

FLOOD RISK REDUCTION IN BOTSWANA: ANALYSIS AND RECOMMENDATIONS

Keofitlhetse Moetsabatho-Moipisi

A thesis submitted in partial fulfillment of the requirements for the degree of Masters of Arts in the Department of Geography and Environmental Studies, University of the Western Cape.



Supervisor:

Professor G. H. Pirie

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DECLARATION

I declare that *Flood Risk Reduction in Botswana: Analysis and Recommendations* is my own work, that it has not been submitted before for any degree or examination in any university, and that all the sources I have used or quoted have been indicated and acknowledged by means of complete references.

Keofithetse Moetsabatho-Moipisi

December 2006



Signed:

A handwritten signature in black ink, appearing to read 'Keofithetse Moetsabatho-Moipisi'.

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ABSTRACT

The turn-of-the-century floods in Botswana resulted primarily from prolonged heavy rainfall which started in December 1999 and extended into January 2000. The floods covered almost the whole of Botswana. They caused devastating economic losses to the value of US\$ 214 million (Mogwe, 2001), afflicted 80,000 people and caused 13 fatalities (Thedi, 2003).

Although the extent of damage caused by the 2000 floods was unexpected, paradoxically, the occurrence of the floods was likely. Botswana's past rainfall records indicate that drought is interspersed by high rains and floods. This being the case, the 2000 floods were not an anomaly but a matter of course. The impacts of the floods were however exacerbated by a number of factors. The geological foundation of the areas of acute flooding consists mainly of hard impermeable rocks overlain by loose mobile soils with minimal infiltration capacities. In addition the country's physiography comprises flat terrain which also had a significant bearing on the infiltration of rainfall run-off. The other factor relate to anthropogenic influences. Human interference with the natural environment has changed the landscape. In Botswana, there is acute deforestation in and around settlements coupled with the creation of impervious roads, pavements and roofs; this affected percolation and infiltration, increasing rainfall run-off and exacerbating flooding. Arising from these factors, the research argues that flood risk disasters are as important as drought and animal disease and must be included in state policy.

The research also documents Botswana's intervention strategies and mechanisms employed during the 2000 floods in relation to best practice in flood risk management through the application of the UNISDR Disaster Risk Reduction framework. The management of the 2000 flood risks by the Botswana government was predominantly traditional in approach, with great emphasis on preparations for response operations. This involved contingency planning and identification of the actors or role players, but made minimal reference to the involvement of communities at risk. Evacuation centres were identified and relief was organised from local and international organisations. Response involved mainly rescue operations, evacuation of victims, and distribution of relief aid. Rehabilitation and recovery was limited to repair and reconstruction activities. The management of the 2000 floods revealed that it followed a top-down approach in which the government was mainly a provider of aid and other necessary coping strategies. Other weaknesses include communication gaps between the National Disaster Management Office (NDMO) and Meteorology Department, ambiguity in relation to role designation, and fragmentation in statistical records of flood incidence and disaster. In conclusion, the research makes recommendations with close reference to the UNISDR's Disaster Risk Reduction framework in relation to effective warning channels and information dissemination. Further training and research in the various aspects of disaster risk management is also essential.

Keywords

Botswana

Contingency planning

Crisis management

Disasters

Floods

Inundation

Mitigation

Physiography

Preparedness

Rehabilitation

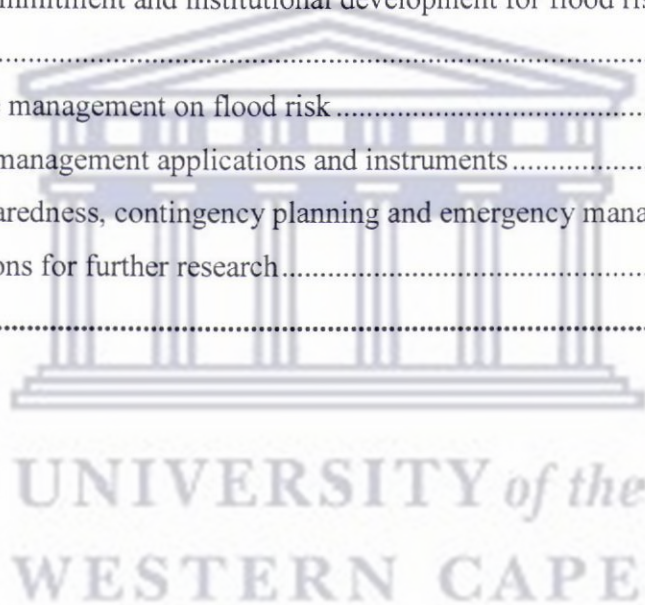


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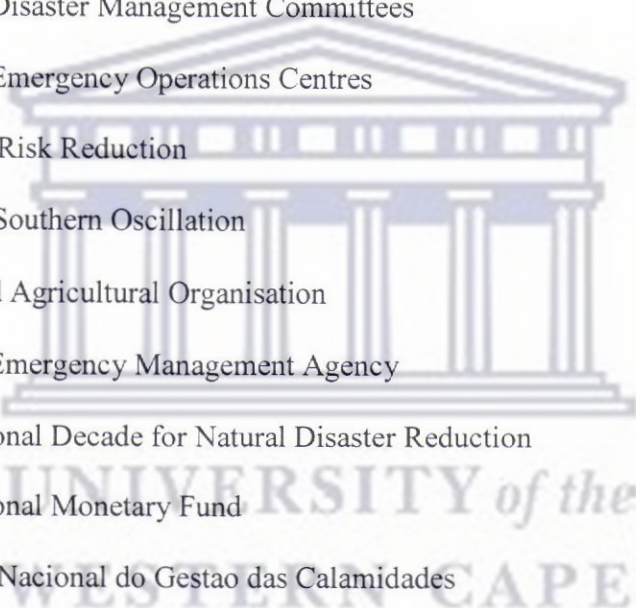
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ACRONYMS



BDF:	Botswana Defence Force
BPS:	Botswana Police Services
CRED:	Centre for Research on the Epidemiology of Disasters
DDC:	District Disaster Committee
DDMC:	District Disaster Management Committees
DEOC:	District Emergency Operations Centres
DRR:	Disaster Risk Reduction
ENSO:	El Nino Southern Oscillation
FAO:	Food and Agricultural Organisation
FEMA:	Federal Emergency Management Agency
IDNDR:	International Decade for Natural Disaster Reduction
IMF:	International Monetary Fund
INGC:	Instituto Nacional do Gestao das Calamidades
ISDR:	International Strategy for Disaster Reduction
NCDM:	National Committee on Disaster Management
NDMO:	National Disaster Management Office
NDMTC:	National Disaster Management Technical Committee
NFIP:	National Flood Insurance Program
NPDM:	National Policy on Disaster Management
OCHA:	Office for the Coordination of Humanitarian Assistance
PPIAF:	Public-Private Infrastructure Advisory Facility

- PPR: Plan for the Prevention against Natural Risks
- SADC: Southern African Development Community
- UNDP: United Nations Development Programme
- UNEP: United Nations Environment Programme
- UNESCO: United Nations Educational, Scientific, & Cultural Organisation
- UNPFA: United Nations Population Fund Agency
- UNICEF: United Nations Children’s Fund
- WFP: World Food Programme



CHAPTER 1

INTRODUCTION

Flooding in August, September and October 2005 in a very poor nation, Bangladesh, and in a wealthy nation, the USA, attracted enormous media attention, public anxiety and critical comment. Flooding in New Orleans, Louisiana, Mississippi, Mexico and Bangladesh devastated property, afflicted millions of people and caused many deaths. More than 1,300 people died in the USA (ISDR, 2005a). In 2005, the USA pledged over US\$60 billion for relief effort and recovery (BBC NEWS, 2005a). A year after the eventful floods the losses had almost doubled: approximately US\$105 billion was sought by the US government for repairs and reconstruction (CNN News, 2006). Flood risk management has emerged as a major challenge around the world. National and local governments and individuals around the world struggle to combat disasters that result from flooding and to design flood risk reduction and flood risk alleviation strategies.

Currently, there are no fixed or universally accepted flood proofing measures. Hence flood risk reduction strategies are continuously being rethought (International Strategy for Disaster Reduction (ISDR), 2002b). Amongst all environmental hazards, floods are the most common. They have caused devastating losses worldwide. Of all disasters, floods account for nearly one third of economic losses, half of all deaths and 70% of all homelessness (Abramovitz, 2001). Statistical records indicate that every year floods cause 20,000 fatalities and afflict approximately 75 million people worldwide (Smith, 2001).

Disasters can be triggered by natural hazards such as floods, drought, windstorms, landslides, mudflows, tsunamis and earthquakes. Not all disasters result from natural phenomena. Literature in disaster risk management indicates that it is now accepted that human activity has created the conditions for disaster events. Hazards are seen as ‘hybrid’ events that are a result of interactions between environmental, technological and social processes (Smith, 2001).

Although hazards are natural, disasters that result from them are not (Cannon, 1994). It is the condition of the people (vulnerability) that make an occurrence of a hazard a disaster. In addition, exposure to a hazard is created when people and property are in the ‘wrong’ place at the ‘wrong’ time (Smith, 2001). There is a close relationship between disasters triggered by natural events and developments. Disaster risk accumulates as time goes by due to inappropriate development interventions. For instance, every health centre or school that collapses during an earthquake represents a loss of capital intended for developing the country (UNDP, 2004). In developing countries, the poorest occupy hazardous locations and are often the hardest hit by disasters. Poverty makes them more vulnerable and less resilient to disasters and hampers their recovery from disaster (Smith, 2001).

The term “disaster” may be defined according to the International Strategy for Disaster Reduction (2002b) as a disruption of the way a society or community functions thereby causing widespread human, material, economic or environmental losses which are beyond the society or community’s coping abilities with the resources they own. Conversely, a “hazard” is defined as a potentially damaging physical event, phenomenon or human activity that may cause injury or death, property damage, social and economic disruption or

destruction of the environment. Worldwide, disasters have led to significant economic losses and many deaths, but their impact on developing countries is more acute, more extreme and causes chronic suffering of many people (Cannon, 1994).

In the period 1992-2002 approximately 200 million people were affected by disasters with a natural trigger, and the economic loss for the period was an estimated US\$69 billion per annum (UNDP, 2004). Cumulatively, the economic loss for the period 1992-2002 is an estimated US\$ 659.9 billion. This figure is 7.3 times more than records of disasters recorded in the 1960s (UNDP, 2004). Yet the period 1990 to 1999 was a decade devoted by the United Nations towards the reduction of losses resulting from disasters triggered by natural phenomena. The 1990s was a decade declared by the United Nations to be the International Decade for Natural Disaster Reduction (IDNDR) (ISDR, 2002b). The year 1989 marked the inception of the IDNDR, initiated by the United Nations General Assembly. This was a global programme aimed at reducing losses occurring from disasters triggered by natural phenomena (Smith, 2001, ISDR, 2002b). The IDNDR was based on the principle or view that losses from natural hazards were growing and were creating problems in many areas or countries, many of which are developing. During the IDNDR period, the UN expressed its concern regarding human suffering and the disruption of development that resulted from disasters with natural drivers. It was during this period that significant attention was given towards the improvement of emergency preparedness and response capacities of countries towards disaster alleviation (Matsimbe, 2003). The IDNDR was succeeded by the ISDR in 2000 with the motto to proceed from “protection against hazards to the processes involved in the awareness, assessment and management of disaster risks” (ISDR, 2002b: 19).

Observations by the ISDR (2002a) indicate that two thirds of disasters are weather related. Among the disasters that have drawn significant attention are hurricane Mitch which in 1998 damaged 70% of Honduran and Nicaraguan infrastructure; a cyclone which destroyed about 18,000 villages in one night in the state of Orissa, India; typhoon Lingling which caused significant damage and over 500 deaths in the Philippines and Vietnam (ISDR, 2002b).

Serious floods have occurred several times in Bangladesh, China, and India. Bangladesh is rated as the most flood-prone country in the world. The Bangladeshi flood risk disasters account for nearly three quarters of the global deaths that result from river and coastal floods (Smith, 2001). India is second after Bangladesh, and loses about 1,439 people to flood risk disasters annually (Sharma and Priya, 2001).

While the 1990s socio-economic losses are debilitating enough, disasters triggered by natural events have also taken their toll in the period 2000 to 2005. Disasters continue to prevail around the world and are more devastating than ever before. They have continued to make headlines in the most prestigious news channels such as BBC News and CNN News. Disasters triggered by natural phenomena have brought hopelessness among victims, disaster risk reduction practitioners and experts. For instance, according to news reports, the December 26th 2004 Tsunami is said to have claimed more than 128,000 lives, while at least 37,000 people are missing, and the discouraging fact is that the exact number of the victims will never be known (BBC NEWS, 2005b). These figures are devastating, however, current up-dated figures of the people killed by the Tsunami is an estimated 150,000 of which 50,000 are children (BBC NEWS, 2006). Asian countries such as Indonesia, Sri Lanka and India were hardest hit while Somalia, Africa was also highly affected (BBC NEWS, 2006). In 2005

alone, the death toll due to disasters triggered by natural phenomena such as earthquakes, hurricanes and floods was 82,061 (ISDR, 2005b).

Africa is no exception to the occurrences of disasters. Some disasters that have occurred in Africa were triggered by natural phenomena such as earthquakes, drought, floods, forest fires and epidemics such as HIV/AIDS. In North Africa, Algeria and Morocco experienced devastating earthquakes in 2003 and 2004. In 1999 Algeria experienced floods which claimed 800 lives (ISDR, 2002b). In southern Africa, Mozambique, Namibia, South Africa, Zambia and Botswana experienced flooding at the end of 1999 and beginning of 2000. The former was hardest hit by four recurrent floods between January and March 2000. The Mozambican floods caused over 700 deaths and left half a million people homeless. The 45,000 people who were rescued (Christie and Hanlon, 2001) had to return to damaged or destroyed homes, destroyed public services, diminished livestock and damaged harvests. The affected communities literally had to return to destroyed livelihoods.

The 1999-2000 floods, which affected Mozambique, did not stop at international boundaries. They covered 90% of Botswana and affected 23 administrative districts, cities and towns. Some of the affected areas include the capital city, Gaborone, and surrounding areas such as Tlokweng, Kgalagadi district, which is mostly desert, and the Francistown area (Mogwe, 2001; OCHA, 2000).

Botswana is better known for its problem of drought than of flooding. Living with drought is a way of life for the Batswana people. The country's drought problem derives from its arid/semi arid climate. The phenomena attracted extensive research in the late 1970s and

early 1980s (Cooke, 1979; Hitchcock, 1979; Jones, 1979; Sandford, 1979; Verstappen, 1979; Vierich and Hitchcock, 1979; Kgathi and Opschoor, 1981; Ringrose and Matheson, 1987). Owing to the problem of recurrent drought, the Botswana government established comprehensive strategies and activities aimed to provide effective early warnings and response measures (National Policy on Disaster Management (NPDM), 1996). Regrettably such measures do not exist for flood risk disasters. Flood risks appear as unusual, rare and erratic, and little research particularly addressing flood risk disasters and their management has been done into the seemingly paradoxical problem of flooding in drought-prone Botswana. Nonetheless, this is not to deny that research has been done regarding the effects of floods on soils, vegetation and environment in the Okavango River (Mubyana *et al*, 2003; Gumbrecht *et al*, 2004; Omari *et al*, 2004).

The sudden occurrence of the 1999-2000 floods is of particular interest because of their socio-economic impact on Botswana. The floods covered almost the whole of Botswana. While prolonged rains caused by cyclones that originated in Mozambique triggered the floods, their impacts (discussed in Chapter 3) were exacerbated by a number of factors. These include the Botswana's physiography that comprises the flat terrain and hard geological foundation both of which had significant bearing on the infiltration of rainfall runoff. The other factors may be associated with what Savenije (1996) terms anthropogenic influences. These factors relate to the impact of urbanisation on rainfall runoff processes.

1.1 Research problem

Botswana has experienced floods amid recurrent droughts. Social scientists and geologists in Botswana such as Silitshena and McLeod (2002) claim that weather records for the country suggest that periods of drought alternate with heavy rains flooding. They assert that rainfall records which date back to the time when they were first kept indicate that the stretch of time can be divided into rainfall periods. Each of the rainfall periods lasts between 18 – 20 years, with each period having a wet and a dry season. Thus it is possible for a drought to occur within a wet period and vice versa (Silitshena and McLeod, 2002).

Botswana's 1999-2000 floods were the heaviest ever recorded in the history of the country (Mogwe, 2001). These floods caused extensive damage to infrastructure and property and left thousands of people homeless. A total of 17,000 dwellings were destroyed and about 80,000 people were left homeless. Thirteen people died due to drowning or collapsed dwellings. Livestock were washed away and hectares of cultivated land were inundated (OCHA, 2000; Thedi, 2003). People's livelihoods were destroyed.

1.2 Research aim

The research aims to examine the extent to which flood preparedness and response measures taken by Botswana Government were consistent with international best practice in flood risk management through the application of the UN International Strategy for Disaster

Reduction's (ISDR) disaster risk reduction framework to the case example of the 2000 southern African floods. The objectives for this study include:

- Documentation of the 2000 Botswana flood event, including the meteorological conditions that triggered the event, the extent of flooding and key impacts.
- Collection and consolidation of key policy, planning and other government documents related to disaster risk management in Botswana that informed flood risk management, preparedness and response.
- Application of the UNISDR's disaster risk reduction framework to the Government of Botswana's flood preparedness and response.
- Identification of strengths and limitations in the government's response in relation to international risk reduction policy practice.

The research also identifies and discusses flood alleviation measures currently in place in Botswana and how they can be enhanced so as to minimise risk to life and property. As Lewis (1994) states, studying disasters with a natural trigger such as floods show how people responded to warnings, under which conditions people panicked and whether the country's media helped in changing people's behaviour. Information derived from the 2000 flood preparation and response in Botswana will form the basis of future flood management planning for the country. The study also draws out a comparison between Botswana's response and flood risk management measures and those in other countries. The comparison provides an opportunity to learn about what response and risk management measures work in other countries and how they could be applied or adapted to Botswana.

The experiences and effects of disasters are broadly similar worldwide. Researchers in disaster risk management cannot limit themselves to “typically domestic and local events”: students of disaster and crisis management “...should cross the borders and engage in cross-national studies which fit in with the transnational dimensions of contemporary and future disaster and crises” (Rosenthal and Hart, 1998: iii). This statement is supported by the view that

... the project of comparative analysis is worthwhile because in producing findings on the practices of other countries, we are better able to see the basis of our own practices. On an instrumental level, this means the borrowing of ideas from other countries: the goal is lessons rather than creating or testing theory. Countries that are similar are more likely to borrow from one another (May, 2001: 208).

The importance of drawing out lessons from other countries cannot be over emphasised. This research draws lessons from Asia, Europe and the Americas as well as southern Africa. In disaster risk management, global thinking on natural disasters has been significantly influenced by the past and prevailing patterns of risk in Asia, Europe and the Americas (Holloway, 2003). The three regions experiences epitomise the disaster risk patterns of the world. Over the years, they have had their share of natural disaster risks, among others, those resulting from floods. These disaster risks have impacted significantly on their environments and lives. Asia, the hardest hit by disasters with natural triggers, accounts for almost half of all the disasters in the world (Yodmani, 2001) and also provides a similar economic background to most developing countries. However, the three regions have diverse socio-economic and cultural environments which indicate varied ways in which flood crises can be managed.

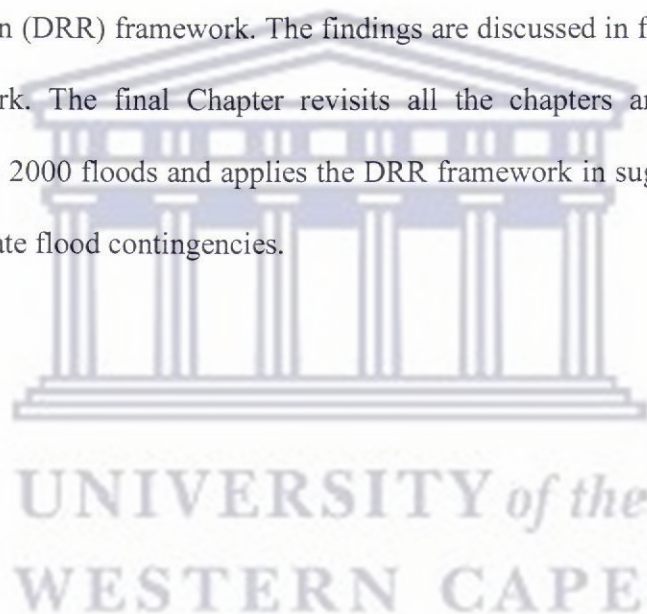
The effects, impacts and management of flood risk disaster experiences in the aforementioned regions have been well documented (Rodier and Roche, 1984; Haque and Zaman, 1994; Rosenthal and Hart, 1998; Smith, 2001; Yodmani, 2001; Herschy, 2002; Walter, 2002). Although the regions have deployed a combination of early warnings, structural and non-structural mitigation measures in an attempt to alleviate flood risks and other disasters, there is evidence that disasters with natural triggers still impact negatively on them and the world at large.

The research explores the actions and ideas that have been successful in curtailing the impact and effects of floods in these (Asia, Europe, the Americas and southern Africa) regions. It also takes into account the mistakes, incompetence and other problems encountered by the regions as they too provide lessons to be learnt, rectified and or avoided. Botswana, whose history of disasters and disaster risk management has been and is still dominated by drought, can draw lessons from research in southern Africa, Asia, Europe and USA. Poorly managed floods risk undermines development progress in Botswana, as evidenced by the devastating 2000 losses. By increasing understanding of the factors that increased the severity of the 2000 floods, the thesis aims at identifying measures that might be deployed in minimising the impact of future flood events, thus enhancing Botswana's resilience to cope with recurrent flood events and to maximise development potential.

1.3 Structure of the thesis

Chapter 2 reviews literature concerning flood preparedness, response and mitigation. It outlines successes and failures encountered in flood mitigation and management in various

regions. A case study of the 2000 Mozambican floods is provided as the research draws heavily on the Mozambican experience. Geographical information relating to Botswana and a brief overview of the disasters that affect the country is provided in Chapter 3. Specific attention is given to flood incidence in time and space. The significance and impacts of the 2000 floods are discussed. A methodological Chapter describes the sources used in information collection. Chapter 5 outlines the research findings and analyses Botswana's flood risk reduction in relation to the International Strategy for Disaster Reduction's (ISDR) Disaster Risk Reduction (DRR) framework. The findings are discussed in five thematic areas of the DRR framework. The final Chapter revisits all the chapters and sums up how Botswana managed the 2000 floods and applies the DRR framework in suggesting measures that might better alleviate flood contingencies.



CHAPTER 2

LITERATURE REVIEW

Several dominant theories and ideas have guided policy formulation, strategies and activities employed in managing disasters with a natural trigger. These theories shed light on why certain disaster risk management measures dominate or are preferred over others. In terms of flood risk management the theories elucidate why structural as opposed to non-structural measures, have dominated the disaster risk field. Flood risk management measures deployed in the different regions of the world such as parts of Asia, Europe, the USA and southern Africa are discussed. The former is characterised by high, catastrophic flood incidence and devastating losses both in property and human life. Asia also has more or less similar economic power to that of most developing countries for instance, Botswana. By contrast, Europe and the USA are highly industrialised, and therefore offer a contrasting socio-economic background. Lastly, southern Africa is characterised by an almost homogeneous socio-cultural and economic background. The socio-economic and cultural differences between the regions would present diverse and dynamic methods of flood alleviation and flood risk management.

2.1 Evolution of disaster as a theoretical construct

People's perceptions of hazards influence how they manage them and the consequent disastrous events that arise from them. These perceptions have shaped early thinking in the field of disaster risk studies. Some of the ideas regarding hazards were organized around the

hazard paradigm. The paradigm viewed natural hazards such as typhoons, hurricanes, earthquakes and floods as agents “external to, or accidentally erupting within, society” (Hewitt, 1997:55). In this regard, people were perceived to have no connection in causing the disaster that arises from a hazard because the hazard itself is an “act of God” (Hewitt, 1983:17). The hazard paradigm maintained that the geography of risk is represented by the occurrence of a hazardous agent; in other words, risk is viewed as being controlled by the geophysical event (Hewitt, 1997).

It follows that disasters with a natural trigger were viewed as a result of the extreme in the geophysical process. Theoretical perspectives that shaped thoughts regarding disasters triggered by natural phenomena were organized around what became the “dominant view.” The hazard approach maintained that calamity was initiated by nature “which decides where and what social conditions or responses will become significant” (Hewitt, 1983:5). In other words, disasters occur because of the chance recurrence of natural extremes, altered either significantly or otherwise, by human circumstances (Hewitt, 1983). The hazard approach maintained that disasters with a natural trigger were synonymous with natural events such as floods, that is, a flood was a disaster per se (Hewitt, 1983). Additionally the approach maintained that disasters are inevitable if the magnitude of the hazard was high (Hewitt, 1983). The magnitude of a disaster was regarded as a function of the magnitude of the hazard (UNDP, 2004).

The hazard paradigm view had a significant influence on how early scientists and policy makers sought to combat natural disasters. Because the paradigm detached people from having a bearing on the occurrence of disasters, a technocratic approach was seen as a

solution to controlling and preventing disasters. Scientists such as hydrologists, geologists and civil engineers have since the 1970s sought to mitigate hazards by controlling them using improved prediction devices and methods to predict the natural event, and building structural infrastructures that resist the hazards (Smith, 2001). To date the technocratic approach to disaster mitigation still dominates albeit the abundant literature that contends its advantages and disadvantages.

However, to counter the dominant view, one of the founders of the human ecological framework perspective, John Dewey, asserts that if people live in a natural environment that is innately hazardous they will face insecurity. He elaborates that natural hazards such as floods do not exist in isolation from society; he argues that these perils are defined, reshaped and redirected by human behaviour (Mileti, 1999). In addition, other scientists such as geographers and social scientists such as anthropologists also sought to illustrate that although natural forces exist, they are not themselves dangerous but become so when interacting with people (Blaikie *et al*, 1994; Cannon, 1994; Varley, 1994 and Hewitt, 1997). They argued that social conditions such as human vulnerability was responsible for turning a natural event into a disaster. In addition, the impact of a natural hazard does not depend on the resistance of the structural measure as was perceived by technocrats, but depends on the ability of the affected people to resist or absorb the impact (Manuta and Lebel, 2005).

To further illustrate the issue arising from human vulnerability, social scientists and geographers emphasised that disasters are caused not only by natural events. It is the interaction between a natural event and a vulnerable population that constitutes a disaster. Disasters also result from the social, political and economic environment and the way it (the

environment) structures people's lives and livelihoods (Blaikie *et al*, 1994). The environment is indeed partly a social construction. Opportunities and risks are created by the demands that each society puts on nature, coupled with differing impacts that nature has on different societies. In effect, unequal access to opportunities and unequal exposures to risks results from the socio-economic system (Cannon, 1994). For instance many people live in adverse economic situations that force them to occupy less habitable areas such as those that are easily affected by natural hazards (Blaikie *et al*, 1994). The social and economic structure of societies has created vulnerable populations and influences the impact of disasters even if it does not create them. In other words, economic and socio-political factors are the underlying causes of disasters.

In light of the UNDP's (2004) perception of disasters within the context of development, disasters with a natural trigger are closely associated with human development processes.

Through time, disaster risks accumulate as inappropriate development interventions are made. These processes have in turn, spawned different levels of vulnerability. The UNDP (2004) further observes that not only does development fashion vulnerability but it also alters and magnifies patterns of hazards.

In view of the hazard paradigm and the dominant paradigm, disasters triggered by floods are also perceived as a result of the occurrence of the geophysical event such as flood. Experts are required to predict the occurrence of a flood event and thereby control it using structural measures, thus a technocratic approach is used. This approach focused more on controlling and containing flood risk disasters as well as providing relief and emergency measures following a disaster (Smith, 2001; Manuta and Lebel, 2005). Although the technocratic

approach is associated with engineers and governments especially those involved in decision-making, it is also favoured by other social groups such as people who are directly affected by floods (Plate, 2002). Small communities around the world have also sought to mitigate the impacts of floods by using simple traditional structural measures.

Gilbert White, a geographer and an internationally renowned natural hazard researcher, was the first person to question structural measures to control flooding in the USA. He stated that river control measures were inappropriate or not the best way in mitigating flood risk disasters (Smith, 2001). His critique was based on the fact that whilst high expenses were incurred in flood control, such measures were undermined because the damages incurred from the flood risk disasters were increasing. He introduced a social perspective to addressing flood disasters, and his works form the basis of debate regarding flood management. His contribution towards research in flood risk disasters, just like any other natural event, were cast in a human ecological framework which takes into consideration the interaction of both natural and human systems, and acknowledges solutions other than structural measures towards flood mitigation (Smith, 2001). Interestingly the human ecology perspective generated more theoretical perspectives within different disciplines.

Geographers followed White's contribution to flood alleviation measures. Whereas they investigated how people adjust to natural hazards, sociologists sought to understand collective human behaviour during a crisis and the impact of a disaster on people. Sociological interest was focused on ways to improve preparedness and response measures for large groups of people during an emergency. By contrast, geographers arrived at the conclusion that in addition to the existing structural measures, human adjustment methods

such as land use planning, building codes and hazard prediction should be used (Mileti, 1999; Smith, 2001).

While the natural disaster risk field is multidisciplinary in approach, and has amalgamated thoughts from geologists, hydrologists, geographers and anthropologists, it has proved a daunting task to identify flood risk management measures that are universally accepted as appropriate. As mentioned in Chapter 1, flood risk management measures are constantly being rethought and investigated (ISDR 2000b). Nonetheless the positive outcome that emerged from the multidisciplinary approach to natural hazards is that while a new hazard paradigm did not emerge, a shared and more integrated approach to hazards emerged (Mileti, 1999). It integrates differences within different disciplines in relation to natural hazards by focusing on common methodologies such as those concerned with risk analysis. As a result countries do not solely rely on structural measures but use a mix of anti-hazard measures which include non-structural measures (Smith, 2001). Thus current international best practice regarding disasters with a natural trigger is centred on disaster risk reduction. Disaster risk reduction is a “conceptual framework of elements considered with the possibilities to minimise vulnerabilities and disaster risks throughout a society, to avoid or limit the adverse impacts of hazard, within the broad context of sustainable development (ISDR, 2004a: 17). In view this definition, disaster risk reduction is holistic; it takes into account vulnerability as well as risk factors in addressing the impact and effects of disasters triggered by natural events (ISDR, 2004a).

2.2 Critical concepts for examining disaster risk in the context of riverine flooding

A flood may be conceptualised as the high flow of surface water that overflows the normal confinement of a river (Nuhfer *et al*, 1993). Conversely, a flood might better be defined as the discharge that can cause damage or the discharge that overtops the river banks (Alexander, 2000). The latter definition takes into consideration the risk factor posed by floods. Hence floods can also be conceptualised using the risk notation: risk = hazard x vulnerability. Where hazard means a potentially damaging phenomenon and vulnerability means the degree of susceptibility of an element exposed to that phenomenon (ISDR, 2004). For instance, if a flood interacts with a poverty stricken society which is unsafely sited within a flood zone, with insubstantial housing, this will result in a disaster.

In most places of the world two types of floods occur namely, flash and riverine floods. Flash floods occur mostly in arid and semi-arid areas like Botswana. However they also occur in humid areas; south France is prone to flash floods for instance. Flash floods are of short duration with high peak discharge. They have high velocity and have powerful erosive forces (Plate, 2002). Often localised, these floods result from a heavy downpour into a small drainage basin (Nuhfer *et al*, 1993). The high concentration of rainfall in a small area causes the flow of a stream or river to rise faster than the normal flow within a short period. In the arid or semi-arid regions the heavy rains coupled with the poor absorptive desert soils leads to rapid run-off which produces sudden floods. The effect of the persistent rains is the same in the humid regions. In humid mountainous regions such as parts of France, the steep slopes are characterised by thin soils, which absorb rain much faster and produce subsequent run-off resulting in flash floods (van Hassel and van Lindt, 1998).

Conversely, in the built environment the paved surfaces are waterproof and cause rapid runoff. In order to remove the run-off, drains are constructed in the streets to channel and transport water to streams and rivers. This increases the speed of the onset of the flood downstream (Nufher, *et al*, 1993; Kovach, 1995). The destructive nature of these floods is exacerbated when the flash floods pick up debris of earth, logs, rocks and other material along their path. They then turn into a heavy mudflow which spreads out. The mudflow can move boulders, cars and even buildings, thus causing significant damage (Kovach, 1995).

Riverine floods are common throughout the world. They occur when water from rain or melting snow flows into a major stream from its drainage basin (Nuhfer *et al*, 1993). When the discharge exceeds the capacity of a stream, it spills out of its channel and then flooding occurs. Several conditions contribute to this type of flooding. These can be categorised as human and natural factors, for instance, heavy rains, storm surges as well as dam failures (Coch, 1995).

2.2.1. Riverine floods as a resource and a disaster risk

While riverine floods may pose a threat to human beings, property and the environment, the paradox is that they have benefits too. For instance, when seasonal floods occur, silt is deposited in the floodplain and this enables the floodplain to be restored (Wisner *et al*, 2004). Some countries such as Bangladesh are “riverine countries.” Bangladesh is located in a floodplain and benefits from the seasonal floods; the country would neither exist nor be productive as it is now without the annual floods that renew and extend the landscape (ISDR,

2004a). The Bangladeshi people even have local names for the beneficial and the destructive floods.

Additionally, floods are a normal and vital component of agricultural and ecological systems since they provide the basis for regeneration of crops, plant and aquatic life and livelihoods derived from them. Floods provide natural irrigation. In some countries such as Bangladesh, people practice flood agriculture which involves sowing seeds in wet soil (Wisner *et al*, 2004). The seasonal floods provide the basis for considerable Bangladeshi livelihood.

Conversely, flood events that increase the likelihood of damaging losses may result in disaster risks. For instance some of the historical flooding of the Yantze River in China and the Mississippi River in South America have claimed several hundred of lives and caused massive losses in terms of property as well as environmental damage.

2.2.2 Floods as concatenating hazard

Large disasters are made of many small disasters. When small disasters lead to large disasters, the scenario is called the concatenation of risk (UNDP, 2004). In the same context, riverine flooding results from heavy rainfall which in turn is produced by weather systems such as cyclones (Alexander, 2000). Then riverine flooding becomes a flood risk disaster which may results in damaging agriculture, property and infrastructure.

2.3 Flood risk management and reduction: focus on flood mitigation

Disaster mitigation refers to measures taken to reduce the destructive and disruptive nature of a hazard and to lessen the impact of a disaster (Maskry, 1989). A mitigation approach assumes a disaster can occur at any time as long as there is a hazard; hence mitigation measures can be taken in advance of a disaster, at the time of the disaster, or after the disaster has occurred. For the purposes of this research, the words mitigation and alleviation will be used interchangeably. Mitigation measures range from physical measures to planning, training and public awareness (Maskry, 1989). Structural mitigation measures attempt to keep hazards away from people. Non-structural mitigation measures attempt to keep people away from hazards.

2.3.1 Introduction to flood mitigation

Countries, both developed and developing have employed various strategies for the prevention and mitigation of floods. In this regard flood mitigation focuses on two paradigms. The first conceives flood hazard as a naturally generated phenomenon which requires structural mitigation. The application of technological measures to flood prevention and change in the physical processes of floods is key (Haque and Zaman, 1994). The second paradigm takes into account the socio-economic factors that contribute to disasters. This paradigm stresses the use of non-structural mitigation measures. These involve the adaptive strategies of communities and other strategies aimed at risk reduction. These include flood forecasts, warnings and flood plain rehabilitation.

2.3.2 Structural mitigation

There are two major categories of structural measures. The first focuses on strategies that reduce the amount of water in an area through surface or underground storage, notably reservoirs or dams. The second category mitigates floods through the construction of embankments to prevent, divert and regulate flood waters (Haque and Zaman, 1994). These measures are designed to confine flood waters to well-defined, low-value land along flood plains. Embankments “offer protection up to the height or design limits of a particular flood” (Smith, 2001: 279). This research focuses on the latter group; mitigation through the construction of embankments, levees and dykes. The use and successes of these measures have been well documented over the years. Conversely their failures have also been identified.

China and the USA rely heavily on structural measures. Dykes and levees were used as early as 2000 BC by the Chinese. China’s dykes built around early 1949 currently protect the country’s large alluvial plains from floods with a return period of ten to twenty years (Smith, 2001). Yet, since the beginning of the 20th century, China’s levees and dams have succumbed to floods and have caused enormous loss of property and many deaths (Kovach, 1995; Cai *et al*, 2001). Major floods occurred before the 20th century. Devastating floods along the Yangtze River were recorded; approximately twenty major flood incidences between 1153 and 1998 affected different parts of the country (Kovach, 1995:139; Cai *et al*, 2001: 339). The Hwang Ho River or Yellow River (known poignantly to the Chinese as “China’s Sorrow”) is said to have taken more lives than any other single natural feature due to levees and dykes bursting (Nuhfer *et al*, 1993).

Dams were used by Egyptians as early as before 3000 BC. Four centuries later countries continue to rely heavily on physical structures. By 1993 the USA had 50, 000 dams (Nuhfer *et al*, 1993: 107). China boasts more than 86,000 reservoirs (Zhang *et al*, 2002; Cheng and Chau, 2004). In addition to the engineering works, China and Bangladesh also use traditional structural measures. The former uses measures such as dredging river channels to control flooding. Some of the measures used by Bangladesh include building temporary shelters along fertile flood plains which can be easily moved during floods. Regrettably, some of these measures also succumb to floods. For instance China's dredging of the Yellow River and Bangladesh's adaptation of housing to suit the annual flooding also failed (Abramovitz, 2001).

Needless to say, not all structural mitigation measures should be dismissed as useless or limited. Some have proven useful. For example, some communities which live along the Amazon and Mekong build houses that sit on stilts above high water mark or float up and down with the water. Building houses on stilts, as an adaptive strategy is most appropriate where flooding occurs so often that it is taken as a part of life. For instance, Bangladesh's floods occur almost annually. In Bangladesh, mounds are built which act as refuge during floods (Abramovitz, 2001). However, this is not to imply that building houses on stilts will work in every country. Botswana for instance, is a dry country and experiences mostly flash floods that result from intense convectional storms. Building houses on stilts is done along the Okavango River it is done by a hotel industry for tourism purposes and is not practiced by ordinary people. Nevertheless, since the Okavango River floods seasonally, building houses on stilts is another option to be considered by government of Botswana.

Similarly, some successes and failures have been recorded with engineering and building structures in the USA. Over 4,500km of the Mississippi River are protected by levees. During the 1993 floods some of the structures provided protection as expected, though some structures succumbed (Coch, 1995; Ambramovitz, 2001; Smith, 2001). Out of the 275 federal levees (built and funded by government), 85% withstood the floods, but 31 were overtopped, 8 were eroded and ruptured, 3 were breached. By contrast, of the 1,400 non-federal levees (built by locals and municipalities) 43% withstood the trauma and 800 failed (Coch, 1995: 201). The differences in failures were attributed to the fact that the federal levees were designed for an estimated return period of one in hundred years; and one in five hundred years. The non-federal levees, however, were designed to endure floods that recurred with intervals of 50 years or less (Smith, 2001: 280). In addition, of all the 8, 639 dams surveyed in the USA, 2, 884 were considered unsafe due to inadequate spillway design (Nuhfer *et al*, 1993). This implies the probability that approximately one third of the total number of dams in the USA are a hazard to the people who live close by.

A number of considerations arise from the above evidence on structural measures. First, levees, dams and other structural measures continue to be constructed despite records of failure. The question is why countries still mitigate floods by structural measures if they cause physical or environmental destruction and loss of life? Is it because governments are politically pressurised to act towards mitigating floods before proper research is carried out to establish the strengths and resistance of such measures? Or is it because governments want to be seen to be doing something? Some interesting views arise regarding these questions. In spite of the failures of structural measures and their top down-approach, they still dominate

because in some countries such as Bangladesh, the physical presence of such measures reinforces the benefits of the power system for those who are already in control both in the country and internationally (Blaikie *et al*, 1994). Domination of structural measures is due to the fact that they involve large-scale contracts, foreign donors and lenders receive back large sums of money through consultancy fees and purchase of equipment. By the same token, politicians and elites may also benefit from kickbacks on construction contracts and consultancies, and commissions for arranging the projects (Blaikie *et al*, 1994). In addition, some authorities or legislators look for problems that they can solve so as to advance their reputations and help themselves win re-election (Anderson, 2000). While the above reasons hold much ground, one could conclude that since developing countries rely on international agencies for research, financial aid and technology, the developing nations are powerless in stating what their own preferred measures are, be it structural or non-structural. It is the donor countries that decide on the mitigating measures.

A second consideration regarding dominance of structural measures is that, they are constructed contrary to huge financial investment. The capital outlay for dam and levee construction is very high. For example, one diversion on the river Mississippi cost US\$15 million. The floods of 1993 destroyed parts of the structure. An additional US\$295 million was used to repair and put up an auxiliary structure (Coch, 1995). Structural mitigation requires constant monitoring, repair works and maintenance.

A third point to consider is that little attention is paid to ecological factors. Structural mitigation disturbs the natural environment within which rivers flow. The ecological structure of the rivers, the aquatic life, and the ecosystems which act as 'nature's engineering

technique' are disturbed (Abramovitz, 2001). There has been significant deforestation which left the soil bare along many river channels. The Yangtze River in China flooded in 1998 due to acute deforestation (Abramovitz, 2001; Cai *et al*, 2001). Draining of wetlands along the Yangtze River also compounded the problem of flooding.

Finally, mitigating floods through structural means has been criticised for providing a false sense of security. Ironically structural mitigation leads to an increase in flood damage (Haque and Zaman, 1994; Abramovitz, 2001). Smith and Tobin (1979) and Abramovitz (2001) support this assertion when they state that structural measures change the frequency and magnitude of flood and drought events.

In southern Africa, hazard mitigation has received less attention as opposed to response in emergencies. The preparation and mitigation of hazards is given less priority as opposed to response. Many governmental departments have 'short-term' thinking towards the alleviation of disasters. Rescue and relief operations get more financial support and have more political appeal as opposed to preparing for an event that may not even happen (Abramovitz, 2001).

Additionally, southern Africa's inadequacy in mitigation measures partially reflects the political priorities of the regions' emerging democracies. Developmental issues, national security, struggles for independence and freedom from oppression have dominated national and regional agendas (Holloway, 2003). Mozambique is a typical example. The country gained independence from the Portuguese colonisers, fought a ten-year war to keep control, is poverty stricken, and faces a cycle of flood and drought events. Mozambique has experienced 11 floods and more than 16 drought events between 1970 and 1998 (Moore, Eng

and Daniel, 2003). In spite of these disaster experiences the country still prioritises developmental issues; it lacks disaster risk management. Yet the cycle of disasters has contributed significantly to the country's poverty and inadequate development. Thus Mozambique faces a dilemma between prioritising the development of the country and funding "invisible" disaster risk management.

In response to the failures of structural measures, there is a realisation of a need to deal with flood hazards using an integrated approach. There is a need to acknowledge that environmental hazards such as floods have both natural and human components. For instance, flood problems may be aggravated by climatic change such as increased storm frequency, and also by human activities such as deforestation (Smith, 2001) (Tables 1 and 2). There is also a realisation that environmental degradation aggravates the impacts of disasters (ISDR, 2002b; Cai *et al*, 2001; Sharma and Priya, 2001; Blaikie *et al*, 1994). As mentioned at the beginning of the chapter, research by scientists and anthropologists sought to show that floods and other hazards are natural processes but the disasters that are associated with them are not. In order to understand disasters, they argued that "it was necessary to focus on social processes: on human vulnerability rather than natural hazards" (Varley, 1994: 2). Such an understanding would lead to suitable and successful strategies for mitigation purposes (Varley, 1994). Therefore, scholars in disaster risk management now advocate a holistic approach that takes into account the various causes of disasters (McEntire and Fuller, 2002; ISDR, 2002b). Countries now seek to employ an array of socio-cultural strategies towards the alleviation of floods. Non-structural measures have become the order of the day for most flood-prone countries. These steps range from structural to non-structural measures. Countries such as the United States have shifted from reliance on structural measures to a

more holistic approach which employs a comprehensive array of activities and programs to managing flood risk disasters.

Table 1: Main natural causes of floods

Cause	Natural factors	Human factors
River siltation	Occurs due to bank erosion. Earthquake loosening soil.	Rivers silt up due to construction of dams and embankments.
Cyclones	High precipitation. Absorbing capacity of soil.	
Heavy rainfall	High run-off. Topography and obstruction of the natural drainage.	Inadequate drainage capacity; urbanisation in low-lying areas.
Common floods in the main and tributary rivers	Flash floods due to high discharge in main river.	Breaking of embankments for irrigation purposes.

Source: Adapted from Sharma and Priya (2001).

A combination of natural factors such as bank erosion and human factors such as building of dams along rivers can aggravate siltation of rivers which in turn can lead to and exacerbate the impacts and effects of flooding (Table 1). In other words bank erosion creates more sediments or silt, and coupled with the construction of dams slows and limits the natural river processes of sediments transportation, as a result deposition of sediments occurs on the river bed raising the level of the river. Human beings can aggravate the effects of floods (Table 2). For instance, deforestation caused by human activities reduces absorptive capacity of soils and thereby accelerates rainfall run-off processes and sheet wash.

Table 2: Main human causes of floods

Cause	Natural factors	Human factors
Deforestation	Effect on hydrological cycle. Soil type and its absorptive capacity. River bank erosion.	Increase in urbanization Increase in cultivated area along river.
Increase in urbanisation	Decrease in vegetation More built-up area Increase in run-off.	Land use change along river.

Source: Adapted from Sharma and Priya (2001).

2.3.2 Non-structural mitigation

Non-structural measures are behavioural adjustments that rely on pre-planned action by people who live in floodplains (Smith and Tobin, 1979). They include adjustments strategies that seek to reduce vulnerability within communities.

In order to be completely free from a flood hazard there should in theory be no land use in floodplains (Smith and Tobin, 1979; Smith, 2001). In practice this is impossible. People live along floodplains because the benefits outweigh the disadvantages. Besides, some communities are forced to live in floodplains and other dangerous locations for economic and political reasons. Poverty, which leads to marginalisation of certain communities, shortage of land, overpopulation and even flood plain benefits, are some of the reasons people live in flood plains.

Today, many communities around the world occupy flood plains. People live with risk, so are major developments that are located in harms way. For instance in the USA alone, over six million buildings are located within the boundaries of flood plains (Burby, 2001) and recent studies indicate that in spite of the catastrophic floods of 1993 in the Mississippi River Basin, there are new developments in the basin (Hipple *et al*, 2005). Likewise, approximately 50% of China's population lives along and on river-banks (Zhang *et al*, 2002). Arising from the aforementioned observations, it is imperative therefore, to plan to live with flood hazards. Future disaster risk planning must therefore, take into account the risk factor posed by floods. Additionally if developments are not permitted along flood plains or zone, the cost of such will increase over time as the attractive land around the flood plains become scarcer (Stephenson, 2002).

The question to be asked is what then is the appropriate way to deal with floods? At an international conference on the Mozambican floods held in Maputo on 27-28 October 2000, emphasis was laid upon the concept of 'living with floods'. The idea of living with flood include among others, accepting large numbers of people living in flood plains, and developing mechanisms to minimise risk. We must learn to reduce risk through using appropriate measures focused on planning, forecasting and mitigation (Marjanovic and Nimpuno, undated). Preparing for impending disaster should focus on vulnerability reduction, and humanitarian assistance should not be viewed as a panacea for all problems associated with major disasters (Marjanovic and Nimpuno, undated). Prevention of and preparedness for disasters reduces the need for huge relief operations (ISDR, 2002b).

2.3.3 Flood forecasts and warning

Comprehensive hydrological and meteorological processes are required so as to provide rainfall forecasts and suitable flood warning messages (Smith and Tobin, 1979). In Mozambique, as part of the flood forecasting and warning system, it was agreed to use the 1977 and 2000 floods as benchmarks (Christie and Hanlon, 2001). This was due to the fact that both floods were of great magnitude and would be remembered for a long time. In addition it was decided to assimilate into the forecasting system a rainfall and upstream river monitoring system. The system monitors rainfall and upstream river level, and gives advance warnings that enable people to prepare themselves in time. Advanced warnings of a possible flood are given, and a siren sounds 30 minutes before the crest is expected. This system was used in South Africa during the 2000 floods and it worked successfully (Stephenson, 2002).

Flood forecasts are then followed by warnings. Warnings should be timely and accurate, and should be issued in simple, straightforward language. Warnings that are heavily laden with technical language are incomprehensible to many people. According to the International Decade for Natural Disaster Reduction (IDNDR) (1998), an effective warning channel starts with the scientific generators or originators of warnings, such as meteorologists. An intermediary category might comprise government decision makers and media. Last, are the disseminators and receivers, including members of the public. Most important, warnings should be disseminated through means that will reach all parts of a country, both rural and urban. Use of radio as opposed to television is most appropriate because the government's own radio channel can reach most of the country.

Evacuation of people in times of floods was emphasised during the International Conference on the Mozambican floods (Christie and Hanlon, 2001). For evacuation purposes, it was suggested that escape routes and zones of safety be defined clearly. Flat roofs of strong buildings, schools, mosques and hills were suggested as refuges where people could stay until the floods subsided. These emergency sites and shelters would also serve a dual purpose of being the distribution point for humanitarian assistance. In Bangladesh, such shelters coupled with early warning systems and evacuation plans resulted in a decline in casualties (Macks, 1996; Public-Private Infrastructure Advisory Facility (PPIAF), 2000). Moreover, for effective evacuation, an understanding of what is valuable to people is most important. In the case of the 2000 Mozambican floods, many of the 700 people who died had stayed behind to save their cattle which are a form of wealth (Christie and Hanlon, 2001). Cattle and other valuable property should be evacuated to safety.

2.3.4 Community preparedness

Community participation is one of the key factors reinforcing the effectiveness of preventative measures against flood disasters. Victims are the first to respond to a disaster crisis. It has been noted that contrary to popular belief that the international community is the first to reach out to at risk communities with rescue and relief aid during a crisis, it is the victims themselves who take the initiative to respond by assisting each other (Blaikie *et al*, 1994; Walter, 2002). Local communities have their own institutions, social networks and organisations that employ mechanisms to help one another during a crisis before external aid arrives (Blaikie *et al*, 1994). Therefore, communities must be involved when planning for emergencies because they can identify their resources, capabilities, coping mechanisms and

existing facilities which are appropriate for their needs (Newport and Jawahar, 2003). Such being the case, it is imperative that governments build on local capacities and increase them since they are the point of departure for developing disaster response (Heijmans and Victoria, 2001).

Governments now appreciate that local communities should be actively involved in disaster reduction activities, and should be considered as proactive stakeholders not passive targets for intervention (ISDR, 2002b; Newport and Jawahar, 2003). It is imperative that in the planning and preparation process, the participatory approach be adopted. The approach advocates for the involvement of the affected groups such as at risk community, in each stage of development that is projected on their behalf (Osti, 2004). Involvement of the local people is a step forward that governments and aid agencies have encompassed. Such a step ensures that governments and aid agencies change roles from that of provider to facilitator, thereby fostering self-reliance (Osti, 2004).

Although the participatory approach seems a daunting task, it has worked in Asian countries such as Bangladesh, China and India, as well as in Southern Africa for instance, in Mozambique. In the planning process, locals contribute by stating their traditional coping strategies. For instance, in the case of Bangladesh, locals employ structural measures; they build temporary shelters that can be moved easily during floods. Another way the Bangladeshi people coped with 1998 floods is that relatives helped one another to cope with the aftermath of the floods. Assistance consisted of moral support, free shelter, help with moving household goods and evacuating livestock from flood prone areas to safety. Relatives also helped each other with interest-free loans which the victims used to regain their pre-

disaster status (Haque and Zaman, 1994). By the same token, during the 2000 and the 2001 floods, Mozambicans also assisted one another before the NGOs and the international aid arrived.

2.3.5 Land use planning

In disaster risk management, another possible way of reducing the impacts and effects of disasters is through physical or land use planning. It can be utilised to regulate development and prohibit high building density in disaster-prone areas. According to the land use approach, disaster risk management has to take into consideration the relationship between population growth, the physical demands of human settlement, and the most appropriate use of available land (ISDR, 2002b). Although land use planning recognises population growth and spatial growth of settlement as crucial elements in planning, emphasis is laid upon treating the landscape itself as a valued resource to manage risk (ISDR, 2002b). In land use planning, regulatory approaches have worked especially well in developed countries. If adhered to, planning regulations would reduce the risks that people face.

The USA is one country that uses land use management policies to limit developments in flood-prone areas. Floodplain zoning prohibits large populations from settling in flood prone areas; instead it encourages such areas to be used for purposes such as recreation and agriculture. In 1988 the US introduced the Federal Emergency Management Agency Mitigation Program. The program allows voluntary buyouts of properties within the floodplain. Since the scheme was introduced, over 17, 000 properties along flood-prone land have been purchased, mainly to ensure public safety. Another benefit of the exercise was that

some of the land was used to create parks and preserve wetlands (Smith, 2001). In order to effectively and efficiently administer land use planning, the US government has a National Flood Insurance Program (NFIP) which was enacted in 1968. The program is jointly run by the federal government and state and local governments and the private insurance industry (Burby, 2001). In a nutshell, the program identifies flood prone areas and the degree of flood risk. It also establishes criteria such as building standards for construction in flood plains, and sets flood insurance premiums (Burby, 2001). While insurance against unknown natural disaster risks may not be appealing to most developing countries, some parts of the program could work in many countries. Developing countries can adopt parts of the NFIP which involves identification of flood prone and risky areas and providing regulations concerning buildings and infrastructure.

France also has a disaster risk reduction strategy. The French Plan for the Prevention against Natural Risks (PPR) controls and regulates the use of natural and rural land and is charged with the responsibility to notify communities of possible risks that they may be exposed to. It is also responsible for introducing measures appropriate in urban planning and construction (ISDR, 2002b).

Developing countries have also initiated measures to reduce risks. In 1997 India developed a Vulnerability Atlas. The Atlas is used to assess vulnerability and risk levels of buildings within districts. The Atlas has helped to strengthen regulations by amending building by-laws, and creating land use planning regulations concerned with the promotion of disaster resistant design and planning. There are also policies and strategies designed to ensure the optimal use of land, and the prevention of flood hazards (ISDR, 2002b).

In 2001 Mozambique produced a law of Disaster Management whose aim is “to establish strategies, legal norms and operational programmes for prevention, aid and rehabilitation in case of disastrous occurrences” (Matsimbe, 2003:3). Botswana also has a disaster management policy.

Land use planning also involves flood plain rehabilitation. As such, land use planning is also concerned with maintaining or restoring healthy ecosystems (Abramovitz, 2001). An effective conservation measure is to plant deep-rooted grasses and trees on natural drainage systems so that they absorb water (Abramovitz, 2001; Kovach, 1995). Furthermore, efforts are made to tap “nature’s engineering techniques-using the services provided by healthy and resilient ecosystems” (Abramovitz, 2001: 138). Wetlands act as natural sponges that absorb excess water, and under normal circumstances reduce flooding. Forests and vegetation too provide many environmental services. Among others, they regulate water regimes by intercepting rainfall and regulating flow (Soussan and Millington, 1992). They also minimise soil erosion through the binding effects of root systems, and protect soil from the direct impacts of rain (Soussan and Millington, 1992). Therefore, forests can reduce the impacts of flooding.

Whilst land use planning may be heralded as a partial solution to hazard and risk management, it has limitations. The approach overlooks the fact that different segments of the population have conflicting values concerning land (ISDR, 2002b). As mentioned earlier, when the US government offered to buy properties from home owners and business people

along the Illinois River some people refused to sell because they felt the government's bid price was too low (Coch, 1995).

In addition, regarding the application of the land use approach, neighbouring or adjacent communities which are not in the same country have to be considered. According to the ISDR (2002b), actions taken by one community or country that shares a river with another may have an adverse effect on the other. Many countries share rivers as a resource, and some drain in more than one country. Accordingly, control of the resource becomes a shared responsibility which requires collaboration between the concerned countries. If there is no coordination one country suffers the consequences.

As indicated at the beginning of the chapter, contributions regarding flood riskmanagement have been shaped by early views and perceptions of flood hazards. A search for appropriate flood mitigation methods continues, with scientists from different disciplines currently advocating a holistic approach that incorporates a range of structural and non-structural measures. This approach to dealing with flood hazards is yet to penetrate Third World countries. Botswana is no exception.

2.4 Management of flood events

Different intervention methods are employed by different countries against flood crises. These methods relate to preparedness, response and recovery from floods. These stages are not a blue print *per se*, but serve as guidelines towards human adjustment to disasters. They

assist in organising the thinking, activities, research and policy making for hazard management (Mileti, 1999).

2.4.1 Flood preparedness and early warning

Flood preparedness is conceptualised here as activities taken immediately after an adverse weather forecast so as to ensure effective response to flood crises. Flood preparedness involves warning people of the impending danger on time. When warning is effective and timely, people are able to act in ways which can minimise the losses and trauma (Rosenthal *et al*, 1998). In order for preparedness to be effective, Mileti (1999) states that it should entail an assessment of what hazard (for instance flood) can occur in a place, and an analysis of the risk to determine the likelihood of problems that may arise after an extreme event occurs. Preparedness also entails the dissemination of early warnings and temporary evacuation of people from at risk areas (ISDR, 2002b).

Flood warnings in Belgium and France, for example, are treated like any other impending disaster. In France, flood warning is divided into collection and processing of information and the alert systems. The former is performed by the flood announcement service and the meteorological department. The private sector and the community are also included in the disaster management team. The bureaucratic warning channels involve government ministries that are subdivided into many departments. There is clarity in role designation, which facilitates information dissemination to the concerned parties. However, this is not to say that there are no problems regarding information distribution. In France, the prefect who is chief administrative official of a district receives the information from the flood

announcement service. Then he or she has the mandate to decide the alert and relay it to the mayors who in turn disseminate it to the communities (Gilbert and Gouy, 1998).

In France, warnings are disseminated by radio, television, newspapers and posters. The warning mechanisms employed by the French government also included the use of vehicles equipped with loud speakers. Repeated messages are announced in the radio to update the community of the flooding situation. Similarly, Belgium's warning channel involves town mayors, governors and the minister of the interior (van Hassel and van Lindt, 1998). These three administrative levels work within their jurisdiction in collaboration with one another.

Developing countries such as Bangladesh and China have warning channels that involve different departments as well as their communities. Warnings are relayed to people through the same means as those employed in developed countries. During the 1998 floods, Bangladesh employed 33,000 community-based volunteers to relay warnings by megaphones and hand-operated sirens. There was mobilisation of volunteer assistance and training of people in the evacuation process and administering of first aid (Walter 2002). People were also evacuated to safer places on higher ground.

While improved and accurate warnings (especially in developed countries that have sophisticated technology) can save lives and property, they too, like structural mitigation, ironically foster a false sense of security (Abramovitz, 2001). Improved accuracy in warnings, coupled with insurance, can encourage people to settle in environmentally risky areas. Even in developed countries such as the United States of America, rich people take unnecessary risks and settle in hazardous areas because they know that in the event of an

emergency they will be physically and financially rescued (Abramovitz, 2001). Apart from deliberately living in hazardous area, there is evidence that rich people exploit insurance. One example is when the USA government bought and demolished buildings in flood-prone areas alongside the Illinois River. One property owner refused to sell because the government offered him less money than he already had collected from insurance from previous floods (Coch, 1995).

Whereas in developed nations the disaster victims exploit insurance companies by demanding high compensation, in developing nations the case scenario is that some people, who are more resilient and less affected by disaster, exploit others who are less fortunate. Not all people in flood areas are victims; some are more affected than others. This is due to differences in socio-economic systems which determine the level of vulnerability of a group (Blaikie *et al*, 1994). Some groups with sound socio-economic capital are more resilient to floods and have the opportunity to exploit others. The victims' inability to protect themselves and their property through insurance makes them more vulnerable and they become prey to loan sharks. In Bangladesh for instance there are money lenders known as *Mohajons* who lend money to disaster victims who cannot qualify for bank loans because they own minimal property which could not be pledged as collateral. *Mohajons* lend money at exorbitant interest rates and the borrowers' inability to repay the loans ends up with victims losing the few resources that they own. Worse, defaulting borrowers may be required to provide free labour to the *Mohajons* as penalty (Hossain and Kolsteren, 2003).

2.4.2 Flood response

Disaster response involves measures taken to alleviate immediate hardship and meet the basic needs of victims. Immediate actions taken at this stage include, among others, detecting the hazard, warnings, search and rescue operations, and evacuation of victims (Mileti, 1999). In response to the 1993 floods, the Belgian and French governments engaged governors, prefects and mayors who carried out the command and supervision of rescue operations within their jurisdictions. Belgium's and France's air forces and fire services evacuated and lodged victims in accommodation centres. The air forces provided beds and sleeping bags. The Red Cross distributed food and clothes to the victims and to rescue volunteers. Boats and helicopters were used in the rescue operations and distribution of aid. The *gendarmerie* ensured security of victims' possessions, goods and property, and in Belgium they also controlled the influx of 'disaster spectators' (Gilbert and Gouy, 1998; van Hassel and van Lindt, 1998).



In some developing countries international assistance is at times sought in order to alleviate in crises management. For instance, in Bangladesh, the World Bank, the United Nations Development Programme (UNDP), and national donor agencies from the USA, France and Japan provided aid in one way or the other during the 1988 floods (Haque and Zaman, 1994). A decade later, in 1998, Bangladesh experienced yet more heavy floods, and the international organisations such as Oxfam and CARE once again dominated the relief organisations (Hossain and Kolsteren, 2003). Shelters were erected by many external agencies, and some existing structures such as schools were used for temporary accommodation. Free food was distributed by NGOs; the government had little input in this regard. However, the

government, together with some NGOs, concentrated on providing medical care in remote areas through mobile teams. NGOs even distributed cash.

2.4.3 Flood recovery

Recovery from flood crises involves cleaning up debris, sorting out and recovering damaged goods, and rehousing victims and compensating them. In Belgium and France, the municipal fire service and volunteers helped clean up after the floods. In France, the rehousing of families was done within twenty-four hours. Victims were also financially compensated by a private municipal coordination commission. Belgium also compensated flood victims, taking six months to settle claims (Gilbert and Gouy, 1998; van Hassel and van Lindt, 1998).

Even in the Third World recovery from flood crises in Bangladesh was followed by rehabilitation activities. These included repairing damaged houses, supplying agricultural seeds and fertiliser. NGOs provided cash for work programmes. Cash grants and interest free loans were supplied by agencies (Hossain and Kolsteren, 2003).

In the recovery process, bureaucracy becomes a hindrance and stalls efforts to alleviate crises. For instance, the Belgian government was cumbersome when processing claim forms and delayed the compensation process. This worsened the situation of flood victims because they were compelled to make ends meet with the few resources left. In developing countries a delay in compensation is particularly detrimental to the victims who are so often poor and often helpless during an emergency. Disasters leave poor people very few resources to fall back on (Abramovitz, 2001). In the case of the 1998 floods in Bangladesh, many people used

all their resources and were forced into debt in order to survive after the floods. The situation was worsened by the loan sharks known as *Mohajans* who lent money to the poor knowing that it was impossible for the victims to repay the money within the stipulated period (Hossain and Kolsteren, 2003).

2.5 Riverine flooding in southern Africa: the experience of the 2000 Mozambique floods

Media coverage on the 2000 Mozambican floods attracted a lot of interest in the neighbouring countries and the international community. The floods received widespread coverage from media and in turn generated relief aid from the international community. Emergency management of the flood crises had challenges and successes. The study therefore draws heavily on the experience of the Mozambique floods from the perspective of Hanlon and Christie.



2.5.1 Flood preparedness and early warning

During the Mozambican floods of 2000, there was immediate mobilisation of the nation's disaster risk management department known as the National Disaster Management Institute or the *Instituto Nacional do Gestao das Calamidades* (INGC), and other interested bodies. Flood committees were formed at provincial and district level (Matsimbe, 2003). Provincial governments working in collaboration with the nation's disaster risk management team prepared contingency plans. The plans showed how many people were at risk and where they would be evacuated to. The plans also indicated the resources that could be used to respond

to the emergency and which actions were to be carried out. Publicity campaigns and two workshops had previously been conducted by the INGC in preparation for the impending floods. The publicity campaigns involved the participation of the district and local authorities. The Red Cross also ran retraining programmes for its volunteers in 1999 (Christie and Hanlon, 2001). The UN system issued warnings when the rains increased. The Southern Regional Water Administration issued repeated warnings. The national radio station also broadcast warnings and announced the state of affairs regarding the water levels and the flooding in different areas of the country. Administrators and government officials' also relayed warnings by radio and mobile telephones. Loudspeaker messages were broadcast from helicopters when the roads were inaccessible (Christie and Hanlon, 2001).

Notwithstanding efforts taken to disseminate flood warnings, they are sometimes ignored or not taken seriously. People in the warning chain, and residents, fail to react for several reasons. These include previous false warnings, fear of giving erroneous warnings, people not wishing to part with their belongings, and late warnings. In the case of Mozambique, the meteorological department had previously predicted an El Nino drought which did not happen. People lost confidence in the department issuing the warnings. As a result, even the department itself hesitated to give warnings lest they were erroneous.

When issuing warnings, the concerned department also has to deal with public scepticism. Sometimes people just don't have faith in the department or the person delivering the warning. This was highlighted when an elderly female Mozambican flood victim mentioned that an official came to her house to advise about the flood, but she did not believe him (Christie and Hanlon, 2001). Furthermore, a head of department of the provincial directorate

of public works mentioned that when he announced that the coming flood would be bigger than the one in 1977, people did not believe him and told him he was too young to remember the 1977 flood. He further commented that if he, the Director of Public Works and a head of provincial department could not convince his staff that the flood would be worse than that of 1977, how then could the public be convinced otherwise? (Christie and Hanlon, 2001).

Warnings sometimes reach people late. This may be attributed to lack of coordination within a disaster risk management structure. In Mozambique there is centralisation of authority. Here, the ministers and national directors had to make decisions. There was a reluctance to involve other officials subordinate to the ministers and directors. Thus, some officials did not have a clear picture, and the warnings were delayed (Christie and Hanlon, 2001).

The other reason for not taking heed to the warnings is that people were reluctant to leave their possessions behind either for sentimental reasons or fear of theft. Regarding the latter, an informant about the Mozambican floods mentioned that it was difficult to abandon ones house and everything one possesses (Christie and Hanlon, 2001). It is difficult to leave a house, which after all, is a lifetime's investment that constitutes the principal legacy to children (ISDR, 2002b).

Another reason why some people refused to heed the Mozambican flood warnings is because they did not want to leave their cattle behind. In southern African states such as Botswana and Mozambique cattle are a source of income, and are traditionally regarded as a sign of wealth. So there is fear of abandoning ones source of income and wealth. One could also draw the conclusion that people's reluctance to move is due to the fact that they may feel

more afraid and at risk in the new areas than if they had remained in their old familiar environment (ISDR, 2002b).

2.5.2 Flood response

Initial response involves rescue and evacuation operations conducted by local people. The Mozambicans rescue operations involved 56 aircraft flown by aid agencies and foreign air forces to rescue victims from rooftops and trees. Local people also helped themselves using boats (Walter, 2002). Nonetheless, there is a trend of relying heavily on external aid in times of dire need, as illustrated by the Mozambican 2000 floods.

With regard to the sectorally compact organisation of the 2000 flood response, Mozambique's response mechanism was structured into six sectors. The World Food Programme (WFP) coordinated food distribution; the Ministry of Health focused on health issues; the United Nations Development Programme (UNDP) and Red Cross dealt with accommodation and clothing; UNICEF coordinated transport, logistics and communication. An information sector disseminated relevant information to all sectors involved in the relief aid and efforts (Christie and Hanlon, 2001). The six sectors were dominated by international organisations and NGOs in provision of relief aid in Mozambique (Table 3). This is not to say, however, that the organisations dominated the actual operations as the locals were actively involved in that they helped in rescue operations and evacuated victims before external aid arrived.

Table 3 UN agencies working with the Mozambican government during the 2000 floods

INSTITUTION	ACTIVITY
WFP	Distributed 53,000 tons of food to 650,000 people for 6 months.
UNICEF and WHO	Water supply for 29 towns; Disinfecting & major clean-up operation.
WHO, UNICEF, UNFPA	Health and Nutrition.
UNESCO, UNICEF, WFP	Education: reconstruction of schools; distribution of teaching materials and food.
FAO	Agricultural sector and rural communities: immediate response and rehabilitation of essential services.

Source: Adapted from Government of Mozambique (2000).

The local and international community made their mark on the relief aid and operations, but other efforts provided by other actors cannot go unnoticed. One is the contribution made by the media. During the 2000 floods in Mozambique, the media coverage of the flooding generated publicity which spawned aid from different countries (Africa and abroad), international organisations and individuals. During the sudden influx of emergency aid in the country, 49 countries and 30 international non-governmental organisations provided humanitarian assistance (Christie and Hanlon, 2001; Moore, Eng and Daniel, 2003).

Mozambique undoubtedly reaped the benefits of huge media coverage; however the massive aid generated by the coverage created problems. The magnitude of the disaster and the aid that poured in revealed inadequacies within the Mozambican disaster management structure. The distribution of aid posed a problem, the country did not coordinate its relief operations efficiently and effectively.

Whilst developed countries may have clearly defined policies on disaster risk management, most developing countries like Mozambique lack clear disaster risk management policy and structure (Marjanovic and Nimpuno, undated). This affects the coordination of different departments involved in disaster risk management. For instance, during the year 2000 floods in Mozambique, one of the most serious problems was that

“lines of authority were not clear, especially at provincial level. The roles of INGC, governors, ministers and local government were not well defined. Early on in the flood relief, agencies were crying out for coordination” Christie and Hanlon (2001:79).

A Red Cross official mentioned that although many organisations brought in goods which were transported to the locations where they were needed, no distribution mechanism was set up to allocate the goods to areas where they were needed (Christie and Hanlon, 2001). This not only frustrated the disaster risk management officers in charge but affected the victims themselves. The lack of a clear relief distribution system may also explain why disaster relief is sometimes stock piled in store rooms or distribution points and does not reach the intended population.

Two lessons emerge from the Mozambican floods. First, apart from the lack of clarity in role designation, the situation showed that during a serious disaster the disaster risk management department was so overwhelmed that it became an observer rather than manager of relief operations. Even SADC was reduced to a spectator, and the international aid donors took centre stage (Marjanovic and Nimpuno, undated). The implication of this observation is that SADC countries are incapable of handling disasters on their own without the intervention of international bodies. While this may be demoralising, it is to a certain extent true of most

southern African countries. As already mentioned, Mozambique and other developing countries are dependent on aid. Similarly disaster related practice in southern Africa is relief oriented and extremely dependent on external financial aid. Dependence on external relief and financial support has disabled true ownership of disaster risk by southern African countries especially when circumstances are unmanageable (Holloway, 2003; ISDR, 2002b). Ironically, some of these countries are relatively rich. Botswana and South Africa are cases in point, but in the event of a big disaster they too call for aid.

A second lesson to emerge during the Mozambican flood is that it was apparent that there was a lack of communication between the disaster risk management officials and other government officials. As it was later observed during the evaluation of the Mozambican 2000 flood crisis management, communication breakdown sabotaged the efforts of other officials. For example, Maputo air force officials stopped a cargo plane from taking off because of a pending landing fee (Christie and Hanlon, 2001). The result was that different officials were brought in to solve the problem: the ambassador of the country that supplied the plane, a minister and air force officials. Fragmentation within the disaster management team delays aid that is desperately needed by disaster victims, and these avoidable delays aggravate suffering.

The case of the 'landing fee' problem that could have been settled by airport officials, illustrates another problem created by bureaucracy, namely the adverse effect on relationships between the donor and the affected governments or receiving country. During the Mozambican 2000 floods, help from donors was delayed because of the lengthy cycle for negotiating projects (Christie and Hanlon, 2001). Field research suggests that in future NGOs

would become disinclined to work with provincial government authorities. This is because NGOs felt that critical time and energy was lost because of the bureaucracy associated with aid distribution events (Christie and Hanlon, 2001; Moore, Eng and Daniel, 2003).

While the humanitarian role of international non-governmental organisations in developing countries cannot be overemphasised, these organisations do have limitations. Some of the organisations display an element of dominance. This was illustrated when a Mozambican official mentioned that during the 2000 floods the city of Chokwe was run by an NGO and that the NGO refused to recognise the local municipality (Christie and Hanlon, 2001). This evidence suggests a 'power'-related problem. The NGO's refusal to recognise the local authority undermined the municipal administration. Furthermore, there was a request to the effect that all NGOs register their presence with the Ministry of Health, but some NGOs ignored the report. An example of an NGO which failed to register with the Mozambican authorities was reported to be distributing food at Chiaqueline accommodation centre in a disorganised manner, resulting in five fatalities and ten injuries. Another problem was that some NGOs told people to return home when there was still potential for further flooding in the areas (Moore, Eng and Daniel, 2003).

It could be argued that the efforts to alleviate the effects of flood and other disaster crises in developing countries are undermined by poverty. It is evident that poverty and slow development in developing countries amplify the adverse effects of disasters (Walter, 2002). This results in strong reliance on international aid. Mozambique relies more on external aid. Mozambique is ranked amongst the poorest nations in the world. Christie and Hanlon (2001:7) observe "Mozambique is a good pupil of the International Monetary Fund (IMF)

and World Bank, and remains highly fashionable with the international aid community.” This reliance is justifiable on two counts. First, the Portuguese colonisers left Mozambique poor and ill educated. Second, following its independence, the country was ravaged by war. The war cost Mozambique \$20 billion in damages, killed a million people, and afflicted 5 million others who were either displaced or made refugees (Christie and Hanlon, 2001:6).

Coupled with the lack of financial resources, Mozambique has inadequate qualified human resources to manage disaster risks. Lack of skilled personnel prevails with most SADC countries. Botswana is no exception in this regard. If SADC is to be successful in managing disaster risks there has to be training programmes in disaster risk reduction and vulnerability reduction (Marjanovic and Nimpuno, undated). In Mozambique, the lack of human resources in disaster risk management is partially blamed on colonialism. In the past, colonial authorities allowed few Mozambicans to become educated. Thus the current disaster risk management team is headed by young people who have received secondary school, university and postgraduate education and have accumulated little technical and managerial experience (Christie and Hanlon, 2001).

Another challenge lies with the competing demands for resources in most African states. Governments have to deal with too many developmental issues, at the same time deal with pressing issues relating to contingencies which require immediate financial as well as human resources. In this regard, it is difficult to concentrate finances and other efforts on disaster risk management. Most developing countries face a dilemma when it comes to allocating finances to disaster risk management. In other words there is no pressure on the countries to plan for extraordinary events that may never occur when there are so many pressing, visible

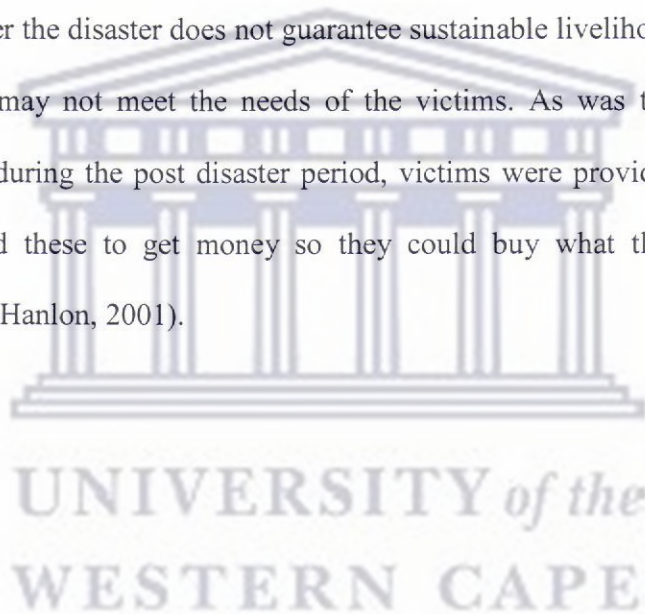
current problems such as those related to health matters, education and poverty eradication. In countries in southern Africa, Botswana for instance, the HIV/AIDS pandemic has claimed more lives than any other disaster in the 1990s. The country is ranked amongst countries with highest HIV/AIDS incidence (Marjanovic and Nimpuno, undated). Efforts to combat such a pandemic are to a certain extent justified albeit at the expense of other disasters. In Mozambique, there is competition between development of disaster risk management and say, education or agriculture. In this regard, the argument is often made that a day taken up in emergency training of officials is a day lost in carrying out routine tasks (Christie and Hanlon, 2001).

Regarding flood crises and flood risk management, scholars such as Holloway (2003) and Abramovitz (2001) have observed that disaster risk management is dominated by disaster response as well as rescue and relief operations, as opposed to building sound mitigation measures. Responding to a disaster crisis is immediate. Disaster response is almost a reflexive outpouring of help to alleviate the victims' suffering (Abramovitz, 2001). After the deluge,

long-term rebuilding and disaster prevention efforts rarely elicit the same level of empathy and support. Among donors, governments and even humanitarian organisations, there is a well-developed culture of response but not an underlying culture of mitigation (Abramovitz, 2001: 134).

Many countries in southern Africa (as is characteristic of the whole continent and other developing nations) have a culture of focusing on response measures when dealing with contingencies and disasters. The countries display a reactive approach, where rescue and relief operations dominate mitigation measures. As observed by Holloway (2003) and ISDR

(2002b), southern Africa is limited in disaster mitigation capability notwithstanding the region's prolonged droughts and flood relief operations. Southern Africa's prolonged relief operation has an adverse effect on the region's ability to handle its own disasters because the reactive approach creates dependency on external aid (ISDR, 2002b) and disempowers the victims as well as the receiving country. Dependence on external aid also restrains the aid recipients (countries receiving aid) from becoming proactive, as it discourages local initiatives in disaster risk reduction and preparedness (ISDR, 2002b). Moreover, continuing to provide relief aid after the disaster does not guarantee sustainable livelihoods. In fact some of the relief provided may not meet the needs of the victims. As was the case with the Mozambican situation during the post disaster period, victims were provided with building materials but they sold these to get money so they could buy what they judged more necessary (Christie and Hanlon, 2001).



CHAPTER 3

BOTSWANA'S FLOOD RISK CONTEXT AND THE 2000 FLOOD EVENT

Knowledge of the physical geography of Botswana is crucial for understanding the conditions that make Botswana (a drought prone-country) experience flooding. This chapter examines the physical regions of Botswana and their contribution to flooding. Also examined are disasters with a natural trigger that occur in Botswana such as drought, floods, animal diseases and veld fires. These disaster risks threaten the agricultural sector which is the basic livelihood of Botswana people. These disasters are indeed a threat to human life.

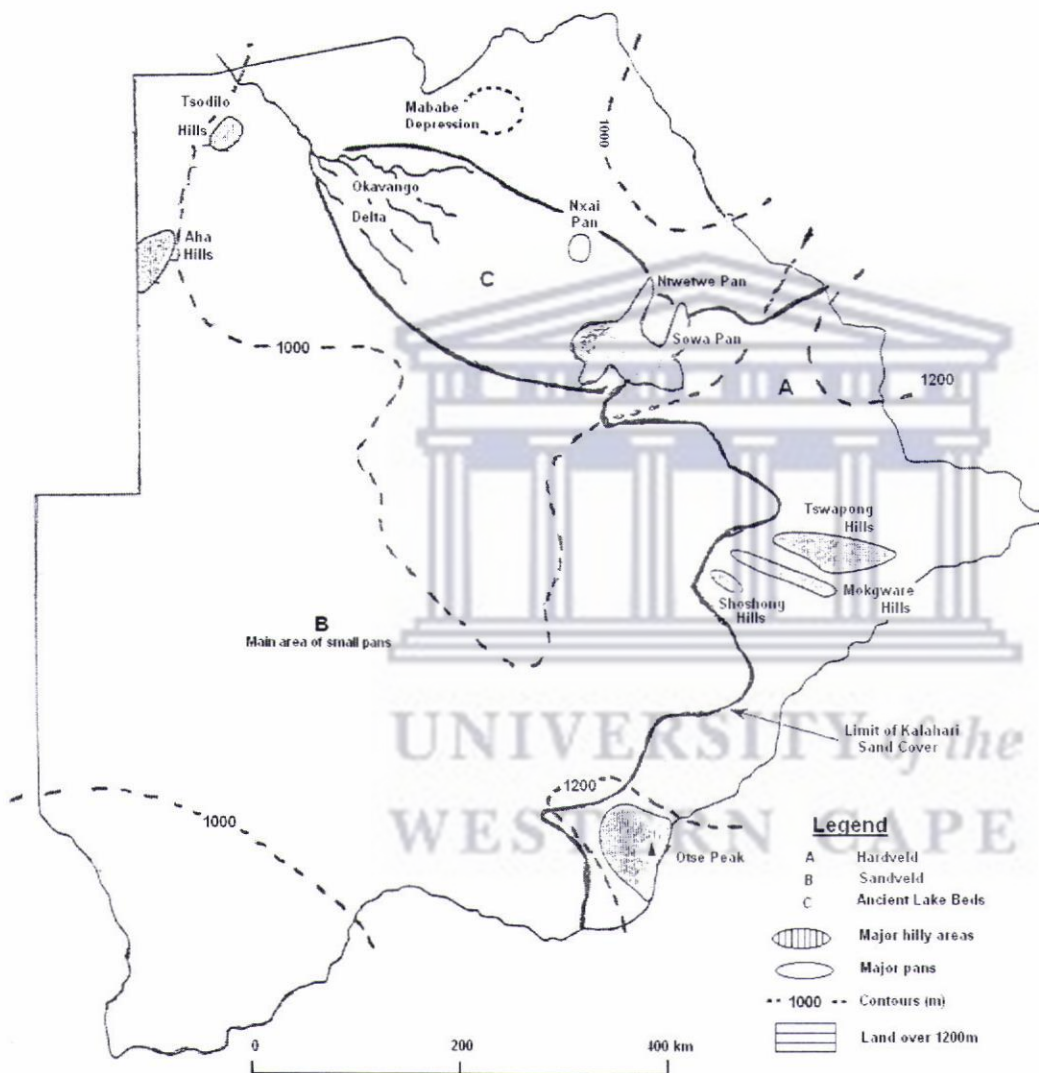
As alluded to in the previous chapter (in Tables 1 & 2), flooding is controlled by a number of interrelated factors which can either be physical or human induced, or a combination of both. Human factors exacerbate flooding but climate and landscape determine the magnitude of the flood itself (Clark, 1984; Baker *et al*, 1988). In order to understand flooding in Botswana, a country characterised by sporadic but occasional intense rainfall, it is important to look at the conditions that contribute to flood events. An evaluation of the extent of flood potential in arid regions requires an examination of a “detailed mosaic of terrain surface properties” (Schick, 1988:193) and, it should be added, climate.

3.1 Relief and climate

Botswana is a flat country with a mean altitude of 1000m above sea level (Cooke, 1979). The low altitude and flat terrain (Figure 1) make the land vulnerable to floods should there be

intense prolonged rains. The country has three main environmental regions, namely the Hardveld, the Sandveld and the Ancient Lake Beds (Parsons, 1999).

Figure 1: Botswana: physiography



Source: Adapted from Selitshena and McLeod, 2002.

The Hardveld occurs mainly in the south east and east central part of the country. Altitude here varies considerably between 1, 489m at Otse Peak between Gaborone and Lobatse, and 520m at the confluence of the Limpopo and Shashe Rivers. The area consists of a rocky area and areas of shallow sand cover. There is also Hardveld in the extreme west in the Gantsi area.

However, elsewhere in the region the area is flat or undulating (Silitshena and McLeod, 2002). The country's population and economic activities are concentrated in this region, and this heightens flood vulnerability, or the socio-economic impact of hazardous event that may occur in the region.

The Sandveld is a flat area of deep loose, non-resistant Kalahari sand which covers the entire country, except there are rock outcrops in the north west. The rock outcrops of the north west are strong, hard, compact igneous rocks which allows minimal infiltration.

The ancient Lake Beds consist of the Okavango River and Delta, the Mababe depression, the Makgadikgadi Pans. This region is located in the Kalahari basin which is superimposed on the Sandveld in the north western part of the country.

Botswana experiences a semi-arid climate. Summer months from October to April are hot with temperatures of above 34 degrees Celsius. The winter months (May to September) are cold with night temperatures that sometimes fall below 2 degrees Celsius. The mean annual rainfall ranges from over 650mm in the north east to less than 250mm in the south west, thus the mean annual rainfall for the country is 450mm (Cooke, 1979; Parsons, 1999; Silitshena and McLeod, 2002). Rain occurs mostly in the summer. Rainfall is sometimes torrential and produces flash floods. Winters are dry.

3.2 Botswana' disaster profile: disaster risks with natural triggers and changing patterns of social vulnerability

The country faces both natural-and human-induced disasters. Disasters with natural triggers include drought, veld fires, and epidemics such as HIV-AIDS, pest infestations, animal diseases and earthquakes. Human-induced disasters include industrial and motor vehicle accidents, dam failures, urban fires and refugee influx. The degree of regularity and intensity with which these disasters occur varies considerably (Mogwe, 2001). Drought and HIV-AIDS are “creeping emergencies” (Holloway, 2003). They constitute the country’s most significant threats. By contrast, other disasters risks occur occasionally. The Okavango River, for instance, experiences seasonal floods that cause significant damage to property. Likewise, the occurrence of disasters in the country may be simultaneous. A case in point is the period between July 2004 and June 2005 that was declared a drought recovery year by the President of Botswana, following insufficient rains in the first half of the year 2003 and 2004. Paradoxically, during this period of generally insufficient rains there was a period of high rainfall which resulted in flooding in parts of the country. This variation can be accounted for by the country’s geographical location, large surface area, and rainfall variability.

3.2.1 Disaster risks with natural drivers

(a) Drought

Over the years, Botswana has experienced prolonged periods of drought. The year 1981 marked the advent of severe drought spells. The severity of drought was felt during the periods 1981 to 1987, and 1991 to 1992. Drought continues to pose a threat to the country's economy, especially the agricultural sector. In Botswana 79% of all the total land is occupied by agriculture. More than three quarters of the land (77%) is pastoral or grazing land and 2% is cropland (Selitshena and McLeod, 2002). The agricultural industry comprises pastoral and arable farming. The latter is rainfed. A lack of rain is a disaster to the farming industry.

So crucial is agriculture that during the 2003-2004 drought year, expenditure on relief measures amounted to P282 million, approximately US\$47 million (BOPA, 2003; Botswana Daily News, 12 May 2003). The importance of issues relating to agriculture make headline news in most local newspapers. For instance headline article "Botswana drought stricken" in the Botswana Daily News, draws attention to one of the recurring national problem. Although Botswana boasts of mining and tourism as major economic activities, agriculture is still the resource base for most Botswana people. Statistics indicates that 51% of the total population is engaged in agricultural activities with mining, manufacturing and construction constituting 17% (Selitshena and McLeod, 2002). The beef industry is one of the three main foreign income earners in the country. Experiences of drought constrain the livelihoods of most Botswana people taking into account that of the 51% who are engaged in agriculture, 41% practices family or subsistence agriculture. Great reliance on agriculture coupled with continuous drought events, has led to the establishment of strategies and mechanisms to curtail the impacts of drought within the country.

(b) Livestock disease

Not only does drought create havoc in the agricultural sector, animal disease and pest infestations are a problem too. Foot and Mouth disease, lung disease and other diseases and pests such as tsetse fly have plagued Botswana. A recent example is Foot and Mouth disease which attacked the northern part of the country in 2003. The government spent approximately P22 million, about US\$3, 67 million, eradicating the disease and restocking (Mudongo, 2003 Botswana Daily News, 7 May 2003). The eradication process involved the massacre of animals. The cattle were shot and carcasses were buried in mass graves.

(c) Veld fire

Veld fires are a threat too. They are common during the dry winter season. The decline in forest resources in southern Africa has been blamed on veld fires. Like any other disaster risks, bush fires result from human action and natural causes. In Botswana, 10% of fires result from natural phenomenon such as lightning whilst 90% are caused by people (Mathe, 2004a; Botswana Daily News, 21 June 2004). Human-induced fires are either accidental or intentional or are a result of carelessness.

Veld fires cause tremendous if not irreparable damage to biodiversity however, they are a natural management tool used to maintain the ecology of grasslands as well as forests. Research on the positive effects of veld fires dates way back (Daubenmire, 1974; Viro, 1974) similarly extensive research on the global importance of fire has been done (Bond and van Wilgen, 1996). Many living organisms and species are adapted to natural disturbances. These disturbances are essential in maintaining their health, vitality and propagation. Some forests

and grasslands need periodic forest fires to facilitate new healthy vegetation growth and to restore soil fertility (Abramovitz, 2001). Thus some species within the plant and animal kingdoms have evolved to co-exist with fire. These species require fire to reproduce, survive and be competitive (Enviroteach, 1998). In other words, veld fires lead to reforestation and, at the same time, a new species of trees grow. Another advantage of fire is that species which are fire resistant benefit from fire because it destroys species and eliminates competition for soil nutrients (Daubenmire, 1974; Viro, 1974).

In Botswana, farmers have deliberately burned bush for three main reasons. First, when grasses grow in infertile soils they become dry and indigestible to animals. Fire is then used to remove the dead, coarse inedible grasses from rangelands to make way for the new palatable grasses to grow. Second, fire is used to rid rangelands of the unfavourable prickly grass material. Last, high bush density and growth hinders the growth of good edible grasses in rangelands thus reducing the carrying capacity of the rangelands. Fire is then used to prevent bush encroachment and to curb growth of unwanted plants (Enviroteach, 1998).

However, uncontrolled veld fires lead to loss of plant and animals affecting biodiversity or the variety of life on earth. Fires damage the ecosystems that is, the community of living organisms interacting with their environment. In their natural state, ecosystems comprise integrated and largely self-regulating communities of organisms which exist in harmony with their chemical and physical environment. The processes of ecosystems dominate the global cycles of oxygen, carbon, phosphorus and other important elements fundamental to life (United Nations Environment Programme (UNEP, 1992). Ecosystems maintain the habitability of the earth by providing valuable 'ecosystem services,' for instance; forests

provide a myriad of services such as flood control, water supply, timber and many others (Abramovitz, 2001). Uncontrolled forest fires therefore put strain on ecological systems. In the past few years Botswana has been seriously affected by veld fires. Satellite imagery indicates that 40% of Botswana's land was ravaged by uncontrolled bush fires between the period, July and October 1997 and that in some districts 90% of the area was affected (Enviroteach, 1998).

(d) Desertification

The effects of veld fires are complex and can lead to environmental degradation. Not only do fires threaten ecosystems, they retard vegetation growth and leave land bare and open to agents of erosion. Barren land, aridity and drought, together with veld fires, contribute to desertification. Desertification is "land degradation in arid and semi arid and dry sub-humid areas resulting mainly from adverse human impacts" (UNEP, 1992). Globally, 70% of productive dry lands (approximately one-quarter of the earth) is threatened by desertification. In Botswana about 18% of the country (104,760 square kilometres) is degraded (Enviroteach, 1998). While aridity and drought exacerbate desertification in the country, human interference with the natural environment is the main cause of the problem. Observations by UNEP (1992) have established that the underlying cause of desertification is excessive land use. In Botswana, desertification is associated with over-cultivation of land, deforestation and pastoralism. The growth of pastoralism has been influenced by the development of a market-oriented economy which gave cattle a high monetary value. This resulted in rapid increase in livestock which in turn has put enormous pressure on rangelands (Darkoh, undated). Thus uncontrolled fires have a significant bearing on desertification. This has implications for farming and the livelihoods of many Batswana.

3.2.2 Changing patterns in social vulnerability

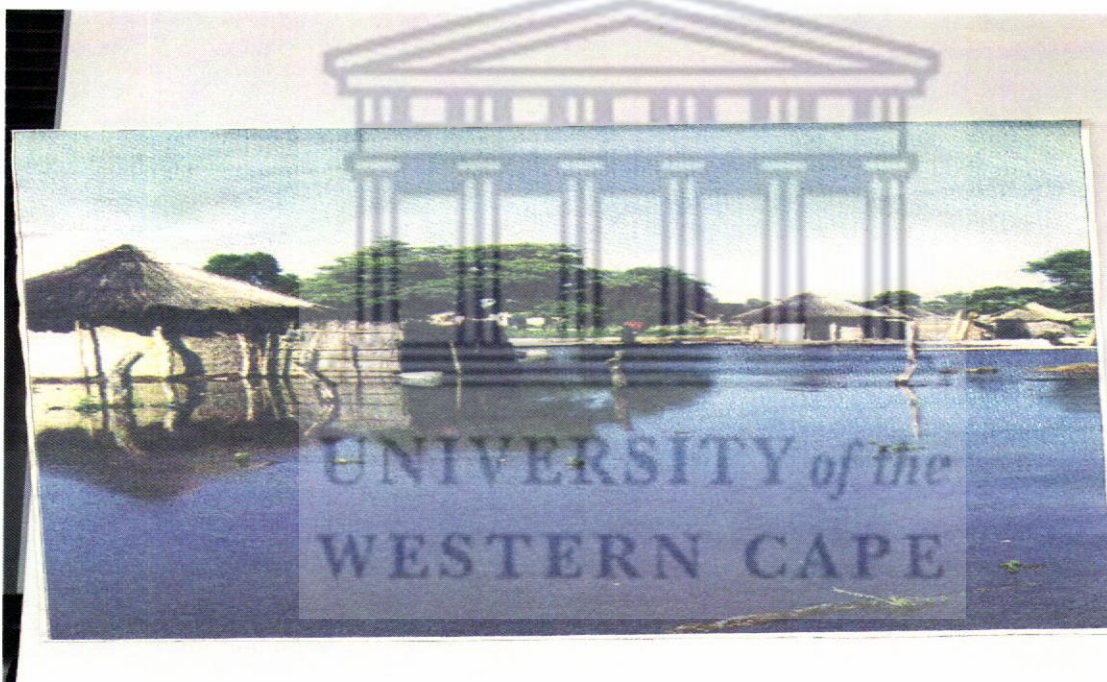
(a) Social vulnerability and small recurrent disasters

This chapter has highlighted the disaster risks that threaten life and property in Botswana. In addition to the major disaster risks experienced by Botswana, there are small disasters that occur regularly but may not be recognised as disasters but affect communities especially the poor. Even reliable statistics fail to “reveal the full impact of natural hazards on society because many disaster events fall below the arbitrarily defined threshold of what constitutes a disaster” (Walter 2002: 11). For instance research in Latin America revealed that the impact of small disasters that occur in everyday life may be much greater than that of the much smaller number but large events that are formally recognised by the international official disaster register. Between 1988 and 1998 in Guatemala, 1,666 small disasters caused 1,393 fatalities and afflicted 395,961 people (Walter, 2002).

Similarly, in Botswana, several small disasters occur that are not given significant attention. The Okavango River floods seasonally (Figure 2). Accidental fires affect individual households and government property. Veldt fires affect individual farmers. Farmers lose their livestock due to disease and pest infestations. Some of these disastrous events affect a small population, but they are devastating because they usually affect poor people disproportionately and deprive them of their livelihoods, and increase their vulnerability. Most Botswana's livelihoods are predominantly agro-based and such adversities diminish their income. In addition to losing livestock and crops, other household goods used to earn income are lost in small disasters. Replacing such items becomes difficult, as victims may not be insured. Sometimes victims never recover. In light of this observation, small disasters should receive significant attention especially in developing countries. As Walter (2002)

states, disasters seek out the poor and make sure they stay poor. A case in point is that victims of small disasters such as those living along the Okavango River (Figure 2), the east of Mahalapye to mention but two, not only loose crops and livestock but are also left homeless. In rural areas of Botswana, traditional dwellings are built with mud and thatched with grass, making the homesteads less resistant to prolonged heavy showers, which often bring flash floods.

Figure 2: Xaxao Village Flood 2004



Source: Botswana Daily News, 18 March 2004.

The Okavango River's seasonal flooding affects the daily lives of communities such as that of Xakao Village, a desolate inundated rural village reflected in Figure 2. The absence of domestic "activities" such as laundry and small domestic animals for instance, chickens and dogs suggests the home owners may have sought refuge elsewhere. The floods are a seasonal feature in the area and often render the villagers temporarily homeless. Also shown in the

picture, are the mud and thatch dwellings, which in very strong adverse weather conditions such as storms and floods, sometimes get blown or washed away.

(b) HIV/AIDS

As if natural environmental problems were not enough, Botswana faces another scourge. Botswana's HIV-AIDS incidence is high (Mogwe, 2001). The HIV-AIDS scourge has put the country's health delivery system under stress and this impacts negatively on the health sector (Motswakae, 2003; Botswana Daily News, 3 September 2003) and on the country's economy and development. The rampant epidemic reflects poverty but is not a cause *per se*; instead, it exacerbates it and causes perpetual impoverishment which results in the increase of poverty stricken people. This has an adverse effect on, and reverses decades of development (Clover, 2003). In light of this observation, Botswana is economically progressive, but the HIV-AIDS risk management is taking its toll on the country's budget making other developments a second priority. Furthermore, the government's focus on HIV-AIDS and poverty eradication places a greater challenge towards containing the ravages of floods and drought. The government of Botswana needs to address problems arising from extreme natural events such as floods.

Other disasters impact negatively on the country's economy, yet they do not or have never received significant attention like drought or HIV-AIDS. The 1999-2000 flood events have indicated the need for flood risk to be 'recognised.' Floods know no boundaries and affect all sectors of the government, infrastructure, private property and people when they occur. This was revealed by the damage to property and loss of life caused by the 1999-2000 floods.

3.3 Flooding in Botswana: recent history, local impacts and contributing risk factors

With the exception of statistical records of seasonal flooding of the Okavango River, which were kept as early as the 1970s (Gumbrecht *et al*, 2004), Botswana's records of flood incidence is lacking and fragmented. The known reliable records of flooding and their impacts on the country start in 1995 (Tsheko, 2003). Tables 4 and 5 summarise the damage caused by floods.

Table 4: Damage caused by floods, Botswana 1995

District	Fatalities	Population	Shelters	Repair cost (Pula)*	Other costs (Pula)*
Palapye	11	5, 065	1, 299	4, 018	2, 726
Mahalapye	9	12, 129	1, 677	5, 057	489
Boteti	3	704	100	248	–
Kweneng	–	1, 757	296	545	12
Total	23	19, 655	3, 372	9, 868	3, 227

Source: National Disaster Preparedness Committee Report, 1996.

*Cost of repair refers to maintenance of buildings

*Other costs refers to damage to items such as furniture, food, clothing and bedding.

The 1995 floods caused 23 fatalities (a devastating loss for a generally sparsely populated country) and afflicted approximately 20, 000 people (Table 9).

Table 5: Damage caused by floods, Botswana 1996

Districts	Number of shelters
Kgatleng	18
Southern	148
Central	2, 602
Ngamiland	170
North-East	416
Total	3, 454

Source: National Disaster Preparedness Committee Report, 1996.

Regarding the 1996 floods, no human life was lost; approximately 128 farmers were affected by the flood. They lost 1, 275 livestock, including cattle, goats, sheep and donkeys.

3.4 The 1999-2000 flood event

The turn-of-the-century floods resulted primarily from prolonged heavy rainfall which started in December 1999 and extended into January 2000. In some parts of the country the rains started earlier, around October 1999 (National Disaster Management Office (NDMO), 2000b). The 2000 floods in Botswana were devastating; the damages of the floods are reflected in Chapter 1. The total estimated cost of the damages was P1.1 billion (approximately US\$2, 20 million).

The rains were caused by cyclones that originated from Mozambique channels and reached Botswana by 7th February 2000 (Mogwe, 2001). The cyclones were modulated by the El Nino Southern Oscillation (ENSO). These cyclones caused continuous rains. However,

intensive rainfall does not ensure that a flood will follow automatically (Cooke and Doornkamp, 1974). Crucially, the type of ground on which rain falls determines the magnitude of the flood. Infiltration capacity of the surface which in turn is influenced by the geology and vegetation cover influences flooding. Additionally, a flood is only a hazard if it threatens human life and property (Smith, 2001). Flooding is summarised as follows:

“The series of events that results in a flood begins when raindrops strike the earth’s surface and spatter in miniature explosions of moisture. The surface itself has been compared to a sieve placed under a faucet. If the screen is coarse, water passes rapidly through; if the mesh is fine and the tap is opened wide, some water gets through but the rest slowly rises until the sieve overflows” (Clark 1984:22).

Although presented in metaphorical terms, the excerpt translates into the conditions that lead to flooding. These are discussed in relation to the 1999-2000 flood disaster.

Table 6: Rainfall amount (mm) for the period, October 1999 to March 2000

	October 1999	November 1999	December 1999	January 2000	February 2000	March 2000
Francistown	29.9	162.4	98.3	300.9	288.1	135.3
Gaborone	25.1	25.2	267.8	150.2	276.7	87.8
Gantsi	26.1	43.5	120.3	141.4	336.2	276.3
Lobatse	23.5	28.6	168.0	51.4	223.8	50.1

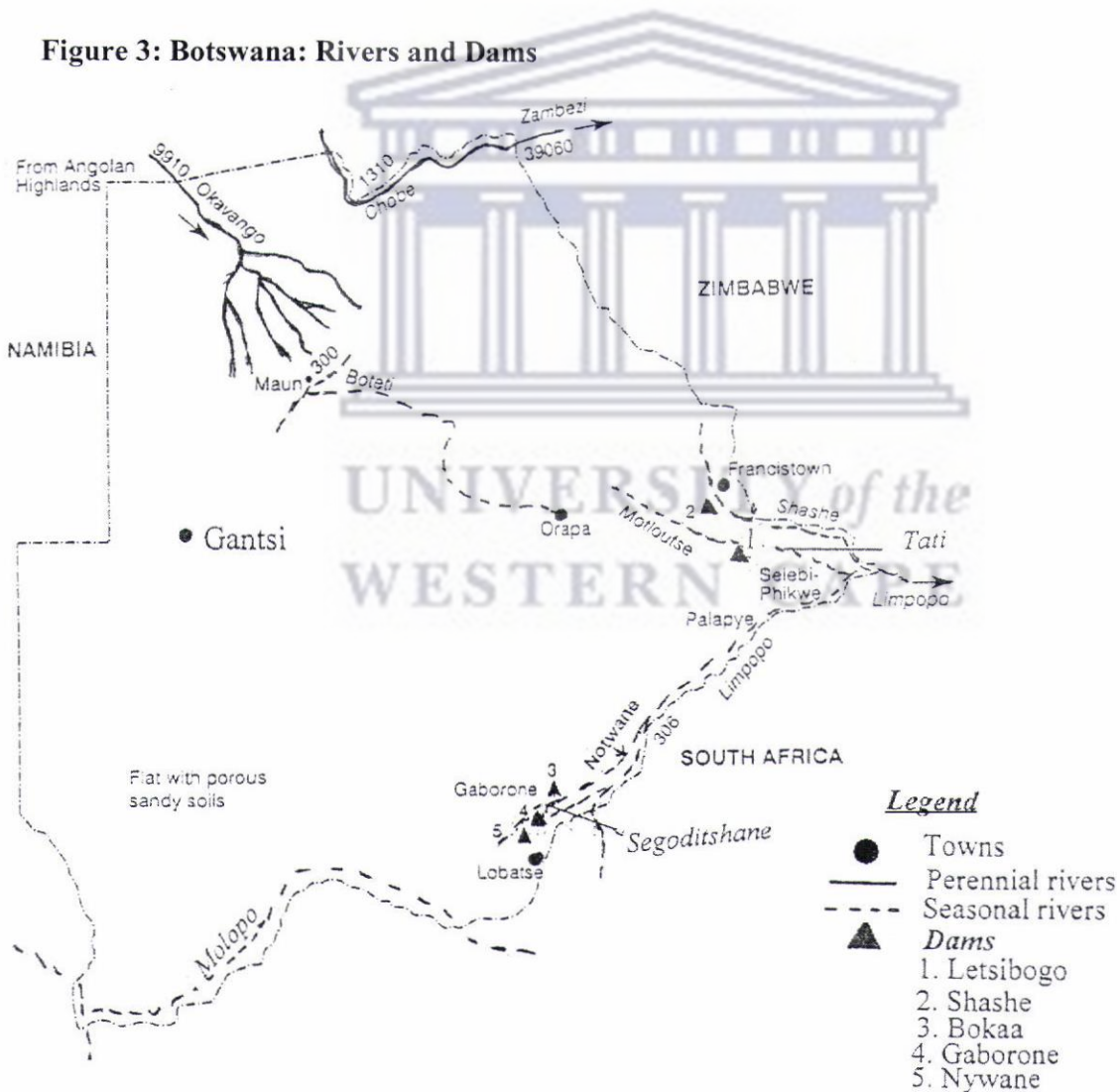
The above Table indicates a progressive increase in rainfall from October 1999 to November 1999; however, from December 1999 to March 2000 rainfall was highly erratic, with significant amounts of rain in Gaborone, Gantsi and Lobatse in February. The Gantsi region which is predominately semi-arid experienced the highest amount of rainfall in February. The erratic rainfall could partially account for the lack of preparedness which culminated in great material and infrastructural losses.

3.4.1 Risk factors that increase the risk of flash floods

(a) Physiographical risk factors

The floods affected the whole of Botswana but their severity was noted around the east and southern part of the country where most rivers and dams (Figure 3) are located. According to the NDMO (2000b), the Shashe River, Tati, Metsimotlhabe, Notwane, and Motloutse rivers all ephemeral rivers, burst their banks whilst the dams Nywane, Shashe, Letsibogo, Gaborone and Bokaa spilled over.

Figure 3: Botswana: Rivers and Dams



Source: Adapted from Selitshena and McLeod, 2002.

Part of the blame regarding the overflowing dams and rivers rests on the terrain or relief within which the dams are located, and on drainage. The geological composition of the terrain directly and indirectly controls percolation and this also influences infiltration. The eastern part of the country consists of rock outcrops and hilly areas and is mainly Hardveld. In this region the rock structure consists very old, hard igneous and metamorphic rocks whilst the Gaborone area consists mainly granite rocks. The rocks in this region are slowly denuded by agents of erosion and river processes (Silitshena and McLeod, 2002). The soils are relatively shallow. A combination of shallow soils and the hard geological foundation in this region reduce infiltration capacity. The 1999-2000 heavy persistent rains exceeded the infiltration capacity of the soils, leading to an increase in overland runoff. Consequently streams filled up and flooding occurred.

Another physical factor that intensified the floods was siltation. According to the NDMO, the Segoditshane and Notwane rivers, both located in eastern Botswana were heavily laden with silt (Thedi, 2003). Siltation raises the river bed and increases the level of the river. The river reaches its capacity relatively quickly and this leads to channel overflow.

(b) Urban growth

Botswana's population is concentrated in the eastern part of the country. More than 85% of the total population lives in this region (Silitshena and McLeod, 2002). Here, there is also concentration of infrastructure making the area highly vulnerable should it be exposed to any kind of hazard. Effects of urbanisation are apparent in the region. Urbanisation impacts on both the social and the physical environment. It heightens social vulnerability. In Botswana there is an influx of people in the urban centres due to rural-urban migration and refugee

influx, leading to rapid urban population growth that exceeds the capacity of the urban economy to provide employment and adequate infrastructural services (Molebatsi, 1998).

Rapid urban growth in Botswana, as in neighbouring countries, brings about shortage of land and or overcrowding as well as other social problems such as poverty. These lead to the establishment of low-income residential areas or squatter settlements in areas not designated for settlements. These areas become home to the economically marginalised. In eastern and north-eastern Botswana, in the cities and towns of Francistown, Gaborone and Lobatse to mention but a few, flood prone areas are occupied by the less privileged. These people establish squatter settlements and build dwellings (structures) from materials that are combustible, weak, and that cannot withstand any form of hazard be it fire, earthquake or floods. Interestingly, not only are the flood prone areas occupied by the less fortunate, there are multi-million dollar developments such as shopping complexes along river banks or in floodplains in the country, a mistake which is made repeatedly by both the developed and developing world. These “flawed developments” (Walter, 2002) or “misplaced developments” increase vulnerability, aggravate disasters, weaken recovery efforts, and adversely affect the development process (Abramovitz, 2001). The impact of the 1999-2000 floods was increased because many people had settled in areas that are dangerous and had been put in harms way.

Regarding the physical aspect of urbanisation, non-urban land is converted to urban land use (Molebatsi, 1998), to make way for infrastructural growth and the physical expansion of settlements. Human interference with the natural landscape results in the creation of impermeable surfaces in the form of roofs, pavements and roads. These impervious surfaces

hindered infiltration and rendered the higher proportion of the 1999-2000 rainfall as runoff. Hard surfaces increase rainfall-runoff processes (Fisher, 2003). This results in rainfall entering the river channels faster, thereby decreasing time taken for the flood discharge to reach its peak (Richards, 1982; Coch, 1995; Campana and Tucci, 2001; Terpestra and van Mazjik, 2001). Urbanisation increases small floods up to ten times such that a flood with a return period of 1 in 100 years may be doubled in size if the land paved is 30% of the total urban land (Smith, 1992). The increase in impervious surfaces shortens lag time and increase peak discharge thereby increasing flooding (Coch, 1995).

(c) Inadequate flood and storm water infrastructure

As is characteristic in all built environments, a network of surface and underground drains are constructed in urban places to ensure swift drainage of water from the developed areas to the channels. Thus the speed of flood onset is increased, reducing lag time between rainfall and peak flow by half (Smith, 2001; Coch 1995). The greater the drainage network in an area and the greater the amount of impenetrable area, the greater will be the ratio of peak discharge to discharge before urbanisation (Cooke and Doornkamp, 1974).

Another reason for flooding resulted from the poor construction of culverts and bridges. Bridges constrain the natural channel and reduce its carrying capacity (Smith, 2001). Thus the frequency with which the high flow overtops the river bank is heightened. The NDMO (2000b) states that the culverts and bridges constructed for floods with a return period of 1 in 25 and 1 in 50 years respectively were inadequate for the 1999-2000 floods.

(d) Deforestation

Smooth surfaces in urban centre and settlements are further increased by acts of deforestation. In spite of the existing policies and Government Acts that protect and ensure the sustainable use of natural resources in the country, there is evidence that they are threatened. Of particular interest is the forest resource. There is the depletion of wood resources both in commercial harvest of forests and as a main source of fuel and building material in most settlements. The Ministry of Local Government and Lands (1992) observed that in the early 1990s approximately 700, 000 tonnes of wood was felled in one year for commercial purposes. In 1994 alone, 69% of the total energy supplied was firewood (Enviroteach, 1998) which is the main source of energy for rural areas. Deforestation also occurs in order to make way for roads and settlements. Grass cover is extremely limited as there is also a concentration of livestock. Additionally, arid climate and drought spells limit vegetation growth. Deforestation contributed to the severity of the 1999-2000 floods. By contrast, when an area is densely vegetated, a soaking rain increases stream discharge slowly; hence the peak discharge will occur well after the rain has started (Kovach, 1995). Forests intercept rainfall and allow it to be absorbed by the soil.

The 2000 floods reveal the intricate nature of the interaction between socio-economic and physical factors as the underlying causes of flood risk disaster. There is high population migration both nationally and internationally, to Botswana's eastern margin. Concentration of people in the region results in urbanisation and unequal access to resources leading to marginalisation of certain groups of people. Some people are then forced to occupy hazardous areas. This creates vulnerability within certain social groups making them prone to any form of environmental hazard. Regarding the physical aspect, Botswana is a large

country characterised by varied geomorphological conditions that respond differently to flood conditions. When flooding occurs, regions are affected disproportionately. Thus, differences in the socio-economic landscape coupled with the physical conditions of the country influence the impacts and effects of flood risks in different social groups and places.



CHAPTER 4

RESEARCH METHOD

In order to strengthen understanding of the effectiveness of the Government of Botswana's management of flood risk in the 1999-2000 floods, a case study research method was applied. This drew heavily on qualitative data from primary and secondary data sources. Documents used in this research play two roles. First, they provide information and are analysed just like any other collected data. Second, they are used as research tools: they assume the role of other research resources such as questionnaires and surveys (Denscombe, 1998). In this research, documents take the central role as the actual thing that is to be investigated (Denscombe, 1998). They are taken "as a source of data in their own right – in effect an alternative to questionnaires, interviews or observations" (Denscombe, 1998:159).

Documents are sedimentations of social practices that have the potential to inform and structure the decisions which people make on a daily and longer basis (May, 2001). Documents can tell us a great deal about the way in which events are constructed, the reasoning of such constructions, as well as materials upon which to base research investigations (May, 2001). It is also advantageous to use documentary sources because they can be easily retrieved and information needed is readily available. Another benefit is that they are less expensive to obtain as opposed to conducting surveys and questionnaires because they are readily available in libraries, government and other relevant institutions. However, their limitation lies with the observation that, they provide information recorded for other people and other purposes and may not be appropriate for the current research needs (Hall and Hall, 1996).

4.2 Data collection

The research is qualitative in approach and describes in detail, analyses and interprets ways in which the government of Botswana responds to flood crises. The study focuses on government intervention and management of flood crises in the context of wider national disaster risk management. The study applies the Disaster Risk Reduction framework (DRR) as a “measurement tool” in assessing Botswana’s flood risk reduction practice against international best practice. It also examines government plans and actions towards the alleviation of flood crisis. The structure, procedures, challenges, failures and strengths of flood risk management in the country are the fundamental part of this investigation.

Data collection was done in Cape Town (South Africa) and in Botswana. In order to obtain some of the research materials, the researcher spent six weeks in Botswana. Several visits were made to different institutions, especially the National Disaster Management Office (NDMO) to collect data. The NDMO is a government institution responsible for disaster risk management and operates under the auspices of the Office of the President (the structure of NDMO is discussed later). Information for this research was derived from a variety of government and non-governmental sources. The documents provide primary and secondary sources.

4.3 Primary sources

(a) Informal interviews

Informal meetings were arranged with officials in the departments of Operations Control and Coordination, the Public Education and Training officials both in the NDMO; the Head of Forecasting in the Meteorology Department and a Water Affairs official. Information was also obtained through electronic mail correspondence with some officials.¹ Interaction with officials highlighted their personal experiences in relation to their work. It also provided an insight into the daily operations of the NDMO. The meetings with the NDMO also highlighted information relating to employment structure. Informal conversations also enabled better comprehension of the roles of the different government institutions in disaster risk management and their liaison with the NDMO when disasters strike.

(b) Government planning documents

Planning documents provided information relating to how government manages disaster risks. They also provided information regarding response and mitigation measures deployed against flood risks and other contingencies. Contingency plans provided information regarding activities planned for the impending flood and mentioned the bodies responsible for the different tasks.

¹ Correspondence through-out the study with Mr Nkosiyo Moyo of the NDMO helped clarify problems relating to organisational structure, and other issues relating to the management of the 2000 flood disasters. Mr Nkosiyo Moyo is head of the Operations Control and Coordination section.

4.4 Secondary sources

(a) Print and electronic media

Newspapers provide information relating to how the government manages disaster risks. They also provide crucial information regarding response and mitigation measures deployed against flood risks and other contingencies. Newspapers and electronic media play the role of bridging information gaps, keeping the public abreast of situations and providing warnings during crises.

The Botswana Daily News, a government-owned paper, was used to inform the study. Some articles in the newspapers expounded disaster impacts such as drought, animal disease and floods, at both local and national level and humanitarian assistance provided by the government and non-governmental organisations. Up-to-date information on disaster risk impacts was covered and their aftermath described and photographed (for instance Figure 2). Imagery or photographs offer visual indications that supplement verbal description (Hall and Hall, 1996). The advantage of using newspapers is that ideally they are indiscriminate in what they report: some small disasters that fall outside the international disaster definition are reported in detail and this provides information on disaster incidence.

Whilst the Botswana Daily News may adequately report on the government's involvement in disaster and crises alleviation, there is an element of bias in the news reports. It appears that positive and not the negative reports dominate the newspaper. Unsurprisingly, there has been little reporting on the failures and weaknesses of the government in terms of disaster alleviation. The media seem to be sympathetic to the government. As such the media has been criticised for promoting official or government viewpoint (Mogapi, 2004). Moreover,

Botswana's media has been criticised for focusing and reporting on issues in urban centres with minimal coverage on the rural areas. The country's media fails to depict the real living conditions of the rural poor and developmental issues, instead it reports on elites at the expense of the rural poor and the problems they face (Mogapi, 2004).

To augment information obtained from the local media a search through the Internet was made to obtain news from international news channels such as CNN (www.CNN.com). Information pertaining to the 1999-2000 floods on Botswana and Mozambique was also obtained from CNN news. The international media provides detailed descriptions of the floods and shows photographs of victims (mainly Mozambican). Detailed images of human suffering generates empathy and sympathy from the international community hence aid. However, the international media has been criticised for providing distorted information on developing countries (Bennett and Daniel, 2002). It is criticised for the highly emotive pictorial presentation of disaster victims as dependent, poverty stricken and helpless when in crisis. This imagery, it is argued, demeans and patronises victims (Bennett and Daniel, 2002) whom, contrary to popular belief, usually provide significant initial help to one another during a crisis.

However, less media coverage impacts negatively on the disaster-hit community because it generates less publicity hence few international aid donors respond either in terms of financial or material resources. For instance, during the 2000 floods in Mozambique, whenever the floods were not televised, donors became less responsive and failed to answer requests made by the Mozambican government for medicines. In addition, some organisations that had pledged monetary aid were slow and reluctant to release the money.

This resulted in the rehabilitation process taking longer than was anticipated (Christie and Hanlon, 2001). Another example relates to the successive floods that hit Mozambique in 2001; few international donors responded because the seriousness of the floods was undermined by paltry TV coverage. This resulted in less food and few rescue boats. Consequently there was starvation among victims, and problems of malnutrition were reported. Due to the shortage of boats, people walked long distances to evacuation centres (Walter, 2002).

(b) Academic publications

Information relating to flood risk reduction was obtained from journals, academic publications (some from the internet), books and academic research papers. These sources also expounded on conditions that exacerbate flooding and the response measures applied by different countries.

(d) Other unpublished documents

These included theses and presentation papers. The latter provided information pertaining to the different issues relating to disaster risk management in Botswana.

4.5 Limitations

Since the NDMO operates under the auspices of the Office of the President it was not possible to get minutes of meetings because they are considered confidential. Such records would have helped to inform the study about the strategic plans undertaken in alleviating flood crisis. They also would have provided follow-up details to the outcomes of plans that were implemented during the crisis and evaluation of such plans and operations. Information

relating to the feasibility and applicability of the plans and actions undertaken during crises might have been detected in the minutes. Omissions and contradictions between what was planned or stipulated in the disaster management policy could have been tracked.



CHAPTER 5

RESEARCH FINDINGS

This chapter presents and consolidates research findings according to the United Nations International Strategy for Disaster Reduction's (UNSIDR) Disaster Risk Reduction (DRR) framework. The DRR framework delineates the fundamental elements and components of disaster risk reduction. It draws up a structured approach that guides future disaster risk reduction efforts and strategies (ISDR, 2003). Additionally, the ISDR's framework aims to build disaster resilience through encouraging awareness of the importance of disaster reduction as key in sustainable development (ISDR, 2004). The framework is structured into five thematic areas which are used as a guiding, monitoring and measurement tool towards Botswana's flood risk management- in particular the year 2000 floods. The following thematic areas are used:

- governance
- flood risk management applications
- flood risk identification and assessment
- knowledge management on flood risk
- flood preparedness, contingency planning and emergency management.

In Botswana, power and responsibility for managing disasters rests with the Office of the President. The Office performs its function through the National Disaster Management Office (NDMO). The mandate of the NDMO is to coordinate management of disaster risks. The NDMO is managed by the Director and comprises three units (to be mentioned later). During an emergency, the Office draws its personnel from different government departments.

Representatives from the non-governmental departments as well as the private sector are also called in to assist in emergency management.

5.1 Governance: political commitment and institutional development

One of the responsibilities of a national government is to protect its people against disasters (Walter, 2002). Every country has the sovereign and principal role of protecting its citizens, infrastructure, and socio-economic assets from the impacts of disasters (ISDR, 2002b). Botswana adheres to these practices. The government of Botswana has integrated disaster risk management into the two administrative systems of government namely, central and local government. Both administrative institutions perform duties and functions within their respective jurisdictions and work in collaboration with one another when disasters strike.

Botswana's central government consists of the president, cabinet, civil service, local government and public enterprise. It is at the apex of the administrative structure, and is supported by the local government and public enterprise (Mfundisi, 1998). The president exercises executive power as per the constitution of Botswana. He or she can exercise the powers exclusively or through his or her subordinates. In executing his or her duties and responsibilities, the president can delegate to the cabinet, civil service and local government and public enterprise. In disaster risk management, the president is charged with the responsibility to declare an event a disaster.

Although the central government operates mainly from the capital city, there is decentralisation of authority to district field officials, or local government. The work of local government “denotes the devolution of power, authority and responsibility to institutions at the local level” (Mfundisi, 1998: 167). These institutions comprise districts (equivalent to provinces) and urban councils. The district commissioner’s office is representative of the central government at district level and carries out duties regarding the implementation of the central government policies. Administration duties in the districts and towns are performed by district commissioners and a council secretary, and mayors. The country has nine district councils, four town councils and one city council (Mfundisi, 1998). However, in order to expedite and facilitate disaster risk management activities, the power of managing disaster risks is devolved to twenty-eight districts and sub districts.

5.1.1 Policy and planning

Disasters occur indiscriminately, hence disaster risk management requires all sectors of the government, the private sector and NGOs and the community to work towards reducing the adverse effects and impacts of disasters. The ISDR’s Disaster Risk Reduction (DRR) framework stipulates that disaster risk management activities from all sectors; line ministries be integrated with planning and development strategies that enable and emphasise the widespread exchange of information. Multidisciplinary involvement of all relevant sectors in disaster risk management is necessary to attain and sustain disaster reduction (ISDR, 2002b; ISDR, 2003). Botswana conforms to this (multidisciplinary involvement) in that state policy encourages the different government and non-governmental sectors to integrate disaster risk reduction activities into their development plans. Known as the National Policy on Disaster

Management (NPDM), the policy was approved through the Presidential Directive and implemented in 1996. It states that government and non-governmental agencies are accountable for the development of their own disaster risk plans and that they should provide details on their internal mechanisms. It is crucial that organisations “be aware of each others missions, structures and styles of operation, the capabilities and limitations of the communication systems and the mechanisms of coordination” (Perry and Lindell, 2003: 343). Proper channels of communication and coordination are essential elements in carrying out activities that alleviate or curb a crisis from becoming a total disaster.

The policy also highlights disaster risks that Botswana faces. Although state policy mentions drought as a principal disaster risk, and highlights early warning and response as its mitigation measures, other disaster risks such as veld fires, epidemics and floods should receive similar status within the policy. Needless to say, the magnitude and extent of these disaster risks have been significant in terms of their socio-economic as well as environmental impact on the country. Hence they are equally deserving of the attention and recognition that drought receives in the disaster risk management policy yet these disasters are mentioned only in passing, and it is not clear which of the disaster risks the policy is trying to address in terms of disaster risk management. This shows inadequate problem identification.

There is also insufficient articulation of the roles of the different stakeholders in disaster risk management policy. However, state policy identifies the Ministry of Finance and Development Planning as the body responsible for drought management. Additionally, the mention of the finance ministry and the President shows confusion and ambiguity in roles and responsibility. The policy fails to define clearly how the two bodies and the disaster risk

management directorate will operate or act when a disaster strikes. The question that arises is who or which institution is responsible for other disaster risks such as floods? In view of this, there is also no indication in the policy how the impacts of floods and other disaster risks are alleviated.

Although there are warning systems and response measures for drought, they are not discussed specifically in the policy and there is also no defined course of action regarding them. They are only inferred in the policy. On the contrary policy should indicate what the government actually does, not just what it wishes or intends to do (Anderson, 2000).

There is also no implementation strategy for the nation nor the districts or sub-districts to follow in terms of disaster risk management. In order to put policies into effect, an implementation strategy is needed as a guideline (McCool, 1995; Anderson, 2000) towards the achievement of the objectives, aims and targets of the policy.

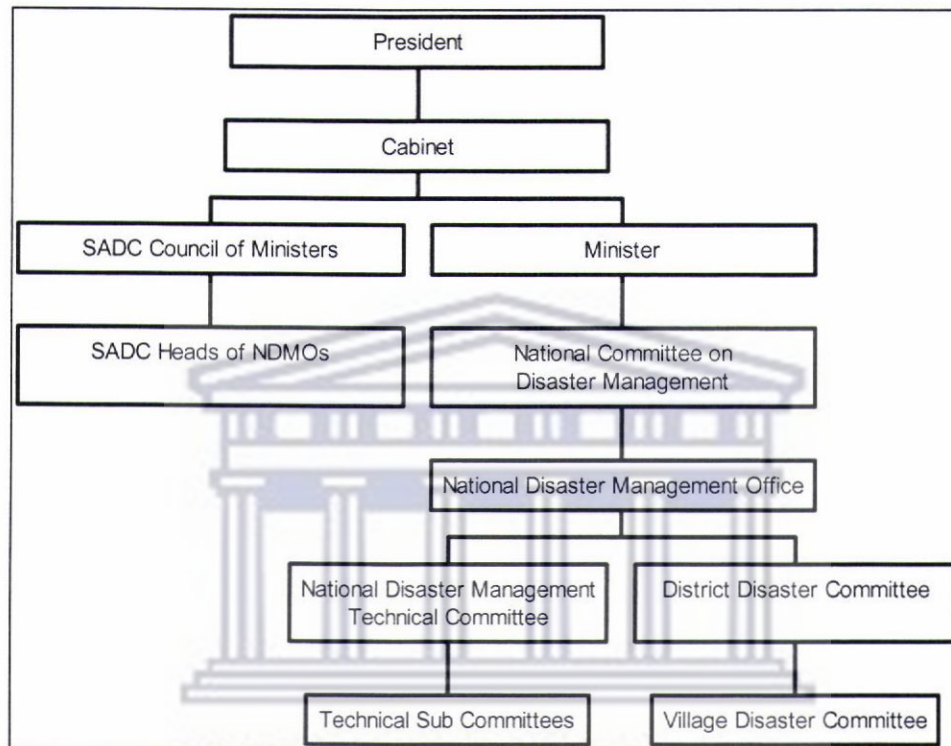
Another concern is the mention of the review and monitoring of the policy. During the eight years since policy was approved and implemented there has been no clear indication as to when and how these activities should be done.

5.1.2 Institutional aspects

In Botswana, coordination of disaster risk management is done at national, district and village levels (Figure 4). Nationally, the Deputy Permanent Secretary of Development in the Office of the President is the overall coordinator of disaster risk management. He or she is the immediate supervisor of the NDMO. His or her duty is to convene and chair the National Committee on Disaster Management (NCDM). The committee comprises deputy permanent secretaries from all line ministries such as Agriculture, Health, Works, Transport and Communication, and representatives from the Botswana Police Services (BPS), Botswana Defence Force (BDF), the Botswana Red Cross Society, and the United Nations Programme.

The committee (NCDM) is charged with the responsibility of developing policies, strategies, plans and activities for disaster risk management, and with facilitating their implementation. The committee also advises the minister and cabinet on crises or situations that require declaration as national disaster. In addition the committee recommends to the cabinet the mitigation strategies developed by different government sectors to be incorporated into the national development plan. The office works in close collaboration with the NDMO and also acts as an advisory body to the NDMO.

Figure 4: Disaster management organisational chart



Adapted from NDMO (Botswana, 2004).

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The NDMO was established in 1998 following the formulation of the National Policy on Disaster Management (National Policy on Disaster Management (NPDM), 1996; Mathe, 2004b). Apart from the Director, three units (Information Education and Public Awareness, Operations Control and Coordination, and Logistics and Communication) run the office. The NDMO coordinates disaster risk management activities in the country. These include among others: providing early warnings of an impending disaster; preparation of National Disaster Management Plans; formulating plans and strategies for emergency response and

management; keeping inventories of resources both at national and districts levels (NDMO, undated).

Alongside the NCDM and the NDMO is the National Disaster Management Technical Committee (NDMTC) which is chaired by the Director of the National Disaster Management Office. The NDMTC comprises professionals of different disciplines from different government ministries. It consists of technical officers from the ministries and departments of Meteorology, Geology and Mines, and Health, Botswana Police Services (BPS), NGOs, the private sector, representatives from United Nations Development Programme (UNDP), Veterinary Services, and government as well as private media. The role of the technical committee is to advise both the NCDM and NDMO on problems and disaster risks related to their specific areas (Mathe, 2004b).

At district level the district commissioners and council secretaries are charged with the responsibility to oversee the implementation of disaster risk management plans. At the sub-district level the same duties are performed by the District Officer and Assistant Council Secretary (Moyo, 2004). Within their respective jurisdictions, the District Commissioners, Council Secretaries, District Officers as well as Assistant Secretaries implement the disaster risk management plans through a multi-sectoral committee comprising members from the central and local government departments, parastatals, and NGOs within the localities (Moyo, 2004). The same applies in urban centres where there are committees that oversee disaster risk management (NPDM, 1996; Mathe, 2004b).

5.1.3 Disaster risk management personnel

From the informal conversations held with some officials², coupled with evidence derived from the disaster risk management structure, there emerged a problem of staffing. The office is charged with a huge responsibility of coordinating disaster risks reduction in the country, yet it appears to be understaffed, being operated by only four people. The shortage is aggravated by trained officials leaving the department prematurely. A similar case in point is that in Mozambique, during the 2000 floods, foreign NGOs were poaching the Mozambican disaster risk management personnel (Christie and Hanlon, 2001).

Also inferred from the informal conversations with officials from the Meteorology, Water Affairs³, and the Disaster Risk Management departments was that none of the departments owned up to being responsible for the management of flood risk disasters. Unlike drought or pest infestations and animal disease or HIV/AIDS which are managed by specific departments within line ministries, there is no single office or department that is charged with the responsibility of managing flood risks. Instead, it is just assumed that during flood crises such as that of 2000, the NDMO will take charge. This structural attitude accounts for the disorganisation regarding preparations and actions taken to alleviate flood risk disasters.

² Informal conversations were held with the NDMO personnel Mr Nkosiyo Moyo and Mr David Mathe in August 2004. Mr David Mathe was then Head of Public Education and Training. More conversations were held in May 2005 with Mr Thedi who is Logistics and Communications Officer in the NDMO. For work-related reasons, it was not possible to have conversations with the NDMO Director.

³ In August 2004 informal interviews were also held with Mr Dambe of the Meteorology Department (Head of Forecasting Division) and Mr Moaparankwe Mpho (Chief Technical Officer) and Mr Kalaote Kalaote (senior Hydrologist) both from the Water Affairs Department.

5.1.4 Flood risk management resources and funding for response

Although Botswana does not have government or national flood relief insurance like the USA, it has the National Disaster Relief Fund (NDRF) as one of the non-structural mitigation measure against all disasters. The fund was established in March 1996, and the Permanent Secretary to the President is responsible for its administration. The fund's principal function is to provide financial assistance to disaster victims. A further responsibility of the fund is to reimburse victims for the cost of reconstructing and repairing their shelters (National Disaster Relief Fund Order (NDRFO), 1996). Sadly, the 2004 flood victims (17, 000 people lost their dwellings) were not given any financial assistance despite the objective that provides for reimbursement for construction and repair of damaged dwellings.

Even though the 2000 flood victims were not financially reimbursed, there are shortcomings associated with disbursing money to victims. The limitation relates to underestimation of the recovery costs, which makes the recovery process difficult for victims. While this is not in relation to the 2000 floods, victims have complained that compensation regarding crop loss due to wildlife destruction is small. The compensation amount is P250.00 per hectare (US\$41.20 per ha) (Mudongo, 2004; Botswana Daily News, 28 January 2004). Another issue concerns bureaucracy which delays the compensation process. For instance, people who reside along the Okavango River complained about the government's delay with compensation during the 2004 seasonal floods.

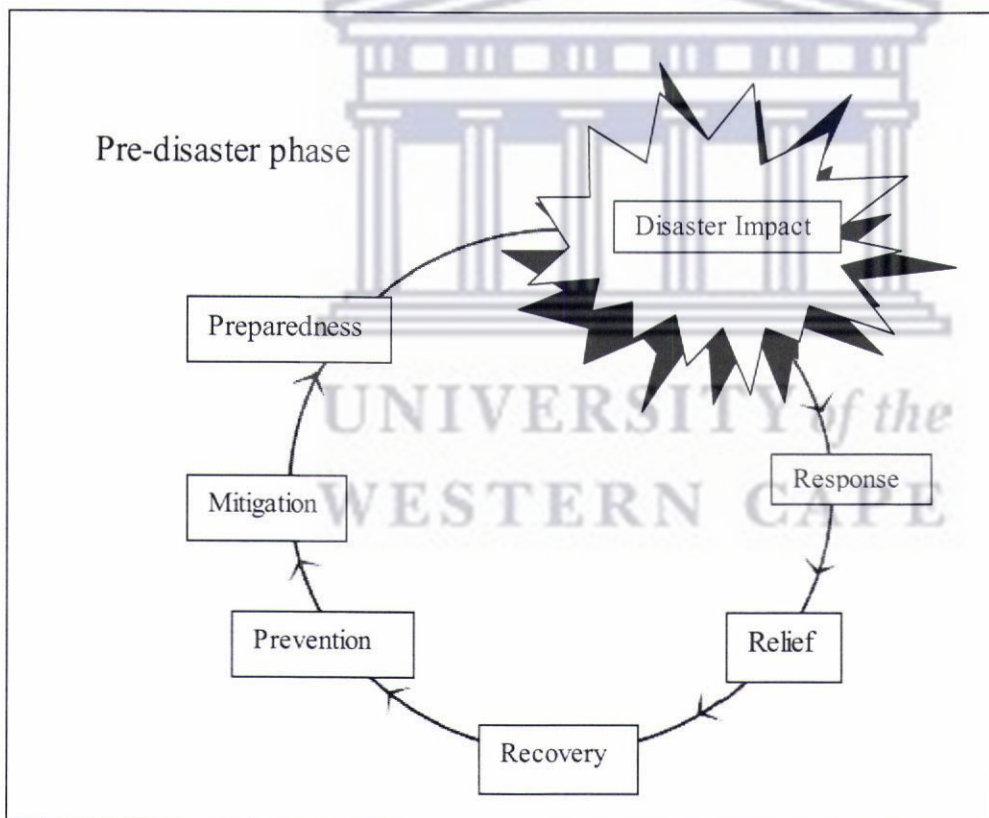
Table 7: Political commitment and institutional development for flood risk reduction (governance)

Sub-component		Not evident	Evident but not applied	Evident and applied
Policy and planning	-Flood risk is a policy priority	X		
	-Flood risk reduction incorporated into post flooding reconstruction	X		
	Integration of flood risk into development planning	X		
Resources	Resources allocation; -funding -human -technical and material		X	X X
Organisational structures	-Inter-ministerial, multidisciplinary approaches -Decentralisation and participation of local institutions -Implementing and coordinating mechanisms	X	X	X

5.2 Flood risk management in Botswana

Botswana acknowledges and adopts the traditional but now outdated pre- and post-disaster management continuum (Figure 5) and applies it towards the alleviation of disaster crises in the country.

Figure 5: Botswana's disaster management continuum



Source: NDMO, undated

Disaster preparedness, prevention, response, recovery and mitigation are Botswana's mainstay strategies for reduction of human and material losses. Notwithstanding, in times of disaster some of the disaster continuum phases are not given significant attention and appear

to be little practiced. At times, they are not implemented at all. In reference to the 2000 floods, strategies and activities centred on preparedness and response; minimal attention was paid to recovery and mitigation. Botswana's reliance on the outdated pre- and post-disaster management continuum partially explains the lack of robust flood risk management hence losses incurred from the 2000 floods were very high and the recurrent seasonal floods continue to impact negatively on people.

Nevertheless, while poor planning and inadequate resources exacerbated the floods, it is worth noting that Botswana is a vast country (582, 000 square kilometres) characterised by considerable differences in flood conditions. These conditions relate to physical geography (see Chapter 3), rainfall variability as well as population distribution. Botswana's population is an estimated 1.6 million of whom 80% reside in the eastern margin, and the rest is widely dispersed with relatively large distances between settlements (Silitshena and McLeod, 2002). The floods of 2000 affected mostly the eastern part of the country.

5.3 Flood risk identification and assessment

In order to prepare for the impending floods, pre-and-post disaster assessments were conducted at the end of 1999 and beginning of 2000. Aerial assessments were conducted by the BDF together with the National Disaster Management Technical Committee (NDMTC). These assessments established people's vulnerability and risk. Vulnerability analysis identifies a hazard within a locality (Mileti, 1999). Vulnerability assessments established and confirmed the imminent floods. The assessments also ascertained the level of possible damage (areal extent) of the impending floods so that appropriate warnings could be issued.

Risk analysis determines the problems that are likely to occur as a result of an extreme hazard (Mileti, 1999). During the 2000 floods, risk analysis identified problems that flooding would create, including health related problems and human casualties. Also established was the magnitude of the floods.

Emerging from the above mentioned assessments, coupled with the meteorological rainfall forecasts, the meteorological department issued rainfall reports and warnings to the NDMO through the technical officer. As the rains persisted, the meteorological department provided regular weather reports and warnings. These were immediately relayed to the District Disaster Management Committees (DDMCs) and to the respective villages. Radio Botswana, a government owned-radio station, broadcast news about the abnormal rains and warned the public against attempts to cross fast flowing rivers and inaccessible roads (NDMO, 2000b). The Botswana Police also assisted in disseminating information to areas that had become inaccessible, for instance, border posts. Two border posts (in the south-east) between Botswana and South Africa were closed, and so was the main road that links the northern and eastern part of the country. Announcements were made to alert the public about major road closures such as between Gaborone and Francistown. This meant that commuters from Mochudi, one of the major dormitory villages north of Gaborone, could not go to work for days.

In spite of the effort taken in issuing warnings, one of the major stumbling blocks faced by the NDMO was that of dispatching information timeously. In emergencies it is indeed a challenge to get the correct information to the right population at the right time (Abramovitz, 2001). Failure to dispatch information speedily was aggravated by inadequate

communications between the Meteorology Department and the NDMO. The NDMO acknowledged that the nations' failure to achieve effective response to the warnings resulted from the fact that the daily and seasonal forecasts were not communicated to them on time (NDMO, 2000b). This was exacerbated by insufficient communication means or devices.

Media access is lacking in Botswana. The country's radio listener-ship is low. Radio Botswana, the only station that reaches every part of the country, was the sole information distribution channel. However, only a small percentage of the population owns radios. Out of 1.6 million people only 237,000 (14.8%) owned radios in 1997 (Murison, 2003). By contrast, in Mozambique, in order to improve and expedite warning communications between the government officials and the affected communities during the 2001 floods, the government distributed radios and bicycles to the areas at risk. Furthermore, the Mozambican government also distributed posters with advice on how to prepare for the floods (Walter, 2002).

The logo of the University of the Western Cape, featuring a stylized building with columns and a pediment.

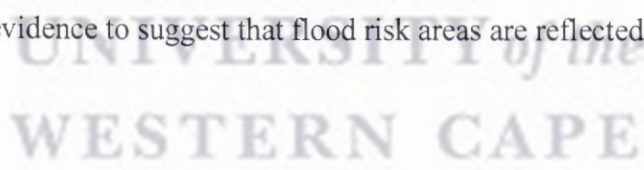
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Table 8: Flood risk identification and assessment

Sub-component		Not evident	Evident but not applied	Evident and applied
Flood risk assessment	-identification of flood hazard- impending flood			X
	-vulnerability assessments			X
Flood impact assessments	-identification of possible losses; socio-economic and environmental			X
Forecasts and warning	-flood forecasts and prediction			X
	-flood warnings			X

This thematic area is assessed in relation to the 2000 floods, seasonal floods are not included.

In addition, there is no evidence to suggest that flood risk areas are reflected in hazard maps.



5.4 Knowledge management on flood risk

Whereas Botswana has experienced disasters in the past, documentation of such is fragmented, as is reflected on Table 9. Records on flood incidence as well as information dissemination on flood risk are inadequate. Furthermore, while the NDMO has a capacity building programme such as a weekly column written in both Setswana and English on the local daily newspaper, it is also questionable whether the paper reaches the population at large. Statistics indicate that in 1997, the government-owned Botswana Daily Newspaper

only circulated 500,000 copies nationally (Murison, 2003). The disaster column is aimed at educating the general public about issues relating to disaster risk management. Such an effort becomes fruitless if the target group is not reached. Another point to consider is that both government-owned radio and newspaper and private print media mainly report on issues arising from urban centres and major villages. In addition, circulation of the newspapers is also focused on urban centres and major villages. As a result the rural population is alienated and is often not actively involved with issues relating to the betterment of their living conditions. Additionally, the private media has also been condemned for reporting exclusively in English, or only nominally reporting in Setswana (Mogapi, 2004).

Table 9: Knowledge management on flood risk

Sub-component		Not evident	Evident but not applied	Evident and applied
Information management and communication	-official information and dissemination programmes and channels on flood risk -documentation of flood risks	X X		
Education and training	-inclusion of disaster risk reduction from basic to higher education -dissemination and use of traditional education on flood reduction	X	X	
Public awareness	-official public awareness policy on flood risk reduction -media involvement in communicating risk		X	X

5.5 Flood risk management applications and instruments

These measures incorporate mitigation strategies. Mitigation measures are a continuous process, carried out before, during and after a disaster. Ideally mitigation measures should be in place before disaster strikes (Mileti, 1999). In Botswana there are structural- and non-structural mitigation measures.

5.5.1 Non-structural mitigation: land use planning

Botswana's land is divided into three major categories also constituting the land tenure system: customary land comprises 72% of the total land; state land and freehold make up 23% and 5% respectively. In order to facilitate and ensure equal distribution and management of land, the government has established laws, institutions and policies (Mathuba, 2003). The umbrella body responsible for land is the Ministry of Lands and Housing. Its work includes acquisition of land, mapping, land use planning and land administration and allocation (Ministry of Lands, Housing Environment, 2004).

Despite the existence of land policies, Botswana has land problems although they are not as complex and pronounced as in other countries such as Zimbabwe. These problems stem from various factors such as rapid economic growth (Mathuba, 2003) which has prompted population migration to urban centres resulting in their physical expansion. The rapid urban growth led to spontaneous development with minimal concern for developmental control

standards that ensure safety and durability of housing structures and infrastructure (Toteng, 2001), and that minimise vulnerability to natural risk. Because of problems associated with urbanisation, land use patterns have also changed. Land shortage has led to the establishment of developments and illegal dwellings in areas not designated for settlement. Presently, people and developments occupy hazardous areas. For instance, in Gaborone, the capital city, the country's only Power Corporation Control Centre and some major developments such as River Walk and Molapo shopping complexes are located within the confines of river banks (Thedi, 2003). The latter is located on the Segoditshane River bank. In addition, further developments such as the construction of a three star hotel have also been set for the area surrounding the Molapo shopping complex. Apart from being located on the river banks, the land was initially set aside for a recreational park: the valley is a bird sanctuary and ecology in the area is therefore protected. Establishing a shopping complex on a river bank fails to take into account environmental management and wetland protection (Table 10).

The establishment of the Molapo shopping complex stirred interest and debate in public as well as in government, and made headline news in most local newspapers. Allocation of the land met with criticism because it not only contravened the Gaborone City Draft Development Plan 1997-2004 which barred developments in the valley (Botswana Daily News, 18 November 2003), but it was issued by the minister who countermanded the initial decision against allocation of the land for a shopping complex. A commission of inquiry was set up to investigate the allocation of the land. Needless to say, this had financial implications for the government. The minister's act of overruling a decision made by the Town and Country Planning Board is indicative of conflicting interests that reflect

inadequacies within the country's political structure, authority and governance. It was not surprising that a member of parliament accused the minister of corruption.

It also appears that Botswana's current land use policies lack regulatory power. As observed in the Government Paper No 1 (1992), a commission on land problems and land planning without implementation capacity would not prevent illegal activities such as conversion to unauthorised use. Ten years after this observation was incorporated in the 1992 commission, the same land problem occurred. Ownership and control of land could be remedied with clear policies and regulations that also prevent senior government officials from maladministration or interference with the administration of the land allocation authorities.

As mentioned earlier in the chapter, the central government has in theory devolved power, authority and responsibility to the local government to expedite efficient implementation of the country's development policies. However, in effect, the central government still maintains most power particularly in both development and environmental policy. Through bureaucracy and administrative centralism, the ruling elites dominate the development policy agenda in Botswana and neglect environmental issues in general and urban environmental management issues (Toteng, 2001). So it is not surprising that despite the existing land and environmental policies, Botswana still experiences land allocation problems that disregard environmental management and conservation. In essence these land problems emanate from acts of maladministration by those in power, as was the case with Molapo shopping complex issue.

5.5.2 Structural mitigation

Structural mitigation is lacking in Botswana. There are two types of structural measures undertaken against weather related hazards. One type, infrastructural mitigation, involves the construction of roads, bridges, culverts and drainage networks. These measures perform different functions such as controlling storm water and reducing the impacts of flood risk disasters. Though construction codes are observed for such infrastructure, they were undermined by the floods of the year 2000.

A second kind of structural measure involves building dams and dykes. In Botswana dams are constructed mainly because water is a scarce resource in the country. Dams ensure additional water supplies and are an insurance against recurrent droughts that occur in the country. In addition, dykes have also been constructed as measures to contain the seasonal floods that occur in the Okavango River. But so far they have failed. In 2003 the dykes spilled over (Chamo, 2004; Botswana Daily News, 8 March 2004).

Table 10: Flood risk management applications and instruments

Sub-component		Not evident	Evident but not applied	Evident and applied
Environmental and natural resource management	-interface between environmental management and risk reduction practices in wetland protection -integrated water resource management		X	X
Social and economic development	-social protection such as solidarity strategies -financial instruments in flood risk reduction e.g. insurance	X	X	
Technical measure	-land use planning in relation to flood risk reduction -construction of infrastructure and flood control techniques		X	X

5.6 Flood preparedness and emergency management

As defined by the NDMO, disaster preparedness involves plans and activities taken in order to respond effectively to the impending disaster (National Policy on Disaster Management (NPDM), 1996). It entails the development of emergency response and management capabilities prior to the occurrence of a disaster so as to expedite effective response (Mileti, 1999). Disaster prevention and preparedness help reduce the need for disaster relief (ISDR, 2002). In addition, the ISDR's definition (2002b) further mentions that part of preparedness

entails the issue of early warnings and the evacuation of people and property out of harms way. Ideally these plans and activities can be carried out before, during and after the disaster. The importance of putting plans and actions in place prior to the disaster as a means to alleviate the impacts of a disaster cannot be overemphasised. This section discusses flood preparedness in Botswana in accordance with the two definitions. It reflects on preparatory actions, response, and activities taken during the 2000 floods and the occasional floods that occur within the country.

During the 2000 floods, activities, strategies and plans designed by the NDMO were put into action. The NDMO designed a contingency plan. A contingency plan is defined by the NDMO as preparations to take specific actions before an unplanned event takes place (NDMO, 2000a). The plan successfully addressed inter-organisational coordination, although with minimal elaboration regarding the participation of the NGOs. It indicated the different roles assumed by all participants involved. The roles reflected only three phases of the disaster management continuum namely, preparedness, mitigation and response.

Similar to the Mozambican contingency plan, Botswana's plan identified areas at risk, evacuation routes and the number of people likely to be affected. It also mentioned the resources needed by the victims. However, a limitation with the contingency plan was that there was no indication on what resources were available. One of the strategies in Botswana's disaster risk management emphasises the use of the country's available resources. In addition, the NDMO is supposed to keep an updated inventory of readily available resources (NDMO, undated). Resource identification enables planners to determine

how much extra of a resource is needed by a community, and how much assistance is required from external donors.

Rescue operations involved emergency services such as the Botswana Police, Med-Rescue International-Botswana, the Botswana Red Cross Society as well as the BDF. Helicopters were used for search and rescue operations. Victims were evacuated from the flooded areas to safety. In some villages livestock was moved to higher ground. Evacuation centres in some districts were mainly schools. Regrettably, using schools as accommodation centres disrupted teaching and learning (NDMO, 2000b). Although the NDMO's Flood Report mentions that people were rescued, there is no indication of the number of people rescued, and no indication of the number of boats or helicopters used. Information pertaining to the rescued victims, and inventory of resources used such as boats and helicopters, would not only reflect the magnitude of the disaster and financial resources used, but offer an indication of how to plan and better prepare for future flood disasters. The mention of resources without specifying how much or how many of a resource was used subtly suggests that the NDMO report puts the best light on emergency operations and management of the 2000 floods, rather than present detailed facts.

Three considerations arise from the above-mentioned observations regarding preparatory efforts. First, while the contingency plans indicated the roles and responsibilities of the different sectors, still an element of ambiguity existed in Botswana's case. In the plan, the Meteorological Department is charged with providing weather forecasts to the NDMO. However, after the NDMO has received the warnings, there are no clear communication channels followed in order to relay the alert message to the public. The lack of an established

communication channel not only hampers preparedness, it causes confusion. By contrast, France's warning process is robust yet simple and could be applied in Botswana. In France, flood warning (discussed in Chapter 2) is divided into collection and processing of information, and the alert systems. Adopting the French government's organisational warning chain would eliminate confusion and expedite warnings and information dissemination between the NDMO, other government departments and the affected communities. In addition to being uncomplicated and robust, the French information dissemination channel appears ideal because France is a wealthier country and has a better-established bureaucracy and technology, which has been frequently tested, during floods. Furthermore, France, like Botswana experiences a lot of flash floods, as such their warning and information dissemination systems would be appropriate to Botswana.

Related to the problem of Botswana's unclear communication channels is the lack of clarity in role designation. Roles were stated in the contingency plan yet the actual dissemination of information was problematic and inadequate. Consequently some departments were over-worked and/or sidelined in the management of the 2000 floods. The NDMO mentioned that there was heavy dependence on the Botswana Police Services and Botswana Defence Force. The former performed many activities ranging from their primary role of law enforcement, to activities such as information dissemination, search and rescue, evacuation of victims, and distribution of relief. According to the NDMO, the BPS' domination was heightened by the poor participation of other departments (especially of the NDMTCs) in the meetings held for planning purposes. The advantages of clear role designation cannot be overemphasised as it allows for accountability should a mistake happen in the process.

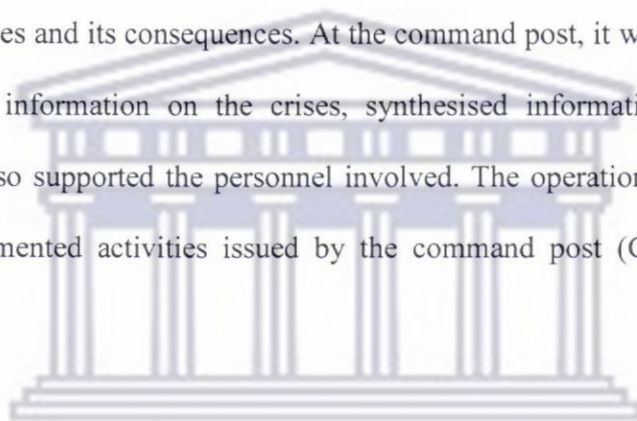
The second weakness in relation to preparedness lies with inadequate accommodation centres especially in rural areas. Mozambique was faced with the same predicament during the 2000 floods. A post-2000 flood disaster study (Gall, 2004) suggests that additional temporary shelters in rural areas could be erected to host victims whilst they recover from the disaster. While this measure is costly and shelter centres do run the risk of becoming white elephants, such centres can serve multiple purposes and could be made cost effective accordingly. Not only can they serve as accommodation centres, they can be used to speed up relief operations, store relief goods as well as serve as distribution points for relief (Gall, 2004). Both Mozambique and Botswana received relief goods from the international community and yet there was insufficient storage space. Accordingly commodities were spoiled and/or stolen.

Third, Botswana's contingency plan itself is equivocal in that it does not specify whether the activities planned for are pre-or post-disaster activities. A distinction between the two phases of planning is crucial during the evaluation process. A clear contingency plan enables modifications to previous emergency operations so as to best suit the situation in hand.

5.6.1 Flood response and preparedness in Botswana

Disaster responses are typically thought of as operations and actions employed immediately after the occurrence of a disaster to assist and support the stricken population and area (NDMO, 1996). But disaster response also embraces actions taken immediately before and during the disaster.

Coordination of the 2000 flood response in Botswana was done at three levels; national, district and village. As is the case in some of the developed nations such as France, response and relief operations in Botswana were organised in two distinctive command posts, namely the fixed command post assumed by the NDMO and the operational command post held by bodies under the NDMO. In France, the fixed command post's main function was to allocate responsibilities to the different bodies in disaster risk management and to find out the likely development of the crises and its consequences. At the command post, it was also imperative that the body sought information on the crises, synthesised information, informed the relevant bodies, and also supported the personnel involved. The operational command post carried out and implemented activities issued by the command post (Gilbert and Gouy, 1998).



Similarly, at national level in Botswana the organisation of relief operations was performed by the NDMO. The office instigated the formation of sub-committees in the districts and defined roles of collaboration between them and the NDMO. A case in point is that the NDMO urged that Districts Emergency Operations Centres (DEOC) be established to coordinate relief distribution in their respective districts. These were supervised by District Disaster Management Committees (DDMCs) chaired by district commissioners. At village level, headmen or Chiefs' (under DDMCs) were responsible for relief operations. Ideally the DEOC should exist well before disaster occurs. France has a similar standing committee called the municipal safety committee. When disaster strikes the committee leaps into action (Gilbert and Gouy, 1998).

Response in Botswana was mainly characterised by provision of relief assistance (Table 11) to the affected population. As mentioned earlier, the emergency services such as BPS and BDF performed the search and rescue operations. In addition, the BPS, BDF and Med-Rescue International-Botswana were also charged with evacuation and the distribution of relief (NDMO, 2000b). Relief aid comprised mainly food baskets, blankets, tents and toilets.

Due to the magnitude of the floods and complete submersion of some villages, there were implications for health. In some villages pit latrines were inundated, posing a health threat and sanitation problems. The Ministry of Health together with some United Nations Agencies assessed the extent and impact of the floods on the health sector. They monitored water borne diseases and the nutritional status of children less than five years. Some water catchment areas had become breeding sites for mosquitoes and posed a health risk. Roads had become impassable, and remote areas that relied on mobile medical services were affected.

The Health Ministry used different measures to address health related problems. The solutions included providing outreach services to inaccessible areas and distribution of food rations to combat malnutrition in children aged less than five years old. Problems relating to protection and supply of water were alleviated by purifying it and supplying the villages with water. Water supply was further protected from contamination by emptying overflowing septic tanks and pit latrines. There were also awareness campaigns to teach people not to drink contaminated water. Temporary portable toilets serviced by councils were also supplied to people displaced by floods (NDMO, 2000b).

While the Botswana government acknowledges and appreciates that the reactive approach of providing relief aid during a crisis is costly to both the government and individuals, the government seems to be entwined in the approach. This observation is in view of the response mechanisms employed during the 2000 floods and the subsequent seasonal floods. This reactive approach is contrary to the country's stated policy that disaster risk management be proactive. The latter advocates that Botswana manages its disaster before calling for external aid. The approach entails the integration of disaster risk management into projects to make them resilient to threats (Mathe, 2004a), yet efforts to build people's resilience and sustainable property are lacking. Thus when disasters strike people are often caught unawares and find themselves overwhelmed and needing external assistance. This is not to say that victims are completely incapacitated; they attempt to alleviate the situation they find themselves in. For instance the victims in the Okavango River during the 2003/2004 floods attempted to make temporary shelters. Sadly, their action proved futile.

The 2000 floods challenged Botswana's capability to contain and manage hazards. Despite its relatively progressive economic growth within the Southern African Development Community region the country fell back on calls for foreign aid. The economic growth rate for SADC was an estimated 3.2% for both 2002 and 2003. Botswana's growth rate was 7.8% in 2002/2003 and 5.7% in 2003/2004 (Government of Botswana, 1992) yet during the 2000 floods the Minister of Foreign Affairs appealed for immediate international aid (NDMO, 2000b). The question is why a prosperous country like Botswana appealed for international aid? It is indisputable that dependence on humanitarian assistance does not ensure a sustainable livelihood for victims. It is made clear in literature on disaster risk management that relying on relief aid is not a solution to dealing sustainably with disasters (Burton, Kates

and White, 1993; Holloway, 2003; Moore, Eng and Daniel, 2003; Gall, 2004; Marjanovic and Nimpuno undated).

Research done on emergency and response measures after the Bangladeshi 1998 floods revealed that in spite of the much needed food programmes and rations, relief aid demoralised the victims. The study indicated that victims needed long-term employment to have sustainable decent livelihoods (Ahmed, 2001). Similarly, in Botswana, comprehensive drought relief programmes such as short-term work provision were established to alleviate drought impacts. However, the programmes only run for a period of time before they are terminated, leaving the victims unemployed. Short term and inorganic employment only temporarily deals with unemployment. With regard to floods there is no indication of any relief work programme that was implemented during the 2000 floods. Future plans on flood relief measures need to consider the effects of short-term projects and to think beyond such projects.

Another problem relating to relief aid concerns the fact that disaster victims' needs are treated as homogeneous despite the fact that the degree of vulnerability differs on an individual basis. Vulnerability results from a combination of factors such as class, gender and ethnicity (Cannon, 1994). In order to successfully achieve all phases of disaster risk management (from preparedness to mitigation), an understanding of social realities and personal vulnerability is required (Abramovitz, 2001). The 2000 flood assessments did take into account the victims' age, gender as well as level of damage per household, but there is no indication whether relief aid distribution took into account other socio-economic factors

or differences relating to female-headed households which implies that women and children may need special medical assistance.

Disaster risk reduction experts warn against the underlying subtle effects associated with disaster relief. They warn that there should be control on the secondary effects of disaster relief such as inflation and profiteering (Burton, Kates and White, 1993, Coch, 1995). During a crisis there may be attempts to make profits from either disaster victims or the government. An example in Botswana was when road construction companies extended their time for completion. This inevitably has financial implications.

While reliance on relief aid may be criticised, there is an argument that the practice is common and even functional. Response to an appeal for international aid demonstrates compassion and international solidarity. It shows humanitarianism for countries to stick with one another during difficulties and times of need. In times of crises even developed nations appeal to one another for help (Christie and Hanlon, 2001). Furthermore, countries also initiate initial aid and transfer the remaining risk to external partners (Holloway, 2003). For instance Botswana mobilised approximately P17, 2 million of its own financial and material resources (approximately US\$3, 7million) (Office for the Coordination of Humanitarian Assistance (OCHA), 2000) and then called for supplementary external assistance from international donors.

Table 11: Flood preparedness and emergency management

Sub-component		Not evident	Evident but not applied	Evident and applied
Preparedness	-effective communication and coordination system between the concerned flood crisis management			X
	-contingency planning			X
	-preparedness and planning			X
Response	-emergency response			X
	-emergency funds and stocks			X

5.7 Flood recovery in Botswana

Disaster recovery entails actions taken in order to return a stricken population and area to normal. In Botswana, repairing and reconstructing damaged infrastructure such as government property, private property, roads and bridges dominated the recovery phase. The road network and drainage systems in the eastern margins were most affected and there was a lot of repair work and reconstruction. Reports by the NDMO mentioned that poor infrastructural design led to poor drainage and collapse of the drainage systems. The infrastructure was constructed to withstand floods with a return period of 25 years for culverts and 50 years for main bridges. Regrettably, the Department of Roads stated that it had no intention of redesigning and reconstructing the existing drainage and road networks to withstand floods of 50 years or more return period (NDMO, 2000b). The question is whether

the road department's budget is constrained so much that it cannot improve existing structures, or whether the department's reluctance is because flood risk disasters like that of 2000 may never occur? This question draws attention to the statement delivered by the United Nations secretary-general Mr Kofi Annan that, although the costs of prevention are paid in the present, its benefits are in the future. These benefits are the disasters that will be prevented (Walter, 2002). Botswana's Roads Department needs to reconsider its decision on the question of upgrading the infrastructural works to suit unexpected future disasters.

As mentioned earlier, another set back regarding the recovery process was that some road construction works that were underway before the floods were disrupted. Construction companies therefore requested more time for completion of the projects. In addition, some bridges that required repairing were along international boundaries. In common with many African countries, Botswana and other countries within the Southern African Development Community (SADC) share watercourses. Botswana and South Africa share the Limpopo, Notwane and Molopo rivers. In the case of Botswana, a water policy was proposed in 1991, but fifteen years later it still does not exist. There is no formal national water policy document (Heyns, 2003). South Africa on the other hand has two water policies, one dated from 1994 and the other from 1997. The collapse of the bridges on the international boundaries between South Africa and Botswana implied that repair and reconstruction costs had to be shared between countries. These works needed collaboration between the two countries. Regrettably, consultation between the two countries took long and caused the repair and construction work to come to a standstill. The lack of policy constrained deliberations between the two countries.

CHAPTER 6

CONCLUSION

It has become evident globally that flood disasters will prevail as long as global warming and climatic change continue to affect the earth. One of the consequences of global warming is climatic instability. As a result of the increase in temperatures there are large amounts of energy in the atmosphere. This is said to make extreme climatic events such as cyclones, droughts and floods more likely (Foley, 1991; Hinchliffe, Blowers and Freeland, 2003). Also associated with global warming is the El Nino Southern Oscillation (ENSO) which affects climate processes around the world (International Strategy for Disaster Reduction (ISDR), 2000). In southern Africa, ENSO is associated with climatic variations such as droughts and floods (ISDR, 2000b).

Human interaction with the natural environment contributes to the increase of naturally occurring greenhouse gases (GHGs). Disruptive human behaviours such as acts of deforestation and desertification, burning of fossil fuels, land use changes and agricultural activities have increased GHGs which in turn warm the earth's surface and lead to changes in climate (Soussan and Millington, 1992). As indicated already, changes in climate have led to frequent severe events such as floods. In addition, cumulative environmental degradation (Mileti, 1999) such as acute deforestation not only increases GHGs but also exacerbate the impacts of floods. Paradoxically, by the same token, the very areas that experience floods are also prone to droughts. The observations outlined above partially explain and reflect factors that have a bearing on flooding in Botswana.

6.1 Discussion of findings

Owing to the management of the record floods of 2000 and the subsequent seasonal floods, one could conclude that Botswana's management of flood risk disasters is in its infancy. Flood crisis management was dominated by the traditional approach where emphasis was laid upon preparations for the response operations. The country's response to the 2000 floods was reactive as opposed to being proactive. Emergency management received significant attention as opposed to mitigation. Rehabilitation activities were limited to repair of government structures such as roads and drainage systems, bridges, schools and clinics. Regrettably, despite the National Disaster Relief Fund Order, which provides for the reimbursements of the cost of repair of dwellings of the disaster victims, floods victims were not compensated. Other limitations regarding management of flood risks include; information gaps in relation to statistical records on flood incidence and disasters, lack of training in the (flood) disaster risk field, and inadequate structural- and non-structural mitigation measures.

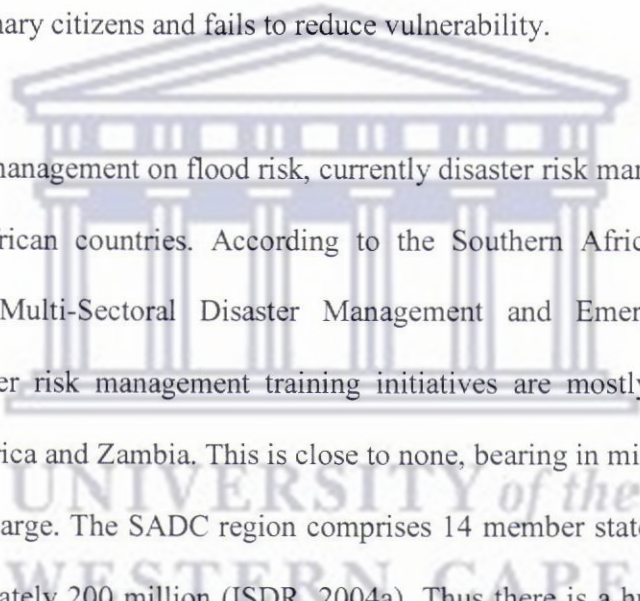
Arising from the management of the 2000 floods, this chapter examines the extent to which Botswana's preparedness, response and mitigation measures were consistent with international best practice through the application of the ISDR's Disaster Risk Reduction (DRR) framework. The application of the framework as a measurement tool not only identifies limitations on Botswana's flood risk reduction practice but also assists in identifying a new direction in terms of flood alleviation measures. The main focus of the discussion is centered on the thematic areas; governance with a focus on policy and

institutional makeup; knowledge management on flood risk; flood risk management and instruments; as well as flood preparedness and emergency management.

While the Botswana government's commitment in disaster risk management is reflected in the country taking a step in establishing state policy on disaster risk reduction, policy regarding flood risk reduction is non-existent. Flood risk is marginalised and no institutional body is identified to manage flood risk disasters. By contrast significant attention is put on drought risk and the Finance Ministry is charged with the responsibility to manage it. Another limitation considering Botswana's disaster reduction policy is that it lacks clear problem identification and a systematic way of addressing individual disasters.

Concerning the institutional make up or organisational structure of the disaster risk reduction management, there is also insufficient articulation of the roles of the different stakeholders in the disaster management policy such that when there is a crisis coordination of emergency management becomes a problem. For instance, during the 2000 floods the involvement of the different departments in the emergency operation was skewed; some departments performed many tasks whilst others were less involved. The NDMO could be held responsible for the dominance of some departments such as the Botswana Police Services in emergency operations, because in the planning phase, the BPS was allocated more tasks than its counterpart, the BDF. Worse, some committees such as the National Committee on Disaster Preparedness (NCDP) were charged with only decision-making responsibility. Whilst it is inherent that the weight of responsibility on decision making in a crisis needs a lot of thought and accountability, the 2000 flood disaster was overwhelming and the NCDP should have lent a hand and performed other tasks in addition to being a decision making body.

Also arising from the management of the 2000 floods is concern that management of flood risk disasters is done in a top-down way. There is a mention of stakeholders in the 2000 flood contingency plan, yet there is neither mention of nor reference as to how at-risk communities would contribute towards alleviating flood risk disasters within their localities. This not only overlooks and undermines local capacities, but local people and institutions are not acknowledged as stakeholders. The top-down approach ignores coping and adaptive measures taken by ordinary citizens and fails to reduce vulnerability.



Regarding knowledge management on flood risk, currently disaster risk management training is lacking in most African countries. According to the Southern African Development Community (SADC) Multi-Sectoral Disaster Management and Emergency Response Strategy (2001), disaster risk management training initiatives are mostly found in some institutions in South Africa and Zambia. This is close to none, bearing in mind that the region plus its population are large. The SADC region comprises 14 member states and has a total population of approximately 200 million (ISDR, 2004a). Thus there is a huge disproportion between the region's population and the number of institutions offering disaster risk reduction training within the SADC region.

In terms of addressing flood risk management applications in Botswana, there is land use planning. However, the problem is that some regulatory laws regarding land use planning are inadequate and are occasionally exploited by some wealthy individuals and politicians. This results in developments being sited on land set aside, for instance, ecological purposes

(discussed in Chapter 5). Also, the construction of infrastructural measures do not take into account the flood risk factors.

Another concern is with regard to preparedness. The NDMO acknowledged that preparedness was inadequate. Preparedness influences the success or failure of the response (Mathe, 2004a). Part of the limitation of preparedness and emergency management was that in spite of having identified evacuation centres, in effect they were inadequate, this resulted in schools being used for accommodation purposes.

6.2 Recommendations for strengthened flood risk management

Arising from the successes and shortcomings of the 2000 flood alleviation mechanisms, several recommendations are possible. Some of these are in line with the Flood Report (2000), policy document and contingency plans released by the NDMO. The ISDR's Disaster Risk Reduction framework is also used to identify possible solution to some of the limitations regarding Botswana's management of the 2000 flood risks.

6.2.1 Political commitment and institutional development for flood risk reduction

Recommendations regarding disaster risk management policy include specific problem identification; identification of the course of action and activities to be undertaken during a disaster event. A policy should outline the course of action that the government follows in dealing with some problem (Anderson, 2000), together with specifications of the tasks to be

performed by the different institutions. While a written course of action does not guarantee success, it is better to have a tangible document that can be taken as some form of reference and that could be improved on over time as social crises and vulnerability change and impacts of hazards change. For instance, the USA has a flood policy which explains what structural measures are in place in terms of mitigation and also states non-structural measures used to mitigate floods.

While the purpose of the policy is to state and define in the briefest possible ways, government intentions and actions towards specific problems, the National Policy on Disaster Management (NPDM) could include all departmental policies or plans from line ministries responsible for animal disease, pest infestations, drought to mention a few. As stated in the policy, government and non-governmental agencies should develop their own disaster risk plans. These should indicate how they manage specific disaster risks that affect them. Each department should also have implementation and strategic plans. Flood risk disasters should be designated a department, which would specifically handle all contingencies arising from floods, draw implementation as well as strategic plans. All these should be reflected in the NPDM. A policy not only reflects what is to be done but it also must show the “subsequent decisions that are intended to enforce or implement the law or rule” (Anderson, 2000:5). The policy also should define and state the institutional make-up of the main stakeholders, their roles as well as their perceived targets. This addresses the problem of role designation and ambiguity. In addition, the success of policy depends on the widespread decision making and participation of others (ISDR, 2004a). Nonetheless, this is not to say that the institutional make-up is overlooked in the policy. There is mention of government departments and NGOs, however, the latter is only inferred in the NPDM.

Moreover, in order not to produce a cumbersome document, all documents from the different departments should be annexed to the main policy or should be kept as subsidiary or affiliated documents. This not only creates a wealth of documentation regarding the administration of policy, it also enhances accountability within line ministries, departments and other related organisations. Documentation also provides a source of data for social and other researchers (Denscombe, 1998).

Another concern is the mention of the review and monitoring of the policy. Policy review should state when and how the review and monitoring processes should be carried out.

Furthermore, disaster risk reduction also requires political commitment. Political will depends on leadership and “a shifting set of incentives, pressures...The political costs of redirecting priorities from visible development projects to addressing abstract long term threats are great” (ISDR, 2002b: 30). Besides, the ISDR’s Disaster Risk Reduction (DRR) framework stipulates that risk reduction should be integrated into development planning (ISDR, 2004). Even though the Botswana Government policy also acknowledges and states that disaster risk reduction be included in the different sectoral or departmental plans, the country’s practice in terms of flood risk reduction suggests otherwise. In Botswana, financial and social resources are concentrated in the fight against HIV/AIDS, persistent drought, and also poverty eradication by the year 2016. As a result a greater challenge is placed on the government to divert funds to deal with flood risk disasters which until recently did not impact significantly on Botswana. However, flood risk management just like drought, needs political and financial commitment.

Political will also is essential to shifting from treating flood risk disasters as emergencies needing only relief and response measures. One of the characteristics of the DRR framework suggests that governments and institutions should shift in approach from response to risk reduction (ISDR, 2003). Government involvement in disaster risk management should shift from short-term to long-term thinking and planning for flood mitigation so as to create a resilient society. Instead of relief work such as that adopted for drought, the Botswana government needs to provide work that will sustain Botswana's livelihood. Sustainable work also curbs unemployment. As is reflected in the speech given by the USA President in the fight against poverty and unemployment, following the devastating 2005 flood, the USA government pledged to provide incentives for job creation as well as provide investment tax relief for small businesses. He further stated that entrepreneurship created jobs and helps break the cycle of poverty (BBC NEWS, 2005a). Botswana too has financial loans and assistance to assist Botswana in micro-and macro-enterprises yet there is increase in unemployment which frustrates government efforts to reduce poverty and the effects of disasters.

6.2.2 Knowledge management on flood risk

Due the lack of training in disaster risk management, institutions that offer such training should be established in Botswana. Not only do institutions address issues relating to disaster risk management, but they also exerts pressure on governments to come up with policies that protect the environment and people from disasters (ISDR, 2002b).

Although Botswana has, over the years, successfully managed to curtail the impacts of drought, animal disease and other related problems such as pest infestations, disaster risk management is a new field in the country and no formal training is offered as yet. The National Policy on Disaster Management (NPDM) (1996: 9) advocates “institutionalisation of training in disaster management and other related themes.” There is need for training in disaster risk management if the country is to build a disaster-resilient nation. Therefore, serious consideration needs to be given to the economics of and the need for the national university to be given funds for introducing disaster risk management training. Establishing disaster risk management courses also requires time and consultation with other institutions outside the country to establish the relevant courses for Botswana. The national university would therefore have to collaborate with other universities outside the country and design courses relating to disaster risk management. NDMO personnel should be trained continuously to meet the demands of the changes in management of disaster risks.

Currently, the NDMO’s weekly column aims to educate the nation about disasters and how to manage them. To supplement the weekly news column, the NDMO should use radio to broadcast information on disaster risk management so as to build awareness. One of the recommendations made in the 2000 Flood Report is that the NDMO should have basic equipment such as communications technology that would facilitate information dissemination to all stakeholders (NDMO, 2000b).

Another concern is with regard to the dearth of statistical data on disaster risks or the lack of data bases on disasters. Botswana needs such data bases so that impacts and effects of disasters can be easily accessed for research and educational purposes. In South Africa for

instance, a data base called Monitoring Mapping and Analysis of Disaster Incidents in South Africa (MANDISA) has been developed to provide public access to information about local disasters. The ISDR's framework also encourages documentation of disasters and that countries should have data bases on the disasters that affect them (ISDR, 2004).

6.2.3 Flood risk management applications and instruments

While structural measures seem unpopular, they have been effective in some countries. For instance, the USA, France and China have dams, reservoirs and dykes that have effectively reduced the amount of losses that would otherwise have been incurred if the structures were not in place (Arnaud-Fassetta *et al*, 2005; Hipple *et al*, 2005; Zhang *et al*, 2002). In Botswana the existing dykes should be reassessed and their strength reinforced so as to withstand floods of the 2000 flood magnitude.

Structural measures as used by vulnerable communities in at-risk areas are valuable and need to be assessed. Community-based approaches to disaster mitigation are useful in that they define the community's problem accurately and apply appropriate measures because they are based on the vulnerable peoples' assessment of their real needs and priorities. Indigenous knowledge is seen as the essential element in building resilience. Communities draw on their skills and expertise in living with the disaster and apply low cost technological measures. These measures are more likely to be sustainable because they originate from the at-risk community (Walter, 2002). As mentioned in Chapter 5, it is evident that there is seasonal flooding in the country and that some communities have developed coping strategies, either through structural or non-structural means or through family dynamics. Nonetheless, while

the local coping strategies may seem ideal, their weakness lies with limited outreach and that they need to be scaled up to reach and benefit the whole nation or population (Walter, 2002). Local coping and adaptive strategies could be investigated and tapped into and developed to suit the country at large. As Atmanand (2003) observes, governments should formulate guidelines and strategies for applying existing knowledge, taking into consideration cultural and economic diversity.

Non-structural measures such as land use planning should be developed to include flood plain management. Regulations need to be improved to prohibit further developments in the flood zone, this will not only curb unplanned and illegal occupation of hazardous areas but it could also avail land that is otherwise unavailable. Regulations should also be strengthened to bar wealthy, powerful and influential citizens and foreigners from actions which may lead to environmentally inappropriate events.

Additionally, the existing land use planning policies or regulations should incorporate hazard assessments in relation to flooding. The Department of Surveys and Mapping should be required to produce maps that show flood prone areas. In order to carry out the assessments, the 2000 floods should be used as a benchmark. These assessments will identify flood prone or at risk areas. This will enable policy makers to make informed decisions regarding regulations on land use. To augment policies and regulations on land use, there should be building codes. According to the NDMO, most infrastructure in Botswana was built without considering future disasters. Where such considerations were made there were inadequacies in planning and construction of such infrastructure.

6.2.4 Flood preparedness, contingency planning and emergency management

As mentioned in Chapter 5, in the post-Flood Report, the NDMO noted inadequate communications with the Meteorological Department. Arising from this evidence, clear channels of information dissemination are essential if warnings are to be effective. This can be achieved by setting up information and communication systems, and by establishing a national alert and warning system (Gall, 2004). A communication channel must comprise the originators such as a meteorology department, intermediaries such as the NDMO, and disseminators and an audience.

Each of these three categories must know to whom information must be relayed. Furthermore, in order to authenticate the warning and alert system channels, the basic steps and links in a warning system should be incorporated into the legislation. The warning channel or system will be legitimised if it is connected to the apex of political power for instance, a Cabinet Minister (International Decade for Natural Disaster Reduction (IDNDR), 1998). Once the warning and alert system has been established and accepted it would be ideal to incorporate it in the Disaster Management Policy or some related government document.

In addition, the means to issue and respond to warnings via communication devices must be readily available to the general public. Distribution of radios for public information to at-risk areas (especially to members of the community who are involved in disaster risk management) would facilitate information dissemination. In addition, telephones should be distributed to managers of disaster risk management activities in all the districts. However, the distribution of communication devices will mean putting pressure on the government

fiscal resources and precautions should be taken to ensure that telephonic devices are not used for private gain. To safeguard against exploitation a monthly record and audit of telephone calls should be kept.

It should be noted however, that considerable time is needed to implement some of the recommended solutions. For instance, establishing disaster risk management training courses, conducting research on the various aspects of disaster risk management, and establishing flood or disaster mitigation strategies suitable for Botswana, requires a lot of consultation between all stakeholders and experts, hence time and money.

6.3 Recommendations for further research

This research is the first to address the management of flood risks in Botswana. It is intended to serve as a basis for further work on the various aspects of flood alleviation strategies. In order to reduce the effects of disasters, vulnerability and risk assessment should be conducted. Research should be done on at-risk areas in north west and south east Botswana, in communities living around the Okavango River, Gaborone, and Mahalapye-East to examine the causes of vulnerability. Demographic composition, economic and political factors are underlying causes of vulnerability since they affect allocation of resources among people (Blaikie *et al*, 1994). Studies should also be done to determine the risk factors in relation to seasonal flooding in the Okavango River and other flood prone areas in Botswana.

Another topic of research should be qualitative ethnographic and sociological inquiry into “collective human behaviour” (Smith, 2001) during times of flood crises in Botswana.

Studies on flood risk disasters and other disasters demonstrate people's breaking points or their resilience (Lewis, 1994). Community anticipation as well as public memory of past flood risk disasters, preparedness and response need to be explored. Ethnographic studies will shed light on the indigenous, cultural coping and adaptive mechanisms applied to flood disasters by communities.

Systematic records of flood risk disasters is lacking in Botswana. A quantitative scientific inquiry is needed to document socio-economic losses regarding flood risk disasters in Botswana. Flood incidence would also have to be noted. Statistical records of floods and flood risk disasters will also elucidate the seriousness of floods and their impact on the Botswana people. The NPDM (1996) itself emphasises that preparedness for disaster involves the systematic collection of data to build an effective information base.

The study here was partly intended to assist policy makers and disaster risk management planners in dealing with flood contingencies. It is hoped that the research has provided a perspective on flood contingencies and disasters that will enhance recognition of flood risk disasters and their inclusion alongside other documented disasters in Botswana's disaster management policy.

Around the world, best practice regarding flood risk disasters is generally considered to include wide consultation, careful forethought, early provision, and swift, comprehensive response to crises in line with coherent, effective policy. Botswana citizens have the right to feel secure in such best practice.

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