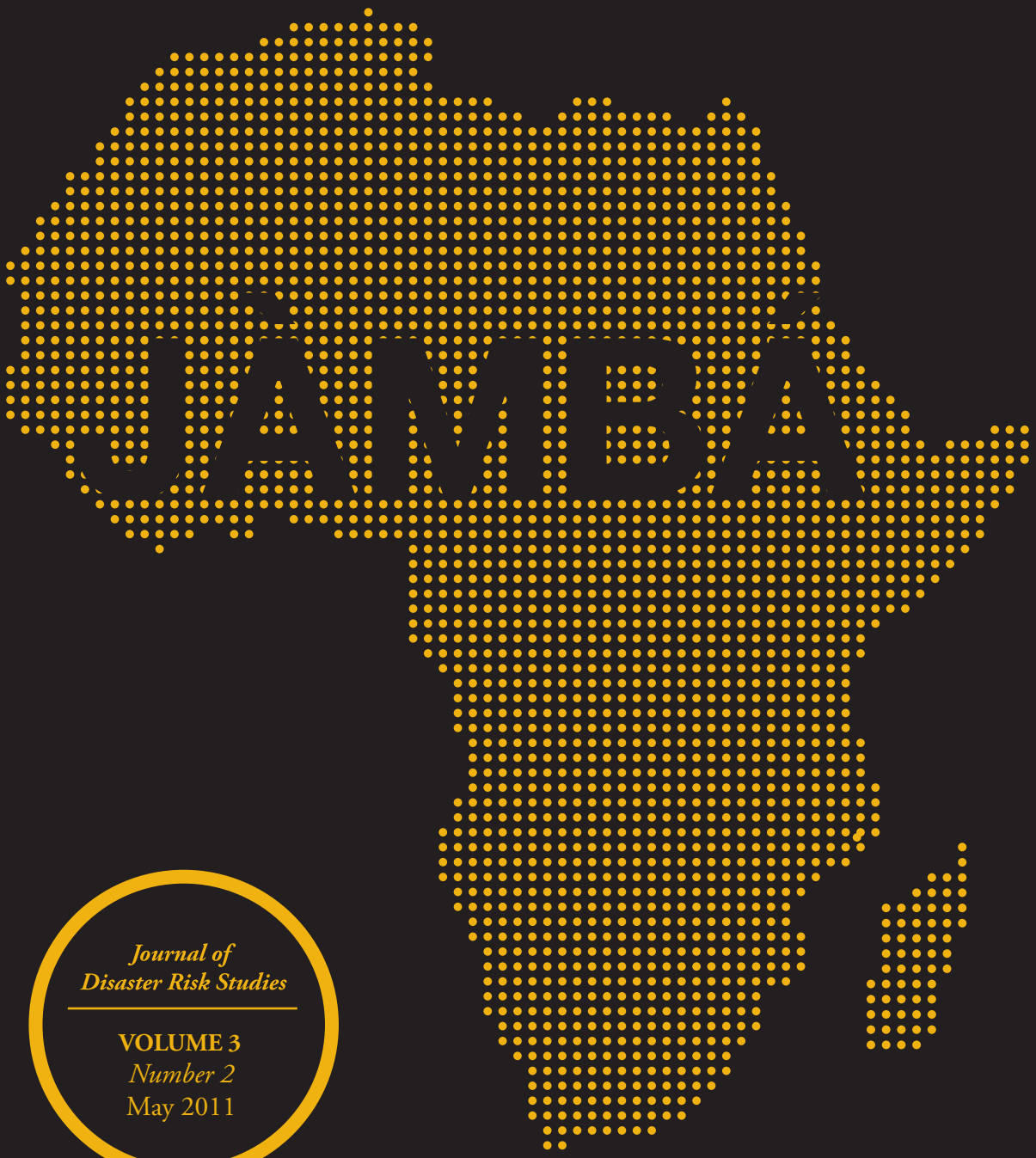


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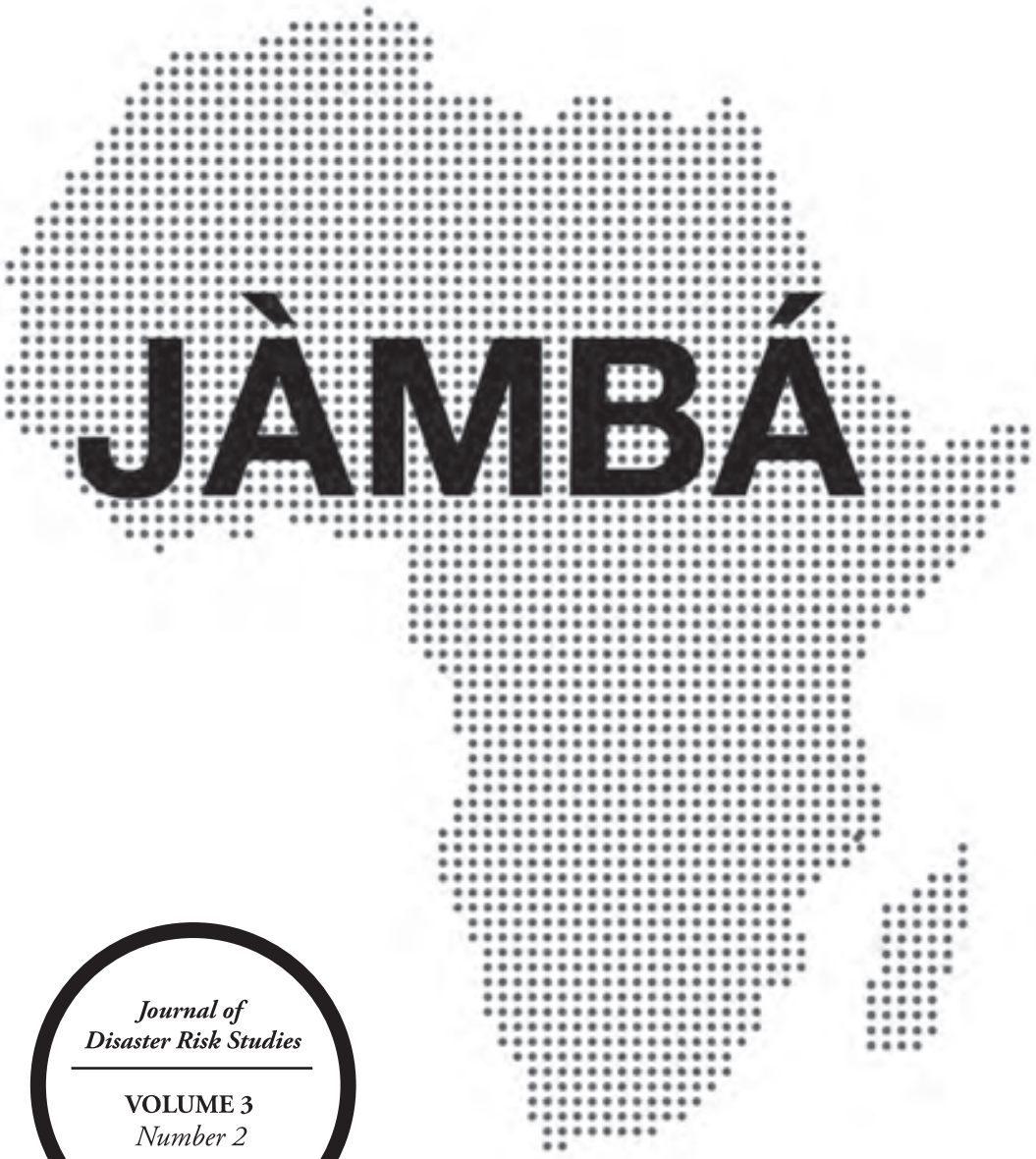


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## CONTENTS

# *An evaluation of the effectiveness of flood disaster mitigation measures in the city of Adigrat, Tigray region, Ethiopia*

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## ABSTRACT

Ethiopia is one of the countries that experience regular flooding. This is mostly confined to certain low areas such as river basins. The Huga River that runs through the Adigrat City in the Tigray Region is one such case. Flooding in Adigrat often leads to loss of human lives, destruction of property as well as disruption of people's livelihoods. Despite a number of response measures that have been implemented by this City's administration, no comprehensive study has been undertaken to evaluate the effectiveness of those measures. Therefore, between March and July 2009, this study was undertaken to evaluate the effectiveness of the City's flood mitigation strategy. Specifically, the study sought to evaluate both the structural and non-structural measures. Structural measures included the construction of new drainage channels; the diversion of river channels; and elevation of riverbanks. Non-structural measures included land use planning; flood disaster preparedness; and enactment and enforcement of rules and regulations. It was hoped that the findings of the study would help Adigrat City Administration to improve its flood disaster mitigation strategies. The study utilised primary data from the affected household heads, the City Administration, the Disaster Prevention and Preparedness Bureau, the Road Construction Authority and some non-governmental organisations. Secondary data were obtained from literature as well as annual reports of the above organisations. The main findings of the study were that most of the drainage channels were sub-standard; land use planning and rules and regulations were not enforced; and a flood disaster preparedness strategy was non-existent. The City fathers attributed their failures to shortages of financial and qualified human resources. The major recommendation of the study is the urgent formulation of a flood management policy to guide mitigation operations and define the roles and responsibilities of each stakeholder.

## KEYWORDS

Early warning, disaster preparedness, flood disaster, risk management, mitigation measures.

## Introduction and background

Historically, floods are among the natural disasters that have affected humanity from time immemorial. According to Abaya (2008), floods are the most frequent and devastating natural events, in both developed and developing countries. However, they tend to have more devastating effects in developing countries than in developed ones. This is often attributed to poor preparedness in developing countries to deal with the effects of the disaster. Quite often, developing countries tend to concentrate on addressing the flood effects after the event. Consequently, a number of people often lose their lives or their properties as well as their means of livelihood. The frequent occurrence of floods may also lead to the diversion of scarce financial resources that would normally have been used for economic and social development (APFL, 2008).

In Africa, floods are also the most dominant natural phenomenon that damages people's lives, shelter and the sources of their livelihoods. For example, in 1998, continuous heavy rains in Southern Africa caused huge damage to Mozambique's largest hydroelectric dam, the Cahora Bassa (Getao, 2002). In 2000, floods along the Zambezi River Basin affected more than 500,000 people, resulting in the death of mote than 700 people and the destruction of crops and infrastructure (Getao, 2000; Christie & Hanlon, 2001).

In Ethiopia, large parts of the country are regularly devastated by flooding. In 2006, for example, unprecedented floods affected some parts of Adigrat and Dire Dawa cities, as well as the South Oromo, Amhara and Somali regions (Ayalew, 2007). This resulted in the destruction of and damage to the physical, economic and social environments, including loss of human lives, crops and livestock; accelerated land degradation; disruption of infrastructure and telecommunications; destruction of human settlements; displacement of people; as well as the resultant psychological trauma (Abaya, 2008).

### *Types of floods*

Floods can be classified into four categories: local floods, river floods, flash floods and coastal floods (APFL, 2008). *Local floods* are common in urban areas where the built environment often generates high surface run-off. In some cases, the run-off can be in excess of the capacity of the local storm water drainage systems to contain it. This type of flooding is common in small and medium-size towns (Ayele *et al*., 2006).

*River floods* can also be triggered by heavy rainfall or snowmelt in upstream areas. They occur when the run-off volume exceeds the river flow capacities. Urban areas that are situated on the low lying parts of such areas tend to be particularly exposed to this type of flooding (Abaya, 2008). According to the APFL (2008), this is more common in cold and mountainous areas such as Canada, Scandinavia, India, Peru and other countries of South America.

*Flash floods* occur because of the rapid accumulation of run-off water from up stream and mountainous areas due to heavy rainfall, breaking up of ice jams or failure of flood control works down stream. They are common in mountainous areas, but are also a potential threat in any area where the terrain is steep, surface run-off high, and stream flow channels narrow (Ayele *et al*., 2006).

*Coastal floods* are due to high tides and storms caused by tropical depressions and cyclones. This type of flooding often causes damage to urban areas located at estuaries and low-lying lands along river basins and coastal areas (APFL, 2008).

To a greater or lesser extent, many parts of Ethiopia are characterised by a combination of the above flood types.

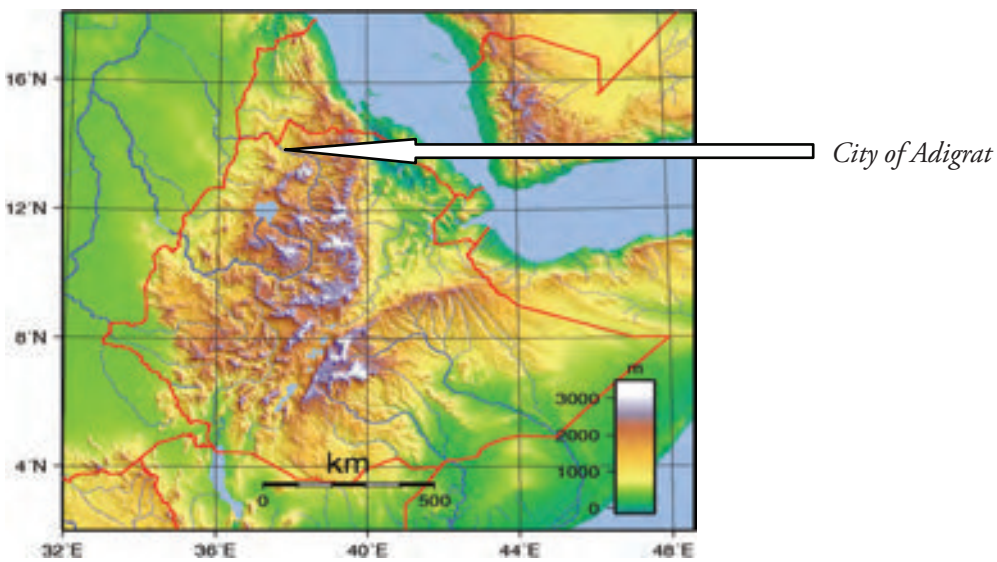
### *Causes of flooding*

Flooding is a function of both natural and anthropogenic factors that take place within certain geographical areas, particularly drainage basins. According to Andjelkovic (2001), in urban areas, natural causes or events include:

- Heavy rainfall, storms or even hurricanes or rainfall combined with snowmelts which exceeds the capacity of the natural water basins;
- Global warming whereby ice caps melt, thereby raising sea levels;
- The topography whereby areas with steep slopes increase the run-off, leading to the high speed of the water flow; and
- Coastal flooding which is caused by high tides or storms, often resulting in flooding of coastal lowlands and damage to human settlements.

In Ethiopia, mountain topography, with altitudes of up to 4,620 metres above sea-level, is the main cause of flooding (Hadush, 2008). The rainfall varies from about 750 mm a year in the Tigray region to over 1,000 mm on the mountains of Oromia. It is this heavy rainfall on some of the mountains that results in increased run-off and subsequent annual flooding of some areas such as Adigrat City.

***Figure 1. The topography of Ethiopia and the position of Adigrat City***




***Source: Extracted from Dar es Salaam City Council (DCC) Fire Brigade records 2004 – 2008***

The City of Adigrat has an elevation of between 2,530 and 2,660 metres above sea level and a topographic relief of steep and sloppy mountain chains on its western, northern and north-western limits (Mebrahtu, 2009). Both the altitude and slope decrease towards the south eastern direction, as shown in Figure 2 below.

***Figure 2. A view of high mountains around Adigrat City (2009)***

***Source: Mebrahtu (2009)***

The City receives a fairly high amount of annual rainfall, ranging from 500 to 800 mm per year. Because of the steep topography of the mountains, the water run-off often has a very high velocity (Mebrahtu, 2009).

As stated above, flooding is also a function of human or anthropogenic factors. For example, accelerated water run-off can result from poor land use and farming practices. This often leads to general land degradation, widespread deforestation, accelerated water run-off, soil erosion and the subsequent silting up of down stream water channels within the watersheds (World Bank, 1996).

In some urban areas, the absence of specific sites for solid waste dumping, coupled with lack of garbage collection and disposal systems, often leads to uncontrolled dumping of solid wastes into rivers and open drainages. Where the urban drainage infrastructure is inadequate for high flood discharge, the solid waste and other debris often reduce the capacity of the drainage by blocking the bottlenecks of drainage facilities and the smooth flow of water, leading to increased surface run-off and local flooding (Asfaw, 2003).

In some African countries, health standards are known to have deteriorated after flood disasters, leading to people drinking or using contaminated water, thus further exposing themselves to diseases such as cholera and typhoid (Getao, 2002).

Adigrat City is one of the African cities that are regularly affected by flooding. The water coming down from the surrounding mountains has a very high velocity due partly to the steep topography and partly to land degradation. As shown in Figure 3 below, rampant deforestation, overgrazing and over-cultivation on the steep and unprotected mountain slopes are the main causes of land degradation in this City (Mebrahtu, 2009).

***Figure 3. Deforested, over-grazed and over-used land (2009)***

***Source: Researcher's Field Observation (2009)***

Land degradation in the City of Adigrat is also exacerbated by an increase in human population numbers, estimated at more that 57,572 people (Central Statistical Agency, 2007). It is run-off from the mountain ranges that often causes annual floods in the low-lying areas of the City. Because the Huga River is shallow and heavily silted, the water often overflows the riverbanks, thereby flooding the City centre in the flood plain below (Cunningham *et al.*, 2005). As can be seen from Figure 4 below, other large volumes of water and sedimentation are brought into the river by huge gullies from other parts of the City.

***Figure 4. One of the huge gullies found within the City (2009)***

***Source: Researcher's Field Observation (2009)***

Flooding within Adigrat City is caused by a poor storm water drainage system. Figure 5 shows poor storm drainage which is too narrow in proportion to the volume of water coming down from the surrounding mountain ridges. The narrow drainage facilities, constructed by both the municipality and some NGOs, tend to be congested with sediments and solid wastes. As a consequence, water flowing down the surrounding high lands, particularly after heavy rainfall, is unable to flow through the narrow and sub-standard drainage canals (Tibebwa, 2002).

***Figure 5. Poor water drainage canal in Adigrat City (2009)***

***Source: Researcher's Field Observation (2009)***

The congestion of the drainage system with solid wastes is exacerbated by the apparent lack of suitable sites for solid waste disposal in and around the City. As a consequence, the residents often dispose of their solid wastes at any available open spaces, including the nearby drainage channels (Cunningham *et al*., 2005). It is this waste that ultimately blocks the smooth flow of water through the channels.

### *Impact of flooding*

According to APFL (2008), flood impact tends to be very severe in countries and cities where urbanisation takes place without much planning; where informal settlements exist in flood prone areas; and where there is a lack of early warning and limited disaster preparedness. As a consequence, flooding often results in adverse social, economic and environmental impacts. These may include large numbers of people losing their lives and properties as well as severe economic disruptions particularly to infrastructure and communication systems. The disruption of infrastructure and communication systems, in turn, may affect the movement of food, medicines and other essential relief materials (Hadush, 2008).

Another economic consequence of flooding is the high expenditure that is often incurred on flood protection and relief measures. This is particularly severe in developing countries.

With particular reference to Adigrat City, flooding has had considerable adverse impacts over the years. *Environmentally,* flooding has resulted in a heavy loss of fertile soil through water erosion. As shown in Figure 4 above, the increased water volumes and velocity have led to the formation of big gullies that have become intermittent stream channels (Ayele *et al*., 2006).

*Economically*, flooding has repeatedly damaged the City and individual property, infrastructure, communication networks and water pipes, and disrupted commerce and governmental services. This, in turn, has resulted in high expenditures for flood protection, maintenance and relief work by the municipality (Gwimbi *et al*., 2008). According to the general manager of the municipality, during flooding in April 2009, one flour factory was severely damaged (approximatly 3 million Birr - US$1 = 13.7 Ethiopian Birr).

*Socially,* constant flooding continues to endanger the social lives of the inhabitants of the City of Adigrat. This has been particularly severe among the low income groups who settle in fragile and flood prone areas such as along the river banks. Figures 6 and 7 below show the devastation caused by flood water. Water from the surrounding mountains usually overflows the banks of the Huga River, the main drainage of the flood plain, thereby threatening settlements in the low plain as well as along the river banks (Ayalew, 2007).

***Figure 6. Flood impact on an illegal settlement area (May, 2009)***

***Source: Researcher's Field Observation (2009)***

***Figure 7. Flood impact on an illegal settlement area (May, 2009)***

***Source: Researcher's Field Observation (2009)***

It was due to the above impacts of flooding in Adigrat City that this research was conceived, in particular, to evaluate the effectiveness of the current mitigation measures.

## Research objectives

The main objective of the research was to evaluate the effectiveness of flood disaster mitigation measures in the City of Adigrat, Tigray region, Ethiopia. Specifically, the study sought to evaluate the extent of implementation of the following mitigation measures:

- Structural measures - new drainage and diversion channels, elevation of river banks;
- Non-structural measures – land use planning, enactment of rules and regulations;
- Flood disaster preparedness – early warning, awareness programmes, and coordination of different stakeholders.

## Research methodology

Between March and July 2009, a study was carried out within the selected kebeles of Adigrat on the effectiveness of the flood disaster mitigation measures within their City. Although the research was specifically concerned with the effectiveness of the mitigation strategies, an identification of the current strategies was carried out in order to establish what exactly was being evaluated and to ascertain to what extent the strategies had succeeded in reducing the impact of annual flooding.

To achieve the objectives of the study, both secondary and primary data sources were utilised. *Secondary data* on strategies being employed to mitigate flood impact were obtained from published and unpublished reports of relevant Government agencies, particularly from the Meteorological Department and the local authority. Other secondary data were sourced from non-governmental organisations (NGOs), community-based organisations and individual organisations in the private sector. In addition, data on flood management were obtained from relevant internet websites.

*Primary data* were mainly obtained from different heads of households, both men and women, and from officials of the Adigrat Municipality, Adigrat Wereda Administration, Aga-azi Comprehensive Secondary School, Wereda Ganta'ashum, Office of Hazard Preparedness and Prevention, the Adigrat Catholic Church, as well as from personal observations.

In terms of the *sampling strategy,* it was decided to administer the questionnaires to household heads. According to the 2007 Central Statistics Agency (CSA), the population of Adigrat was 57,572. Adigrat City covers a huge geographical environment that encompasses six kebeles. According to a United States Agency for International Development (2004) Ethiopian Land Policy and Administration Assessment report (2004), a kebele is a village that forms the smallest or lowest local level administrative unit in Ethiopia. However, the Municipality of Adigrat did not know the exact population of each of its kebeles. In view of the absence of the data, it was decided to use household heads rather than individual City inhabitants. Thus, the total population of 57,572 was divided by 3.4, which is the average of urban households in Ethiopia. The result was 16,933 households. Assuming that each kebele consisted of an equal number of households, 16,933 households were then divided by six, giving a result of 2,822 households.

Because the total household population was above 10,000, the internet sample size calculator was used to determine a reasonable sample size, which turned out to be 338 households.

Due to the limitations of time and financial resources and the homogenous nature of the people of Adigrat, the researcher finally settled for a sample size of 169 households from three kebeles, that is, 338 households divided by 2. The selection of the three kebeles was based on the most flood prone areas. Thus, from every selected kebele, about 57 households were used as sources of information. In addition, 10 officials and one NGO were purposively interviewed, based on the prominent role each played in flood disaster mitigation within the City.

To collect *primary data,* questionnaires, structured and unstructured interviews as well as field observations were used based on the objectives and the research questions of the study. A total of 170 questionnaires were distributed to all household heads concerned. In addition, structured and semi-structured interviews were conducted with senior officials of the Agigrat Office of Hazard Preparedness and Prevention, the Administration of the Municipality of Adigrat, the Rural Wereda Ganta'ashum (NGO), the Wereda Genta feshum, the Aga-azi Comprehensive Secondary School (ADCS), as well as some members of the private sector. It is important to point out that, through the use of an interpreter, both the questionnaires and the interviews were carried out in the local language, Tigrigna, and then translated into English.

Finally, *site observations* were carried out and these enabled the researcher to see and take pictures of the affected areas, including environmental effects and sanitation conditions.

## Results and discussions

The study revealed that, as in other parts of Ethiopia, flood management in Adigrat involved both structural and non-structural measures.

### *An overview of the study area*

Adigrat City is the second largest city in the Tigray regional state of Ethiopia. It is divided into six kebele administrative centres and occupies an area of about 1,877.24 hectares. In 2007, its total population was 57,572 (Central Statistical Agency, 2007).

### *Structural measures*

The study found that the Municipality of Adigrat had launched a programme to construct drainages, dams or water reservoirs and flood walls, as well as to elevate river banks and modify river channels. In addition, sediment control programmes through re-forestation as well as terracing and contour ploughing had been introduced to prevent soil and water losses. Flood diversion channels were intended to re-direct flood waters to drier areas, sometimes for irrigation purposes.

Regarding the measures stated above, the researcher asked the household heads if the measures were effective in mitigating flood impacts. Table 1 below shows the responses from the 169 household heads.

***Figure 8. Location map of Adigrat City***


***Source: UN OCHA (2011)***

***Table 1. Responses regarding the effectiveness of structural measures***

| *Structural Mitigation* | Poor | % | Fair | % | Good | % | Very Good | % | Total | % |
|---|---|---|---|---|---|---|---|---|---|---|
| *Drainage construction* | 97 | 57.4 | 34 | 20.1 | 28 | 16.6.1 | 10 | 5.9 | 169 | 100 |
| *Dam construction* | 67 | 39.6 | 49 | 29.0 | 36 | 21.3 | 17 | 10.1 | 169 | 100 |
| *Flood wall construction* | 75 | 44.4 | 53 | 31.4 | 23 | 13.6.1 | 18 | 10.6 | 169 | 100 |
| *River bank elevation* | 81 | 48.0 | 60 | 35.5 | 20 | 11.8 | 8 | 4.7 | 169 | 100 |
| *Channel modification* | 73 | 43.2 | 63 | 37.3 | 21 | 12.4 | 12 | 7.1 | 169 | 100 |

While the efforts made so far by the Municipality were appreciated, the household heads felt that the measures fell far too short in terms of minimising the impact of flooding. Thus, the majority were not satisfied with virtually all the structural measures that the municipality had constructed so far. For example, out of the 169 household heads interviewed, 97 (57.4%) and 34 (20.1%) felt that the drainage structural works were poor and fair, while only 28 (16.6%) and 10 (5.9%) said they were good and very good respectively.

The household heads informed the researcher that they were particularly concerned about the

slow pace of drainage construction and that the canals were very narrow and substandard. This can be seen in Figure 9 below. The researcher was informed also that the planning and designing of the channels seemed to have taken into consideration only the amount of annual rainfall water, thereby excluding water inflows from the mountain ridges and gullies. As a consequence, flooding was still a problem, particularly during periods of high rainfall intensity. The household heads were concerned also that the construction of the drainage system did not seem to take into account the rapid population growth nor the geographical expansion of the City.

***Figure 9. Substandard storm water drainage in Adigrat City (2009)***

***Source: Researcher's Field Observation (2009)***

While accepting that the pace of drainage construction was slow and that the quality was poor, the Municipality of Adigrat attributed this to the lack of financial resources as well as of skilled labour. On the positive side, however, the General Manager of Adigrat City informed the researcher that the municipality had recently identified drainage networks as one of its priority areas. To this end, the Municipality had "begun field surveys to gather data and perform site investigations". At the time of the study, 39 km of drainage lines had already been surveyed and the data were going to be used "to evaluate flood potential and to design appropriate culverts and bridges".

### *Non-structural measures*

Due to the limited availability of resources to effect structural measures, the study found that the City of Adigrat was gradually turning towards non-structural flood *preventive* strategies.

These included land use planning, re-forestation; and the enactment of rules and regulations.

The researcher was informed that the City had a land use plan that had been prepared by the National Urban Planning Institute (NUPI) in 1995. The Plan was widely regarded as being in conformity with the topography of the City. Among its objectives, it intended to relocate some residents from flood prone areas to safer parts of the City; to give the flood prone areas to the unemployed youths to rehabilitate, develop and use for green infrastructure, parks and wildlife habitats; as well as for recreational activities.

However, when asked to what extent the above measures had been successful, 74 or 43.6% of the household heads told the researcher that the land use plan had not had significant positive effects, while only 12 or 7.0% said they were very good. As can be seen from Table 2 below, their views were that most of the physical, social and economic problems linked with flooding were, in fact, due to inappropriate land use practices. In particular, they cited the allocation by the Municipality of residential and other activities to the flood plain. In their opinion, this was altering the natural waterway, thereby exacerbating the risks of flooding.

The Adigrat Catholic Church Secretariat (ACCS), a local non-governmental organisation, told the researcher that, among the development priorities of the City, the current Development Plan considered flooding as a fifth priority issue. They also expressed disbelief that flood risk management had not been included in the City's Five-Year Strategic Plan.

On their part, the Municipality informed the researcher that one of their biggest problems in relation to land use planning was the presence of mountain ridges on three sides of the City. This made the outward expansion of the City rather difficult.

***Table 1. Responses regarding the effectiveness of structural measures***

| Non-structural mitigation | Poor | % | Fair | % | Good | % | Very Good | % | Total | % |
|---|---|---|---|---|---|---|---|---|---|---|
| **Land use planning** | **74** | **43.6** | **51** | **30.5** | **32** | **18.9** | **12** | **7.0** | **169** | **100** |
| **Land reclamation** | **67** | **39.4** | **50** | **29.4** | **39** | **23.6** | **13** | **7.6** | **169** | **100** |
| **Enactment of rules & regulations** | **73** | **42.9** | **61** | **35.9** | **28** | **16.6** | **7** | **4.6** | **169** | **100** |
| **Flood risk preparedness** | **69** | **40.6** | **53** | **31.7** | **32** | **18.9** | **15** | **8.8** | **169** | **100** |

On the issue of land reclamation and rehabilitation, 67 or 39.4% of the household heads said that it was poor, 29.4% said it was fair, while only 7.6% said it was excellent. The majority of the respondents said that the City was still characterised by extensive land degradation due to deforestation and over-grazing. They cited the formation of numerous deep gullies, including those that were now threatening Aga'azi Secondary School, as evidence of continued land degradation.

Regarding the enactment of rules and regulations, the Municipality informed the researcher that they had enacted rules that required every citizen to clear drainage channels of dry waste, and to desist from dumping waste into storm water drainages. To facilitate the implementation of these regulations, the Municipality had provided temporary collection bins for registered collectors to take solid waste to sites designated by the Municipality. The rules also required all residents of the City to take responsibility and remove all solid waste that was dumped into nearby drainage channels.

While many household heads were appreciative of the above rules, 73 or 42.9% of the respondents informed the researcher that the rules and regulations were good but lacked enforcement. As an example, they said that the clearing of dry waste from drainage channels was not being monitored and enforced by the Municipal officials. They revealed that the control of the dumping of waste into storm water drainages was not effective as some individuals still used open spaces to dump their wastes, particularly during the night.

Some NGOs informed the researcher that the central and fundamental problem regarding ineffective flood risk management was the lack of an overall national policy on flood management. In particular, the Adigrat Catholic Church Secretariat (ACCS) revealed that, while Ethiopia had a policy on disaster prevention and preparedness, the policy only covered drought-related risks. They admitted that, owing to the absence of a government policy, there was always some form of confusion during flood emergency response activities. This was adversely affecting coordination and mobilization of different stakeholders and resources.

On the critical aspect of flood risk preparedness, the researcher was informed by the Meteorological Department that Ethiopia was providing weather forecasts for 24 hours. The Meteorological Department had also opened meteorological stations in different parts of the country, including Adigrat City. The stations transmitted weather forecasts through radio, television, newspapers and monthly published bulletins.

While these were steps in the right direction, Table 2 shows that 40.6% of the household heads were not satisfied with the current measures relating to flood risk preparedness. They told the researcher that the forecasts were rather too general as well as too technical to be easily understood by ordinary people. As an example, they specifically mentioned the dissemination of early warning information for public education and health and safety measures as being poor. They also revealed that they were often told about requisite safety measures only after the event.

In response, the Meteorology Department and the Office of Hazard Preparedness and Prevention informed the researcher that their local stations had problems in terms of making accurate and reliable weather forecasts because their instruments were both inadequate and obsolete. In addition, their annual budgetary allocations were low, collection of data from different stations was late, and inter-sector collaboration poor.

Regarding the effectiveness of the City's health system preparedness, the household heads informed the researcher that, despite the existence of some trained female health extension

workers, they appeared to be concentrating mostly on public environmental health issues rather than on safety and flood disaster emergency services. While admitting this shortcoming, the City authorities said that they lacked professional capacity as well as financial resources.

**Conclusion**

On the basis of the above shortcomings, the major conclusion of this study is that the current flood disaster coping strategies in the City of Adigrat are not effective. While the City continues to do its best under the given circumstances, its efforts still suffer from a number of inadequacies. These include poor drainage infrastructure; inadequate enforcement of land use and zoning plans and other rules and regulations; poor early warning systems and flood risk preparedness; inadequate financial and skilled human resources; as well as poor coordination among different stakeholders.

It is also the opinion of the researcher that, at the core of the above problems, is the lack of a national policy on flood risk management. Therefore, Ethiopia is encouraged to formulate a comprehensive and integrated approach that includes developing a policy as well as streamlining coordination and awareness-raising measures. As submitted by Andjelkovic (2001), a policy is particularly critical in apportioning responsibility and authority to each of the participating stakeholders as well as to ensure their effective coordination. This is a critical and necessary process in reducing flood risk impacts and long term damages to the community.

At City level, the research concludes by observing that the state of disaster preparedness is rather weak. It is important for the City to realise that disaster preparedness does not consist only of weather forecasting, but includes mapping out the flood and giving early warning or informing the people in flood prone areas. As explained by Ayalew (2007), weather forecasting needs to be combined with citizen awareness programmes that teach people what to do in the event of flood disasters. This will give enough time to save lives and property and to prevent potential hazards. According to Wald *et al.* (2006), this approach has been proved to be the cheapest and most effective way of avoiding losses and damages during flood events.

The third and final conclusion is that the participation of different stakeholders in flood risk mitigation is rather weak in the City of Adigrat. The City authorities are therefore encouraged to embrace the concept of active involvement of the citizenry and other stakeholders and to clearly spell out the roles and responsibilities of each. Stakeholders should be involved right from policy formulation and land use planning up to the implementation of flood risk mitigation strategies. As submitted by the APFL (2008), integrated flood management is an important process that promotes a holistic approach to risk management. In the absence of organised community participation, individual interest groups may commandeer most of the activities, resulting in such activities being restricted in their effectiveness.

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# *Urban and rural dimensions in post-disaster adjustment challenges in selected communities in Kwara State, Nigeria*

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ABSTRACT

Human populations are exposed to climate change directly through changing weather patterns as manifested in the more frequent extreme events and indirectly through changes in ecosystem functions. Rainstorm disasters are common events associated with environmental change and settlements in Kwara state, Nigeria were ravaged by rainstorm events between 2003 and 2006. More than 1000 households were displaced from their habitual homes with consequences for human health and other adjustment challenges. This paper examines the variations in the post-disaster adjustment challenges of rural and urban households so as to identify location specific intervention strategies in the domains of environment and health of the victims. A sample of 200 households was drawn from all households affected by rainstorm disaster as reflected in the FEMA records during the period. A structured questionnaire was administered in addition to the secondary data and analyzed using relevant statistical techniques. The findings include that most households required support before replacing the roofs and/or walls of their homes. Sources of support however vary. Urban households received more institutional support but lower than the amount required for the renovation. A significant proportion of urban households moved to poorer homes where they faced challenges relating to the quality of environmental services. Many urban respondents also reported increases in the occurrence of water-borne and weather-related diseases and ailments. Rural households indicated no significant ecological differences between their former homes and the areas to which they relocated. The paper concludes that significant variations exist in the adjustment challenges faced by rural and urban dwellers after a disaster. Community efforts hold promise for emergency response particularly during disasters in rural areas.

KEYWORDS

Disasters, Urban, Rural, Adjustment, Kwara, Nigeria

## Introduction and background to the study

The magnitude of vulnerability to hazards and disasters varies in terms of geographical location, seasonality and exposure of population and infrastructure. Other factors include economic and social conditions, natural resource capital, political and institutional mechanisms, equity in terms of resource distribution and gender, and coping and adaptive capacity.

Socio-cultural and economic factors play a key role in the vulnerability of certain groups to disasters (ICIMOD, 2009). These factors can also have a marked impact on the success or failure of risk reduction strategies in communities. This is because they often influence the readiness to adopt, modify or reject safety measures offered through outside assistance like governments or NGOs. Post-disaster adjustment, like vulnerability, is determined by a range of factors, including the extent of unplanned urbanization, the nature of physical assets and economic activities, and the state of the environment. Recognition of the role of socio-economic factors is important and underlines the fact that technical solutions are necessary but not sufficient.

It must be noted that the poverty-exacerbating nature of disaster vulnerability can be attributable to post-disaster related damage such as temporary loss of income-generating opportunities and increased indebtedness which is also related to deliberate risk-averting livelihood choices that poorer households may make. These choices can also vary between urban and rural areas affected by disasters. Thus, poor and disadvantaged groups can become differentially vulnerable through the differential impacts of the breakdown of traditional familial support, declines in traditional coping measures, and increased occupation of more dangerous land. Without careful attention to needs assessment and design of response strategies between urban and rural communities, increased provision of infrastructure and services can indeed increase disaster vulnerability.

In recent decades there has been an escalation in the incidence of severe disaster events in both the developed and developing worlds which is also believed to be increasing the frequency and severity of droughts, floods and cyclones. This has been in part due to a rise in vulnerability. The increased incidence of major disasters and the associated rise in the cost of post-disaster reconstruction efforts are increasingly recognized as a potential threat to both sustainable development and poverty reduction initiatives. Thus there is a need to understand how the responses of victims of disaster in rural and urban areas differ so as to know how policies can be made better able to address the challenges in the two spatial scales without violating the equity and justice principles.

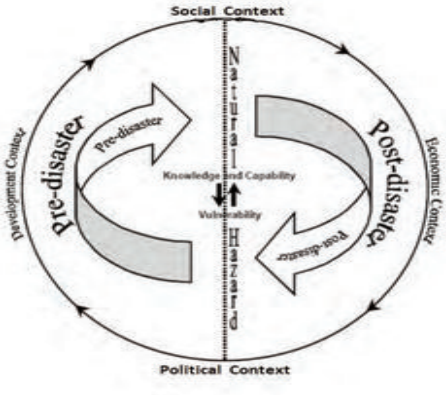
The understanding of the rural and urban circumstances of victims of disaster can aid the understanding of the speed of recovery and the severity of impact. This paper investigates the similarities and differences in how floods and rainstorms affect urban and rural dwellers in selected communities of Kwara state, Nigeria. Pursuant to this broad aim, the study proceeds to answer the question of what differences and similarities exist in the socio-economic, health, environmental and psychological challenges faced by the victims. It also examines the differences in the nature of support they received in periods after the disaster. The significance of this study is that since, in most cases, flood and rainstorm events serve to weaken the economic status of households, an understanding of the various dimensions of adjustment between rural/urban, men/women as well as between the rich and poor will assist in the recognition of the importance of mainstreaming disaster risk reduction in development planning and resource allocation at the local and national levels.

## Disaster and vulnerability: Some conceptual issues

According to Jigyasu (2002), vulnerability is a set of negative conditions within a community, which may be a consequence of several factors. This may be due to inherent weaknesses of these communities or be a consequence of external threats. On the other hand, local knowledge is a determinant of the capacity for reducing vulnerability and is thus a measure of positive conditions in a community. There is therefore an intricate link between the trio of vulnerability, local knowledge and capacities within a society. This is such that disaster vulnerability is both the cause and effect of degenerating local knowledge and capacities and of conditions of poverty. Disaster vulnerability possesses great conceptual complexity. For instance it can encompass various aspects of human sub-systems – physical, social, attitudinal, economic etc. It may hold true with respect to one hazard or multiple hazards, the whole community or a part thereof. Thus vulnerability is dynamic and does not remain the same for all people or communities over a long period of time. For instance, the kinds of vulnerability before a disaster may be aggravated by a disaster event whereas certain reactive actions (as relief and rehabilitation processes) may help in eradicating or reducing certain kinds of vulnerabilities, changing certain vulnerabilities to different kinds and reinforcing or compounding or strengthening or even increasing others. The vulnerability conditions can also change with time on their own through certain inherent community coping mechanisms or other practices (ICIMOD, 2009).

Vulnerability to natural disasters can therefore be understood as 'products and 'processes', existing before as well as after a disaster (Jigyasu, 2002). Disaster vulnerability is therefore not only a pre-disaster phenomenon but also a product of external human interventions and myths or perceptions of decision makers, undertaken as post-disaster decisions or actions. The guiding thesis in this paper is that disaster is a continuous event which only manifests during and after the occurrence of a hazard. The access model (Figure 1) by Blaikie *et al.* (1994) is used to illustrate the pre- and post-disaster challenges and the nexus between social, political and economic contexts in the recovery process.

***Figure 1: Vulnerability and capacity as dynamic process***




***Source: Blaikie et al., 1994, cited in Jigyasu, 2005***

Figure 1 reflects a simple model of the processes by which the underlying factors and root causes embedded in everyday life give rise to dynamic pressures affecting particular groups. This also creates a series of 'unsafe conditions' for the functioning of human systems. The model essentially demonstrates that vulnerability is generated by the interactions of political and economic processes or circumstances of people. Although Jigyasu (2005) had criticized the linear conception of the model, it is believed that the ability of the model to demarcate between the pre- and post-disaster situations as well as the establishment of the interaction of the different contexts of disaster victims in the process of recovery is a strength. Hazards in themselves do not constitute disasters. The magnitude of disaster is usually described in terms of the adverse effects which a disaster has had on lives, property and infrastructure; environmental damage; and the costs attached to post-disaster recovery and rehabilitation. Simply put, therefore, disaster risk is the product of the combination of three elements – vulnerability, coping capacity and hazard (UNDP, 2004). This interaction is illustrated in the following formula:

$$\textbf{Disaster risk (R)} = \frac{\text{Vulnerability (V) x Hazard (H)}}{\text{Capacity (C)}}$$

Extreme natural phenomena do not in themselves constitute hazards. It is only when such phenomena occur in an environment where they pose a threat to human life, property, infrastructure or the environment that they can be classified as hazards. Similarly in the case of technological developments, hazards occur only when such developments pose a danger such as industrial accidents and infrastructure failures. In essence, a disaster is the result of a hazard's impact on society. So the effects of a disaster are determined by the extent of a community's vulnerability to the hazard.

Hazards are increasingly dynamic and have highly varying potential impacts. A wide range of geographical, meteorological, hydrological, environmental, technological, biological and socio-political hazards can threaten livelihoods and sustainable development. Hazards can be classified into three broad categories:

- Natural hazards
- Technological hazards
- Environmental degradation (Palm, 1990; cf. Hunter & David, 2009).

It should be noted that all communities whether rural or urban are vulnerable to hazards. However, different regions will be more prone to certain types of hazards than others.

Natural hazards are those triggered by climatic and geographical variability, which is at least partly beyond the control of human activity (Palm, 1990). Technological hazards represent dangers originating from technological or industrial accidents, dangerous procedures, infrastructure failures or certain human activities which may cause a loss of life or injury, property damage, social and economic disruption or environmental degradation. Degradation of the environment is a process induced by human behaviour and activities (sometimes

combined with natural hazards) that damage the natural resource base or adversely alter natural processes or ecosystems (Palm, 1990). Potential effects are varied and many contribute to an increase in vulnerability and the frequency and intensity of hazards. Accordingly**,** disaster risk reduction or management suggests a systematic process that integrates risk identification, mitigation and transfer, as well as disaster preparedness, emergency response and rehabilitation or reconstruction to lessen the impacts of hazards (Cardona, 2005).

One of the major factors affecting poverty reduction among the poor in African cities is perennial flooding. This also stands in the way of the United Nations 2020 goal of achieving significant improvement in the lives of urban slum dwellers (ActionAid, 2006). This, according to Adelekan (2009), is because many African cities lack the infrastructures to withstand extreme weather conditions. Poor urban planning together with other urban governance challenges contributes to making African urban slum dwellers most at risk. Poor urban planning or lack of planning as urban development increases is evident in not preventing new development on areas at risk of flooding, leaving unprotected areas that should be left undeveloped, for instance wetlands, because of their role as buffers against flooding risks and also not providing safer sites for the urban poor. McGranahan (2007) noted that while economic activity and urban development often increase the environmental pressures that lead to flooding, it is the low income settlements and poor groups within all settlements that tend to be the most vulnerable.

## Disasters occurrence in Nigeria: An overview

The available literature shows the existence of spatial differences in the nature of disasters experienced in Nigeria. While oil and gas pollution is largely a Niger Delta problem, drought and quella birds infestation occur in the Sudano-Sahelian states (e.g. Kano, Sokoto, Katsina, Borno and Yobe). These disasters have been accompanied by numerous casualties including property damage. In 2001, the communal conflict in Akampa Local Government Area in Cross River State led to the displacement of about 3,000 people and left 12 dead. The Tiv/ Hausa-Fulani clash in Nasarawa State culminated in the death of 50 persons and displacement of 50,000 people. Furthermore, during the same period the flood disasters in Aba, Kirfi (Bauchi State),Talata Mafara (Zamfara State) led to the dislocation of about 13,000 people although no casualties were recorded (Orebiyi, 2002). It is important to note that of all disasters, soil erosion, rainstorm and flood disasters are the most common as they are prevalent in virtually all states in the country. This explains the reason for the choice of rainstorm and flood disasters as the focus for this study.

For instance, studies of the hydrological changes associated with urbanization (Akintola, 1994) have described the contribution of topographic conditions, rainfall characteristics, land use changes (especially the expansion of paved impermeable areas), uncontrolled waste dumping and construction on the flood plain, to local flooding (Oriola, 1994; Babatolu, 1997). Olaniran and Babatolu (1996) also pointed to the roles of rainfall amount and intensity as contributing to the frequency of flood events in Nigeria.

The perception of, impacts of and adjustments to urban flooding in Nigeria have been studied in Ayoade and Akintola (1980), Muoghalu and Okonkwo (1998), French *et al*., (1994), and

Ologunorisa (1999). The Nigerian coastal lowland cities of Lagos and Port Harcourt are particularly vulnerable to coastal flooding and flash flooding from heavy rains because parts of Lagos are two metres below sea level. Many slum dwellings are built on stilts over swamps and other wetlands. Blockage of channels by debris and obstruction of floodways by new construction were seen as the main obstacles contributing to the Port Harcourt flooding (Abam *et al.*, 2000). Worsening urban flooding is affected by both global climate change and local changes to drainage systems and rivers. The local changes are due to construction, blockage of drains and increased local runoff from hard, paved and compacted surfaces. These local and global changes work together to increase flood frequency, magnitude and duration. The urban poor are suffering more than other urban residents from these changes. Public health has also suffered as flooding has increased the number of outbreaks of cholera, causing several deaths (ActionAid, 2008).

***Figure 2. During a flood event in Ilorin Metropolis in 2008***

***Source: Photo by author, 2008***

In a nutshell, it is clear from the literature that climate change is altering rainfall patterns and tending to increase storm frequency and intensity, thus increasing the potential for floods. As a consequence, urban flooding is becoming an increasingly frequent and severe problem for the urban poor due to a host of local human factors, especially urban growth, occupation of flood plains and lack of attention to waste management and maintenance of drainage channels.

The small streams in urban areas thus rise quickly after heavy rain, but often have to pass through small culverts under roads. Poorly designed drainage channels produce more flows that exceed the capacity of the culverts. In lowland and coastal cities, wet season flooding may affect some areas for two or more months, because rain and river water combine to raise the

levels of water in swamps which would have naturally been inundated at certain times of the year. Dumping of waste beneath dwellings in these areas tends to help raise levels further. Storm waves can also bring flooding to such areas.

## Kwara State: Some geographical background

The focus of this study is Kwara State in Nigeria. The State was created in May 1967 and occupies a geographically advantaged position on the map of Nigeria. It is located between Latitudes $11^0$ 2` and $11^0$ 45'N and between Longitude $2^0$ 45' and $6^0$ 4'E. It lies midway between the northern and southern parts of Nigeria bounded in the north by Niger State and shares an international boundary with the Republic of Benin in the west. To its eastern border is Kogi State; while in the south it shares a boundary with the four states of Ekiti, Ondo, Osun and Oyo. The location of the State within the Nigerian space is shown in Figure 2.

***Figure 3. Map of Nigeria showing the location of Kwara State***


***Source: Wikimedia (2011)***

The State is covered by the Sudan and Woody Savanna vegetation with a mean annual rainfall and temperature of 1,338mm/year and $26.5^{0C}$ respectively. Added to this is the availability of abundant natural resources. Kwara State is a transition state both physically and culturally. There are thus various cultures and a host of ethnic groups existing in perfect harmony in the State. However, the level of development showcased in the State appears to have betrayed the scenario described above as the State ranks among the least developed in Nigeria. The State is covered by the Sudan and Woody Savanna vegetation with a mean annual rainfall and temperature of 1,338mm/year and $26.5^{0C}$ respectively. Added to this is the availability of

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## Population: Distribution and characteristics

The population of the State was about 1.5 million people in the year 2006 (Kwara State, 2010). The spatial distribution of the population of Kwara State is uneven. The State has a generally low density varying from as low as 8 persons per square kilometre in the north to 968 per square kilometre in the south. The cultural, religious and ethnic mix of the State is reflective of the uniqueness of its geographical location and history. The state's religious mix is a combination of Islam and Christianity, while the major ethnic groups are the Yoruba, Nupe and Baruba. The Yorubas are clearly in the majority but the nature of the relationship is such that a very high degree of integration and intermarriage exists among the different ethnic groups.

The gender distribution of the population shows that the figure is divided roughly equally between the two sexes. The female population constitutes about 50.4% or 1,139,718 persons while the male represents 49.6% or 1,122,393 persons. This sex distribution has an optimistic implication for fertility and hence population increase.

About 52% of the population of Kwara State is in the adult category while 48% are children and youths below the age of 18 years. This means that the structure of the State's population is generally youthful with a high ratio of dependency. This dependency characteristic has great consequences for human wellbeing in particular and economic development of the State in general. This therefore underlines the need for effective planning for rapid economic transformation in the State.

## Methodology

### *Data collection*

The data for this study were obtained from both primary and secondary sources. The primary data were extracted from a structured questionnaire administered to two hundred heads of households sampled from the victims of rainstorm disasters in Kwara State between 2003 and 2006. This represents about 20% of the 1061 households affected by rainstorm and/or flood events recorded by the Kwara State Office of the Federal Emergency Management Agency (FEMA). The records of FEMA included the names of house owners and the location addresses of the houses. It was therefore possible to categorize victims according to their locations. The samples were drawn from ten communities purposively sampled to include five each of rural settlements and urban neighbourhoods. Using the table of random numbers, the rural settlements included in the sample are Lanwa, Oke-Oyi, Oko-Olowo, Egbejila and Eiye-Nkorin. Samples were also drawn from Edun, Pakata, Okelele, Niger Road, and Adangba within the Ilorin metropolis. In each settlement and neighbourhood, twenty households were sampled randomly from the FEMA list and followed up to their location for an interview using

a structured questionnaire. In the event of non-response by the selected household, another household was immediately selected to complete the required sample. The questions were drawn to reflect the socio-economic and demographic backgrounds of rainstorm victims as well as the challenges they face in the periods immediately following the disaster events that affected them. In each case the head of household was the target respondent or any member of the household that was 18 years or over who volunteered to grant the interview.

The secondary data include the recorded victims of flood and rainstorm events between 2003 and 2006 and were obtained from the Kwara State Office of the Federal Emergency Management Agency (FEMA). The agency compiled records of victims in fairly adequate format which enabled the researcher to trace locations of victims, identify the nature of damage and the relief materials that were provided by government. The population and household characteristics in the State were compiled from the National and State population and housing tables (Priority Tables Volume 1) of the National Population Commission (NPC, 2009).

### *Data analyses*

The data obtained through the procedures described above were analysed using simple non-parametric statistics. The method of Chi-Square ($X^2$) was used to establish the nature of variation that existed in the challenges faced by victims and whether post-disaster challenges and adaptation varied significantly between rural settlements and urban neighbourhoods. In most parts, the reports from the five sampled rural settlements were discussed together under the heading 'rural' while those of the five urban neighbourhoods were aggregated as the 'urban'. The findings from these analyses are reported in the sections that follow.

## Analyses and findings

### *Socio-economic characteristics of respondents*

Table 1 shows the summary of the socio-economic characteristics of sampled victims of flood and/or rainstorm events in Kwara State. According to the Table, about 80% of the sampled households were headed by men while the remaining 20% were female-headed households. More than 70 % of the household heads were older than 30 years. It is striking to note that 22% of the household heads were single. These were households where the eldest son stood in for the head in his absence or where the male head was dead and his eldest child assumed headship. Apart from this category of households, other household heads were either married (51.5%) or were among others divorced, separated, and widowed (17.5%). Thirty-one percent and 29% of victims of rural and urban areas respectively had no formal education of any kind while the remaining had at least primary education. In the rural areas, 53% of the heads of households that were affected were farmers, while 32% were artisans. In the city, 26 and 29 percent respectively were civil servants and artisans.

Household sizes were larger among the victims of rainstorm and flooding events in rural areas than in the city. For instance more than 60% of the households sampled in the rural communities had more than six members, while only 38% of the sampled households in the urban

neighbourhoods had more than six members. Finally, income levels were generally low, and up to 65% of heads of households in rural communities and 22% of heads of households in urban neighbourhoods earned between N5,000-N10,000 ($33-$68) per month.

It is important to note that the socio-economic characteristics of heads of households have far-reaching implications for the adequacy, timeliness and appropriateness of the households' response to various challenges faced during and after extreme meteorological events.

***Table 1. Socio-economic characteristics of flood/rainstorm victims in Kwara State, Nigeria***

| Socio-economic Characteristics | | Rural | Urban | Total |
|---|---|---|---|---|
| **Sex** | Male | 86 | 73 | 159 |
| | Female | 14 | 27 | 41 |
| | | ***100*** | ***100*** | ***200*** |
| **Age** | 20 and below | 15 | 3 | 18 |
| | 21-30 | 20 | 17 | 37 |
| | 31-40 | 24 | 28 | 52 |
| | 41- 50 | 18 | 32 | 50 |
| | 51-60 | 10 | 12 | 22 |
| | 61 yrs & Above | 13 | 8 | 21 |
| | | ***100*** | ***100*** | ***200*** |
| **Marital status** | Single | 16 | 28 | 44 |
| | Married | 68 | 53 | 121 |
| | Others | 16 | 19 | 35 |
| | | ***100*** | ***100*** | ***200*** |
| **Education** | No formal education | 31 | 29 | 60 |
| | Primary | 36 | 33 | 69 |
| | Secondary | 21 | 23 | 44 |
| | Tertiary | 12 | 15 | 27 |
| | | ***100*** | ***100*** | ***200*** |
| **Occupation** | Farming/Trading | 38 | 11 | 49 |
| | Civil servants | 21 | 26 | 47 |
| | Artisans | 32 | 29 | 61 |
| | Unemployed/retired | 9 | 34 | 43 |
| | | 100 | 100 | 200 |
| **Household size** | 1-3 | 8 | 21 | 29 |
| | 4-6 | 31 | 41 | 72 |
| | 7-10 | 45 | 25 | 70 |
| | 10 and above | 16 | 13 | 29 |
| | | **100** | **100** | **200** |
| **Income Level** | Below N5,000 | 27 | 6 | 33 |
| (Average monthly) | N5,000-N10,000 | 39 | 16 | 55 |
| | N10,000-N15,000 | 16 | 35 | 51 |
| | N15,000-N20,000 | 11 | 17 | 28 |
| | N20,000 and above | 7 | 26 | 33 |
| | | **100** | **100** | **200** |

***Source: Author's survey, 2009***

## Post-disaster challenges in urban and rural areas: are there significant differences?

The challenges faced by victims of floods and rainstorms were categorised into five categories; namely socio-economic, health, environmental, psychological and the nature of support victims received after the events. These categories were drawn up from the summary of responses in the survey and formed the major challenges identified by the respondents. Table 2 shows the distribution of respondents on the basis of the challenges that they faced in the period immediately after the rainstorms and/or flood disasters that affected their homes. It is important to note that some of the households indicated that they faced more than one challenge under each category, while some households did not indicate any notable challenge in some of the categories used in this survey. This may explain why the responses received in Table 2 may be greater or lower than the total sample for the study.

***Table 2. Post-disaster challenges in rural and urban areas of Kwara State, Nigeria***

| Category | Major Challenges | Rural | Urban | Total |
|---|---|---|---|---|
| **Social/Economic** | No means of livelihood | 47 | 13 | 60 |
| | Loss of working equipment | 26 | 36 | 62 |
| | **Total** | **73** | **49** | **122** |
| **Health** | Drowning | 0 | 3 | 3 |
| | Bodily Injuries | 11 | 29 | 40 |
| | Diarrhoea in children | 18 | 38 | 56 |
| | New cases of meteorological ailments (catarrh, | 27 | 46 | 73 |
| | etc.) Destruction of Health Facility | 31 | 45 | 76 |
| | **Total** | **87** | **161** | **248** |
| **Environmental** | Increased mosquito population | 19 | 59 | 78 |
| | Exposure to human waste | 6 | 33 | 39 |
| | Flooded drainage | 12 | 73 | 85 |
| | Pollution of domestic water source | 38 | 58 | 96 |
| | **Total** | **75** | **223** | **298** |
| **Psychological** | Moved to better location | 16 | 5 | 21 |
| | Moved to poorer location | 33 | 81 | 114 |
| | No difference between the new and old location | 61 | 14 | 75 |
| | **Total** | **110** | **100** | **210** |
| **Nature of Support** | Materials from Government | 18 | 35 | 53 |
| | Cash from Government | 0 | 0 | 0 |
| | Materials from family/friends | 27 | 12 | 39 |
| | Received no support | 70 | 41 | 111 |
| | **Total** | **115** | **88** | **203** |

***Source: Author's survey, 2009***

As the Table shows, about 61% of the sampled households in both rural and urban areas indicated that the rainstorm/flood events that affected their houses also devastated their livelihood systems. This includes loss of farmland to flooding and collapse of business premises.

Moreover, about 20% of the total respondents suffered bodily injuries while diarrhoeal cases were reported in 28% of the sampled households. By far the commonest health related challenge in both rural and urban areas was the increase in cases of meteorological-induced ailments like

severe colds and pneumonia occurring in 31.5% of the sampled households, while health facilities near to 38% of the households were destroyed. In 78 households (39%), the population of malarial causing anopheles mosquitoes increased, while at least 33% of the households sampled in the city and 6% in rural communities indicated they were exposed to human waste as a result of the flood. Pollution of the domestic water sources was therefore a major environmental challenge reported in about 48% of the households, while 43% of the households indicated that the drainage around their houses was flooded.

In all, there is a general variation in the proportion of households exposed to the various challenges after the extreme weather events that affected them. The object of this study is to analyze these post-disaster challenges with a view to determining if there are significant statistical variations between urban communities and rural areas so as to be able to identify specific challenges of each geographic area. To achieve these objectives, a chi-square analytical technique was adopted to examine the significance of the variations observed in Table 2 above. The result is shown in Table 3.

***Table 3. $X^2$-analyses of the variation in post-disaster challenges in urban and rural areas of Kwara State, Nigeria***

| Adjustment Challenges | $\mathbf{X^2}$-*Results* | | Decision on Null Hypothesis |
|---|---|---|---|
| | Calculated value | Table Value | |
| Socio-Economic | 30.62 | 11.07 | Rejected |
| Health | 105.58 | 16.92 | Rejected |
| Environmental | 18.51 | 14.87 | Rejected |
| Psychological | 47.00 | 11.07 | Rejected |
| Nature of Support | 5.62 | 11.67 | Accepted |

***Source: Author's computation, 2009***

***Ho: The variations observed in each of the post-disaster challenges among urban and rural households in Ilorin Metropolis are not statistically significant.***
***Decision Rule: Reject Ho if $X^2$-calculated is greater or equal to $X^2$-tabulated at 5% confidence level; accept Ho if the reverse is correct.***

As shown in the Table above, the variations observed in the challenges to socio-economic life between urban and rural households were found to be statistically significant. This result conforms with the expectation that in rural areas, farm land distribution is scattered and an ample opportunity exists for farmers to farm in land parcels that are less susceptible to flooding or to relocate to other parcels when farms are affected by floods. On the other hand, houses are built close to each other in cities and in most cases, flood or rainstorm events easily become devastating and when these occur, opportunities are limited for the victims to relocate to other houses or business premises. This is worsened by the cost of acquiring new locations and the longer search time.

Aside from this, the public health consequences of floods are greater in cities where flows from even 'normal rains' often carry along their path significant urban waste from various houses to the downstream areas. Thus the heavier the downpour, the greater the exposure to unprotected human wastes and dead animals washed from open pits, refuse dumps and open septic tanks. This is worse in the inner parts of the cities where houses are often built without toilets and bath-places. In such areas, flooded streets are aggravated by the existing poor sanitation and drainage systems.

In all, a significant difference is shown to exist in the psychological challenges suffered by victims of extreme weather events. These challenges include the need to relocate from their former residence to a poorer apartment or neighbourhood particularly in the city. Rural houses are relatively homogeneous; therefore victims of extreme events indicated that they did not feel much stress because their new location was not too different from the former. This is not the case in cities where houses are scarce and expensive. Thus the victims are often forced to settle in any available apartment or neighbourhood consequent upon the urgency and cost. Finally, this study found no significant variation in the nature of support received from government by victims of flood events in both rural and urban areas. Most of them claimed that the relief material came when they had borrowed or sold their properties to repair their houses after the disaster.

## Summary and conclusions

This study investigates the differences and similarities that exist between flood and rainstorm victims in rural and urban communities of Kwara State, Nigeria. The study obtained data from a survey of flood and rainstorm victims selected from both rural communities and urban neighbourhoods in the State. The survey employed a structured questionnaire to elicit information on the challenges they faced in the periods immediately after the disaster. The study found significant statistical variations in post-disaster challenges faced by victims in the areas of health, environmental/ecological problems as well as in psychological challenges among rural and urban areas. On the other hand, the study found no significant statistical difference in the support received by both rural and urban victims.

The implications of these findings include the fact that the severity of the impact of floods and rainstorms varies between urban and rural areas. As the study shows, this variation may be related to the spatial structure of buildings and the generally low pressure on the ecological systems in rural areas. The opposite is the case in urban neighbourhoods where buildings are compact and place higher anthropogenic pressure on the urban ecological systems.

This calls to question the urban planning strategies by revealing the near absence of disaster preparedness mechanisms and systems. In most parts of the pre-colonial African cities, especially in the inner parts, housing and road constructions show a demonstrable inability of planners to envisage extremes of any 'normal' situation like traffic, population growth, rainfall, etc. thus a slight drift of any of these 'natural events' towards the extreme easily puts planning and policy out of their precarious balance. To worsen this, institutional responses are too politicised, irregular, meagre, untimely and of no effect in the context of the damages caused by the disaster.

The solutions to these problems lie in a deliberate intervention in the development of the inner cities of pre-colonial African cities. This can take the advantage of urban renewal efforts in these parts by legislating on the minimum standard for houses. The existing legislation seems to isolate inner parts of the city and allow random development to occur. The municipal authorities responsible for city planning often abandon the inner parts of the city where planning laws and initiatives do not necessarily take effect. Overtime, these areas may become slums even when the outer parts of the city are well planned.

In addition, government must move to bridge the gap between the time of disaster and the time when victims receive the relief materials or funds. Moreover, as Costello *et al.*(2009) note, "Management of the health effects of climate change will require inputs from all sectors of government and civil society, collaboration between many academic disciplines, and new ways of international cooperation that have hitherto eluded us". Local communities must be involved in monitoring, discussing, advocating, and assisting with the process of adaptation particularly in the mitigation measures that directly concern them and innovative actions that are targeted at the local communities. Finally, as the study shows, disaster risk vulnerability and adjustment challenges among households are related to geographical scales as well as socio-economic characteristics; thus a sustainable intervention from governments and non-governmental institutions is the one that develops an integrated framework aimed at accommodating both geographical and socio-economic dimensions of vulnerability of households to disaster risks.

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# *Invasive plant species and their disaster-effects in dry tropical forests and rangelands of Kenya and Tanzania*

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ABSTRACT

Invasive plants are a hazard in the tropical dry forests and rangelands of East Africa. Although often not reported, they have increasingly created disasters that have affected the environment and socio-economic wellbeing of communities inhabiting these dry regions. This paper reports on the key invasives in the drylands of Kenya and Tanzania and their effects, and suggests some disaster risk reduction (DRR) strategies. The study was largely based on secondary data analysis and supported by surveys in the affected drylands. The findings show ten key invasive plant species that affect the drylands. Their disaster-effects vary and include: causing the death of livestock by poisoning and destroying livestock foliage, accelerating biodiversity loss via suppression of native plants, to increasing diseases by offering a breeding ground for mosquitoes and other insects that carry ailments like nagana and sleeping sickness.

The DRR initiatives include (1) having a prudent land use system that discourages activities like unplanned burning of drylands, (2) assessing and monitoring phytosanitary risks associated with introduced plant species, (3) strengthening national and local institutional capacities that enhance invasive species awareness and preparedness for disasters, and (4) enhancing early warning systems related to plant invasion.

KEYWORDS

Disaster risk reduction, invasive species, drylands, East Africa and slow onset disasters

## Introduction

A looming disaster that has been poorly reported and at times neglected is the loss of biodiversity across the East African dry forests and rangelands. The biodiversity of dry lands offers tremendous socio-economic and environmental benefits to society. These include the provision of direct goods and services such as foods, medicines, timber, fuelwood, tourism and indirect services such as climate regulation, water catchment protection and soil conservation. Inevitably the decline and loss of this biodiversity has ultimately led to certain societal disasters (Rejmanek, 1995; Pimentel, 2002; Mooney *et al.*, 2003). Biodiversity loss, particularly the decline of

plants, has been associated with deforestation, land degradation, climate change effects and spread of invasive alien species. Some of these invasive species have caused considerable disasters in East African dry forests and rangelands (Wakibara & Mnaya, 2002; Pasiecznik *et al.*, 2006; Kenya Law Report, 2007a; IUCN, 2010). The United Nation Environmental Programme (UNEP) estimates that alien invasive species cost the global economy an annual US $1.4 trillion. In Africa limited studies have been done to quantify the cost of invasive plants species. However, studies in South Africa alone show the country spends over $60 million annually to eradicate invasive plants (Enviro-Conserve, 2010).

Like many areas globally, invasive species in the dry forests and rangelands (which are hereafter jointly referred to as drylands) of East Africa have been introduced both intentionally and accidentally and are damaging the natural and man-made ecosystems. In East Africa, and particularly Kenya, pastoralists have been adversely affected and disasters registered in many communities. For instance, in 2006, following the heavy livestock losses caused by the invasive plant *Prosopis juliflora* or Mesquite, communities of Baringo, Kenya, instituted a constitutional case against the government of Kenya for introducing Mesquite in their environment (Kenya Law Report, 2007b). The communities pointed out a pack of disasters that befell them as a result of the mesquite tree (Kenya Law Report, 2007b). These include the lack of water around Lake Baringo due to the colonisation of mesquite on the lake shores and human diseases such as asthma, lung inflammation and allergies.

Invasive plant invasion is a man-made and slow onset disaster (SOD) that is least noticed, often forgotten and neglected. Several reasons are given as to why disasters caused by invasive plant species are often neglected. These include the fact that the disaster-impacts arising from invasive plants are often considered not high enough to attract the attention of the media and disaster managers. Another factor is that disasters of invasive plants are often misunderstood (Pasiecznik *et al.*, 2006). As such they are among the neglected and under-reported disasters (Pidot, 2005; Krueger, 2007; Wisner & Gaillard, 2009). This paper reports on the invasive wood plant species found in the drylands of Kenya and Tanzania and looks at their disaster-impacts. It explores the process of invasion, particularly the opportunities that facilitate invasion and in doing so seeks to understand and thus "reduce the underlying risk factor" as pointed by the Hyogo Framework for Action priority 4. Coupled to the latter, the paper further suggests disaster risk reduction (DRR) strategies that will limit invasions and their associated disasters.

## Research methodology

The study was undertaken in two regions of East Africa. These were in the drylands of northern Kenya in an area called the Baringo District and in the Morogoro area of Central Tanzania. Within the Baringo district, the study was largely confined to the Marigat Division, which covers an area of 1,276 km$^2$ between latitudes 0$^0$20'N and 0$^0$44'N and longitudes 35$^0$57'E and 36$^0$12'E. In Tanzania the study was confined to the Morogoro Region of latitudes 6$^0$34'S and 6$^0$45'S and longitudes 37$^0$53'E and 38$^0$04'E. Although in different countries, these study areas have similar socio-economic and environmental characteristics that include low incomes, prevalent poverty, pastoralism and poor natural resource management that has led to increased environmental degradation such as deforestation, invasive species and soil erosion. It is the

prevalence of these factors and their close link to invasive plant species that led to the choice of these study sites.

In both study areas primary and secondary data sources were used. Primary data largely involved field surveys in the areas where invasive species were prevalent. A list of woody plant species in these drylands was compiled focusing on those species whose quantities or population had increased by over 75% during the past three decades, and which were thus suspected to be highly invasive. The basis of determing plants that had greatly increased in population was established by comparing current records of the plant population with similar old records existing in the areas in the mid-1980s. For the Baringo area in Kenya, these records were available from the Kenya Forestry Research Institute and the Kenya Forestry Service. For the Morogoro area (Tanzania), records were obtained from the archives of the Ministry of Environment and Natural Resources and the Faculty of Forestry at the Sokoine University of Agriculture - both institutions are based in the Morogoro region and are active in dryland forest management. This information was compared with that obtained from inhabitants of the two regions who had lived there and had knowledge of the region from the 1980s. In both cases the inhabitants involved were local village elders and questionnaire interviews were used to obtain the information. The questionnaires sought information on the occurrences of invasive plants and their disaster-impacts. This was compared with data collected in the field survey and from forestry records earlier mentioned (i.e. secondary data). A checklist of species in the two study areas was developed and their disaster-impacts compared.

## Findings

### *Invasive woody species in Kenyan and Tanzanian drylands and their disaster effects*

Only limited studies have been done on invasive species in Africa. The Invasive Woody Plant Database (with over 5000 publications on species invasiveness) has only 6% referring to tropical Africa. Of the few reports and studies done in East Africa, *Lantana camara* (commonly referred to as Lantana) is the most widely distributed invader (Table 1). Eight species considered invasives were found to be common to both the drylands of Kenya and Tanzania (Table 1). The most common were *Psidium guajava* (Guava tree), *Prosopis juliflora* (Mesquite), *Opuntia ficus indica* (Prickly pear cactus) and *Lantana camara* (Lantana). The driest parts of East Africa have the least number of reports despite covering the largest area (Binggeli *et al*., 1998).

In both Kenya and Tanzania there is a plethora of laws governing the management of invasive species. Among the key laws in Kenya are the Environmental Management and Coordination Act (EMCA), the Seeds and Plant Variety Act, the Agricultural Produce Act and the Plant Protection Act which are largely implemented through the National Environmental Management Authority (NEMA). In Tanzania there are the Forest Act No. 14 of 2002, the Plant Protection Act of 1997, the National Disaster Management Policy of 2004 and the Environmental Management Act No. 20 of 2004 that are mainly administered via the Ministry of Environment and Natural Resources (MENR). Despite these laws and institutions, the invasion of plant species continues to be a threat and key contributor to environmental disasters in the drylands. The occurrence of invasives is mainly the result of the unauthorised and poorly planned introduction and movement of plant materials.

In Kenyan drylands the major reported invader is Mesquite. This is one of the most widespread dryland invasive species in north and east Africa, having already invaded 500 000 and 700 000 hectares in Kenya and Ethiopia, respectively. Under ideal conditions, it has the ability to double its range every 5 years (IUCN, 2010). Although initially introduced to stabilise the drylands by revegetating barren land, Mesquite went on to outcompete and replace the native plants and trees. It has been blamed for many disaster-effects such as replacing the foliage (grasses, herbs and shrubs) eaten by local livestock, injuring livestock with its poisonous thorns and causing goat teeth to rot and fall out because the small seeds get stuck between the teeth (Table 1). Thousands of goats have been rendered toothless and died from starvation following teeth loss. In addition the roots of Mesquite make the soil loose and unable to sustain water; thus enhancing drought and soil erosion. Furthermore, because of its aggressive growth the plant forms thickets that are an ideal breeding ground for mosquitoes that transmit malaria. Another serious invasive plant is the prickly pear cactus or *Opuntia ficus indica*. This plant, which has been blamed for destroying grazing land in the Kenyan and Tanzanian drylands, is originally from Mexico. It was introduced as a hedge plant but has become a serious and difficult to control pest, because it spreads rapidly degrading the dry lands. Other prolific woody invasive plant species include the Lantana and the *Acacia polycantha* (White thorn) tree. All these invasive plants and trees have had serious socio-economic impacts and ultimately increased poverty in the local communities.

In the Tanzanian drylands two species have been largely reported as weedy or invasive: *Senna spectabilis* or Cassia (Wakibara & Mnaya, 2002) and the White thorn (Obiri *et al.*, 2010). These species suppress the growth of native trees, shrubs and grasses growing beneath or close to them. Subsequently foliage for wildlife animals is reduced leading to starvation and death of the animals. Although there are few invasive species in Tanzania there is no guarantee that the numbers will remain so in the future. A species that is not invasive today can in the future turn into an invader with disastrous effects.

Some introduced plants and tree species have been known to remain in small localized populations for long periods of time but later turn into burgeoning populations of invasives (Kolar & Lodge, 2001). The time period between the first introductions of a species in a new location and when it is declared invasive varies with different species and is referred to the species time lag. This time lag is largely responsible for why invasive plant species show slow onset disasters or SOD characteristics. Slow onset disasters are a category of disasters whose impact on the environment is not felt immediately but often takes time to build up. Common examples include drought and its effects of crops failure and famine. Similarly, heavy rains in a highland area can be followed later by flooding in a lowland area elsewhere. In both cases there is a lag in time between the onset of the disaster and the effects to be felt. For invasive tree species a typical example is found in the Usambara Mountains of Tanzania where the *Maesopsis eminii* (or Msira) tree was declared invasive and a disaster to the forest ecosystem 65 years after it was first introduced in 1913 (Binggeli, 1989). More recently Mesquite has been declared a serious invader in Kenyan drylands twenty years after its first introduction in the early 1980s (Pasiecznik *et al.*, 2006).

***Table 1. Incidences of invasive plants and their disaster effects in Kenyan and Tanzanian drylands. Plant occurrence indicated by the + symbol. Common names are put in brackets.***

| | *Occurrence in Tanzania* | *Occurrence in Kenya* | *Disaster effects / impacts* |
|---|---|---|---|
| *Lantana camara* (Lantana) | + | + | Breeding ground for sleeping sickness & Nagana, disrupts plant succession & lowers biodiversity |
| *Prosopis juliflora* (Mesquite) | + | + | Reduces livestock foliage, deep roots enhance drought, thorns poisonous |
| *Prosopis pallida* (Mesquite) | | + | ,, ,, ,, |
| *Opuntia ficus indica* (Prickly pear cactus) | + | + | Poisonous to wildlife in parks, affecting potential of tourism |
| *Caesalpinia decapetala* (Mauritius thorn) | + | + | Shades out grass & shrubs eaten by animals, limits animal movement |
| *Psidium guajava* (Guava) | + | + | Outcompetes native plants and lower species biodiversity |
| *Senna spectabilis* (Cassia) | + | | Suppresses growth of native park trees |
| *Acacia farnesiana* (Sweet acacia) | + | + | Suppresses growth of native trees, forms impenetrable thickets on rangeland and limits access to water |
| *Acacia mearnsii* (Black wattle) | + | + | Outcompetes native plants lowers biodiversity & increased water loss |
| *Acacia polyacantha* (White thorn) | + | + | Suppresses native plant species |

***Source: Author's computation, 2009***

## Discussion

### *What are invasive plant species?*

Although there is a growing global awareness of invasive plants and the disasters they cause, little attention has been paid to them and few studies have been conducted in tropical Africa (Binggeli *et al.*, 1998; Wakibara & Mnaya 2002).

Invasive plants are regarded as species that are capable of penetrating and replacing the existing indigenous vegetation of a location. Classically invasive plants are defined as exotic plants that have been introduced in a location, either intentionally or unintentionally, and that reproduce and spread on their own (Rejmanek, 1995). In East Africa most of the invasives were introduced

intentionally. For instance, the obnoxious mesquite was introduced in the Kenyan drylands through the initiatives of the Food and Agriculture Organization (FAO) and the Kenya Forestry Research Institute to curb desertification and increase fuelwood (Pasiecznik *et al.*, 2006).

Four key features are associated with invasive plants: (1) they show prolific seeding and early age of first reproduction, (2) have unpalatable foliage, (3) can easily establish in degraded environments, and (4) have an ability to regenerate profusely from direct seeds, stems or roots. These features make them good competitors amongst other plant species and allow their survival and abundant establishment.

There is a link between invasive plants, ecological integrity and human social livelihoods. First and foremost, maintaining the integrity of ecological systems is an important part of achieving sustainable use of natural resources. Ecological integrity is often disrupted by invasive species which encroach vigorously upon native species and degrade ecosystem services such as soil conservation and water catchment protection, thus causing severe damage to the economy and social livelihoods (Sudmeier-Rieux & Ash, 2009). Indeed the Millennium Ecosystem Assessment (MA), an international assessment initiative, has shown strong links between human wellbeing, human security, livelihoods and intangible benefits such as equality and freedom of choice with ecological or ecosystem services. The MA also highlights that a number of human activities (that include invasive species) degrade the ecological integrity of ecosystems (Sudmeier-Rieux & Ash, 2009).

### *Time lags and slow onset disaster characteristics*

What are the reasons for the time lags between the introduction of the plant species and their subsequent disaster? Hobbs and Humphries (1995) suggest two grounds: (1) species take some time to adapt to new environments, i.e. genotypic adaptation, and (2) species with exponential growth go unnoticed until populations are at critical sizes. Time lags are affected by changes in abiotic and biotic factors. Large and dramatic disturbances caused by abiotic factors (e.g. fires, deforestation and floods) often create new conditions for prolific regenerations or 'invasion windows'. For instance, *Cecropia peltata* (the Trumpet tree), was first introduced in Ivory Coast as a shade tree for coffee plantations in 1910, but spread over a radius of 100 km between 1950 and 1960 following heavy deforestation. Its spread enhanced biodiversity loss and caused disastrous disintegration of the native forest ecosystem. Biotic determinants of time lags may include factors associated with seeds and seedling dynamics such as the introduction of animal pollinators and changes in the population of grazing animals and their trampling intensities.

### *How do plant invasions occur?*

Invasion opportunities largely occur or follow disturbances in an ecosystem. Disturbances are common in East African drylands and are largely caused by human agro-pastoralism activities of shifting cultivation. This is a process whereby nomadic inhabitants cultivate crops on an unoccupied fertile piece of land and later move off it when the land loses soil fertility. Periodic shifting from unfertile lands to uncultivated fertile lands is a continuous cycle of movement that has, in recent times, increased in frequency due to population increase. Subsequently this

has caused patches of highly degraded or disturbed areas (having invasive tree and shrubs) within the drylands that were previously occupied by native trees. Land disturbances release resources which invasive trees and shrubs exploit (Davis *et al.*, 2000). Although both the native and invading plant species respond to disturbances it is the differences in their responses that determine if invasion occurs or not (Chesson & Huntly, 1997). For example, an invasive plant may show stronger positive response to a disturbance because it possesses an advantage at a particular time or place or may have a beneficial characteristic such as a strong ability to colonize a certain habitat. In Tanzanian drylands, the highly colonizing and invasive White thorn tree places vast amounts of seeds in the soil (or a rich soil seed bank) unlike other species (Obiri *et al.,* 2010). Another example is Mesquite which survives in disturbed moisture-stressed environments of Kenya and Ethiopia largely because of its deep roots that reach the low water-tables (Pasiecznik *et al.*, 2001).

Invasion opportunities also arise from disruptions of the historical pattern of resource supply and consumption (Sher & Hyatt, 1999). These disruptions, mostly caused by human activities, include alteration in patterns of fire regimes (D'Antonio, 2000), wood harvesting, nutrient enrichment (Jefferies, 2000) and climate change (Vitousek *et al.*, 1997; D'Antonio, 2000). Because they are not adapted or rarely occur in disturbed ecosystems, native species are likely to decline in numbers under disrupted patterns of resource supply and consumption. This results in disused resources that become entry points for invaders. On the other hand, invaders, such as those found in human-disturbed environments, may already have adaptations suited for pattern-disrupted environments (Drake & Mooney, 1989). The northern lowlands of Ethiopia are an example whereby, following land degradation, *Acacia nilotica* (Egyptian thorn) trees have declined in density and been replaced by the drought resistant Mesquite (Pasiecznik *et al.*, 2001).

### *Invasions and plant community dynamics*

Plant invasions can perhaps be best explained within a framework of plant community ecology (Shea & Chesson, 2002) where various viewpoints of biological invasions are considered. These include the characteristics of the plant invaders (Kolar & Lodge, 2001), the characteristics of the invaded plant community (Lonsdale, 1999), resource availability (Davis *et al.,* 2000) and the role of natural enemies (Keane & Crawley, 2002). Invasions occur through three stages: transport of invaders to new sites, establishment and population increase of the invaders in the new sites and their secondary spread from initial populations to other sites. All three stages have a vital link or input of human involvement as it is man who introduces the species into the community, in the first instance, and facilitates its spreading. Furthermore the manifestation of hazards to disasters occurs as a result of the increased presence of man in areas previously sparsely populated. Undoubtedly the establishment of invader plants at a location depends on their successful arrival in that locality in the first instance (Kolar & Lodge, 2001). Their subsequent establishment, however, depends on the way they interact with biotic and abiotic factors at the new location and particularly their ability to exploit opportunities available at the new location. The two most basic requirements of invaders are opportunities for obtaining resources for growth and opportunities for escaping natural enemies. The way a species responds

to these opportunities (both of which vary in time and space) determines the species' invading ability. It also determines the species' management and DRR strategies to control it. These factors are discussed in the sections below.

***Invading opportunities related to resources***

Invasion occurs if a plant species has a better ability than native plant species to extract resources in a location or if its cost of maintenance is much lower than that of native species (Shea & Chesson, 2002). This does not mean that plant invaders have better or superior structural systems (e.g. roots and leaves) that enable them to manufacture more food and grow faster than the native plants. However, they may have a superior response to particular conditions relating to resources such as an ability to extract resources even as the resources fluctuate with time or space (Chesson, 2000). In certain cases an invasion is facilitated by an ability of the invader to change a small spatial area around itself to its own advantage. For instance, some invader plants are known to produce poisonous (or allelopathic) compounds in the soil roots that kill and lower densities of its neighboring native species (Callaway & Aschehout, 2000). This phenomenon is also thought to occur with Mesquite (Pasiecznik *et al.*, 2001).

***How do we manage these plant invasions and their accompanying disasters?***

One question is often asked in regard to the DRR of invasive plants. Is it possible to predict species that are likely to be invasive and hence become a risk? Despite the currently substantial information compiled on biological invasions there are very limited pointers for species likely to be invasive and a risk. The general tendency has been to consider the plant species that first occupy the open non-inhabited areas that often have harsh conditions such as dry rocky ground devoid of moisture. These plants are referred to as pioneer species (as they break new ground) and are the likely invaders. However, given the right locations, climate and environment any species is potentially invasive (Shea & Chesson, 2002). Perhaps the best single DRR initiative for predicting invasiveness is to consider the behaviour of invasive species in other regions (Reichard, 1994). If a species is being considered for introduction in a given region and it is a known invasive in second region elsewhere, then the species is likely to be invasive in the region meant for introduction if the two regions have similar environmental characteristics. In other words, once an invader often an invader. In this case it is of paramount importance that checklists of all species listed as invasive be available and consulted at all time in programmes of tree planting whether for ornamental or economic purposes. Furthermore, these checklists need updating particularly for the areas that previously were sparsely populated but now have increased human immigration and are thus more likely to face disasters.

A second DRR question also often asked is: how can resistance to invasive plants be increased. Various studies suggest that invasion resistance increase with species diversity (Knops *et al.*, 1999; Naeem *et al.*, 2000). This relationship is explained by the empty niche hypothesis (Simberloff, 1995) where under low species diversity resources are not efficiently exploited because of a scarcity of species with ideal niches. Therefore niche opportunities exist for any invading species. Consequently having many different species in a habitat or high biodiversity is one approach to invasion resistance.

Traditionally, the management of overgrown vegetation in dry forests is largely done through fire, grazing and browsing (Chidumayo, 1997). Fire is probably the most important as it has the most significant effect on seedling dynamics. Although fire is necessary for resprouting in East African drylands (Luoga *et al*., 2004) under intense conditions or frequent occurrences it causes seedling mortality, species loss and therefore increases opportunities for invading species. The fiercest fires occur in the late dry seasons when conditions are most favourable (i.e. when there is a high quantity of excessively dry litter collected on the forest floor). Such fires should be monitored and discouraged as they are very destructive and greatly contribute to increased opportunities for plant invasion. As a DRR initiative there is a need for a preparedness mechanism to ensure that the old dead stems and branches are not left piling up on the forest floor, but are removed, as they increase the fuel load during fire outbreaks.

## Conclusion

Invasive plant species are hazards that have shown negative environmental and socio-economic impacts in East African drylands. They have degraded the environment and led to serious impacts on human wellbeing such as reduced availability of goods and services for local communities, increased spread of diseases and reduced economic opportunities. This, in turn, has led to loss of livelihoods, and reduced food security. Among the most serious of cases is the Mesquite tree that has devastated social livelihoods of many dryland communities in Kenya and even led to constitutional court cases between local communities and the Kenyan government. In both Kenya and Tanzania key legislations (such as the EMCA, the Forest and Plant Protection Acts) and institutions such as NEMA and the MENR monitor and control invasive species, however their outcomes have not been successful. The invasive plants related disasters have risen as communities have progressively moved into the drylands and remained ill-prepared to cope with the hazards. For instance, in the Baringo area the population was 210,000 when the mesquite was introduced around 1986 but by 2006 it had risen to 540 000, meaning that more people were exposed to hazards and thus disasters were likely to occur.

How do we combat invasive species? Like most environmental disasters, environmental management is central to building the resilience of communities and nations under the Hyogo Framework for Action (HFA), especially HFA priority 4. Therefore, environmental-based DRR policies, practices and guidelines need to be an integral part of managing the drylands. This includes, first, incorporate wise land-use planning whereby irregular disturbances such as random fires and the traditional dry season woodland burning that destroys existing vegetation are reduced. Secondly, since most invasive plants are introduced from foreign regions, it is critical to identify, assess and monitor phytosanitary risks of plant species being introduced into the country and drylands. Introductions should be preceded with counter-checking for any disaster-effects that a plant, intended for introduction, may have caused in an environment similar to where it is intended for introduction. Thirdly, establishing early warning systems and other preparedness measures such as ensuring that the fuel wood load in the dry forest floors does not accumulate as this enhances intensities of fires that burn and open up habitats for invasive plants. Fourth, it is important to strengthen the institutions of environmental management, mechanisms and capacities at different levels (especially at the community level)

so as to systematically build resilience towards invasive species' hazards. In this regard the National Environmental Management Authority in Kenya and the Ministry of Environment and Natural Resources in Tanzania need to increase their efforts regarding environmental education issues such as awareness of invasive species among local communities. Although this study took an East African approach, it was limited in scope as the drylands of Uganda, which are part of the region, were not included. Thus it is recommended that future studies need to explore other regions such as Uganda and also increase the number of regions under study in each country.

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# *The vulnerable state of the Ghana coast: The case of Faana-Bortianor*

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ABSTRACT

Coastal communities worldwide are becoming increasingly vulnerable to a wide range of potential hazards including shoreline erosion and coastal resource degradation. The problem is exacerbated due to rapid urbanization and the concomitant anthropogenic beach changes which influence coastal processes. The lack of basic services and disaster warning as well as response mechanisms makes the situation daunting. Using mainly qualitative methods, which include two Focus Group Discussions and 17 in-depth interviews, the authors explore the perception of respondents in regard to coastal erosion and how to mitigate the observed condition. The research incorporates both physical and social science knowledge. Our key finding is that although the Faana coastline is eroding at a significantly high rate, residents are resolved to maintain their occupancy for as long as they have the opportunity to practise their trade. The authors argue that proactive measures can be taken to reduce vulnerability and provide the enabling conditions for communities to absorb and bounce back from disruptions in basic services and economic activities.

KEYWORDS

Coastal erosion, sea level rise, coastal management, Faana, Ghana

## Introduction

The coastline of Ghana like many in the rest of the world has changed over the years in response to changes in the natural environment. Such changes have occurred over a wide range of temporal and spatial scales that reflect influences such as movement of the earth crust, and variations in sea level and climate. The physical shoreline change is also influenced by coastal engineering structures and other human activities. Although the coastal environment can retain some degree of natural character, increased human modification reduces the "naturalness"

(Dahm, 2000). Coastal erosion, which is a natural geomorphic process, becomes a hazard when it poses or is perceived to pose a threat to life and property (Ricketts, 1986).

Studies by Nail *et al*. (1993) identified twenty-four coastal erosion hot-spots in Ghana that need urgent attention. In the worse affected parts of Ghana near Keta, coastal erosion has persisted for over a century (NADMO, 2007). The historic rate of erosion was about four metres per annum (Ly, 1980) before the construction of the Keta Sea defence structures. The high rate of erosion is due to the shoreline's orientation and the damming of the Volta River. It is also reported that the erosion currently being experienced at the Prampram beach is the "end effect" of the breakwaters of the Tema Harbour (NADMO, 2007). Notwithstanding the above, the coastal environment continues to attract settlers not only for the aesthetic and recreational value, but also for the occupational opportunities and cultural values it provides.

According to Boateng (2006), most attempts at solving coastal erosion problems in Ghana have been based on ad hoc measures which have not been effective, hence the need to tackle the challenge in a holistic manner. The dilemma faced by governments is the lack of sufficient funding to protect the coastal communities or to completely relocate them. According to Appeaning Addo (2009), controlling coastal erosion using engineering interventions such as the construction of groynes as in Keta, only transfers the problem to the adjoining coastlines. In the case of the Keta Sea defence project, the problem of erosion has resurfaced between Horvi and Brekusu (NADMO, 2007; Oteng-Ababio, 2010b). Negative environmental outcomes also result from mitigation measures that adversely affect natural character such as revetment. Such 'hard' engineering approaches may succeed in controlling shoreline retreat and thus protect the coastal beachfront. However, the practices influence changes in geomorphic features along the adjoining shoreline.

'Soft' mitigation options, like dune re-vegetation or beach nourishment are deemed positive environmental outcomes because they do not reduce the public amenity value of the coast. In addition to buffering the sea front properties, the 'soft' engineering method enables continuous use of the beach for recreational purposes. Sand for such projects could be dredged from harbours or pumped from offshore sandbars (Schlacher *et al*., 2007). However, the technique has several disadvantages and may not be effective after all. Dredging disrupts marine organisms and the sand of the right texture may be hard to come by. The replenished beaches are also short-lived. According to Flanagan (1993), more than $5 million was spent replenishing the beach at Ocean City, New Jersey, in 1982. The beach disappeared within three months, after a series of northeasters (storms of speed exceeding 100km/h and accompanied by precipitation and lightning) hit the area. Similarly, a massive dredging project that cost more than $17 million replenished eight kilometres of beaches along the San Diego coast in 2000. Within months, after the largest waves of the year pounded the coast, more than half of the sand was gone (Flanagan, 1993). Thus the choice of mitigation strategy obviously has important social, cultural, aesthetic and economic impacts.

In this paper, the authors explore relocation as a viable alternative to either using "hard" or "soft" engineering measures to control coastal erosion along the Faana coast in Ghana, despite

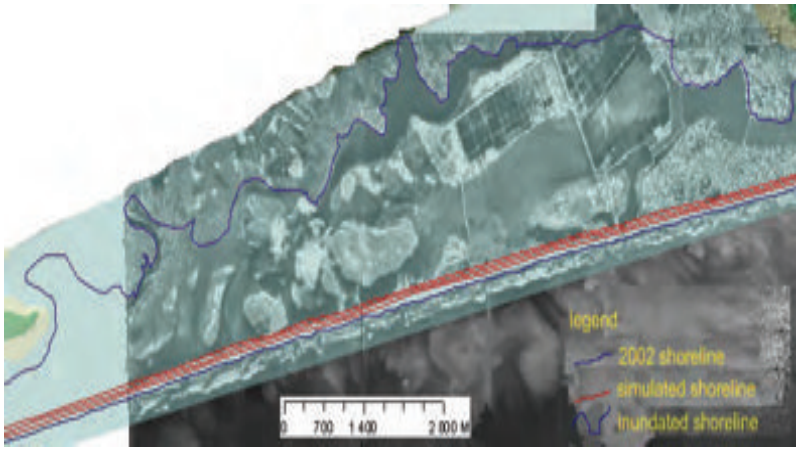
the fact that this approach has not been effectively adopted in Ghana. The study explores the Faana coastal community's perceptions of the coastal erosion and how the situation can be managed to help maintain the "natural character" of the environment.

## Background – The evolution of the Faana shoreline

The coastline of Ghana is approximately 550km long. The zone is generally described as low lying and below the 30m contour above sea level, thus making it prone to erosion. Its vulnerability to erosion is further heightened by its zonal orientation and the fact that it is an open coast that enables swell waves to break obliquely to the shoreline, generating long shore currents that carry sediment alongshore (Armah, 1991). The coastal communities in Ghana are mostly permanent indigenous settlements, many of which are centuries old. The settlers live and permanently earn their livelihood at these settlements. In recent years, private property developers, both foreign and local, have also acquired land along the coast for residential and commercial purposes. This, in a way, compounds the challenges of coastal erosion as mobility of the indigenes becomes restricted.

Coastal erosion affects the social and economic life of the local population, threatens the cultural heritage and hinders coastal tourism development. In the western part of the Accra coast, 17 coastal inhabitants have lost their buildings to coastal erosion over a 26-year period (Campbell, 2006). Additionally, coastal retreat has also eroded natural fish landing sites and degraded the coastal environment. The historic rate of erosion along Ghana's Accra coast is 1.13 ± 0.17 m/yr (Appeaning Addo *et al.*, 2008). However, the specific rate of erosion at Faana is about 1.30 ± 0.17 m/yr (Appeaning Addo, 2009), which is relatively higher. A model simulation by Appeaning Addo *et al.* (2008) under scenarios of climate change indicates that coastal erosion at Faana may be severe in the future and that the sandbar that separates the sea from the Sakumo wetlands will be breached between 2052 and 2082. Figure 1 shows a 20-year stage shoreline position in the western part of Accra (Faana).

***Figure 1. 20-year stage shoreline position in the western part of Accra (Faana)***




***Source: Appeaning Addo et al., 2008***

Various reasons have been assigned to explain the relatively high rate of erosion in Faana. Firstly, according to Appeaning Addo *et al*. (2008), the coastal erosion in Faana is a result of the dam constructed over the Densu River and the Kokrobite irrigation scheme. Additionally, the unique orientation of the shoreline (approximately east-west direction) enables incident waves to break obliquely and generate long shore currents that facilitate littoral drift, while sea level rise influences tidal current effectiveness. Other anthropogenic activities like sand mining have also reduced the sediment supply to the littoral zone that has resulted in an imbalance in the sediment budget. Meanwhile the breaching of the barrier ridge will result in flooding of the wetlands although the presence of relatively high hinterlands may prevent inundation further inland.

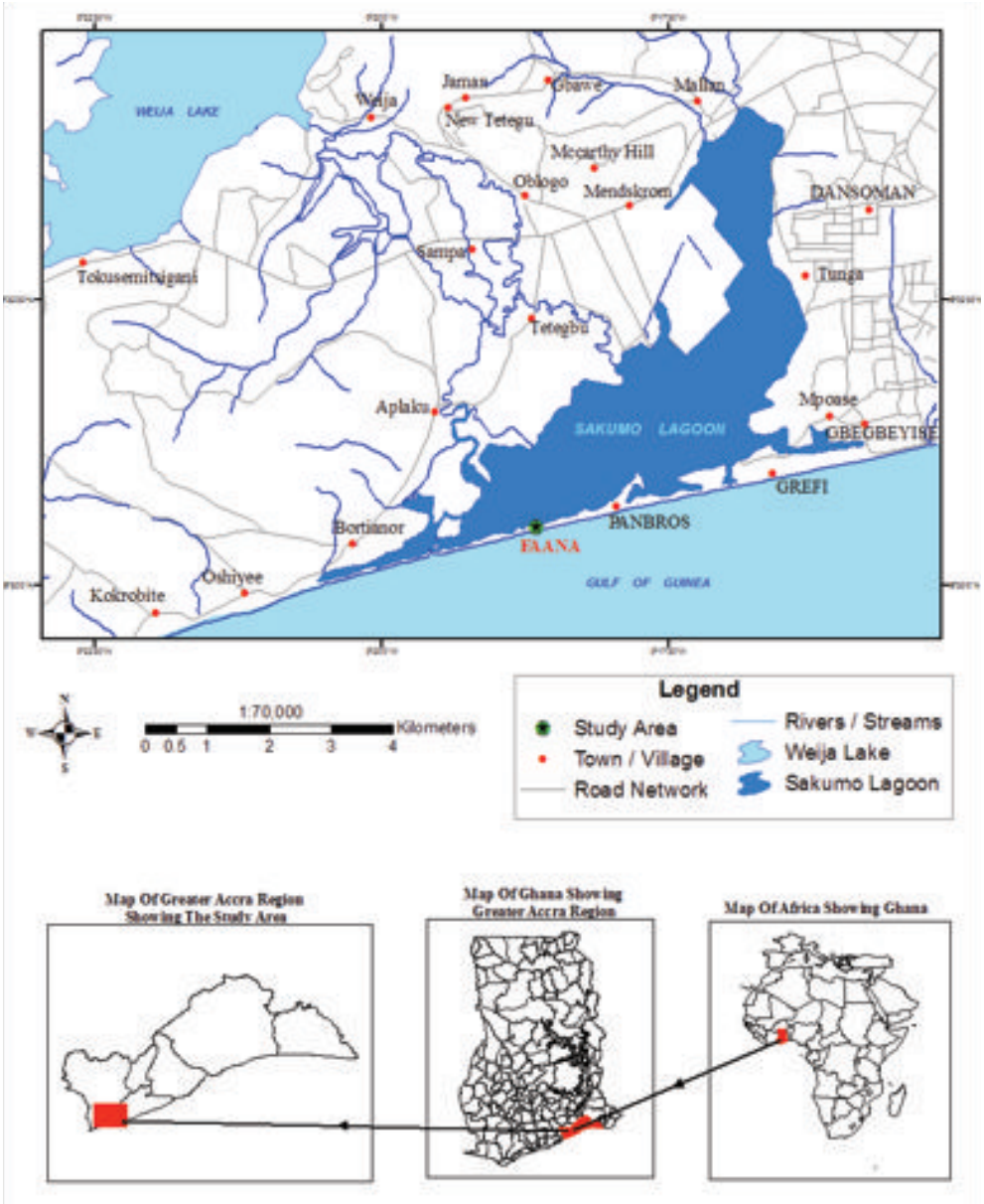
At Faana, the local community has improvised the use of 'solid waste' and other organic material as a barrier along the shoreline, although the effectiveness of such mechanism appears very insignificant. Meanwhile, apart from the fact that the coastline is condemned to extinction, the low elevation of the Faana coastal environment makes the use of engineering techniques in controlling the current erosion doubtful and inappropriate. Indeed, the construction of coastal structures will affect the natural fish landing sites and collapse the local fishing industry. The residents' perception or belief that they experience strong destructive waves only when the sea is disturbed, i.e. if someone dies in the sea, has also affected their understanding of the phenomena and thus negatively influenced their preference for hard engineering defence structures.

In the circumstances, it appears relocation is the preferred alternative solution to this coastal settlement that is on the brink of collapsing. Relocation, if well coordinated, can be executed with limited funds compared with the capital intensive engineering methods, and can also preserve the livelihood of the people. In as much as it may be painful, development planners are beginning to view relocation or 'strategic retreat' from the shoreline as a necessary option.

## The study area

Faana was selected as the study area on the basis of three main criteria. Firstly, the community has in recent times been experiencing a beach erosion problem which threatens local properties (Cambell, 2006). Secondly, a body of scientific knowledge about the behaviour of the beach system has been built up over time. Finally, a history of community action and past decisions is available through key informants but there is a lack of knowledge about the social dynamics of the problem. Faana is a small fishing community located at latitude $5.3180^0$ N and longitude $0.10010^0$ W along the Gulf of Guinea. The community, which is closer to Bortianor, is bounded on the north by the Sakumo lagoon and on the south by the Gulf of Guinea. Figure 2 shows the location of Faana. The community is located on the barrier ridge separating the Sakumo Lagoon from the sea. The geology consists of poorly consolidated rocks (Muff & Efa, 2006).

***Figure 2. The study area***




***Source: Appeaning Addo et al., 2009***

The community (see Fig. 3) is accessible by paddled canoes, which take between 20-30 minutes from Bortianor and the coast is characterized by a gently sloping shoreline. The significant wave height for 50 percent of the time is about 1.4 m, the period is between 10 to 15 seconds and spring high tide is about 1.26 m (Appeaning Addo *et al.*, 2008). Historically, sea level rise in Ghana, which is in conformity with global trends, is estimated at about 2 mm/yr (Ibé & Quélennac, 1989; Armah *et al.*, 2005; Appeaning Addo *et al.*, 2008).

***Figure 3. An overview of Faana Community***

***Source: Field survey, May 2010.***

The population of Faana, estimated to be between 800-1200, consists mostly of migrant fishermen from the Volta Region of Ghana. The majority of the population (over two-thirds) are made up of women and children. The main economic activity in the community is fishing and it is the main source of livelihood for the entire community. While the men are engaged in "corporate fishing", the women work as fishmongers and provide other retail supporting services (selling of drinks, cigarettes, food, etc). Most of the children provide fishing assistance to their parents, including the mending of torn nets.

From the interview with the settlers, it emerged that few of the children in the village attend formal schools. This could probably be as a result of a lack of educational facilities within the settlement and the fact that prospective pupils would have to commute daily between Faana and Bortianor (the immediate settlement with an educational facility) by boat. During the survey period, a school-going pupil was sighted loitering in his school uniform during school hours. In terms of local governance, the community has an elected leader who is also the local representative at the District Assembly. He also doubles as the representative of the land owners. With regard to infrastructure, Faana is deprived of almost all forms of basic socio-economic infrastructure such as electricity, potable drinking water, waste disposal site, clinic and market.

The only facility sighted is a two-seater Kumasi Ventilated Indirect Pit Latrine (KVIP - a local variant on the internationally-used VIP toilet) built by an NGO but since abandoned because residents detested the idea of carrying water to the facility whenever one intends to use it. Instead, the residents prefer the use of the seashore as place of convenience whilst solid waste is disposed along the beach. Almost all the community members live in structures built with thatch while the few affluent ones use timber. Residents access facilities like drinking water,

***Figure 4. Women and children carting drinking water from Bortianor to Faana***

***Source: Field survey, May 2010.***

***Figure 5. A local "Pharmacy Shop" at Faana***


***Source: Field survey, May 2010.***

schools, clinics and markets daily at Bortianor and beyond via canoes. Fig. 4 shows a boat owner transporting women and children to Faana (for a fee) after they had collected drinking water from Botianor. The team also sighted a local pharmacy outlet (see Fig. 5) where residents can access first aid medication like paracetamol and a few antibiotics.

## Data and methods

The study made use of both primary and secondary data sources. As a starting point, there was a review of the available literature on coastal erosion. Secondary data were collected, analyzed and reviewed. These included relevant academic articles, books, newspapers, magazines and reports of previous studies. This process was limited by the reluctance on the part of some public servants to make available certain official documents, because of the State Secrets Act 101 of 1962 and the Government Servants Conduct Rules of 1979 which bind bureaucrats to an oath of secrecy. Notwithstanding these forms of administrative rigidity and restrictions, the available reports were accessed and thoroughly reviewed.

This case study research is intended to shed light on key factors shaping environmental outcomes based on participants' experiences in making decisions to manage the situation. Interviewees were selected to represent the array of stakeholders and interests involved in or familiar with negotiating the outcome, and included representatives from the Local Authority, National Disaster Management Organisation (NADMO), the Environmental Protection Agency (EPA), Town and Country Planning, the Traditional Authority, and the local Assembly member. Additionally, the Head of the fishermen's association and the leader of the fishmongers retailing group were also interviewed. Finally, two youths, one a 'truant' school boy and the other, a school drop-out (both aged below 18) were contacted. In all, seventeen (17) key stakeholders were interviewed.

In assessing the residents' perceptions about the coastal erosion and their coping strategies, the study adopted focus groups in the collection of the primary data. This method was deemed appropriate because, according to Ulin *et al*. (2005), group interviewing is most appropriate when the research aims to explore attitudes or reactions of a group or community in response to some commonly experienced aspect of their environment. Such a technique allows the participants to candidly offer insights on the perspectives of the community, revealing clues to the social contexts that shape their opinions (Scammell & Dearry, 1997; Scammell *et al*., 2009).

In the service of addressing the objectives set, two separate focus group discussions were conducted; the first group consisted mainly of the resident migrant fisherfolk mainly from the Volta region of Ghana. They have almost similar socio-economic demographics (aged between 35 and 65, with at best an elementary level of education and married with a household size of not less than 5). They have lived (as caretakers) and worked on the land for and on behalf of the landowners for decades. During the second group discussion, the absentee traditional landowners and the fetish priest who superintends the activities on the land were invited to participate. This strategy was adopted because it was more likely to generate more free and open discussion. Both groups exhibited higher historical knowledge about the area.

Apart from the traditional landowners and the fetish priest, the other participants in the two discussions were randomly but purposively selected (non-probability) from among the residents with the assistance of the Assemblyman of the area. To facilitate a dynamic interaction between the participants, the first group consisted of nine people while the second group attracted

eleven participants. For eligibility purposes, persons under age 18 or living less than five years in the area were deemed ineligible because such persons were considered to be restricted with regard to authentic local oral history. The list of participants was made up overwhelmingly of migrants and was male dominated. This was because the residents were mostly (90%) migrants while the fishing activity is mainly male dominated. Additionally, most of the females were reluctant to participate in the discussion with their husbands.

The choice of the venue for the focus group was mainly informed by the safety, familiarity, accessibility, comfort and convenience of participants and in both instances steps were taken to ensure the privacy of participants. Both focus groups were conducted using a questionnaire guide which sought to explore participants' knowledge, perceptions and coping strategies in facing the fast eroding beach. For tactical reasons, the initial questions were broad, general and open-ended. Once it became apparent that participants were comfortable speaking candidly, questions became narrower and more focused, after they had been briefed about the likelihood of the beach being completely washed away. This was purposefully done to help stimulate the discussion. All proceedings which were in the local Ga language were recorded, later transcribed, translated into English and analyzed. This paper provides a succinct overview of the case study and then presents a synthesis of the key factors influencing the final environmental outcome. Although every effort has been made to avoid identifying interviewees, the circumstances and nature of the information provided may result in their identity being apparent to some. All those interviewed found this acceptable.

## Results and discussion

Over the years, coastal erosion has been a major problem to settlements along the coast. In the case of Ghana, these problems are more or less seasonal, and intensify during periods of high tides usually between July and August. This period is not only characterised by displacement of settlements but also affects the major economic activity (fishing) of the people through the flooding of the natural fishing landing sites.

### *Risk perception of coastal erosion in Faana*

In order to assess the knowledge and level of awareness of residents of Faana about the problem of coastal erosion and how they are coping with the menace, a series of focus group discussions were conducted. During the discussions participants were asked if they were aware of erosion in their coast land. Further questions were asked about when such an event becomes quite noticeable and what their future plans are regarding the phenomenon. The results of the analysis show that all the participants are aware of the "devastating" effects of the erosion.

They unanimously indicated that the problems associated with coastal erosion became apparent about fifty years ago and since then it has been a cyclical annual affair which intensifies during July and August. They added that the process has resulted in the continuous reduction in the stretch of land. One participant was even of the opinion that "at the end of each year, the sea takes away about a foot of the land". Most significantly, they intimated, *"It is the sea that has consumed all our block houses, to the extent that today we have to use thatch in building. At times,*

*the waves are too severe that the whole area gets flooded. Sometimes, we have to temporarily relocate till the waves recede before returning. There are times you get up in mornings only to find out that your room is flooded".*

With regard to the possible causes of the erosion, participants attributed it to natural factors which in their estimation affect every coastal settlement. They however noted that the situation becomes severe when the "sea is disturbed". According to them the "sea is disturbed" when somebody dies in the sea or defies the traditional norms governing its use. It was for example, revealed that it is a taboo to fish in the sea on Tuesdays and this is to be respected by all without any compromise. According to them, the residents thus incur the wrath of the sea once this norm is disrespected, a traditional belief which until recently has been used to harmonise effectively a man's relationship with his ecosystem. Concerning the consequence of the periodic erosion in the area, the 'Chief' of the community intimated that *"The periodic loss of structures and belongings has contributed to the increasing number of forced migrants in the community. During periods of such severe tides, many of our youth return home (in the Volta region) but some always fail to return when things have normalised. Some also find solace in living and doing menial jobs in Accra, thereby compromising their future. We lose at least 50 young men annually through such distress situations and this has serious consequences on the future of our profession".*

A few dissenting views were however noticed during the second group discussions, on the reason why the youth are leaving the settlement. According to this dissenting school of thought, mainly the landowners, the youth are migrating because of the lack of social infrastructure in the town. They were of the opinion that *"This town is deprived of all basic infrastructure. There are no schools, place of convenience, clinic, social amenities etc. The boys and girls will have to ferry drinking water from a nearby settlement daily while the very few school-going children do the same. Both men and women openly and jointly use the sea shore as place of convenience. These conditions cannot put the youthful exuberant tendencies in them in check hence their experimental trips to the cities".*

Asked whether there has been any government intervention or a proposition ever since the problem became apparent, all the participants in both discussions unanimously responded in the negative. The participants observed; "*At the national level, nothing has been done to mitigate the problem. Nobody has ever stepped here, not even the District Chief Executive. The only person who visited here was the Member of Parliament during the periods close to the general elections and I sincerely believe that she will be here again when the next election is due".*

### *Coping strategies of the community*

In the absence of clear-cut government plans and policies to address these problems, the communities have adopted some coping strategies which are informed by their knowledge and awareness about the dynamics of ocean tides. First, their residential structures are mainly built with thatch which is seen as very cost effective. The participants noted that they had to stop using sand-crate blocks because of the strong tidal waves, which also facilitate corrosion of the blocks. This is also due to the loss of structures associated with occasional relocation when

there are high tidal waves. Secondly, to avoid occasional unexpected flooding at night, residents have to mount their beds higher above the ground. It is also a common practice in the neighbourhood to see most structures being anchored with ropes.

Another common coping strategy among residents is the use of solid waste and tree branches to serve as sediment entrapment. It was observed during the field study that, at the backyard of every structure, is a pile of rubbish, a mechanism to reduce the landward limits of the high tides. Similarly, they have deliberately raised the level of the sea shore to prevent the ocean tides from overflowing the banks of the shore. The community also has a mechanism by which an outlet is opened to enable the water to rejoin the sea to avoid flooding, when they realise that the level of the lagoon has reached an alarming proportion.

The community also has a strong social network that has helped them withstand the atrocities of the sea till the present. The community is united by tribe and profession (fishing). As already stated, most of the settlers are from the Volta Region which shares similar socio-cultural characteristics and practices. The language, dietary pattern and cultural values are virtually identical. In terms of their profession, these migrants (settlers) are all fishermen while their spouses are also engaged in fishing-related activities. Indeed, the men engage in group fishing (corporate fishing) while the group leaders keep the proceeds until an agreed period when all the proceeds accumulated over the period are shared among members. This has made each member of the community become his brother's keeper, thus it is not uncommon to see the whole community wholeheartedly rushing to the aid of a distressed colleague.

## Is relocation or reconstruction an option?

Participants were asked to suggest a preferred solution which in their view could help solve or mitigate the problem. The results show that residents are not in favour of any possibility of the government or a Non-Governmental Organisation (NGO) constructing a sea defence wall. According to them, the construction of a sea defence wall is incompatible with the fishing profession and will deny them their fishing expeditions, which are their major source of livelihood. They also displayed their displeasure at any relocation option.

The few who demonstrated some willingness to relocate, however, mentioned some conditions: *"we will choose relocation as an alternative, only if any planned defence infrastructures will enable us to come back to fish, perform our annual rituals and of course, with some monetary compensation".* By implication, relocation will not only be difficult but in terms of current community knowledge and appreciation a very remote possibility. In their considered opinion, "continuous traditional sacrifices to our gods will stand between us and the continuous erosion of our sea shore".

From the foregoing it is clear that the existence of the community is dependent on the accessibility to fishing, which is the major source of livelihood. Additionally, local knowledge and awareness about the dynamics of the ocean tides inform their coping strategies. Responses from the residents indicate that, as long as the above conditions exist, they will continue to manage their stay at the present location. The authors acknowledge that the low representation of women and children less than 18 years as well as the exclusion of the newly arrived residents

could in some geographical settings potentially bias the data and possibly the conclusions. However, within this traditional setting where the views of the elderly and men in particular reign supreme, and within the limit of the current data collected, the conclusions reached are legitimate.

## Summary and conclusion

Coastal erosion, exemplified in this study, is a natural process; however, it may become a problem when exacerbated by human activities or natural hazards. It is widespread in the coastal zone of Accra and indeed coastal Ghana owing to a combination of various natural forces, population growth and unmanaged economic activities. This has necessitated major efforts to manage the situation and to restore the ability of the coast to accommodate short and long-term changes induced by human activities, extreme events and sea-level rise.

Disputes over how to address such coastal erosion are frequently emotional and contentious because of the values and interests associated with the coastal environment and the distribution of costs and benefits generated by different management strategies. We argued that environmental outcomes as a result of a coastal erosion event which impact negatively on private or community assets are influenced by who is involved in negotiating solutions and how contending interests are reconciled, how resource management agencies behave and the nature of the physical coastal environment.

We were further of the opinion that generally, a co-operative relationship between local authorities, technical experts and communities through facilitated discussion, learning, information exchange and resolution of conflicting values and interests leads to a positive environmental outcome. It is also argued that the absence of such a consensus gives birth to independent action by individuals or community groups. For an environmentally harmonious relationship, it is important to ensure that all interests are represented in the decision-making process and that power differences are addressed to avoid capture of the process by a group with narrow interests that conflict with community interests. This may mean incorporating interests beyond the immediately impacted community.

To ensure a sustainable outcome, the local authority which most invariably is the lead agency in such negotiations, ought to have a clear understanding of the scientific and historical (traditional) information relevant to an event and this provides a good basis for beginning negotiations with stakeholders over potential options. Although there is an obvious discrepancy between residents' lay knowledge and 'scientific' findings, the authorities can improve and reorient this traditional knowledge towards providing a nucleus for a more sustainable management practice. Indeed, any management framework should harness both traditional and scientific knowledge to ensure a sustainable process (Oteng-Ababio, 2010a). One of the dangers in addressing coastal erosion as occurring at Faana is the tendency to focus on short-term stakeholder interests at the local community level rather than longer term regional and national interests. In most cases, a response to individual community concerns, if not managed carefully, could lead to a highly modified coastal environment. It is imperative for the authorities to provide national guidance on how to manage coastal erosion.

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# *Challenges to disaster risk reduction: A study of stakeholders' perspectives in Imizamo Yethu, South Africa*

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ABSTRACT

South Africa is a complex and dynamic society, with overwhelming and increasing problems with disaster risk in the vulnerable urban communities in and around its rapidly growing metropolitan centres. The purpose of this study is to improve the understanding of the challenges for disaster risk reduction in such communities. It focuses on the case of Imizamo Yethu, in the Western Cape, in order to build theory that is grounded in the empirical realities of stakeholders involved in disaster risk reduction there. The result points towards five interrelated key challenges, which must be concurrently addressed through large-scale development efforts. Without such investments, it is unlikely that disaster risks can be reduced to tolerable levels.

KEYWORDS

Disaster risk reduction, development, South Africa, urban, vulnerable, community

## Introduction

South Africa is a dynamic developing country in a challenging transition. The economic purchasing power per person increased more than 173 percent in the first 15 years after Apartheid (World Bank, 2010), while the Human Development Index (HDI) is more or less unchanged since then (UNDP, 2011). South Africa is thus not only one of a few countries in the world that has not experienced human development in this period (Khandlhela & May, 2006), but this also indicates an overall deterioration in the non-economic indicators of HDI. Next to the mounting impact of HIV/AIDS on life expectancy, this deterioration is mainly caused by policies making a minor part of the population increasingly rich, while the majority becomes increasingly poor. This inequality has obvious roots in Apartheid, but it is important to note that it has been growing ever since. It is in this context that South Africa is struggling to protect life and health, property, infrastructure and the environment from disasters.

It is generally accepted that prevention is better than cure when it comes to disasters (e.g. Davis, 1984; Chafe, 2007; Ki-moon, 2009), and South Africa's well-developed National

Disaster Management Act (Act 57 of 2002) and Framework have a strong focus on proactive disaster risk reduction. The country is experiencing rapid urbanisation (UN, 2009), which in the African context generally "is driven by natural growth among already marginalised urban populations and in-migration of the poor" (UNISDR, 2009). The main proportion of the urban growth is thus in unplanned and mostly informal urban settlements, where buildings are of low quality and on land often unsuitable for habitation (UNISDR, 2009). Although South African local government has the responsibility to reduce risk in such urban environments, the task is difficult at best and overwhelming at worst.

Imizamo Yethu, a township in Hout Bay in the Western Cape, illustrates well the complexity and struggle in relation to disaster risk that is the reality in many parts of contemporary South Africa. The settlement was originally designed to accommodate around 3000 people, but now, 20 years later, the exact number of occupants is unknown, ranging from 16 000–36 000 inhabitants. Although Imizamo Yethu has been earmarked for upgrade for over a decade, no substantial improvements have been implemented, while the community faces a wide range of hazards.

The purpose of this study is to improve the understanding of the challenges for disaster risk reduction, within vulnerable South African urban communities, in relation to reoccurring rapid and slow onset disasters, as well as everyday emergencies. To meet that purpose, the study focuses on the case of Imizamo Yethu and intends to answer the following research question:

What challenges to disaster risk reduction are expressed by stakeholders in Imizamo Yethu?

## Methodology and methods

There may be several research methodologies appropriate for answering the research question. However, Grounded Theory stands out as particularly suitable considering the pragmatic purpose of the study (Wuest, 1995; Hammersley, 2004), as well as the potential complexity of the challenges involved (Glaser, 1992; Wells, 1995). Grounded Theory research begins with an inductive approach, involves simultaneous data collection and analysis, and gives scientific rigour to qualitative research through flexible guidelines (Charmaz, 2006).

This application of Grounded Theory involves qualitative interviews with stakeholders in disaster risk reduction in Imizamo Yethu, i.e. the local chairman of the South Africa National Civic Organization (SANCO, interviewed together with the vice-chairman), the community development worker, a community guide, the health centre of Imizamo Yethu, the fire department of Hout Bay (group interview with a captain and his platoon), the NGO Envirochild, City of Cape Town Disaster Risk Management Centre (group interview with seven managers and experts) and one of the town planners of the city of Cape Town.

Data collection and analysis are interrelated processes in Grounded Theory (Corbin & Strauss, 1990), meaning that the data are analysed continuously during the data collection. For every interview, the data are analysed by coding segments, identifying concepts by merging codes in and between interviews, and by grouping concepts that include the same phenomenon in categories that are the building blocks of new theory (Charmaz, 2006). In this case, numerous

codes are merged into 25 concepts, which in turn form five categories that are the building blocks of the constructed grounded theory concerning challenges for disaster risk reduction. For example, many segments of text from the interviews are related to the concept *Immigration and migration from the Eastern Cape*, which together with the concepts *Unregulated rapid settlement growth*, *Population dynamics* and *Over crowding*, form the category *Community growth*. The analysis is in other words based on constant comparison of data, concepts and categories (Corbin & Strauss, 1990).

The final result consists of five categories that together form a grounded theory of the main challenges for disaster risk reduction in Imizamo Yethu. The resulting theory is referred to as grounded in the empirical realities of the people involved, which is crucial in order to link theory and practice, and to facilitate the adoption of the research results into urban disaster risk reduction in Imizamo Yethu and beyond.

## Analysing and discussing the empirical findings

### *Constructing empirically grounded categories*

To be able to present the analysis and discussion of the empirical findings in a structured way, this section is subdivided according to the resulting five categories. It is important to note that these categories are the end result of the actual Grounded Theory process, and not any preconceived notions.

*Community growth*

The rapid and uncontrolled community growth of Imizamo Yethu has resulted in very dense living conditions on land largely unsuitable for habitation, posing multiple risks for the residents. All the participants of the study agree that the overcrowding of the settlement causes a wide range of problems and risks. The community growth causes an increasing strain on the already scarce resources in the township, which is pointed out by one participant to be the main reason for the problems. A majority of the residents in Imizamo Yethu have their roots in the Eastern Cape and it is widely discussed by the participants how people migrate to Cape Town for better employment opportunities, education and service delivery, as well as for medical reasons, e.g. treatment of TB or pregnancy. The on-going migration between the Eastern and Western Cape adds to the already complex and multidimensional risk context. Considering that the site was designed for approximately 3000 residents, and today it is assumed to be home to 16 000 – 36 000 people, community growth is unquestionably a major challenge in terms of risk reduction.

The participants' opinions are conflicting whether the community and/or the city have control over the erection of new dwellings or not. This so called influx control is discussed by most of the participants, and it is widely mentioned that influx control and forced removal of people is a sensitive subject due to South Africa's history of pass laws and forced removal during the Apartheid regime. However, risk and the impacts of disasters multiply when population growth is not met with proper land-use planning and appropriate institutional and legislative arrangements (Marjanovic & Nimpuno, 2003), and urbanisation is one of the major factors

that influence the risk level of a nation (Wisner *et al.*, 2004; Coppola, 2007). Imizamo Yethu illustrates well how an unplanned settlement results not only in poor living conditions, but also continues to marginalise its residents.

### *Lack of land*

There is a consensus among all participants that a lack of land, relative to the number of residents, is a major challenge, both in term of risk reduction and in terms of the proposed upgrade. It is also discussed how the large fire in 2004 changed the settlement dramatically, as it is estimated that approximately 5000 people were left homeless after the event. The city could not find alternative sites for the affected people and the frustration grew. They felt they were being ignored by the city, by not getting land or services and as a result the affected people relocated up the hill. This area is called Dontseyake, meaning un-ruled area, and is characterised by high population density and limited accessibility. The participants discuss the challenges associated with the lack of proper infrastructure, the accessibility within the community, and how the lack of services combined with a high influx pose multiple risks. It is pointed out that it is not only the lack of roads, difficult terrain and the mountain slope that are challenges, e.g. for service delivery, but also the fact that roads become narrowed down or blocked due to the construction of new dwellings and so called 'spaghetti wires' (makeshift electric wires in informal settlements). Even though the fire department is located next to the settlement, it can take up to 30 minutes before the fire fighters can arrive at the top of the settlement, or as one of the fire fighters put it: 'it doesn't matter how much we practise, access is still the biggest challenge'.

Risk accumulation can often be traced to unplanned housing, housing densification, unregulated livelihood activities and a disregard of disaster risk accumulation in urban planning (Pelling, 2007). All these factors can be seen as contributing to the situation in Imizamo Yethu, and although the need for an upgrade has been recognised for a significant time, the lack of new land strongly limits the possibilities to address the situation. The stakeholders all acknowledge the need for development but also add that it would probably require people to move, which most likely would create a conflict situation. How the situation in Imizamo Yethu came to be, and who was to blame, could be discussed ad nauseam. However, the situation clearly shows the importance of land-use planning as a measure to reduce risk.

### *Politics*

The upgrade of Imizamo Yethu has been an on-going debate for over a decade. This programme is supposed to be the government stakeholder's comprehensive solution to the Imizamo Yethu problem. However, in reality, the process exemplifies the stagnation of the entire situation. The participants mention that conflicting agendas, bureaucracy, disagreements and lack of accountability have meant little has been accomplished. The community residents and leadership are divided, as some residents want all the land to be used for housing, while others want mixed-use development to include community facilities such as schools, community centres and a taxi rank. On a provincial level, conflict between the two biggest political parties (DA and ANC) has contributed to a hold up in the process. Additionally, there are objections

from neighbouring communities and conservation groups. Several participants point out that the development of the community has unfortunately advanced towards more hazardous areas instead of the opposite.

It should not be forgotten that Imizamo Yethu is filled with people from a range of different cultural backgrounds, and does not necessarily fit the definition of a community. This has according to the participants proven to be a major challenge for accomplishing unity in the township. The participants offer different perspectives on how the upgrading process is held up. Although they voice different opinions of what would be best for the community, they agree that the conflicting agendas, both between the community residents and with the neighbours, pose a major challenge. As previously stated, discussing the reasons why and how Imizamo Yethu came to be what it is today could go on ad infinitum. What was initially planned to be an opportunity for the original residents turned instead into a highly hazardous living situation. Even though root causes of the risks in Imizamo Yethu seem to be understood, the treatment of them is highly polemical. This is no surprise, as it has been suggested that such activities are always political (Wisner *et al.*, 2004:61).

*Institutional capacity*

The definition of disaster and the view on the ongoing disaster risk management in Imizamo Yethu differ between participants, but they all agree that the lack of human and financial resources to implement the objectives of the Act, as well as to address the daily needs of the residents, is a major challenge to disaster risk reduction. The National Disaster Management Act states that an event is a disaster if it 'is of a magnitude that exceeds the ability of those affected by the disaster to cope with its effects using only their own resources'. However, the participants disagree on whether or not certain events are disasters or not. Regardless of this, each event is a setback in the sense that it keeps people in a vulnerable state until the next event strikes. These recurrent setbacks, in combination with the lack of resources to provide housing and services, are viewed by the participants as causing a stagnant situation with limited chances to develop the community. The participants from the community state that city officials are often unable to help out and deliver what the residents think they are entitled to. Whether this is due to lack of knowledge, resources or will, it could be argued that inefficient city offices pose as much of a challenge to risk reduction in Imizamo Yethu as any structural challenges.

The National Disaster Management Act declares that disaster mitigation is a 'multi-sectoral, multi-disciplinary process of planning and implementation'. Unless all involved stakeholders are working towards the same goal, within an organised coordinated framework, and are aware of their roles and responsibilities, improvements will be difficult to achieve. Vermaak and Van Niekerk (2004) point out that one of the main challenges for disaster risk reduction is to find 'effective means, a comprehensive and multi-sectoral approach, to reduce risk through professional disciplines as well as public participation' and they conclude that this requires both political and public commitment as well as an understanding on local community level. Advanced legislation shows a will to achieve a certain standard but it needs to be followed with education and skills training to achieve the set goals and to fully implement the aims and goals.

The Act is a very advanced piece of legislation and, as one of the participants points out, it could be described as a 'westernised' Act. South Africa's context is very complex in the sense that it comprises issues associated with so-called 'first world' countries, as well as 'third world' countries. Implementing such a ´westernised Act´ in the less developed parts of South Africa may be very difficult (Martin *et al.*, 2002).

*Community risk behaviour*

Human behaviour is mentioned by many participants as playing an essential part in the progression of risk in the community. The participants share different theories as to why people put themselves in hazardous positions, ranging from desperation to strategic motivations caused by lack of education, lack of consideration or lack of options. One of the challenges all stakeholders express is the lack of understanding among the community residents that there is no space left for housing – as soon as one area opens up, e.g. to provide services, it get filled with new dwellings instantly. The problems with the lack of sanitation facilities and people's habit of using the hillside as a public toilet are also discussed. Additionally, fires are mentioned as a massive problem in Imizamo Yethu, and it is argued that the consequences of fires would be less devastating if dwellings were built a certain distance apart and/or not on top of fire hydrants, and if roads were kept clear. Another considerable issue that is mentioned is the number of informal dwellings constructed on top of the pipe leading from the water reservoir of Hout Bay, located on the top of the settlement. These constructions make it impossible to monitor and do repairs on the pipe and have also become a political dispute in view of the court order to remove the dwellings.

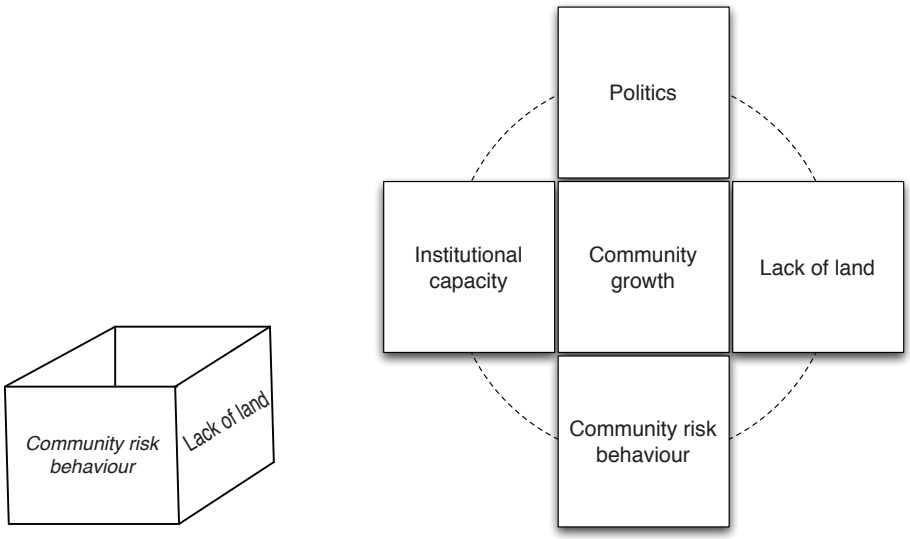
Basic infrastructure and land use planning are crucial to address risks, but risk reduction efforts also need to have an educational focus so that people are able to take responsibility for their own situation. However, at this point, the lack of space and resources limits the residents' opportunities to improve their situation. It should also be noted that if a community is struggling with day-to-day challenges, disaster risks are unlikely to be considered important and long-term perspectives are not necessarily a part of their decision-making process. Risks that are considered acceptable are not necessarily reflecting the actual risk level, but the subjective determination (Coburn *et al.*, 1994). Disaster risk reduction requires ownership from not only the officials but also people living within the community. If people feel that they have little control over the situation, it often results in undermining their attempts to reduce the risks impacting on their day-to-day life (Nomdo & Coetzee, 2002). Some risk behaviour by the community can also be viewed as vain attempts to address the challenges themselves, where they consider the authorities have not delivered. Without alternative solutions being given to people, or the tools to improve the situation in a way that complies with the rules of a society, people are forced to sit and wait for the different spheres of government to address the problems.

## *A grounded theory of challenges for urban disaster risk reduction in South Africa*

The challenges to disaster risk reduction in Imizamo Yethu are complex and related to each other in such a way that it is futile to address one in isolation. In grasping this complexity, it

may be helpful to view each of the five key challenges as sides of an open box (*Figure 1*). At the bottom of the box is *Community growth*, which is enclosed by the other four challenges. As the community grows, it hits wall after wall in attempts to address its situation and eventually becomes boxed in and unable to reduce its risks. In addition to *Community growth*, which is connected to all the others, *Politics* is closely connected to *Institutional capacity* and *Lack of land*, which in turn are connected to *Community risk behaviour* (*Figure 1*). As the population pours in, each side of the box must be concurrently addressed in order for the box to hold as the pressure increases**.**

***Figure 1:The box analogy as an overview of the challenges for disaster risk reduction in Imizamo Yethu.***




***Source: Compiled by Author***

## Conclusion

So, what challenges to disaster risk reduction are expressed by stakeholders in Imizamo Yethu? In many ways Imizamo Yethu illustrates how disaster risk is a complex mix of environmental processes and human actions. The main challenges for disaster risk reduction expressed by the involved stakeholders are:

*Community growth* – the uncontrolled growth and the overcrowding of the community are viewed as a major challenge as they cause multiple risks for the residents and increase their vulnerabilities. Such growth is also seen as a challenge in terms of relocating people due to the history of South Africa and its previous forced removals.

*Lack of land* – the overcrowding of the area results in use of land largely unsuitable for habitation and the limited space combined with a rapid growth results in an unplanned settlement. The lack of land is seen as a challenge as it limits the ability to address the identified hazards through prevention and mitigation measures, and also the ability to respond to rapid onset disasters.

*Politics* – the upgrade process, initiated to address the problems in the settlement, is seen as another considerable challenge due to conflicting development agendas, disagreements within the settlement, objections from outside stakeholders, and political disputes.

*Institutional capacity* – the lack of institutional capacity to provide housing and service deliveries is considered a major challenge. The definition of disaster and the view on ongoing disaster risk reduction initiatives in Imizamo Yethu differ between stakeholders, but the common point is the lack of resources to implement the objectives of the Act, as well as the lack of human and financial resources to address the daily needs of the residents.

*Community risk behaviour* – understanding and ownership of risk among the community residents is considered another challenge. In addition to battling over a lack of land, Imizamo Yethu also struggles with the fact that human behaviour puts people and the environment at risk daily.

These five categories, the sides of the box presented in the previous section, depend on and determine each other in such a way that it is futile to attempt to deal with one in isolation. At the very bottom of the box is the rapid inflow of people into a fixed and static space, like water flowing in. Eventually the box will be full and the pressure will break the box. Addressing this apocalyptic scenario, which may not be far away for Imizamo Yethu, requires massive development initiatives to be implemented. Not only in and around the township itself, but also in the Eastern Cape to reduce the socio-economic gravitation towards the Western Cape that drives people to migrate. However, the already high population density must also be addressed, either by allocating more land, build multi-story buildings or presenting an alternative location that is attractive enough for inhabitants to choose to move. The political deadlock around the future of Imizamo Yethu must in other words be solved, which obviously is easier said than done, especially as large public investments are necessary to have capacity to meet the needs for housing and service deliveries in the township. Finally, large-scale public awareness raising campaigns are needed to address various and widespread behaviours and activities that increase risk in the community.

South Africa may have one of the most sophisticated policy frameworks for disaster risk reduction in the world, but its implementation is difficult in a situation where the identified challenges require such fundamental developmental changes. Hence, this study shows yet again that disaster risk reduction is a development problem and must be an integrated part in development planning. Although this study focuses on the challenges for disaster risk reduction in Imizamo Yethu, it is likely that the complex challenges facing this particular township are common to most townships in and around Cape Town and other rapidly growing large urban centres in South Africa. If so, the result of the study gives further backing to already established ideas that all administrative levels and sectors of government in South Africa must start pulling in the same direction. A direction towards not only economic growth, but towards sustainable development in which the government must dare to formulate long-term strategies for how to facilitate viable livelihoods and attractive living conditions in other locations than the large urban South African metropoles.

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# *Field note from Pakistan floods: Preventing future flood disasters*

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ABSTRACT

Unusually heavy monsoon rains in Northern Pakistan have caused disproportionate levels of extreme flooding and unprecedented flood losses across the entire Indus River basin. Extensive land use changes and environmental degradation in the uplands and lowlands of the river basin together with the construction of a "built environment" out of balance with the functioning, capacities, scale and limits of the local ecosystems have exposed millions of people to an increased risk of extreme flooding.

The catastrophic nature of the August flooding provides a unique opportunity to fundamentally change Pakistan's current socio-economic development path by incorporating disaster risk reduction and climate change measures into the post-disaster recovery process to rebuild a safer, more resilient nation.

In January 2005 one hundred and sixty-eight nations adopted the Hyogo Framework for Action (HFA) 2005-2015 to bring about a "substantial reduction in disaster losses" by 2015. Despite this global initiative a series of major disasters, including the recent flooding in Pakistan, all indicate that we are not on track to achieve the substantial reduction of disaster losses. The following fieldnote considers what can be done to accelerate progress towards implementation of the Hyogo Framework, drawing on insights and lessons learnt from the August flooding to understand how Pakistan and neighbouring countries can prevent a repeat of such catastrophic disasters in future years.

KEYWORDS

Pakistan; floods; August 2010; Hyogo Framework for Action (HFA); prevention; disaster risk reduction

## Introduction

In January 2005 one hundred and sixty-eight nations, committed to bringing about a "substantial reduction in disaster losses by 2015" through the implementation of the *Hyogo Framework for Action* (HFA). In August 2010, at the midway stage of the HFA, the world has just witnessed what has been described as "the greatest humanitarian disaster in recent history" (Tweedie, 2010). The UN estimates 1,600 people died in the Pakistan floods with a staggering 20 million people affected – losing their homes, livelihoods and assets; the estimated cost of the flood damage is as high as $43 billion and rising – representing a significant proportion of Pakistan's GDP and potentially threatening the country's political stability (Georgy, 2010; Hyder, 2010). The unprecedented scale of the Pakistan flooding in the wake of other recent

major disasters including Haiti, China and Myanmar, and other smaller less dramatic events across Asia, Africa and the Americas, all serve to indicate the world's governments are not on track to achieve a substantial reduction in disaster losses by 2015.

So what can be done to accelerate progress towards implementation of the Hyogo Framework and importantly what lessons can we draw from the Pakistan flooding to ensure the nation rebuilds itself in a way that can prevent a repetition of such catastrophic disasters in future years? The following fieldnote discusses why unusually heavy monsoon rains in northern Pakistan had such a devastating impact across the entire Indus River basin. It explores the relationship between people, the "natural environment" and the "built environment" and concludes with recommendations for the post-disaster recovery process that incorporate disaster risk reduction and climate change measures to achieve the rebuilding of a safer, more resilient nation.

## Unusually heavy rains leading to unprecedented flooding

Seasonal flooding in Pakistan due to the annual monsoon rains is a regular and in many respects welcomed occurrence, albeit usually affecting a geographically limited area. By comparison the late July - August 2010 monsoon rains were unusually heavy in northern Pakistan; the region formally known as the Northwest Frontier Province recorded July rainfall totals of 180% above normal, with reports of 24-hour totals in excess of 300 mm on 29 July (Sayah, 2010; Slingo, 2010; Vastag, 2011; Pakmet, 2010). The heavy rains are thought to have been caused by a combination of strong winds (jet stream) high in the atmosphere over northern Eurasia serving to concentrate the monsoon over Northern Pakistan, together with "*La Nina*"-induced high sea surface temperatures and large amounts of moist air over the Indian Ocean. Whilst it is difficult to attribute specific weather events to human-induced global warming there is strong evidence from the Intergovernmental Panel on Climate Change and others that we are in a period of changing weather patterns characterised by an increase in the severity of extreme weather events, attributed in part to anthropogenic climate change (Cruz *et al.*, 2007:488; Gray, 2010; Gronewold & Climatewire, 2010; Walker Institute, 2011). It is expected that in future years heavy rainfalls as experienced in northern Pakistan will become more frequent across the region and other parts of the world.

Notwithstanding the intensity of the August 2010 rainfall, it is apparent that the unusually heavy rains in the north of the country caused disproportionate levels of extreme flooding throughout the Indus River basin, leading to unprecedented losses across virtually every province in the country. To understand why these rains had such a catastrophic impact it is necessary to consider how the land use in the river basin has changed in recent times.

## Land use changes in the Indus River basin

The Indus River basin has long been considered one of the "cradles of civilisation" with evidence of human settlements going back over five millennia. Water management had been a key to the emergence of these early cities. Modern irrigation was introduced by the British around the 1850's with the upgrading and extending of a network of irrigation and drainage canals (Hasan, 2010; Guisepi, 2007). Since that period, there have been substantial land use changes in the

Indus valley and adjacent uplands to accommodate Pakistan's socio-economic development and the needs of a growing population (estimated population growth 2.2% PA (World Bank, 2010:63). Extensive deforestation of natural forests in the upland catchment area for timber and fuel wood reduces the water-retention capacity of the forest eco-systems. This can increase surface water runoff and soil erosion, increasing the quantity, velocity and sediment load of the headwaters entering the river system. In turn this causes repeated landslides, damages riverine infrastructure and results in additional siltation of the downstream water channels.

In the lower reaches of the river basin there has been widespread clearing of shrub-lands and deforestation on the floodplains as well as extensive drainage of fertile wetlands to make way for expanding human settlements and agricultural cultivation. These land use changes and accompanying degradation of the natural environment continue along the entire river system culminating in the destruction of mangrove forests and fisheries of the Indus delta. Further research would be beneficial to better understand the political economy of land use changes amongst different user groups.

## Inappropriate built environment

Little effort has gone into ensuring that the physical infrastructure is designed and constructed in balance with the capacity, scale and limits of the local ecosystems. The rapid expansion of formal and informal human settlements together with the construction of hydroelectric dams, barrages and an extensive system of roads, railways, bridges, flood protection embankments and drainage channels all serve to divert or constrain the natural pathways of the Indus and its tributaries, interrupting the natural ebb and flow of the monsoon flood waters.

Lack of sensitivity in the design and location of physical infrastructure in relation to the natural environment interferes with the important "regulating" function that the local eco-systems provide to the river system. A combination of increased inflows from the highlands and reduced water-carrying capacities of the heavily silted river channel, fertile wetlands and flood plains (now densely populated) exposes large numbers of people to increased risk from severe flooding during times of heavy rains. In the short-term, small localised flooding has been reduced and land protected for settlements and cultivation, but in the longer term the river system has little flexibility and redundancy to absorb heavy rainfalls which climate scientists predict will occur with increasing regularity.

The problem is further compounded by claims that much of the infrastructure was substandard in quality and inadequately maintained by government authorities (Gaadi, 2010; Gall, 2010; Lahiri-Dutt, 2010; Witte & Khan, 2010). For example, in the recent flood event retaining walls and embankments failed. Canals and irrigation headworks have not been properly de-silted and drainage channels, culverts and sluice gates are non-existent or else blocked with vegetation and debris.

## The importance of governance

Good governance in the form of a capable, accountable and responsive government working together with civil society and at-risk communities is one of the single most important factors determining progress in reducing disaster risk. Governance is about the way states and people

manage their affairs and is central to the solution to natural hazard risks (ISDR, 2009:97; UNDP, 1992). For example, the relationship between *people*, the *natural* and *built environment* is influenced by social, political and economic systems, and these in turn are mediated and regulated through the "governance" process.

As is often the case during a major disaster, the severity of a crisis can provide a major incentive to reform the system, serving to highlight mutual-dependencies and expose deficiencies in government development and disaster risk management policies and practices not readily apparent during "normal" times. Once the intensity of the monsoon rains became apparent it is possible that lives could have been saved and losses reduced had there been an effective community-based early warning and evacuation system that gave people time to sound the alarm and take evasive action – moving families, livestock and essential belongings to higher land. In terms of managing an effective emergency response, numerous agencies (including the United Nations) have highlighted the slowness and inadequacy of the state's response. There were shortages of basic emergency supplies and reported tensions between military and civilian authorities as to who had control of the emergency response programme.

The creation of the Pakistan *National Disaster Management Authority* following the 2005 Kashmir earthquake resulted in national and provincial-level policies and legislation being put in place in support of a more proactive approach to disaster risk management (Nguyen, 2010; UN, 2010; Aley, 2010). However, there remain significant gaps between government policies and local practices. Reports indicate policies are being weakened by a lack of resources and capacity at the provincial and district level to carry them out, notably good quality leadership, technical competencies and sufficient financial resources to invest in disaster risk reduction.

## Building community ownership and engaging local capacities

On a positive note, Pakistan's citizens and locally-based organisations have been at the forefront of the emergency response with local authorities and civil society organisations working together from the outset of the flooding, taking a leading role in the search and rescue operations and providing essential supplies to people in hard-to-reach areas. Experience tells us the most effective way to increase societal levels of disaster preparedness is to enable local people to organise themselves and link them with the national disaster response mechanisms (Alam, 2008:3; ISDR, 2007). The most effective responses are those that build local ownership and strengthen local-level capacities as the first line of defence towards enhanced safety and protection. In a similar vein, affected people must be fully involved in the recovery process to ensure it is effective and sustainable in the longer term.

For many poor people dependent on agricultural-based livelihoods the recovery will be a long and difficult process; it is likely they have lost at least one year's crop production together with livelihoods and households assets. Food production levels may be significantly lowered for the next few years because of the combined effect of soil erosion, destroyed infrastructure and contaminated soils. Once immediate needs such as shelter, food, healthcare, water and sanitation have been met an extended period of support will be required to restore the necessary inputs and ensure food security from sowing through to harvest. Livestock too will have to be

fed and looked after. The related problem of re-establishing land tenure is also likely to be a complex and difficult process.

Effective recovery will depend significantly on how quickly livelihoods and supporting infrastructure are restored. Fortunately the Pakistan authorities have considerable experience of organising and mobilising large-scale social protection and food security schemes through cash or food-for-work programmes. Such people-intensive approaches could be well suited to major infrastructure and environmental restoration work. For example, poor people whose livelihoods are dependent on natural resources have substantial local environmental knowledge and are well positioned to support national efforts to restore and enhance the functioning of the river basin ecosystems.

## Addressing underlying drivers of risk

Notwithstanding the value of utilising local institutions and indigenous knowledge and capabilities, addressing the underlying political, social and macro-economic processes that put people at risk is beyond the remit and capacities of communities and local authorities. It will require a coordinated approach that takes into account the dynamic relationship between people, the natural and the built environments across the upland and lowland reaches of the river basin. This will necessitate a high degree of collaboration across a multitude of organisations at local, national, regional and international level involving the development of a comprehensive Indus River basin management strategy for Pakistan and neighbouring countries. The challenge lies in incentivising, designing and implementing a national recovery process which brings together different and sometimes conflicting interest groups, takes local context as the starting point, strengthens the capabilities of local people, and meets basic "*unmet needs*" whilst addressing pre-existing vulnerabilities. It will require the right technical advice, planning and management support; involve the connecting of local indigenous and external "scientific" knowledge; and importantly, building a sense of ownership, trust and mutuality between different actors to forge effective partnerships.

Executing a comprehensive recovery programme will undoubtedly require substantial international and national financial commitment to implement "at scale" bearing in mind that 20 million people were affected. Within the context of sustainable development, harmonised action on disaster risk reduction, climate mitigation and climate adaptation as well as livelihood resilience offer a possible way forward. For example, the restoration and maintaining of upland and lowland forests can reduce greenhouse gas emissions, support the restoration of the vital "regulating" function of forest ecosystems (essential to increase water retention and absorption capacities), whilst also serving as an essential *adaptation* strategy for local people whose livelihoods are dependent on natural resources against a future of climate change. The UN's *Reducing Emissions from Deforestation and Forest Degradation* (REDD) mechanism in developing countries potentially offers Pakistan a source of global funds for activities that could contribute towards both climate and disaster resilience (APPC, 2010). In using such funds the Pakistan government would have to consider the concepts of justice and equity to ensure the benefits of such programmes are widely shared amongst all stakeholders, particularly the most vulnerable groups.

Perhaps the greatest need now is for a vision and belief by the people and government of Pakistan that it is possible to use the post-disaster recovery to rebuild a safer and more resilient society. In this respect perceptions are important because people's level of interest and ability to build safer communities is based on their knowledge, attitudes and experiences. Clearly the experience of the recent floods will have changed how people perceive disaster risk and in so doing open minds as to how to rebuild less disaster-prone communities and nations.

## Conclusions

Pakistan's current socio-economic development path has created disaster risk by increasing people's exposure and vulnerability to extreme flooding during heavy monsoon rains. To prevent future catastrophic floods a fundamental change in the country's development path is needed that decouples exposure and vulnerability from economic growth and is more in harmony with the functioning, capacities and thresholds of the natural environment. With the benefit of hindsight it is apparent the catastrophic flooding in Pakistan was far from "natural" or an "act of God" but lay primarily in the hands of the Pakistan government who have the authority to manage its affairs in the economic, political and social spheres.

In this respect adopting a risk management approach in the post-disaster recovery offers a unique opportunity to build a safer more resilient society that provides for the basic protection and wellbeing of its citizens; in the short term the increased sense of awareness and interest in disaster risk reduction can provide the impetus to raise levels of disaster preparedness through developing forecasting, and early warning and evacuation systems. In the longer term, the greatest opportunities to prevent future disasters lie in harmonising actions on disaster risk reduction, climate change (mitigation and adaptation) and livelihood resilience to address the "underlying drivers" that configure risk in the first place.

To achieve this ideal the Pakistan government should lead in efforts to:

- Restore, conserve and enhance the capacities of the Indus River basin ecosystems and their services in both rural and urban areas (including linkages with relevant climate change actions).
- Protect and strengthen the resilience of rural livelihoods that depend on agriculture and other natural resources, including equitable access to common resources, productive assets (e.g. land, livestock, agricultural / business tools, financial services) and markets.
- Regulate land use and reconstruct a physical *built environment* that is sensitive to local (multi-hazard) risk conditions and in balance with the capacity, scale, thresholds and functioning of the natural environment and local eco-systems.
- Adopt a *governance* approach based on a capable, accountable and responsive government empowered by the decentralisation of authority and resources from central government and supportive of local initiatives in partnership with private sector and civil society organisations.
- Shift individual and societal perceptions, attitudes and behaviour towards a culture of

safety and resilience through increased awareness and understanding of the interdependence of social, economic and ecological systems.

The main argument against adopting such an approach appears to be that it would slow down short-term economic growth (estimated 4.1 % - 2009) considered essential to reduce poverty for a growing and already impoverished population, thereby increasing the risk of political instability. What the recent flooding has shown is that high levels of economic growth are ultimately not sustainable unless disaster risk reduction measures are incorporated into the development processes. In the words of Mahatma Gandhi (Phypers, 2009) – *"speed is irrelevant if you are going in the wrong direction".*

The August floods have inflicted a major setback to Pakistan's development. As the global climate changes, and Asian populations and economies continue to grow, such floods can and will happen again in Pakistan and neighbouring countries unless there is greater political commitment to tackle head-on the underlying drivers of disaster risk that are exposing millions of people to the type of suffering we are now witnessing. The extreme flooding in Pakistan has graphically illustrated the need to uphold one of the fundamental principles underlying the functioning of the Indus River basin and indeed the planet's biosphere, i.e. that social, economic and ecological systems on which millions of people depend are intrinsically interdependent - the future of one depends on the wellbeing of the other.

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# JÀMBÁ

LECTURES

# *Corruption: The hidden perpetrator of under-development and vulnerability to natural hazards and disasters*

**James Lewis**
Datum International

**The Pat Reid Lecture 2010**
African Centre for Disaster Studies
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September 2010

*"Formerly Leverhulme Senior Research Fellow and co-founder of the Disaster Research Unit, University of Bradford (1973-77), James Lewis relocated to the University of Bath and became Visiting Fellow at the Centre for Development Studies. Datum International was created in1980 for consultancy to the United Nations (UNCTAD, UNEP, UNESCO, UN Habitat & WHO), the Commonwealth Secretariat/Commonwealth Fund for Technical Cooperation, and the European Commission. James Lewis is author of Development in Disaster-prone Places: Studies of Vulnerability (1999: IT/ Practical Action, London) and of numerous chapters and papers on vulnerability to natural hazards, corruption, island vulnerability, climate change, and interconnections with socio-economic capacity, development and disaster risk reduction. As a commissioned author to Transparency International Berlin, he has contributed to Global Corruption Reports of 2005, Corruption in Construction, and 2011, Corruption and Climate Change. Trained and practiced as an architect and member of the Royal Institute of British Architects (RIBA), James Lewis has been involved in applications, implications, management and inspection of construction, destruction and reconstruction in Algeria, Bangladesh, the Caribbean, China (Hong Kong), the South Pacific, the United Kingdom and the USA. www.datum-international.eu "*

May I first of all say that it is my great privilege to be at North-West University Potchefstroom, and with the African Centre for Disaster Studies who I thank most sincerely for their invitation to deliver this Pat Reid Lecture 2010.

I have known of South Africa since my boyhood but, though my work has taken me to other parts of the Continent, this is the first time I have had the opportunity to visit.

My lecture is based upon a fully referenced paper but it is not an academic paper that contains evidence from which it draws conclusions. It's in the nature of corruption that there is little evidence and there are no text-books, no journals devoted to its practise and no guidelines. Instead there is observation, financial calculation, investigative journalism, and an increasing number of legal investigations and trials of its perpetrators to draw upon. When evidence is in short supply, therefore, it becomes necessary to rely upon inquiring minds.

Corruption is the abuse of entrusted power for private gain. It hurts everyone whose life, livelihood or happiness depends on the integrity of people in a position of authority (Transparency International, 2010).

Corruption, in some degree pervades all countries, so I want to say at the outset, that my being in South Africa is not the reason for the selection of my topic. That South Africa may have its problems (Smith, 2010) does not make it internationally a special case. My purpose is to speak generally about the link that indubitably there is between corruption, underdevelopment and disasters, and to describe some of the longer-term consequences of corrupt practises.

Transparency International in Berlin, with more than 90 locally established national chapters, annually tabulates a scale of corruption as internally perceived in 180 counties and known as the Corruption Perceptions Index (cf. Transparency International, 2009). Countries high on the scale are perceived to have less corruption than those lower on the scale. The offering of a bribe is regarded as being as wrong as is the taking of bribes.

I appreciate that the topic of corruption is not an attractive one. As a conversation stopper amongst the "chattering classes" it is usually passed off as "hasn't there always been corruption?" or, "isn't that the usual way of doing things *there*?" or, "isn't that the oil that makes society work *there*?" - always with the idea that corruption is something that happens elsewhere than in one's own country. We all prefer not to discuss those things with which we feel uncomfortable but, I have come to realise, corruption is so significant that it can no longer be shrugged off and that, moreover, the legacies of corrupt practises are consequences that must be exposed and understood for the damage they do to all of us - and in so much of what we do.

Having faced the tentacles of corruption in some of my earlier working environments, I have researched and written about corruption for a number of years (cf. Lewis, 2008a). I began by exploring corruption in construction and how it can be a cause of the collapse of buildings in earthquakes (Lewis, 2005). Not only does corrupt practice pervert the execution of construction but, by the siphoning of finance at its source, it denies the opportunity to build or, at most, reduces the amount and the quality, and increases the cost, of new building and infrastructure.

Construction bad practice, a result of attempted reductions in overheads exacerbated by the payment of dues and backhanders, may not be revealed except by an earthquake many years after builders and original owners have moved on. And, as the maxim goes, earthquakes don't kill anyone but collapsing buildings do. Not only are people killed and injured in very large numbers but, in one form or another, there is the cost to society of that loss and of the cost of reconstruction. But although the construction industry world-wide is recognised as one of the most corrupt, corruption pervades more than that one sector.

Perhaps as an indication of corruption now being taken more seriously, investigations into corruption have increased in recent years. As well as those undertaken internationally by Transparency International, there are investigations by the World Bank, the Organisation for Economic Co-operation and Development (OECD) and by private consultancies, into the economic effects of corruption. Work on corruption in some African countries is being

undertaken in Construction Management at the Nelson Mandela Metropolitan University in Port Elizabeth (Shakantu, 2003).

The link between corruption and disasters, however, is more pervasively invidious, even, than its effect in earthquake damage. The audacity of corruption and its massive impact, combine in their enormity to the extent that, in some of the poorest countries, it is difficult not to conclude that corruption should be investigated as a significant cause of regional and sometimes even of national poverty.

It is not so much the hierarchical greed with which corruption is riddled, nor even its spread, but its scale and the consequences of that scale in relation to under-development, vulnerability and disasters that I have become concerned about.

The few examples that follow are in alphabetical order of country, so a general reference to Africa has to come first:

**Africa**

In some African countries and before it could be spent on infrastructure and general construction, millions of dollars of international aid have been sent to private external bank accounts, often those in the countries of the origin of the aid. To quote an American source: "...we have $50,100 billion of aid flowing into poor countries, and $500,800 billion of dirty money flowing out. In other words, for every dollar Western governments have been handing out across the top of the table, crooked Western banks, businesses and middlemen of various descriptions have been taking back up to ten dollars of illicit proceeds under the table" (Baker *et al.*, 2008).

**China**

In China, the government has more than 1,200 laws, rules and directives against corruption but implementation is ineffective. With only a 3 percent likelihood of a corrupt official being sent to jail, corruption is a low-risk high-return activity. Even low-level officials have the opportunity to amass an illicit fortune of tens of millions of yuan.

In 2007, for example, the year before the Richter 7.9 Sichuan earthquake, the CCP secretary in Janwei county of Sichuan province was reported as having acquired 34 million yuan (US$ 5 million / ZAR 36 million). An anti-corruption chief of another province collected bribes worth more than 30 million yuan (US$ 4.4 million / ZAR 32 million). Despite the laws, rules and directives against it, corruption in China is concentrated in those sectors with extensive state involvement, such as infrastructure projects and government procurement (Pei, 2007).

Strong public allegations were made after the Sichuan earthquake, when so many schools were destroyed, some buildings collapsing adjacent to others that did not. Seven thousand school classrooms were reported as having been destroyed. The inward total collapse of Juyuan Middle School itself caused the deaths of 900 children, triggering vociferous local protests: "The local officials get money from above and then they take it for themselves". The school has become "a bleak symbol of the deadly mix of natural destructive power and slipshod building...". The Chinese government have instituted an inquiry into why so many schools collapsed but the results have not yet been made accessible.

The costs of corruption in China have been estimated as 10 per cent of spending during a ten year period ending in 2005. Minxin Pei, a Chinese-American writer has claimed that: "To estimate roughly the direct costs of corruption, we can suppose that 10 per cent of government spending, contracts, and transactions is used as kickbacks and bribes or is simply stolen" (cf. Pei, 2007).

"In the heart of the disaster zone", the Bechuan county Liu Han Hope Elementary school and all of its 483 children survived, its community expressing gratitude for "the effort the company put into building the schools in the first place". Its project manager recalls "his bosses had stressed the importance of safety" but also he recalled "the battles that had been involved... to force the builders to replace substandard cement (ie: concrete) and with officials who had intercepted part of the funding" (Branigan, 2008).

Design and specification to statutory regulations and codes is compromised by depletion of funds for contract payments. Institutionalised depletion of funding for new schools would explain the high incidence of school building failure. On site, Chinese builders are said to often use a series of local subcontractors, a practice that complicates working procedures, obscures shortcomings and substandard substitutions, and by which costs are increased "as each contractor takes his share of the project budget".

In 2009, China was 79th on the Transparency International corruption index of 180 countries.

## Italy

In Italy, according to Alexander (2005), all of the four mafias are based in the area known as the Mezzogiorno, in the south, where incomes and standards of living are generally lower, illiteracy higher, and earthquakes are larger and more numerous than in other parts of the country.

In 1946, following the end of World War 2, large-scale land reforms were instituted much later than in the prosperous north and a fund was initiated by central government to stimulate social and economic development for the South. From these and other development initiatives, billions of dollars for development support from the Italian and United States governments, the World Bank, and the European Commission "disappeared". It has become impossible to separate the mafia from political corruption in this region of Italy.

The extent and enormous scale throughout Italy, of criminal fraud and corruption in the management of public works construction is revealed as intended and premeditated. In 2005 public works infrastructure was declining in spite of declared national policy to achieve the contrary. This comparison of built infrastructure values against government public works expenditure per region, shows southern Italy as having received more public works finance over the years, even though it has less infrastructure, with the most corrupt region spending four times more per infrastructure unit than the least corrupt region. The difference is interpreted as a measure of corruption: the regions that did not get what was paid for are those where politicians and bureaucrats were siphoning-off public money before and during the construction process.

In contexts of this kind, where endemic criminal fraud and embezzlement have become entrenched, almost traditional and in some areas, a tourist attraction, it would be difficult for any relatively small-scale building contractor to behave honestly – if, after paying his backhanders, such a contractor could afford to do so.

Italy is at 63 on the 2009 Transparency International PC Index of 180 countries, equal with Saudi Arabia.

In the **United Kingdom** – you may have been wondering - BAE Systems, formerly British Aerospace, admitted guilt in February 2010 to false accounting and making misleading statements, but not of alleged bribery. They were fined £300 million (ZAR 3,423 million). Payments had been made to intermediaries for an already rich Saudi prince of "secret commissions" totalling £10 million and US$ 9million in connection with a contract worth £43 billion (ZAR 491 billion) for the provision to Saudi Arabia of al-Yamamah fighter planes. It was alleged that similar payments had been made to Tanzania, South Africa, the Czech Republic, Hungary and Romania.

In 2009, before this case came to court, the United Kingdom was at 17 on the Transparency International PC Index, equal with Japan.

Other countries provide other examples: for example, large proportions of post-conflict USA-funded reconstruction budgets in **Iraq** were made to entirely disappear due to corruption (Glanz, 2006); corrupt construction practice was identified in **Turkey** as the reason for poor quality building stock and the collapse in the 1999 earthquakes of "mid-rise apartment blocks constructed of reinforced concrete". State authorities allocated blame solely to a failed system of building control, allegedly to deflect blame away from facilitation and condonation of corrupt practices within their own management systems.

Across earthquake-prone **Japan** in 2005, 78 buildings including 36 hotels were declared unsafe. Falsified earthquake resistance data had been submitted by their architect under pressure from his client during pre-construction stages. Apartment block residents were ordered to leave and hotels were forced to close to await demolition. In some cases, it was reported, steel structural members were one quarter of their required size.

Most of my examples are taken from the construction industry, I think not only because of my own background and experience but because physical examples are more visible. These physical examples can be regarded as epitomising corrupt practise in all sectors of activity.

Contracts and permissions procured by bribery lead to backhanders down the line to such a degree that contractors and subcontractors are obliged to make "substantial economies", for example, by the omission of cement and steel from reinforced concrete. In much the same way, bribery everywhere filters money away that could and should be spent to the benefit of community, society or country, that is, building occupants, people at large, taxpayers and governments.

Payments of sometimes massive bribes are set against declared company profits, the basis upon which tax payments usually are calculated. Money which could have been spent for the benefit of society at large is therefore depleted on such a scale that health care, housing and education, social stability and natural environments are threatened or rendered inadequate and degraded.

In large scale public works, such as in the example from Italy, in which collusion between levels of administration, elected officials, bureaucrats and private contractors is endemic, it has to be obvious that for such abuse of public office for personal gain to persist country-wide, elected officials are necessarily and regularly involved (Golden & Picci, 2005).

According to Golden and Picci (2005) extensive and persistent corruption in any sector can't be regarded as a phenomenon isolated from its broader political context; a political environment of corruption involves a non-benevolent principal rather than being a benign bureaucratic or institutional slippage from a benevolent one.

As in construction, whether localised, national or international, frequent, consistent, informed and independent inspection to ensure accurate execution is required. The same requirement for a higher degree of transparent audit applies to all government and commercial accounting procedures. Inspection needs to be inclusive of contractual authority to facilitate the stopping of work or the cessation of trading, the in-depth examination of suspect work, and the removal of work or materials shown to be inadequate. These are expensive procedures and awareness of their potential implementation will be a first measure towards compliance (Lewis, 2010b).

The very availability of land upon which to build, and permissions or licences to build upon it, is achieved by bribes and backhanders; land more likely to be exposed to flooding or slippage, or to be not firm - in other words, land which would not normally have qualified for permission to build.

The places in which people are obliged to build, or where buildings are built which people then occupy, have as much to do with vulnerability to natural hazards as does building construction and occupation; vulnerability being exacerbated for millions of people for whom there are no options about the places they inhabit, who are obliged to respond to policies and activities in the control of others, or to corrupt external pressures in the interests of others.

Such perpetrations as these, and others like them, are serious contributors to underdevelopment.

## Under-development

We need to look at the concept of under-development so as to explore connections between corruption and development. The following extracts, as relevant today as when they were written, are taken from Henry Bernstein's book of 1976, a reflection of the intensity of application to the subject of that time. He and Celso Furtado, a writer from Brazil and one of his contributors, wrote:

"...the movement for development embodies a value judgement with which few would disagree: the desirability of overcoming malnutrition, poverty and disease which are the most immediate and widespread aspects of human suffering. In positive terms some advocate a commitment to

development that transcends the limiting terms of economic growth to embrace such features of social justice as equality of opportunity, full employment, generally available social services, equitable distribution of income and basic political freedoms. In these terms a broad consencus may be discernable, but such an agreement on desired ends does not necessarily take us far in understanding the realities of the contemporary world." Surely a prescient observation ?

"The result...[has been] almost always to create hybrid (administrative) structures, part tending to behave as a capitalistic system, part perpetuating the features of the previously existing system. The phenomenon of underdevelopment today is precisely a matter of this type of dualistic economy" (Furtado, 1976).

"The practical result of this...is that the occupational structure of the country changes only slowly. The part of the population affected by development remains minor, and there is a very slow decline in the relative importance of the sector whose main activity is production for subsistence. This explains why an economy in which industrial production has already achieved a high degree of diversification...may present a rather pre-capitalistic occupational structure and have a large portion of its population cut off from the benefits of development" (Furtado, 1976).

Underdevelopment then, is the presence in any country of some areas of a consistency less than that recognised as the prevailing norm. The "desirability of overcoming malnutrition, poverty and disease", of "social justice and equality of opportunity" and "equitable distribution of income" may progress nationally but the poor remain poor and "cut off from the benefits of development".

By development funds being siphoned away for personal gain, corruption depletes or impedes the "desirability of overcoming malnutrition, poverty and disease", so that although the norm of national development may rise, underdevelopment persists. "Social justice and equality of opportunity" are denied and defiled, as is "equitable distribution of income". Corruption confirms an inequitability that ensures that the poor remain "cut off from the benefits of development" and consequently, impoverishment and the vulnerability it feeds are exacerbated. Everywhere and in any country, the poor and marginal invariably are the most vulnerable.

Further than this, corruption achieves its own "development", skewed and designed for further personal gain, that is not only not in the public interest but which is contrary to it. Corruption twists the flow of development to its own ends and to its own advantage. The housing development by Italy's prime minister, following the 2009 L'Aquila earthquake, is a topical example (Poirier, 2010).

## Vulnerability

It becomes possible, therefore, to envisage how corruption contributes to vulnerability to natural hazards (Lewis, 2010c). According to Lewis and Kelman (2010) vulnerability results from applied processes by which accrue the susceptibilities of people, infrastructure, communities, and environments. Due to poverty, oppression, and lack of choice, people become obliged, or are forced, to lead their lives in hazard-prone places, or in places that become hazard-prone by

change over time. "Vulnerability is a morphological, cumulative and collective condition. It is not one which results only from each isolated damaging possibility as it becomes apparent or manifest" (Lewis, 1999:31).

Vulnerability is therefore dynamic, not static and it has frequently been demonstrated that some, perhaps the majority, of vulnerabilities result, or evolve from, the actions of others, taken usually in *their* self-interest, either in present time or in the past (cf. Oliver-Smith, 1986; Jeffery, 1982; Hewitt, 2007; Lewis, 2007; Wisner *et al.*, 2004).

Current vulnerabilities have a past in which they may have accrued, or have been caused or exacerbated, by the actions of others - others, who may be remote and beyond the influence or control of people and places rendered vulnerable.

Domestic vulnerabilities, brought about, for example, by a lack of awareness or by inappropriate decision making, can be caused by limitations of livelihood options, by restrictions upon land use, by exploitation of people and resources, or by resulting poverty, lack of control and powerlessness.

Other vulnerabilities are caused by political and economic pressures; partitioning of communities for land acquisition; removal of occupants from traditional resources and, by all of these, the resulting occupation of marginal land inevitably more exposed to environmental change and its hazards. Consequently no longer able to grow food crops or to maintain livestock in sufficient quantities, or effectively access employment, resources or services, communities are made to become disparate, exploited, disadvantaged, marginalised - and increasingly vulnerable.

Marginalisation, as an end product of external control, appropriation, disadvantage and inequality (Dorling, 2010), is a process not unique to rural areas. It exists in urban and periurban areas of formal and informal settlements (Kreimer *et al.*, 2003) where, due to similarly invidious processes, high land and property values are made an excuse for evictions of the many in favour of profit for the few and a cause of vulnerability for destabilised occupants.

Corruption is a serious driver of social and ecological imbalance, and a contributor to vulnerability of industry, commerce, construction, health and agriculture. By aggressive siphoning of funds at source, and by exploitation, acquisition, insider dealing, cartels, price fixing and sub-standard construction (cf. Lewis, 2003; Lewis, 2008a; Lewis, 2008b; Baker *et al.*, 2008; Salih, 2010), access is denied to millions of their share of the benefits of development.

Clearly, vulnerability not only has to do with poverty, but with the causative actions and inactions that create poverty.

## Disasters

Not all failed development, and not all failures of construction, are caused by corruption but, nonetheless, these descriptions of how conditions of vulnerabilities to natural hazards accrue, and of some of the influences that contribute to that process, indicate that disasters don't commence with the drought, the storm, or the flood, the earthquake or the fire, or the food scarcity. The contexts for disasters commence before, sometimes a very long time before,

the occurrence of the event that triggers what we have misleadingly come to call a "*natural* disaster". Corruption is an insidious contributor to that process.

In **Pakistan** this year, for example, millions of people have been affected by torrential monsoon rains and serious fast-flowing floods. In August, 54 entire villages had been washed away entirely, 1,600 people had died, 2 million made homeless (Shah, 2010) and dissent was leading to political instability (Ellick, 2010).

It was reported by Shamsie (2010) that the "timber mafia", "one of the most powerful and ruthless organisations within Pakistan" had long been engaged in illegal logging...worth billions of rupees each year". De-forested regions anywhere are more susceptible to flooding, landslides and soil erosion but, in Pakistan, illegally felled trees, hidden in ravines, were dislodged by floodwaters and, by their impact, destroyed bridges essential for access to flooded areas. Dams and retaining walls intended for flood control possibly were weakened.

Pakistan is 139th on Transparency International's PC Index of 180 countries.

## Climate change

As the consequences of climate change world-wide are making themselves apparent, adaptation, corruption and people's vulnerability are interlinked. Corruption acts as an engine of poverty and vulnerability, creating weaknesses that are exacerbated by changes of climate. Climate extremes will especially affect poorer countries, in many of which endemic corruption accompanies weak governance and adaptation funding is exposed to corrupt depletion. Impoverished communities already suffer a disproportionate share of losses in extreme weather events and are then rendered even more vulnerable to subsequent extremes of climate and corruption.

As massive amounts of money are directed towards adaptation to the effects of climate change, issues of corrupt practise must be raised so that governance can itself adapt to the rigorous and disciplined management that is required to ensure that funds are used in their entirety for the purpose for which they have been raised and to the benefit of us all (Lewis, 2010a).

I hope I have shown something of how the disasters that ensue from the hazards with which we are all afflicted, are not "natural" at all but are brought about by the actions and inactions of mankind. But that we, as humans, have the capacity to perpetrate these and other causes of disasters, is indication that we also have the capacity to prevent or to ameliorate them. If, for example, we undertook to examine in-depth the contexts in which disasters occur, whether they be triggered by epidemic, drought, food insecurity, flood, fire or storm, and inclusive of longer-term as well as recent pasts, we would be better equipped to manage our development, not only to improve current conditions where improvement is required, but to ensure that what we do now will not exacerbate risk for the future.

As I have written in Lewis (1999), it is high time that development itself came to be designed

with people's survival as its objective because, without survival, recovery cannot succeed. To this purpose, one of the first things to be done is to eradicate the pernicious perpetrations of corruption that serve to make matters worse – not better.

*Responding to Professor Frik van Niekerk's (Institutional Director: Research and Innovation: NWU) question "What about South Africa", James Lewis referred to reporting in a current issue of the Mail & Guardian of an investigation into the provision by the South African Police Service of three police stations (cf. Donnelly, 2010).*

*Inanda Police Station had taken six years to build during which costs soared from a budgeted R15.9 million to an actual cost of R42 million; Ezakheni Police Station had been estimated to cost R10.6 million but grew to an actual cost of R23.9 million and construction of Hebron Police Station, begun in June 2006, was continuing (at September 2010) with a budgeted cost of R14.7 million and a current cost of R18.6 million and rising. The average cost of consultants' fees was reported as 18% of a project's budget, "but in some projects it was as high as 25%".*

*Mr Lewis commented that reportedly high consultants' fees would usually imply appropriately rigorous financial management and control. Contracts for buildings under construction normally allow for "contingencies" to cover unexpected costs, especially below ground level involving foundations but perhaps also involving fluctuations in market prices or agreed substitutions of materials or fixtures.*

*Such contingencies, however, would not normally be expected to increase contract costs by more than 10-15 per cent, whereas the cost of two completed police stations had reportedly increased by 264 and 225.5 per cent and that of the then incomplete police station by 126.5 per cent. Close examination was required into the reasons for extended completion times which suggested the possibility of contractor and consultant complicity, perhaps under external pressure.*

*For these three police stations, including one not yet complete at the time of reporting, R84.5 million of public money had been over-spent on three contracts budgeted at a total of R41.2 million - an overall expenditure of more than twice the budgeted cost. Six police stations, or their equivalent, could have been provided for the ultimate actual cost of three.*

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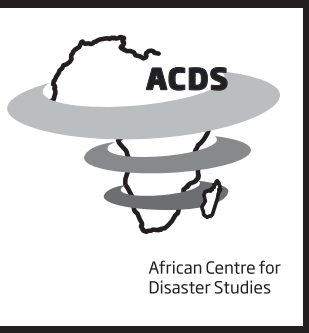


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