

## POPULAR COMMUNITY PERCEPTIONS ON FLOOD DISASTERS AND CLIMATE CHANGE ISSUES IN BOTSWANA

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### Abstract

*This paper reports on a 2012-2015 study that set out to investigate the problem that although Botswana is a semi-arid country there have been increasing instances, frequency and intensity of flood disasters in space and time in the country since 2000. Despite this, there have been no major investigations to determine community awareness on the link between climate change, community vulnerability and its resilience capacity to flood disasters and how that could affect the sustainable human settlements drive. The purpose of the study was therefore to assess community perceptions on their vulnerability to floods disasters in human settlements in eastern Botswana based on case studies of Gaborone, Francistown, Mahalapye and Palapye. The stakeholder theory is the analytical framework used. The methodology of the study comprised of a social survey based on a sample of 686 household interviews drawn from the general population in the study area. Complimentary qualitative data was obtained using key informant interviews on officials and community leaders. The main findings were that: first, there was much awareness on the climate change issue among 3 in 5 (63.2%, N=686); second, the majority of the respondents (78.6%, N=686) did not feel that their communities were vulnerable and exposed to flood disasters as a function of climate change; third, overall about 70% of the respondents were neither aware nor prepared for floods disasters induced by climate change; finally, there were mixed results on flood mitigation and resilience strategies identified by communities in the study area. The main conclusion drawn is that most communities were aware of the issue of climate change but there was not much awareness about the risk of flood disasters to communities and assets in settlements. Decision and policy makers, particularly urban planners and environmental engineers are challenged to be aware of the risk of flood disasters such that they encourage sustainable land use planning. Similarly, the two set of professionals should facilitate the design of environmental management infrastructure such as drainage systems that reduce vulnerability of settlements and communities to floods disasters.*

**Key Words:** *Community Perceptions, Floods Disasters, Climate Change Awareness, Human Settlements, Botswana.*

### INTRODUCTION AND RESEARCH ISSUE

The main aim of the study from which this paper is derived was to assess community perceptions in urban and semi-urban human settlements on their vulnerability to floods disasters in human settlements in eastern Botswana, and also assess their knowledge and perceptions on climate change and its linkages to floods disasters. The study had six objectives, one of which was - to investigate community levels of awareness and preparedness for flood disasters as a climate change driven hazard. It is this component that is the subject of this paper.

The research issue investigated was that there has been increasing frequency and intensity of

flood disasters in space and time in Botswana since 2000. Despite this, there have generally been no major investigations on floods disasters in human settlements to determine levels of community popular perceptions and awareness on climate change issues such as vulnerability and resilience capacity to flood disasters. Such research could enable evidence-based decision and policy making to reduce communities' vulnerability and enhance their resilience to flood disasters. Table 1 shows areas and numbers of households that were affected by the June 2009 floods in Botswana.

Table 1: Location and Number of Households Affected by Floods in Botswana in June 2009

<b>District</b>	<b>No. of affected households</b>
Serowe/Palapye	381
Kweneng	122
Tutume	32
Boteti	27
North West	20
Mahalapye	58
Bobirwa	17
<b>Total</b>	<b>657</b>

Source: International Federation of Red Cross and Red Crescent Societies (2009)

From Table 1 it could be observed that based on the 2001 census of Botswana that showed an average household size of 4 persons per household, about 2,628 people were directly adversely affected by floods in June 2009. Most of those affected lived in areas of high population concentration, which are urban and peri-urban areas. The urban areas host some of the most expensive investment and sensitive physical infrastructure such as building assets.

In recent years, the extent of floods disaster related damages have been experienced throughout Botswana, although no systematic research particularly on community awareness on climate change and flood disasters has been undertaken in eastern Botswana, an area in which about 80% of the country's population resides. Table 2 shows the growing significance of flood vulnerability in Botswana between 2000 and 2006.

Table 2: Floods inflicted damages in Botswana by District: 2000-2006

<b>Year</b>	<b>District</b>	<b>Location</b>	<b>Damages</b>
<b>2000</b>	Gaborone	Extensions 1,7,8,9,12,15,16,18,37, Phase 2, Old Naledi, Prisons, Block 5	Unknown. Not officially recorded.
<b>2001</b>	Gaborone	Residential areas of Taung, Segoditshane, Phase 4, Old Naledi, Village, Kgale View, Phase 1, Phase 2, Universal Estate, Extension 2, Bontleng, White City	P5million worth of private and public property was damaged
<b>2003</b>	Central	Sowa Town	Independent Electoral Commission tents were affected at Nata, Gweta, Tshwaane, and Zoroga
	South East	Ramotswa	52 chicken and/fowls were reported killed
<b>2004</b>	Central	Tutume	120 households were affected at Nata, Gweta, Malelejwe, Semowana, and Manxotae. The following facilities were submerged – classrooms, post office, standpipes, and internal roads.
	Ngamiland	Shakawe, Nxamasere, Mohembo west, Xakao	992 households, water treatment plants at Sepopa and Mohembo East, waiting rooming at pontoon area, Mohembo/Seronga road
	Central	Letloren; Machaneng	973 people affected, 199 mud huts destroyed; Machaneng water reticulation pipes destroyed
	North East	Francistown	125 families affected and displaced
	Chobe	Chobe Enclave	Kachikau, Satau, Parakarungu road rendered inaccessible. Kachikau borehole flooded and adversely affected water quality
<b>2005</b>	Ghanzi	Ghanzi Township	437 people affected
<b>2006</b>	Gaborone	Taung	8 households affected
	Central	Tsetsejwe	16 housing structures affected
		Shoshong; Mosolotshane	15 households affected
	North East	Botalaote, Toteng, Mambo, Tshesebe, and Tati Siding villages	32 households were assisted with food rations
	South East	Ramotswa	2 sewage pump stations were affected

Source: Central Statistics Office (2009)

Clearly from Table 2 the adverse impacts of floods in Botswana have become more widespread in time and space despite the fact that the country has dominant semi-arid climatic conditions where historically incidences of floods are not common. This factor increases community vulnerability to flood disasters.

## **THE MANIFESTATION OF THE FLOODS DISASTER ISSUE**

### **The Global and Regional Situation**

In the global context within the United Nations (UN) system community of nations of which Botswana is a member and signatory to numerous multilateral environmental agreements (MEAs), the importance of sustainable human settlements in global environmental change has long been recognised. For example, about forty years ago in 1975 the UN established the United Nations Centre for Human Settlements (UNCHS), to coordinate and promote sustainable human settlement planning and development. In 1992 the United Nations published Agenda 21 (2000-2099), which among other things seeks to promote sustainable human settlements. Planning for and management of disaster-prone areas was one of the key issues in the Agenda. Recently in 2015 the UN adopted 17 Sustainable Development Goals (SDGs) for 2016-2030. Among these is SDG 11, which aims to “make cities and human settlements inclusive, safe, resilient and sustainable.” The documentation of issues surrounding sustainable human settlements in Botswana is therefore important. This would among other things encourage the urban planning system to consider none traditional planning issues such as climate change awareness and floods disasters.

Floods are the most common natural disaster and the leading cause of natural disaster fatalities worldwide (Doocy *et al*, 2013a). For example, a historical review of flood events from 1980 to 2012 was undertaken; it was found that for more than 30 years about 3 billion people were adversely affected by floods, with 4.5 million left homeless, at approximately 540,000 deaths and 360,000 injuries, excluding an estimated 38,000 to 2.7 million injuries that went unrecorded (Doocy *et al*, 2013a:21).

Between 1988 and 1997 natural disasters claimed an estimated 50,000 lives a year, and caused damage valued at more than \$60 billion a year (World Bank, 2001). Developing countries are often the worst affected by disasters because in most cases they are densely populated, they are poor economically, and therefore are less prepared than developed countries to respond to and cope with disasters. According to the World Bank (2001), between 1990 and 1998, 94 per cent of the world’s 568 major natural disasters and more than 97 per cent of all natural disasters-related deaths were in developing countries. Poor quality infrastructure among poor communities increases their vulnerability to disasters.

In other parts of the world flood disaster trends have been experienced in China and Bangladesh in Asia. Similarly, in 2002 flood disasters occurred in parts of Europe, for example, in Germany and the United Kingdom. In 2009 parts of the United Kingdom were again afflicted by severe and unprecedented floods in recent times. This has also been the case in other semi-arid and arid areas, for instance, in Saudi Arabia. The occurrences of severe floods are associated with global climate change. Much of the visible adverse impacts of floods take place in human settlements. This brings into question the ability of past and present urban planning systems to

plan for and enable mitigation of the impact of floods in large settlements. Africa, where Botswana is located, has in recent years been afflicted by floods related to climate change. FloodList (2014 and 2016) documents several flood disaster events as shown in Table 3.

Table 3: List of some 2014 and 2016 Flood Disasters in Africa

- 1) **2016: Mali and Burkina Faso**, 13 deaths, and affected more than 9,500 people (1,400 households) in the regions of Sikasso, Kolikoro, Segou, Mopti, Timbuktu, Gao, Kidal and Menaka, 31 July 2016;
- 2) **2016: Sudan** – 114 killed in floods, over 100,000 affected, 17 August 2016;
- 3) **2014: Ghana**, Jomoro, Wester Region, 10 July 2014, flood disaster, 1 person dead, 6,000 people affected;
- 4) **2014: Cameroun**, Douala, 08 July 2014, widespread floods, fears raised about malaria outbreak; 3200 people died from flood related malaria outbreak in 2013;
- 5) **2014: Cote d’Ivoire** (Ivory Coast), 04 July 2014, dozens of people killed; in 2013 about 50 people killed in flood calamities;
- 6) **2014:South Africa**, Cape Town, June 2014 floods; 20,000 people and over 5,000 households affected;
- 7) **2014: Zimbabwe**, Masvingo Province, Chingwizi, May 2014, 3000 families displaced
- 8) Numerous other 2014 examples from other African countries such as Mozambique, Tanzania, and Somalia are recorded. Similarly, examples from Asia, Europe, North and South America, and Australia and New Zealand are recorded.

Source: FloodList (2014, 2016) [www.floodlist.com](http://www.floodlist.com)

A few case studies from Africa are noted below to show the extent of concerns over flood disasters in the continent in recent years. In Uganda Doocy *et al* (2013b) investigated relationships between disaster preparedness, impacts, and humanitarian response among Eastern Uganda populations affected by the 2010 landslides and floods. The key findings were that: human mortality was significantly higher in the landslide-affected populations as compared to flood-affected populations (deaths reported: 4.5 vs 1.6 percent) whereas injuries were more common in the flood-affected areas (injuries reported: 3.1 vs 1.1 percent); livelihoods impacts were widespread in more than 95 percent of households; the community and government were unprepared to respond in both flood (90.5 and 77.8 percent, respectively) and landslide (95.3 and 74.9 percent) affected areas (Doocy *et al* 2013b:1).

Another study still in Uganda by Agrawal *et al* (2013) assessed risk factors for injury in the March 2010 floods and landslides in Eastern Uganda, and compared the effects of location, injury type, and severity. It was found that: the odds of injury were 65% higher in the flood-affected groups than the landslide-affected groups; the injury rate was greater in individuals under 42 years of age, and location of injury was a contributing factor; more people were injured in the flood-affected population compared to the landslide-affected population, and injuries were more severe (Agrawal *et al*, 2013:314).

In Nigeria, Nabegu (2014) assessed the vulnerability of households to flood in Kano State, Nigeria, using questionnaires survey, infrastructure analysis and flood impact information of the most recent flood disaster collected by the Federal and State agencies responsible for disaster management. The results showed variations between the zones in coping strength and vulnerability, signifying varying local coping capacities to flood disasters (Nabegu, 2014:22).

In Southern Africa in 2000 the worst floods in living memory occurred, affecting Mozambique, Madagascar, South Africa, Zimbabwe and Botswana in that order (United Nations Children's Fund (UNICEF), 2000). As a result, there was extensive loss of human life, destruction of property and widespread outbreak of water borne diseases such as malaria, diarrhea, and cholera. In Botswana about 100,000 people constituting approximately 10% of the population at the time were affected by the flood disasters, and approximately 10,000 dwellings were also destroyed (UNICEF, 2000).

The picture painted above on the floods disaster situation in Southern Africa is consistent with what has been documented recently in the Africa region at large. For example, Douglas *et al* (2008:187) argue that many of the urban poor in Africa face growing problems of severe flooding associated with climate change by way of increased storm frequency and intensity that are worsened by local factors and conditions such as human occupation of flood plains, increased run-off from impervious surfaces and siltation on drainage systems.

### **The Botswana Situation**

In Botswana recurrent drought and occasional floods are the most prevalent natural hazards (Ramoethwa and Wilnest, 2000:43). By far floods have become the most common devastating disasters in human settlements in Botswana in recent times. As a semi-arid country Botswana has historically experienced isolated pockets of flood disasters in different parts of the country depending on rainfall amounts in a particular year. In recent times however, particularly since 2000 there have been frequent incidences flash floods disasters throughout Botswana. These are attributed to global climate change. In 2009, for instance, the Ngamiland area in the northern Botswana was hard hit by floods due to excess rainfall amounts upstream in Angola and Namibia (Daily Nation, 2009). Residents from some flood vulnerable settlements in Ngamiland had to be evacuated by government disaster emergency services at significant monetary costs that had not been anticipated, thus straining limited budgets.

Major urban and peri-urban settlements in Botswana that were afflicted by floods in 2009 and before include Kasane, Palapye, and Mahalapye. In Palapye, for example, flash flood in the urban village caused much destruction of property as the Lotsane River overflowed; luckily no human life was lost. Similarly, the Chobe District adjacent to Ngamiland was also afflicted by

floods in 2009. It was reported that the 2009 were the worst floods in Ngamiland since 1965 (Mmegi, 2009). Kasane, the urban to semi-urban capital of Chobe District, was one of the hardest hit by the 2009 floods due to population and property concentration.

The synoptic literature reviewed above cascading from the global, regional and down to national level shows that Botswana as a semi-arid country has since 2000 witnessed increasing frequency and intensity of flood disasters. The existing gap or problem however from a research perspective is that there have been no major investigations to determine community awareness and vulnerability to flood disasters as a function of climate change, particularly how this affects sustainable human settlements.

To conclude this section the following general observations should be noted.

Climate change refers to a change in global or regional climate patterns, which change is attributed primarily to the increased levels of greenhouse gas emissions into the Earth's atmosphere, especially carbon dioxide produced by the use of fossil fuels.

Floods are linked to climate change in the sense that in semi-arid environments such as in Botswana, where this suddenly becomes exposed to excess rainfall, the excess water flow is usually unexpected and unplanned for, thus causing damage to property and human life in settlements.

There are anthropogenic or human factors that may worsen the effects of floods, such as lack of good design in drainage systems, human occupation of flood prone areas due to lack of prior environmental assessment before designating land use for such purpose. Floods are natural hazards, and only become disasters when they are uncontrollable, and also threaten human life and property.

The measurement of awareness on climate change and floods was based on perceptions, which were captured through the survey questionnaire. Floods experienced in Botswana like anywhere else become classified as disasters when they are uncontrollable and threaten human life and property alike

It was not possible within the scope and duration of the study to show a cause-effect link between climate change and floods in Botswana. The study aimed at measuring perceptions on climate change and flood vulnerability rather than prove causality between the two.

## **THEORETICAL FRAMEWORK: THE STAKEHOLDER THEORY**

Stakeholders are groups or individuals who affect or are affected by the achievement of an organization's mission. (Freeman, 1984, p.52). There are numerous "stakeholders" in any development and physical planning context and processes. The underlying principle in defining the stakeholder concept is that the concerns of all groups and individuals that can affect, or are affected by the accomplishment of an organization's purpose are taken into account (Polonsky 1995). Theoretically, the stakeholder concept "must be able to capture a broad range of groups and individuals" (Freeman 1984, p. 52). Mitchell *et al.* (1998) extend the stakeholder theory to

enhance its use in analyzing the attributes of power and legitimacy of stakeholders in decision making.

Power is an important concept in stakeholder analysis. Power in social science is the probability that one actor within a social relationship will be in a position to carry out their own will despite resistance, and regardless of the basis on which that probability rests (Green 1998, p. 610). This conception of power is normally seen in terms of how the state or government functions.

Legitimacy is another important element of stakeholder analysis. Legitimacy is the rightfulness of a holder of power to exercise it (Beetham 1998). In political science, legitimacy is often associated with the rightfulness of a government to rule. In this paper, legitimacy is the rightfulness of different stakeholders to influence decision making and policy process affecting communities' awareness of the interconnectedness between climate change, vulnerability and resilience to flood disasters. To assess the attributes of power and legitimacy among stakeholders, a typology adapted from Mitchell *et al.* (1998) which comprises of three groups of stakeholders emerge: i) dominant stakeholders, ii) discretionary stakeholders, and iii) dormant stakeholders (Mitchell *et al.* 1998, pp. 299–303).

The dominant stakeholders in the study consisted of state agencies. Dominant stakeholders wield the most power (Mitchell *et al.* 1998). State agencies in the land management and land use planning system in Botswana include Land Boards, the central government Department of Lands, urban and rural council authorities, all of which have both power and legitimacy backed by provisions of the law.

Discretionary stakeholders consist of community organizations such as village development committees and the chieftainship (*bogosi*) institution. Discretionary stakeholders have legitimacy but often do not have much power. For example, community based organisations such as village development committees and chieftainship authorities can encourage communities to avoid settling in flood disaster risk areas but they cannot stop them from doing so, unless other state agencies intervene using the power of the law, and at times with the backing of court orders.

Dormant stakeholders include all other groups that could be affected by floods disasters, for instance, business enterprises; these normally have some financial power but lack legitimacy to the same extent enjoyed by both state agencies (dominant stakeholders) and discretionary stakeholders. In addition, dormant stakeholders often have minimal interest on local concerns and affairs except where there is threat to their business performance and profitability. Usually they attempt to gain legitimacy through their corporate social responsibility such as creating local employment opportunities and making donations among other things.

## **METHODOLOGY**

The data was collected through a survey using a structured questionnaire. The questionnaire was administered by trained data collectors or enumerators, who were also conversant with the national Setswana language. The survey was carried out at four sites in Gaborone, Francistown, Mahalapye and Palapye according to the sampling approach described below. The actual sample sizes are shown in Table 4. There were five samples as follows: total sample for four

study sites (N=686), Gaborone sample (Na=205), Francistown sample (Nb=180), Mahalapye sample (Nc=151), and Palapye sample (Nd=150). Table 4 shows the distribution of general population samples in the entire study area and at respective study sites.

Table 4: Distribution of Population Samples in the Study Sites

<b>Name of Site</b>	<b>Frequency</b>	<b>Percent</b>
Gaborone (Na)	205	29.9
Francistown (Nb)	180	26.2
Mahalapye (Nc)	151	22.0
Palapye (Nd)	150	21.9
Total/All Sites (N)	686	100.0

Source: UB-ST Survey (2012-2015)

The sampling approach used in the study was based on use of pre-published sample planning tables from Watson (2001), Israel (2009) and Defence Contract Management Agency (DCMA) (2011). From those sampling plans minimum sample sizes of 150 respondents were determined and selected from each study site. The sources were adequate since they consisted of three independent and credible organisations. A 5% margin of error was set for the study. Similarly, a 95% confidence level was chosen.

Several factors were taken into account in choosing the sample size in the social surveys. These included the following-:

- a) Cost considerations (e.g., the maximum budget available, the need to minimize cost).
- b) Administrative concerns (e.g., complexity of the design and research deadlines).
- c) Spatial distribution of population and other physical considerations such as accessibility.
- d) Minimum acceptable level of precision.
- e) Confidence level.
- f) Variability of attributes to be measured within the population or subpopulation (e.g., stratum, cluster) of interest. In urban areas population is segregated according income, although the segregation is not perfect.
- g) Sampling method (this was based on published sample plan statistical tables), which yield similar results to calculating the required sample using a sampling equation.

In this study pre-published sample planning tables from the following sources were used: the Penn State University “How to Determine a Sample Size” by Watson (2001) and the University of Florida “Determining Sample Size” by Glenn Israel (2009); and the Defence Contract Management Agency (DCMA, 2011) of Government of the United States of America. The sources are considered adequate in that they are from independent and reputable organisations, two out of three (67%) of which are universities and one of three (33%) a state agency regularly involved in sampling. The choice of the sources was based on accessibility to the information and its veracity.

Three criteria are commonly taken into account to determine and specify the desired sample size in social surveys (Israel, 2009). These are-: sampling error or level of precision; confidence or risk level; and degree of variability in the parameters or attributes of the population being studied. The three criteria are not mutually exclusive.

Using published statistical tables at +/- 5% the corresponding sample sizes were chosen for the general population survey. The DCMA (2011) table was also applied because it has a much wider range starting from 1 to 500,001+. It also has a much wider range of pre-calculated acceptable levels of quality (margin of error) to accommodate small populations. The Penn State University table starts at 100, with a +/-5% level of quality.

In the 2011 Botswana population census, Gaborone, Francistown, Mahalapye and Palapye had respective populations of 231 592, 98 961, 118 875 and 41 102, according to records of Statistics Botswana. A hundred and fifty (150) minimum household threshold sample was chosen for each settlement to satisfy the +/- 5% Penn State and DCMA threshold. The actual samples drawn were 205, 180, 151 and 150 in that order for Gaborone, Francistown, Mahalapye and Palapye.

The general sampling frame used for each settlement used was the 2011 census data. The enumeration area maps were also used to select the dwellings from which to select households. The target was the heads of households. A systematic random sampling procedure was used to select the households in rural or semi-urban areas of Mahalapye and Palapye. In Gaborone and Francistown a stratified systematic random sampling procedure was followed. In urban areas in Botswana there are housing or land use strata based on income, although these are by no means perfect. Every fifth plot was selected. Non response cases were dealt with by repeat visits, sampling different times of the day, and sampling different days of the week.

A 5% sampling error was chosen because it was the most realistic level. The 5% sampling error meant that a 95% confidence level was to be achieved. This reduced the burden of a much larger sample with all the associated disadvantages, particularly financial costs and time.

Degree of variability is the extent to which attributes, concepts or variables being measured in a population are distributed. In heterogeneous population there is higher variability and in a homogenous population there is lower variability. In rural the semi-urban settlements of Palapye and Mahalapye there were no major apparent spatial or geographical variability attributable to housing or land use. In the urban areas of Gaborone there was apparent land use and housing variability, normally associated primarily with income.

## **DATA ANALYSIS AND DISCUSSION OF RESULTS**

The data was analysed using Statistical Packages for the Social Sciences (SPSS). MS Excel was used mostly to produce graphics. The statistical analysis was kept simple and based on descriptive statistical analysis rather esoteric inferential statistics because the idea is to communicate the basic message on climate change awareness and flood vulnerability to readers of all levels.

This section presents results from the study on climate change awareness and flood disasters in the study area organised around nine sub-topics:

- 1) The Demographics Summary;
- 2) Flood risk awareness and preparedness among communities;
- 3) Perceptions on the link between climate change and floods;

- 4) Community knowledge and perceptions on climate change;
- 5) Sources of information to communities on climate change;
- 6) Characterization of climate change by communities;
- 7) Perceptions on the reversibility of climate change;
- 8) Perceptions on effects of climate change on Botswana;
- 9) The relationship between climate change and natural disasters.

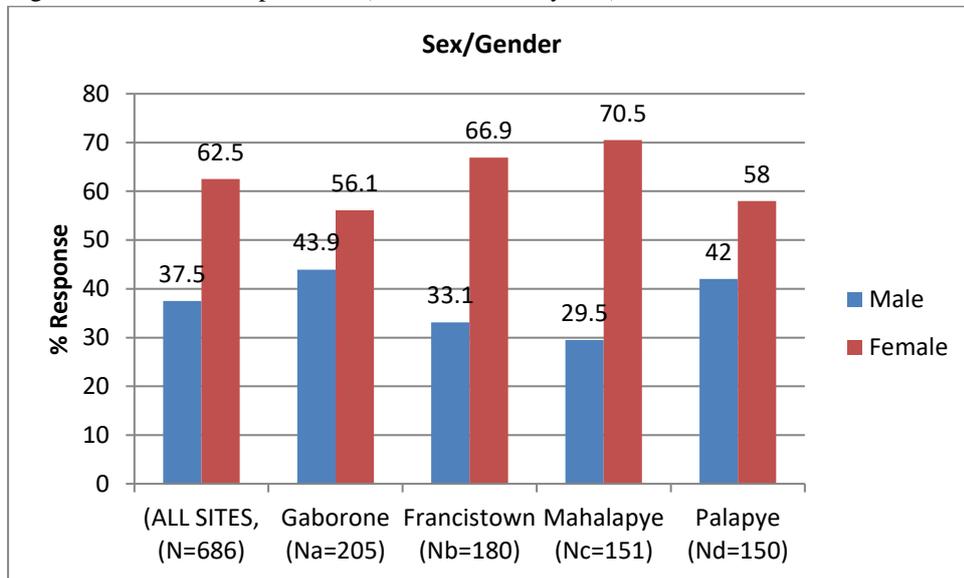
### The Demographics of Respondents

The essential demographics of the respondents that were captured in the questionnaire included: gender, age, level of education, employment status, and sources of livelihood. This section provides a brief of those demographics.

#### Gender

The majority of respondents in the entire study were females. The gender distribution response pattern is shown in Figure 1.

Figure 1 Gender of Respondents (% Distribution by Sex)



Source: UB-ST Survey (2012-2015)

#### Age of Respondents

The age distribution of the respondents was placed in seven categories is shown in Table 5, with a provision for “refused to answer”. No person under the age of 18 years was allowed to answer questions in the survey because in terms of the laws of Botswana and research ethics they are considered minors with no capacity to grant informed consent. Across all study sites more than half, 67.2% (N=686) of the respondents were in the 18-30 and 31-40 age groups,

with 18-30 age group being dominant. This scenario is consistent when the data is disaggregated across individual sites.

Table 5. Age of Respondents (% Distribution by Category)

Age Category	(ALL SITES, (N=686))	Gaborone (Na=205)	Francistown (Nb=180)	Mahalapye (Nc=151)	Palapye (Nd=150)
18-30 years	44.5	46.3	53.7	35.3	40.7
31-40 years	22.7	28.8	19.4	23.7	17.3
41-50 years	13.0	12.2	9.7	14.1	16.7
51-60 years	8.2	4.4	6.9	10.9	12.0
61-70 years	6.9	6.3	4.6	8.3	8.7
71-80 years	2.8	1.0	2.3	5.8	2.7
81+ years	1.7	1.0	2.3	1.9	2.0
Refused to answer	0.3	0.0	1.1	0.0	0.0
Total	100.0	100.0	100.0	100.0	100.0

Source: UB-ST Survey (2012-2015)

#### Level of Formal Education

Level of formal education like other demographic variables can influence human perceptions over a wide range of issues, for instance, community perceptions towards vulnerability to floods disasters and also perceptions to climate change. Formal education could be correlated with other variables in the study to test the strength of the associations. The response pattern on formal education is summarized in Table 6.

Table 6. Levels of Formal Education of Respondents (% Distribution by Category)

Age Category	(ALL SITES, (N=686))	Gaborone (Na=205)	Francistown (Nb=180)	Mahalapye (Nc=151)	Palapye (Nd=150)
None	7.4	4.4	10.3	7.1	8.7
Primary	18.7	10.7	11.4	32.7	23.3
Junior Secondary	28.3	22.0	32.0	28.2	32.7
Senior Secondary	23.9	29.8	27.4	19.2	16.7
Tertiary Certificate	6.6	8.8	5.7	3.8	7.3
Tertiary Diploma	7.3	10.7	6.9	3.8	6.7
Tertiary B. Degree	7.3	12.7	5.1	5.1	4.7
Tertiary M. Degree+	0.6	1.0	1.1	0.0	0.0
Total	100.0	100.0	100.0	100.0	100.0

Source: UB-ST Survey (2012-2015)

The single most dominant cluster of formal education across all sites is the secondary education category, which accounted for a cumulative 52.2% (N=686). This picture is generally consistent with that found at individual sites, except that in the urban villages of Palapye and Mahalapye primary education as a single cluster accounted for more than 20% at each of the two sites, with this level of education accounting for one-third at Mahalapye alone (32.7%, Nc=151). Tertiary education respondents were generally poorly represented, the worst case scenario being at Masters Level and above, with only 0.6% (N=686) in the entire study area.

### Employment Status and Livelihoods Sources

A question to determine employment status of respondents in the questionnaire was posed thus: “Are you engaged in formal employment?” The majority of respondents were not engaged in formal employment in the whole study area: 62.0% responded “No” and 38.0% responded “Yes” (N=686). The response patterns for the individual sites were as follows: Gaborone (Na=205) – “Yes” (41.5%), “No” (58.5%); Francistown (Nb=180) – “Yes” (24.0%), “No” (76.0%); Mahalapye (Nc=151) – “Yes” (25.0%), “No” (75.0%); Palapye (Nd=150) – “Yes” (28.0%), “No” (72.0%).

A follow up-question to the employment question was on livelihoods. The respondents were asked to specify their sources of livelihood. The question posed was: “What is your main source of livelihood?” The responses generated are contained in Table 7.

Table 7: Main Source of Livelihood among Respondents

Source of Livelihood	(ALL SITES, (N=686))	Gaborone (Na=205)	Francistown (Nb=180)	Mahalapye (Nc=151)	Palapye (Nd=150)
Formal Employment	26.1	36.1	20.0	23.1	22.7
Informal Employment	5.5	6.8	4.0	2.6	8.7
Subsistence Agriculture	5.8	3.4	2.3	11.5	7.4
Business Enterprise	9.3	9.3	9.1	10.3	8.7
Other (Miscellaneous)	53.2	44.4	64.6	52.6	52.7
Total	100.0	100.0	100.0	100.0	100.0

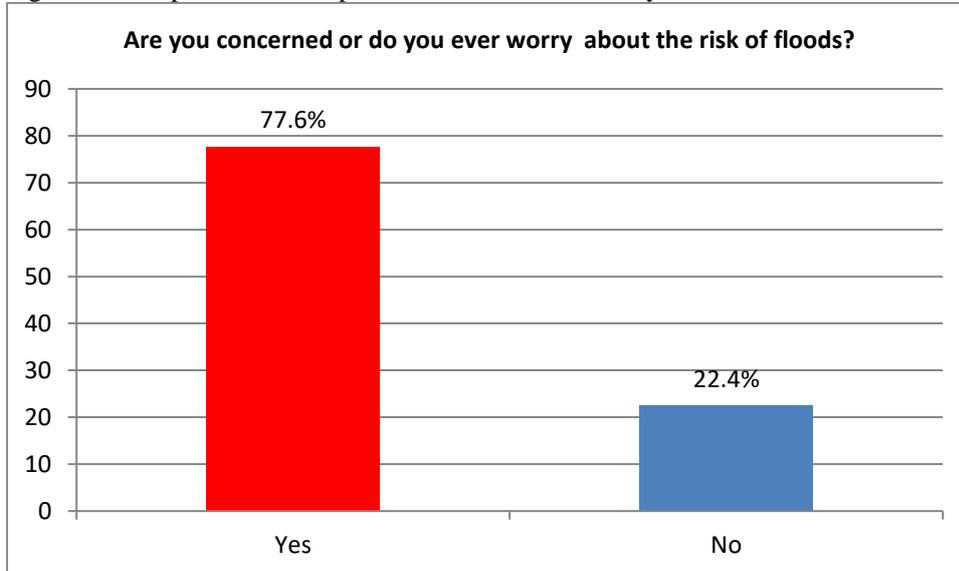
Source: UB-ST Survey (2012-2015)

From Table 7, the dominant source of livelihood was miscellaneous activities, the bulk of which are short term and informal. This was followed by formal employment.

### Flood Risk Awareness and Preparedness among Communities

The level of flood risk awareness and preparedness among communities in the study area was assessed. The consolidated results from the whole study area are shown in Figure 2.

Figure 2: Perceptions about Exposure to Flood Risk in Study Area



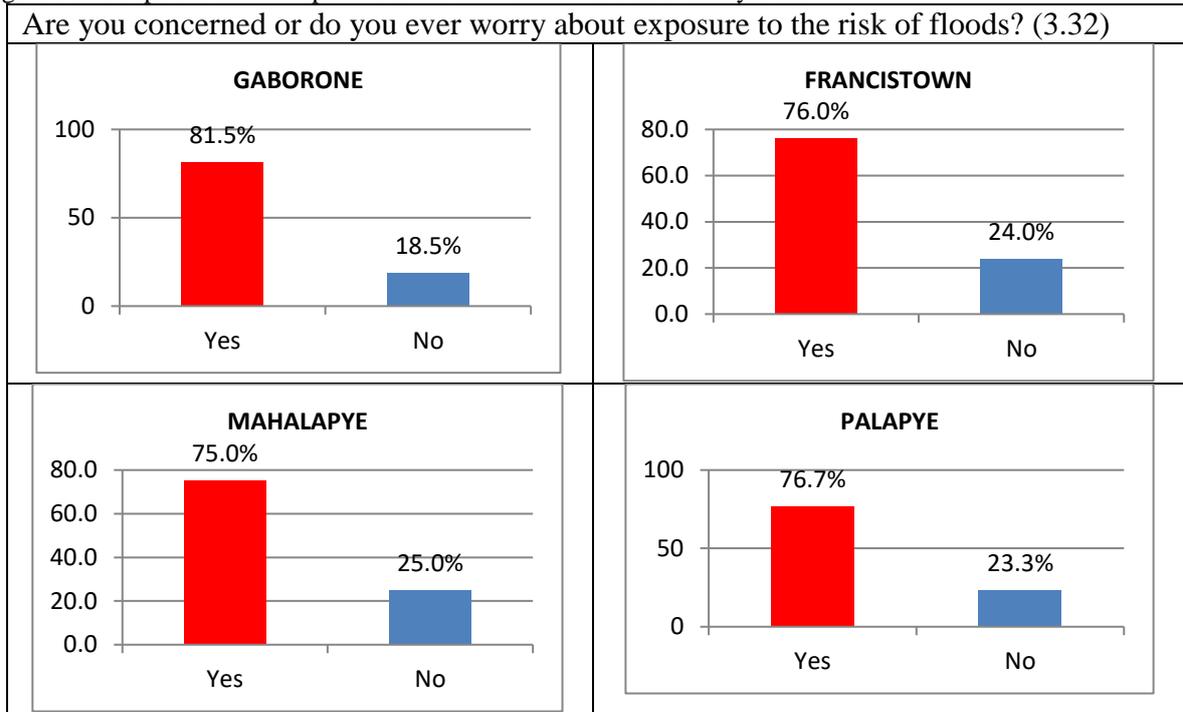
Source: UB-ST Project (2012-2015)

The results in Figure 2 show that the majority of respondents (77.6%, N=686) in the whole study area were concerned about exposure to flood risk. This response pattern is surprising given that earlier the majority of respondents across the study area had responded as follows:

- a) That their **towns or villages were not flood prone** (77.5%, N=686, question 3.3);
- b) That their **neighbourhoods were not flood prone areas** (77.6%, N=686, question 3.4);
- c) That their **own plots/compounds were not susceptible to floods** (81.9%, N=686, question 3.5);
- d) That their **own compounds or houses had never been affected by floods** (82.7%, N=686, question 3.6)

The results in individual study sites are shown in Figure 3. The pattern is consistent with that found in the whole study area.

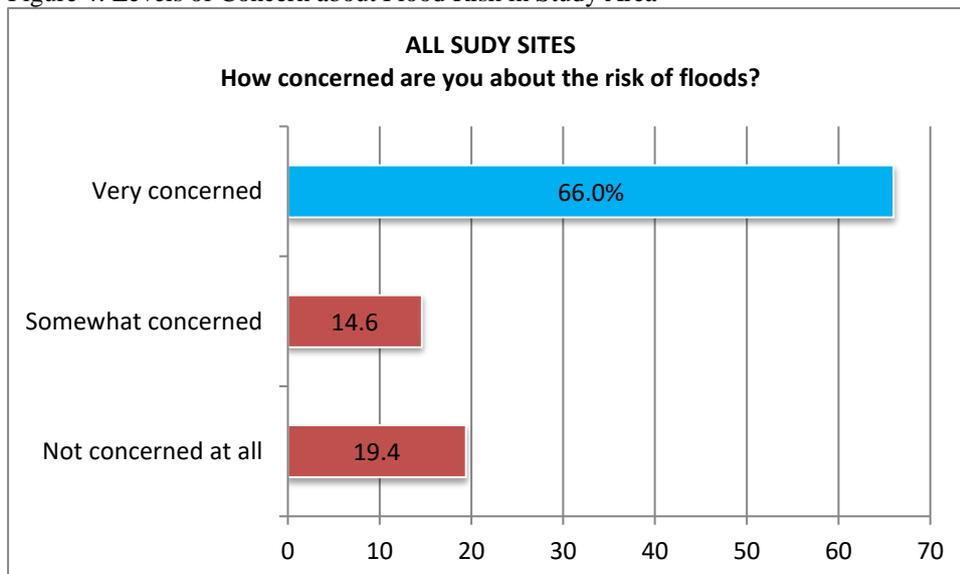
Figure 3: Perceptions about Exposure to Flood Risk in Individual Study Sites



Source: UB-ST Project (2012-2015)

A follow up question was posed for respondents to express their levels of concern about flood risk into three categories: not concerned at all; somewhat concerned; and, very concerned. The results are shown in Figure 4 for the entire study area and Figure 5 for the individual study sites.

Figure 4: Levels of Concern about Flood Risk in Study Area

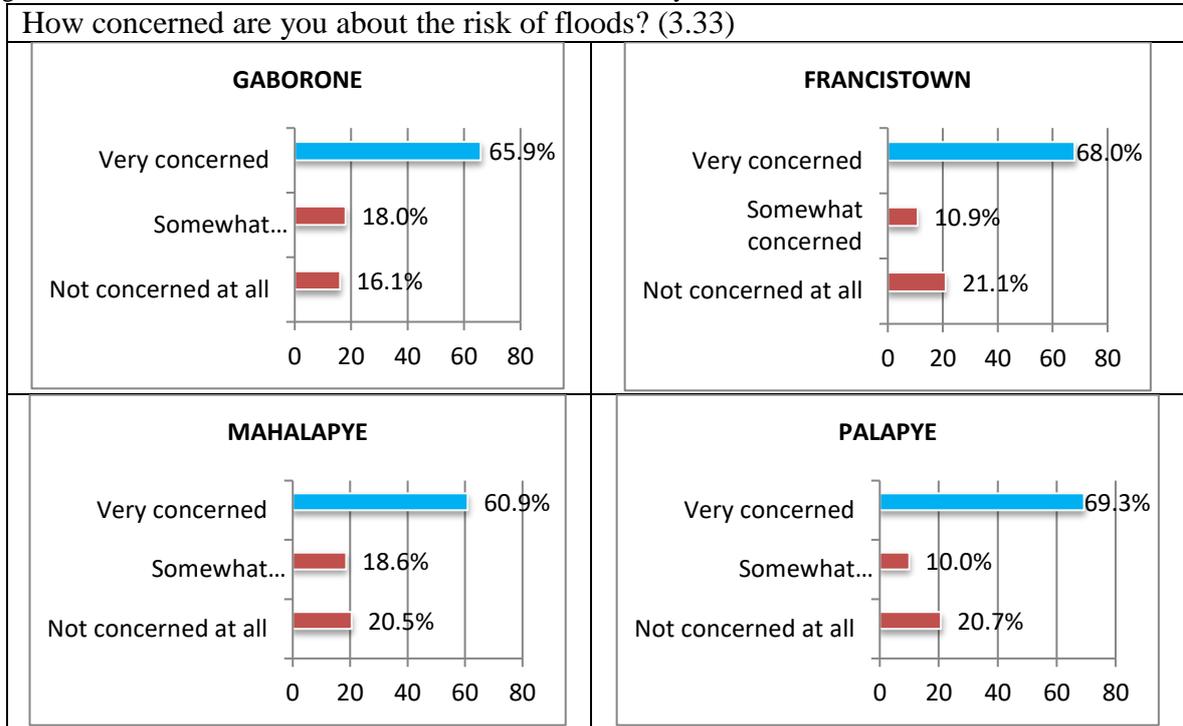


Source: UB-ST Project (2012-2015)

From Figure 4 above a majority of the respondents, two thirds, (66%, N=686) were “very concerned” about flood risk compared to just under two fifths that were “not concerned at all”.

The results for individual settlements are summarised in Figure 5. These results are consistent with the aggregated results for the whole study area as shown in Figure 4.

Figure 5: Levels of Concern about Flood Risk in Individual Study Sites



Source: UB-ST Project (2012-2015)

The question under the flood risk and preparedness section sought to find out what exactly the respondents were concerned about. The results are shown in Table 8.

Table 8: Areas of Concern on Flood Risk among Residents in the Study Area

What is your concern about flood risk? (3.34)					
Areas of Concern	All Sites	Gaborone	Francistown	Mahalapye	Palapye
None	18.7% (2)	11.2%	23.4% (1)	19.9% (2)	22.0% (2)
Personal Safety	22.9% (1)	21.5% (1)	23.4% (1)	19.9% (2)	27.3% (1)
Disruption of livelihoods	9.5%	19.0% (2)	5.1% (3)	5.1% (3)	6.0%
Damage to personal property	18.4% (3)	17.1% (3)	14.9% (2)	26.9% (1)	15.3% (3)
Other (miscellaneous)	30.5%	31.2%	33.1%	28.2%	29.3%
TOTAL		100.0%	100.0%	100.0%	100.0%

Source: UB-ST Project (2012-2015)

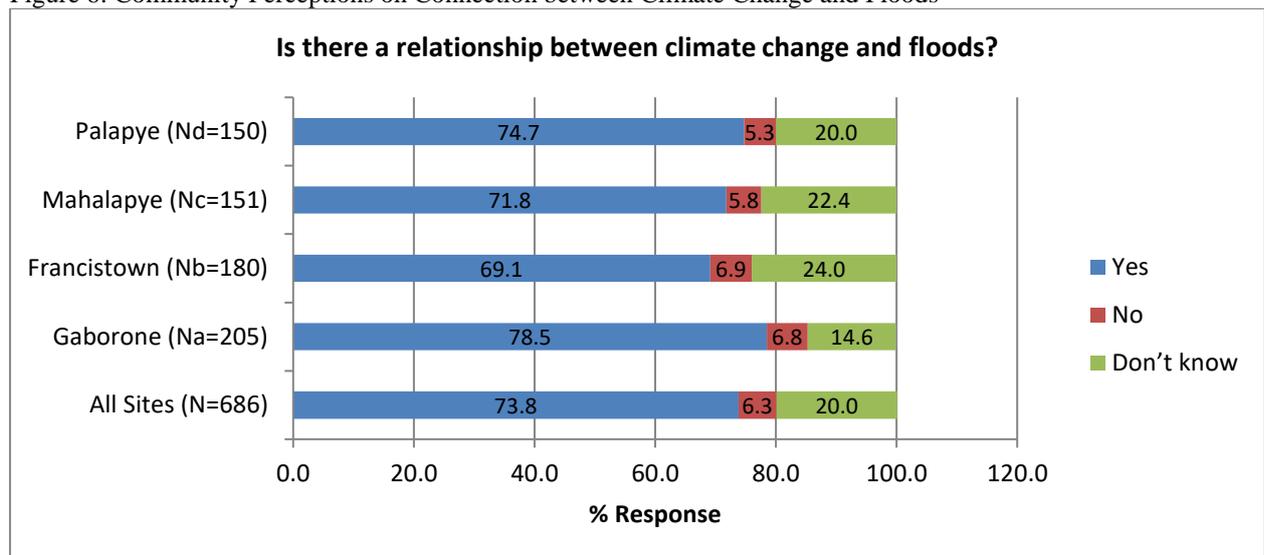
The results in Table 8 show that overall in the entire study area the points of concern were: personal safety (1), none (2), and damage to personal property (3) in that sequence. However,

the results in Table 8 also show that there was considerable variation in the prioritization of concerns at individual study sites. For example, in Gaborone the order of concerns was as follows: 1) personal safety; 2) damage to personal property; and 3) disruption of livelihoods;. In Palapye the order of concerns was as follows: 1) personal safety; 2) none; and 3) damage to personal property.

### Perceptions on the Link between Climate Change and Floods

The intention here was to establish what respondents thought and knew about the relationship if any between climate change and floods disasters. In the whole study area the majority of respondents (73.8% (N=686)) reported that there was a relationship between climate change and floods. A summary cross section of the consolidated results is shown in Figure 6.

Figure 6: Community Perceptions on Connection between Climate Change and Floods



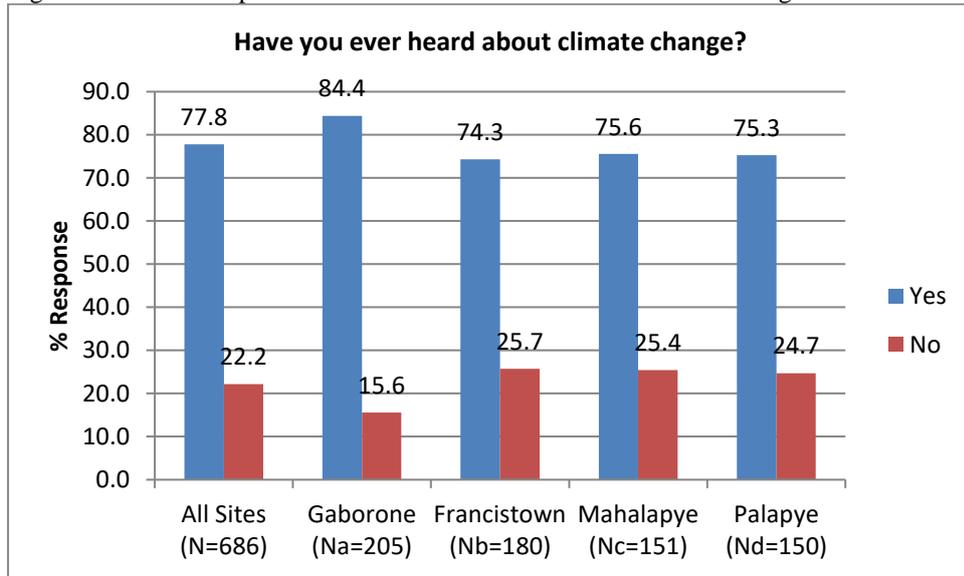
Source: UB-ST Project Survey (2012-2015).

The overall result from all study sites is reflective of and consistent with the response pattern in the individual study sites: respondents were adamant that there was or is a relationship between climate change and floods although they were not required to specify the nature of the relationship.

### Community Knowledge and Perceptions on Climate Change

This section sought to establish if respondents had ever heard about climate change. A good majority of respondents, more than three in four (77.8%, N=686) reported that they had heard about climate change in the whole study area. A breakdown summary of the results is shown in Figure 7.

Figure 7: General Population Levels of Awareness about Climate Change

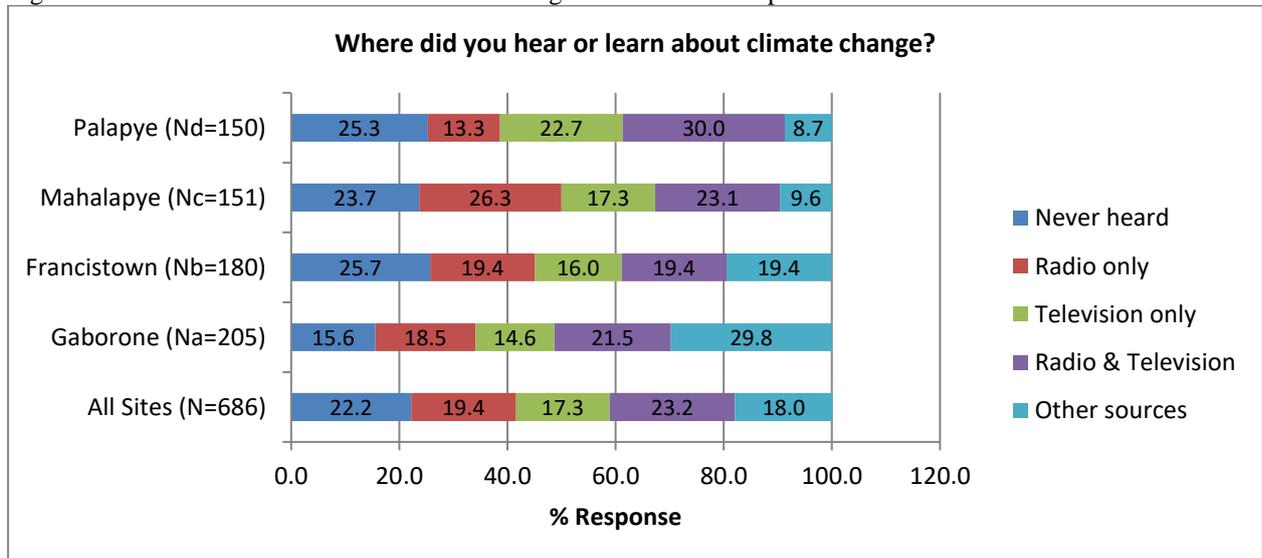


Source: UB-ST Project Survey (2012-2015).

### Sources of Information to Communities on Climate Change

Respondents were asked to specify where they had learnt or heard about climate change. The media, particularly radio and television, was identified as the major source of information on climate change. Approximately two in five of the respondents in the survey across all sites (59.9%, N=686) indicated that they had learnt about climate change from the media; 22.2% had never heard about climate change, and 18.0% had heard about climate change from other sources such as public meetings, friends and relatives, government officials etc. The disaggregated results on the sources of information on climate change are summarized in Figure 8.

Figure 8: Sources of Information on Climate Change to the General Population



Source: UB-ST Project Survey (2012-2015).

## Characterization of Climate Change by Communities

Four options were provided in the survey instrument to enable respondents to describe climate change. From a climate science point of view most of the substantive descriptions that were provided are not mutually exclusive. The descriptions were that climate change is: 1) “Drastic changes in weather conditions”; 2) “increase in temperature extremes”; 3) “Increase in frequency of climate change disasters (e.g. floods, fires, drought, and diseases). The results are summarized in Table 9.

Table 9: Descriptions of Climate Change by the General Population

What is climate change?	All Sites (N=686)	Gaborone (Na=205)	Francistown (Nb=180)	Mahalapye (Nc=151)	Palapye (Nd=150)
Drastic changes in weather conditions	53.5%	60.0	45.1	52.6	42.3
Increase in temperature extremes	8.6%	17.0	10.3	7.1	8.0
Increase in frequency of climate disasters (floods, fires, drought, diseases)	6.7%	5.4	8.6	6.4	6.7
Other	7.1%	5.4	6.3	7.1	10.7
Don't know	24.1%	13.2	29.7	26.9	29.3
Total	100.0%	100.0%	100.0%	100.0%	100.0%

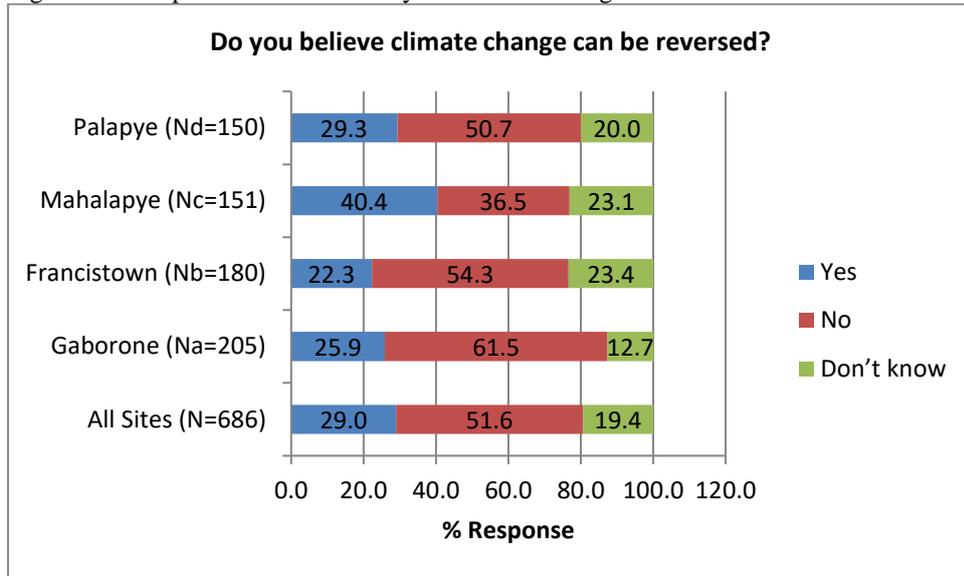
UB-ST Survey (2012-2015)

From Table 9, the most common description of climate change was “drastic changes in weather conditions”. This was mentioned by more than half of the respondents at all sites (53.5%, N=686), followed at a distant second position of 8.6%, which is a margin of 44.9 points by “Increase in temperature extremes”, and further 46.8 points down at third position by “Increase in frequency of climate disasters” such as floods.

## Perceptions on the Reversibility of Climate Change

A question was posed to the general population whether it thought climate change can be reversed. More than half of respondents at all study sites (51.6%, N=686) were of the view that climate change is irreversible; 29.0% were optimistic that it could be reversed; 19.4% did not know whether or not climate change is reversible. Summary results on the variable are contained in Figure 9.

Figure 9: Perceptions on Reversibility of Climate Change



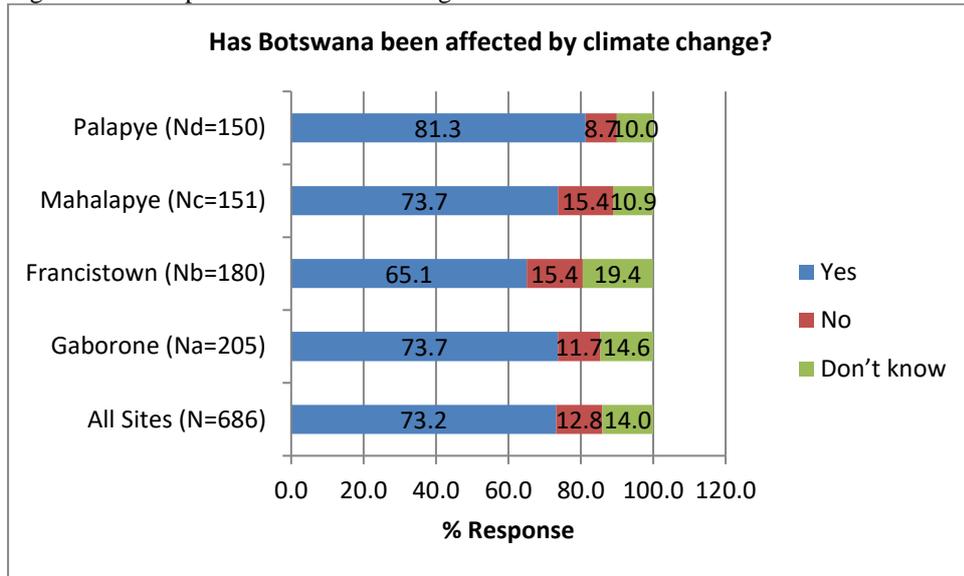
Source: UB-ST Project Survey (2012-2015).

In terms of disaggregated results for individual sites, only the results for Mahalapye were inconclusive in that there was no clear majority of over 50% in all the three response options.

### Perceptions on Effects of Climate Change on Botswana

Respondents were asked: “Has Botswana been affected by climate change?” The majority of respondents at all sites (73.2%) were of the unequivocal view that indeed Botswana had been affected by climate change. The rest of the results are shown in Figure 10. They show that the majority of respondents across the whole study area (73.2%, N=686) perceive Botswana as having been adversely affected by climate change.

Figure 10: Perceptions on Climate Change on Botswana

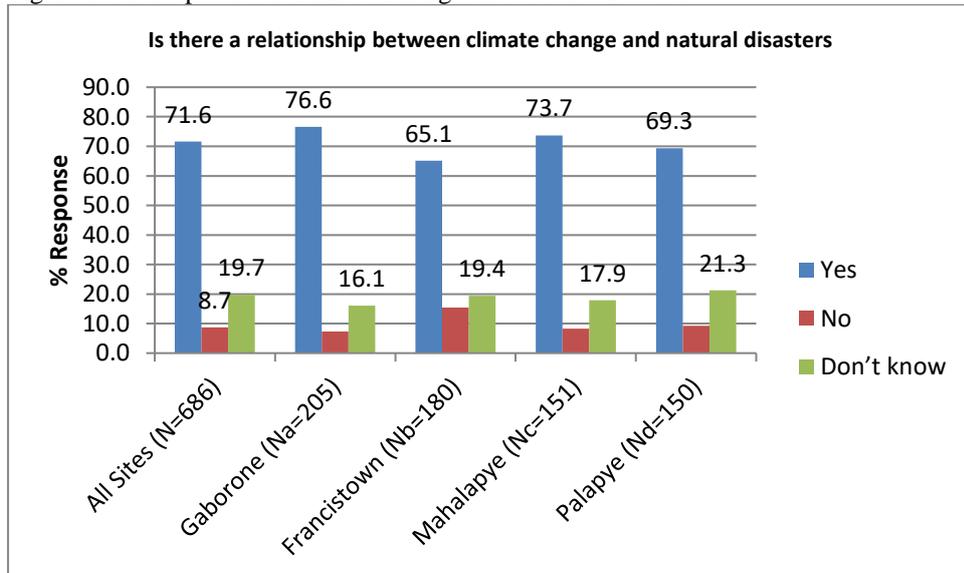


Source: UB-ST Project Survey (2012-2015).

### The Relationship between Climate Change and Natural Disasters

“Is there a relationship between climate change and natural disasters?” This is a general question that was posed to the general population respondents. The majority (71.6%, N=686) answered it in the affirmative, i.e. they believed that there is a relationship between climate change and natural disasters. Figure 11 is a consolidated version of the results from the question.

Figure 11: Perceptions on Climate Change and Natural Disasters

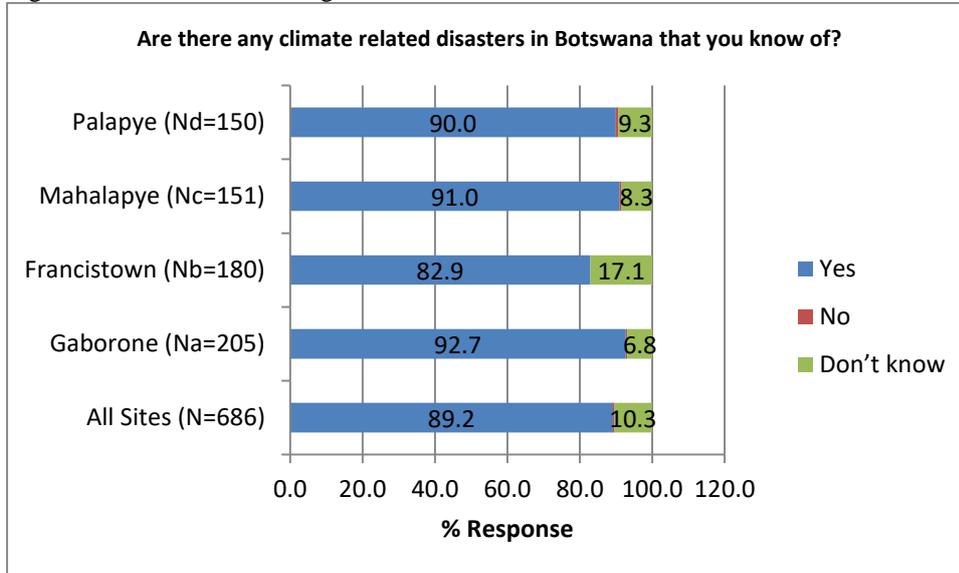


Source: UB-ST Project Survey (2012-2015).

The results in Figure 11 show that at least seventy percent (71.6%, N=686) of respondents in the whole study area were of the view that there is a relationship between climate change and

natural disasters. The majority of respondents (89.2%, N=686) from the whole study area responded in the affirmative to a question that was posed to them thus: “Are there any climate related disasters in Botswana that you know of? Composite results are shown in Figure 12.

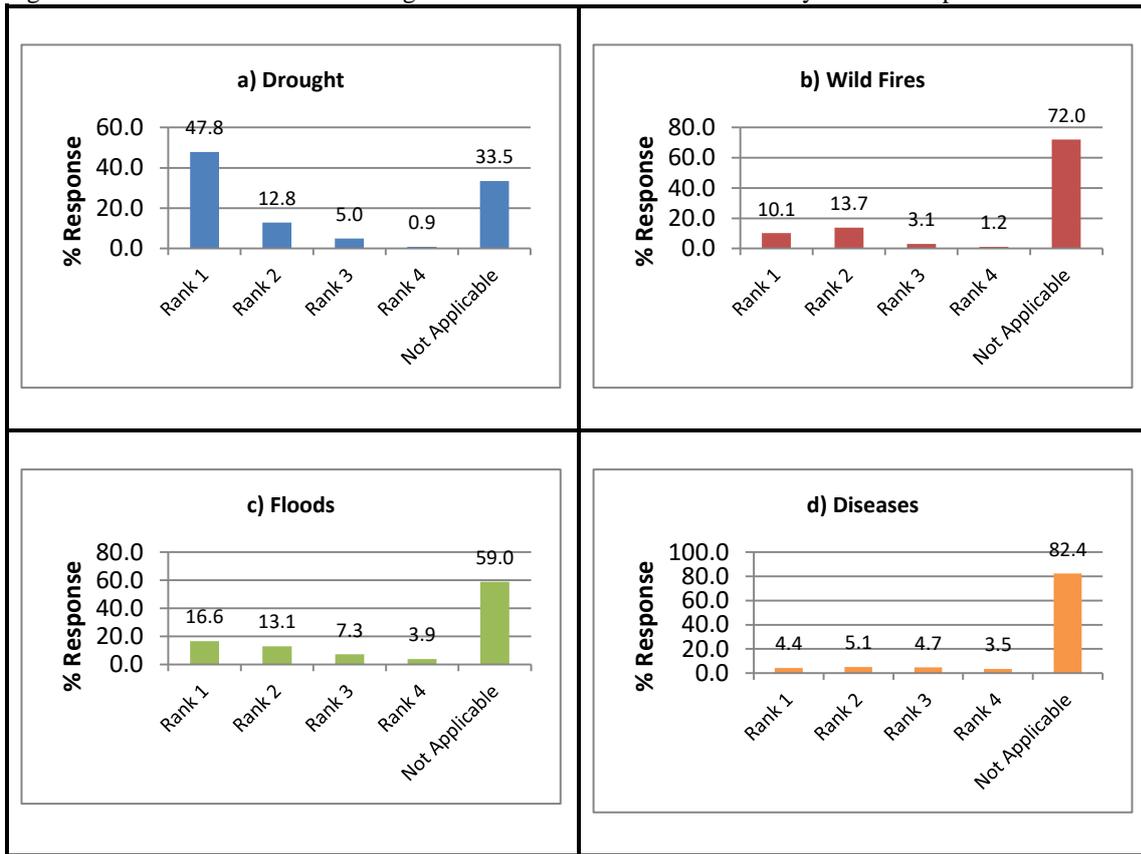
Figure 12: General Knowledge about Climate Disasters in Botswana



Source: UB-ST Project Survey (2012-2015).

Once they had indicated that they knew about climate related disasters in Botswana, respondents were then asked to identify these. (What climate related disasters are common in Botswana?). A list was provided in the questionnaire but this was not shown to the respondents. The first disaster that a respondent identified was ranked number 1, the second was ranked number 2, and the third was ranked 3, which was the lowest rank. Composite results of the disaster identification and ranking exercise for the whole study area (N=686) are shown in Figure 13.

Figure 13: Identification and Ranking of Climate Disasters in Botswana by General Population



Source: UB-ST Project Survey (2012-2015).

Drought was the most commonly identified and highest ranked (47.8%, N=686) climate related disaster in Botswana. It was followed by floods at a distant second place at only 16.6%, which is 31.2 points after drought.

### SUMMARY AND CONCLUSION

The highlights of summary key results from the study are presented below.

The majority of respondents (63.2%) were aware of the climate change issue. The predominant source of information on this was from radio and television. The dominant description of climate change was “drastic changes in weather conditions”; while climate change was seen as not reversible by about half (51.6%) of the respondents in the survey. Most (7 in 10) of the general population was of the view Botswana had been affected by climate change.

The majority of the respondents (78.6%, N=686) did not feel they were vulnerable and exposed to flood disasters as a function of climate change. Overall the majority (about 70%) of the respondents were neither aware nor prepared for floods disasters induced by climate change. There were mixed results on flood mitigation and resilience strategies found among communities in the study area, for example: a negligible 5.0% had “ever been evacuated”; only 3.0% had “ever had to boil water” to avoid water contamination due to floods; sixteen (16.0%)

had “ever undertaken any flood mitigation initiatives”; the majority (76.7%) thought flood mitigation measures were feasible; 40.3% reported that “improved design of public culverts and storm water drainage was a possible mitigation strategy.

It can be concluded that most communities were aware of the issue of climate change. The majority of the general population did not however feel there were at risk of flood disasters in their areas. This is often the case amongst most communities until a major calamity or disaster strikes and there is need to cope with that. The burden of coping is usually placed on the state and donor agencies. The majority of the communities were neither aware of any level of flood disaster risk they faced nor were they prepared to cope with such an emergency should it occur. Also, it can be concluded that since in terms of the theoretical framework the majority of respondent stakeholders did not wield much direct power on decision making power even if their level of awareness was high on climate change, most (78.6%) did not feel at risk of flood disasters. For this reason there was no incentive to push their leaders to take decisions aimed at reducing their vulnerability to floods.

There was much uncertainty and some degree of being uninformed about viable flood mitigation and resilience or coping strategies, mostly because the majority of the general population in the study area had not been exposed to real floods in recent years. The majority of more than three in four of the general population however felt that coping strategies were in principle feasible.

The challenge is for human settlements planners to be aware of the risk of flood disasters so as to encourage land use planning and environmental management infrastructure development that reduces vulnerability of communities and investment in infrastructure found in human settlements such as buildings to flood disasters.

## **ACKNOWLEDGEMENT**

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## **REFERENCES**

- Agrawal, S., Gopalakrishnan, T., Gorokhovich, Y., & Doocy, S (2013). Risk Factors for Injuries in Landslide- and Flood-Affected Populations in Uganda. *Prehospital and Disaster Medicine*, 28(4), 314-321.
- Beetham, D., (1998). Legitimacy. In: E. Craig, ed. *Routledge Encyclopedia of Philosophy*. London: Routledge, 538–541.
- Central Statistics Office (2009). *Natural Disasters Digest 2008*. Gaborone: Central Statistics Office.
- Daily Nation (2009). Botswana warns over floods disaster. <http://palapye.wordpress.com/2009/03/25/botswana-warns-over-floods-disaster/>
- Defense Contract Management Agency (DCMA), DCMA Sampling Guidelines/Guidance, Fort Lee, Virginia: DCMA, United States Federal Government Agency.

- Doocy, S., Daniels, A., Murray, S. and Kirsch, T.D. (2013a). The Human Impact of Floods: a Historical Review of Events 1980-2009 and Systematic Literature Review. PLOS Currents Disasters. 2013 April, 1-27.
- Doocy, S., Russell, E., Gorokhovich, Y., and Kirsch, T. (2013b). Disaster preparedness and humanitarian response in flood and landslide-affected communities in Eastern Uganda. *Disaster Prevention and Management*, 22 (4), 326-339.
- Douglas, I., Alam, K., Magenda, M., MCDonnell, Y., McLean, L., and Campbell, J. (2008). Unjust waters: climate change, flooding and the urban poor in Africa. *Environment and Urbanization*, 20:187-205).
- FloodList (2014) [www.floodlist.com](http://www.floodlist.com)
- Freeman, R.E., (1984). *Strategic Management: A Stakeholder Approach*. Boston: Pitman.
- Green, L., (1998). Power. In: *Routledge Encyclopaedia of Philosophy*. London: Routledge, 610–613.
- International Federation of Red Cross and Red Crescent Societies (IFRC) (2009). *Botswana Floods*. Johannesburg. IFRC Southern Africa Zone.
- Israel, G.D. (2009). *Determining Sample Size*. Gainville, FL: University of Florida.
- Mmegi (2009). Kasane under threat of floods. [www.mmegi.bw/index.php?sid=1&aid=4&dir=2009/March/Monday30](http://www.mmegi.bw/index.php?sid=1&aid=4&dir=2009/March/Monday30)
- Mitchell, R.K., Agle, B.R., and Wood, D.J., (1998). Toward a Theory of Stakeholder Identification and Salience: Defining the Principle of Who and What really counts. In: M.B.E. Clarkson (Ed.), *The Corporation and Its Stakeholders: Classical and Contemporary Readings*. Toronto: University of Toronto Press, 275–313.
- Nabegu, A.B. (2014). Analysis of Vulnerability to Flood Disaster in Kano State, Nigeria. *Greener Journal of Physical Sciences*, 4(2):22-029.
- Polonsky, M.J. (1995). Incorporating the natural environment in corporate strategy: a stakeholder approach. *Journal of Business Strategies*, 12 (2) 151-168.
- Ramothwa, G. and Wilnest, M. (2000). Weather and climate. In *Department of Surveys and Mapping (Ed.) Botswana National Atlas*. Gaborone: Department of Surveys and Mapping (Botswana). Pp. 31-44.
- United Nations Children's Fund (UNICEF) (2000). *Southern Africa Floods*. [www.unicef.org/africafloods/](http://www.unicef.org/africafloods/)
- Watson, J. (2001). *How to Determine Sample Size*. College Township, Pennsylvania: Penn State University.
- World Bank (2001). *World Development Report 2000 / 2001: Attacking Poverty*. Oxford: Oxford University Press.