# ASSESSING AND MAPPING SOCIAL VULNERABILITY TO FLASH FLOODS

***(A Case Study of Bwaise III, Kampala, Uganda)***

CHRIS ADEBOLA ODEYEMI
MARCH, 2013

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Enschede, the Netherlands, March, 2013

Thesis submitted to the Faculty of Geo-Information Science and Earth Observation of the University of Twente in partial fulfilment of the requirements for the degree of Master of Science in Geo-information Science and Earth Observation.
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# ABSTRACT

The increasing frequency of flooding around the world, which is sometimes attributed to climate change, is not only becoming severe but also impacting negatively on the population. With global urbanization flooding is also becoming an urban problem. This study was part of the Integrated Flood Management (IFM) of Kampala, a UN-Habitat sponsored project, which recognises that flooding in Kampala is multi-dimensional and multi-sectorial; other issues that characterised the study area include among other problems, are, inadequate storm water drainage, informal settlements and other development in hazard-prone areas, inappropriate or inadequate land-use, inadequate disaster response plans and underlying many of the above named issues are poverty and lack of resources and high rates of urbanization.

The impact of flooding on the population can be reduced by designing a methodology for assessing and mapping the socially vulnerable population to flash floods at the household level, which is the main objective of this study. It is believed that the methodology will enhance methods used in reducing the impact of flash floods incorporating this method into governments' policies and programmes on disaster reduction. The methodology is based on the main components of social vulnerability, which captures the exposure, susceptibility and coping mechanisms of households to flash floods.

The study started with a review of relevant literatures about the traditional or "classical" indicators of vulnerability assessment, in order to identify which one contributes to or reduces social vulnerability to flash floods. A questionnaire was administered to a sample of 90 households in the study area, the Bwaise settlement in Kampala. The study also carried out interviews with official of Kampala Capital City Authority (KCCA), NGOs and some residents, and secondary data from other sources. These various data were then integrated into a database, and indicators have been identified by using descriptive statistical. The main factors that contribute to social vulnerability were then categorized under the components of social vulnerability, and spatial multi-criteria evaluation (SMCE) was then used to evaluate these components to obtain the overall Social vulnerability Index (SVI). One significant outcome of this study is a Social Vulnerability Index (SVI) map, which shows respondents' exposure, susceptibility and coping, mechanism levels of the study area. The results reveal that, though, households may vary somewhat in terms of their exposure, susceptibility, and coping mechanism, the majority of the households have a high social vulnerability index (SVI). The resulting SVI map is not a static one, there is a need to update it regularly, because certain indicators doo change.

**Keywords: Urban Flooding, Flash floods, Social Vulnerability Index (SVI), Households.**

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# DEDICATION

To

*My late grandmother*

**Mrs Marion Obaje Odeyemi**

*who knew the value of education and put me in school.*

*My late wife*

**Mrs Adebimpe Odeyemi (1974-2004)**

*My present wife*

**Mrs Omobolanle Odeyemi**

*For your love and prayers*

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# 1. BACKGROUND TO THE STUDY

*This chapter discusses the general background of the research; it describes the justification, motivation, the research problem, research objectives and its sub-objectives. It further describes the thesis structure and concludes with the work plan.*

## 1.1 Introduction

People around the world are getting more vulnerable to natural disasters. The impact these disasters are occurring with increased rate, as a result of socio-economic and urban developments and due to increased climate irregularity. Most of these adverse impacts from disasters are the predictable result of interactions between the physical environment, the socio-economic and demographic characteristics of populations, and engineered systems (Pelling, 2003). Disasters have mostly impacted much on the lives of ordinary people, furthermore it is increasingly becoming difficult for governments and other organizations to implement comprehensive disaster prevention programs at the family/household level in disaster prone areas, due to insufficient human and financial resources (Tran et al., 2009). Reducing the consequences of such natural disasters could contribute meaningfully to sustainable human development.

Typical of these disasters are that of flood occurrence, which had increased significantly in the past twenty years Figure 1.1. The effects on the number people affected, the financial and economic losses had also increased. In 2010 above 178 million people were affected, and while between 1998 and 2010, about $140 billion was lost (Thrupp, 1989). Most common of floods are ones that characterize urban areas, they are becoming a serious challenge in both developed and developing countries. The damages they cause are also on the increase.

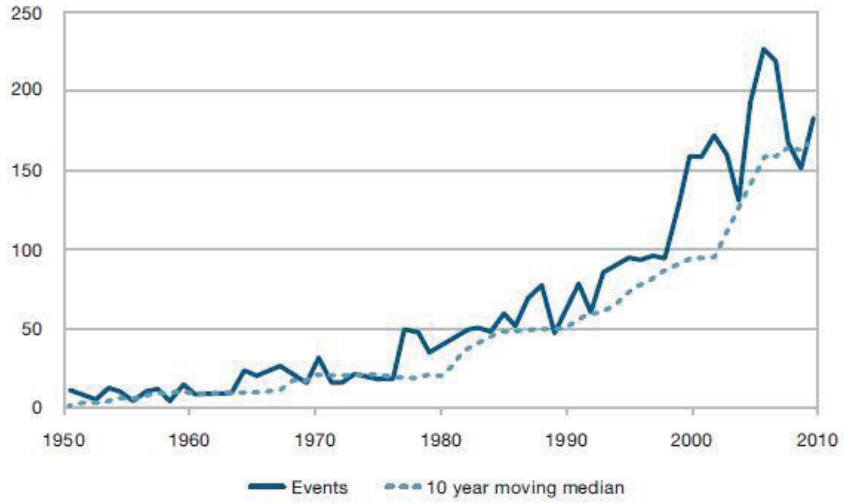



Figure 1.1 Number of reported flood events.

Source: EM-DAT/CRED, adapted from Jha *et al.* (2012)

Asia has had the most economic loss due to flooding in recent years, followed by Europe and the Americas. The impact of flooding to an African family can be more disastrous in monetary terms, as compare to a family in Europe, because a while a family in Europe will get assistances from government and probably from insurance companies, but in the African society ether in the slums or in rural areas the

best a family or an individual can receive may be temporary camp material or help from non-governmental agencies (NGOs) (Wisner et al., 2012).

Urban floods have a strong correlation between natural and man-made causes. When floods are caused by extreme rainfall, heavy storm or typhoon, it is as regarded as natural, besides floods can be man-made, this is when people dispose their garbage in rivers and water ways, the resultant effects are the reduction of water flow or total blockage of the water ways or river channel. Other man-made cause is the continuous concreting of urban surfaces, consequently reducing water permeability. Urban flooding is a serious and growing development challenge; the observed increase of flooding impact across the world poses a serious challenge to development and on peoples' lives, especially on the inhabitants of the fast growing cities and towns in developing and developed countries. The is the need for governments to make flood risk management a matter of high priority on the political and policy agenda, because of the current and projected levels of flood impacts on urban settlements a (Jha et al., 2012).

People living in flood prone areas have different levels of vulnerability; the social impacts of disaster all too often fall disproportionately on the poor, minority groups, children, the elderly and disabled people. These groups of people are the one who are least prepared for an emergency and this because they have little or no resources with which to prepare for a hazard. These people tend to live in the highest-risk locations, in substandard housing, and they also have little or no social and political connections necessary to take advantage of resources that would help them cope with disaster (Dunning, 2009; NRC, 2006).

## 1.2 Justification

Extreme weather events in recent times had caused large scale devastation to urban population and economies and these impacts are much more felt in urban areas in developing countries. Climate change may be attributed to this extreme weather events, but if that is not so, then there are evidences, that shows that urban population are increasingly becoming more vulnerable to floods and storms. In this regard the Fourth assessment of the Intergovernmental Panel on Climate Change (IPCC) of 2007, noted that, with high confidence that, the most vulnerable settlements are generally those in coastal and river flood plains. People living rapid urbanized areas, which is synonymous to slums expansion, which usually have a high concentration of poor communities, are prone to extreme weather events, such as flooding. (IPCC, 2007; Satterthwaite et al., 2007).

In this respect, there is an increase of flood risk impact on increase areas across the world, even though the immediate loss of life from flooding is increasing more slowly in the developed countries, but this is not so in the developing countries, as the fatalities are still record high, also floods events impacts dis-appropriately on the poor, socially disadvantage population especially children and women (Jha et al., 2012). The various researches aimed at minimizing the risks of floods and society's ability to mitigate and adapt to the impact floods (Solecki et al., 2011), including Kampala (Lwasa, 2010) had shown that researches on the impacts of floods especially concerning social vulnerability could greatly be improved upon.

## 1.3 Relevance of this study

According to the inception report for Integrated Flood Management (IFM) of Kampala, stated that Cities and Climate Change Initiatives (CCCI) of the UN-HABITAT is promoting the role of local leadership in mitigation and adapting to climate change in urban area. CCCI had identified Kampala as a pilot city for the IFM approach in combating flood risks associated with climate change. According to the report, flooding in Kampala is multi-dimensional and multi-sectorial; the report went further to identify the

following issues that characterised the study area include among other problems, are, inadequate storm water drainage, informal settlements and other development in hazard-prone areas, inappropriate or inadequate land-use, inadequate disaster response plans and underlying many of the above named issues are poverty and lack of resources and high rates of urbanization (Sliuzas et al., 2012).

## 1.4 Research Problem

Kampala's natural environment is threatened by both climate change and the city's fast-paced expansion. This has increased vulnerability of the population in the region. Vulnerability assessment of the city-region shows a higher risk to the population thus a higher spatial resolution analysis would identify vulnerability level in more detail; such analysis brings to light the vulnerability at the household level. (Lwasa et al., 2011). No matter the type or size of the natural disaster, preparing for it does not decrease its destructive power, but identifying the social vulnerable population is a very important significant issue for the pre- and post-disaster interventions.

## 1.5 Research Objective

The objective of this study is to develop a methodology to assess and map the social vulnerability of households subject to flash floods. To assess social vulnerability of households in the study area, this study will measure their exposure, susceptibility and the coping mechanism, in dealing with floods. Major issues relating to flooding, their socio-economic activities and demographic characteristics will be measured, assessed and mapped. Table 1-1. Sub-Objectives, Research Questions, Data Required and Methods/Tools

### 1.5.1 Sub-Objectives

1 Identify the characteristics of flash floods, in the study area.
2 Identify and describe the households that are susceptible to flash floods.
3 Identify households' coping mechanism.
4 Develop and test a Social Vulnerability Index (SVI) for the study area.

### 1.5.2 Research Questions

1 Identify the factors that make households exposed to flash floods in the study area.
*What is the level of water at door step of building?*
*What is duration of floods event within and outside building?*

2 Identify and describe the households that are susceptible to flash floods.
*What makes household susceptible to flash floods?*
*Which households are susceptible to flash floods?*
*What are the main socio-economic characteristics of the affected households?*

3 Identify households' coping strategies to flash flood.
*How do households' cope with flash floods?*
*What factors influences their coping mechanism?*

4 Develop and test a Social Vulnerability Index (SVI) for the study area
*Which variables can be used to create a SVI?*
*Which households are vulnerable in the study area?*

Table 1-1. Sub-Objectives, Research Questions, Data Required and Methods/Tools

| No | Sub-objectives | Research Questions | Data Required | Method(s) to use |
|---|---|---|---|---|
| 1 | Identify the factors that make households exposed to flash floods in the study area | *1.1 What is the level of water at door step of building?* | Results from measuring the level of door step | Measuring tape |
| | | *1.2 What is duration of floods event within and outside buiding?* | Result from Household Interview | Household Interview by means of Questionnaire |
| 2 | Identify households that are susceptible to flash floods. | *2.1 What makes household susceptible to flash floods?* | Result from Household Interview<br><br>Observation<br><br>Focus Group Disscuassion (FGD) | Household Interview by means of Questionnaire.<br><br>Observations |
| | | *2.2 Which households are susceptible to flash floods?* | Result from Household Interview<br><br>Data analysis and integration<br><br>Focus Group Disscuassion (FGD | Data analysis and integration using SPSS |
| | | *2.3 What are the main socio-economic characteristics of the affected households?* | | |
| 3 | Identify households' coping strategies to flash flood. | *3.1 How do households' cope with flash floods?* | Result from Household Interview<br><br>Observationocus Group Disscuassion (FGD) | Household Interview by means of Questionnaire |
| | | *3.2 What factors influences their coping mechanism* | | |
| 4 | Develop and test a Social Vulnerability Index (SVI) for the study area | *4.1 Which households are the most vulnerable study area?* | Result from Household Interview<br><br>Observation<br><br>Data analysis and integration | Data Analysis using SPSS |
| | | *4.2 Where are the vulnerable groups clustered?* | Result from Household Interview<br><br>Data analysis and integration | Data analysis and integration SPSS and ArcGIS<br><br>Create a Social Vulnerability Index (SVI) for the study area |

## 1.6 Thesis Structure

**Chapter 1** **Background to the Study:** Discussed the general background of the research, justification, research problems, questions, objectives and sub-objectives.

**Chapter 2** **Social Vulnerability to Flash Flood:** Theoretical framework and background to the study was discussed in this chapter. Urban flooding and the concept of vulnerability, it dimensions and how it can be measured was thoroughly reviewed.

**Chapter 3** **Study Area and Research Methodology:** This chapter will discuss the characteristics of the study area. Methods and approaches of data handling and tools applied to the studies data collection, focus was on socio-economic and hosing data.

**Chapter 4:** **Assessment and Mapping of Social Vulnerability**. This chapter analysed socio-economic and demographic structure of the household data by using simple descriptive statistical procedures, such as frequencies, percentages, charts, tables, and graphs, to help identify the main factors that increase or decrease the households' social vulnerability to flood event in Bwaise, this help to develop indicators for the study area. The resultant indicators were then categorized into the component of social vulnerability (exposure susceptibility and coping mechanism), a SMCE was then used to evaluate these components to obtain the overall Social vulnerability Index (SVI) of the study area. The SVI was then plotted on the map of the study area this is to help emphasize graphical view of data.

**Chapter 5:** **Conclusion and Recommendations**. This chapter presented a summary of main findings from this research and made recommendation for further research.

# 2. FLASH FLOODS AND SOCIAL VULNERABILITY

*This chapter discusses the relevant literatures used to support this research. It gives the definition of floods and differentiated flash floods as a kind of urban floods. It reviews some definitions vulnerability and its dimension. The chapter went ahead to define and discuss social vulnerability index (SVI) and its spatial aspect.*

## 2.1. Floods

Flooding take place when a great volume and body of water inundate an area or built-up area that is not usually submerged. It is usually caused by combination of metrological and hydrological events, such as precipitation and flow. Floods can be categorized and described based on various combination of source, causes or impact. They can be generally be characterized as river or fluvial floods, overland or pluvial floods, coastal floods, groundwater floods or failure of artificial water system. Flash floods a kind of urban floods, can be described as either fluvial or pluvial floods. It usually happens when the intensity of precipitation is very high. They may cover a small area as compared to other types floods, but for the fact that they rise very high and quickly makes them very dangerous (Jha *et al.*, 2012).

## 2.2. Urban Floods

Urban flooding can be difficult to define, because countries define "urban" in various ways, but floods impact and effects can be seen in all types of settlements. Conversely floods impact on urban areas are usually difficult to managed, especially when its impact on the where there are concentration of population and assets. The overriding issue is clearly the competition between floods, the natural environment and human settlement for the scarce resource of limited land (Cadag & Gaillard, 2012).

As population increases in developing countries, urban area increases spatially to accommodate the people, this growth usually takes place in dense, low quality informal settlements called 'slums'. These unplanned developments usually occur in floodplain, another feature associated with these slums are that the poor are concentrated within these areas; which typical lacks adequate housing, infrastructure and services, thus increasing flood disaster (Jha *et al.*, 2012).

## 2.3. Vulnerability

Various literature reviewed, shows a number of contrasting definitions of what vulnerability means, with many conflicting viewpoints, this indicates the complexity of vulnerability concept (Jean-Baptiste, Kuhlicke*, et al.*, 2011), vulnerability transcends along such terms as, at risk, natural hazards, coping and adaptive capacity, sensitivity, resilience, poverty and even food security in disaster and development studies literature as well as in climate change discourses, also vulnerability studies had been given a considerable attention within policy studies in both social and natural sciences over the last decades. Cutter (1996a) reviewed eighteen (18) definitions of vulnerability while Thywissen (2006) gave 28 different definitions what is vulnerability. In most literature the concept of vulnerability is confused with that of risk, hazards, and poverty concepts. Even though there may be some connections between these concepts, the issue of vulnerability is should be distinguished from them (Cutter, 1996b; Nyakundi *et al.*, 2010). There is also confusion when assessing vulnerability, because almost all areas that are vulnerable are ones mostly at risk but it is not all that is at risk is vulnerable (Birkmann, 2006b).

### 2.3.1. Dimensions of Vulnerability

Vulnerability assessment has now been accepted as a requirement for the effective development of emergency management capability, but vulnerability assessment and measurement often lack a systematic, transparent and understandable approach, (Birkmann, 2006a), this is because there is no general agreement to the definition of vulnerability, so also assessing the characteristics of vulnerable people (Birkmann & Wisner, 2006). Birkmann (2006b), vulnerability is composed of physical, social, economic and environmental dimensions and is all related to human activities, which are usually affected during disaster. However, the importance levels of these vulnerability dimensions change in different from one area to another.

#### 2.3.2. Economic Dimension

"The economic dimension of vulnerability acknowledges economic damage potential, which can be understood as anything concrete that affects the economy of a region and can be damaged by a hazard. The economic dimension of vulnerability represents the risk to production, distribution and consumption" ((Kumpulainen, 2006) p.66)

#### 2.3.3. Environmental Dimension

"The ecological dimension of vulnerability acknowledges ecosystem or environmental vulnerability or fragility. In the case of ecological vulnerability, it is important to find out how different kinds of natural environments cope with and recover from different hazard" ((Kumpulainen, 2006) p.66).

#### 2.3.1.1 Social Dimension

The social dimension of vulnerability is seen as the socio-economic activities and socio-demographic characteristics that make a certain groups to be more vulnerable than the other. It is believed that the poor, disable or seriously ill and weak are considered to be more vulnerable and these groups of people, do not always have a choice of where to locate, thus making these group of people to live in hazardous area, for example on a flood plain (Kumpulainen, 2006). Cutter *et al.* (2003b) The social dimension of vulnerability is a concept, helps to identify, the characteristics and experiences of certain group of people or individual that enable them to respond and recuperate from disaster.

## 2.4. Social Vulnerability

The social dimension of vulnerability, which is the demographic and socio-economic factors, or personal characteristics that affect the way a community, household or an individual to bounce back after a disaster or hazard is regarded as social vulnerability (Blaikie *et al.*, 1994; Messner & Meyer, 2006). Cutter *et al.* (2003b) p. 221, defines "*Social vulnerability is partially a product of social inequalities—those social factors and forces that create the susceptibility of various groups to harm, and in turn affect their ability to respond, and bounce back after the disaster.*" The definition may not be complete, but it embraces social science researches' points of view on social vulnerability, as it manifests the individual's ability to resist and recover from disaster within a geographical area.

Social vulnerability is a term that has been widely used in the natural hazards literature for quite a few years now especially in the scientific research community and has developed exemplary conceptualizations of social vulnerability to hazards and disasters ranging from root causes, to underlying drivers, to differential impacts (Cutter & Finch, 2008; Morath, 2010; Zahran *et al.*, 2008). One main purpose of social vulnerability maps is to identify where the vulnerable population are located. Social vulnerability as a dimension of vulnerability assessment can be seeing as "Who are vulnerable" and "Where do they live".

This will provide policy and decision makers, with scientific basis for disaster prevention, reduction and mitigation (Holand *et al.*, 2011; Kuhlicke *et al.*, 2011; Zeng *et al.*, 2012).

### 2.4.1. Accessing Social Vulnerability

The World Conference on Disaster reduction the Hyogo framework for Action 2005-2015 (UN/ISDR, 2005) describes the measuring of vulnerability and risk as a key activity in vulnerability assessment. The underlining factor within the framework is that the impacts of disaster should be measured or assessed through indicators or with indicators system (Tapsell *et al.*, 2010; Vincent, 2004).

To identify these vulnerable groups, it therefore necessitate assessment, but as Hoppe (2010), puts it this is a "wicked" or unstructured problem. There are multiple solutions, but there are uncertainties about concepts, rules, and principle involved to reach these solutions. Thus, recognizing a suitable technique from among these opposing options is definitely the most important part of vulnerability assessment. Since there are different ways and perspective of measuring vulnerability, Blaikie *et al.* (1994) poised these key questions to help clarify the choice and methods of assessing, who is vulnerable, and why are they vulnerable, this the point, where there is the need for social vulnerability assessment. Having basic social information about the people, households' vulnerability can be determined distinctly. Therefore, the social part of the vulnerability assessment must be considered separately.

The Social Vulnerability Index (SoVI), was developed by Cutter *et al.* (2003a). The SoVI examined the spatial characteristics of social vulnerability as compared to natural hazards at the county level in the United States so as to help identify the locations of populations with high levels of social vulnerability.

Accessing social vulnerability is usually operationalize by means of indicators and indices (Tapsell *et al.*, 2010). The understanding is that; there exists a strong positive correlation between low socio-economic status and high vulnerability. Various social vulnerability indicators developed for natural disasters: age, income, formal qualifications, gender, race, employment residence type, tenure type, disability, single parent etc. are considered the basic indicators of social inequality, it is believed that the lower the socio-economic status, the more vulnerable such individual (Cutter *et al.*, 2003a; Dwyer *et al.*, 2004; Jean-Baptiste, Kuhlicke*, et al.*, 2011; Tapsell *et al.*, 2010).

Most vulnerability assessment studies are usually carried out based entirely on census data at either the country level, (Cutter *et al.*, 2003b; Jean-Baptiste, Kuhlicke*, et al.*, 2011; Linnekamp *et al.*, 2011) regional level (Birkmann, 2006b; Morath, 2010; Sebald, 2010), state level (Morath, 2010), or at city level (Birkmann *et al.*, 2006; Dewi, 2007; Hasiholan Sagala, 2006), and one major problem with such statistical data is that they are too generalized for vulnerability assessment at the household level (Wisner, 2004). That is why thesis will make use of local knowledge of the study area, at the household level in its assessment, which Cutter and Finch (2008) refer to as "downscaling".

Social vulnerability assessment needs to be explicit, as there are various approaches and viewpoints that have been developed by various authors. The conceptual framework for this study is illustrated in Figure 2.1, and is composed of exposure, susceptibility and coping capacity. Exposure is described as the physical precondition to be harmed; susceptibility describes the precondition to suffer harm, because a person or group of people are at disadvantage socio-economically or otherwise, while coping capacity is the ability of the individual or group to come to terms with a disaster (Jean-Baptiste, Christian*, et al.*, 2011). Since this study is based on assessing social vulnerability at a micro-level, the conceptual framework will be used to link the local peoples' perception of their exposure to flood characteristics, their susceptibility and coping mechanism, that is using their local knowledge of the study area.

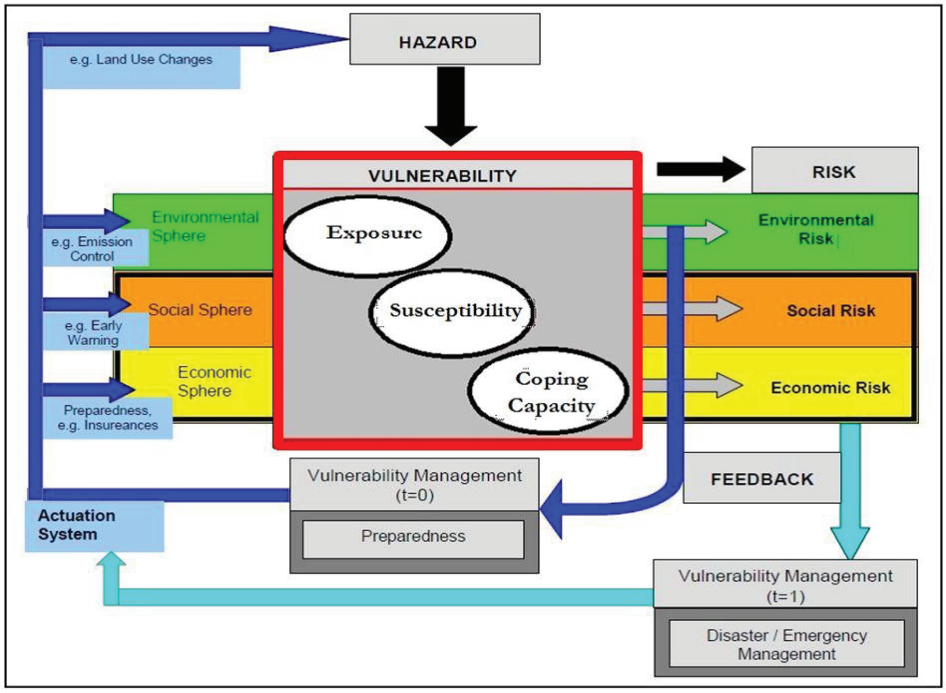



Figure 2.1. The Bogardi-Birkmann-Cardona vulnerability framework, the highlighted area in red is the focus of this study

*Source: Modified from Bogardi/ Birkmann 2004 and Cardona 1999/ 200,*

Social Vulnerability can be assessed or measured systematic using the following components

i. Exposure
ii. Susceptibility, and
iii. Coping mechanism

#### 2.4.1.1 Exposure

Exposure to disaster risk is growing faster than governments' ability to build resilience. Loss of lives, suffering and damage due to disasters in many parts of the world are a constant reminder of our vulnerability to natural hazards, economic loses are also on the rise, various communities are being threatened due to various disasters, in addition rapid regional economic growth had also contributed to the raid growth of disaster exposure. Exposure to disasters has multiplied as urban centres grows, people and economic activity expands into increasingly exposed and hazard-prone lands, this trend can be a challenge to control for especially for countries with high deficits and less diversified economics structure, as grater strains of vulnerability can be faced even with relatively small-scale disaster (Jean-Baptiste, Kuhlicke*, et al.*, 2011; UNISDR/UNESCAP, 2012).

When disaster strikes, it is mostly the people or communities, who bear the burden. The burden mostly in monetary terms shows the ways in which socio-economic vulnerability is intertwined. As economic weaken, social spending becomes threatened, making the poor, women, elderly and the disable to become more vulnerable. These groups may be mostly hit by disaster; vulnerability can also increase for everyone within a community. The main challenge therefore is to control both the rate of exposure and rising vulnerability to disaster (Jean-Baptiste, Kuhlicke*, et al.*, 2011; UNISDR/UNESCAP, 2012).

#### 2.4.1.2 Susceptibility

This is the precondition to suffer harm because of some level of fragility or disadvantageous conditions, the assessment of vulnerability requires an ability to both identify and understand the susceptibility of elements at risk, and emphasise individuals' and communities' conditions that particularly have the potential to magnify the effect of disaster. Susceptibility can also be seen as the socio-economic and physical characteristics of a system that differentiate the magnitude of impacts for a given exposure. (Birkmann, 2006a; Fuchs, 2009; Jean-Baptiste, Christian, *et al.*, 2011; White *et al.*, 2005).

#### 2.4.1.3. Coping Mechanism

The United Nations (UN/ISDR) (2005), defined coping mechanism as the level of resources and the manner in which people or organisations use these resources and ability to face adverse consequences of disaster. From the UN/ISDR's definition, coping mechanism can be the strategy and capacity to deal with disaster by an individual, or institutional which are the ones provided by the society or the Government to deal with disaster (Billing & Madengruber, 2006).

Vulnerability and coping mechanism can be seeing as two side of coin. Assessing coping mechanism will inevitably include, identifying and evaluation of social network structure among stakeholders, and because of its complexity of coping mechanism, participatory approach is important, since no single person can grasp the whole social network structure, it will also be a good opportunity to trigger the capacity building activity.

### 2.4.2 Indicators for assessing social vulnerability

The assumption in social vulnerability research arena is that, disaster affects the poor, children, the elderly, and the handicaps/disable, the most. Framing the concept of social vulnerability based on literature shows that, it is all about social inequality which are, age, income, formal education/qualification, gender/sex, race/ethnicity etc. There are may be controversies in the selection and use of specific indicators to represent these broader concepts of social (Cutter *et al.*, 2003b; Jean-Baptiste, Kuhlicke, *et al.*, 2011) its major merits lies in the fact that it helps in policy formulation for disaster reduction.

As discussed before social vulnerability is composed of exposure, susceptibility and coping mechanism. Under each of these components there are multiple factors to be considered, such as socio-democratic, socio-economic, housing gender, social network, risk awareness, means of recovery, as they contribute to social vulnerability to flash flood. Indicators are considered as the factor that contributes to social vulnerability, they are benchmarks which serve as a reference point for target to be achieved. To develop methodology for social vulnerability, data are usually base on indicators. These indicators are usually expressed in inhabitants' socio-economic status. Some examples are given below:

**Social Indicators**

- **Education level**: The literacy level, the last school which an individual had completed
- **Age**: The age respondent
- **Gender**: Sex of an individual
- **Household size**: Small families/large families

**Economic Indicators**

- **Employment status**: If working or not
- **Household income level**: Monthly or annually income of the individual or household
- **Social security**: Social network or savings

- **Type of Housing Occupancy**: Owner of any properties/ Tenancy

### 2.4.3 Scale/Level of Social Vulnerability assessment

Assessing social vulnerability needs to base on location and should be scale specific. The scale of assessment of disaster is very important, not only that they happen at various spatial and temporal scales, they are also place based, that is why is there is a need for a unit of analysis (Cutter, 1996b; Fekete *et al.*, 2010; Kasperson *et al.*, 2001). For example, social vulnerability assessment for international comparisons, national indicators are used to compare nation at the same level of development, while for national comparisons, regional or sectorial indicators are usually developed and at the local or community level, assessment is usually at the individual or household level (Stephen & Downing, 2001).

# 3 STUDY AREA AND RESEARCH METHODOLOGY

*This chapter gives a general overview of the study area, and also discusses the research methods and techniques that were used to carry out this research. The first part of the chapter, started by giving a historical background of Kampala city and went ahead to give a general background of the study area. The second part dealt with research methods and techniques that were used for collecting both primary and secondary data, focusing on socio-economic and hosing data.*

## 3.1 The Study Area

### 3.1.1. Historical background

Kampala derives its name from the land of "Impala" (antelope), which roved on "the seven hills", round the region before people started settling there. The city had grown from a small town in to a modern day city. When the British declared Ugandan, as a protectorate, Kampala served as both political and administrative capital, of the country until 1893. The city originated from Kibuga, meaning "city or an urban settlement" was built on a hill for security reasons and developed around the king's palace thus making it the capital of the kingdom during the reign of a particular king. It is considered to be the last of the traditional capitals of the kings of Buganda, which is currently the largest and most dominant of the kingdoms found in modern day Uganda. Kampala was set up as an administrative post, in 1890 at "Old Kampala Hill" by Lord Lugard the then British Administrator and it existed together with Kibuga, but each serving a different role, while the Old Kampala Hill became well organised, in accordance with modern urban principles, Kibuga have rural administrative methods, making the area develop in a disorganised manner, with poor infrastructure, resulting to a duality that has had implications for city development up to today (Kibirige, 2006; Oonyu & Esaete, 2012).

### 3.1.2. General Information on Kampala

Modern day Kampala city started developing in 1962 when the British granted independence to Uganda. The city is expanding faster than most cities in Uganda, and urban growth in Uganda had been estimated to around 12% of the population growth, thus engulfing most satellite town around it, thus continuously changing the rural landscape into urban usage. Kampala city region is estimated to cover a land area of 1,895km$^2$, making it functional city region wherein economic, social and environmental processes and systems are all connected spatially (Lwasa *et al.*, 2011; Norstrand, 1994; Nyakaana *et al.*, 1994; Nyakundi *et al.*, 2010; UBOS, 2002). As per temperature, there is an rise in average temperatures of just 2°C in Kampala (Okeowo, 2007) and according Lwasa *et al.* (2011) it will increase by 1.5 °C in the next 20 years thus creating changes in patterns and total annual rainfall. The most critical climate changes in Uganda are increased in rainfall areas around Lake Victoria and in mountainous regions; the runoff has an implication on flooding with associated effects. The process of urbanization in Kampala is stirred by demographic process in the form of rural-urban migration, which had resulted into unplanned settlements at the periphery of the city, with inadequate infrastructure, services, and environmental sanitation problems (Lwasa, 2002; Wegener, 2001).

This research was conducted in the Bwaise III area of Kampala which is part of Lubigi sub-catchment. Bwaise is a low-lying swampy location and is subject to flooding whenever it rains. In fact, the settlement is popularly known for its severe flooding during the rainy season.

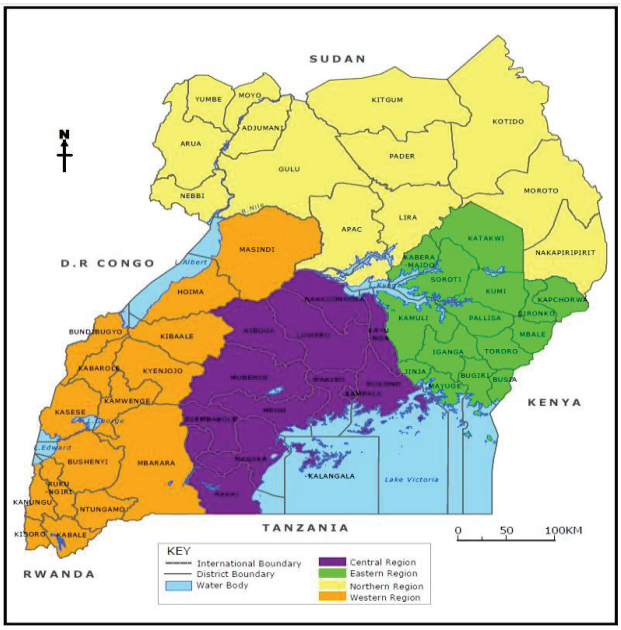



Figure 3.1 Map Uganda showing Kampala

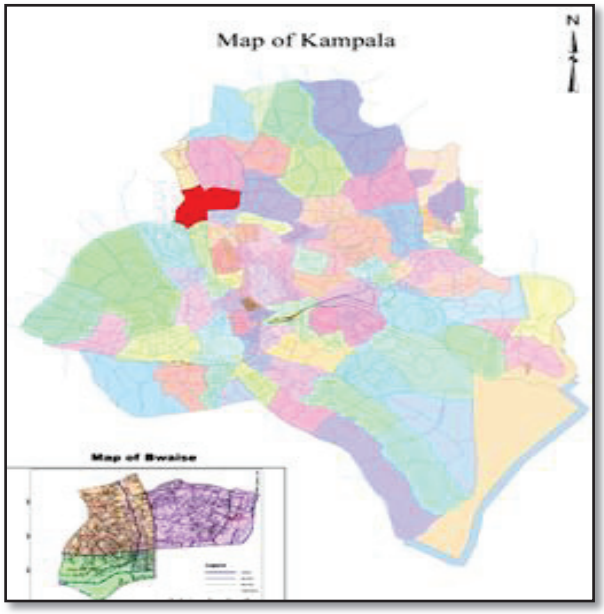



Figure 3.2. Map of Kampala showing Bwaise

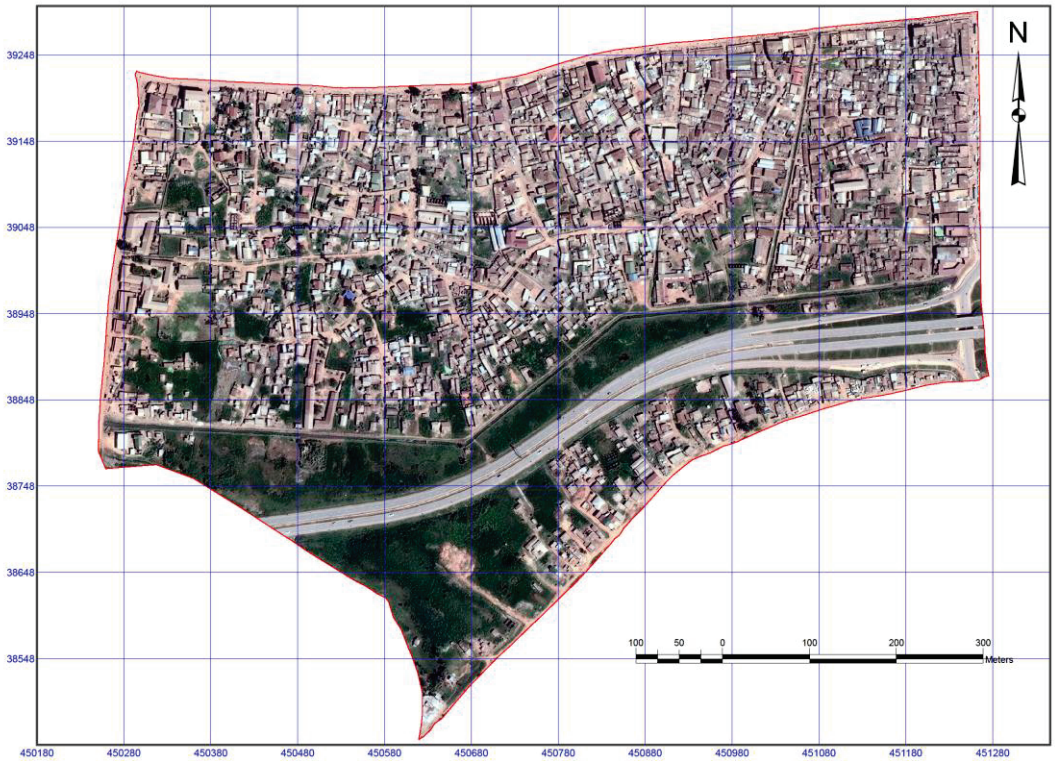



Figure 3.3 Map showing the location of the study area

## 3.2 Research Methodology

A literature review was first carried out with the aim is to identify and defining the different terminologies and methodologies which have been used so far in vulnerability assessment, this is to better understand the different aspect of vulnerability assessment, to help complement and fill in the knowledge gap. The process helped in identifying the main factors which cause vulnerability to flash floods. These factors facilitate the development of indicators; these indicators was then categorize among the components of social vulnerability. The fact that the impact of flooding can be disproportionately among residents, this study wish to better understand which socio-economic and socio-demographic variables that affects and influence household's exposure, susceptibility and capacity to cope. Figure 3.4 shows the methodological and outline of the research process. Data that were elicited from the perspective of the residents' are integrated into the research analysis, as far as possible, but the information gathered was analysed by the researcher alone. A major problem encountered on the field was that of cooperation with respondents, they were sceptical. The researcher was told that there had being many NGOS and researchers who had come around to elicit same information from them, and thing had not really change for them. The researcher was able to overcome this problem by appealing to them that this is not only a purely academic work but which will be integrated into an Integrated Flood Management (IFM) project that is going on in Kampala sponsored by the United Nations (UN Habitat).

### 3.2.1 Fieldwork

The field work for this study was conducted between 17th October and 3rd of November, 2012, in Bwaise III community, Kampala, in Uganda. Data were collected by the use of questionnaire to certain elements of social vulnerability; exposure, susceptibility and coping mechanism against flood. Both primary and secondary were collected (Table 3.1). The outcome of the fieldwork is a database containing all information of household that was sampled. The socio-democratic and socio-economic conditions (gender, age, educational level, income, occupation, length and reason for living in the flood prone area, etc) which make residents to be socially vulnerable due to flash floods were collected.

### 3.2.2 Data Collection

Table 3.1: Shows the methods that were used to collect data and various data types that were collected. Secondary information was also reviewed prior to the field research and complemented when needed afterwards by the fieldwork. The secondary data sources included a review of reports Kampala City Capital Authority (KCCA), NGOs (Slum Dwellers Association of Kampala, ACTOGETHER etc), and the academia (Makarere University and Outspan Primary School both in Kampala).

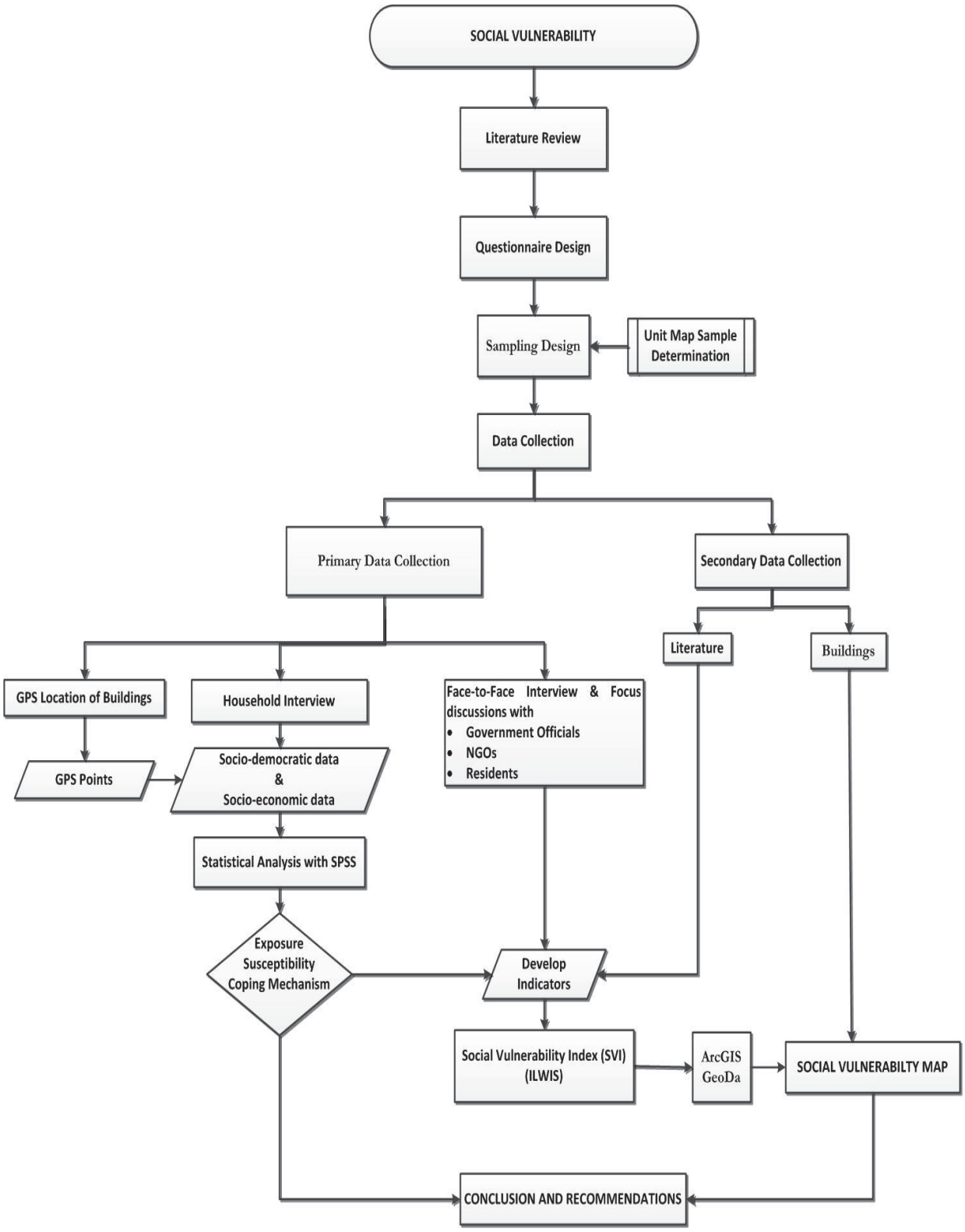



Figure 3.4. Methodological and outline of research process

Table 3-1 Methods of Data Collection and Data types

| **Primary Data** | | |
|---|---|---|
| **Data Types** | **Descriptions** | **Sources** |
| Questionnaires Survey | 90 households conducted between 19th to 30th October 2012 | Interviews using questionnaires at the house level, was administered through regular sampling technique. |
| Building location | GPS Survey of building where household interviews were conducted | GPS Survey |
| Interviews | Interviews with the Drainage engineer and the Community Development officer at KCCA, and with 6 residents that were affected by flooding | Face-to-Face interview<br><br>Focus Group Discussion,<br><br>Field Observations |
| Conventional photographs from the study area | Photographs of buildings, drainage, flooded area, drains, etc. | Digital camera |
| **Secondary Data** | | |
| **Data Types** | **Descriptions** | **Sources** |
| Digital Maps | Building footprint covering Bwaise III (Building_2010_ARCs) | Kampala Capital City Authority (KCCA)<br>Integrated Flood Management (IFM) |
| Literature | Background Information | Kampala Capital City Authority (KCCA)<br><br>NGOs<br>✓ National Slum Dwellers Federation of Uganda<br><br>✓ ACTOGETHER<br><br>Academia |

### 3.2.3 Sampling Method

A systematic spatial sampling method was adopted (Rogerson, 2010), for the study area by creating a fishnet of 50m interval (Figure 3.5). Any point that falls on a building is sampled; GPS coordinates of such building were taken with the aid of Garmin 12x GPS. In overall there 90 samples were taken in the study area.

### 3.2.4. Questionnaire survey

The questionnaire provided information about the context and purposes of the study were explained and the confidentiality of the data was assured. Questionnaires were administered on sample at the level of the individual respondent, which is at home at the time of visit. Figure 3.6, shows a map of the study area, which buildings the household interview were conducted. With aid of a GPS the household surveyed was spatially referenced. The questionnaire was organized into four parts (Appendix I), these are, personal information of respondent, exposure/perception, elements at risk and coping mechanism of respondents; it aims at the biographical and emotional bonds of the respondent to the research location as well as their collective and an individual perspective. Also the questionnaire survey produced a specific kind of "qualitative" data, since open questions were integrated and will be incorporated into the data analysis. Preceding the proper survey, ten questionnaires were tested among socially and demographically residents in the study area, this is to check the comprehensibility and effectiveness of the questionnaire and its logic.

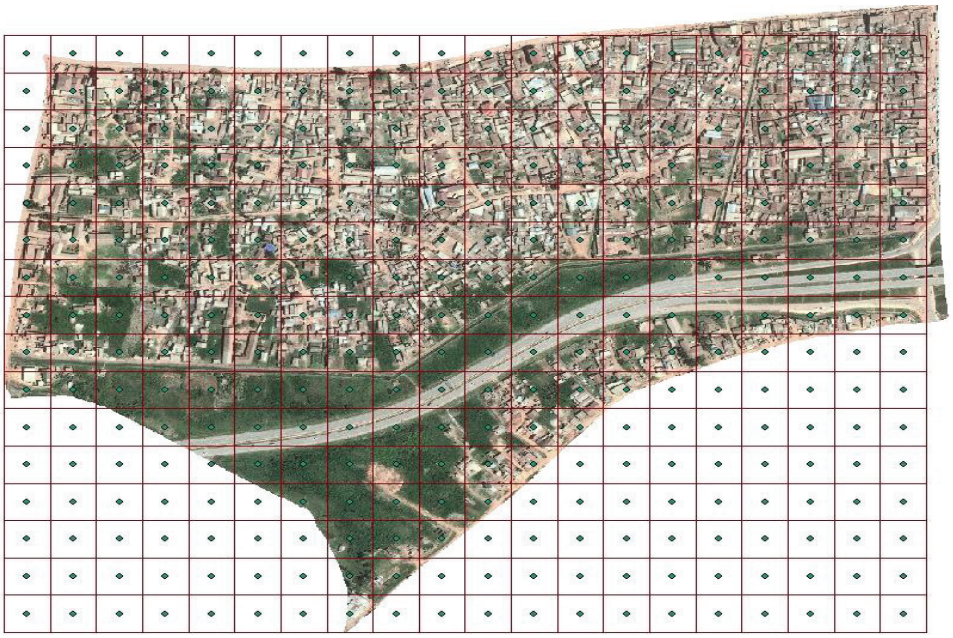


Figure 3.5: Map of the study area (Bwaise III), of fishnet of 50m interval

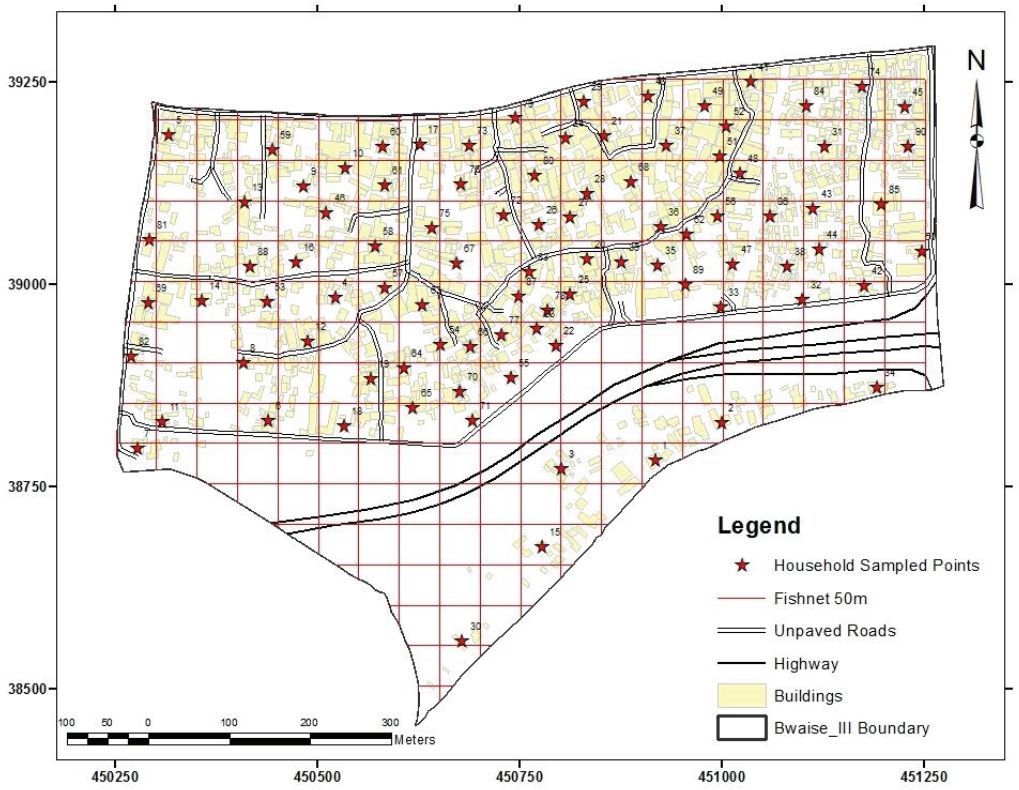



Figure 3.6 Map of the study area showing buildings where household samples were administered

### 3.2.5. Face-to-Face Interview

Face-to-Face interviews were necessary to get the perceptions of decision makers on the problems in the study area; this interview was conducted with Drainage Engineer and the Community Development Officer of the Kampala Capital City Authority (KCCA). Furthermore, 6 residents who were not part of the sample, who are directly or indirectly affected by floods in the study area were also interviewed; the aim is to gained specific knowledge on the history of flooding in the area. The interviews were semi-

structured in order to help interviewees develop their own emphases and views on flood issues they felt is as important to them; In most cases a snow-ball sampling method was applied, that is, after interviewing a resident, the researcher asked the interviewee, if they know of any other persons (family members, friends etc.) within the study area, who will be willing to discuss their own experiences about floods in the area. This provided a sort of data that is different from those of the questionnaire survey.

### 3.2.6. Focus Group Discussion

This was carried out with the National Slum Dwellers Federation of Uganda and its coordinating agency ACTOGETHER, the purpose of this discussion is to gain insight of how the people in the study are affected by flash floods. The discussion was taped and transcribed word for word.

## 3.3. Data Analysis

In order to analyse social vulnerability in the study area, a statistical analysis using SPSS and Analytical Hierarchical Process (AHP) will be used. The traditional socio-economics and socio-demographic indicators will be identified and analysed. The outcome will show how the components of vulnerability, *that is,* exposure, susceptibility and coping mechanism interacts to make households vulnerable to by flash flood in the study area.

The following the steps in SMCE module within ILWIS-GIS (ITC, 2001), was adopted (Figure 3.7):

- Definition of the problem. Structuring of the problem into a criteria tree, with several branches or groups, and a number of factors and/or constraints.
- Standardization of the factors. All factors will be in different format and will then be normalized to a range of 0-1.
- Weighting of the factors within each group.
- Weighting of the groups, in order to come to an overall weight value.
- Classify the results.

The resultant values were used to assess and map social vulnerability for Bwaise Community in Kampala, Uganda, in ArcMap.

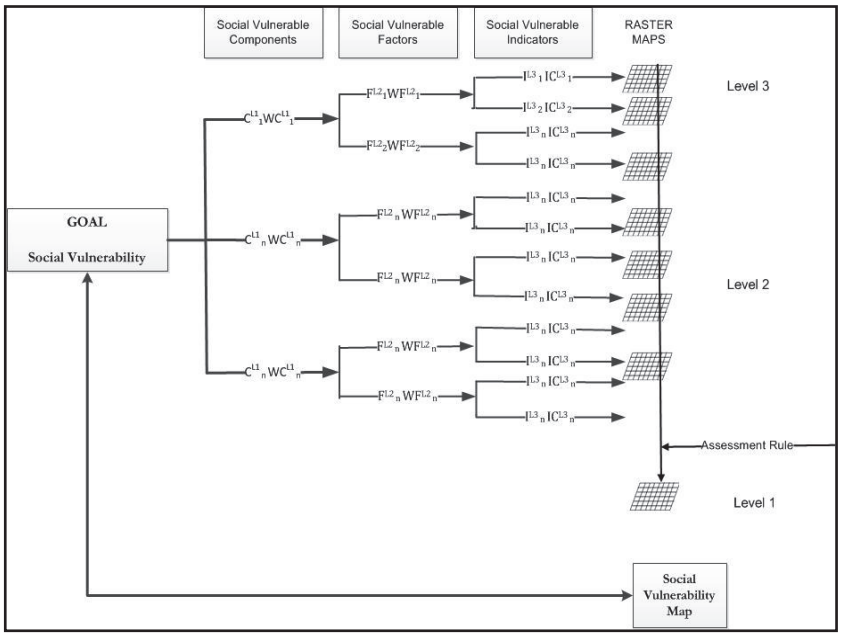



Figure 3.7 Analytical Hierarchical Process adopted for this research

*(Source; Modified after Westen and Kingma (2009))*

# 4 SOCIAL VULNERABILITY ASSESSMENT OF BWAISE

*This chapter analysed socio-economic and demographic structure of the household data by using descriptive statistical procedures, to help identify the main factors that increase or decrease the households' social vulnerability to flood event in Bwaise, and to develop indicators for the study area. The resultant indicators were then categorized into the components of social vulnerability (exposure susceptibility and coping mechanism), and used to evaluate these components to obtain the overall Social vulnerability Index (SVI). The SVI was then plotted on the map of the study area this is to help emphasize graphical view of data.*

## 4.1 Indicators that contribute and influencing factors to social vulnerability in Bwaise III.

Vulnerability assessment needs to be explicit, as there are various approaches and viewpoints that have been developed by various authors. The conceptual framework for this study was discussed in chapter 2 (figure 2:1), and is composed of exposure, susceptibility and coping capacity. As study is based on assessing social vulnerability at a micro-level, the framework will combine the peoples' perception, of their exposure, susceptibility and coping mechanism to flood events. To develop indicators for social vulnerability for the study area, therefore, the socio-economic and socio-demographic characteristics of the study area was analysed, using descriptive statistical procedures, such as frequencies, percentages, charts, tables, and graphs. This is to help identify which ones are relevant to the study area

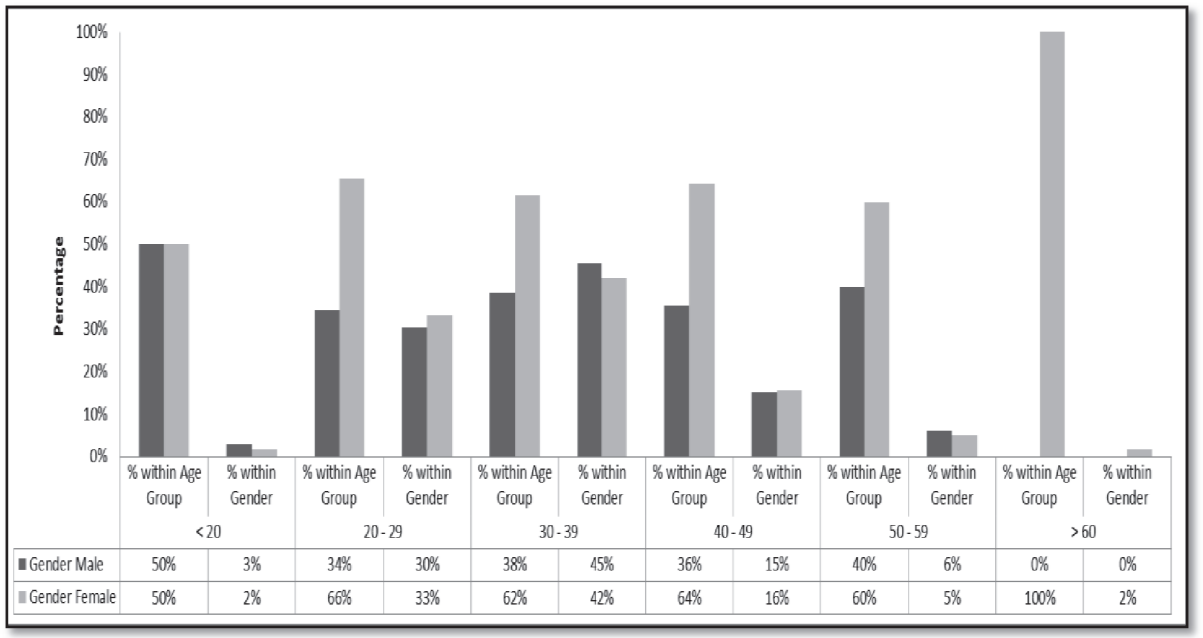
## 4.2 Exposure and Susceptibility to Floods in Bwaise III

Exposure is described as the physical precondition to be harmed, while susceptibility describes the precondition to suffer harm. In this study indicators relating to exposure and susceptibility were derived from the household survey based on the following analysis.

### 4.2.1 Socio-demographic structure of the household survey

#### Gender and Age Structure

Gender is a factor to consider when assessing the impacts of flood event. It is assumed that women are more vulnerable than men not because of their biological differences, but their traditional role in the society of taking care of their family member tend to place some burden on them during disaster events. The gender structure of the whole questionnaire showed that there were more female respondent (63.3%) than male (36.7%) who took part in the survey (Figure 4.1). It is assumed that the traditional household structure and the a respective internal structure of division of labour in traditional African society where the male goes to work during the day and the women stay back to take care of the home and children, may be responsible for the higher percentage of female respondent than male. The respondents' age ranges from 18 to 75 years, with a mean age of 34 years and a standard deviation of 9.4. With age group 30 to 39 years having a higher percentage of 43%. Figure 4.1 shows that 30-39year age range and female were mainly interviewed.




| | < 20 | | 20 - 29 | | 30 - 39 | | 40 - 49 | | 50 - 59 | | > 60 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | % within Age Group | % within Gender | % within Age Group | % within Gender | % within Age Group | % within Gender | % within Age Group | % within Gender | % within Age Group | % within Gender | % within Age Group | % within Gender |
| Gender Male | 50% | 3% | 34% | 30% | 38% | 45% | 36% | 15% | 40% | 6% | 0% | 0% |
| Gender Female | 50% | 2% | 66% | 33% | 62% | 42% | 64% | 16% | 60% | 5% | 100% | 2% |

Figure 4.1: Gender and Age group structure of the respondents

### Household Size

When there are emergencies or when natural disasters happen, for example flooding, the assumption is the ability of household to react in an appropriate way, is very crucial, and this is dependent on the structure of the households. Households with dependent persons (with children and/or disabled or permanently ill persons) are often considered to be more vulnerable than households in which has less persons or in which every person can rely on herself/himself. In the survey household size was group in to small (families with less than 5 persons) represent 58%, while large family (equal or more than 5 persons) is about 42% of the respondents. The implication is that household size will be considered as an indicator. Also about 10% of respondents have one or disable or seriously ill-person in their household, making that household to be vulnerable.

## 4.2.2 Socio-economic structure of the household survey

Economic, cultural and social capital is an systematic tool used to describe and interpret the social structures of modern societies (Jean-Baptiste, Christian, et al., 2011). All forms of income and assets that are translated to monetary value are considered economic capital, while formal and informal qualification, skills are considered cultural capital. Social capital relates interpersonal relationships, which allow an individual or households to get access to resources. One of the widely used indicators of cultural capital is usually operationalized through formal educational qualification. This is assumed to be a decisive factor or predictor of the position one can attain in professional ladder, as stated earlier in this work that social vulnerability is about social inequality.

For the sake of this study formal educational qualification was operationalized through highest level of education and was classified into None, Primary School, Secondary School and Higher Education. About 49% of the respondents are secondary school certificate, while 43% of the household interviewed are self-employed, also majority of the self-employed respondents are secondary school certificate holder (Figure 4.2). The implication of this analysis is that the households that fall in these categories people will be less vulnerable.

Household incomes used to measure economic capital in this study exhibit a tendency of low range in the study area. Missing value (no response) represents 40%, may be, because of the delicate questions pertaining income. This indicator will not be used in the SMCE, instead educational level and employment status will be used since they are highly correlated with income.

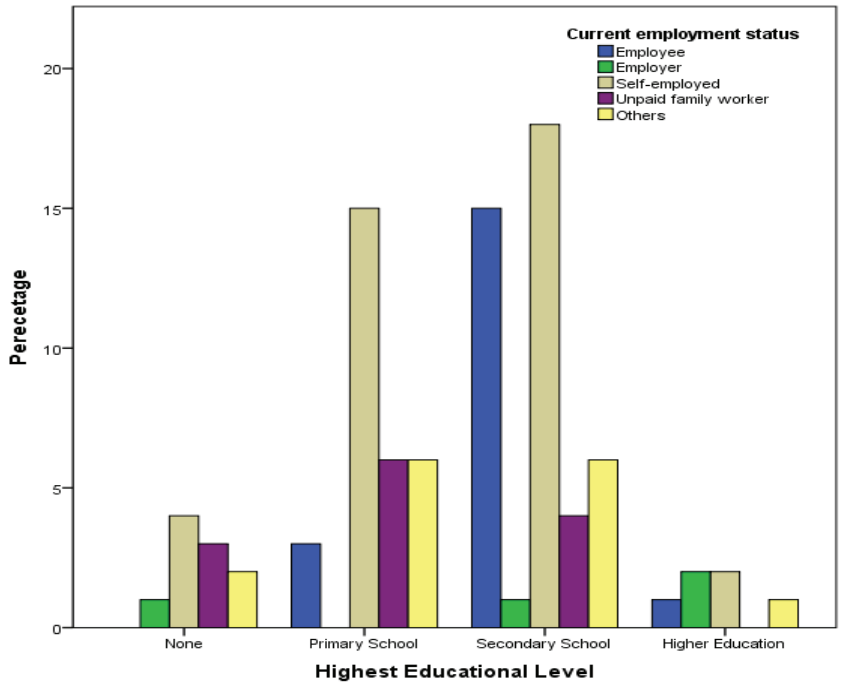



Figure 4.2: Highest educational level compared to current employment status of respondents

The socio-demographic and socio-economic structure of households for this study has some implications for social vulnerability in the study area. The households with large family or dependent persons (children, disable and permanent ill persons) are regarded more vulnerable, this is evident in Figure 4.3 where respondents with large family believed that flood event in the study area have much impact on their life style and income, also the capability of such households to react in an appropriate manner is negatively affected by mobility at the very instant of a flood event.

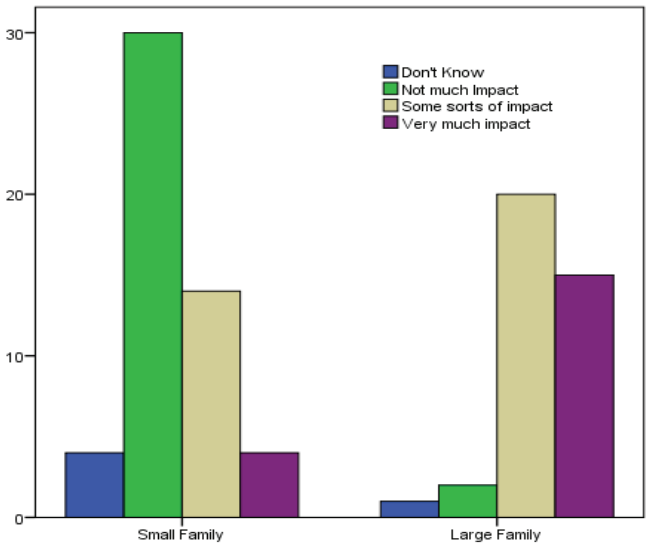



Figure 4.3: Impact of flooding on life style and expenditure of respondents

On the issue of gender is related to this dimension, women are regarded to be more vulnerable since they are the ones stay at home who takes care of children, the elderly, the disable or permanently ill persons in a traditional African society, also at times they lack resources and power, which is evident in this study.

In social reality, the dimensions of low income, low educational level and the unemployed, are often interrelated; people who fall to any of these categories are often considered to be more vulnerable to disasters. This may be due to lack of knowledge of disaster that is about to happen, or lack of resources to cope with disaster and absorb losses resulting to such a disaster.

### 4.2.3 Flood scenario in Bwaise III

The study shows that about 98% of the households that were interviewed had experienced flooding for at least 3 times since 1st of May 2012. Data on flood duration was measured in number of hours it stays within and outside their house, was acquired from each household, and while the flood depth was measured based on water level at the front of their doorstep, in meters.

Table 4-1 shows 35% and 18% of the respondents believe that flood in Bwaise III is caused by poor drainage management by residents and poor planning by the authorities respectively. Other causes of flooding in the study area from the respondents' perspectives, ranges from uncontrolled development (14%) and heavy rains (13%), to poor drainage management by the authorities (12%).

Table 4-1 Factors stated by respondents as being the most important causes of flooding in Bwaise

| Causes | Percentage of respondents |
|---|---|
| Inadequate/Poor drainage channel | 8% |
| Poor drainage management by the government | 12% |
| Wetlands and Heavy rains | 13% |
| Residents construct on drainage channels | 14% |
| Poor planning by the authorities | 18% |
| Poor drainage management by residents | 35% |

One major finding in this study relates to the issue of waste management. Most of the respondents believe that the drains are blocked by garbage being dumped by residents, into the water channel to causes floods, as this is an easy way to dispose of their wastes and garbage. From the observation during the field work, it is considered that rapid urbanization and high land price in Kampala, made most of the people to settle in flood prone area, this evident from Figure 4.4 which shows that about 69% of the respondents, started living in Bwaise in the last ten (10) years. Furthermore about the 37% who responded, gave others in the reasons why they live in Bwaise stated cheap land price as one of their reasons, while 70% were aware of the flood situation in Bwaise area before moving to the area This had caused some people to build on water channels in an uncontrolled manner, which in turn allow water to rise during floods. In conclusion flooding in the study area, can be said be caused by socio-cultural characteristics, that is poor land management due to rapid urban growth and poor refuse disposal system on the part of residents (dumping of refuse in drains) and government (poor collection system).

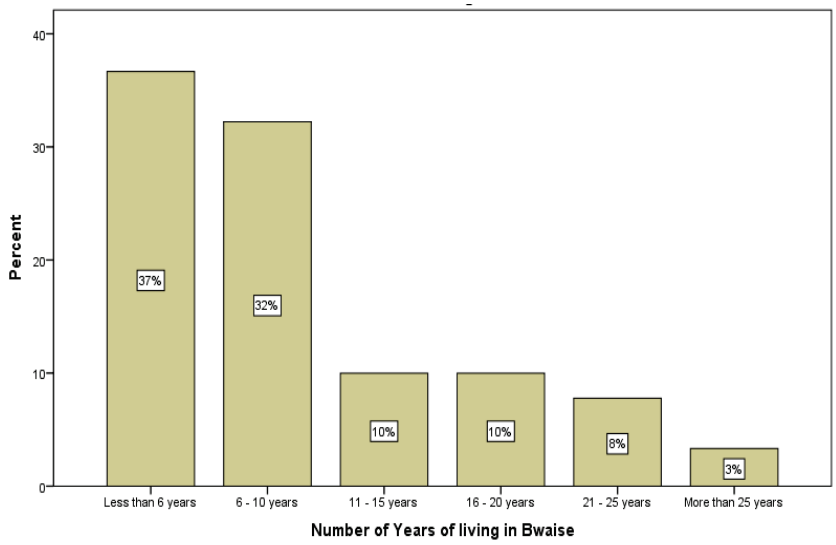



Figure 4.4: Number of years respondents had lived in the study area

Table 4-2 Reasons for living in the study area

| Why do you prefer to live in this area | Percentage |
|---|---|
| Easy access to school | 2% |
| Friendly Neighbours | 9% |
| Own Properties | 11% |
| Family Ties | 18% |
| Easy access to work place | 23% |
| Others (cheap land and house rents) | 37% |

Table 4.2: Highlights the reasons that make respondents stay in flood prone area, which is influenced by occupational and livelihood activities such as easy access to work place, friendly neighbours and family ties. Other (37%) represents diverse reasons, like cheap house and land rent.

### 4.2.4 Impact of Flood in the study area

- **Impact on households' life style, households' buildings, home appliances and other properties**

The impact of flood on households sampled revealed that 52% believed that flood occurrence in the study area have some of impacts on their life and expenditure, while 30% of respondents believe that it does not have much impact. This reason maybe, that the flood occurrence in the study area is not life threatening. This is further confirmed in Figure 4.6, where 70% of respondents believed that flooding in Bwaise is not a threat to their lives, but have some impact on their buildings/properties and neighbourhoods (**Error! Reference source not found.** & Figure 4.8). In one session of face-to-face interviewed conducted with some residents, the outcome of the interviews coupled with household questionnaire and observations during the fieldwork confirmed that the flood affect residents from going to work, thus reducing their income, it also disrupt their children from going to school anytime it floods. Majority (69%) of the respondents have had damages to their buildings, while 60% stated that they had their home appliances and other properties was affected by flooding in the study area, at one time or the other. Many of the households stated that minor damages to building, wet clothes, furniture, mattress and pillows were some of the impact of floods on their household. Based on observation by the author, because of frequency of flooding in the area some houses are totally abandoned by the owners and tenants of such building (Figure 4.9).

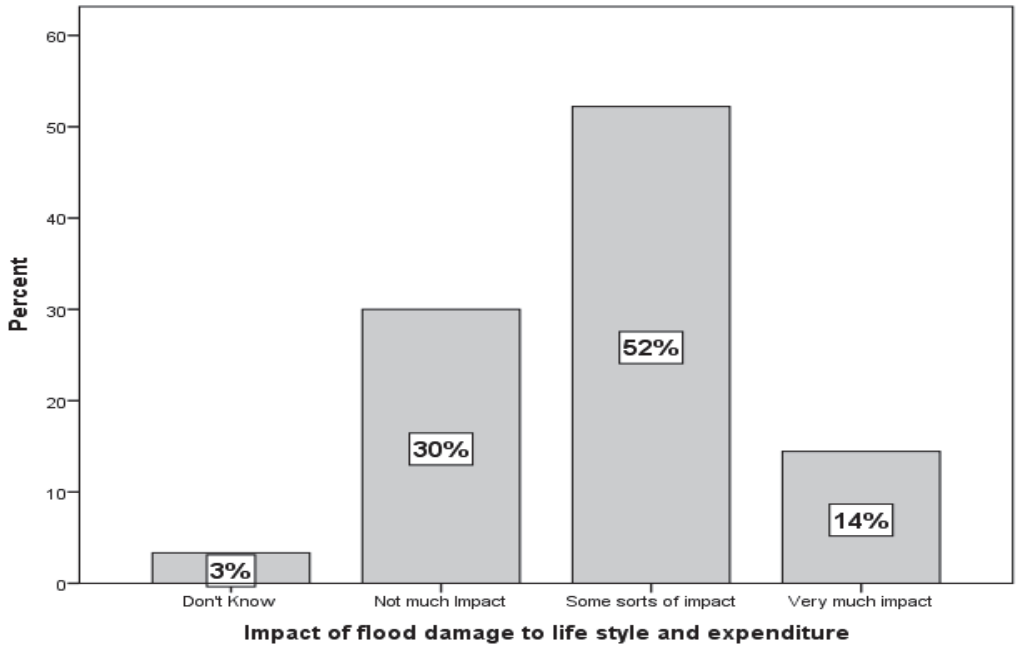



Figure 4.5. Impact of flooding on the life style and expenditure of respondents

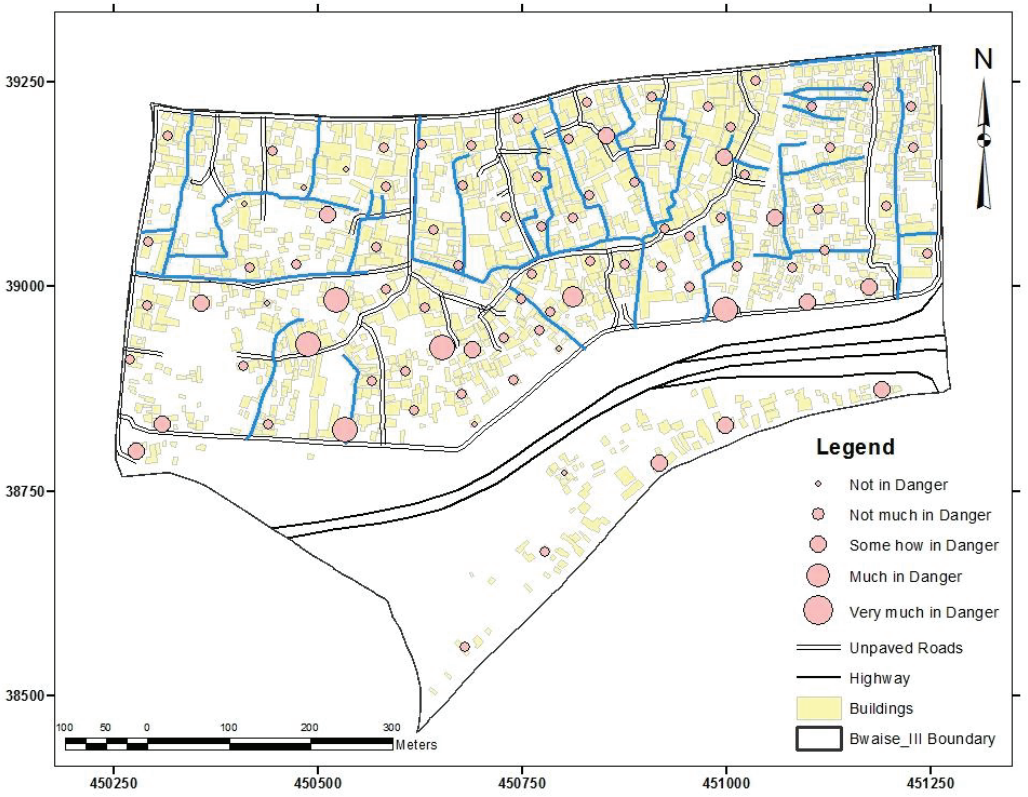



Figure 4.6: Degree at which respondents' life is in danger due to flooding

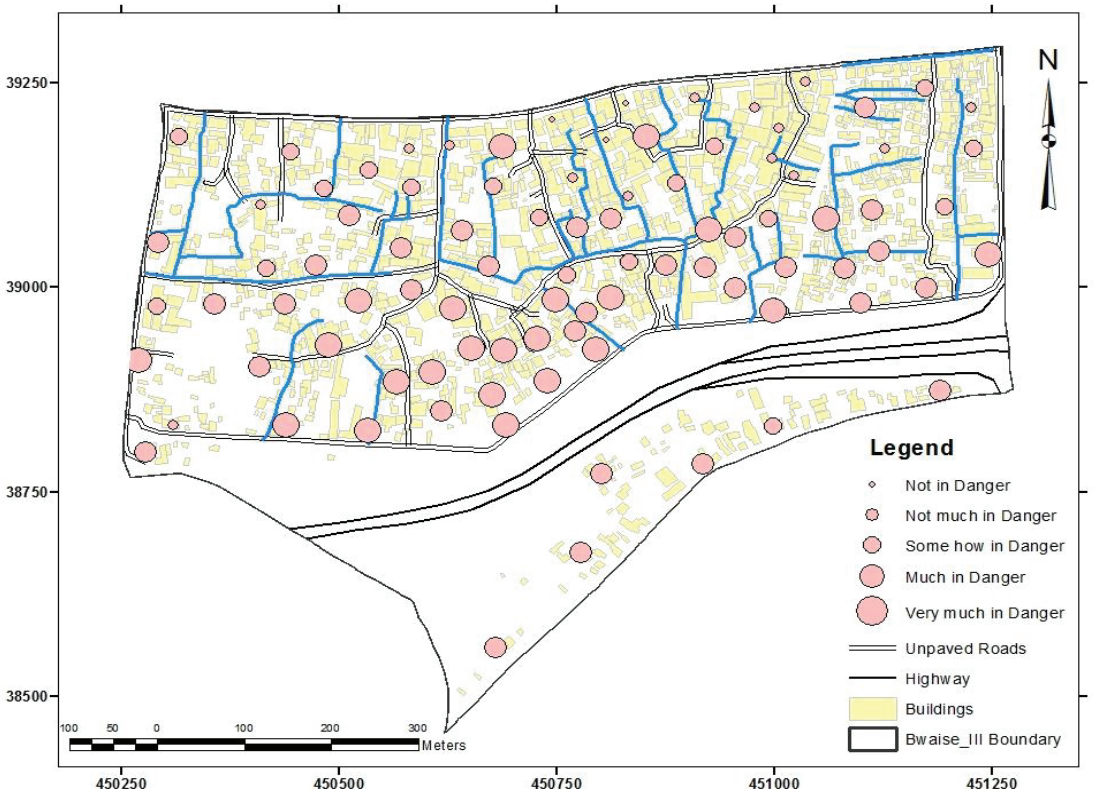



Figure 4.7: Degree at which respondents' home is in danger due to flooding

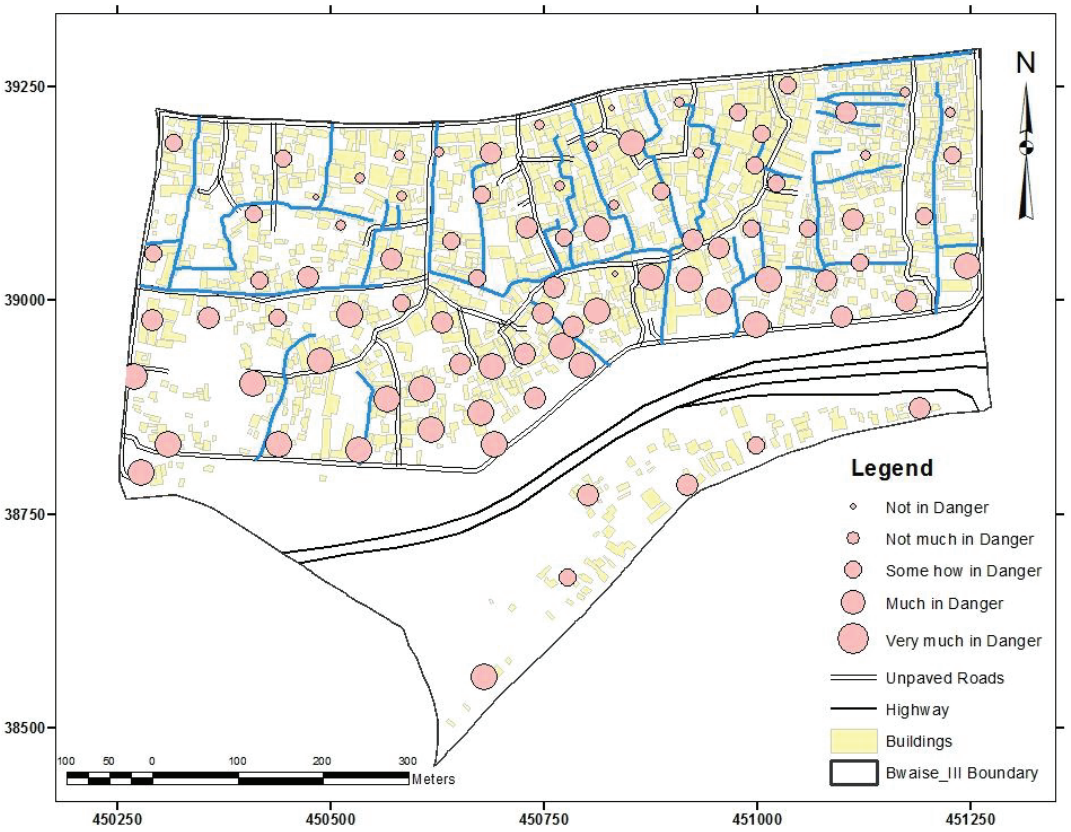



Figure 4.8: Degree at which respondents' neighbourhood is in danger due to flooding


Figure 4.9 People living conditions in the study area

### Impact of flooding on health of households

The incident of dysentery, diarrhoea, cholera and other fever are common diseases that affect the health of households in the study area. Though only 49% of the respondents have reported cases of water borne disease, diarrhoea seems to be prevalence in the study area with 22% of the total reported cases, the respondents, also believed that the diseases are related to flooding. Other reported cases are vector-borne diseases, like malaria.

Table 4-3: Reported cases of diseases

| Disease type | Percentage |
|---|---|
| None | 51% |
| Dysentery | 18% |
| Diarrhoea | 22% |
| Cholera | 2% |
| Others | 7% |

## 4.3 Coping mechanisms to Floods in Bwaise III

The study area is a flood prone, and people living in the area had developed coping mechanism to flood events. Based on the report of face-to-face interviews carried out by the researcher most respondents stated that flooding started in recent years. Observation and household interview during the field work revealed that residents had developed certain coping mechanism within their own capacity, and available resources, during and after flood events. An interesting situation in this study shows that 68% percentage of respondents are neither prepared for flood events nor save any money (90%) for flood events, which preparedness for flood events awareness by respondents is very low.

Cleaning of drains and water channels, raising the foundation of buildings/sand filling are the major means of which residents cope with flood events in the study area, from household survey (Figure 4. & Figure 4.9). Response from sample survey (Table 4-4, Table 4-5, &Table 4-6), and observations during the fieldwork shows that these measure seems not to be very effective in controlling flood damage to their properties as flood water still flows into their compounds and houses also it was found that most of the residents had abandon their house as evident in some of the pictures in Figure 4.

Table 4-4 Type of household flood protection measures against properties

| Response | Percentage |
|---|---|
| Cleaning of drains and water channels | 35% |
| Construction of more drains | 5% |
| Don't Know | 5% |
| Rainwater Harvesting | 7% |
| Raising of building foundation and sand filling | 48% |

Table 4-5 Effectiveness of household flood protection measures

| Response | Percentage |
|---|---|
| Don't Know | 5% |
| Not effective at all | 15% |
| Not effective | 50% |
| Somehow effective | 25% |
| Much effective | 3% |
| Very much effective | 2% |


Figure 4.10: Clearing of a drains and water channels as a form of coping strategies the study area

| | |
|---|---|
| Raised foundation | Nylon being place between foundation of a building and wall against rising damp |

Figure 4.9: Other form of coping mechanisms by residents

Table 4-6: Type of household flood protection measures against properties * Effectiveness of household flood protection measures Cross tabulation

| | Effectiveness of household flood protection measures | | | | | | |
|---|---|---|---|---|---|---|---|
| **Type of household flood protection measures against properties** | **Don't Know** | **Not effective at all** | **Not effective** | **Somehow effective** | **Much effective** | **Very much effective** | **Total** |
| Cleaning of drains and water channels | 13 | 3 | 3 | 13 | 0 | 0 | 32 |
| Construction of more drains | 3 | 0 | 0 | 1 | 2 | 0 | 6 |
| Don't Know | 4 | 0 | 0 | 0 | 0 | 0 | 4 |
| Rainwater Harvesting | 0 | 1 | 3 | 1 | 1 | 0 | 6 |
| Raising of building foundation/sand filling | 25 | 4 | 3 | 8 | 0 | 2 | 42 |
| | 45 | 8 | 9 | 23 | 3 | 2 | 90 |

This developer do not care of the effect of sand filling his/her neighbour

Figure 4.10: An example of Sand filling by a developer.

Table 4-7 Degree of help received by households during and after flood events

| | **No help at all** | **Some help** | **A lot of help** | **Do not need help** |
|---|---|---|---|---|
| Family/relative | 58% | 13% | 3% | 26% |
| Friends/neighbour/ co-worker | 55% | 11% | 5% | 29% |
| Central government/ local authority | 53% | 7% | 12% | 28% |
| International Organisations/ NGOS | 47% | 7% | 200% | 26% |

Table 4-8 Degree of help giving by households during and after flood events

| | Do not give any help | Gave some sort of help | Gave a lot of help |
|---|---|---|---|
| Families/relative | 72% | 20% | 8% |
| Friends/ neighbour/ co-worker | 79% | 20% | 1% |

The issue of social network as a form of social capital consist of extended family, friends and relatives, the assumption is that these people are supposed to play a big role in giving aid in time of crisis, by asking for help or seeking loan from relatives and friends, but this is not the case in the study area, as this seems to be absent, the situation in the study area is that, everybody seems to mind his/her own business, also the aspect as government intervention not felt, as contributes rarely to the residents' everyday life (Table 4-7 & Table 4-7).

## 4.4 Implication for Social Vulnerability Assessment

One major aspect of this study is to assess household's social vulnerability, is to understand the root causes of vulnerability, show where the vulnerable live, how they cope and adapt to disaster situation, this information will help disaster managers an indication of their susceptibility to disaster in the future, and help them to improve on how to manage damages to their buildings and material loss

In this section issue of exposure, susceptibility and coping mechanism, components of social vulnerability was analysed with the aid of independent variables in order to come to a deeper understanding of flood event in the study area. One major finding in this study relate to the issue of waste management. Most of the respondents believe that the drains are blocked by garbage being dumped by residents, into the water channel to causes floods, as this is an easy way to dispose of their wastes and garbage. People move to Bwaise III because land is cheap, but because of improper planning by authorities, residents build on water channels in an uncontrolled manner, which in turn allow water to rise during floods. In conclusion, flooding in the study area, can be said be caused by socio-cultural characteristics, that is poor land management due to rapid urban growth and poor waste and refuse disposal system on the part of government and the residents.

Vulnerability of households due to flood in the study area was examined by using "classical" indicators, such as: gender, age, employment status, formal education, household type, income etc. these indicators had being derived from conceptual deliberations as outlined in chapter 2 and also the socio-economic situation found during the fieldwork. The majority of the people in Bwaise had experienced some sort of material damages due to flood event; this finding may be based on sample survey, but observation by the researcher shows the same characterises for parts of the Lubigi sub-catchment for example Bwaise I & II.

Table 4-9: Major aspect of social vulnerability in the study area is summarised below to help develop indicators, variables and factors for SVI

| | |
|---|---|
| **Exposure** | ✓ Living in wetland had made residents be exposed and susceptible to flooding |
| **Susceptibility** | **Income** |
| | ✓ Respondents are low income earners not is income far less than the basic salary (350,000shillings) in Uganda, but also far below international acceptable standard of $1.25 per day. |
| | **Education/Formal education** |
| | ✓ Almost half of respondents are uneducated. |
| | **Employment** |
| | ✓ High unemployment rate |
| | **Job Security** |
| | ✓ Most of the respondents are self-employed and also working in area susceptible to flooding (job insecurity). |
| | **Housing/ House structure** |
| | ✓ Poor housing condition, poor service and infrastructures.<br>✓ Most houses are built with bricks |
| | **Type of Occupancy** |
| | ✓ Land are rented out to residents |
| | **Health Issues** |
| | ✓ Reported cases of diseases, taking a toll on their income |
| | **Household size** |
| | ✓ Majority of respondents have large household size |
| **Coping Mechanism** | **Social Network** |
| | ✓ Everybody to him/herself |
| | **Savings** |
| | ✓ Almost all the respondents do not save |
| | **Aids and Relief from NGOs** |
| | ✓ Little or no help from government or other organisations. |

## 4.5 Social Vulnerability mapping at the household level

In other section of this chapter the studies takes a look at the socio-demographic and socio-economic factors that contributes to social vulnerability of households' daily life in Bwaise III. The section will use those factors, to display spatial distribution and spatial extents of households' vulnerability.

### 4.5.1 Creation of SMC Model

Many factors make people (households' for the sake of this work) vulnerable to disaster, but also these factors do not contribute equally, that is, they contribute in a different proportion to vulnerability. The tool that can help in determining the proportion in which each factor and indicator contribute to total vulnerability is a multi-criteria technique.

The "Goal" of this study is to create a Social Vulnerability Index (SVI), for the study area to see the spatial distribution and pattern of households' SVI. The first step is to decide which indicators to use and see how each of these indicators contributes to social vulnerability in the study area. Table 4-10 shows the 19 indicators that were developed for the study area, they are based on the outcome analysis and main findings, these indicators were chosen because they contribute favourably to the overall social vulnerability in the study area.

Table 4-10: Social Vulnerability components, the factors, indicators developed for the study area

| **Components and Factors** | | |
|---|---|---|
| **Exposure** | | |
| | **Indicators** | **Rationale** |
| **Physical Exposure** | Height of door step | The lower the level of door, the more vulnerable |
| | Flood duration within and outside building | The longer the time of inundation within and outside household building, the more time the more vulnerable |
| | Flood frequency | The number of time they had experience flood from 12th of May 2012 |
| **Susceptibility** | | |
| **Socio-Economic** | Educational Level | Those who are illiterate, especially women are considered to be more vulnerable |
| | Employment Status | The unemployed persons are considered to be more vulnerable and vice versa. |
| | Impact of flood on life style and spending | The level at which incidents of floods incidents had impacted on households' daily live. The higher the more vulnerable |
| **Socio-Demographic** | Age | Those over 65 and those under 14 years old will be considered more vulnerable. |
| | Gender | Females are considered more vulnerable than males |
| | Household Size | Larger households are considered to be more vulnerable than smaller households |
| | Disability | Disable are more vulnerable |
| **Health** | Reported case of diseases | Reported cases of diseases, Going to the hospital or treating the illness will take toll on their income. |
| **Housing** | Occupancy type | Tenant are considered to be vulnerable, because they are either transient or do not have to own a home for home ownership |
| | Damage to building | If household damages to their building during flood event |
| | Wall type | Wall type of household building, cement wall are less vulnerable than bricks walls |
| **Level of danger perceived by respondent** | Degree of life in danger | The degree at which each household perceives their life to be in danger. The higher the more vulnerable |
| | Degree of home in danger | The degree at which each household perceives their home/house to be in danger. The higher the more vulnerable |
| **Coping Mechanism** | | |
| **Flood Awareness** | Savings | If a household have savings, or not, in case of flood events |
| | Households' Preparedness | The degree at which each household is prepared for flood events, the higher the less vulnerable |
| **Social Network** | Help received from friends or relative | Degree of help received from friends or relatives |

### 4.5.2 Standardisation, weighting the criteria and evaluation

The data that was in the SPSS data file was first linked with GPS-points of houses at which the household interviewed was carried out. A database was then created in ArcGIS, after which a shape (householdsampleoint.shp) was generated and exported into ILWIS-GIS, and further converted to a raster file, in order to implement a spatial multi-criteria model. The SMCE module in ILWIS-GIS was use to carry out multi-criteria evaluation in a spatial manner. The method of standardising, weighting of criteria and evaluation was followed based on the AHP steps. The first step in making spatial multi-criteria analysis possible is to determine positive or negative contribution of the criteria for the proposed goal was carried out for each and every indicator. If the criteria contributes positively to the overall goal is considered a benefit and it contributes negatively is considered a cost

The next step is for the input layers need to be standardised from their original values to the value range of 0–1. The purpose standardisation is to bring all criteria in the same scale or measurement level in order to make them comparable to each other. Taking into account these elements, different standardisation methods provided in the SMCE module of ILWIS (ITC, 2001) were applied to the indicators. In this study for social vulnerability index, the standardisation procedure was performed at the indicator level which means that each individual indicator was standardised by setting the range from 0 "not vulnerable" to 1 "highly vulnerable".

After standardisation and the hierarchical structure weights were assigned to each criterion this is to determine the importance of difference criteria based on its contribution to the overall SVI. For this study three main weighting methods were used: Direct Weight, Pairwise Comparison and Rank Order methods (Figure 4.11) for the indicators. The analysis was carried out from the lower to higher levels of the criteria tree.

## 4.6 Sensitivity Analysis

In order to validate and appreciate the robustness of the model, a sensitivity analysis was carried out. Since the actual data cannot be tampered with, different weighting method was used on exposure, susceptibility and coping mechanism. Three models were created, for each model different weighting method was applied, for model 1 direct weighting was used (Figure 4.11), here values were entered directly based on the judgement of the researcher and on the outcome of the statistical analysis. Susceptibility was giving a higher value of 0.45, the reason is that the socioeconomic and socio-demographic characteristic of the people forced them move to flood prone area, exposure 0.35, while coping mechanism was given a value of 0.25.

As for model 2, a pairwise comparison was applied (Figure 4.16), the pairwise method, compare factors in pairs and based consistently of the selection and relative importance, quantitative values are given to the factors, that is why again susceptibility have a higher value of 0.58, while exposure this time have a value of 0.28 and coping mechanism 0.13. However for model 3 rank order method was used (Figure 4.18), here exposure, susceptibility and coping mechanism were assigned equal amount of weights, which is 0.33 each.

The output from each of the models were then was then exported into SPSS to perform analysis of variance (ANOVA) in order to appreciate, if there are any variety between the output of the models. Table 4-11 shows that there is no statistically significant difference between the three model, this because the sig. value is greater than 0.05. The results of the three model shows there is not much difference between the models, thus making the model robust. The sig. of model 3 seems to be rather higher compared to the other two models may because an equal weight was assigned exposure, susceptibility and coping mechanism. The weighting in this model was based purely of the researcher inputs; the model can further be validated to include residents and decision makers, probably the output result could be different. To further confirm the validation of the models the spatial distribution of SVI level for the three model are shown in Figure 4.15, Figure 4.17 & Figure 4.19

Table 4-11: ANOVA table of the 3 models

| | | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|---|
| SMCE Model 1 | Between Groups | .449 | 87 | .005 | 7.944 | .118 |
| | Within Groups | .001 | 2 | .001 | | |
| | Total | .451 | 89 | | | |
| SMCE Model 2 | Between Groups | .457 | 87 | .005 | 5.258 | .173 |
| | Within Groups | .002 | 2 | .001 | | |
| | Total | .459 | 89 | | | |
| SMCE Model 3 | Between Groups | .468 | 87 | .005 | 2.529 | .325 |
| | Within Groups | .004 | 2 | .002 | | |
| | Total | .472 | 89 | | | |

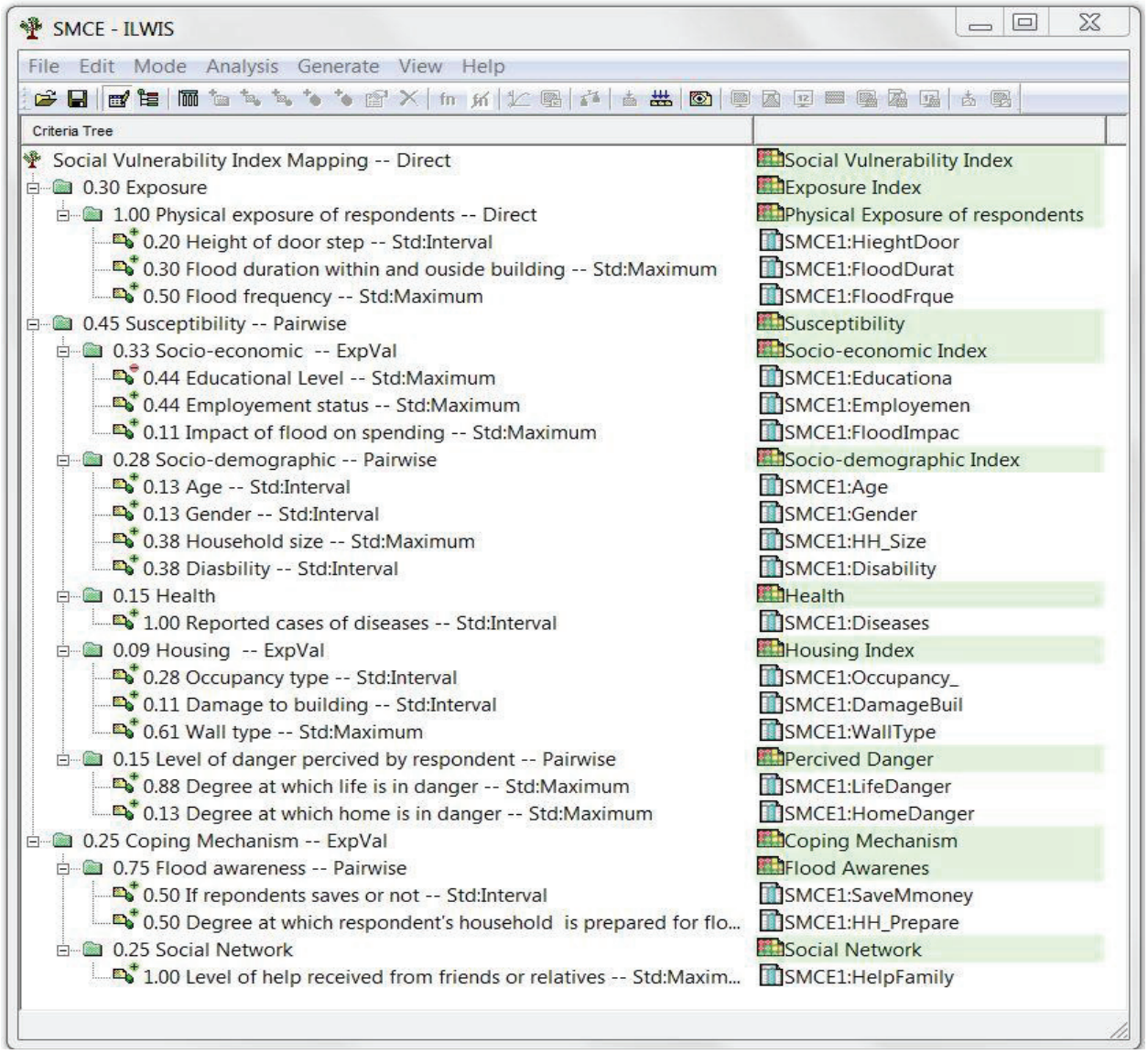



Figure 4.11: Criteria tree built Model 1

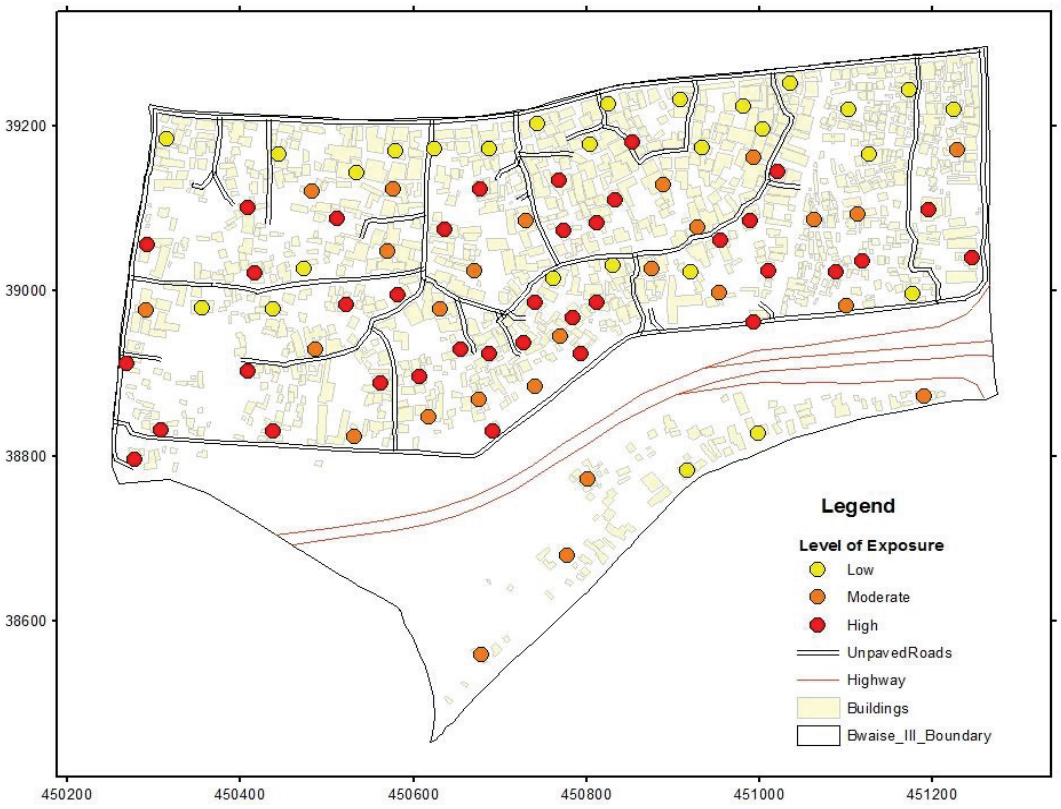



Figure 4.12: Map showing Exposure level of respondents

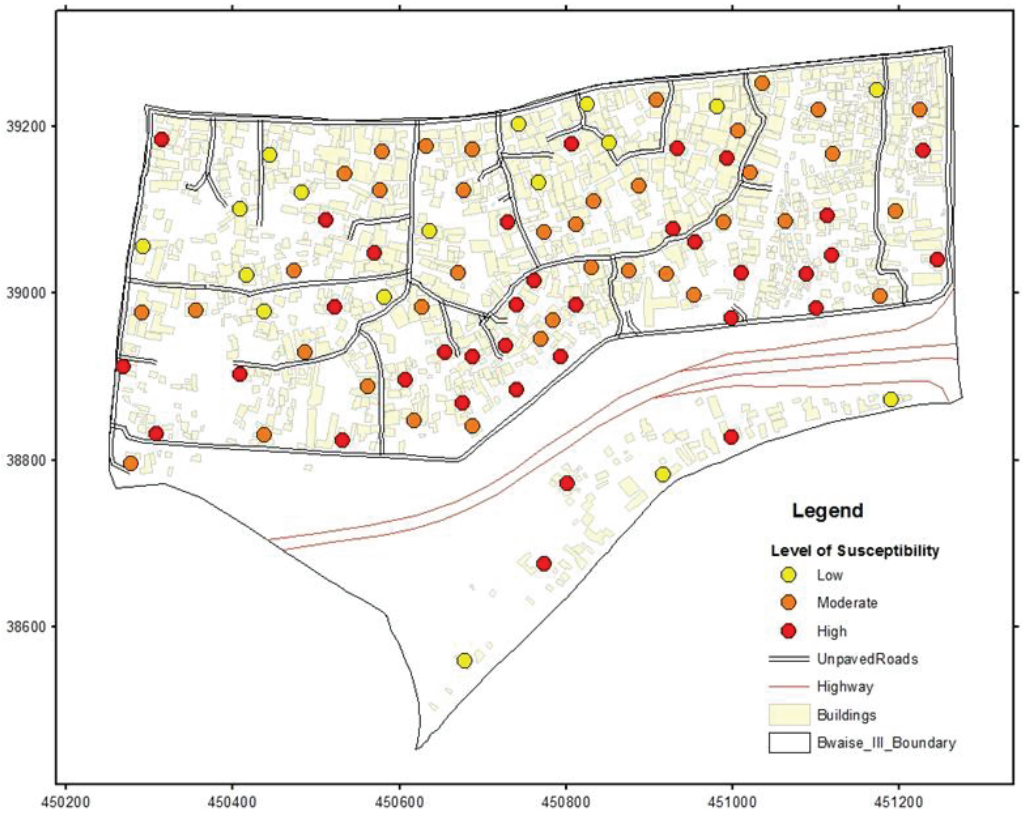



Figure 4.13: Map showing Susceptibility level of respondents

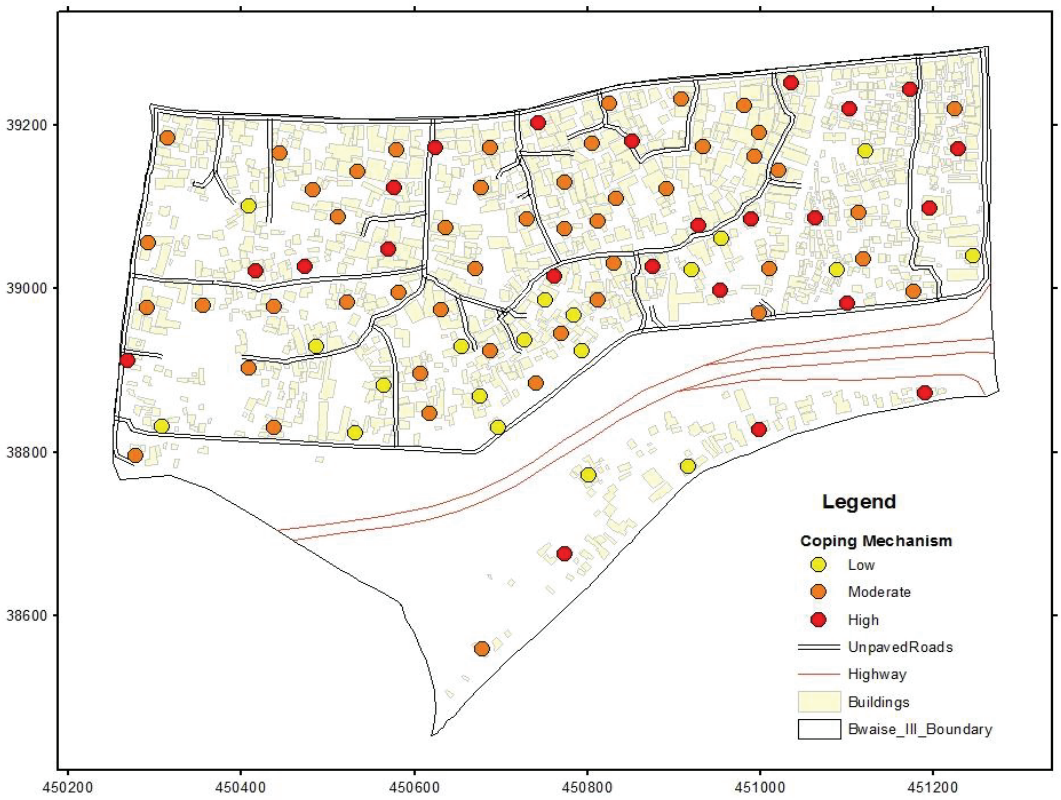



Figure 4.14: Map showing Coping Mechanism level of respondents

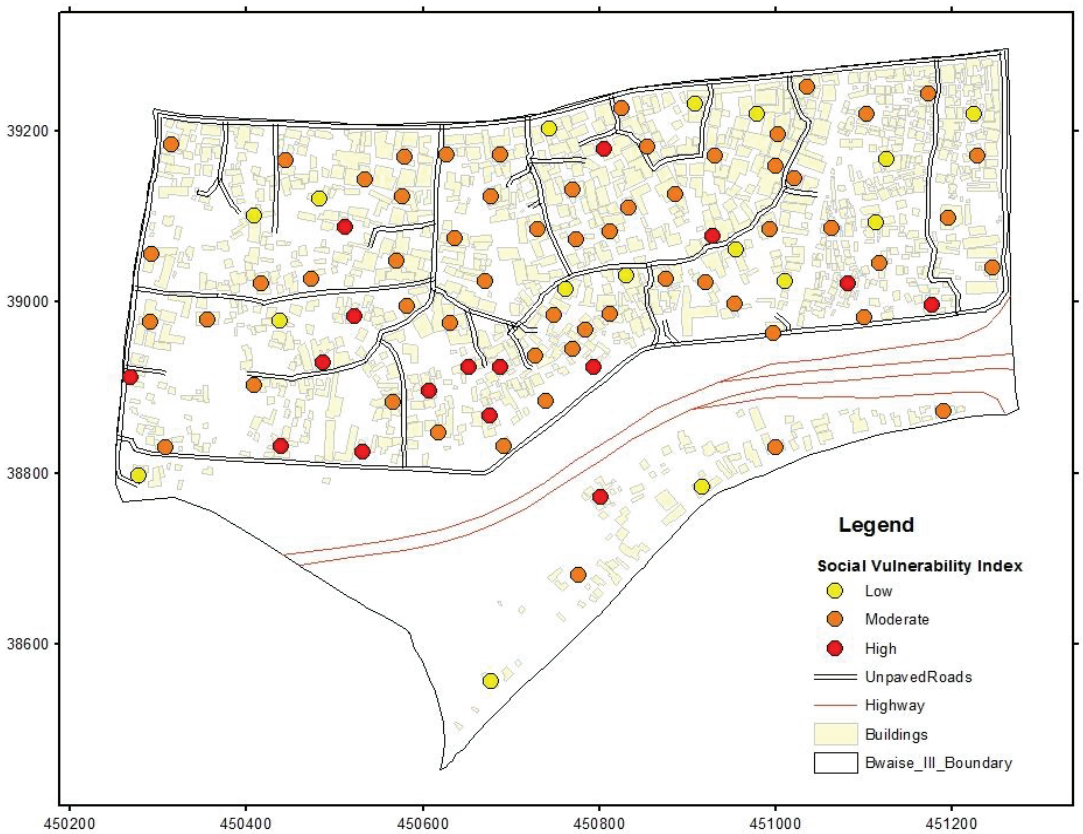



Figure 4.15: Map showing Social Vulnerability Index (SVI) level of respondents

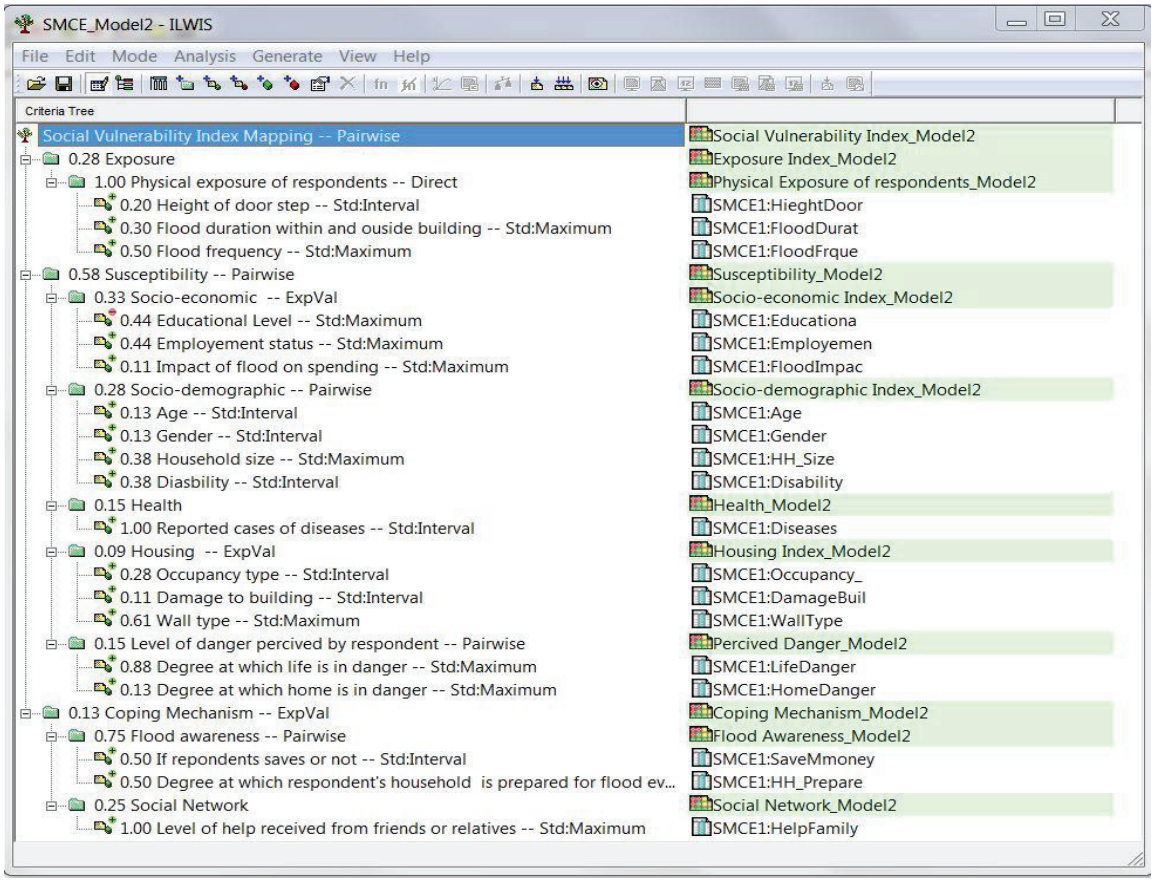



Figure 4.16: Criteria tree of Model 2

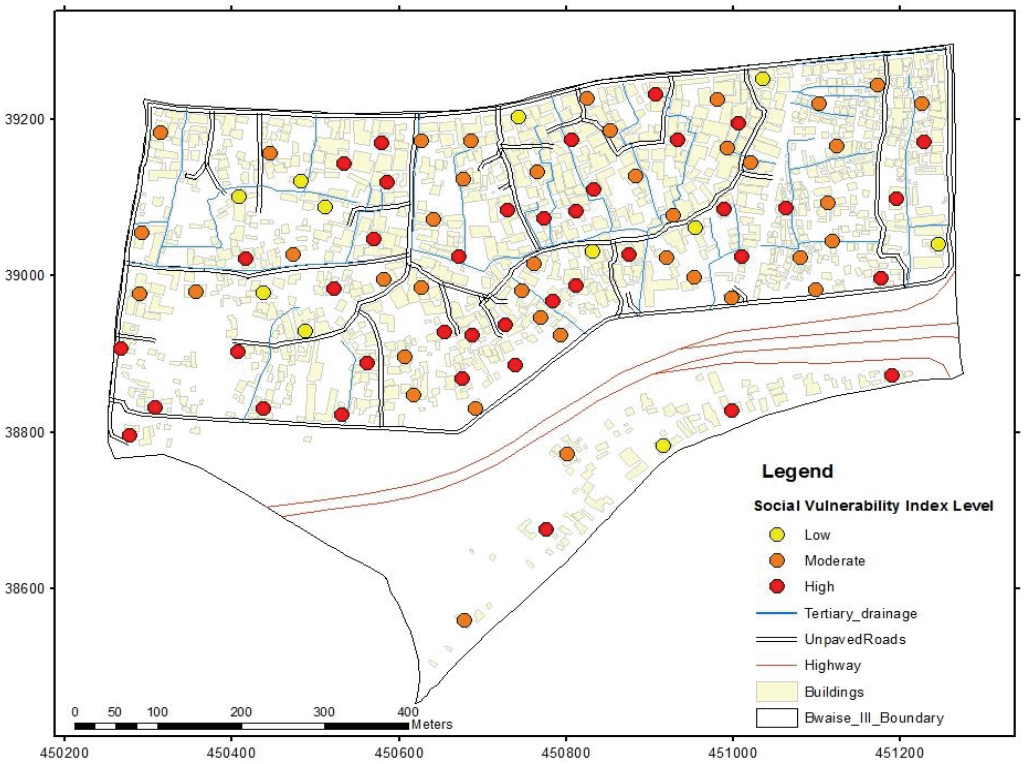



Figure 4.17: Map showing Social Vulnerability Index level for model 2

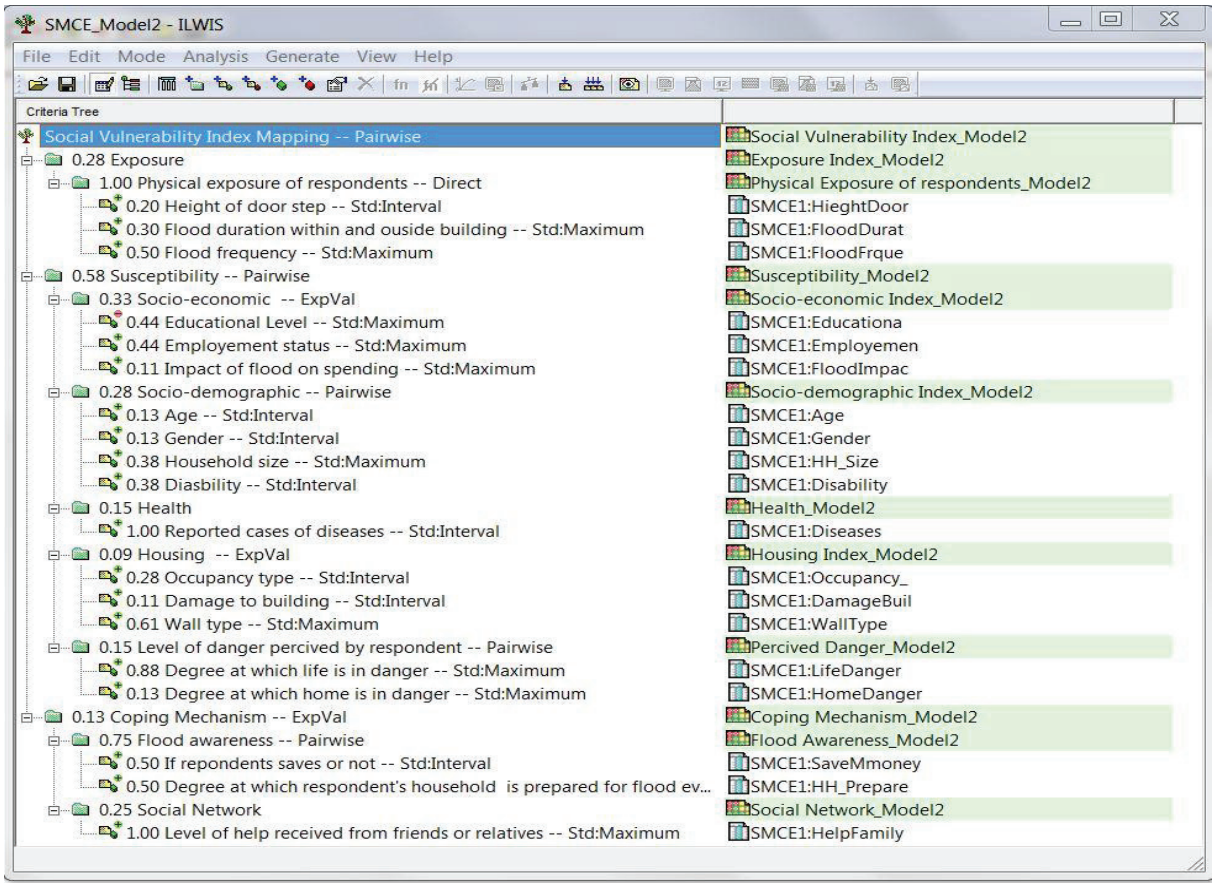



Figure 4.18: Criteria tree of Model 3

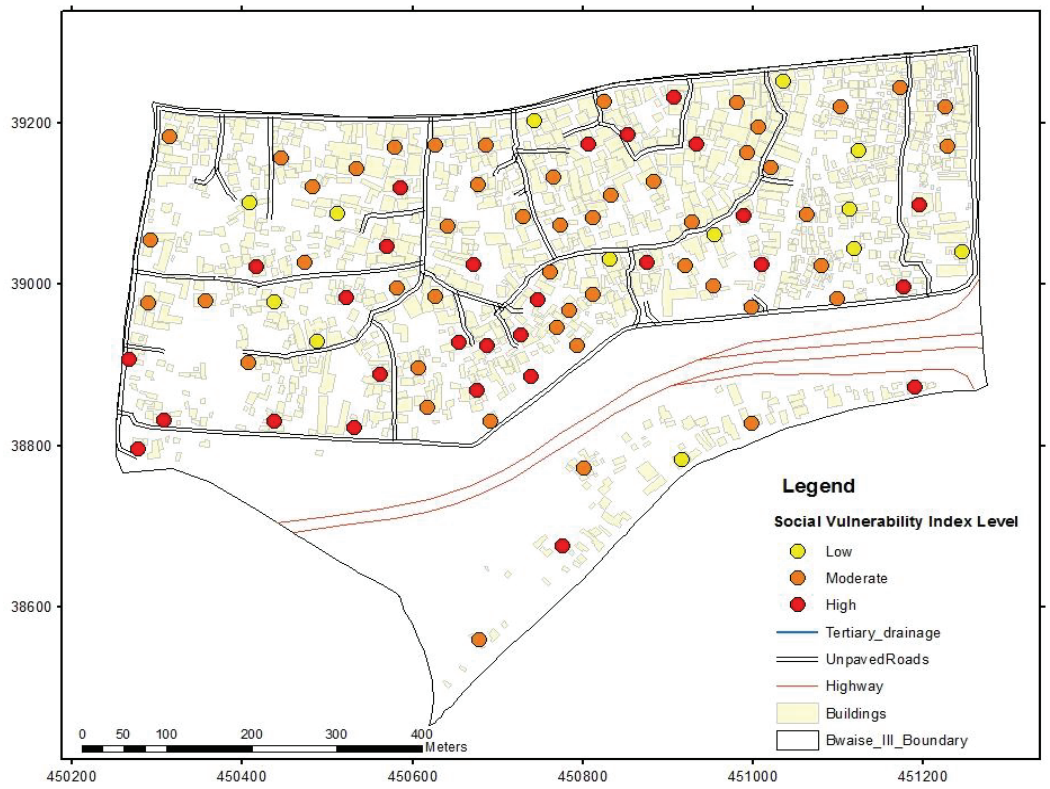



Figure 4.19: Map showing Social Vulnerability Index level for model 3

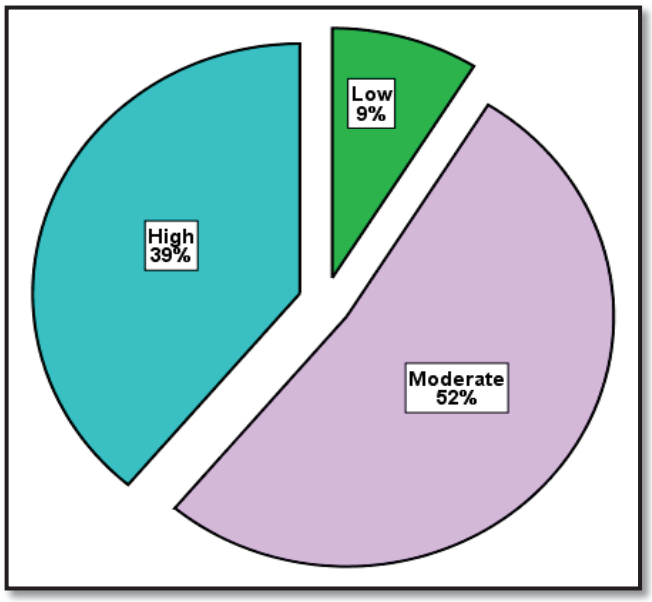



Figure 4.20: Percentage of Social Vulnerability Index Level of respondents

### 4.5.3 Social Vulnerability Index (SVI) to Flash Flood at the household level

The analysis carried out in ILWIS-GIS, produced intermediate composite maps, exposure index, susceptibility index, and coping index, (**Error! Reference source not found.**, **Error! Reference source not found.**, and **Error! Reference source not found.**), showing a spatial distribution of these indices and the final Social Vulnerability Index map of respondents in the study area (**Error! Reference source not found.**) Majority of the households have a moderate level of SVI ( 52%), while 39% of respondent have high level (
Figure 4.20: Percentage of Social Vulnerability Index Level of respondents
).

## 4.6 Summary

One imperative issue in pre- and post-disaster is in identifying the vulnerable group. Social Vulnerability Index (SVI) provides information of those affected with disaster, such as flood events. Mitigation measure can therefore be put in place; because these are the group of people who mostly needed assistance and relief material. SVI developed here was achieved by analysing socio-economic and socio-demographic data of sampled household, in the study area. To determine the SVI scores, the component of social vulnerability, exposure, susceptibility and the coping mechanism of households were calculated and integrated together, using SMCE. The SMCE used 19 indicators to generate the final index. The issue of income, need to be mentioned here, and income being one major indicator used in social vulnerability assessment was left out, the reason being that, during statistical analysis it was discovered that about 40% of respondent refused to give the information on their income, may be because of the sensitive nature of the issue of income. Employment status and educational level were then used in the SMCE, this because they are highly correlated and often overlap with the issue of income. Furthermore a sensitivity analysis was carried out on the model, by changing the weighting method, the outcome have no much effect on the output of the model, thus making it “robust”.

# 5 CONCLUSION AND RECOMMENDATIONS

*This chapter presented a summary of main findings from this research and made recommendation for further research.*

## 5.1 Introduction

The methodology that was developed here will help in identifying, those group of people that are socially vulnerable and where they are located. This information can will enhance approaches used in reducing the impact of flash floods by targeting the most vulnerable group. The study recognizes the fact that social vulnerability is all about social inequality, and the type of disaster to be assessed, in this case, flash flood. In the "heart" of the conceptual framework adopted for this study, are the components of vulnerability, (exposure, susceptibility and coping mechanisms) of the people living in a flood prone area. Since social vulnerability was identified as a dimension of vulnerability, all analysis was based on these components help to understand the factors that contribute, influence and diminish social vulnerability. Nineteen indicators were developed based on these components. In developing these indicators, attention was given, that they should be realistic, measurable and provides useful information of residents living in Bwaise. Based on the research questions at the beginning of this study, the main finding in the study area are summarised as follows:

### Exposure

The issue of flooding in the study area is caused by heavy rainfalls coupled with the terrain conditions (natural and built environment). As much of the area was once part of a wetland there is a substantial likelihood of flooding. From interviews with some residents and focus group discussions with the National Slum Dwellers Federation of Uganda, flooding in Bwaise in recent times had increased, and probably will continue as long as no solutions are put in place to help the community. Other factor, that can be said cause flooding in the study area, are related to the socio-cultural characteristics, of the study area, which include poor land management due to rapid urban growth and poor refuse disposal system on the part of residents (dumping of refuse in drains) and government (poor collection system). Residents often dump their wastes and garbage in waterways, any time it rains, an easy way to get rid of the waste materials and this in turn, clogs the drains thus increasing flooding of their neighbourhood and making water enter their home and destroying their properties and unless a sustainable efforts are followed with necessary investments by government, people will continue to move to Bwaise, which in turn will continue to increase disaster exposure.

### Susceptibility

Social vulnerability is commonly seen as an issue of inequality, these are socio-economic and socio-demographic characteristics of certain groups of people which make them live in disaster prone area. Based on the analysis of questionnaires face-to-face interviews with some residents and focus group discussion, it was revealed that all surveyed households' exhibit factors that contributes to poverty in the study area. These include low income, low educational level and high unemployment, poor housing conditions, over population. Furthermore, respondents complained that flood events had not only impacted on their income and life style, but floods had damage their buildings and properties. Any time it floods it disturb them from going to their working place. There are reported cases of water borne and vector based diseases, which had to be treated, thus placing further pressure on their limited income and financial reserves.

### Coping mechanism

As regards coping mechanism adopted by the respondents, most their efforts to protect themselves, to prevent their homes being inundated and their properties being destroyed by flooding had not helped. On the issue of social network is a source of concern, in the study area. Unlike a typical African society where people come out to help their neighbours in time of trouble, there is little evidence of a strong mutual help in Bwaise. Another one is that of savings from the analysis carried out revealed that most respondents do not save, for flood event, may be because they do not earn enough. On the issue of help expected from the government, it was discovered, during a session of focus group discussions with National Slum Dwellers Federation of Uganda, that residents are not well consulted when projects to help cope with flooding are implemented. They complained that most projects that are carried out in the study area, in recent past, by government agencies and some NGOs do not really help them in most cases; they gave an example of a toilet constructed in the wrong place which is not useful to them. Nevertheless, at the moment they are working in collaboration with an NGO (ACTOGETHER), who is helping to liaise with relevant government agencies to help implement some projects that are important to them and possibly get funds from other international NGOs and agencies.

## 5.2 Conclusion

The study reveals the advantage and the possibility of assessing and mapping social vulnerability as it pertain to flash flood at the household level. The study evaluated the major components of social vulnerability of households through the use of questionnaires. Face-to-face interviews with official of the Kampala Capital City Authority (KCCA) and some residents to further understand the situation on ground. A focus group discussion (FGD) was also carried out with Slum dwellers association of Kampala and certain NGO, to understand the impacts of floods event on residents and how they cope with it. The various findings from these data collection methods and statistical analysis on the household database allowed indicators to be developed. A total of 19 indicators were identified and developed. An SMCE was then performed on the resultant indicators using AHP approach for the study area, based on the main components of social vulnerability. The resultant output index was further classified into low, moderate and high and mapped. A sensitivity analysis was carried out by creating three models to test the stability of the models. The results of the three models, from a subjective interpretation show there is not much difference between the models, thus making the model robust. The SVI map is thus the first map of its kind the study area shows households' vulnerability level and where they live. The results show that households in the study area may have varying exposure, susceptibility and coping indices, the overall SVI is high.

## 5.3 Recommendation

This study has contributed to some extents to the goals of Hyogo Framework for Action (HFA) which is not only to reduce the impact of disaster on the population substantially, but also to make disaster reduction policies an essential component of government developmental programmes. The SVI map will go a long way to help disaster manager, spatial land-use planner and decision makers to develop policies and strategies for disaster risk reduction and management (DRRM), as it shows the varying vulnerability level of households and where they live.

Further research can take look at social vulnerability level of individuals within household to further test the validity of the methodology and also applied it to other part of the sub-Lugbigi catchment and also across the city of Kampala.

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# APPENDICES

## APPENDIX 1: Questionnaire

Questionnaire for Assessing and Mapping Social Vulnerability to Flash Floods, using Local Spatial Knowledge (LSK).

*A Case Study of Bwaise Community in Kampala, Uganda.*

**Questionnaire for: Assessing and Mapping Social Vulnerability to Flash Floods, using Local Spatial Knowledge (LSK).**

***The personal information provided will remain confidential and will only be used for scientific research purposes***

Researcher: Chris Odeyemi
Contact: odeyemi07463@itc.nl
University of Twente
Faculty of Geo-information Science and Earth Observation (ITC)
Enschede, the Netherlands.

GPS: Eastings | Northings

### 1. Personal Information of Respondent

Name of respondent……...……

| Gender | Male | |
|---|---|---|
| | Female | |

| Age | |
|---|---|

| 1.1 Highest Educational Level | None | |
|---|---|---|
| | Primary School | |
| | Secondary School | |
| | Higher Education | |

| 1.2 Employment/Occupation | Employee | |
|---|---|---|
| | Employer | |
| | Self-employed | |
| | Unpaid family worker | |
| | Others | |

| 1.3 Reason for not working | Retired | |
|---|---|---|
| | Housewife | |
| | Student | |
| | Unemployed | |
| | Disabled | |
| | Others | |

| 1.4 Household Type /Family composition | One-person household | |
|---|---|---|
| | Single parents | |
| | Large families | |

| | | |
|---|---|---|
| 1.5 Household Size | Number of persons in the household | |
| | Number of Adults | |
| | Number of children (Age < 18) | |

| | | |
|---|---|---|
| 1.6 Are there any disable or permanently ill people living in your household? | Yes | |
| | No | |

| | |
|---|---|
| 1.7 If yes in above question, how many | |

| | |
|---|---|
| 1.9 Total Income for the household per month (*in Shillings*) | |

| | |
|---|---|
| 1.10 Total Expenditure for the household per month (*in Shillings*) | |

## 1.2 Building Contents

### 1.2.1 Appliances

| **Item** | **Quantity** | **Value** (*in Shillings*) |
|---|---|---|
| Television | | |
| Radio | | |
| Stereo System | | |
| Stove | | |
| Refrigerator | | |
| Gas Cooker | | |
| Washing Machine | | |
| A/C | | |

### 1.2.2 Furniture

| **Item** | **Quantity** | **Value** (*in Shillings*) |
|---|---|---|
| Sofa | | |
| Carpet | | |
| Dining Table | | |
| Desks | | |
| Table | | |
| Chairs | | |
| Single Bed | | |
| Double Bed | | |
| Curtain | | |

### 1.2.3 Other Properties

| **Item** | **Quantity** | **Value** (*in Shillings*) |
|---|---|---|
| Domestic Animals | | |
| Bicycle | | |
| Motorcycle | | |
| Car | | |
| Truck | | |
| Others *(please specify)* | | |
| | | |
| | | |
| | | |

**2.0 Floods Occurrence: Elemsnts at risk**

| 2.1 Building Usage | Residential | School | Place of worship | Shop | Hall | Others *(please specify)* |
|---|---|---|---|---|---|---|
| | | | | | | |

| 2.2 Building Type | | | | |
|---|---|---|---|---|
| | Detached | | | |
| | Semi-detached | | | |
| | Blocks of apartments | | Number of floors | |
| | Others (please specify) | | | |

| 2.3 Type of Occupancy | Owner | |
|---|---|---|
| | Tenant | |
| | Both | |

| 2.4 Roof Type | Zinc | Thatched | Tiles | Wood | Others *(please specify)* |
|---|---|---|---|---|---|
| | | | | | |

| 2.5 Wall Type | Cement Block | Brick | Wood | Bamboo | Zinc | Others *(please specify)* |
|---|---|---|---|---|---|---|
| | | | | | | |

| 2.6 Floor Type | Tiles /Ceramic | Cement | Bare Soil | Wood | Others *(please specify)* |
|---|---|---|---|---|---|
| | | | | | |

| 2.7 Building Area | |
|---|---|

2.8 What is your primary source of water supply?

| | **Normally** | **During Flooding** | **After Flooding** |
|---|---|---|---|
| Piped water into dwelling or yard | | | |
| Public tap/Communal standpipe | | | |
| Wells/Boreholes/Hand pumps | | | |
| Rainwater | | | |
| Surface water (e.g lake, river, pond, dam, or spring) | | | |
| Vendors/tanker trucks | | | |
| Other (for example, bottled water) | | | |

2.9 What is your primary source of sanitation?

| | **Normally** | **During Flooding** | **After Flooding** |
|---|---|---|---|
| Flush toilet to network or septic tank | | | |
| VIP latrine/Basic pits with slaps | | | |
| Traditional pit latrine | | | |
| Bucket or other container | | | |
| No facility (nature or bush) | | | |
| Other (please specify) | | | |

2.10 Have you experienced any material damage due to flooding since 1st May 2012?

| | Yes | No | If Yes give approx. cost *(in shillings )* of repair or replacing properties |
|---|---|---|---|
| 2.10.1 Damage to building | | | |
| 2.10.2 Damage to home appliances and outside properties | | | |

2.11 What impact does flood damage your life style and normal expenditure?

……..……

……..……

2.12 Do you save money to provide for flood damage?

……..……

……..……

## 3 Floods Occurrence: Exposure/Perception

| | |
|---|---|
| 3.1 How long have you being living in this area | |

| 3.2 Were you aware about flooding problems in this area, before moving here? | Yes | No |
|---|---|---|
| | | |

3.3 Why did you move here, if you knew about flooding problems?

…..……..……..

……..……

3.4 In your opinion what are the main causes of floods in this area

……..……

……..……

| | |
|---|---|
| 3.5 What is the frequency of flooding in the area since 1st May 2012? | |
| 3.6 What was the highest water level *(measured at the front door level (m))* | |
| 3.7 How long was the area around the house flooded *(in hours)* | |

3.8 To what degree is your neighbourhood, home and life in danger due to flooding?

| | *Not in danger at all* | | | | *Very much in danger* | |
|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | *Don't know* |
| Neighbourhood | | | | | | |
| Home | | | | | | |
| Life | | | | | | |

| | |
|---|---|
| 3.9 Physical distances of building to flood prone area *(m)* | |

| | Diseases Type | Yes | Number |
|---|---|---|---|
| 3.10 Have any household member experienced water borne diseases since 1st May, 2012 | Dysentery | | |
| | Diarrheal | | |
| | Cholera | | |
| | Others *(please specify)*….. ……..…… | | |

3.11 Do you think these instances are related to flooding?

…..……...

……

3.12 Why do you think they are related to the flood instance?

……...…..

……..…

4. **Floods Occurrence: Coping Mechanism**

4.1 Why do you prefer to live in this area? *(More than one answer is possible)*

| Family ties | Friendly neighbours | Own properties | Easy access to schools | Easy access to work place | Easy access to business centres | Others *(please specify)* |
|---|---|---|---|---|---|---|
| | | | | | | |

| | *Not prepared at all* | | | *Very much prepared* | | *Don't know* |
|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | |
| 4.2 To what degree were you prepared for flooding in your area? | | | | | | |

| | *Not prepared at all* | | | *Very much prepared* | | *Don't know* |
|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | |
| 4.3 In your opinion to what degree are people in the neighbourhood prepared for flooding in your area? | | | | | | |

| | Yes | No |
|---|---|---|
| 4.4 Are you aware of any flood protection measure in your area? | | |

4.5 Which ones are you aware of? …….

4.6 How effectives are they? ……...

4.7 What kind of protection measures do you have for your properties against floods?

…..……...

| | *Not very successful* | | | | *Very much very successful* | *Don't know* |
|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | |
| 4.8 How successful are these protective measures? | | | | | | |

4.9 To what degree do you receive help from the following during and after floods events your area?

| | *No help* | | | | *A lot of help* | *Don't know* |
|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | |
| Family/Relatives | | | | | | |
| Friends, Neighbours/co-worker | | | | | | |
| Government/Local Authorities | | | | | | |
| Volunteers/Charitable organizations/ International Organizations | | | | | | |
| Others (please specify): …….. | | | | | | |
| I do not need help | | | | | | |

4.10 To what degree did you give help to the following during and after floods events your area?

| | *No help* | | | | *A lot of help* | *Don't know* |
|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | |
| Family/Relatives | | | | | | |
| Friends, Neighbours/Co-worker | | | | | | |
| Others (please specify): …….. | | | | | | |

***End of Questionnaire thanks for your time and cooperation***

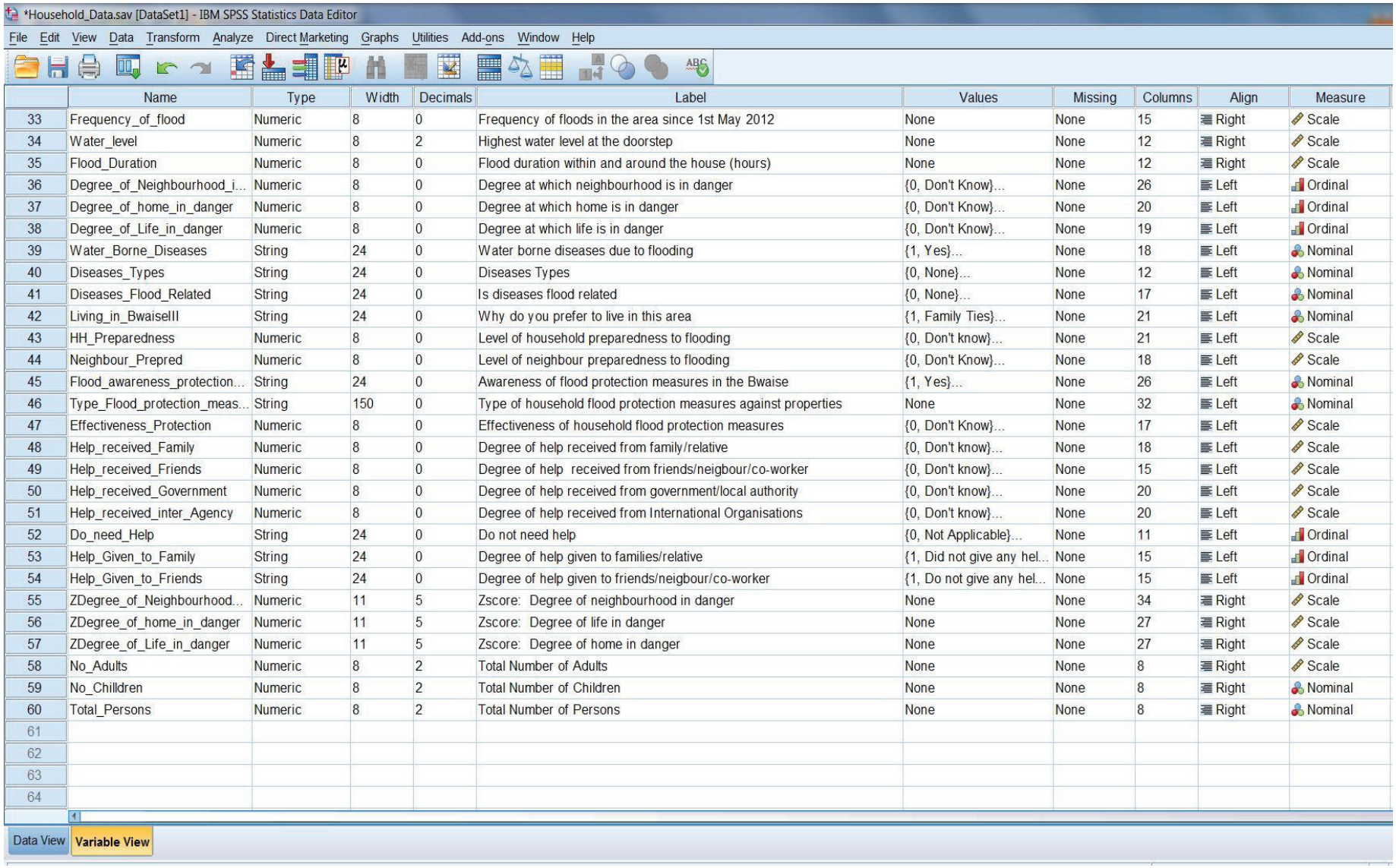
## APPENDIX II: SPSS Metadata

Household_Data.sav [DataSet1] - IBM SPSS Statistics Data Editor

File Edit View Data Transform Analyze Direct Marketing Graphs Utilities Add-ons Window Help

| | Name | Type | Width | Decimals | Label | Values | Missing | Columns | Align | Measure |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Eastings | Numeric | 8 | 2 | Eastings | None | None | 7 | Right | Scale |
| 2 | Northings | Numeric | 8 | 2 | Northings | None | None | 7 | Right | Scale |
| 3 | Gender | Numeric | 8 | 0 | Gender | {1, Male}... | None | 5 | Right | Nominal |
| 4 | Age | Numeric | 5 | 0 | Age Group | {1, < 20}... | None | 10 | Right | Nominal |
| 5 | Educational_Level | String | 24 | 0 | Highest Educational Level | {0, None}... | None | 16 | Left | Nominal |
| 6 | Employement_Status | String | 24 | 0 | Employment Status | {1, Employee}... | None | 17 | Left | Nominal |
| 7 | Reason_for_not_Working | String | 24 | 0 | Reason for not working | {1, Retired}... | None | 18 | Left | Nominal |
| 8 | HH_Type | String | 24 | 0 | Household Type | {1, Small Family}... | None | 10 | Left | Ordinal |
| 9 | Disability | String | 24 | 0 | Disability | {1, Yes}... | None | 8 | Left | Ordinal |
| 10 | No_Disability | Numeric | 8 | 0 | Number of Disable Persons | None | None | 9 | Left | Nominal |
| 11 | Income | Custom | 12 | 0 | Household's Total Income per month | {999, No Response}... | 999 | 15 | Right | Scale |
| 12 | Expenditure | Custom | 10 | 0 | Household's Total Expenditure per month | {999, No Response}... | 999 | 13 | Right | Scale |
| 13 | Electronics | Custom | 10 | 0 | Value of Electronics | {999, No Response}... | 999 | 8 | Right | Scale |
| 14 | Kitchen | Custom | 10 | 0 | Value of Kitchen item | {999, No Response}... | 999 | 8 | Right | Scale |
| 15 | Furniture | Custom | 10 | 0 | Value of Furniture | {999, No Response}... | 999 | 8 | Right | Scale |
| 16 | Other_Propertie | Custom | 10 | 0 | Value of other properties | {999, No Response}... | 999 | 11 | Right | Scale |
| 17 | Building_Usage | String | 75 | 0 | Building Usage | {1, Residential}... | None | 13 | Left | Nominal |
| 18 | Building_Type | String | 24 | 0 | Building Type | {1, Detached}... | None | 11 | Left | Nominal |
| 19 | Occupancy_Type | String | 24 | 0 | Type of Occupancy | {1, Owner}... | None | 13 | Left | Nominal |
| 20 | Roof_Type | String | 24 | 0 | Roof Type | {1, Iron Sheets}... | None | 8 | Left | Nominal |
| 21 | Wall_Type | String | 24 | 0 | Wall Type | {1, Cement}... | None | 8 | Left | Nominal |
| 22 | Floor_Type | String | 24 | 0 | Floor Type | {1, Tiles/Cere}... | None | 8 | Left | Nominal |
| 23 | Build_Area | Numeric | 8 | 2 | Building Area | None | None | 8 | Right | Scale |
| 24 | Damage_to_building | String | 24 | 0 | Damage to Building | {1, Yes}... | None | 16 | Left | Ordinal |
| 25 | Value_of_damage_building | Custom | 10 | 0 | Value of repair or replacement | {99, Don't Know}... | 999 | 18 | Right | Scale |
| 26 | Damage_to_Other_properties | String | 24 | 0 | Damage to home appliances and other properties | {1, Yes}... | None | 22 | Left | Nominal |
| 27 | Value_of_Other_properties | Custom | 10 | 0 | Value of repair or replacement home appliances and other properties | {99, Don't Know}... | 999 | 18 | Right | Scale |
| 28 | Impact_of_flood | String | 30 | 0 | Impact of flood damage to life style and expenditure | {0, Don't Know}... | None | 14 | Left | Ordinal |
| 29 | Save_money | Numeric | 24 | 0 | Save money for flood damage | {1, Yes}... | None | 9 | Right | Nominal |
| 30 | Years_of_Living | Numeric | 8 | 0 | Number of Years of living in Bwaise | {1, Less than 6 years}... | None | 11 | Left | Nominal |
| 31 | Flood_Awareness | String | 8 | 0 | Awareness of flooding before moving to the area | {1, Yes}... | None | 13 | Left | Nominal |
| 32 | Main_causes_of_Flood | String | 150 | 0 | Main causes of flooding in the area | None | None | 32 | Left | Nominal |

Data View | Variable View




| | Name | Type | Width | Decimals | Label | Values | Missing | Columns | Align | Measure |
|---|---|---|---|---|---|---|---|---|---|---|
| 33 | Frequency_of_flood | Numeric | 8 | 0 | Frequency of floods in the area since 1st May 2012 | None | None | 15 | Right | Scale |
| 34 | Water_level | Numeric | 8 | 2 | Highest water level at the doorstep | None | None | 12 | Right | Scale |
| 35 | Flood_Duration | Numeric | 8 | 0 | Flood duration within and around the house (hours) | None | None | 12 | Right | Scale |
| 36 | Degree_of_Neighbourhood_i... | Numeric | 8 | 0 | Degree at which neighbourhood is in danger | {0, Don't Know}... | None | 26 | Left | Ordinal |
| 37 | Degree_of_home_in_danger | Numeric | 8 | 0 | Degree at which home is in danger | {0, Don't Know}... | None | 20 | Left | Ordinal |
| 38 | Degree_of_Life_in_danger | Numeric | 8 | 0 | Degree at which life is in danger | {0, Don't Know}... | None | 19 | Left | Ordinal |
| 39 | Water_Borne_Diseases | String | 24 | 0 | Water borne diseases due to flooding | {1, Yes}... | None | 18 | Left | Nominal |
| 40 | Diseases_Types | String | 24 | 0 | Diseases Types | {0, None}... | None | 12 | Left | Nominal |
| 41 | Diseases_Flood_Related | String | 24 | 0 | Is diseases flood related | {0, None}... | None | 17 | Left | Nominal |
| 42 | Living_in_BwaiseIII | String | 24 | 0 | Why do you prefer to live in this area | {1, Family Ties}... | None | 21 | Left | Nominal |
| 43 | HH_Preparedness | Numeric | 8 | 0 | Level of household preparedness to flooding | {0, Don't know}... | None | 21 | Left | Scale |
| 44 | Neighbour_Prepred | Numeric | 8 | 0 | Level of neighbour preparedness to flooding | {0, Don't Know}... | None | 18 | Left | Scale |
| 45 | Flood_awareness_protection... | String | 24 | 0 | Awareness of flood protection measures in the Bwaise | {1, Yes}... | None | 26 | Left | Nominal |
| 46 | Type_Flood_protection_meas... | String | 150 | 0 | Type of household flood protection measures against properties | None | None | 32 | Left | Nominal |
| 47 | Effectiveness_Protection | Numeric | 8 | 0 | Effectiveness of household flood protection measures | {0, Don't Know}... | None | 17 | Left | Scale |
| 48 | Help_received_Family | Numeric | 8 | 0 | Degree of help received from family/relative | {0, Don't know}... | None | 18 | Left | Scale |
| 49 | Help_received_Friends | Numeric | 8 | 0 | Degree of help received from friends/neigbour/co-worker | {0, Don't know}... | None | 15 | Left | Scale |
| 50 | Help_received_Government | Numeric | 8 | 0 | Degree of help received from government/local authority | {0, Don't know}... | None | 20 | Left | Scale |
| 51 | Help_received_inter_Agency | Numeric | 8 | 0 | Degree of help received from International Organisations | {0, Don't know}... | None | 20 | Left | Scale |
| 52 | Do_need_Help | String | 24 | 0 | Do not need help | {0, Not Applicable}... | None | 11 | Left | Ordinal |
| 53 | Help_Given_to_Family | String | 24 | 0 | Degree of help given to families/relative | {1, Did not give any hel... | None | 15 | Left | Ordinal |
| 54 | Help_Given_to_Friends | String | 24 | 0 | Degree of help given to friends/neigbour/co-worker | {1, Do not give any hel... | None | 15 | Left | Ordinal |
| 55 | ZDegree_of_Neighbourhood... | Numeric | 11 | 5 | Zscore: Degree of neighbourhood in danger | None | None | 34 | Right | Scale |
| 56 | ZDegree_of_home_in_danger | Numeric | 11 | 5 | Zscore: Degree of life in danger | None | None | 27 | Right | Scale |
| 57 | ZDegree_of_Life_in_danger | Numeric | 11 | 5 | Zscore: Degree of home in danger | None | None | 27 | Right | Scale |
| 58 | No_Adults | Numeric | 8 | 2 | Total Number of Adults | None | None | 8 | Right | Scale |
| 59 | No_Chilldren | Numeric | 8 | 2 | Total Number of Children | None | None | 8 | Right | Nominal |
| 60 | Total_Persons | Numeric | 8 | 2 | Total Number of Persons | None | None | 8 | Right | Nominal |
| 61 | | | | | | | | | | |
| 62 | | | | | | | | | | |
| 63 | | | | | | | | | | |
| 64 | | | | | | | | | | |