark clouds in the direction of Mt. Elgon indicates rainfall and flood onset

- Appearance of safari ants in homesteads and riverbanks/dyke indicates flood onset
- Shedding of leaves by the *Omulodo* tree heralds rains onset

ITK Techniques Used After Flood Onset:

Some of the ITK used after floods include:

- Fishing in flood waters- fish is plentiful in flood waters and fishing was done by men, women and the youth in flood waters using traditional traps made of reeds and sticks. The fish was used for both household consumption and sale.
- Traditional herbs and cow-dung was burnt in open fireplaces to deal with mosquito menace that affected both humans and livestock. Herbs are used to purify drinking water and cure water borne diseases.
- Food Storage/ Preservation:
 - Maize and meat is dried and then staked on sticks above the fireplace for preservation through smoking.
 - Food preparation includes processing and treatment using traditional methods such as mixing cereals (maize, beans and groundnuts) with ash in gourds and pots sealed with cow dung to make them air tight.
- Household Movement during Floods/ Temporary Migration:
- ITK on flow of flood waters enables community members to know the locations of danger and safety zones and the routes to travel for the safety of those affected.
- Alternative Shelter: relates to skill in construction of shelter using natural materials such as grass, sticks/branches of trees and reeds, and residing in homes of friends and neighbors.
- Safety & Security: relates to informal arrangements by men and boys to patrol homesteads using boats and canoes. In many cases men remained behind in homesteads to guard household assets stored on the roof tops and in the eaves of houses.

Awareness and Use of ITK

A majority of respondents reported a high level of awareness of the use of ITK techniques for predicting the onset of rainfall (81%,340) and floods (72%,299). However, only about a third of respondents (29%, 123) reported using ITK to cope with floods. Despite the seemingly high awareness and knowledge of ITK, most respondents (86%, 361) reported that they no longer use ITK to cope during and after floods; and only a very small number of respondents reported being able to cope with floods better by using ITK. Despite the lack of trust or use, there is still awareness of ITK uses; only 8% of respondents were unaware of ITK.

The households who use ITK to deal with the impacts of floods primarily do so as a means of food preparation and storage (79%, 72). ITK was used to a lesser extent to determine where to move households during flood events (43%, 39) and migration (34%, 31). Migration is defined as temporary relocation, which takes place after flood onset. ITK is used in these latter two scenarios by following traditional migratory corridors taking into account topography of the area.

There were several reasons individuals reported for not using ITK, including lack of access to ITK (48%, 131), reliance on modern forecasts (35%, 97), and lack of trust in ITK (24%, 65). Upon further investigation it became clear that ITK techniques were generally not thought of as useful, with about half of participants reporting no usefulness of ITK whatsoever (49%, 200) and only a very small number reporting being able to cope with floods better by using ITK (7%, 27).

However, information from FGDs and KIIS demonstrated that some individuals were aware of ITK uses. One example discussed was how ITK was used to open up drainage channels to speed up the flow of flood waters toward Lake Victoria by community members, a practice organized by work parties called *silabalaba*, and coordinated by village elders. But this is no longer practiced. As a result blocked drainage channels in the study area have not been opened up, thereby exacerbating flood water retention.

Changes in Use of ITK Measures

The findings show that despite the perception that there have not been significant changes in the use of ITK in Bunyala, when asked about past and present use of ITK as a means to deal with floods; some differences were found (Figure 7). In addition, 25% (104) of the respondents claimed that ITK is no longer used at all as a technique to cope with floods.

The study also found that, historically, ITK was mainly used in storage of food (76%, 296), flood prediction (66%, 258), migration (62%, 240), alternative shelter (38%, 149), safety and security (36%, 140) (safety of people and security of belongings in the homesteads/villages), and healthcare (traditional medicine for management and treatment of illnesses/diseases that affect human and livestock) (3%, 11). It is interesting to note that although ITK was seen to be used significantly in the past for preserving safety and security, whereas it is hardly used for this purpose today. ITK was previously used and is still used about the same amount for alternative shelter and storage of food. Current and past use of ITK was seen to be minimal for flood prediction and healthcare (Figure: 7).

POTENTIAL USES OF ITK

Alternative shelter: relief camps or the homesteads of relatives and friends in non-flood prone areas

Migration: following traditional migratory corridors taking into account topography of the area in order to temporarily relocate household. Make sure to distinguish difference between alternative shelter, migration and safety and security

Safety and security: ensuring that all household and community members are safe and that household property is protected

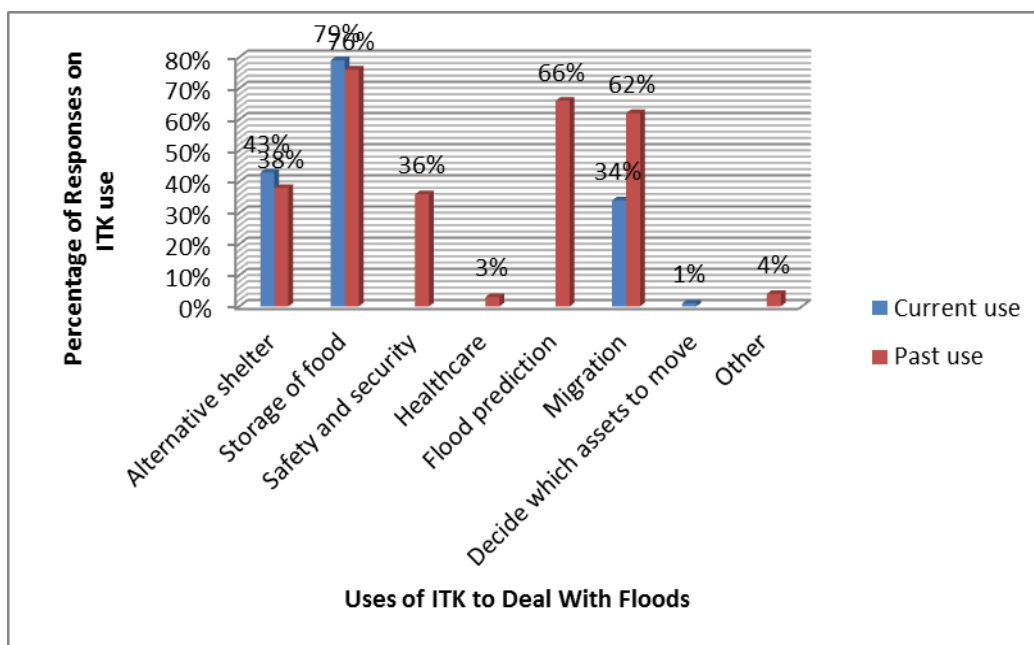
Storage of food: using traditional pots, gourds and plastic containers to preserve staple maize, sorghum, millet and fish

Healthcare: use of herbs to manage and treat human and livestock diseases

Flood prediction: (for example, what you could place here is a statement like: monitoring changes to weather patterns and the environment to predict when rains and floods will occur and to determine when crops should be planted)

Decisions on assets: prioritizing assets for immediate use and items to be left behind in homesteads or discarded

FIGURE 7: CURRENT AND PAST USE OF ITK



The respondents in the household survey identified some reasons for the changes in use of ITK including the following:

- Impact of modern education: 65% (258)
- Lack of transfer of ITK from the older to younger generations: 60% (241);
- Low level of accuracy of ITK: 52% (208);
- Negative attitudes by the younger generations: 41% (163);
- Contradictory and sometimes competing information from government agencies and other external organizations 28% (111);
- Climate change: 30% (119);
- Low level of accuracy: 29% (116);
- Use of modern forecasting methods: 17% (67);
- Lack of trust in ITK experts: 4.3% (17); and
- Association with witchcraft: 3% (10).

The views expressed above were corroborated by information provided by FGD participants, who observed that:

- ITK has been ignored by the present generation;
- There is a generational gap between the youth and elders who possess ITK on rainfall and floods;

- The population of the elderly who possess ITK has declined and they have also isolated themselves and are selfish in sharing knowledge – for example, during hardship the elders would rather exchange their knowledge for money;
- Technology has denied the old men and women the chance to exercise their ITK;
- The meteorological department has discouraged ITK; and
- There is lack of respect for the elderly by younger community members which limits intergenerational transfer of ITK.

Despite the seemingly negative perceptions of trust in and use of ITK that came from the household surveys, the FGDs and KIs indicated that a reasonable number of people actually did still trust and use ITK for dealing with floods events.

One KI informant who is an ITK expert observed that he provides flood prediction information to the area chief/assistant chief and to the community members at public gatherings. He reported that some people listen but those who do not, regret later and recognize his earlier warnings. He also observed that his elder son who has gone to school has integrated modern education and ITK and is now more knowledgeable than the father. The informant wished he could get similar education to improve his practice. According to this particular informant, the continued trust in ITK in the community is supported by invitations received from primary school teachers at Busagwa and Buhoba primary schools where he volunteers teaches pupils about rainfall, floods and wind patterns in Magombe sub-Location to pupils in classes four, five, six, seven and eight. He also volunteers to mentor children to learn about ITK.

Another KI informant from the Ministry of agriculture mentioned that some aspects of ITK informs one critical adaptation practice for food security: the planting of fast crops (mainly beans, cow peas and sweet potatoes) immediately after flood waters recede. This is done for both household consumption and sale.

Institutions and ITK

The respondents were asked about their perceptions on use of ITK by institutions to deal with floods. Many respondents (63%, 265) observed that public and private institutions do not use ITK in their interventions, while 15% (61) reported that institutions used aspects of ITK. For example, one KI interviewee observed that officers in the Ministry of Agriculture in Bunyala use ITK only in crop production during extension.

In order to address the challenges to use and integrate ITK into institutional interventions, participants in all the FGDs observed the need for:

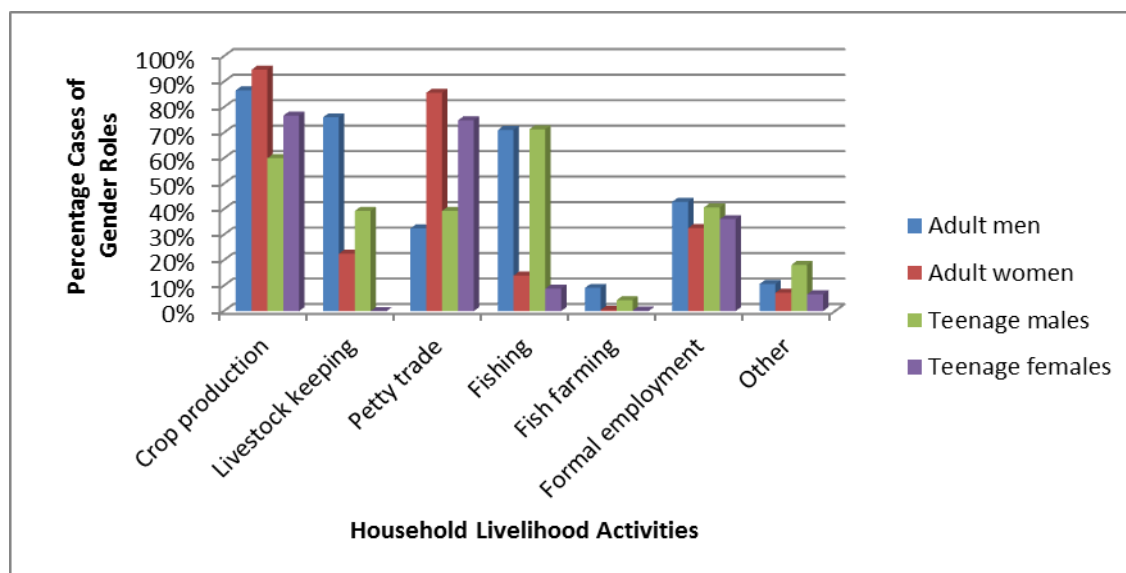
- Scientists to work with and consult ITK experts and to involve the community in research to enhance acceptability and success in implementation.
- The government to put in place policies where the elderly with ITK are acknowledged and even compensated monetarily.
- Modern climate forecasting should consult local ITK experts to improve presentation of climate information for public dissemination.

5.2 GENDER AND FLOODS

Gender and Livelihoods

While women and men both engage in crop production as a primary livelihood activity, among men, this activity is supplemented most commonly with livestock keeping and fishing, whereas for women it is supplemented mostly with petty trade. Among youth, fishing and petty trade dominate for males and females, respectively. All four groups participate about equally in formal employment (Figure 8).

FIGURE 8: GENDER ROLES IN LIVELIHOOD ACTIVITIES



Household Decision-Making

The household surveys, key informant interviews and focus group discussions repeatedly revealed that men were the primary household decision makers, with few cases citing women as playing a part in contributing to household decisions. Women were reported to contribute to less than a third of the decisions on livelihoods activities, land ownership (generally in Kenya land title deeds are in the names of men who own and decide on the use to which land is put) and how to respond to floods (Figure 9).

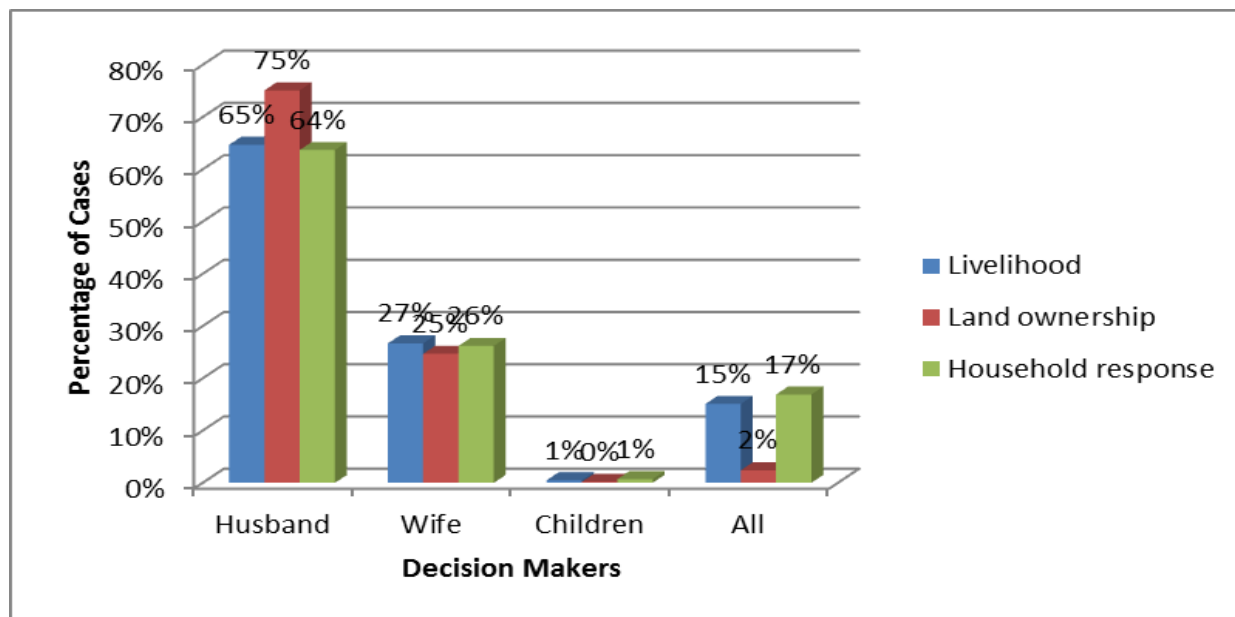
“Culturally, men are the sole decision makers” – KII participant from Western Kenya Community Driven Development & Flood Mitigation Project (WKCDD & FMP)

As discussed above, although women do have some freedom to own livestock and often engage in small-scale farming activities slightly more than men (other than the staple crops maize, sorghum, and beans; women also have their own vegetable kitchen gardens) they do not have control of the decisions and income associated with these activities. For example, women can own livestock but they have to consult men, usually their husbands, for permission to sell. Furthermore, as noted by one informant “women can farm but may not keep the money, so men are more resource-equipped” (KII from WKCDD&FMP). Since farming is the main livelihood activity, this demonstrates the low level of decision-making power women have. Since it was found that women typically do not own land they have little say in decisions on how to use that land. This situation echoes what occurs in Kenya, where nationally, women account for 5% of registered land holders but contribute over 80% of the agricultural labor force, 64% of subsistence farmers, and produce approximately 60% of farm-derived income. There are huge disparities

in land ownership and transfer of land between men and women. In addition, women and the youth are excluded in land decision-making processes. Furthermore, traditional inheritance rights and customary laws and practices exclude women and widows from inheritance of land (Benschop, 2002; Syagga, 2006).

However, the exception to this was when women were the primary bread winners. As one individual said, “decisions are always made by the bread winner--usually men but to a small extent, by women”. Although the household surveys did not ask who the primary bread winner was, they did ask whether the household was headed by a male or female. About 20% of households were female-headed.

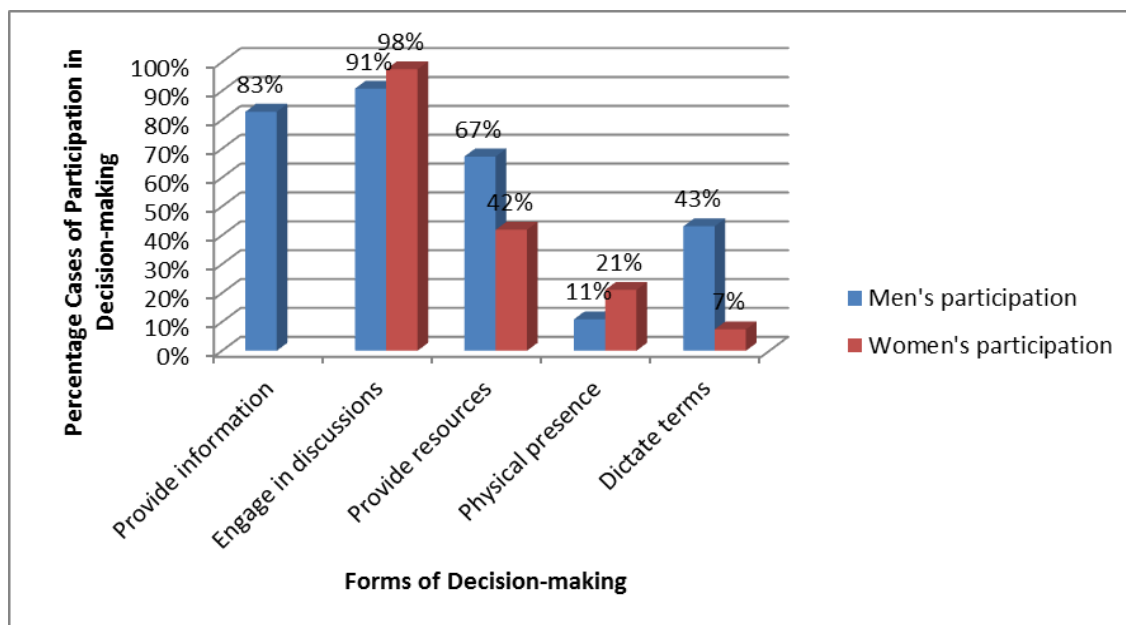
FIGURE 9: HOUSEHOLD DECISION-MAKING



The household survey shows that the common decision-making processes used by men and women are: discussions in which men and women talk about household matters that concern them; provision of resources (since men are more endowed they provide more resources compared to women; while physical presence (means being personally present at the time of discussion and decision-making) is more important for women than men at the time of decision-making; the provision of information was found to be entirely the preserve of men, with no women stating that they were providers of information whether on knowledge of floods or livelihood activities. This indicates that men are seen to occupy the space of knowledge-providers, hence have greater authority when it comes to household decision-making.

Comparatively, men provide more material and financial resources than women as they are more resource-endowed. Men own land and livestock and also participate in wage employment more than women, who are restricted to domestic tasks in or around the home and small-scale/ petty trade. This tilts the balance of authority in household decision-making in favor of men. The implications of all these issues mean that men are able to get their way or “dictate terms” in as far as decision-making in household is concerned. For women, being personally present at the time decisions are made is important since they are able to explain their position while men have to be consulted by women even when they are not present (away from home at work or due to any other reason) (Figure 10).

FIGURE 10: LEVELS OF GENDER PARTICIPATION IN DECISION-MAKING



Gender and Flood Impacts

In assessing perceptions of respondents on the effects of floods on women and men, approximately half of the respondents reported that women and men were affected differently. Although the households survey seemed to be split on the perception that men and women are affected differently, the FGDs gave very different results. During all seven FGDs it was echoed time and again by the vast majority of participants that, despite most households and community members being negatively affected by floods, the negative impact was greater on women. This was seen particularly due to the typical gender role of women – i.e. their domestic responsibilities, and responsibility for caring and nurturing children and family – which are exacerbated during times of floods. Women in Bunyala have to deal with the impacts of floods but also have to:

- Remain at home (or camp) while men go out to work within or outside the study area;
- Take care of children and other family members; and
- Perform domestic chores such as looking for food, water and fuel wood and cooking.

Similarly, the KII informant from WKCD & FMP observed that, “the impact of floods is felt more on women and children than men. During floods men can do fishing or casual labor to get some income, but women and children have nowhere to go.” Much of the burden women face is because they are displaced from their place of work (their home). During the FGDs women and men discussed many of the burdens women face, including:

- Loss food and stored farm produce, household utensils/goods but still have to care for their children;
- Loss of income due to destruction of crops and displacement;
- Lack privacy in camps where they have to stay with children and teenagers in tents/temporary shelter in camps;

- Increased sexual harassment, exploitation and promiscuity at camps which increase the risk of HIV/AIDS and STI/STDs;
- Increased spread of water-borne illness, health issues such as cholera, typhoid and malaria;
- Pregnant mothers are unable to visit maternal clinics;
- Conflicts and family break ups; and
- Petty businesses run by women are either disrupted or destroyed by floods for example retail kiosks/shops, sale of food stuff and second hand clothes.

The KII informant from Ministry of Livestock identified some additional problems experienced by women including loss of food and income from kitchen gardens and petty trade, which in turn leads to increased reliance on men for food and income. Worse still, increased sexual harassment and promiscuity at camps was discussed as resulting in increased risk of HIV/AIDS and sexually transmitted infections (STI/STDs) particularly for women. Although this was not asked in the household survey, during many of the KIIs and FGDs individuals spoke up about the lack of privacy in the temporary camps, which lead to increased sexual activity and sexual exploitation and STI/STDs. During the household survey it was reported that women are particularly affected by rape, prostitution and drug abuse (11%, 39) and early marriage (5%, 18), respectively. Other problems experienced by women are conflicts and family break ups, poor diet for lactating mothers, and inability of expectant mothers to access antenatal clinics.

Accordingly, another KII interviewee from the Department of Livestock stated that women, children and youth are the most vulnerable to floods. In the case of women, floods destroy kitchen gardens, and water for domestic use becomes contaminated. Flood damage to crops therefore affects women most as they have to feed the children.

Gender Roles in Their Immediate Response to the Onset of Flooding

The participants in FGDs were able to distinguish the roles played by men and women in response to the onset of flooding.

Specifically, women

- Pack and care for household goods – utensils, food and bedding;
- Take care of children;
- Search for food and firewood;
- Cook food and wash; and
- Use gunny bags to strengthen dykes to stop over topping.

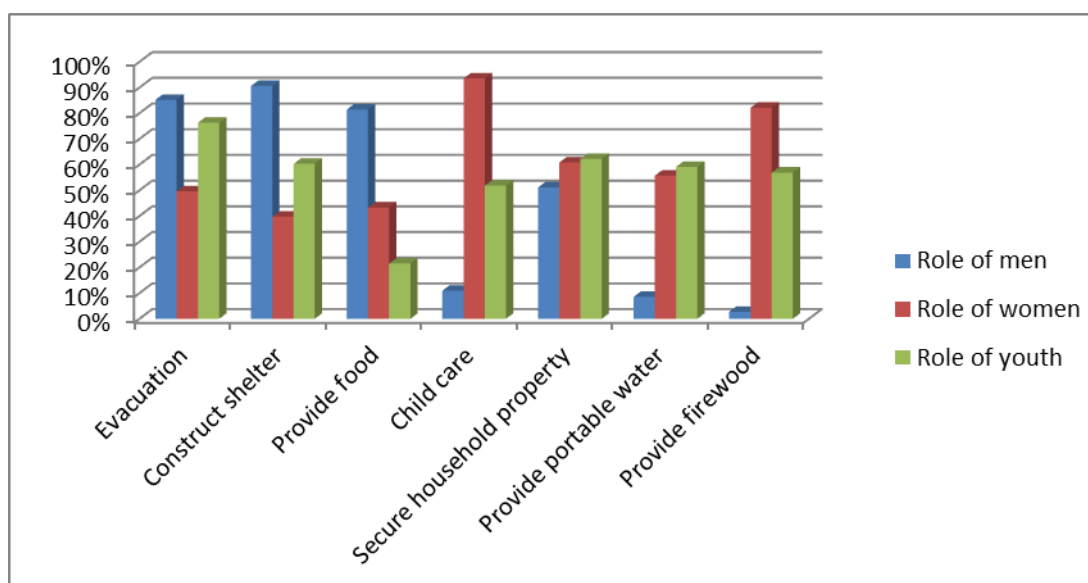
While men

- Source for boats for evacuation;
- Coordinate relief food distribution;
- Construct shelter – tents, tarpaulins and natural materials;
- Search for food;

- Remain in homesteads to provide security; and
- Use gunny bags to strengthen dykes to stop water over-topping.

The household survey revealed that the roles of men in dealing with flood are mainly evacuation, construction of shelter, provision of food and securing household property (more masculine roles in Bunyala context) but have low contribution in childcare, provision of water and firewood (more feminine roles in Bunyala context). The contribution of women is more important in childcare and provision of water and firewood but they also contribute towards securing household property, evacuation, provision of food and shelter construction (more masculine roles in Bunyala context). The roles of youth were not segregated based on gender. In the more masculine roles of evacuation, construction of shelter, youth contribution was greater than that of women except provision of food. Similarly, youth contribution was higher than that of men in the more feminine roles such as child care, provision of water and firewood. The contribution of youth and women in securing household property is about the same (Figure 11).

FIGURE 11: GENDER ROLES IN DEALING WITH FLOOD EVENTS



Despite the fact that women, men and youth play specific roles when floods occur as discussed above, the roles played by women tend to be more stressful as compared to those of men.

For men:

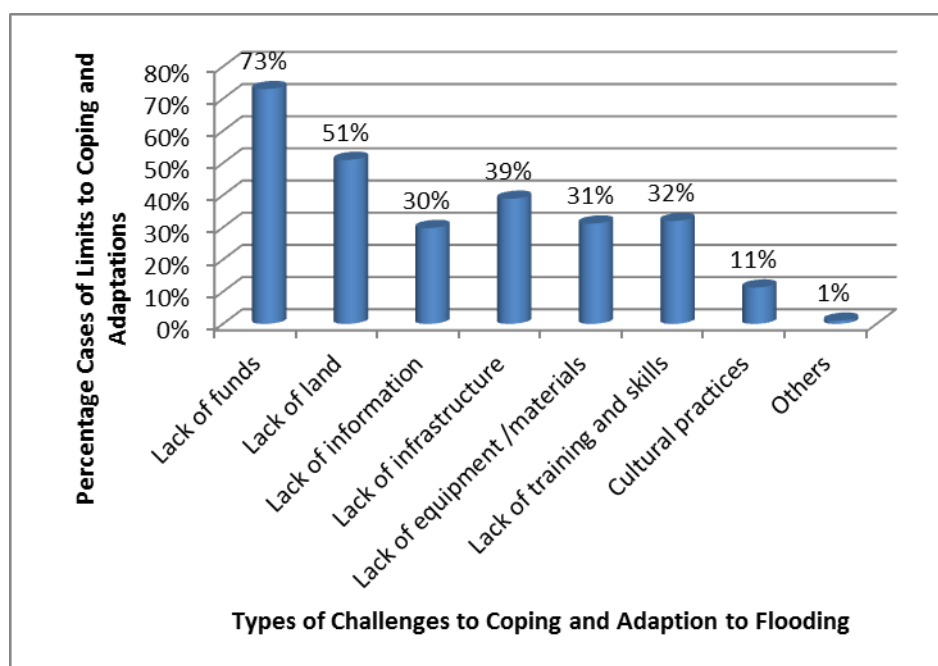
- The need to search for food to supplement household food stores take them away from other jobs but only temporarily;
- The need to organize evacuation of household property reduces time available for other tasks like tending livestock, fishing or participation in manual labor which affect income;
- The need to replace lost household goods or items and to reconstruct houses and latrines after floods is not immediate and can be undertaken over long period of time subject to availability of resources after floods; and

- The need to cater for medical care of household due to water borne diseases such as cholera is not very difficult as they only supplement the free relief medical services and drugs provided by public, private and faith based organizations.

Challenges of Dealing with Floods

The challenges that limit the capacity of men and women to deal with floods in Bunyala include lack of money, lack of land, lack of infrastructure, lack of information, lack of equipment and lack of skills (Figure 12).

FIGURE 12: LIMITATION TO COPING AND ADAPTATION TO FLOODS



Youth and Floods

Just like everyone else, youth also experience flood impacts. According to one KII interviewee, the youth are displaced and, due to lack of food and incomes in home ventures, may move into activities that can jeopardize their lives including crime, substance abuse, teenage sex and prostitution. Promiscuity among teens/ youth at camps results in teenage pregnancies, early marriages among teenage girls and exposure/ risk of HIV/AIDS and STIs (for both young women and men). In addition, due to impassable roads and inaccessible public facilities such as schools and village polytechnics, some youth temporarily discontinue schooling or drop out altogether.

In the household survey, more than half (52%, 217) of respondents reported that the youth are affected differently from other community members. The reasons for this range from school dropout (18%, 73); forced migration/relocation (13%, 48); rape, prostitution and drug abuse (11%, 39); and early marriage (5%, 8), respectively.

Gender and Institutions

Generally, women have low education and therefore occupy fewer positions of leadership in public and private institutions. Apparently, there are very few women (experts/professionals) who work in the institutions that operate in Bunyala Sub-county. For example, the Ministry of Agriculture has a staff of nine with only one woman. Similarly, in the Western Kenya Community Driven Development and Flood Mitigation Project (WKCDD/FM), women work as support staff. There are no female staff members in the Department of Livestock.

However, the perception of respondents in the household survey on leadership in institutions reveals that some women are in leadership positions in institutions. (It should be noted that, in the context of Bunyala, people make no distinction between experts and support staff in public or private institutions. For them, it does not matter that an individual is a secretary, cleaner or accountant – all these are leadership positions and the holders of the positions are usually consulted on various matters).

A minority of respondents said that women did not play any role in leadership. The findings also show that women moderately influenced decision-making. About a quarter of the respondents felt that women had limited influence in decision-making (Table 3).

TABLE 3: PERCEPTION ON WOMEN'S INFLUENCE IN DECISION-MAKING

Influence	Frequency	Valid Percentage
To a moderate extent	178	48
To a less extent	99	27
To a great extent	89	24
Don't Know	6	2
Total	372	100

5.3 INSTITUTIONS AND FLOODS

A variety of public and private institutions implement flood-related activities in the study area. Although, most of the institutions are not directly active in the area of climate change adaptation, they have activities and interventions to support communities during floods.

Institutional Activities Related to Floods

The main public institutions in Bunyala working in areas related to climate change and flooding include the Ministry of Agriculture which provides seeds for planting after floods and extension services; the Ministry of Health which provides drugs/medicine, mobile toilets, mosquito nets, clean water, mobile clinics, water purification tablets, and soap; and the Ministry of Special Programs which provides relief food and tents. Private institutions in Bunyala working in flood-related activities include NGOs/CBOs, FBOs and international organizations.

Institutional Provision of Assistance

Generally, institutions provide assistance targeted at people affected or displaced by floods. Participants in all the FGDs were in agreement that the private institutions provide the following services/ assistance:

- United Nations International Children's Emergency Fund (UNICEF) provides – tents, buckets, jerricans and soap
- World Food Program (WFP) – food items such as soyabeans, maize, beans, rice, cooking oil and unimix
- Kenya Red Cross provides – tarpaulins/tents, blankets, mosquito nets, cooking utensils, jerricans for water, food items – maize, soap, shoes.
- BUCODEV – information, gunny bags, boats for evacuation
- Population Services International (PSI) provides – treated mosquito nets
- Catholic Diocese of Bungoma provides – food items and blankets
- Anglican Church provides – food items and bedding

IMAGE 3: DISPLACED PERSONS CAMP ON TOP OF SOUTHERN CAMP AT MAKUNDA, DECEMBER 4, 2011.



Credit: BUCODEV

Despite the material assistance provided by both public and private institutions, it was found that most forms of assistance were not only inadequate but unsustainable. During a KII interview, one female community leader observed that "food rations are too little – a 2kg tin of maize cannot feed a family for one week, and the interventions are not sustainable because institutions only provide assistance during

the period that people are in camps. But when they return home, no more assistance is forthcoming to help those affected to rebuild their livelihoods and move on.”

From the household survey, it is clear that many respondents felt that most of the flood-related assistance is required: 70% (278), 18% (71) and 17% (69) of respondents said that assistance was required during, before and after floods, respectively. Only 1% (45) said that assistance is needed during drought.

TABLE 4: PERIODS IN WHICH ASSISTANCE IS REQUIRED

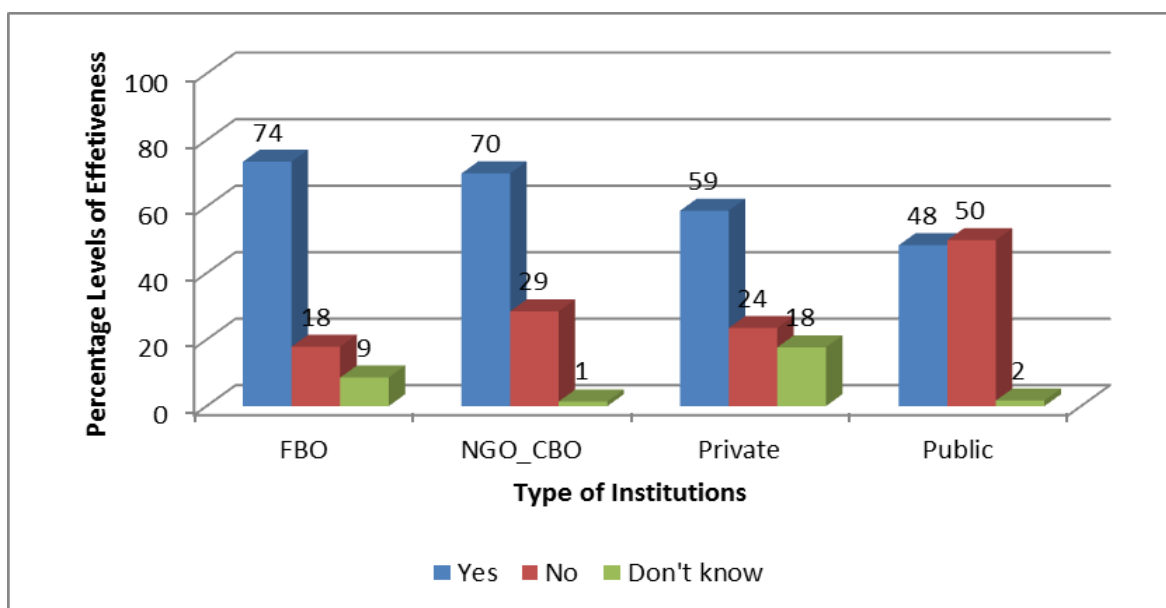
Period	N	Percent of Cases*
During floods	278	70
After floods	71	18
Before floods	69	17
During drought	45	11
When floods occur	32	8
Always (all the time)	8	2
During planting	5	1
During food shortage	2	1

Note: Respondents were allowed to provide more than one response to this open-ended question, thus the total adds up to more than 100%

Effectiveness of Public and Private Institutions

There appears to be significant involvement of public and private institutions in helping households and communities deal with flood impacts. Most respondents 74% (300) reported FBOs as the most effective, with approximately 70% (290) of respondents indicating a positive perception towards the effectiveness of NGOs. Public institutions were seen as less effective compared to FBOs and NGOs. However, approximately half of the respondents were still pleased with their involvement.

FIGURE 13: PERCEPTIONS ON COMPARATIVE EFFECTIVENESS OF PUBLIC AND PRIVATE INSTITUTIONS



Three quarters of the respondents observed that interventions by the institutions meet some of their expectations while less than one quarter reported that interventions by these institutions did not meet their expectations.

The respondents who perceived that the activities of institutions met their expectations to a moderate extent were (49%, 154), to a great extent (33%, 100) and to a less extent (18%, 58). This information is presented in Table 5.

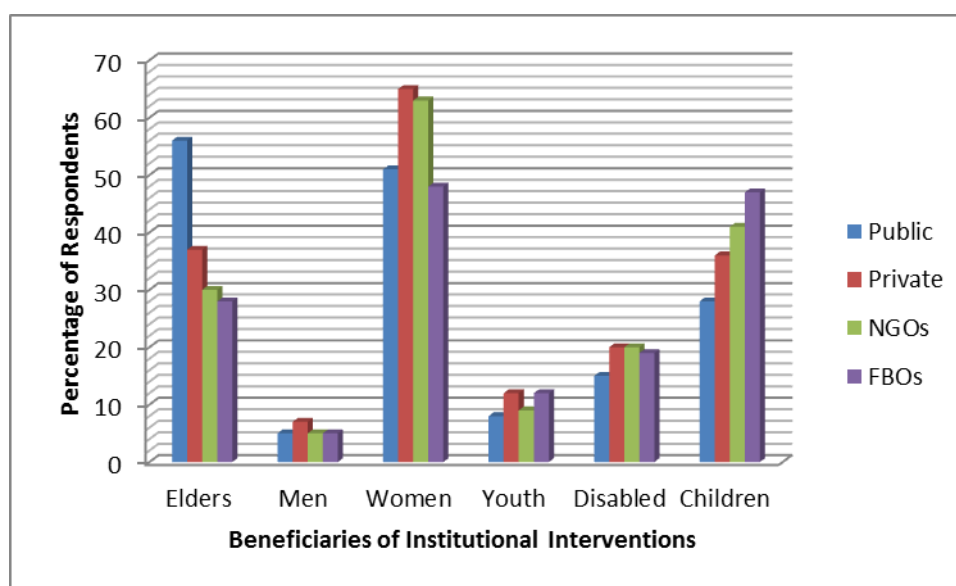
TABLE 5: PERCEPTIONS ON EXPECTATIONS OF INSTITUTIONAL INTERVENTIONS

	Frequency	Valid Percent
Great extent	105	33
Moderate extent	150	48
Less extent	60	19
Total	315	100

Beneficiaries of Assistance

Respondents perceived that mainly women, elders, and children benefit from activities of institutions, as to some extent do the disabled. Men and youth benefit less. The perceptions (Figure 7) are that elders benefit more from public institutions; women from all types of institutions; and children mainly from the private sector, NGOs and FBOs

FIGURE 14: BENEFICIARIES OF INSTITUTIONAL INTERVENTIONS



Platforms for Information-Sharing

An open-ended question was used to assess the perceptions of respondents to the sharing of information on floods. The findings indicate that the main channels for information sharing are the chiefs' barazas (local administration meetings), local radio programs and FBO meetings (religious functions) which are open and accessible to the general public. Other communication channels used are meetings organized by the District Disaster Management Committees, Self Help Group meetings, NGO/CBO meetings, workshops and seminars, Constituency Development Fund (CDF) meetings. These channels are accessible to a small number of individuals expected to disseminate information to others (Table 6).

TABLE 6 : PLATFORMS FOR SHARING INFORMATION ON FLOODING

Information platforms	Number	Percent of cases*
Chief's baraza	381	94
Local radio talk shows	327	81
District disaster management committee	178	44
FBO meetings	112	28
Self-help group meetings	109	27
NGO/ CBO workshop	92	23
CDF meetings	90	22
Other	4	1

*Note: Respondents were allowed to provide more than one response to this open-ended question, thus the total adds up to more than 100%

How to Improve Effectiveness of Institutional Assistance

Community members who participated in the household survey and FGDs suggested some measures which they believed could be used to improve the assistance provided by both public and private institutions. It was perceived that public institutions could provide assistance better by:

- Providing sufficient assistance to flood victims, that was effective/adequate;
- Constructing dams and dykes; and
- Eradicating corruption in relief distribution.

Specific recommendations for where private institutions (charities, NGOs/CBOs, and FBOs) could improve the effectiveness of assistance included:

- Provide sustainable support rather than handouts;
- Increase the amount of food aid;
- Work together with government agencies;
- Eradicate corruption during relief distribution;
- Involve community members at the planning stages of interventions;
- Since it was perceived that some religious or faith-based CBOs only provided assistance to those of the same religious denomination, and in essence did not provide or distribute assistance to the community members fairly, one recommendation was for such organizations to distribute food and provide spiritual support to people from all religious denominations; and
- Partner with other institutions to avoid conflicts.

A majority (65%, 265) of respondents identified construction of a new set of dykes as the most effective way of reducing negative impacts of floods. The respondents also proposed other interventions including opening up of canals and the silted mouth of River Nzoia, construction of dams in the upper catchment of the river and repair and maintenance of dykes in Bunyala. Only 5% (20) proposed creation of awareness and capacity building of the community affected. Most FGD participants supported the view that, interventions to deal with floods should be planned in consultation with community members and local community organizations for ownership and sustainability

As highlighted above, some coping and adaptation practices in Bunyala are facilitated by public and private institutions. Assistance during flood events in the form of relief food, bedding and shelter are short-term and unsustainable. These short term interventions for coping disregard local practices and may contribute negatively to dependency on external support. Therefore institutional interventions should, in addition to short-term assistance, focus on long term measures that enhance adaptation by providing opportunities for household livelihood sustainability.

6.0 DISCUSSION AND CONCLUSION

The study findings have been summarized into five categories: respondent characteristics, household vulnerability and food security; gender and flood impacts; indigenous traditional knowledge; and institutions. This section summarizes key findings.

Respondent Characteristics

Most respondents (62%) are women compared to men (38%), and mainly from the Luhya ethnic community. Most marriages are monogamous (51%) but there is a high level of widowhood (26%). Most of the respondents had low levels of educational attainment, with only about a quarter of respondents being literate. Housing is a good proxy for poverty and typical dwelling units are made of iron sheet roof with walls and floors made of earth. Many houses have earth (mud) floors and walls; a few are made of bricks and blocks. Most respondents (90%) do not have electricity in houses, but 9% do. Most households have pit latrines while a few use bushes.

Household Vulnerability and Food Security

The main purpose of crop production was identified as household consumption. A very small portion (10%) is sold. Dependence on crops for household consumption and income makes farmers extremely vulnerable during extreme climatic events, such as floods and droughts. Approximately 90% of respondents reported months of food shortages (between January and May). The impact of floods on livelihoods leads to negative coping mechanisms, and increased vulnerability such as sale of assets, decreased household consumption/nutrition, and children withdrawn from school.

Gender and Flood Impacts

Since 2006, floods have occurred annually: The most recent and severe flood was in December 2012 followed in severity by those of 2011 and 2013, respectively. Floods have negative effects on crops, food prices, housing and property, trade and livestock.

The general impacts of floods on women and men include temporary displacement and relocation, loss of income due to destruction of crops and displacement, and water borne diseases. The unique impacts on women include pregnant mothers who are unable to access maternal health clinics, poor diet for pregnant and lactating mothers, as well as babies and young children, and loss of income-generating activities that women are typically in charge of (small-scale businesses and petty trade); conflicts and family break ups; sexual exploitation and increased exposure to sexually transmitted infections (STIs) and HIV/AIDS. In addition to typical roles (child care, domestic work), during flooding events, women experience increased pressure to contribute to household income/nutrition – especially if they are without husbands; and women lose food, household utensils and other goods but still have to care for their children.

The specific impacts of floods on men include the need to search for food and engage in other livelihoods (limited) such as fishing and casual day labor; organizing evacuation (routes to be taken) of family, livestock and household assets; and pressure to provide for family (food, shelter, school feed, medical expenses) with limited resources.

The specific effects on the youth include venturing into petty crime and substance abuse; promiscuity among teens/youth at camps which results in teenage pregnancies and early marriage of young girls, as well as increased risk of HIV/AIDS and STIs for both young women and men; and increased school drop-outs as girls marry early and boys go into fishing/ *boda-boda activities* (informal public transport business using motorcycles). These findings also highlight some of the challenges to empowerment of men, women and youth including lack of money, lack of land, lack of information, and lack of equipment/tools and lack of skills.

Indigenous Traditional Knowledge

A majority of respondents were aware or used ITK for prediction of rainfall and flood onset. Examples of ITK are observation of wind direction, behavior and sighting of animals, change in water consistency, and weather patterns.

ITK influenced decisions on how and where to move household members in order to avoid floods. ITK also influenced livelihood decisions during times of flooding: farming choices (crops, planting), and alternative sources of income. There is very little use of ITK after floods. Only about 30% of respondents use ITK techniques after floods for food storage and preservation. Non-use of ITK was attributed to lack of access to ITK, reliance on modern forecasts and lack of trust in ITK.

Institutions

Both public (government agencies and ministries) and private organizations (NGOs/CBOs, FBOs International organizations) work with communities to address the impacts of floods (but not necessarily directly with climate change adaptation).

Most assistance from these institutions is provided during and after flood events. The assistance is temporary and short-term. FBOs and NGOs were perceived as being the most effective in providing assistance. Public institutions were perceived as less effective compared to FBOs and NGOs. Women, children, elders, and to some extent disabled people, benefit more from institutions.

The respondents also suggested measures to improve assistance from public institutions during flood events. These included construction of upstream dams and permanent dykes; provision of adequate assistance to flood victims; and eradication of corruption in relief distribution. Respondents suggested that private institutions should move towards sustainable support rather than handouts; increase the amounts of food aid; partner/work with government agencies and other institutions; eradicate corruption in relief distribution; involve community members at the planning stages of interventions; distribute food to all people irrespective of religious affiliation; partner with other institutions and to avoid conflicts.

6.1 SIGNIFICANCE OF THE STUDY

This study has attempted to show that, despite the frequent incidence of flooding in the study area, there have been no long-term interventions to lessen the impacts of floods on local communities. Flood events result in short-term, *ad hoc* interventions by many government institutions and private organizations (including NGOs, public and private organizations, and government). Because interventions tend to be limited to short-term ones, the capacity for long-term resilience by affected households and communities remains low. Until longer-term, sustainable adaptation strategies can be employed, the short-term coping measures taken will not only continue to be inadequate, but are also likely to be unsustainable, and perhaps even detrimental, in the long term.

Therefore, until longer-term, sustainable adaptation strategies can be employed, the short-term coping measures taken will not only continue to be inadequate, but are also likely to be unsustainable, and perhaps even detrimental, in the long term.

Indeed, poverty levels in the study area seem to be persistent, if not increasing. This supports the idea that at least some strategies adopted by households are erosive in nature and leave people worse off for the next flood event. This study has emphasized the necessity of long-term adaptation strategies that integrate community indigenous knowledge within effective institutional arrangements that also enable the ecosystems to continue providing livelihood support services. This has implications for any strategy for flood management in Bunyala Sub-county.

The study has examined the social aspects of flood impacts, particularly the gender aspects. It has shown that in Bunyala Sub-county, just like in other parts of Kenya, women, youth and children play an important role in small-scale subsistence agriculture – the mainstay of the livelihoods in rural areas. However, the contribution of women, in particular, is constrained by lack of, and access to, resources (land, information, and money) and involvement in decision-making processes at the household, community and institutional levels.

Currently, the new constitutional dispensation in Kenya has created new institutions--the most notable being the devolved government structure. In this case, devolution has provided new opportunities for engagement between households, communities and institutions in developing measures to enhance both coping and adaptation strategies and to build resilience to the impacts of flooding. However, the mechanisms put in place to promote community participation in planning and decision-making initiatives to address the problem of floods and other development challenges haven't been effectively felt on the ground. While well-appreciated by their beneficiaries, the interventions by public and private NGO/CBOs and FBOs still lack coordination, community participation, and sustainability.

6.2 RECOMMENDATIONS

This study aimed to examine the reasons for absence of long-term interventions in Bunyala despite perennial/frequent flooding in the context of existing ITK, gender and institutional dynamics. Therefore, the findings of this study have implications for policy makers and planners at both county and national government levels, and inform the following recommendations.

Indigenous Traditional Knowledge

There is potential for use of ITK in climate information and it is proposed that:

- Flood management can take advantage of the integration of modern scientific forecasting and climate modeling with ITK to strengthen the understanding, dissemination and use of climate information in Bunyala Sub-county;
- ITK be integrated into current approaches (i.e., integration of ITK on flood prediction into Early Warning Systems for preparedness);
- ITK experts can be tapped as a means to disseminate climate information; and
- ITK on climate should be documented for posterity.

Gender

The gender dynamics of flood impacts represent a complex situation. Dealing with the gender issues of flood impacts requires a multi-pronged approach which combines public interventions, cultural/attitude changes, and community action. It is proposed that:

- Local communities be empowered through trainings/skills (new technology for farming) to improve small-scale agricultural productivity (small-scale irrigation for food production and income generation can be promoted);
- Education (adult and regular education) vocational training to diversify livelihoods should be provided, along with other informal education and knowledge sharing; and groups should be formed for the empowerment of women and youth;
- Women are particularly affected negatively due to their domestic responsibilities and nurturing roles. As the primary producers of food, women have little or no control of resources such as land, livestock and money; and decision-making authority. Therefore, targeted measures to empower women with skills, knowledge and resources such trainings for women groups and credit schemes to promote their petty trade and small-scale businesses should be promoted for example by taking advantage of the governments Women Enterprise Fund; and
- Promotion of community education and attitude change towards women's empowerment, violence against women and sexual exploitation in the era of HIV/AIDS.

Institutions

Households and communities in Bunyala Sub-county have limited capacity to deal with the negative impacts of floods. Improving the livelihoods requires interventions to address their coping and adaptation practices. The short term coping practices such as sale of land and household property, less expenditure on household requirements and temporary relocation worsen the vulnerability of affected households to future flood events in the context of illiteracy, lack of skills and resource constraints. This situation can be addressed by institutional investment in interventions to enhance household adaptation and resilience through long-term measures to improve the sustainability of livelihoods. In any case, coordinated interventions by public and private institutions can help address both structural and non-structural measures in flood management.

The interventions of public and private institutions that improve short-term household resilience to cope with immediate impacts of floods, should:

- Promote participation and decision-making by women in income generating activities such as small-scale agriculture and trade for income generation and livelihood diversification;
- Train farmer groups and women groups in modern farming techniques to not only improve agricultural productivity but also to enhance post-harvest conservation of food stocks;
- Institutions should collaborate to set up emergency relief facilities for accommodating households displaced by floods, taking into account, sleeping quarters/dormitories, sanitary and medical facilities. This will address the problem of privacy, lack of water, toilets/latrines and bathrooms and health concerns of pregnant mothers, children and the sick;
- Partner with communities to develop water storage facilities for domestic purposes to reduce incidence of waterborne diseases; and
- Provision of learning facilities to ensure learning in primary, secondary and tertiary institutions is not disrupted to the disadvantage of learners.

The interventions of public and private institutions in Bunyala Sub-county may have the capacity to mobilize (which is beyond the capacity of individual households and community members) resources (whether in the form of public-private partnerships or otherwise) for investment in adaptation strategies for long-term household resilience to flood impacts. The interventions should aim to:

- Develop mechanisms for collaboration between ITK experts and climate scientists to promote dissemination viable ITK related to floods, and to develop local flood prediction and early warning instruments for application to emergency preparation that take into account local resources and community participation;
- Strengthen potential of agricultural production in Misingo area of Bunyala Sub-county through land adjudication and issuance of titles. This will provide incentive for modern commercial farming;
- Promote livelihood diversification initiatives to reduce reliance on subsistence agriculture and fishing which are vulnerable to climate change and climate variability in order to improve household food security and incomes;
- Promote flood proof housing technology using locally available resources to reduce flood damage in homesteads;
- Capacity build the relevant to national and county government institutions to mainstream gender and climate change policies into institutional policies. This will in turn help to institutionalize climate change issues in the activities and interventions by these institutions and also provide mechanism for coordinated community participation;
- Implementation of integrated catchment management initiatives of River Nzoia basin watershed to provide mechanisms for environmental conservation and management, as well as flood control to limit the exposure of household communities to in low lying areas and floodplains to adverse flood effects. This could be achieved through public/ private and community initiatives to address deforestation, soil erosion and ecosystem conservation;
- Invest in structural flood control measures such as dams and dykes. This could be achieved through public/private investment in multipurpose dams for water harvesting, storage and production of electricity. This can be exploited for fish farming and small-scale irrigation projects that target local communities in the study area; and
- Conduct floodplain mapping, land use planning and enforcement of laws on land use, agriculture and settlement. For example, homesteads should not be constructed in the flood plains, near dykes or along river banks.

6.3 AREAS FOR FURTHER RESEARCH

This report has identified knowledge gaps that can provide opportunities for building long term resilience to floods in the Bunyala Sub-county. Thus, further research can be conducted to:

1. Examine how existing ITK and experiences of communities in dealing with floods can be mainstreamed into interventions by public and private organizations to deal with flood impacts in Bunyala Sub-county.
2. Assess coping and adaptation best practices to improve agriculture based livelihoods in the context of Misingo.
3. Identify mechanisms that can be used to enhance the capacity of local county government institutions to promote community participation in planning and decision-making in adaptation interventions to address climate change impacts in Bunyala Sub-county.

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