

The Vulnerability of Low-income Communities to Flood Hazards, Missionvale, South Africa

P. Q. Siyongwana^{1*}, D. Heijne and A. Tele

Nelson Mandela Metropolitan University (NMMU), Port Elizabeth, South Africa

KEYWORDS Flood Risk. Nature-disaster Management. Low-income Communities. Urban Areas

ABSTRACT This study reports on the vulnerability and coping strategies of low-income communities living in Missionvale in dealing with severe floods in Port Elizabeth. The data for the study was obtained by conducting structured face-to-face interviews with ninety local people consisting of Missionvale residents, government and non-government officials who were selected by a snowball sampling. The fieldwork was complemented by field observations on the relief, drainage and settlement locations. The findings indicate that the vulnerability of the Missionvale community to flooding is high, owing to weak social resources, insufficient institutional support, poorly built houses and limited infrastructure. Insecurity, crime and a lack of disease control have become negative spin-offs in this situation. With climate change likely to exacerbate floods and disasters, it is recommended that the policy directions should effectively respond to severe flooding by improving service delivery, providing structural flood measures in housing and storm-water drainage, supporting the flood victims with the needed resources, strengthening community participation, acknowledging indigenous knowledge on flood management, and providing effective early warning systems.

INTRODUCTION

Since the late 1990s literature globally has increasingly demonstrated the vulnerability of people to the threat of hazards, which are associated with climate change, and notably severe floods (Flood Management Australia 1998; Magadza 2000; IPCC 2001; Lindsell and Practer 2003; Ariyabandu and Wickramasinghe 2005; Douglas et al. 2008; Roberts 2008; Trenberth 2008; Collins 2009; Mwape 2009; Bradshaw 2013; IPCC 2014). The perspectives from which the researchers discussed the issues varied and included the discussions on the major causes of severe flood hazards (Magadza 2000; Trenberth 2008; Douglas et al. 2008), an analysis of the most vulnerable group of people during severe flooding (Flood Management 1998; Ariyabandu and Wickramasinghe 2005; Collins 2009; Bradshaw 2013; IPCC 2014), and debates on the impacts of severe flooding on people's livelihoods and health (Lindsell and Practer 2003; Mwape 2009).

Regarding South Africa, until 1994, the disaster management framework remained ineffective despite the frequent occurrences of floods and high risk of flooding and population vulner-

ability. Prior to 1994, the Civil Protection Act, No.67 of 1977 administered disasters and it can be associated as just an emergency response to natural catastrophes. Hence, the act was regarded as of limited scale to the management of disasters as has been demonstrated by the response during the Laingsburg disaster of January 1981. According to the South African Weather Disaster Information System (2009), the Laingsburg town's catastrophe has been described as South Africa's greatest natural tragedy, which resulted in floods washing away a considerable part of the town (Laingsburg) and 104 individuals also lost their lives. Besides, the floods also caused severe damage to infrastructure. Thus, when the post-apartheid government took over in 1994, it implemented the Disaster Management Act No. 57 of 2002 to deal with natural disasters. The act moved away from a purely emergency response to disasters, as was the case with the Civil Protection Act, No 67 of 1977. It was a multidimensional process, which focused on a variety of stages including inhibiting or reducing the risk of disasters, alleviating the severity of disasters, emergency watchfulness, swift effective responses to disasters, post-disaster recovery, and the formation of national, provincial and municipal disaster controlling centers and disaster hazard management volunteers (Republic of South Africa 2002).

Following the application of the Disaster Management Act, Act No 57, of 2002 in the coun-

^{1*}Address for correspondence:

P.Q. Siyongwana
Nelson Mandela Metropolitan
University, Port Elizabeth
Telephone: 0415042543
E-mail: pakama.siyongwana@nmmu.ac.za

try, there were widespread research activities on the vulnerability to floods and the management of natural disasters associated with floods. The research activities focused on issues such as the status of disaster management in South Africa (Buys 2003), participatory approaches to public alertness for climate-associated disaster risk reduction in the country (Mqguba and Vogel 2004; Chagutah 2009), debates on an integrated approach to disasters (Van Niekerk 2006), the impact of severe flood disasters on rural communities (Khandlhela and May 2006; Durham 2007), discussions on a decentralized mechanism on funding for Disaster Risk Reduction in South Africa (Van Niekerk and Visser 2010), discussions on Disaster Risk Management Status Valuation at municipality levels in South Africa and an analysis of allocation of funding at local level (Botha et al. 2011), an analysis of the methods for estimating floods (Smithers 2012), discussions on legislative framework for flood disaster management and its current challenges (Zuma et al. 2012), and plotting the flood line zone of the Diepsloot Township using a Geographic Information System (GIS), which incorporated expert and professional knowledge (PK) with indigenous knowledge (IK) (Ngie 2012).

Notwithstanding these important considerations, there has been a notable lack of empirical studies from a bottom-up approach specifically reporting on the vulnerability and the coping strategies of low-income communities living in urban areas who are continuously traumatized by severe water flooding. Thus, this paper does not only examine vulnerability to flood hazards but also social vulnerability of Missionvale community to severe flooding. Against this background, the aim of the study reports on an empirical investigation of the vulnerability and coping strategies to flood hazards of low-income communities living in low lying area in Missionvale in Port Elizabeth.

Objectives

From this aim the following objectives were extracted. Thus, the intentions of the study were to evaluate the community's knowledge of the Missionvale area, as one that is prone to water flooding, to assess the extent of this vulnerability (personal experience and physical exposure) of Missionvale residents during the occurrence of severe floods, to evaluate the government's

response during severe flooding, to examine the community's responses/reactions during flooding, to analyze the impact of such flooding on the livelihoods of the residents, to evaluate the government's approach in the management of severe flooding, and to discuss the residents' coping strategies to severe floods.

Research Location

This study was conducted in Missionvale, a township in Port Elizabeth, South Africa, which forms part of the Nelson Mandela Bay Municipality (NMBM) (Fig. 1). In terms of relief, the lower part of the Missionvale human settlement lies on a gentle slope at the edge of the Missionvale Saltpan Lake, which lies to the northwest of Port Elizabeth's central business district. The geomorphology of the Missionvale area, where the informal settlers reside, is dominated by a saltpan lake that is seasonally, or sometimes annually, wet. The pan gets water through the inflow of salt water that is pumped out regularly, as well as from the overland inflow of rainwater from the surrounding built-up area. The dominant soils are low-lying clay soils. The clay soil that dominates the higher areas, which are approximately between 5 and 60 meters above sea level, allows the pan to retain water for a long period. However, the saltpan lake is prone to flooding in periods of high rainfall, or when the muddy soil becomes waterlogged, and the system discharges this water into a local drainage system. There has been an increase in extreme flooding events during the last forty years, with serious impacts in Port Elizabeth (NMBM 2011). For example, during the last four decades the number of disastrous flood events have shown a steep rise in Port Elizabeth and the most recent heavy floods occurred in 2012 (NMBM 2012). The effects of the 2012 flooding event were so severe that the NMBM was formally declared a disaster area in the same year. The damage was estimated at approximately R1 billion (The Herald 2012) with the greatest damage affecting the infrastructure.

In 2013, there were about 2,253 informal houses and approximately 2,498 state-subsidized houses in the area (Statistics South Africa 2011). The household to population density is six people per household, which is considered high (NMBM Report 2011). Missionvale is a community that is divided into four population groups,

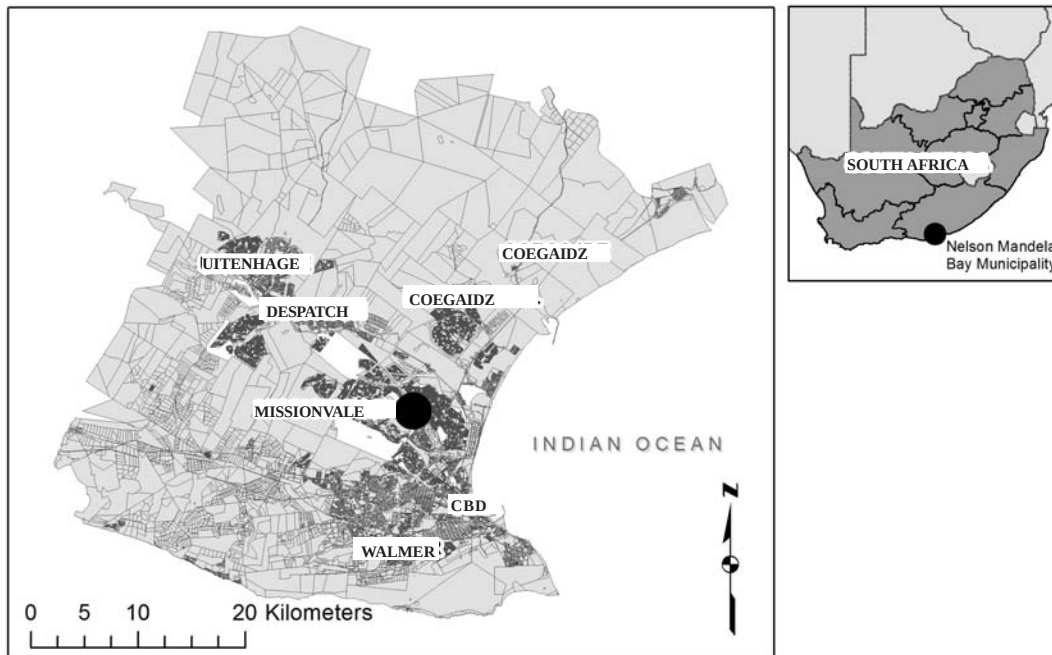


Fig. 1. Nelson Mandela Bay Municipality

namely, Coloreds and Blacks (Africans) are the majority, while Indians and Muslims form the minority groups. The bulk of the Missionvale community are poor, and the household income of the population is below the minimum poverty line, with their main sources of income being the social grants derived from grants for children and for people with disabilities, old-age pensions, as well as from occasional employment (NMBM Report 2011). Crime rates are high, with 869 incidents of contact crime in 2012 (South African Police Service 2013). Most of the Missionvale households have access to electricity (but a substantial number of houses have illegal electricity connections), and they own at least one cell phone per household. The area utilizes community water points and sanitation facilities, which comprise mainly of pit latrines without ventilation, and the bucket system (South African Broadcasting Corporation 2011).

METHODOLOGY

The area of investigation is the low-lying Missionvale. The study utilized mixed method-

ologies, namely, the quantitative and qualitative research methodologies. The study used structured face-to-face interviews with ninety respondents who were selected by snowball sampling, in order to gather data on people's experiences with regard to flooding, public warnings about floods, the impact of floods on their livelihoods, the forms of assistance rendered to the people during flood times, and the coping and adaptation strategies against floods. In practice, however, the final selection of the household respondents was mainly dependent on their availability. Of the ninety people interviewed, fifty-six percent were females; while forty-four percent were males aged between 19 and 89 years of age. Only one member of a household (in many instances the head of the family) was interviewed, but other members of the family were allowed to assist him/her in responding during the face-to-face interviews. In addition, key stakeholder interviews were conducted with the ward councilor, the secretary of the ward councilor, and the Nelson Mandela Bay Municipality disaster management officials. The survey took place during June and July 2013. Non-participa-

tory observations were also made, and recorded in a data book *in situ* (Interview Ward Councilor 2013). The data collected from the closed-ended questions was captured and entered into a Microsoft Office Program Excel file. For the data analysis, this program was also utilized. The data from the open-ended questions were transcribed verbatim into English. The responses were thematically analyzed at the first level, and the relations between the themes were conducted during the second stage. In addition, the text captured in the form of phrases and statements, was used to enrich the accounts of people's experiences of floods.

RESULTS AND DISCUSSION

In order to give a detailed account on the extent of vulnerability of lower Missionvale community to floods and isolate the major determinants of the low-income people vulnerability nexus the following themes have been generated to guide subsequent discussion on information about floods, residents' vulnerability to severe floods, government response to severe flooding, impact of floods on people's livelihoods, government's management and flood-recovery plans, and Missionvale people coping strategies during severe flooding.

Information About Flooding

One of the objectives of the study was to evaluate the Missionvale community's awareness and knowledge of flooding. However, from the awareness point of view to constant flooding of the ninety respondents interviewed, 87.7 percent of them precisely stated that they knew that the lower part of Missionvale human settlement was prone to flooding, while a few (5.6%) did not know that the houses in which they lived could also be threatened by floods. In the context of the respondents' knowledge about that the lower part of Missionvale was prone to flooding is that people tended to prioritize locational advantages of the area for their livelihood than the issue of flooding that often occurs at irregular intervals. The respondents indicated that Missionvale was close to employment opportunities, business activities, health facilities and educational facilities for example, the university. One of the respondents commenting about the locational advantages about Missionvale remarked, *"Personally I would rather remain subjected to the constant flooding of the*

area than to relocate to the newly established township elsewhere in the town because here my children just take ten minutes to walk to the University. Also, even if there are bus boycotts, the education of my children is not affected" (Interviewee, Fifty year old respondent July 2013). However, only 6.7 percent admitted that they were mindful of the possibility of flood hazards. Also, besides being aware of the possibility of frequent flooding in the area, ninety-three percent of the respondents also confirmed that government officials or stakeholders had informed them of the possibility of severe flooding in the lower part of Missionvale. Almost half of the respondents (45%) who knew that the area was prone to flood hazards, indicated that they were used to flooding in the area, and they acknowledged the intensification of floods in recent years, such as the floods of 2011 and 2012, which they claimed were more severe than those before, in terms of the impact on houses, roads and personal belongings. This is consistent with the findings of Ngie (2012) on local people's knowledge of the frequency of severe floods in Diepsloot Township but because of the close proximity of area to facilities and services they could not be easily swayed to leave the place.

In a similar vein with people's knowledge about flooding in Missionvale, one of the respondents indicated that as much as she was aware that Missionvale was a flood-prone area she would not easily relocate from the area to another area because she has a deep attachment to the area because she shared good memories and experiences of the area, the place is regarded as her home, and it complies with her cultural values and identity (Interviewed Local Community July 2013). Thus, the severe floods that occurred in recent years are overshadowed by a deep sentimental attachment to the area. It can therefore, be reasonable to suggest that to some residents the 'sense of place' was more important than flood hazards. Furthermore, when the respondents were requested to assess the frequency of severe floods over the recent years (the past three years) their replies varied. Forty-one percent stated that floods occurred very often, followed by thirty-six percent who stated that floods happen frequently, and a lower percentage of sixteen percent who maintained that floods hardly ever occurred, while four percent said that they did not occur at all. From the respondents' (77%) experiences with severe

floods, the implication was that the lower part of Missionvale was indeed prone to floods.

Regarding the early warning systems concerning the risks of flooding, the overall impression that was gathered was that diverse strategies were used to find out about the hazard, which included radio (74.4%), television (64.4%), newspapers (36.7%), neighbors (24.4%), and councilor's office (5.6%) (Interview, Ward Councillor 2013). The information on floods was mainly communicated through broadcasting by radio and television, while only a few respondents (2%) pointed out that the council office informed the Missionvale community about the possibility of flooding in advance. This low percentage illustrates that either the warning by the government officials is not conducted regularly in the case of a flood, or that the warning is only heard in the immediate vicinity of the councilor's office. These findings illustrate that the announcement done by the media plays an important role in informing the citizens about flood warnings, so that they could take measures in advance. It is also clear that any official implementation of an early warning system is of limited value. Interestingly a small percentage (2%) indicated that they heard about the possibilities of floods by word of mouth from neighbors and friends. This trend reflects limited social network, which can provide some protection among the members of the community. When actual flooding occurred in the area, ninety-two percent of the respondents revealed that they saw water coming into their houses/shelters, as well as seeing the overland flow of water that was not in the channels or the drains. This reflects the very high impact of floods throughout the investigated area.

Residents' Vulnerability to Severe Floods

Within the context of direct vulnerability to severe flooding, the majority of the respondents (over 80%) indicated that their belongings, including carpets, furniture and houses were damaged (Table 1). More than fifty percent of the respondents said that their house/shelter's walls and electricity infrastructure were affected. They pointed out that the water in the houses was knee-high, and that it infiltrated the houses from underground, as well as from the outside, because of the bad drainage system and the outward flow of the upper part of the Missionvale

human settlement. The foundations of the houses were also affected through the infiltration and water covering the floor for days, and sometimes weeks. A substantial number of the respondents also expressed the view that clothing was the least-affected item in their houses because it could so easily be removed during flooding. The respondents also pointed out that power failures were very common during flooding in Missionvale. They experienced the inconvenience of not having an energy source during flooding. Furthermore, because of the failure of electricity, food became spoiled, communication broke down, and access to information via radio or television was cut off.

Table 1: Responses to the affected items in the house

<i>Items damaged by floods</i>	<i>Responses [%]</i>
Floor / Carpets	77
Furniture	76
Roof	72
Electricity	55
Wall	54
Clothing	1

The experiences of the respondents were probed, by requesting them to provide an estimation of their losses by aligning them with financial value in Rands and US dollars. Indeed, thirty-eight percent of the respondents reported that their financial losses were less than R 15,000, while thirty-five percent indicated that their financial loss was between R15,000 and R24,999, and twenty-seven percent cited losses of between R25,000 and R50,000 (also refer to Table 2). The respondents considered the financial loss significant if it is taken into consideration that the bulk of the Missionvale community is poor. The amounts reflect a huge financial

Table 2: Financial loss to flooding
(exchange rate about R11 per US\$ in July, 2013)

<i>Amounts</i>	<i>No. of respondents</i>	<i>%</i>
Less than R5000 (US\$ =454)	19	21
R5000- R14,999 (US\$ =454-1363)	15	17
R15,000- R24,999 (US\$ =1364-2272)	32	35
R25,000-34,999 (US\$ =2273-3181)	14	16
R35,000-R44,999 (US\$ =3182-4090)	05	5.5
R45,000- R50,000 (US\$ =4091-4545)	05	5.5
Total	90	100

loss, and in many instances, the people are incapable of replacing the damaged items for many years, if at all. In all cases, the losses reflect the value of goods, such as televisions, stereo systems and music players, kitchen equipment, and other furniture. When analyzing these findings on the financial loss, it is important to understand that people who live in poverty often strive to acquire expensive items, which to them are status symbols. While being excluded through their poverty from social and economic participation, poor people often use the acquisition of global status symbols, such as a flat screen television, smartphones, loud stereo systems, furniture for the lounge, and beds. These items are seen as symbols of their identification with a global society they often see on the television (Interview Stakeholder 13 July 2013).

Government's Response to Severe Flooding

As important as it is that the government and the media continue to alert the public about the possibility of heavy floods, it is also important to the citizens to see or feel that the post-apartheid South African laws show some similarity in practice, and that preventive measures and disaster management are put in place before the next disaster strikes. During floods, about forty-four percent of the respondents said that they did not receive any aid from government (Table 3), while fifty-six percent were supported along a varied time span. Amongst the 50 households that received aid from the government, 21.1 percent received aid on the same day of the floods, 12.2 percent received aid within three days, ten percent received it within a week, and 12.2 percent after a month. The concerns of the residents were that the government's response to flooding was very slow, and therefore they feel that their problems are not being taken seriously. This low response in government aid concurs with the findings of Khandlhela and May (2006) in their study on the socio-economic valuation of the effect of the 2000 flood catastrophes on two rural communities of the Limpopo Province in South Africa. Quite significant is that the most-needed help by the victims of floods, that is to say financial support, is not readily available.

In terms of help during flooding, the respondents specified assistance from the government, which included helping residents to evacuate

and to find another place to stay such as in public buildings (churches, university halls and the councilor's office), and providing clothing, blankets and food. They also indicated that the local councilors appeared to delay responses to the situation, and in some flood occurrences, they did not respond at all. It is important to notice that measures, when taken, apparently frequently lack proper coordination when dealing with the flood victims. Only 2.2 percent of the respondents said that they were given shelter and building material after floods. Some respondents complained about the small amount of food parcels and clothing/blankets since in many instances, the items given to the flood victims were insufficient. In addition, the respondents complained that the donated food parcels often did not reach the intended beneficiaries because of corruption and a lack of proper coordination. This resulted in pandemonium as only those who could fight their way through the crowd usually got their food parcels.

However, from a different perspective, Missionvale residents complained that alternative accommodation, which was provided in public buildings was not well organized, and that the living conditions were appalling. Most of them regarded the public accommodation as merely a matter of transferring the flood victims to other forms of exposure, such as crime, diseases, and the feeling of insecurity from being accommodated with strangers under one roof. Under these conditions, women, elderly people and children felt the most insecure. It was not only the feeling of insecurity they faced in the halls, 87.9 percent of the respondents felt that their assets (furnisher and houses) would not be safe, when no one was there to guard it. As a consequence of that crime activities become rife during severe flooding. Hence, most of the affected people (78%) were reluctant to be temporarily settled in these provisional shelters. The resentment of the women and elderly people to be housed in public buildings during flooding can be encapsulated by the statement made by an 83-year-old woman: *"Personally, I do not like to be dumped in public halls because the females become vulnerable to infectious diseases and crime"* (Interview an eighty-three year-old lady, July, 2013). Arguably, this implies that public shelters are considered by some females as being unsafe and thus they prefer to be with friends, relatives or remain in their flooded hous-

es than to expose themselves to the potential harms caused by men that arise from shared temporary accommodation and sleeping as well as poor sanitary facilities. This outcome corresponds with Bradshaw's (2013) findings who rightly stated in her study that the female group of the population was more vulnerable to natural hazards than men. To some respondents there was a strong feeling that to be accommodated in public buildings like a school, it was a matter of transferring them from flood vulnerability to another type of vulnerability. However, viewing temporary public accommodation from another perspective is that, inasmuch as there is a group of people who resented being accommodated in public halls during severe flooding, there were also those who considered being relocated to public buildings as a safety measure. The extent of appreciation of being provided with alternative accommodation can be supported by the statement that was made of the respondents who said, *"I arrived late from work. My household items all under water, but now I feel safe here in this hall"* (Interview of a female respondent, July 2013).

In terms of the recovery phase, following the subsiding of the flooding event, the responses of the flood-affected citizens showed that the support, which was provided by the government was quite inadequate. Only 2.2 percent of the interviewees said that they were given building material, 4.4 percent were referred to psychological services, and only 1.1 percent said that electricity was restored. In addition, the respondents complained that in many instances, the building material was inadequate, while in many instances, the building material that did not reach all the intended beneficiaries. As unhappy as the respondents were with the government food packages and clothing assistance, they appreciated the assistance from the Missionvale Care Centre, an NGO initiative. This concurs with the findings of Ngie (2012: 76) who

stated that, *"They (people of Diepsloot) expressed their grievances with local government authorities for not showing concern with the victims, and that they perceived the aid process as heavily influenced by nepotism."*

It became clear during the study that the help that the Missionvale residents needed most was financial assistance, which was not provided. It was also revealed in the study that there were neither post-cleanup efforts, nor disaster inspection after the flood disaster, despite the environmental degradation and impacts on the community that had been caused by the flooding. For some days after the disaster, one could see unattended pockets of stationary contaminated water and undrained pit latrines across the Missionvale informal settlement, which in turn becomes the fertile breeding grounds for diseases that threaten people's health.

Impact of Floods on People's Livelihoods

Within the context of indirect vulnerability the Missionvale community's experience of floods was also probed on the impacts of floods, focusing on the provision of services, the availability of basic services, and on health status. Regarding service provision in the area, a substantial number rightly indicated that service delivery is greatly affected during the flooding period, in particular the provision of transport. Indeed, without transport the settlement becomes dysfunctional. About eighty-six percent of the respondents indicated that public transport could not operate due to flooded and damaged road infrastructure. In addition, more than two-thirds of the respondents stated that the entries to roads and streets were blocked. The affected transport system had ripple effects, such as most of the children not being able to go to school, thereby disrupting education. On the economic front, people could not go to work, with serious effects on household income.

The respondents were also asked to share their experiences during flooding with regard to the basic services, notably, food, electricity, water and sanitation, healthcare and solid waste disposal (also refer to Table 4). A fair percentage of the respondents could not access potable water due to piles of sediment on the paths making it very difficult to go to the communal taps. They added that due to the muddy roads in the area, food and medical supplies had to be cut,

Table 3: Time span for the government assistance to arrive during floods

Arrival of government assistance during floods	(%)
Not at all	44.5
After a month	12.2
Within a week	10.0
Within 3 days	12.2
Within 4 hours	21.1

prompting food and medical insecurity. Even if the electricity was not damaged in the house, the supply of electricity was cut in the whole area, and the residents were not able to buy either electricity or food, because of the shops were closed in the area and the failure in public transport, in order to buy it in another area. The respondents also revealed that during flooding, the open pit latrines are filled with storm water collected in upper-Missionvale. Indeed the infected water from the pit latrines is a grave health hazard during flooding. In addition, owing to a lack of storm water drainage, the water accumulates in the lower parts of Missionvale, and becomes infested with mosquitoes. Owing to muddy and slippery roads, the residents related that the municipality service providers cannot collect the toilet buckets for weeks, and thus the excreta spread throughout the lower part of Missionvale, causing a bad smell, unhygienic living conditions and diseases.

The respondents were also asked to state whether floods affected their health status and wellbeing. Most of the respondents overwhelmingly agreed that their health status was negatively affected. They pointed out that during the whole period of flooding, they suffered from coughs, colds, influenza, pneumonia (87.8%), diarrhea (64.4%), chest infections and respiratory problems (23.3%), especially in winter, but after the flood in 2012, their health status was the worst. Diarrhea, which is a waterborne disease, was reported to be the most serious illness, which occurred soon after every flood. While the symptoms of influenza are also serious, the symptoms of diarrhea have the most extensive effects by encouraging unhygienic circumstances, which accelerates the disease and it affects the well-being of the community. Sanitation and hygienic conditions become paralyzed and sorely afflicted during floods. The responses of the residents were consistent with

the findings of the in-depth interviews with local health government officials. They also revealed that a substantial number of Missionvale residents were reported to have waterborne diseases after flooding. The health impact on Missionvale residents resulting from severe flooding concurs with the findings of Mwape (2009) in his investigation into the impact of flooding in a rural Community in Zambia.

Furthermore, the outcome of the investigation on health status also revealed that the poor health status of the residents was not limited to the physical aspect since 34.4 percent of the respondents mentioned that with the increase in the number of incidents of crime and violence, the severe loss of assets during flooding, the appalling circumstances due to the unsanitary conditions, the physical exposure to floods and the insecure state of living, caused high emotional and psychological stress. The extent of trauma that one of the respondents experienced resulting to loss of her assets during the occurrence of severe flooding can be encapsulated in this statement. *“When my furniture was destroyed by the floods, I was so devastated that I told my children not to bother buying furniture again as long as I still live in this shack.”* Khandela and May (2006) have also indicated that the vulnerability caused by emotional and psychological stress is often underestimated because it lacks any visible evidence, and it is difficult to measure, but its effects on human beings can last for decades, if not properly handled during the early stages. However, at a deeper level, the reactions of traumatized people and people at constant risk from the consequences of flooding can be disastrous. This implies that healthcare during flooding is a vital necessity, and it should not be limited to medication, but it also requires counseling.

Government’s Management in the Event of Flooding

Although the floods had wide negative impacts on the lower part of Missionvale, there were also positive outcomes after the severe floods. For example, after the 2012 floods, the Nelson Mandela Bay Municipality area was declared a disaster area. According to the interview with the ward councilor, during and soon after the floods, the area became a focal area for assisting the community with food and cloth-

Table 4: Basic services being affected during severe flooding

<i>Basic services affected during floods</i>	<i>(%)</i>
Power / Electricity	71
Sanitation	70
Water	69
Food supplies	26
Healthcare	14
2 weeks without sanitation	1
Buckets don’t get collected	1

ing. Electricians came to the area to fix power failures and there was an increased urgency to improve service delivery. For instance, after the floods, the municipality started to install a proper drainage system and speeded up the development of state-funded subsidy houses. However, it remains a challenge, since some houses are built on flood plains, despite the constant advice against this practice from the building professionals. Therefore, the possibility of continuous exposure of the Missionvale population to flooding cannot be ruled out. The field observation also revealed that the new houses that were built for the informal settlers, who were still living in shacks, were based on unsustainable housing planning by the local municipality. On the one hand, efforts were made by the municipality with building Reconstruction and De-

velopment Program (RDP) houses, but on the other hand, the field observation and the interviews with the local community revealed that the houses were built in exactly the same flood-prone area, without any preliminary evaluation to plan sustainable housing and drainage systems.

Furthermore, the drainage system is still unsustainable since the uninhabited houses whose construction was unfinished, have already been affected by the floods. Figure 2A shows the inside of newly built houses for the informal settlers three weeks after a flood, and it reveals wet walls plus water that still covers the floor of the house. Figure 2B shows the drainage around the house, but as the first picture shows, this does not prevent water from flooding the new houses. Figure 3A shows that the municipality is helping by draining the water in front of an



Fig. 2. (A) New built house weeks after the flood and (B) Drainage in front of the house after the house has been built



Fig. 3. Municipality pumping off the water in front of the informal settlement house and B) Area with new buildings, built on flood plain (All photographs were taken during fieldwork observation).

informal house, although this was some days after the flooding. Figure 3B represents the area where the new houses are built, which is still on a plain. Thus, the unsustainability of the new houses, combined with the direct impacts of the floods has deepened frustration with service provision. The situation generates tension, protests, and confrontations between the residents and the municipality. In a similar vein, a fair percentage of the interviewees also voiced their opinion that because of community politics they have the impression that people from the Colored population group appear to get preferential treatment.

Residents' Coping with Flooding

With floods making living uncomfortable for Missionvale residents, questions were asked about their adapting and management measures to reduce their vulnerability to flooding. The respondents reported that from their experiences with flooding events, community people have a veritable wealth of ideas on how best to deal with flooding. These ideas range from devising structural measures to various unstructured interventions. A number of structural measures suggested include building strong durable houses that can withstand flood damage, improving drainage systems and storm drains, improving the road infrastructure, and managing water-logged areas by diverting mud and water away from their houses by using trenches and building barriers were indicated by a fair percentage. However, the most prevalent responses were providing better roads (63%), better houses (38%), better healthcare (21%) and better drainage (18%). Views from the respondents as to what measures could assist them in reducing the effects of flood damage in Missionvale, were as follows. Many of the respondents (87%) reported that clothing, which included gumboots and raincoats, should be kept safe and ready to be used during a flood. A fair number (21%) of the respondents stated that they kept garden equipment (spades, forks), which they used to push or divert the water and mud. Other respondents indicated that they lift certain areas in the house with bricks or tins to raise valuable items in their houses. Furthermore, some of the respondents also maintained that as much as they keep sandbags in their houses to divert water during flooding, sometimes this strategy is not

suitable against heavy rainfalls because the sand dykes are often washed away, and children and the elderly find it difficult to use improvised footbridges. Other suggestions by the respondents included the provision of social services, such as safe water, security medication and safe houses. These suggestions all seem to point to rudimentary coping strategies to flooding and thus they highlight the need to improve the management strategies. However, from the angle of unstructured interventions, the community members understand the significance of early warnings through timely information dissemination on flooding events and education. About 15.6 percent of the respondents indicated that they are helped by friends, neighbors and families to remove the water, to move valuables and to support each other where needed. This was a striking comment because inasmuch as their resources are few, as the results show, only one quarter used their neighborhood and community network in order to help each other. This can be seen as an indicator of rather weak social cohesion in the area, perhaps due to interracial misunderstanding.

Conversely, the most prevalent ones taken by the community to deal with floods were identified as follows. Community members go to the accommodation hall to get assistance (35.6%), report to the councilor and hold meetings (24.4%), call family members or friends from other areas to help (15.6%), or deal with floods by himself/herself (7.8%). A few of the respondents listed further assisting other vulnerable members of the community, and consulting disaster management practitioners. These responses revealed that the first step that they take is going to the accommodation hall and to the councilor's office even though earlier it has been shown that the majority is reluctant to be accommodated in the halls. This emphasizes that their coping capacity is small because although they complain about the institutional response, for some of the respondents, it is one of the first steps they take during floods. Indeed another group in the community replied that they either remain inactive, or wait to get assistance from disaster management practitioners. Instead of devising appropriate safety measures, this group seems to be captivated by the disaster. Essentially, they desperately look towards immediate rescue by stakeholders, such as the municipality, the police, churches or non-governmental organizations.

CONCLUSION

Elucidating on the vulnerability and coping strategies of a low-income community in a flood-prone area in Missionvale in Port Elizabeth was the purpose of this study. It has been revealed in the study that the high vulnerability of the community in Missionvale is an outcome of severe poverty, poor service delivery from the government, people settling in low-lying areas, inadequate logistics in development, a poor disaster-management structure and administration at local level, and inadequate relief funds at local level. The coping and adaptation capacities of low-income communities are very small due to a lack of financial, social and institutional resources, and to weak social cohesion. Equally important is that inasmuch as the country has accepted sustainable development as an appropriate approach, the study reflects the lack of sustainable urban spatial planning in South African cities, and more particularly in Missionvale, for if sustainable development were to adhere to the construction of RDP-houses in the lower part of Missionvale human settlement, much of the disaster could have been avoided. This implies that a proper evaluation of the area of the risks in housing development was obviously missing in this low-elevation zone with scattered waterlogged patches. The study confirms that the vulnerability of low-income people to natural disasters is an acute problem in Missionvale. As it stands now, the management of disasters for the poorest of the poor is not properly addressed.

RECOMMENDATIONS

It is recommended that the issue of natural disasters should be a joint effort by the government departments, for example, the office of the housing sector, together with the office of the disaster management sector should work together to reduce the future physical growth or development of settlements especially low-cost housing in low-lying areas or former wetlands that are currently threatened by floods and in the past, as is the case in Missionvale. Inasmuch as the researchers are suggesting that there should be tight restriction in housing development in flood-prone areas, the implementation of such a

strategy is equally a challenge, given the sporadic nature of informal settlements, and also those destitute people who need houses in South African cities. Also, from the perspective of future preventive measures of vulnerability in the Missionvale community, the researchers suggest a more radical measure would be the relocation of the residents, whose houses are built in high flood-prone areas, to safer areas. However, it is critical that the relocation of residents must be done in consultation with the residents. While proactive measures to disasters that are already outlined in the Disaster Management Act No 57 of 2002 are important, the post-disaster measures are of a limited scale. Thus, there is a need to reinforce post-disaster measures, as well as to conduct an impact assessment after the flood disaster. The study also recommends that there is a need to increase the disaster relief funds allocated by local government, which could help the affected communities recover some of the losses, which resulted from severe flooding. At the community level, the study also recommends the implementation of capacity building and empowerment at community level, to reinforce people's preparedness to flooding, to increase security measures in order to protect peoples' assets during the occurrences of severe floods, and improve peoples' adaptation tactics. More important is that where possible, the expert or professional strategies that are provided by government and agencies on coping and recovering from flooding should also take cognizance of local knowledge (LK) or indigenous knowledge (IK). Thus, local knowledge on flood management should be used alongside professional knowledge. Finally, the study recommends that the issue of flooding should involve all relevant stakeholders, ranging from communities, the government, politicians, business sector, and NGOs. As the conditions are today, there is still a great need to improve disaster management and coping strategies of the people to flooding in South Africa.

ACKNOWLEDGEMENTS

The National Research Foundation (NRF) is acknowledged for its financial support for the study.

NOTES

Interview, Ward councillor, 13 July, 2013.

Interview, Stakeholder from the area, 13 July, 2013.

Interview, A fifty year old man 14 July, 2013.
Interview, An eighty-three year-old woman, 14 July, 2013.

REFERENCES

- Ariyanbandu MM, Wackramasinghe WM 2005. *Gender Dimension in Disaster Management: A Guide for South Asia*. Sri Lanka: ITDG Practical Action South Asia.
- Bradshaw S 2013. *Gender, Development and Disasters*. United Kingdom: Edward Elger.
- Botha D, Van Niekerk D, Wentink G, Coetzee C, Forbes K, Maartens Y, Annandale E, Tshona E, Raju E 2011. *Disaster-Risk Management Status Assessment at Municipalities in South Africa*. Pretoria: South African Local Government Association.
- Buys LM 2003. *Status of Disaster Management of South Africa*. Pretoria: Department of Provincial and Local Government.
- Chagutah T 2009. Towards improved public awareness for climate-related disaster-risk reduction in South Africa: A participatory development communication perspective. *Journal of Disaster Risk Management*, 2(3): 113–126.
- Collins TW 2009. The production of unequal risk in hazardscapes: An explanatory frame applied to disaster at the US-Mexico border. *Geoforum*, 40: 589–601.
- Douglas I, Alam K, Maghenda M, McDonnell Y, McLean L, Campbell J 2008. Unjust waters: Climate change, flooding and the urban poor in Africa. *Environment and Urbanisation*, 20(1): 187–205.
- Durham C 2007. *River Flood Risk Reduction in Western Cape: A Case Study of the Bath River*. Master's Dissertation, Unpublished. Cape Town: University of Cape Town.
- Flood Management in Australia 1998. In *Disaster Risk Management Guide Study for DIM 605: Module 2*. Bloemfontein: University of Free State.
- Intergovernmental Panel on Climate Change (IPCC) 2001. *Climate Change 2001: Impacts, Adaptation, Vulnerability, Summary for Policy Makers*. From <<http://www.ipcc.ch/pdf/climate-changes-2001/synthesis-syr/english/wg2-summary-policy-makers.pdf>> (Retrieved on 03 May 2013).
- IPCC 2014. Summary for Policymakers, *Climate Change 2014: Impact, Adaptation and Vulnerability Part A: Global Sectorial Aspects Contribution of Working Group 11 to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*. C Field et al. From <http://ipcc-wg2.gov/AR5/images/uploads/WG2AR5_SPM_FINAL.pdf> (Retrieved on 24th August 2015)., pp.1–32.
- Khandhela M, May J 2006. A socio-economic assessment of the impact of the 2000 floods on two communities of the Limpopo Province, South Africa. *Natural Hazards*, 39(2): 275.
- Magadza CHD 2000. Climate change impacts and human settlements in Africa: Prospects for adaptation. *Environmental Monitoring and Assessment*, 61: 193–205.
- Lindsell KM, Prater SC 2003. Abstract on assessing community impacts on national disasters. *National Hazard Review*, 4(4): 176–178.
- Mqguba S, Vogel C 2004. Living with the environmental risk and change in Alexandra township. *South African Geographical Journal*, 86(1): 30–38.
- Mwape YP 2009. *An Impact of Floods on the Socio-economic Livelihoods of People: A Case Study of Sikaunzwe Community in Kazungula District of Zambia*, MTech Degree Mini-dissertation, Unpublished. Bloemfontein: University of the Free State.
- Nelson Mandela Bay Municipality 2011. *State of the Environment Report*. Port Elizabeth: Nelson Mandela Municipality.
- Nelson Mandela Bay Municipality 2012. *State of the Environment Report*. Port Elizabeth: Nelson Mandela Municipality.
- SABC 2011. Bucket System Still a Huge Problem. From <<http://www.sabc.co.za/wps/portal/news/pages>>. (Retrieved on 18th May 2014).
- Ngie A 2012. *A GIS Approach for Flood Vulnerability and Adaptation Analysis in Diepsloot, Johannesburg*. A Minor Dissertation for MSc in Environmental Management. Johannesburg: University of Johannesburg.
- Republic of South Africa 1977. *The Civil Protection Act, No.67 of 1977*. Pretoria: Government Printer.
- Republic of South Africa 2002. *Disaster Management Act No.57 of 2002*. Pretoria: Government Printer.
- Roberts D 2008. Thinking globally, acting locally institutionalizing climate change at the local government level in Durban. *Environment and Globalization*, 20(2): 521–537.
- Smithers JC 2012. Methods and design of flood estimation in South Africa. *Water South Africa*, 4(38): 633–646.
- South African Police Service 2013. Crime Research and Statistics – Crime in Algoa park (EC) for April to March 2003/2004 - 2012/2013. From <http://www.saps.gov.za/resource_centre/publications/statistics/crimestats/2013/crime_stats.php> (Retrieved on 19 September 2013).
- South African Weather Services 2009. *South African Weather Service Corporate Profile*. South African Weather Service.
- Statistics South Africa 2011. *Statistics South Africa*. Pretoria: Government Printer.
- The Herald. 16 July 2012. *East Cape, Port Elizabeth Weather, Chaos*. Port Elizabeth: The Herald.
- Trenberth K 2008. The impact of climate change and variability on heavy precipitation, floods, and droughts. In: MG Anderson, JJ McDonnell (Eds.): *The Encyclopedia of Hydrological Sciences*. Chichester: John Wiley & Sons.
- Van Niekerk D 2006. Disaster risk management in South Africa: The function and the activity towards an integrated approach. *Politei*, 25(2): 95–115.
- Van Niekerk D, Visser R 2010. Experience on Decentralised Mechanism on Funding for Disaster Risk Reduction in South Africa. *Second Ministerial Conference on Disaster Reduction in Africa*, Nairobi, 14–16 May 2010.
- Zuma BM, Luyt CD, Chirenda T, Tandlich R 2012. Flood Disaster Management in Southern Africa: Legislative Framework and Current Challenges. *International Conference on Applied Life Sciences ICAL*, Turkey, September, 2012.