

Risks, Livelihoods and Vulnerability to Flooding in Kyela District, South-western Tanzania

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Abstract

This study aimed at establishing how local livelihoods had changed due to flooding in Kyela District, Tanzania. Both primary and secondary socioeconomic data were gathered using a household questionnaire and qualitative methods. The questionnaire was administered to sample households in three villages. Secondary data were gathered through literature search. Findings from this study show that sample villages have experienced normal flooding, occurring between April and May, and excessive flooding which occurs in cycles of 5-10 years. Local people perceive a decrease in frequency and magnitude of flood occurrence. Associated biological changes have included the disappearance of some banana and orange tree species, disappearance of some wild animals, and rotting and drying out of some cocoa and banana trees. Other impacts have included outbreak of new crop diseases. Socio-economic consequences have included destruction of crops, animals, buildings and other infrastructure. Others have included the outbreak of cholera and other waterborne diseases. Coping strategies to excessive flooding have been temporal. Communities' response to flooding has differed according to the economic access qualification of concerned wealth groups. The rich (mnoge) have coped well by shifting to higher areas, and hiring or buying farmland disposed off by other wealth groups. They also employ cheap labour from among the poor (ndondo). During and after floods the mnoge buy commodities from other areas and sell them to the flood affected people at a profit. The ndondo are the most affected group as they are less able to cope with the situation. Often they are forced to sell their assets at very low prices, and end up living on begging or working for other wealthier groups.

1.0 Introduction

1.1 Background

Global climate change has increased climate variability at the local level and impacted on people's life styles and the evolvement of various coping mechanisms as communities have variously adapted to both environmental and climatic changes that affect their day-to-day undertakings. Changes in climate have also contributed to various changes in physical and biological systems (IPCC, 2001). The case of flooding events in Kyela District in Tanzania presents an interesting

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object of study of the impacts of such climate variability in an inhabited area. This study explores how different social groups in the communities have developed adaptation strategies to overcome negative effects of excessive floods.

1.2 Materials and methods

This study was conducted in Kyela District in Southwestern Tanzania (Figure 1). This district was selected on the basis of existing records with regards to recurrence of flooding. Three villages were surveyed, namely Lusungu and Lugombo in Mwaya Ward and Katumbasongwe from Katumba Songwe Ward. The selection of these villages was based on records of areas that had been experiencing such extreme flooding events in the district. The selected villages lie along three rivers that flow into Lake Nyasa, namely the Lufilyo, Mbaka and Songwe River, respectively.

The units of analysis in this survey were households which were randomly selected from existing sub-village (*kitongoji*) rosters of heads of households in the sample villages (Mung'ong'o *et al.*, 2004; Russell, 1993; Wong, 1984). The sample size was 152 households, which is about 8% of the total households in the surveyed villages.

Both primary and secondary socio-economic data were gathered. Secondary data were collected from libraries and documentation centres in Dar es Salaam and Kyela District headquarters. This enabled researchers to identify knowledge gaps to be filled by primary data. Primary data was obtained using a household questionnaire and qualitative methods. The household questionnaire was administered to sample households in the selected villages to capture the household socio-economic characteristics.

The qualitative information was collected through unstructured interviews with key informants and focus group discussions (FDGs). Information from the Participatory Reflection and Action (PRA) activities and FDGs provided a generic overview of the issues (McCracken *et al.*, 1988). Through PRA, coping strategies at the community level were captured while similar information was further obtained through FDGs. Wealth ranking was used to conceptualize and understand poverty at the community level. It was also used to document the different poverty levels within the communities.

Wealth ranking was performed by teams of selected villagers from the *uitongoji* of each village and categorized by age and gender. Lists of assets that are perceived as 'wealth' in the village were first compiled. The importance of each of these assets as criteria for assessing wealth or social status of villagers was then determined. The names of heads of household from *vitongoji* households registers were written in small cards and were used for ranking according to the ownership of these assets (Table 1).

Table 1: Characteristics of the Wealth Groups by Villages

Well-off group (Munoge)	Middle Group	Poor Group (Ndondo)
<p>1. Lusungo village</p> <ul style="list-style-type: none"> • Permanent house constructed with burnt bricks and roofed with corrugated iron sheets or more cattle (cows) • Able to enough food for the household throughout the year • Having oxen cows and plough 2 or more acres of crops especially cocoa and paddy with ability to take care of the crop field/shamba 	<ul style="list-style-type: none"> • May have a house constructed with bricks • Owns 1- 3 cows/cattle • He/she is sure of daily food for the household • May have any size of land with no modern equipment such as a plough 	<ul style="list-style-type: none"> • Temporary house • Not sure of daily food • Land below 1 acre with little ability to take care of such level • Owns no livestock expect chicks • Living on begging; most of these are the old people with no family members to take care of them
<p>2. Lugombo</p> <ul style="list-style-type: none"> • Permanent residence house constructed with burnt bricks and roofed with corrugated iron sheets • 4 or more cattle • 3 or more acres of farmland with ability to take care of them • 200 or more cocoa trees • Fishing gear/equipment (nets and canoes) • Ability to employ others • Assured of food for household throughout the year 	<ul style="list-style-type: none"> • May have a house built with bricks, but may not afford corrugated iron sheets. • 1 - 4 cows/ cattle • 1 -2 farmland • Assured of food throughout the year • May have up to 200 cocoa tress • Opportunity to move on to the higher class • May own fishing gear (net and 1 canoe) 	<ul style="list-style-type: none"> • Temporary house • Not sure of enough food for the whole year • Owns no livestock • Less than one acre of farmland with little ability to take care of such level
<p>3. Katumbasongwe</p> <ul style="list-style-type: none"> • Permanent residence house built with burnt bricks and roofed with corrugated iron sheets • Ability to employ others • 4 or more cattle/cows • Owns fishing gear, nets and 3 or more canoes • Owns more than 3 acres of farm-land with 1 acre of cocoa trees • Assured of food for household throughout the year • 1 or more acres of banana plantation • 1 acre of palm oil trees • May have a plot in another location especially in town, probably with a house • Owns 3 or more bicycles • Business with a minimum capital of 500,000 	<ul style="list-style-type: none"> • A normal permanent residence house 1 to 4 cows, 2 acres of farmland with 0.5 acre of bananas, 0.5 acre of cocoa • May have temporary house but with ability to take children to school • May have farmland for paddy and cocoa with little ability to employ others • Assured of food throughout the year • Cannot do things such as constructing a house and taking children to secondary school simultaneously 	<ul style="list-style-type: none"> • Temporary house • Less than 0.5 acre of farmland with less ability to take care of the land • Unsure of enough food throughout the year • Owns no livestock especially cows • Cannot take children to school especially for secondary education • Living mostly on casual labour activities • Most vulnerable to natural calamities and whenever pressed for financial requirements could sell a farmland

Source: Survey Data, 2005

2. The study area

Kyela District is one of the eight districts of Mbeya Region, located between longitudes 330 40' and 300 00' East and latitudes 91 25' and 980 40' South in south-western Tanzania. Most of the district lies on the floor of the Great African Rift Valley at the northern tip of Lake Nyasa. The district is relatively low lying located between 478 and 600 m.a.s.l. The south and southwest of the district form the international border with Malawi (Figure 1).

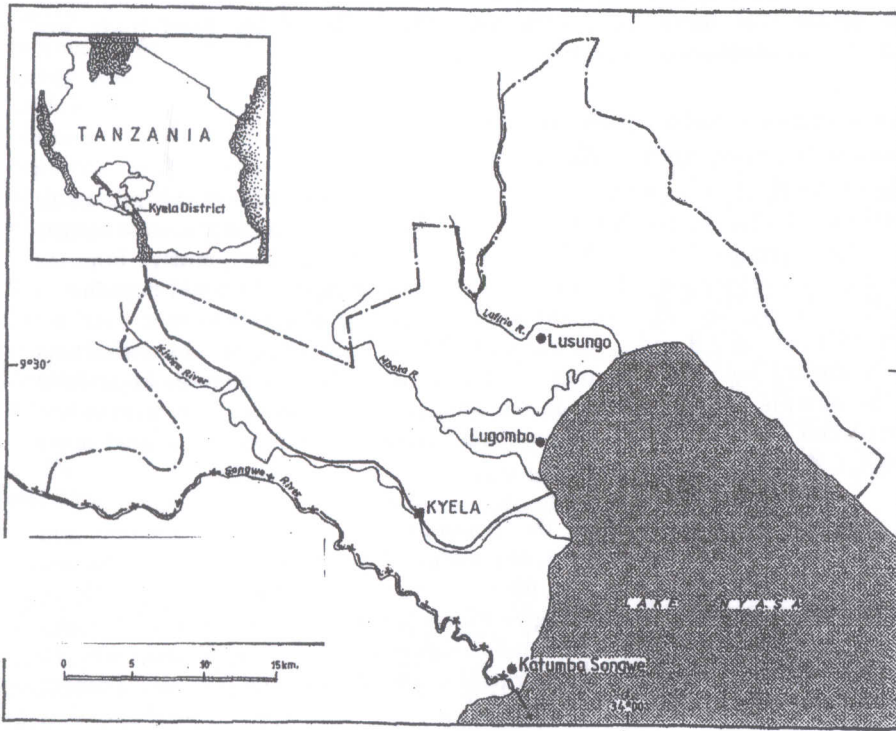


Figure 1: Location of the Study Area

The district's bio-physical features are described by Aberra *et al.* {1994}. The climate is humid tropical with mean daily temperatures of 25°C. The area receives an average annual precipitation of 2,726 mm that commences from November to June, with a dry spell in February. The area receives a minimum rainfall of 1,041 mm and a maximum of 4,644 mm. The tin series analysis shows a wide variation in total annual rainfall over the period 1972-1982. With the exception of 1987 and 1988, the annual rainfall totals were more consistent from 1983 onwards.

The main rivers in the district include Songwe, Kiwira, Mbaka and Lufilyo. They all originate in the highlands to the north and west of the district. The catchment area of the four rivers is approximately 58,000km² with a combined annual runoff

estimated at 4.6m³ billion. Large areas of the plain are subjected to flooding. Kiwira River has the highest discharge and villages between this and Songwe River usually experience some degree of flooding every year between April and May. Characteristics of these floods are discussed in sub-section 3.6.1.

The floodplain with its high, middle and low benders dominate the landscape to the south and east, while moving north and westwards the prominent landforms are hills with rising ridges, steep slopes and river valleys. The ridges eventually reach an altitude of more than 800m.a.s.l. The soils of the flood plain are predominantly alluvial comprising Fluvisols and Cambisols.

3. Analysis and discussion of the results

3.1 Households demographic characteristics

According to the Kyela District Socio-Economic Profile, the main ethnic groups in the district are the Nyakyusa, Ndali, Yao and Kinga. Inter-marriages are common between ethnic groups from both Malawi and Tanzania. Frequently, families have members on either side of Songwe River. According to the 2002 population and housing census, the district had a population of 174,470 people with an annual growth rate of 2.0 and a sex ratio of 92. The district's household size was 4.1. This is slightly below the regional average size of 4.2. The average household sizes in the sample villages were 4.9, 5.5 and 7.3, respectively. The figures are higher than the overall district, regional and national average household sizes which are 4.1, 4.2 and 4.6, respectively.

Overall, 44%, 38.1% and 39.1% of the population in Lusungo, Lugombo and Katumbasongwe villages, respectively, are under 15 years of age. Those who are in the age group of between 15 and 60 years are 54.3%, 42.1% and 51.4% in Lusungo, Lugombo and Katumbasongwe villages, respectively. 1.7%, 19.9% and 9.5% in Lusungo, Lugombo and Katumbasongwe villages, respectively are 61 years and above. Hence the dependence ratios are 0.84, 1.38 and 0.95 in Lusungo, Lugombo and Katumbasongwe, respectively.

The data further reveal that child dependence is greater than old-age dependence in all three villages. While the age group below 15 has higher a proportion of males than females in two of the villages (Lusungo and Katumbasongwe), the active working age group has higher composition of females than males in all villages.

Generally, the lower basin of the Songwe River catchment is more densely populated than the middle basin, mainly due to the transboundary trade activities that take place across the Malawi-Tanzania border. The land is also subjected to intensive cultivation even along the marginal areas of the riverbanks.

3.2 Education level of the household heads

The data from this study shows that there is a concentration of many people (70.4%) in the three surveyed villages, with a lower than primary education levels, and with no formal training. Low level of education has not only negative

impact in the short-term with regard to income generation, but also has negative implication for the long-term human resources development. Measures to raise the income of the people should go hand in hand with raising people's education in terms of training them on good farming practices and/or enforcing a mechanism that would increase people's capital and market opportunities.

3.3 Characteristics and distribution of the wealth groups

According to the wealth ranking exercise and focus group discussions conducted in the study villages, three wealth groups were identified, namely the poor (*ndondo*), middle and well-off (*mnoge*). Participants in the FGDs further estimated proportions of these wealth groups as follows: in Lusungo the *mnoge* group was estimated to account for 15% of the villages, and 60% and 25% for middle and *ndondo* groups, respectively; in Lugombo the *mnoge* group was estimated at 10% of all households, while the middle and *ndondo* groups were reported to be 70% and 20%, respectively. The FGDs in Katumbasongwe estimated 10% of villagers to comprise the *mnoge* people, and 65% and 25% to comprise the middle and the *ndondo* groups, respectively.

These data from the FGDs are perceptibly similar to the statistical data from the household questionnaire interviews proving that data collected by qualitative methods are not always inferior to those acquired through quantitative techniques. According to the household questionnaire interviews, the *mnoge*, middle and *ndondo* groups in Lusungo account for 13.7%, 58.8% and 27.5%, respectively. With respect to the Lugombo village, the well-off, middle and poor groups count for 13.7%, 64.7% and 21.6%, respectively. While in Katumbasongwe village, 14%, 60% and 26% comprise the *mnoge*, middle and *ndondo* groups, respectively.

3.4 Income levels

The survey results indicate that the majority (35.3%) of the interviewed villagers in Lusungo village earn income between Tsh 300,000 and 500,000 per year, followed by those who earn income above Tsh 500,000 (23.5%) and between Tsh 200,000 and 300,000 (21.6%). The rest of the respondents in Lusungo reported to earn income between Tsh 30,000 and 200,000.¹

In Lugombo village, like Lusungo village, the majority of the respondents 33.3% reported to earn between Tsh 300,000 and Tsh 500,000, followed by those who earn income above 500,000 and between Tsh 20,000 to Tsh 300,000 whereby they account for 25.5% each. The rest of respondents in Lugombo reported to earn income between Tsh 60,000 and Tsh 200,000.

In Katumbasongwe village, unlike in Lusungo and Lugombo, the majority (40%) of the respondents reported to earn above Tsh 500,000 per year, followed by those who earned between Tsh 300,000 and Tsh. 500,000 (30%). The rest were said to earn Tsh 100,000 and Tsh. 200,000 per year.

¹ The exchange rate at the time of this study was US\$ 1 = Tsh. 1,000.

3.5 Economic profile

According to URT (2001) a number of economic activities in Kyela District have to do with tilling the land, livestock and poultry keeping, and fishing. Major food crops grown include rice, maize, beans, groundnuts, cassava, sweet potatoes, soybeans and sunflower. Rice is the most important cash and food crop, and it is grown twice a year by all the farmers in the district. Cash crops produced are cocoa, palm oil and cashew nut. A range of off-farm activities, including small scale trading and brewing and sale of local beer, also contribute to the household livelihoods.

As is the case with many rural households in Tanzania, the majority of the households in the study area are engaged in farming activities. Of the interviewed households, 100%, 98% and 92% in Lusungo, Lugombo and Katumbasongwe villages, respectively, ranked farming as their main occupation. Subsistence crop production was the dominant economic activity in the surveyed villages.

Food crops are generally harvested in April and by December most people have run out of food. Acute food shortage is experienced in some areas in January and February when people survive on bananas. The poor and those without goods to sell perform casual labour work either for food or cash. The marketing of produce is hampered by poor transport network. Coping strategies during the four to eight months of post-harvest food insecurity include purchasing from markets from business people or exchanging labour power for cash. Officially, there are no known systematic coping strategies for food insecurity in this area.

Family labour is the main source of farm labour. Often household farms may not cope with the labour demand, especially during the periods of peak labour requirement, such as during weeding. Farmers use oxen for ploughing rice fields. These could be their own work oxen, or they could hire them or combine resources: one with an animal and another with a plough may combine in order to provide draught power and labour for ploughing.

The study results also indicated that average sizes of farmland owned are relatively small. In the villages of Lusungo, Lugombo and Katumbasongwe, for example, they are 2.95, 2.69 and 3.7 acres, respectively. While flooding considerably increases the fertility of these plots of land and maintains it in the flood plain, the risk of erosion is a constant threat to their owners.

Livestock keeping is the second most predominant economic activity in Kyela District. The most important types of livestock kept are cattle, goats and sheep. The cattle population is mostly made up of the indigenous *zebu* breed. There are a few animals of improved breed. Other livestock kept include mostly pigs, chicken, ducks and pigeons.

Some fishing is done in the middle basin of Songwe River. Fishermen along the river and even those from further northern areas such as Misuku also migrate to the middle basin to catch fish during the breeding season. In total, 13 fish species were identified to be of economic importance to the people, and all are found in this basin, showing that it is a basin with high fish biodiversity (Ngatunga, pers.com).

However, the people complained that the amount of fish being caught these days is less than what they used to catch some 5-10 years ago. Also, the size of fish being caught now is smaller than in the past. They attributed this to inappropriate fishing methods, such as complete blocking of the river with traps and nets at the mouth of the river and also the use of seine nets as fishing gear.

'Flood-fishing' is an important means of livelihood just after the floods. Such fishing takes place on the flood plain in recession lakes in the lower delta. Fishing methods that are commonly used include rod and line, nets, and fish traps made from reeds. A special fishing method applied in the lower delta during the floods is fishing by large landing nets from platforms on the riverbank (NorPlan, 2001).

Formal employment is rare in the catchment. Other income generating activities are also limited. Some male-headed households are engaged in occupations other than farming and fishing. Although there are no reliable roads, business people (especially women and boys) engage in border trade as a source of income. Monkey bridges are the main means of transport across the Songwe River. Small-scale informal trading is pursued by nearly everybody. The border provides good trading opportunities and sale of agricultural products across the border, thereby exploiting cross-border price differences for rice, sugar and clothes. At Kasumulo border there is an informal bureau of exchange of Tanzanian, Malawian and United States currencies.

In general, women are more industrious in the district and contribute greatly in ensuring food security and sustainable income generation in the household. Small scale trading seems to be an important activity to women as this is one of the few income earning opportunities that are not controlled by the husband or other male family members. There are also women groups in the district that participate in palm oil processing, brewing and sale of local millet beer and running of milling machines. Palm oil is, nevertheless, locally processed in a very traditional and time-consuming way. The economic potential of this activity is yet to be fully realized to increase the income levels of the people, improve their livelihoods and alleviate poverty, especially for women and children.

The poor purchasing power of the majority of the people, however, renders much of these business opportunities relatively unprofitable. Moreover, local brews seem to consume a lot of men's time, as drinking starts as early as 8.00 a.m. in most of the places visited.

3.6 Adaptation to flooding

3.6.1 Flooding characteristics

The characteristics of the Kyela floods are well described in NorPlan (2001). Between April and May all villages lying between Songwe and Kiwira Rivers, including Kyela town, experience flooding every year. Whereas the Tanzanian side of the Songwe River channel length is 40 km, the straight valley distance is around 25 km, meaning that the sinuosity of the river is around 1.6. The river is

morphologically active, with primary and secondary meanders, and frequent 180° bends. There is heavy active erosion during floods on the outside of bends, with developing shoals on the inside. Historical records show numerous lateral course changes and avulsions, while major rapid changes in the river course are reported.

The flood plain is subject to flooding from several sources, including spilling from the Songwe River, spilling from the Kiwira River, run-off from local rainfall regime, and increases in the lake level. The intensity of the floods ranges from about 30 cm above normal ground on the upper side to about 150 cm in the middle section, and 50-100 cm in the lower section of the flood plain.

The impact of local rainfall on the extent of flooded areas was simulated by NorPlan. The Kiwira River does not appear to contribute significantly to flooding according to the model simulations. The increase in flooded area due to local rainfall was in the order of 170 ha of which 120 ha are on the Tanzanian side of the Songwe flood plain. Thus, it was concluded that local rainfall alone had a minor flooding impact in the area.

There are no measures instituted by the villagers to arrest bank erosion at most eroding bends. It is only at those bends where the river threatens to abandon the bend and go straight into villages or gardens that the local people will try to redirect the river back into its normal course. The most commonly used method is by driving bamboo stakes into the ground on the longer bank across the direction of flow at the most vulnerable sites where water overflows threaten to break.

The stakes are sometimes woven across with split bamboos, reeds or other debris to form a barrier to the speeding water, which is forced to slow down and change direction into its normal course around the bend. This method has apparently been used with some degree of success and it is deployed at most of the bends in the very lower reaches of the plain where the banks are quite shallow. The other method that is seldom used is blocking the potential break with gunny sacks filled with sand. This method has worked well in places like Ndwanga, where a potential avulsion seems to have been successfully contained with the use of gunny sacks. The same method has failed to work in other areas as the river still abandons its circuitous course and takes a shorter route going downstream.

Generally, the use of gunny sacks is not very popular because of the cost implications involved and wherever they have been used either government or some other donor agency has been involved in the procurement of the sacks while the villagers provided the sand and the labour.

Overall, the use of bank protection measures by the villagers does not seem to have been very successful since in almost 85% of the cases the river has still broken through. This can be attributed, in part, to the fact that the mitigation measures are only instituted when the damage has already started taking place and not before. The work is, therefore, carried out as a remedial exercise to an ongoing problem rather than a proactive one.

3.6.2 Flooding episodes

According to the FGDs the sample villages have been experiencing normal flooding, which usually occurs between April and May, and excessive flooding which occurs in cycles of between 5-10 years. Participants of the FGDs were able to recall the years the area experienced excessive flooding as shown in Table 2.

Table 2: Years of excessive flooding in the sample villages

Name of Village	Observation Years				
Lusungu	1957	1963	1979	1998	2003
Lugombo	1957	1963	1979	1983	2003
Katumbasongwe	1962	1972	1979	1984	1989

Source: Survey Data, 2005.

According to the FGDs, causes of flooding included overflow of riverbanks, accumulation of surface water from heavy rains and poor drainage of the soils, and changes in the river courses. Another cause of flooding mentioned was the rise in the water level in Lake Nyasa due to closure of the River Shire on the Malawian side. The river discharges its water into the Indian Ocean.

According to the household interviews, the majority of respondents in Lugombo (52.9%) and Katumbasongwe (50%) said that the frequency of flood occurrence had decreased, while in Lusungu village the majority of the interviewed villagers (62.7%) reported an increased trend. Regarding the magnitude of flood occurrence, the majority of respondents from all three villages (54.9%, 64.7% and 58% in Lusungu, Lugombo and Katumbasongwe villages, respectively) reported a decrease in magnitude.

These data would suggest that there has been a general trend towards a decrease in frequency and magnitude of flood occurrence possibly due to increased desiccation as observed by the IPCC (2001). They also suggest that the increase in frequency of flooding in villages like Lusungu may be a result of localized events, such as the closure of the River Shire, as encouraged by terrain and nature of soils.

3.6.3 Biological changes associated with floods

Apart from the already mentioned *mimosaceae* family plants brought by flooding rivers from neighbouring Tukuyu District, FGDs participants reported of the disappearance of a certain banana species known as *harare* due to floods. They also reported of the disappearance of some wild animals such as antelopes. Moreover, flooding resulted into the rotting and drying out of some cocoa and banana trees/plants. Other impacts included occurrences of crop diseases such as rice yellow, and disappearance of a certain species of oranges. It was reported during the FGDs in Lusungu village that it is now difficult to predict occurrences of flooding, unlike in the past when people used to count years. In the past there were spiritual leaders who had ability to forecast. The only means of forecasting used today is by looking at the signs of onset of heavy clouding in the Tukuyu highlands in the north.

Some of the weather indications mentioned at Katumbasongwe village, but not authenticated in the other sample villages, included:

- Appearance of a bird locally known as *mwalalo* at the beginning of the rain season is believed to indicate the possibility of onset of heavy rainfall or storm. Otherwise, the beginning of a normal rain season is accompanied by the appearance of birds locally known as *ngwazi*.
- The onset of the rainfall pattern locally known as *kakese* was also mentioned as an indication of heavy rainfall during the year that could cause floods.

3.6.4 Effects of floods to the different wealth groups and coping measures

Socio-economic consequences of floods mentioned during the FGDs included destruction of crops, animals, buildings and other household property. Other effects included destruction of communication systems, drainage systems, transport infrastructure and the outbreak of diseases such as cholera and other waterborne diseases.

Judging from the FGDs and information from literature (Aberra et al., 1994), there is little apparent effort to permanently contain flooding or avoid flooded areas, as consequences are less serious in the higher areas. This raises the question of indigenous perception of floods with respect to their impact on agriculture and the social life of the people. Farmers associate flooding with overflows of riverbanks, accumulation of surface water from heavy rains and poor drainage of the soils and changes in river courses. However, their response to the phenomenon differs according to the economic access qualification of a concerned wealth group.

The *mnoge* people are able to cope with floods because they are able to shift to higher areas. This group of people is able to hire or buy farmland disposed off by people from other social groups, especially the *ndondo*. The *mnoge* normally employ casual labourers from among the *ndondo* to work in their farms. During and after floods the *mnoge* people are in a position to trade by buying commodities such as food from other areas and bringing them to the flood affected people. This implies that at any event of floods the *mnoge* group has an opportunity to get richer at the expense of the other wealth groups, especially the *ndondo*. To the *mnoge*, flooding is a blessing in disguise.

The most affected wealth group, however, is the *ndondo* because whenever flooding occurs they are less able to cope with the situation. It is difficult for them to even migrate to the un-flooded areas. Instead they are often forced to sell their assets such as farmland at very low prices. They end up getting poorer and poorer; living on begging or working as casual labourers for other people, especially the *mnoge* group. Hence, coping measures to excessive flooding mentioned during the FGDs were mostly temporal. They included construction of platforms in the houses, shifting to the un-flooded areas, buying and/or hiring farmland in dry areas, etc. Assistance by government and other organizations or friends and relatives in terms of food and shelter was mentioned as an important coping mechanism for the *ndondo*.

Data from FGDs are supported by the household interviews data that show that the majority of respondents from Lusungo (73.3%), Lugombo (58.3%) and Katumbasongwe (61.7%) villages reported to shift to dry areas during flood events. Other coping strategies included platform construction (24.4%, 2.1% and 2.1% in Lusungo, Lugombo and Katumbasongwe, respectively), and assistance by government, friends, neighbours and relatives in terms of food and shelter (2.2%, 6.3% and 2.1% for Lusungo, Lugombo and Katumbasongwe, respectively).

3.6.5 Gender and impacts of flooding

Both males and females experience excessive floods and other natural calamities. However, males and females are affected differently depending on the gender category and wealth group they belong to. The chi-square test shows P-value of 0.830 with a linear association value of 0.648. Moreover, the effects differ as different wealth groups adapt differently to the impact of flooding. During flooding events, for example, men tend to go out to other places to seek employment and/or business opportunities, leaving behind their wives with all the household responsibilities.

3.7 Sanitation and health hazards associated with floods

The study results show that pit latrines are the most commonly used toilet system in the study area. All the respondents in Lusungo and Katumbasongwe reported as using this particular toilet system. In Lugombo village 98% of respondents reported as using pit latrines and the rest 2% said they had no toilet facility at all—all of them came from the *ndondo* wealth group.

Regarding refuse disposal systems used by most households, the majority of respondents (49%, 47% and 62% in Lusungo, Lugombo and Katumbasongwe, respectively) said they buried the refuse within the compound, 25.5% and 21.6% in Lusungo and Lugombo villages, respectively, said they dumped it in the neighbourhood, and 23.5% and 36% of respondents in Lusungo and Katumbasongwe villages, respectively, said they burnt the refuse in the compound.

With respect to the primary means of water treatment used by the households, the majority of respondents (64.7%, 58.8% and 62.0% in Lusungo, Lugombo and Katumbasongwe villages, respectively) reported boiling the water; 29.4%, 35.3% and 16.0% in Lusungo, Lugombo and Katumbasongwe villages, respectively, said that they did not treat the water at all; while 5.9%, 5.9% and 2.2% of them in Lusungo, Lugombo and Katumbasongwe, respectively, said that they treated the water with a suspicious chemical concoction locally known as *water guard*. A majority of those people who did not boil their drinking water belonged to the *ndondo* wealth group and stood a great risk of acquiring contagious diseases such as cholera, diarrhoea, dysentery and typhoid; because during flooding pit latrines tend to overflow and contaminate all the water.

3.8 Housing conditions

Most of the houses in Lusungo (66.7%) and Lugombo (64.7%) were constructed using mud and poles; while 54%, 31.4% and 35.3% of the houses in Katumbasongwe, Lusungo and Lugombo villages, respectively, were made of burnt bricks. Almost all of the houses in the three villages had earth floor (i.e. 92.2%, 88.2% and 90% in Lusungo, Lugombo and Katumbasongwe villages, respectively). With respect to roofing, the majority of the houses in all three villages were thatched (80.4%, 54.9% and 60% in Lusungo, Lugombo and Katumbasongwe, respectively). Only 19.6%, 45.1% and 38% of the houses in Lusungo, Lugombo and Katumbasongwe villages, respectively, were roofed using corrugated iron sheets.

Hence, more than 60% of the houses were, therefore, likely to collapse during floods as they were built of mud, poles and thatch. Most of these houses belonged to the *ndondo* wealth group, and as said before, suffered most from the floods.

4. Concluding remarks

4.1 Overview

From the foregoing discussion it is clear that Kyela District and the ecosystem of the Songwe River have been affected by flooding which has been identified in this study as a frequent phenomenon leading to loss of crops, livestock, property, and sometimes, human life in the lower part of the Songwe River catchment. Although it was not conclusively established that flooding episodes in the Kyela flood plain are a result of local climate changes or climate variability, it is clear that anthropogenic disturbances (such as expansion of settlements and deforestation due to the extraction of fuelwood, charcoal and logging as a poverty alleviation strategy for the local communities) in the upper reaches of the river catchments have had an adverse impact on the flood plain.

Data from this study demonstrate that people's response to floods differ according to the economic access qualification of a concerned wealth group. The *mnoge* people have been able to cope with flooding by using a diversified response portfolio, e.g., by shifting to higher areas, hiring or buying farmland disposed off by people from other social groups, and employing casual labourers from among the *ndondo* people to work in their farms.

During and after floods the *mnoge* people are in a position to trade by buying commodities from other areas and bringing them to the flood affected people. In the process they are able to benefit from flooding at the expense of the other wealth groups, especially the *ndondo* who end up poorer; living by begging and working on other people's farms. Indeed poverty levels are a significant factor in the ability to cope with flooding in these communities.

As reported in Lusungo village, it would seem that traditionally farmers had an early warning system based on monitoring of changes in the atmosphere and the natural environment. Spiritual leaders had the ability and responsibility to

forecast and predict occurrences of flooding handed down to them by custom. That indigenous knowledge is no longer tenable. The only means of forecasting left and used today is by looking for signs of onset of heavy clouding in the north and the emergence of indicator birds, themselves made rare by the changing environment.

4.2 Transforming structures, processes and livelihood strategies

Generally, people will develop strategies based on the constraints, assets and what support structures are in place. People of Kyela District in the Songwe River catchment are subject to the rules and regulations of the local government, customary law and national government policies that control the utilization of natural resources in the area.

People are engaged in a number of activities in a sequential and sometimes simultaneous ways that contribute to their well-being, or constitute their livelihoods. The communities utilize a realm of opportunities and assets to achieve their goals and aspirations, including engaging in a range of activities in agriculture, fishing, petty businesses as well as cross-border trading.

However, as noted above this exposes them to a range of beneficial or harmful ecological, socio-economic and political perturbations that may help or hinder their capacities to make a living depending on the economic access qualifications of the concerned wealth group. Hence, in Kyela District, flooding is the main ecological perturbation that the people must live with in a love and hate relationship. It is a perturbation that largely determines whether people engage in sustainable livelihoods or not. Data from this study would suggest that sustainable livelihoods in the district solidly depend on people's capacity to survive shocks and stress from floods and improve their material condition. As stated elsewhere in this article, measures to raise the income of the people should go hand in hand with raising people's education in terms of training them on the good farming practices and/or enforcing a mechanism that would increase people's capital and market opportunities.

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