



Social Work Insights on Flood Early Warning in Botswana

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The sole author designed, analyzed and interpreted and prepared the manuscript.

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ABSTRACT

Flood early warning systems are crucial for communities (households and individuals) to act appropriately and mitigate or prevent hazards from becoming disasters. They empower communities and households to respond and act appropriately to reduce the risk of death, injury, loss of property or damage from floods. Botswana communities are prone to floods and heavy rains. These floods have had a significant impact on communities (individuals and households). Between 1980 and 2010, the country experienced 14 floods disaster events which killed a total number of 686 people and affected 1, 340 496. During the same reporting period, averages of 22 people were killed per year, 43,242 people were affected, and the number affected by floods continues to increase over the years [1]. In 2009, Botswana received heavy rainfall (100 mm) with the most affected areas being Dukwi, Sua, Mmatshumu, Lephephe, and Moseitse. The rationale for the present paper arose from a realization that disasters are increasing in number and severity but no early warnings systems have been developed. John Oliver [2] defines disaster as a part of the environmental process that is of greater than expected frequency and magnitude and causes major "human hardship with significant change". Despite the frequency of flood disasters, communities have not developed early warning systems that will assist with the minimization of disaster risks. It is vital to note that the structure and functioning of flood early warning systems will vary from one

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community to another in order to fit the population group/community at risk. Therefore, this paper explores and interrogates flood vulnerability factors and the design of flood early warning systems for Botswana communities, their significance, and the need for enhanced mechanisms to reduce the risk of disasters. Furthermore, it charts the way-forward in relation to developing community relevant flood early warning systems by social workers and communities.

Keywords: Disasters; early warning system; social work; communities; crisis.

1. INTRODUCTION

Social work as multi-faceted profession plays a vital role at the community level in disaster risk management and/or problems that emerge from disasters such as heavy rain and floods. The social work profession has long been involved with disaster relief, both through the profession's roots in the provision of wartime relief, and its concern with the peoples' physical and social environment. Beginning with the Civil War and continuing with the formal role of social workers in Vet Centers, social workers have helped treat the trauma resulting from wartime deployment [3]. Social workers are community developers, counselors, educators, policy makers, and coordinators amongst many other roles that they play. As such, they play a key role in disaster recovery through facilitating community development, restoring livelihoods, providing psychosocial support, and building local capacity.

Just as disaster prevention is part of the mission of the social work profession, disaster social work should be concerned with the designing of appropriate flood warning intervention in the social and physical environments. The flood warning system will be for individuals and groups a means of preventing serious long-term social, health, and mental health problems after disaster [4]. Individuals and families in the communities are traumatized and debilitated in every area of their daily lives from the loss of life and health, infrastructure, property, jobs, and social ties to some extent during disasters [5,6]. For social workers, the focal point of disaster management involvement should be to ensure people are warned on time, minimize disaster risks, maximize resources, and streamline administrative processes for vulnerable populations [7,8].

In social work research, disasters are seen as a type of collective stress situation, in which many individuals fail to have their needs met through societal processes [9,10]. Disasters are distinguished from other types of collective stress because, first of all, disasters are crisis situations

[11,12]. Social work intervenes in disasters in different ways to relief individuals, families, organizations and communities from stress and trauma. As such, social work practice in the form of casework, group and community work, or social policy and planning should incorporate disaster risk management, in particular effective early warning system [13]. Areas of concern for social work in disaster situation should include coping with traumatic stress, early warning dissemination, resource mobilization for disadvantaged and vulnerable groups, advocacy for pro-disaster policies, and coordination of various intervention systems [14,15].

Social work should enhance community participation in early warning development, adoption, and implementation using its method and techniques devoted to improving the well-being of communities and help to meet their basic human safety needs, with particular attention to the needs and empowerment of people who are vulnerable to disasters, oppressed and living in abject vulnerability [16]. There is also a need for social workers to integrate disaster risks resulting from the social, economic, and environmental factors into social policy and community social work practice, and ultimately the design of relevant flood early warning systems for community practice. The study explored the need to develop flood early warning systems for flood prone communities in Botswana, their significance, and the need for enhanced systems to reduce the risk of disasters.

2. THE CAUSES AND DANGERS OF FLOODS IN BOTSWANA

Social workers in Botswana work with communities, individuals, and households that are affected by floods on yearly basis. Therefore, there is need for them to understand risks associated with flooding in their communities and design appropriate early warning measures. Flooding in Botswana, results from multiple factors. For example, storm surge, sudden and

heavy rains, overflowing dams, and river spillages. The 1999/2000 floods are considered the worst in the history of Botswana, they were sudden and from heavy rains. During the 1995 floods, areas severely affected by floods were Palapye, Serowe, Mahalapye and Boteti. In five Botswana veterinary districts, 128 families were affected. They lost 26 cattle, 1 139 goats, 20 sheep, 90 donkeys, and 3 535 chickens [17]. There have since been other floods in 2000 though the damage was less severe than during the 1995 floods. Also in 2009 the Chobe and Northwest Districts were flooded by waters overflowing from the Okavango and Chobe rivers into the low plains that for years have been dormant [18].

The heavy rains in June 2009 flooded seven districts, which are; Serowe, Palapye, Tutume, Boteti, North-West, Mahalapye, and Bobirwa) and affected 620 families which translates to 3 100 individuals. The affected families occupied traditional mud huts which could not withstand the heavy rainfall, leaving them in urgent need for shelter, blankets, and food. Approximately 3 789 persons were affected in the flood-ravaged Ngamiland District, located in the North-west corner of the country. In addition, the Southern African Development Community (SADC) Regional Remote Sensing Unit established that more than 100 mm of rain was recorded in 24hours in these districts by the Department of Meteorology registered rainfall figures [19]. This was far above the 50 mm average annual rainfall for most parts of Botswana. The central region of Botswana was again on the 16-23 Jan 2013, experienced heavy rains and extensive flooding. This time around 842 families (4210 persons) were affected, 300 families were relocated including 125 refugee families. These rains damaged homes, roads, flooded dams and fields and killed livestock which is the communal livelihoods [20].

The Botswana Government [21] showed that the floods in 2010 were worse than those of 2009 and the situation was complicated by the natural reservoirs which were relatively full from the 2009 flows. Despite experiencing heavier floods in 2010 as compared to 2009 in the Okavango Sub District, fewer families were relocated based on adopted disaster risk reduction interventions. The past intervention measures included the allocation of plots on higher ground and building of more than 91 houses for some of the survivors by the NDMO.

3. THE GENERAL EFFECTS OF FLOODS IN BOTSWANA

Botswana is mainly semi-arid to arid because of its average position under the descending limb of the Hadley cell circulation. Botswana is a landlocked country in southern Africa. It lies roughly between latitudes 18 and 27°s and longitudes 20 and 29°E, a region covered by approximately 582, 000 km² with a population of 1.7 million people [22]. The landscape is flat to gently; the Kalahari Desert, located in Botswana's southwest, covers nearly 70 percent of the country, with remaining areas being primarily tropical grassland and savanna. Almost all rainfall occurs during the summer months of November to March: in early summer, the interior thermal low and most northeasterly flow deepen, allowing upper westerly waves to bring isolated rainfall; in mid to late summer, tropical easterly systems and continental troughs edge into Botswana [23,24]. During these periods, most rainfall occurs in spells of 24 days with occasions of heavy rainfall accounting for the bulk of the rainfall [25]. This climatic environment means that the presence or absence of a few weather systems makes the difference between a wet or dry year and thereby makes Botswana prone to floods and heavy rains [23,24].

Floods have large social consequences for communities and individuals in general and Botswana. Impacts of flooding includes loss of human life, damage to property, destruction of crops, loss of livestock and deterioration of health conditions owing to waterborne and other communicable diseases [25]. Roads and bridges are damaged and movement of people from home to work is disrupted. Some economic activities come to a standstill, people are forced to vacate their homes and relocate to temporary shelter, and normal life is interrupted. Damage to infrastructure also causes long term impacts, such as disruptions to supplies of clean water, wastewater treatment, electricity, transport, communication, education and health care. Communities can be left vulnerable, both socially and economically.

Floods also traumatize victims and their families for long periods of time. The loss of loved ones has deep impacts, especially on children and surviving spouse. Displacement from one's home, loss of property, and disruption of business, and social affairs leads to continuing stress. For some people the psychological impacts can be long term while for others it can

be short term depending on their coping ability and the support within the social environment. Stress is a relational concept that reflects an imbalance between environmental demands and individual and social resources to cope with those demands. It is further argued that the effect of stressors results from the perceptions and responses to the stressors by the people involved [26].

The National Disaster Management Office [21] reported that the flooding of the Okavango River in 2009 left more than 800 families displaced. The floods had submerged the water treatment plants, schools, and community halls in the Okavango district. Roads and bridges were also destroyed and communities were cut off from the outside world. In 2010, 170 families had to be relocated to higher grounds [18]. The villages affected by the floods in that year were Mohembo East, Nxamasere, Ikoga, Kauxi, Etsha 13, Eretsha, Tubu and Jao (Botswana Government, 2010). The affected families and households were relocated to safe and higher areas. Auspiciously, they had harvested their crops and which minimized the impact of flooding on food availability. Etsha village amongst the rest was the hardest hit with 94 households affected. In Tubu, the water damaged the access road and isolated the residents and pupils from going to school and the clinic. The families were response was led by the District Disaster Management Committee (DDMC) in Gumare.

Due to the intense rainfall, flash floods are commonly experienced on local scales, although widespread flooding at the national scale sometimes occurs. For example, the combination of a tropical low in early February 2000 and a tropical depression later that month resulted in floods that ravaged the Southern Africa sub-region, including Botswana, causing extensive damage to infrastructure and property [21,24]. Floods are the most frequent natural disasters in Botswana; they have continued to cause socio-economic losses. Therefore there is need for flood early warning systems to be put in place in order to prevent or mitigate the effects of this natural phenomenon.

4. THE NEED FOR FLOOD MANAGEMENT SYSTEMS

Damage caused by a floods can be effectively contained if flood early warning can be given and communicated to disaster management department, decision making officials, and to all

those communities and households that might be affected and if the correct decision is made and carried out to ensure that everyone is aware of and prepared for it (preparation includes emergency evacuation of people and variables, and training people in what actions to be taken when facing a disaster, for example, hiding, self-protection, and first aids skills). Flood risk management is dependent on effective flood forecasting and early warning systems providing additional preparation time before a flood event. Currently the European Flood Alert System (EFAS) is one initiative extending flood forecasting and warning lead time at continental and/or global-scale early warning systems. –. The EFAS, an advanced prototype of a continental flood alert system, uses several deterministic weather forecasts to produce probable flood alerts with the lead times of up to 15 days [27].

EFAS appears to be a valuable early warning resource for Africa and Botswana. This stems from its large-scale approach underlying its hydrological model (LISFLOOD) [27], its adaptability to limited input data, the lead time of up to 15 days, and its clear, concise and unambiguous visualization and decision making support products. As such, it can facilitate the flood management at national and continental level and improve the coordination of international flood aid [28]. The Lisbon Declaration on 'GMES and Africa' shows that the development of this system in Africa has gained increased political and scientific attention [29]. It is projected that the vulnerability to floods will rise due to climate change and variability alongside the steady increase in population and urbanization [30]. In Africa, severe flood events have increased over the last 10 years, affecting millions of people and economic development, and exerting enormous economic pressure on the affected poor countries [31,32]. Therefore, considerable effort has to go into the mitigation of flood-induced damages in Africa and Botswana.

5. THE METHODOLOGY OF FLOOD EARLY WARNING SYSTEMS

Methodologically, flood warnings can be viewed in terms of a system involving a complex array of interconnected components. Warning processes and responses involve at least the following steps: 1) detection and estimation of hydro-meteorological conditions by either official or unofficial sources; 2) collation and evaluation of hydro-meteorological information; 3) decisions on who should be warned about the flood

danger, and in What way; 4) transmission of a warning message through available communication channels; 5) response to the warning message by the public, and; 6) feedback resulting from evaluation and actions of warning recipients [33]. However, to be appropriate, this ideal flood warning system must be tailored to the individual region, with careful attention given to climate, economic, social, and political constraints. An early warning system should integrate social factors that affect public response to warnings. Understanding the processes of the system within a social context is essential to understanding its effectiveness within the socio-physical environment. Refer to Fig. 1.

The United Nations International Strategy for disaster Reduction [34] asserts that early warning information systems must be people and location centered and they should integrate four (4) elements namely; knowledge of the risk faced, technical monitoring and warning service, dissemination of the meaningful warning to those at risk, and public awareness and preparedness.

Furthermore, failure in any one of these elements can mean failure of the whole early warning systems. Basing on the past community disaster experience in Botswana, it is evident that flood early warning would play a vital role in the safety and resilience of people to disasters. Through the 1990s, the improved and effective flood early warning systems lead to the reduction of loss of life, property damage, and social and economic disruption caused by floods, especially in developing countries. From the beginning of the decade, it has been recognized by the United Nations and professionals that early warning needs to bring scientific and technical abilities of hazard identification and forecasting together with effective communication, the commitment of public policy and the understanding and participation of local communities. Early warning systems are an important means to reduce disaster losses. To be effective, early warning systems need to actively involve the communities at risk, facilitate public education awareness of risks, effectively disseminate messages and warnings and ensure that there is constant of preparedness.

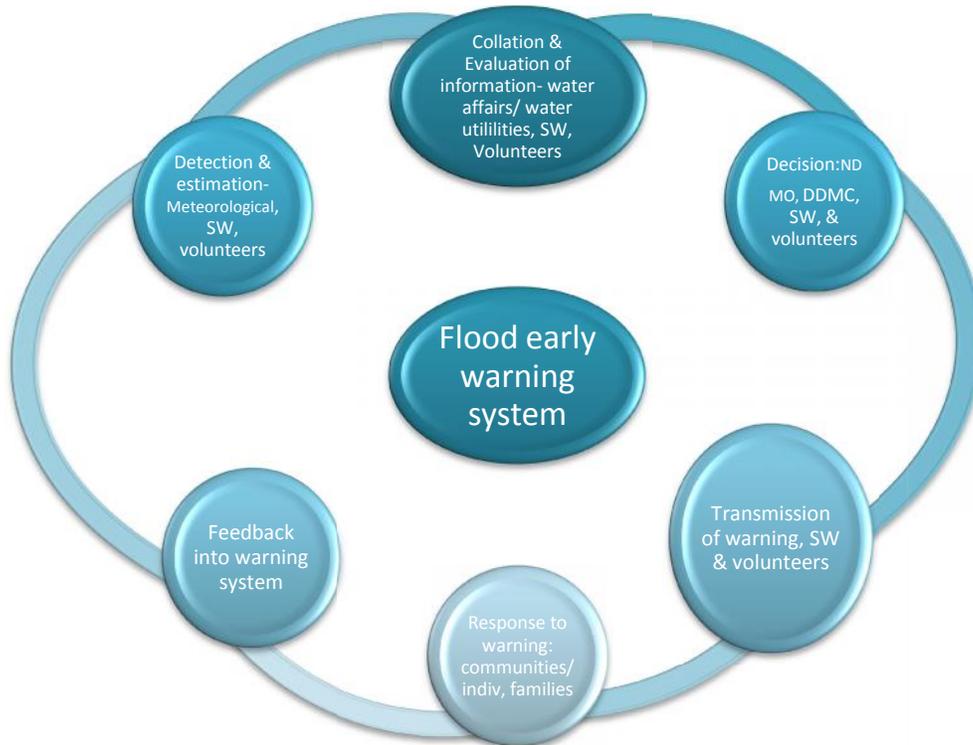


Fig. 1. Flood early warning system

The Hydro-Framework for Action [34] spells out the need to have “early warning systems whose warnings are timely and understandable to those at risk including guidance on how to act upon receiving warning”.

Disaster management committees in China established their specific monitoring and early warning systems, which they have gradually evaluated and strengthened. The monitoring and early warning is built from four networks consisting of the following three (3) components:

1. The network for observation of natural hazards, relevant elements and phenomena;
2. The telecommunication system for real time collection, transmission and exchange of the observation data;
3. The system for data processing, analysis and diagnosis, modeling and formulation of forecasts or warnings; and to the system for services, including the transmission and dissemination of such forecasts or warnings.

The normal process of any early warning system has three inter-related stages [35]:

1. Evaluation/forecasting (observation and prediction), based on scientific expertise and advanced technologies (e.g. mathematical modeling, remote sensing). A great deal of effort and resources have gone into this stage, resulting in significant advances in some areas of forecasting. This stage is the scientific and technical dimension of early warning.
2. Warning / dissemination, where forecasts are turned into messages and transmitted by appropriate agencies as recommendations for action. There has been considerable investment in this stage too. In particular, rapid advances in communications technology have greatly improved the speed in which warnings are transmitted. At this stage, early warning requires institutional and political characteristics.
3. Responses, where warnings are turned into actions. The actors in this process are more numerous and diverse. They include officials at the national and local level, non-governmental organizations (NGOs), communities and individuals. This 3rd stage sees the institutional and political aspects of early warning broadening out and the

early warning process acquiring an essentially social dimension where the ‘human factor’ of risk perception and decision making plays a crucial part. It has not received as much investment as the first two stages.

Key elements in the success of an early warning system:

- (i) Forecasts must be accurate in predicting the location, time and severity of a hazard event.
- (ii) Warnings must be disseminated in time for populations at risk to make themselves safe.

Early warning could be more effective if the threatened population is made aware of the hazards and risks they face and communication based approaches in disaster preparedness must be put into practice. There is a pressing need to accurately predict hazards and reduce the devastating effects of disasters. Early warning is an important activity within the general scope of disaster preparedness [28]. An early warning is issued only after detecting the forthcoming hazard based on careful analysis of geological, meteorological and atmospheric interactions and processes. Monitoring and predicting hazards involves scientific and technical skills, knowledge and expertise. Issuing alerts involves communicating the forecast by translating the findings into terms understandable for the general public. Comai and Tena [36] argue that an early warning system sets the framework for a systematic process of gathering and analyzing data, based on several indicators defined by the organization and prepared after reviewing the different key actors in a specific environment.

6. THE GENERAL BENEFITS OF FLOOD EARLY WARNINGS

Flood early warning saves lives and property, if people are warned early about the hazards, they are more likely to evacuate to safety and take precautionary measures without undue resistance and delays. The flood early warnings will enable individuals and groups to arrange their lives in relation to the hazards within their environment. Mozambique, which has suffered severely from seven major floods (hurricanes and tropical cyclones) since 1980, has drastically reduced the loss of lives and property by establishing flood early warning systems.

Mozambique flood forecast is coordinated by the National Directorate of Water, the National Institute of Meteorology, and National Disaster Management Institute. It provides forecast of flood risk, detects and monitors flooding, and put out flood warnings and paving the way for a coordinated response [37]. It is vital to invest in flood early warning systems to save lives and help protect property. Timely flood warnings, effective communication and response will permit a country's and community economy to rebound quickly from hazards. Hellmuth [38] argues that reducing uncertainty caused by vulnerability to climate variation could have direct positive effect on people's livelihoods.

We know that we are capable of reducing the death toll even in poor countries; moving food averts a famine despite droughts and early warning reduces deaths from storms and floods. However, in general, the evidence suggests that we tend to spend more on relief than on prevention and that this is a public preference despite the evidence that indicates investment in prevention is more valuable than spending on relief [39]. Early warnings give people time to flee from a flash flood, enable local authorities to evacuate or shelter large numbers of people in advance; provide information on the occurrence of a public health hazard; and enable a faster response to problems of food and water insecurity. Warnings issued well before an event also enable people to protect some property and infrastructure. In general, the longer the lead time, the greater amount of property and infrastructure that can be protected. Early warnings of flooding risk have been shown to be effective in reducing flood related deaths [40].

7. WAY FORWARD FOR SOCIAL WORK

Social workers, communities, and households in Botswana should identify areas prone to floods risks using their disaster risk management knowledge and skills as well as working with vulnerable groups within their physical environment that are the most susceptible to floods. They should work to map the capacities and the vulnerabilities and factors that promote vulnerability to floods then design community early warning system geared towards reducing the flood risk and impact in the event of disasters. In addition, they should establish community action teams that will be responsible to disseminate community education and awareness on early warnings and codes, response systems, monitoring the changing

patterns of hazards and risks, and compiling information on the successes and failures of interventions for good community flood early warning practice.

8. CONCLUSION

It is the responsibility of both communities, households and social workers to reduce the risk of floods and / or the impact it has on vulnerable populations in Botswana and worldwide. This requires the design, adoption, and application of appropriate comprehensive flood warning interventions that will aim at improving the safety of individuals, families, and communities and build resilience. In summary social work functions could be; support for passing flood early warning messages to individuals and families; Link individual's information needs and early warning resources and help the clients to access these resources; prevent severe physical and mental problems; prevent individuals, families, groups, organizations, communities from breaking down during disasters; intervene to change the flow of disaster information at the micro and macro systems to improve clients' well-beings. Social work plays a vital role in mitigating and managing floods early warning systems at individual, family, household and community level and the profession should be an important part of any disaster recovery processes.

COMPETING INTERESTS

Author has declared that no competing interests exist.

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