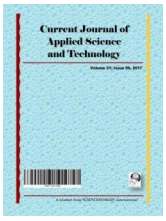

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Community Vulnerability in Climate Disaster and Environmental Sustainability: A Botswana Perspective

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Authors' contributions

This work was carried out in collaboration between both authors. Author KM designed the study, performed the statistical analysis and wrote the protocol. Authors KM and MJR wrote the first draft of the manuscript and managed the literature searches. Both authors read and approved the final manuscript.

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ABSTRACT

Community vulnerability to climate related disasters and environmental degradation is a concern for social workers. This concern accentuates when the physical environment from which communities derive livelihoods cannot sustain their subsistence. Social work is a profession that is committed to the development of communities adhering to social justice, human rights, and respect for diversity amongst people and cultures. It advocates for sustainable community development and protection of people from environmental hazards and risks. While serving the person in the social environment, it seeks to reduce their vulnerability to disasters that could jeopardize sustainable developments in their locality. Globally, the changing weather patterns, environmental pollution, and natural hazards with grave consequences for communities have become burdensome. Climate change has brought about increased flooding, frequent drought episodes, and new health hazards that require researched corporate actions and interventions in communities. The researcher moved by the devastating impacts of disasters in Botswana carried out an empirical study in three localities of the

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South East Administrative District. The study adopted the mixed methods research design to assess the community preparedness, disaster risk reduction strategies, the role of social workers in enhancing community resilience to disasters, and efforts to promote sustainable environmental, cultural practices. Data were collected through face-to-face interviews, questionnaires, focus group discussions, and review of government policies and reports. A total sample population of 3567 respondents were randomly selected for the quantitative phase and 90 participants were conveniently selected for the qualitative phase. It was found that local communities are vulnerable to floods, windstorms, drought, torrential rains, and wild-fires which negatively impact their livelihoods and degrade the environment. The community vulnerability resonated with their lack of knowledge on climate change, hazards and risks, lack of hazard zone map. The article recommends a community-based disaster strategy for building disaster resilience and risk management capacity. The main concepts in this paper are: climate change, vulnerability, disaster, hazard and risks, and resilience.

Keywords: Climate change; vulnerability; disaster; hazard and risks; resilience.

1. INTRODUCTION

Communities are important stakeholders in environmental sustainability and climate disaster vulnerability reduction. Governments should engage community leaders and communities to prepare against disasters and promote sustainable environmental practices. Disaster risk management activities that exclude the active involvement of vulnerable communities may be fatalistic. The principle behind community involvement in disaster risk management is premised rights-based approach and the realization that communities are the key players in shaping their environment [1]. In addition, communities derive livelihoods from the land they occupy for residence. The physical and social environment provides communities with various resources. These resources may be food, water, air, and social relations that are important for survival in difficult times. Therefore, social work is committed to the development of communities under the principles of social justice, human rights, and respect for diversity amongst people and cultures. It advocates for sustainable community development and protection from exposure to disastrous hazards. Disasters result from a combination of hazards and human vulnerability. Human vulnerability is a product of the inability of an individual or community to reduce the potential consequences of a hazard. While social work serves the person in his/her environment, it seeks to reduce human vulnerability to natural hazards that could jeopardize their sustainable livelihoods. Therefore, there is a need for communities to prepare for an effective response in the event of an emergency. According to UNISDR [2] disaster preparedness refers to the critical steps based on the ability of the community and its effectiveness and efficiency to absorb the disaster shocks. Globally, the changing weather patterns, environmental pollution, and other natural hazards with grave consequences for communities have become burdensome, hence need for community preparedness [3]. In addition, climate change increased the frequency of damaging weather patterns, for example, heavy rains, floods, frequent drought episodes, and new health hazards. As such, the vulnerability of communities to climate change related disasters need concerted efforts of all parties to prepare against disasters and strengthen sustainable environmental practices. The need for a community-based disaster strategy for building resilience and risk management capacity is high in Botswana. Therefore, this article advocates for community based disaster interventions to reduce vulnerability to various hazards and weakened livelihoods and promote sustainable subsistence. It discusses the need for a strategy based on the findings of an empirical study which investigated the community perceptions of hazards and vulnerability, assessed community preparedness, and the role of social workers in enhancing community resilience and sustainability. The article expounds the subject, the problem statement, the methodology, the findings, the way-forward, and conclusion and the main concepts are: climate change, vulnerability, disaster, hazard and risks, and resilience.

2. PROBLEM STATEMENT

Botswana is overwhelmed by windstorms, floods, livestock diseases, and droughts which are proving complex to address. The National Disaster Management Office [4:11] reported that in 2007 and 2008 four districts; Chobe, South

East, Ngamiland, and Ghanzi districts, were seriously affected by floods, heavy rains, and wildfires besides road accidents, malaria, and foot and mouth disease. In 2007, 12.7 percent of the total land area in Ngamiland district was burnt and 157 households were affected by floods which forced them to evacuate to temporary camps. Other hazards that endanger communities in the district are foot and mouth disease, contagious bovine pleura pneumonia, tsetse fly, locusts, and lethobo flies [5: 5]. In the same year, Ghanzi district was hit by floods and wildfires which destroyed more than 5 million out of the 11, 791, 000 hectares of land. In the Chobe district, the following communities; Satau, Parakarungu, and Kachikau villages suffered from floods, wildfires, migratory pests, and high HIV and AIDS prevalence [4: 8].

The International Federation of Red Cross and Red Crescent Societies (IFRC) [6:127] states that weather related disasters globally have increased from an annual average of 200 in the early 1990s to more than 350 a year since the year 2000. The increase in disasters relates to equally rising numbers of people affected worldwide. These numbers have risen from an average of 190 million per year in the 1990s to 243 million in 2008. IFRC [6:77] further stated that the high number of climate related disasters in 2008 (floods, storms, heat-waves, and droughts) accounted for 60 percent of grants allocated by its Disaster Relief Emergency Fund (DREF), of which Botswana was a beneficiary for Gweta and nearby villages.

Disasters affect all groups of people from the young to the elderly, the sick, women and children, people living with disability, and the economically deprived. These groups are vulnerable to various hazards because of their age, gender, physical ability and mental deficiencies, and social status. The Asian Development Bank [7:3] showed that 600 million people worldwide live with physical, sensory (deafness, blindness), intellectual or mental health impairments; significant enough to make them vulnerable to disasters. It is also indicated by the World Bank [8:1] that 80 percent of the 600 million live in developing countries (Botswana included). Their disability and mental health impairments make them vulnerable to disasters because they are subjected to discrimination during humanitarian interventions [9:87]. This is further complicated by the nature of their impairment and whether they have access to the disaster warning information and disaster capacity building programs. Most often than not they are excluded and marginalized.

3. LITERATURE REVIEW

International Federation of the Red Cross reported that 330 million people in sub-Sahara Africa live in extreme poverty and fail to keep pace with the rest of the world in terms of maintaining sustainable development. Poverty makes people vulnerable to various hazards (including HIV and AIDS) and limits their choices [6]. Natural disasters, such as, floods and sudden illness in Africa overwhelm poor households and destroy their ability to cope. The poor experience crop failure without alternative sustainable means to provide for their family [9]. It is estimated that 70 percent of the population of sub-Saharan Africa survives on subsistence agriculture which relies heavily on rain and fails when there is no rain. Other problem prevalent in Africa is malaria which is influenced greatly by climate change and affects the poor more than other groups [6]. The Asian and African countries appear to be the hardest hit by Tsunamis, windstorms, floods, drought, and other climate change related hazards. Local communities in Kenya, South Africa, Zimbabwe, Zambia, Namibia, and Botswana have suffered from varying disasters annually [6]. Communities that suffer severely from the impact of disasters are poverty-stricken, discriminated, and marginalized [10]. The IFRC [9:1] asserts that the number, severity, and impact of disasters in Africa have been increasing dramatically due to climate change, environmental degradation, poverty and inequity, unplanned mass-urbanization, rapid population growth, and civil conflict.

According to Woods and Lusaka [11] droughts have increased in frequency in north and western Uganda. The changing rainfall patterns have led to food insecurity and increased social conflicts between communities for scarce water and pastures. OCHA [12] estimated that in 2008 there were 108 internationally reported disasters 99 percent of which were climate related. The number of people affected by disasters annually has doubled over the last twenty years from 9 million to 16.7 million in 2008. Drought accounts for 75 percent of disasters on the continent and 220 million people are annually exposed. It is stated that the poor and the most vulnerable communities are the ones who suffer most from the negative effects of climate change [13]. OCHA projects that by 2020 rain-fed agriculture

will have reduced by half because of shifting rainfall patterns [12].

The South Africa Weather Service [14] states that southern Africa has experienced floods in 2003 that affected more than 500, 000 people and displacing nearly 100 000 in Angola, Botswana, Madagascar, Malawi, Namibia, and Zambia. The floods are said to have washed away 230, 000 hectares of crops and left nearly eight million people food insecure and at heightened vulnerability. The challenges brought about by floods are complicated further by cholera epidemics affecting more than 150,000 people in the nine countries. In Angola, the 2008 floods killed 60 people, affected 220 000, more than 81 000 were displaced, and 4000 houses were destroyed. The Madagascar Cyclone, Jade, in the same year killed 6 people, affected 60,818 people, left 4000 without shelter, and 5628 houses damaged. The situation was worse in Namibia where 350 000 people were affected, 92 were reported dead, and 54,581 were displaced. This is a sign of vulnerability to flood disasters in the Southern Africa region and the need for preparedness to mitigate against risk [12].

The impact of extreme changing weather conditions is felt heavily by subsistence farmers in Botswana. The country is semi-arid and characterized by 75 percent of the land being a semi-desert [15]. Botswana's major engines of foreign exchange growth besides diamonds are tourism and agriculture which are climate sensitive. The tourism industry in Botswana is based on wetlands, grasslands, forest reserves, and wildlife [16]. The effects of climate change negatively impacted community tourism and agriculture due to increased floods and severe drought. Climate change is defined as "any change in climate over time, whether due to natural variability or as a result of human activity" [17:2]. Vulnerability to climate change varies depending on the combined effect of the systems internal coping capacity and the nature and severity of the shock.

Extreme climatic events threaten the lives and livelihoods of the poor more than other social groups. Climate change may be characterized by extensive heat, extremely cold winters, flooding, windstorms, prolonged episodes of drought, and heavy rains. The International Federation of the Red Cross and Red Crescent Societies [9] found that 250 million people are affected by natural disasters every year. This is complicated further by the behavior of community members' management of the environment, livestock, agricultural practices, and attitudes towards the changing weather patterns.

It has been established by the Intergovernmental Panel on Climate Change (IPCC) that there are gaps in the utilization of climate change information: integrating climate into policy; integrating climate into practice; climate service; and climate data [18]. Red Cross / Red Crescent [19] reported that there is strong increase in climate related disasters in terms of numbers, economic damage, and people affected. It recommends disaster risk management as the best approach (rather than disaster response) and it should include an early warning system, ploughing drought resistant crops, and reforestation to prevent flooding. Africa has been identified as the most vulnerable continent to projected climate change related disasters because of its highest statistics regarding population growth and food insecurity [18]. Cipryk [17:5] states that the United Nations has identified mitigation and adaptation as the most relevant two broad responses to climate change worldwide. Mitigation refers to an anthropogenic intervention to reduce the source or enhance the sinks of greenhouse gases while adaptation to the impact of climate change refers to adjustments in natural or human systems in response to actual or expected climate stimuli or their effects which moderates harm or exploits beneficial opportunities [20:750].

3.1 Social Work Practice and Disaster Risk Management in Botswana

Social workers in Botswana serve communities who live in areas that are prone to disasters. They are supposed to serve under the guidance of the District Disaster Management Committees (DDMC) and are expected to perform their function in line with the United Nation Sendai Framework for action 2015-2030 [21]. However, social workers' roles and responsibilities are not clearly defined at the district and community level apart from being included in the assessment team during emergencies. They are not involved in community hazard assessment and mapping, designing preparedness plans, prevention and mitigation processes, and recovery. Botswana Millennium Development Goal Report [22] show that communities lack adequate preparedness and management capacity to handle climate and environmental disasters. It was further established that the measures to ensure quick and effective response and recovery, decision making, improved planning, effective risk

management, and innovation in the development and environmental protection activities were weak at the community level.

Social work services available to communities during disasters are limited to temporary relief food ration for three months [23]. This intervention does not include risk assessment and management, disaster mitigation, and prevention of the re-occurrence of losses from the hazard. Besides, the national policy on disaster management is silent about their involvement in disaster risk and hazard management. It further implies that the role of social workers is more pronounced during the emergency phase of disasters and thereafter, it fades away. Community social work practice in Botswana that focuses on mass education and literacy, and general social work must incorporate disaster risk management [24]. It must emphasize in its work with village development committees (VDC) and other local association the need to educate community members on prevalent hazards and related risks. VDCs were established by a Presidential Directive of 1968 to promote self-reliance and build unity amongst community members which are critical ingredients for building the social capital for resilience against disasters. The VDC functions should extend beyond identifying and discussing local development needs, developing proposals, and fund raising to include disaster risk management [25,21].

4. METHODOLOGY

Research methodology implies how social science research should be organized, structured, and conducted. It describes the procedures a researcher uses to study a problem in sufficient detail to enable readers to interpret the findings and conclusions. Methods of research include four important aspects: 1) sources of data, 2) measurement processes used, 3) procedures carried out by the researcher, and 4) analysis of the information collected that was used to answer the research question or test the hypotheses [26:246,27:97]. The researcher adopted the mixed methods research design which combines both qualitative and quantitative research paradigms for complementary purposes and triangulation. Data for both phases were collected through face-to-face interviews, questionnaires, and focus group discussions and complemented by the review of country and international disaster policy documents and statutory instruments.

4.1 Sampling

A total sample population of 3567 respondents were randomly selected for the quantitative phase of the study. The sampling process involves the use of two or more sets of samples that are extracted at different levels of the study [28:292]. The final units are included in the sample obtained by first sampling among larger units called clusters, in which the small sampling units are contained [29:134].

The sampling designs enabled the researcher to conduct interviews and administer the questionnaires to obtain the respondents' perspectives on community resilience to disasters. A total of 90 participants were conveniently selected in three (3) wards for each of the three local communities for the qualitative phase. The sample included community leaders, social workers, and members of district disaster management committees as key informants. Thereafter, the researcher studied the details of the data memos' key phrases, ideas, and concepts. The classifications were drawn based on the disaster terminology related to community resilience studies, that is, to describe the social, physical, and geographic environmental hazards and associated risks.

The quantitative data analysis followed a sequence of stages that are stated as follows: step 1: The researcher reported by tabulating the number of returns and non-returns of the survey instrument based on the number of respondents and non-respondents; step 2: Response bias was determined by following non-respondents by phone to assess whether their responses differ substantially from those of respondents; step 3: A descriptive analysis was made of all independent and dependent variables including the means, standard deviations, and range of scores for the variables [30:122]. The analysis of documents took into account four aspects which are; authenticity, representativeness, credibility, and meaning [31:208,32]. The researcher made reference to the national, regional, and international disaster policies and programmes, national legislation (statutory acts and regulations), and strategic frameworks from social workers, stakeholders (UNDP, Red Cross Movement, and SADC), disaster committees, and community leaders.

5. RESULTS AND DISCUSSION

The findings established that Botswana has a national disaster management policy and

national response plan which seeks to enable local communities to participate in disaster risk management. Despite the existence of the national policy, local communities are vulnerable to disasters (floods, windstorms, drought, torrential rains, and pollution) which impact negatively on their livelihoods. Community vulnerability to disasters is increasingly complicated by climate change and variability. The vulnerability of communities to disasters resonates with the lack of knowledge in disaster risk management, inadequate information on environmental hazards and risks, and appropriate intervention.

Climate related hazards, such as, floods, torrential rains, windstorms (hurricanes and cyclones), droughts, and lightening fires are increasingly becoming complex and a threat to environmental sustainability in Botswana. These hazards and associated risks do not only kill people and livestock but destroy housing, infrastructure, the physical environment, from which communities derive their livelihood. Red Cross and Red Crescent Movement [19] shows that climate change leads to more weather extremes including increased floods, heatwaves, droughts, intense hurricanes, and typhoons. These climate hazards and related risks negatively affect the most vulnerable people, that is, the elderly, the sick, and the poorest of the poor in communities. These group of people dependent more on subsistence crops, livestock, and fishing which are climate sensitive by nature and environmentally specific too [33].

As such, the increase in floods, heatwaves, droughts, intense hurricanes, and typhoons subject households, communities, and the physical environment under pressure and increased vulnerability. According to UNISDR [2] a hazard is "a potentially damaging physical event, phenomenon or human activity that may cause the loss of life or injury, property damage, social and economic disruption or environmental degradation. Climate change hazards include latent conditions that may represent future threats and can have different origins: natural (geological, hydro-meteorological, and biological) or induced by human processes (environmental degradation and technological hazards). This shows that climate change is pregnant with destructive power that households and communities should prepare, prevent, and mitigate against. As such, the community history of climate change related hazards associated with the disastrous impact on human life and the physical environment must be used to develop measures to protect communities and promote environmental sustainability.

Climate change related hazards are aversive circumstances that threaten the well-being and functioning of individuals, households, communities and /or society in general [6:127]. The hazards with associated risks place an inconsiderate demand on households and communities to respond with limited social, economic, and psychological resources. When the resources demanded to contain the risks associated with a hazard exceed ability and capacity of households and/or communities to meet strong needs, stress results and it increases the vulnerability and destroys the ability to recover from disaster losses [34:191]. It was established that the negative appraisal of environmental threats and the lack of adequate resources to manage the risks increases stress and anxiety amongst poor households in communities, hence high vulnerability. Morris and Maisto [35:477] argue that stress is an environmental demand that creates a state of tension or threat and requires positive change or adaptation. The positive change or adaptation will depend on the availability of social capital accessible to households and communities to contain and recover from the impact of the hazard. As such, the vulnerability related stress results from the characteristics of the stressor, appraisal of the stressor, the response to effects of the stressor, and the various conditions that influence the relations between the factors [36].

The torrential rains, floods, droughts, and heatwaves affect the physical environment in many ways and change the adaptation patterns of species and human beings. The mere observation of dark clouds and the likelihood of heavy rains may trigger painful memories of past disaster experiences and increase household or individual anxiety [37].

The communities that are vulnerable to climate related hazard have to pre-plan and to define the roles and responsibilities of households in disaster risk management. This must include active participation in hazards identification and risk prioritization based on their vulnerability to the most threatening hazards. As such, their culture must influence them to acquire routines and habits that promote and enhance their capacity against disasters. The institutional cultural practices must generate disaster sensitive interactions and negotiations between and amongst relevant social groups to reduce vulnerability to climate change risks [38].

The community habits and routines that promote ignorance, unpreparedness, weak response, and vulnerability to hazards must be reduced. It was established that respondents' knowledge of climate related risk is low despite the frequency of weather disasters and this may complicate their vulnerability [39:2]. Morrow [40] argues that the roots of local disaster vulnerability are increasingly recognized to be the pre-existing patterns of community settlements and development. Therefore, it is necessary for communities to acquire cultural habits and routines that will enable them to efficiently and effectively develop safety and resilience knowledge and safety oriented social actions ethos. The impact of natural event is determined by everyday patterns of social interaction and organization, particularly the community members and the social structures which determine who has access to resources. Data showed that 52% of the respondents as compared to 48% were not familiar with disaster terminology and that they were not prepared for the following climate change-related hazards are shown below.

- No Floods response 63% (2241)
- No Windstorms response 59% (2107)
- No Torrential rains response 56% (2007)
- No Overflowing dams response 63% (2240)
- No Wild veld fires response 58% (2071)
- No Drought response 63% (2241)
- No Climate change response 72% (2576)
- NO Earthquake response 84% (3012)

The flood vulnerability assessment is an important means of keeping the community safe. In Botswana, communities on a yearly basis suffer the loss of crops, livestock, and property from floods. Historical trends show that in 1995, 2000, 2005 and 2009 several communities in Botswana were affected severely by floods and these were Palapye, Serowe, Mahalapye, Chobe, Maun, Tutume, Bobirwa, Ramotswa, and Boteti and losses were enormous. Families lost 26 cattle, 1139 goats, 20 sheep, 90 donkeys, and 3535 chickens [33,11]. Despite the losses experienced by these communities, appropriate preparedness and response measures have not been developed. Floods are rapid onset disasters that must be conceptualized based on their pattern of occurrence and frequency in the community. Floods may result from heavy torrential rains; water flowing from high areas to low areas, flash floods, overflowing rivers, and dams. The Dartmouth Flood Observatory [41] and EM-DAT [42] showed that severe floods have increased, restrained economic development, and exerted enormous pressure on affected communities. It may also flood simply because the floodplains have been blocked by new settlements, and building homes without considering waterways [39]. In terms of floods vulnerability, amongst a total of 3457 (97%) respondents, 2241 (63%) indicated that they were vulnerable while 1216 (34%) said they were not. In addition, 110 (3%) could not evaluate their status and thus becoming even more vulnerable. It may demonstrate that, in the event of floods, 66% will be vulnerable and may complicate response measures. See Table 1:

Windstorms pose a serious risk to communities in the South East and other districts in the country. UNDP [43] states that 220 million people in Africa are exposed annually to natural disasters and have the highest vulnerability to windstorms. Therefore, communities should identify their vulnerability levels to windstorms and develop preparedness and response systems to protect their property and livelihoods. The government of Botswana [44] identified droughts, floods, windstorms, and veld fires as prevalent natural hazards in the country. Section 12 of the national policy on disasters states that each agency (government and non-governmental) is responsible for developing its own internal disaster plan detailing the

responsibilities at national, district, and local levels. This means building and positioning houses based on knowledge about the direction of strong winds and their speed, and frequency, and vulnerability to loss. Failure to utilize the knowledge when building houses and other structures may lead to weak preparedness measures for windstorms. In this regard, 2107 (59%) said they were vulnerable to windstorms while 1245 (37%) said they were not, and 215 (6%) could not evaluate their risk status. Table 2 below shows vulnerability to windstorms;

Gender related vulnerability must be taken seriously by communities various district, especially as it applies to women and children. Community measures to reduce vulnerability to disasters must be sensitive to gender differences. Vulnerability to disasters and associated factors manifest differently for women and men. Both genders are affected differently by disasters and women coping capacity may be weakened further by low socio-economic status (9). It was ascertained that amongst the respondents, 774 (58%) men were vulnerable as compared to 556 (42%) who were not; and 1333 (66%) females were vulnerable compared to 689 (34%) who were not. There are large numbers of both males and females who are vulnerable to windstorms. Therefore, gender sensitive programmes are needed to strengthen community resilience to climate related disasters in the South East District.

The heavy rains in the central region of Botswana in June 2009 caused seven districts to flood and affected a total of 620 families or 3 100 individuals. The affected families lived in and occupied structures built with mud that collapse easily under heavy rain, leaving them in need of emergency shelter, blankets, and food. Rains are experienced in Botswana in summer and communities are rarely prepared to absorb the shocks [45]. It was found that 2007 (56%) of the respondents were not prepared and vulnerable while 1350 (38%) reported that they were not. The lack of preparedness of communities for heavy rains complicates floods response and evacuation. Table 3 below shows the percentages of vulnerable people.

Table 1. Vulnerability to flood/flash floods

		Frequency	Percent	Valid percent	Cumulative percent
Valid	yes	1216	34	35	35
	no	2241	63	65	100
	Total	3457	97	100	
Missing	System	110	3		
Total		3567	100.0		

Table 2. Preparedness against windstorm

		Frequency	Percent	Valid percent	Cumulative percent
Valid	yes	1245	35	37	37
	no	2107	59	63	100
	Total	3352	94	100	
Missing	System	215	6		
Total		3567	100.0		

Table 3. Status of preparedness to torrential rains

		Frequency	Percent	Valid percent	Cumulative percent
Valid	yes	1350	38	40	40
	no	2007	56	60	100
	Total	3357	94	100	
Missing	System	210	6		
Total		3567	100.0		

The communities in Botswana are vulnerable to overflowing dams. There is a need for a response plan which should be part of the dam management and/ or construction agreement. During the dam construction, the company should conduct flood simulation exercise with communities and ensure that they continue the process after the completion of the project. The simulation exercise will strengthen community flood preparedness knowledge and skills incorporation in their daily living activities [46]. Overall, it was found that 2240 (63%) lacked knowledge on flood risk and vulnerability assessment while 1093 (31%) said they had. The Table 4 shows vulnerable to overflowing dams.

Dams in Botswana that are built in the major rivers have over-spilled and flooded communities living along the rivers. Despite threats from overflowing dams, community preparedness against floods must be strengthened. The findings show that age distribution regarding vulnerability to overflowing dams is that 106 respondents aged 20 and below were vulnerable while 49 were not. For those aged 21-30, 972 were vulnerable while 494 were not; 589 of those aged 31-40 years were vulnerable while 323were not; 238 of those aged 41-50 years were vulnerable while 117 were not; and 332 of those aged 51 and above were while 109 were not. All age groups have to be targeted for hazard and risk management education to minimize the threats and dangers. The findings show high numbers of both women and men who are vulnerable to overflowing dams. It was established that 472 of the males had some understanding of what to do when dams overflow while 846 did not and 621 of the females also reported to be knowledgeable of what to do while 1394 did not.

Wild land fires (veldt fires) in Botswana occur in spring, summer, and winter when the grass is dry and the harvesters are in the field doing their work [4,46]. Although the government has strengthened its fire-fighting systems, communal lands are still vulnerable to wild land fires. It was established that amongst the 3321 respondents, 2071(58%) were vulnerable to wild land fires while 1250 (35%) were not. Table 5 shows the vulnerability to wildland fires;

The age distribution indicates that, of those aged 20 and below, 87 were vulnerable while 68 were not. Of the 21-30 year age group, 879 were vulnerable while 581 were not; of the 31-40 year group 579 were vulnerable while 338 were not; 225 of those aged 41-50 were vulnerable while 124 were not exposed; and 318 of those aged 51 and above were vulnerable while 118 were not at risk.

Drought in Africa affects the food security of more than 2 billion people who reside in dry countries. Drought is defined as “a deficiency of precipitation over an extended period of time resulting in water scarcity” [17]. The 1983/84 drought cost the Botswana Government US$ M51 939 to mitigate [10]. Many Batswana still dependent on agriculture (commercial and subsistence) for both food and income [47]. But rainfall deficiency in the country affects crop and livestock production negatively. During the 1985 drought, there was a reduction of 87% in crop production [40]. Drought is defined as a period in which moisture availability falls below the current requirements of some or all of an area's residential communities and below their ability to sustain the deficit without damage, disruption or excessive costs [38]. A total of 3305 (93%) of the respondents answered a question on drought and 2241 (63%) reported to be vulnerable to drought. Table 6 below displays the numbers of those vulnerable to drought.

The age distribution shows that vulnerability to drought affects all age groups. Ninety-one (91) of those aged 20 and below were vulnerable while 65were not; of those aged 21 – 30 years, 947 were vulnerable while 509 were not; of the 31 – 40 year age group, 628 were vulnerable while 282 were not; of those aged 41-50 year, were vulnerable while 112 were not in this regard; and for those aged 51 years and above, 339 were vulnerable while 93 had systems in place to survive drought period. There is need therefore for community based interventions to address

Table 4. Preparedness level to overflowing dams’

		Frequency	Percent	Valid percent	Cumulative percent
Valid	Yes	1093	31	33	33
	No	2240	63	67	100.0
	Total	3333	93	100	
Missing	System	234	7		
Total		3567	100.0		

Table 5. Preparedness for wild land fires

		Frequency	Percent	Valid percent	Cumulative percent
Valid	yes	1250	35	38	38
	no	2071	58	62	100
	Total	3321	93	100	
Missing	System	246	7		
Total		3567	100		

Table 6. Preparedness to drought

		Frequency	Percent	Valid percent	Cumulative percent
Valid	Yes	1064	30	32	32
	No	2241	63	68	100
	Total	3305	93	100	
Missing	System	262	7		
Total		3567	100.0		

vulnerability to climate related disasters and risks. These interventions should include community education and awareness of hazards and risks and best ways to avert them [48].

5.1 Recommended Community Based Interventions for Disaster Risk Management

Community interventions are needed to promote environmental sustainability and preservation of herbage and livelihoods. Community daily survival activities, settlement patterns, and social interactions may degrade and/ or increase the environmental damage caused by natural events. Unless their actions, habits, and attitudes are changed and geared towards environmental sustainability and minimization of risks, vulnerability to climate change related hazards will continue and be fatalistic [48,46]. Communities that deliberately engage in disaster risk management enjoy the greater benefits of preparedness than those who remain passive and reactive. Rock and Corbin [49:383] argue that recovery from disaster for unprepared communities and households can take many agonizing years and complicated further by vulnerability and lack of resources. Guyana which was still recovering in 2007 from the 2005 flood and Grenada, from 2004 Hurricane Ivan which killed 28 people are good examples. As such, recovery from disasters for unprepared communities may constitute an additional burden to already weak economies. The social structures may crumble and development resources may have to be diverted to pay for reconstruction costs that could have been avoided. As such the following actions are recommended:

- **Community hazard and Risk mapping:** community maps showing hazards and risks are important and the map isolates areas according the level of risks. IFRC [50] urges communities to rely on local knowledge when identifying the dangers they face, assessing their capacities, vulnerabilities, and formulating solutions. The areas of high, moderate, and low risks are clearly marked for purpose of mobilizing appropriate resources for response. Red Cross and Red Crescent Movement [19] asserts that communities experience impacts of climate change first hand, with crops dying because of seasonal wind patterns, fish poisoning, and storm surges.
- **Community risk management plans:** this follows after the community has identified and mapped hazards and risks. The intention is to develop climate change risk management plans to guide actions against adverse impacts of climate disasters. As such, a community risk management plan identifies the dangers and defines roles and responsibilities for stakeholders in the community before, during, and after disaster. It is a framework that outlines essential activities for the development of a preparedness strategy [51:11]. These include community and household preparedness towards climate change-related hazards, prevention / mitigation, response, recovery, and reconstruction measures. The preparedness plan will detail the early warnings, the evacuation plan and processes, response activation, and the recovery strategy.

- **Early warning systems:** are fundamental to disaster resilience and safety for communities and families. IFRC [52:17] argues that early warning and early action can save thousands of lives and livelihoods, reduce vulnerability, and strengthen resilience. The selected communities do not have structured early warning systems and / or traditional systems. They rely heavily on Radio Botswana and Botswana television weather broadcast which gives only an overview of the weather and nothing beyond. The radio and television weather forecast focus more on prediction of the weather than on response and expected behaviour. Furthermore, the messages do not communicate in simple and understandable terms the information about risks to vulnerable members of the community. The lack of clear communication about actions to be undertaken may affect the evacuation of people from a disaster zone to safety, particularly those who live in high risk areas.
- **Evacuating** people from a disaster scene is a complex process. It requires extensive preparation of the communities before disaster to avoid unnecessary delays. The lack of an evacuation system and preparation may turn out to be frustrating and very stressful exercise for survivors and the rescue teams. According to Perry [53:25] evacuation which is instituted before disaster impact can result in the preservation of life, reduction of personal injuries, and the protection of property." The study indicated that the selected communities do not have disaster evacuation plans. They rely heavily on the police, the army (BDF), and the Fire Brigade service for evacuation during disasters.

The communities should have clearly marked evacuation routes, evacuation sites, and evacuation protocols that have been rehearsed and are known to members by heart and would be followed with little effort before, during, and after disasters. The lack of evacuation processes is extremely precarious and can cause the loss of lives in communities, as it did in Ramotswa in 2006. The failure to develop an evacuation plan is rather choosing a reactive stance with its negative consequences than a proactive position with its benefits. Drabek [54:76] argues that thousands who perished or suffered injury because of the three extreme windstorms in the United States (hurricane Georges, Mitch, and torrential rains) are testimony to both the hazardous of the place and the potential represented by ineffective disaster warning and evacuation systems.

- **Community education and awareness:** Community education on climate change, hazards and risks, and sustainable environmental practices are central to survival of people and their resilience. Community knowledge of global warming and its effects on agriculture and daily subsistence is inadequate and including preparedness, and in particular positive lifestyle adaptations [8]. The education and awareness in schools, clubs, churches, and traditional gatherings should be driven by community volunteers. This will ensure that appropriate information on hazards and related risks and ways to reduce vulnerability is shared adequately. The teams should address hazard and risk monitoring, early warnings, and related protocols as well as information on who to contact in the event of disaster.
- **Community capacity building (climate change and environment):** Communities need to build internal capacity to adapt to climate change related hazards for sustainable livelihoods. Already, communities have fundamental resources to absorb the shocks and leverage until external support is provided in the event of disasters. These resources constitute the social capital needed for preparedness, response, reconstruction, and recovery from disaster within a short time. In Otse, for example, they have hills, culverts for water drainage, supplementary cattle feed provided by government during drought, school buildings, church buildings, clinic, and water catchment tanks, and tarred roads to build as capacities. Mogobane has farms, culverts, roads, bridges, clinics, and police offices as resources to use in the vent of disasters. These must be constantly assessed to keep an up to date inventory and resource mobilization for emergencies.
- **Community monitoring and evaluation:** The community must consistently monitor the hazard and risk in their locality and share information with community members. This will provide the community

with timely information in a language and culture they understand and can follow without much difficulty. Disaster related information is vital to activate the early warning systems, evacuation systems, and response system for any particular threat [13,32]. Communities will not have to wait for the national radio announcements and other related processes to know what is prevailing in their socio-environment. As such, the team responsible for monitoring and evaluating hazards and risks should know whom to send the information to and make appropriate follow ups.

6. CONCLUSION

Although communities in Botswana are vulnerable to environmental hazards and related risks, they can work to build their capacity to respond and contain the shock. It has been established that the vulnerability is accentuated by the failure to prepare against hazards and risks. These hazards are windstorms, floods, torrential rains, overflowing dams, wildland fires, and drought which are climate related hazards. Furthermore, these hazards complicate the community recovery and reconstruction processes because there are no established systems. So the impact of successive hazards becomes even more complex and depletes already weak response capacities. Therefore, communities must deliberately engage in community hazard and risk mapping, develop community risk management plans, early warning systems, identify volunteers who will carry out the community education and awareness campaigns, build capacity by training teams, and monitor the changing patterns of hazards and risks. These activities must not only be carried out during emergencies but must continue post disasters to ensure that communities are kept ready for other eventualities.

Community development practitioners, particularly social workers have knowledge, competencies, and skills to help communities organize to prepare against disasters. They are the key players in community mobilization and organizing which are fundamental to driving the preparedness process and establish various teams for disaster risk management. They are familiar with the community leadership structure, situations and their complexities, and possess practical knowledge essential for preparedness and response. They can also work with volunteers to stockpile relief material and coordinate the recovery and reconstruction of damaged structures after disasters. As such, communities have the potential to prepare and build resilience against disasters, thus reducing their vulnerability and sustaining their subsistence in the physical environment.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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