

Human perceptions and responses to floods with specific reference to the 1987 flood in the Mdloti River near Durban, South Africa

G du T de Villiers* and R Maharaj

Department of Geography, University of Durban-Westville, Private Bag X54001, Durban 4000, South Africa

Abstract

The aim of this paper is to examine the awareness, attitudes, perception and response of residents to floods in the Mdloti floodplain near Durban. The results indicated that nearly 50% of the respondents lived in a flood-prone area, but were completely unaware of the flood hazard. Nearly 70%, however, indicated their desire to relocate after the 1987 flood. A more sophisticated flood warning system would alleviate the problem.

Introduction

River floods present one of the most common global hazards, encompassing a wide range of events, from largely unpredictable, highly localised, flash floods to anticipated and widespread floods such as those which occur annually on the Nile River (Smith and Tobin, 1979). There is also evidence that the spread of urbanisation, forest clearance, the ploughing up of natural grasslands and the destruction of wetlands have increased flood potential (Begg, 1988).

In any study of floodplain behaviour patterns, perception of the hazard is of utmost importance since it is very likely that an individual will respond according to his beliefs rather than to the real situation as viewed by an objective outsider (Smith and Tobin, 1979). Many researchers have analysed the perception of the flood hazard and have concluded that it waxes and wanes (Kates, 1962; White and Haas, 1975; Smith and Tobin, 1979; Smith et al., 1981). Immediately after a flood, the danger is appreciated and even exaggerated. The majority of studies, however, show that in general people have very short memories. This lack of awareness is highlighted in a British survey in 1971 in Shrewsbury, in which more than 50% of the residents questioned were unaware that it was a flood hazard zone (Smith and Tobin, 1979). However, the inhabitants of the Ganga floodplain in India were fully aware of the flood hazard (Ramachandran and Thakur, 1974). The ability to provide sufficient advance warning of flood occurrence is important in reducing the potentially disastrous effects of floods. It may, for example, save lives by giving floodplain residents time to remove themselves and their possessions to safety, and it may save property by allowing them time to effect various structural and other adjustments (Dacy, 1969; White and Haas, 1975).

The aim of this paper is to examine the awareness, attitudes, perception and response of residents to floods in the Mdloti floodplain near Durban with specific reference to the 1987 flood.

Study area

The Mdloti River, 20 km north of Durban has a catchment area of 497 km² and a total length of 74 km. The mean annual runoff (MAR) is 105 x 10⁶ m³. The river flows perennially and the mean annual flow is given as 2 m³/s (Begg, 1978). The river gradient decreases from about 30 m/km at the source to less than 5 m/km close to the coast. The Hazelmere Dam is situated in the coastal zone, about 20 km from the river mouth. The Mdloti catchment experiences a subtropical climate with an annual rainfall that varies around 1 000 mm.

Physiographically there is little diversity in the structure and surface of the floodplain. It has a relatively flat landscape which rises steadily from the river with abandoned meanders and a highly eroded escarpment in the west. The channel pattern in the floodplain is bifurcated with an average width of about 40 m. The river mouth is about 5 km from the floodplain which has a total area of just less than a 1 000 ha. The 60 households that were affected by the September 1987 flood formed the study's population, and it comprised middle and lower socio-economic groups in formal residential areas.

The September 1987 flood in Natal

The central and southern parts of Natal were ravaged by floods between 28 and 30 September, that were amongst the most devastating to have occurred in South Africa. The destruction of property was catastrophic, nearly 400 people were killed and about 50 000 were left homeless. Damage to agriculture, communications, infrastructure and property amounted to R400 million (Van Bladeren and Burger, 1989).

Heavy and prolonged rains which fell during the flood period resulted in widespread flood conditions. In the Mdloti catchment between 400 and 600mm of rain fell over the period 25 to 30 September 1987. This was preceded by a wet fortnight in which between 40 and 60 mm had been recorded (Van Bladeren and Burger, 1989). This rainfall resulted in serious flood conditions in the area under study. A peak flow of 1 660 m³/s was recorded at the Hazelmere Dam on 29 September. According to Begg (1988) overgrazing and poor veld management aggravated the situation.

*To whom all correspondence should be addressed.

Present address: Department of Geography, University of the Orange Free State, PO Box 339, Bloemfontein 9300.

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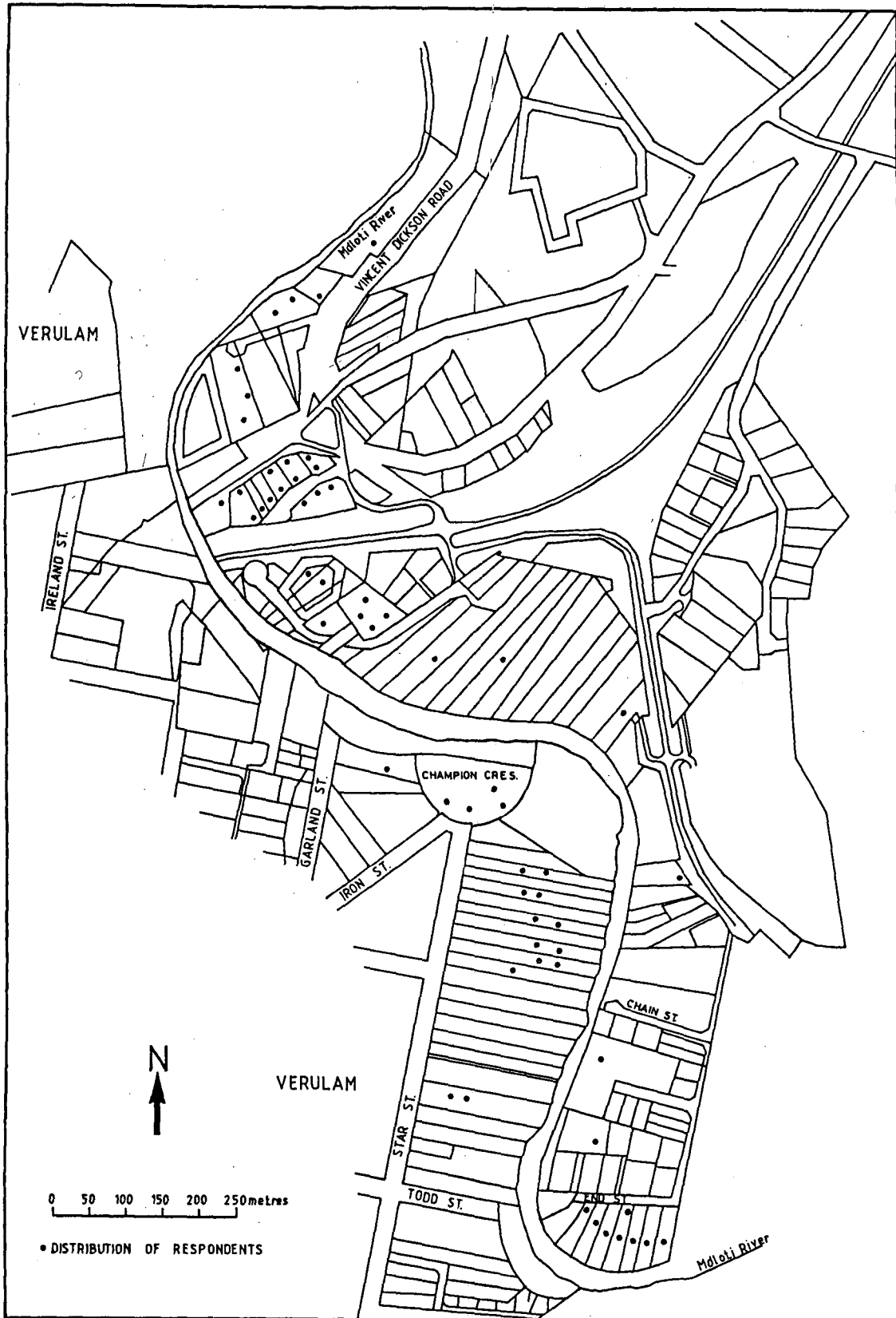


Figure 1
The Mdloti floodplain

Damage

Appraisal of the extent of flood damage in the Mdloti River in 1987 showed that residents suffered catastrophic damage and loss with regard to buildings, household contents and motor vehicles. Total tangible damage of R857 880 was recorded in the study area.

Methodology

A questionnaire was used to collect data from all 60 households that were affected by the 1987 flood. The questionnaire consisted of 4 types of questions, viz. forced-choice questions, open-ended questions, close-ended questions and scaled questions. In the first instance the questionnaire sought to establish the socio-economic characteristics of the floodplain residents and the extent of their flood experience. Detailed information was then collected on the residents' perception of the flood hazard with particular reference to adjustments and responses.

Analysis and discussion

Previous experience of floods is a good indicator of residential behaviour during and after floods. The study showed that only 23% of the respondents had had prior personal experience of flooding. It also revealed that 48% of the respondents lived in a flood-prone area, but were completely unaware of the flood hazard. The 52% that were aware of the flood hazard had lived in the area for more than 8 years. The analysis therefore suggests that length of stay influences respondents' awareness of floods. A total of 274 people forming the 60 households were affected by the 1987 flood.

Tenure of household is a further indicator of flood awareness because home-owners would be more inclined to undertake protective measures to prevent damage to their properties. Tenants are less likely to take any individual measures because of the cost factor as well as the fact that they do not own the property (Smith and Tobin, 1979; Eriksen, 1971).

Sixty-eight per cent of the respondents in the study area were tenants whilst 32% were home-owners. The tenants were renting houses, portions of dwellings, as well as outhouses and garages. The majority of the home-owners (16 out of 19) were aware of the flood hazard, compared to only 15 out of 41 tenants. Fourteen of the 16 home-owners who were aware of the flood hazard settled in the study area because they owned the land whilst 11 tenants attributed their location to the availability of a cheap house to rent. In addition, 4 tenants who were aware of the flood hazard were living in the study area because they could not find any other accommodation.

Precautionary measures taken against floods are sound indicators of awareness and attitude of floodplain dwellers, and those measures used by residents in flood-prone areas include structural as well as non-structural adjustments. Structural adjustments involve engineering schemes, abatement policies and flood-proofing. Non-structural measures are essentially behavioural adjustments, which rely on some form of pre-planned action by floodplain residents prior to a flood e.g. flood insurance, floodplain zoning and flood warning schemes (Smith and Tobin, 1979; White and Haas, 1975). Whilst 31 (52%) of the households were aware of the flood hazard, only 12 (20%) took precautionary measures after occupation of their properties. This is probably related to the fact that 30 out of the 31 respondents regarded the flood as a mild problem. Of the 12 respondents who took precautionary measures, 10 were home owners and 2 were tenants. The measures employed by the 10 home owners were cost-related i.e. purchased insurance

and built retaining walls. The 2 tenants who took precautionary measures resorted to building embankments from the sand and stone found in the area.

The main reason advanced by the majority of the tenants (36 out of 39) for not taking any precautionary measures was cost-related. Some of these tenants (10) felt that it was the responsibility of their landlords to protect their properties. Others (26) stated it was beyond their means to build retaining walls, embankments or employ flood-proofing techniques. Home owners (6 out of 9) who did not take any precautionary measures after occupation were influenced by the distance factor. They stated that their homes were located far away from the river and as a result felt no need to take any precautionary measures.

Perception of the flood hazard

In any study of floodplain behaviour patterns, perception of the hazard is of utmost importance. Accordingly, this study attempted to assess this aspect of respondents' attitudes.

TABLE 1
PERCEPTION OF THE FLOOD HAZARD BY THE 60
RESPONDENTS IN THE MDLOTI FLOODPLAIN.

Perception of the flood hazard	Number	%
(A) An act of nature		
YES	46	77
NO	14	23
TOTAL	60	100
(B) Negligence by local authority and Government		
YES	21	35
NO	39	65
TOTAL	60	100
(C) Other (Specify)		
YES	12	20
NO	48	80
TOTAL	60	100

NB: Respondents had to indicate either a YES or NO for each of the categories A, B and C.

Table 1 indicates clearly that 46 (77%) of the respondents perceived the flood as an act of nature, 21 (35%) as negligence by the local authority and Government and 12 (20%) as related to other factors. All respondents who perceived the flood to be related to other factors, stated that the location of the Hazelmere Dam was the main cause of the flood.

Studies conducted by several researchers have shown that floodplain residents have varying opinions regarding expectation of future floods. For example, James (1974) and Ramachandran and Thakur (1974) found that over 85 per cent of floodplain residents in Atlanta (USA) and on the Ganga floodplain (India) respectively, expected a flood to recur in the future. On the other hand Smith and Tobin (1979) and Eriksen (1971) found that 50% of the floodplain dwellers in Shrewsbury (UK) and 30% of the

residents in the Opotiki floodplain (New Zealand) did not expect floods to recur.

Fifty-four of the respondents in the Mdloti River floodplain expected floods to occur again within the next 10 years, although a further 6 were undecided. The large proportion expecting future flooding, therefore, either have little faith in the ability of authorities to overcome such problems, or are unaware of the abatement measures that could reduce the hazard.

Personal experience of floods did not appear to influence perceived future flooding. Only 14 (23%) respondents had experienced a flood previously but the majority 54 (90%) stated that the area would flood again within the next 10 years because of the absence of flood alleviation schemes and the close proximity of houses to the river channel.

In the time context, just over half of the respondents (32) expect another flood within 5 years whilst 22 held the view that floods would recur within the next 6 to 10 years. The 6 respondents who were uncertain about the expectation of future floods stated that the Hazelmer Dam would have a major role in actually preventing flooding in the Mdloti River floodplain. This is a contradiction of a previous view which described the Hazelmer Dam as a possible cause of the flood.

There was no apparent relationship between awareness of the flood hazard and expectation of future floods. The majority of the respondents (30) who were aware of the flood hazard expected a flood to occur within the next 10 years. However, 24 of the respondents who were unaware of the flood hazard also expected a flood within the next 10 years. This suggests that awareness of the flood hazard is not necessarily an indicator of the perceived expectation of future floods.

To some extent the degree of fear of the flood hazard was measured by a consideration of the relocation factor. Respondents were requested to state if, given a choice, they would relocate in the same area. Nineteen (32%) of the respondents indicated that they would remain in the study area whilst the remaining 41 (68%) indicated their desire to relocate. It was evident that the September 1987 flood had a significant influence on residents' attitudes to choosing future habitation. The findings of this study are in contrast to those of Smith and Tobin (1979) who found that 86 per cent of the respondents in the flood-prone areas of Carlisle and Appelby (UK) preferred to live in the same area despite the flood hazard. Of the 41 respondents who wanted to relocate, 38 were tenants and only 3 were home owners.

Economic pressures and social preferences added to the desire of the respondents to remain in the study area after the flood rather than to move to a less vulnerable area. Eleven of the 19 respondents who would remain in the study area would do so because they were attached to the area. However, to 4 respondents it was too costly to relocate. Equivalent proportions (2 each) had no choice or stated that other factors (availability of aid and relief) influenced their decision to remain in the study area.

A factor encouraging a small number of respondents to remain in the study area was the availability of aid and relief. These respondents did have misgivings about the nature and extent of emergency relief, but the provision of relief without any reciprocal obligation may reduce the inhabitants' concern about the flood hazard. Provision of aid and relief may well increase hazard loss potential. In their studies Ward (1978), White (1974) and Sewell (1969) found that the provision of financial assistance and aid may substantially increase the potential of flood damage. They argue that provision of aid will encourage new development in flood-prone areas, further adding to the problem. Relief was viewed as a source of increased flood losses since some people might be

encouraged to locate or build in a hazard zone in the belief that any losses could be recovered at no cost to themselves. Flood relief funds may, therefore, generate a poor response to the flood hazard but they would appear to be necessary on humanitarian grounds.

One of the more common alternatives to accepting the loss is to rely upon public relief. An immediate reaction to the announcement of a flood disaster is the establishment of a relief fund to assist flood victims. Sometimes such funds are purely voluntary, and calls are made for contributions from people in adjacent communities, from the country at large, or even overseas. Often these voluntary relief funds raise substantial amounts of money. Another type of relief fund is the one provided by the Government. A third type of relief is that which is administered by the Red Cross and other similar voluntary organisations. Friends and relatives may also offer assistance to flood victims, providing them with food, clothing and accommodation.

All respondents sought assistance with regard to accommodation, food and finance whilst a significant number of households also needed items of clothing. A large proportion of households approached the local authorities (49 out of 60), Government (58 out of 60) and relatives (58 out of 60) for assistance. Other sources that were approached for assistance by flood victims included the Verulam Islamic Society, Verulam Child Welfare, South African Police, employers and the Canelands Health Committee.

Flood damage

The variability of flood damage in both space and time reflects a large number of influencing factors. The most important are the type of land use, characteristics of the flood water and damage-reducing action taken by the occupants of flood-prone areas (Ward, 1978). Several studies (Smith and Tobin, 1979; White 1974 and Sewell, 1969; Smith et al., 1981) have found high correlations between flood depth and damage. In the Mdloti floodplain the damage was catastrophic in view of the fact that 41 of the respondents experienced depths of inundation in excess of 1 m.

Flood damage in the study area was divided into a number of categories according to the guidelines provided by Smith et al. (1981). Flood damage data were then collected from the respondents with the assistance of insurance clerks. Most of the damaged items were available and could be viewed. Table 2 depicts the flood damage in the different categories.

Damage to household contents	R533 290
Damage to buildings	R188 600
Damage to motor vehicles, tools and other equipment	R 62 000
Site damage	R 44 000
Loss of income	R 29 990
Total	R857 880

Water depth influenced damage in all the categories and in total, as can be seen from Table 3. The most damage was recorded where the depth of water in the houses was more than 2 m.

Although a flood warning was issued, the time between the warning and the actual flooding was less than 4 h. All the

TABLE 3
RELATIONSHIP BETWEEN TOTAL FLOOD DAMAGE AND DEPTH OF WATER IN HOMES

Damage (Rands)	Depth of water in homes (cm)					Total
	0-50	51-100	101-150	151-200	201+	
0 - 5000	2	10	-	-	-	12
5001 - 10 000	-	4	7	1	-	12
10 001 - 15 000	-	3	11	10	-	24
15 001 - 20 000	-	-	3	2	-	5
20 001 - 25 000	-	-	-	2	-	2
25 001 - 30 000	-	-	-	2	1	3
30 001 - 35 000	-	-	-	-	1	1
35 000 +	-	-	-	-	1	1

respondents, furthermore, did not receive a warning. The respondents that received a flood warning, however, took some precautionary measures like moving smaller valuables. Bulky items could not be moved.

Conclusion and recommendations

There is a demonstrated need for all floodplain occupants to have a realistic perception of the hazard which threatens them. Since this awareness is most unlikely to come from other sources, the local authority should take responsibility for an education programme on an ongoing basis.

The ability to provide advance warning of flood occurrence is important in reducing the disastrous effects of floods. It gives floodplain dwellers time to remove their assets to safety, and it allows them time to effect various types of adjustments. In September 1987, 48 of the 60 respondents in the Mdloti River floodplain received an official flood warning. Yet 36 households had less than 4 h at their disposal after the flood warning to protect their property. The present warning system therefore needs refinement and extension.

It is furthermore suggested that residents of the Mdloti floodplain establish a neighbourhood watch which could deal with flood-related issues as well as other general problems like security. Further development on the floodplain must also be halted by appropriate legislation, and relocation must be encouraged whenever possible. Where relocation is impossible some form of flood-proofing must be applied.

It is also apparent that there are dangers in removing completely from the individual the incentive to consider the risks they are running by occupying the floodplain. The greatest danger is the fact that activities could move into the area that might be more efficiently located elsewhere.

Finally, the lack of a clear definition as to who is responsible for dealing with flood problems generally means that there will be inaction. Floodplain dwellers will assume that the Government or

local authority is dealing with the matter, while Government and local authority agencies assume that it is beyond their terms of reference. Meanwhile the flood loss potential continues to grow. Catastrophe is the inevitable result.

References

- BEGG, G (1978) The Estuaries of Natal. Natal Town and Regional Planning Report 52.
- BEGG, G (1988) The 1987 Natal Floods. Natal Town and Regional Planning Commission, Newsletter No. 11, Pietermaritzburg.
- DACY, DC (1969) *The Economics of Natural Disasters*. Macmillan, London.
- ERIKSEN, NJ (1971) *Human adjustments to floods in New Zealand*. New Zealand Geographer 27 105-29.
- JAMES, LD (1974) *The Use of Questionnaires in Collecting Information for Urban Flood Control and Planning*. Georgia Institute of Technology, Atlanta.
- KATES, RW (1962) *Hazard and Choice Perception in Flood Plain Management*. University of Chicago, Department of Geography, Research Paper No. 78.
- RAMACHANDRAN, R and THAKUR, SC (1974) India and the Ganga Floodplains. In: White, GF (ed.) *Natural Hazards : Local, National, Global*. Oxford University Press, New York.
- SEWELL, WRD (1969) Human response to floods. In: Chorley, RJ (ed.) *Water, Earth and Man*. Methuen, London. 431-51.
- SMITH, DJG, VILJOEN, MF and SPIES, PH (1981) Guidelines for Assessing Flood Damage in South Africa. Water Research Commission, Pretoria.
- SMITH, K and TOBIN, GA (1979) *Human Adjustment to the Flood Hazard*. Longman, New York.
- VAN BLADEREN, D and BURGER, CE (1989) Documentation of the September 1987 Natal Floods. Department of Water Affairs, Directorate of Hydrology, Pretoria, Technical Report 139.
- WARD, RC (1978) *Floods : A Geographical Perspective*. Macmillan, London.
- WHITE, GF (1974) *Natural Hazards : Local, National, Global*. Oxford University Press, London.
- WHITE, GF and HAAS, JE (1975) *Assessment of Research on Natural Hazards*. MIT Press, Cambridge, London.