EFFECTS OF FLOODING DUE TO TROPICAL STORM GREG 1996 IN SABAH, MALAYSIA: SOME LESSONS LEARNT IN EMERGENCY MANAGEMENT

Ngai Weng Chan[1] and Hsiang-te Kung[2]
[1] School of Humanities, Universiti Sains Malaysia, 11800 Penang, Malaysia
Email: waterwatchchan@hotmail.com
[2] Department of Geography, The University of Memphis, 38152 TN, USA
Email: Hkung@memphis.edu

Keywords: Flood, Tropical Storm Greg, Sabah, Malaysia, Emergency Management

Abstract

On the 26th of December 1996, Tropical Storm Greg dumped a massive amount of rain in the Keningau area in Sabah, Malaysia, resulting in severe floods. The toll of the disaster was devastating with 238 deaths and more than a hundred missing; 4553 houses completely or partially destroyed; damage to amenities and facilities estimated at about RM58.5 million; damage to crops and livestock totaled RM22 million; damage to shipping and fishing vessels; lost of business, equipment and goods; losses in tourism; the cost of evacuation; disruption to schooling; the spread of infectious diseases; population displacement; and the relocation of victims. The lessons on display were the inadequacy of the forecasting and warning system; a need to relocate communities in hazardous zones; the illegal immigrant issue; inadequacy of low-cost housing; the reactive nature of disaster management; the need to incorporate traditional coping mechanisms into official systems; the need for international co-operation amongst ASEAN countries in forecasting and warning; awareness and education of flood-prone communities; a changing climate; and the sustainable management of forest. The authorities should pay attention to these lessons but whether or not they have learnt from the experience remains to be seen as the majority of the victims have moved back into the affected areas and started rebuilding their homes in the hazard-prone location.

1.0 Introduction

Tropical storms are typically frequent in the South China Sea, routinely affecting Hong Kong, the Philippines and Indo-China. Only rarely do they affect Malaysia and that too in its northernmost island outposts off the northern Sabah coast. However, all these changed on the 23rd of December 1996 when a depression built up in the South China Sea near the Layang-Layang atoll off the Sabah coast. Wind speeds were initially around 10 kph blowing from west to east. There was nothing unusual or alarming about it. In fact, no one had noticed anything peculiar or dangerous, including the weatherman who failed to forecast that the storm would hit Sabah. Then as the storm took a turn towards Sabah, wind speeds increased to around 30 kph heading towards Labuan and the south western coast of Sabah state. On Christmas eve, the storm was well inside Sabah but winds were not exceptionally strong. What was more alarming was the large amount of rainfall dumped in one night alone. By Wednesday 25th December 1996 - Wind speeds increased to around 72 kph. Direction of winds 120 ^{o} T from the South China Sea towards Labuan and the coastal towns of Beaufort, Sipitang, Weston and Papar. By Thursday 26th December 1996 (0100 hours), wind speeds had increased to around 90 kph and areas hit were the coastal areas of Sabah and the interior areas of Tenom, Keningau, Tambunan, Papar, Kota Kinabalu, Tuaran, Ranau and Kota Belud. By 1100 hour, the weakening storm headed towards Sandakan on the east coast of Sabah state and thereafter towards the Sulawesi Sea before dissipating on the 27th of June in a 125 ^{o} T direction.

The real damage was not caused by the winds, as they were not exceptionally strong. What was more alarming was the large amount of rainfall deposited in one night alone. As a result, the subsequent floods in and around the Keningau area was devastating as hundreds of houses built on river banks were washed away and destroyed. As the floods came at the early hours of the morning, the responses from the inhabitants was slow and ineffective. Many were caught unaware. The toll of the disaster was devastating with 238 deaths and more than a hundred missing; thousands of houses completely or partially destroyed; damage to amenities and facilities; damage to crops and livestock; damage to shipping and fishing vessels; lost of business, equipment and goods; losses in tourism; the cost of evacuation; disruption to schooling; the spread of infectious diseases; population displacement; and the relocation of victims (Kukreja, 2000) (Table 1).

2.0 The Lessons Learnt

2.1 Inadequacy of forecasting and warning system

While the Malaysian Meteorological Service (MMS) routinely forecasts winds, rains and other climatic elements for the major cities and towns in the country, there is no formal forecasting and warning system for typhoons and tropical storms in Malaysia. In the case of strong winds, the MMS makes the forecasts in the region within the country. It also forecasts heavy rains associated with the winds,

the former being used for forecasting floods by the Department of Irrigation and Drainage Malaysia (DID). As a result, the MMS missed forecasting that Greg would swerve into Sabah even though Greg was already identified some days ago brewing in the South China Sea. After the event, the Civil Defence Department of Malaysia has started planning to set up an Integrated Catastrophes Warning System, which would warn and keep people informed about impending natural disasters. The MMS and DID have been also been directed by the Government to upgrade their early storm (heavy rains) and flood forecasting systems to include a larger area, particularly the region where typhoons and tropical storms frequent. Both departments have been allocated extra funds to improve their systems. Malaysia has also joined the ASEAN Specialised Meteorological Centre (ASMC) based in Singapore in monitoring climate related natural disasters. There have also been talks about international cooperation with the Philippines, which has relevant expertise in the area of monitoring, forecasting and warning of tropical storms.

Table 1: The toll of Tropical Storm Greg in Sabah, 1996

- Deaths: 238 dead and more than a hundred still missing. The police, the public, NGOs, dogs, and even monitor lizards were used to locate dead bodies but the search was finally called off on 15th January, 20 days after the disaster.
- Property Damage: 4553 houses either completely or partially destroyed, estimated at about RM9 million.
- Amenity Damage: Telephone, electricity, water lines damaged. Roads, bridges, public buildings, port etc damaged. Estimated cost of repairs about RM58.5 million. State roads - RM10 million, Council roads - RM10.5 million, Kota Kinabalu port - RM10 million, Bridges - RM6 million, water supply - RM6 million, railway services - RM1 million, and drainage & irrigation facilities - RM15 million.
- Crops and livestock Damage: Total damage amounted to RM22 million.
- Damage to shipping and fishing vessels: 6 ships were blown aground & damaged. Dozens of fishing vessels capsised & were damaged, including some trawlers in the 3-4 metres high waves. No estimates were made but based on the cost of repairs and the price of fishing vessels, the damage is again expected to be in millions of Ringgit.
- Lost of business, equipment and goods: Damage to privately owned businesses is high. The majority in the path of the storm & ensuing floods were forced to close for several days to several weeks. Damage to equipment, machinery goods and raw materials are high though not estimated.
- Tourism: sharp drop in the number of tourists after the event. Between Jan - June 1997, a drop of 4.2 % from 3.61 million visitors for the same period in 1996 to 3.46 million in Sabah. This is estimated to have cost the country millions of Ringgit in foreign earnings. The Minister of Culture, Arts and Tourism blamed the drop in visitors on the bad publicity generated by this disaster.
- Evacuation: The total affected population was estimated at about 26,000. The evacuated population was 5699 people (3219 in Keningau, 1885 in Beaufort, 585 in Kota Kinabalu and 10 in Tamparuli).
- Disruption to schooling: All schools in affected areas were forced to close, some in Keningau for as long as a week. Some 10,000 children were affected. Greg ripped the roof and walls off 39 schools as well as teachers' quarters and canteens. Estimated cost of repairs was RM1.5 million.

- 10 Spread of infectious diseases: Damage to water supply and sewage disposal affected hygiene and health. There were 30 reported cases of Cholera with another 30 confirmed carriers.
- 11 Population displacements: A total of 5699 people evacuated and 145 illegal immigrants (139 Filipinos & 6 Indonesians) deported.
- Relocation: The decision by the Malaysian Cabinet to relocate riverine population in Sabah is expected to cost the Sabah government at least RM158 million for the 1,000 families.

2.2 Relocation of riverine communities

Historically, rivers have been preferred locations for settlements. In fact, the majority of Malaysian cities and towns are riverine settlements (Hj Keizrul Abdullah, 1999). Many, in fact, have begun as riverine squatter settlements. The issue of squatting along the rivers is a major problem in urban as well as rural flood plains (Chan, 1995). It results from a combination of poverty, landlessness, rural-urban migration (to search for better paying jobs), influx of illegal immigrants (mostly Indonesians and Thais) and other structural causes. Since urban flood plains are probably the only vacant space left undeveloped in the cities, squatters inevitably occupy these hazardous flood-prone areas, and consequently become exposed to flood hazards (Chan, 1995). In urban areas, squatters are the most vulnerable group of people as they are amongst the poorest in Malaysian society (Parker et al., 1997), and least able to recover from a flood disaster. Because squatting is a significant social problem in Malaysia, riverine squatters are amongst the most vulnerable communities to flood disasters (Chan, 1995).

Squatting is both a historical as well as a modern phenomenon. During the colonial period, squatters were mainly immigrant Chinese and Indians but after independence, squatting by Malays due to rural-urban migration, also became a problem. In 1957, one out of three persons in Kuala Lumpur was a squatter and there were as many as 20,000 squatter families. By 1980, there were 48,709 squatter families in Kuala Lumpur and it has been estimated to increase at a rate of 9.7 per cent per annum. Squatting in Kuala Lumpur is only one example. All the major urban centres in Peninsular Malaysia have squatter settlements. For example, Ipoh (Perak state), Johor Bahru (Johor state) and Prai (Pulau Pinang state) have approximately 60,000, 50,000 and 20,000 squatter families respectively. Squatting on flood-prone areas in the major in Malaysia urban centres is a social problem facing the authorities. Squatters live in the most hazardous of flood plains simply because they are too poor to live anywhere else. It is clear that squatting on flood-prone areas is not done by choice. People who squat are those who are poor, have no land or house of their own, or are illegal immigrants (Wan Abdul Halim bin Othman ,1982). This is reinforced by socio-economic and political forces which strongly influence squatting and thereby the persistent occupation of flood plains and the increasing vulnerability of communities to flood hazards.

After Greg, relocation became a Government priority. The Prime Minister himself had called for relocation of riverine communities in an attempt to reduce loss of life. After the Greg episode, a wise decision was made by the Malaysian Cabinet to relocate the riverine population permanently. However, relocation is expensive. For example, just providing the land to relocate 43 families in Kuala Kemaman, Pahang would cost RM6.8 million. In Sabah, at least 1,000 families have to be relocated. Based on the above cost, the total sum for to relocate the 1,000 families is at least RM158 million. However, relocation is not only a very costly exercise but also politically unpopular and socially disruptive. Some of the squatters have been living in the area for more than 40 years and displacement could lead to more hardship, loss of livelihood and jobs, and breaking up of social and communal relationships which is central in rural life in many Malaysian communities. Yet, despite the high cost of relocation and the break-up of communal/kinship ties, relocation is necessary in saving lives. In the light of the experience gained from Greg, relocation is necessary to avoid similar future disasters. Yet, despite the incentives and schemes provided by the Government, it was reported that Greg's victims were already moving back into the affected villages and starting to rebuild their damaged/destroyed houses. In fact, many who previously did not stay in the area have also taken advantage of the situation by claiming their lots. This is one area in which the authorities must put their foot down. Households which have been given compensation for relocation and then move back into their old houses should be severely punished. Without such enforcement, it is anticipated that whole new villages would be re-established in hazardous riverbanks in no time.

2.3 The illegal immigrant problem

Although not a new problem, Tropical Storm Greg re-opened a can of worms. Greg exposed a sensitive current issue of illegal immigrants entering the country in search of work. These are mostly Filipinos, Thais, Indonesians and Bangladeshis. Illegal immigrants, while good for the economy as they make up a sizable portion of the work force (especially in odd jobs and unskilled labour) have created a very grave situation. Notwithstanding the increased incidence of crime, pressure on housing, drugs, illegal labour, and others, the most severe problem created is the mushrooming of squatter settlements in the major urban centres. It is estimated that close to 2 million foreigners are currently living in the country. Without access to proper housing, the immigrants occupy hazardous flood-prone zones. Chan (1995) has shown how rapid urbanisation has deteriorated the environment of urban areas with higher incidence of flash floods. Chan (1998) has also shown that flood losses have increased as a result of the occupancy of riverine areas. This was exactly the case in Keningau whereby the riverine areas of the Sg Pampang, Sg Bayayo, Sg Sanagan and Sg Liawan were heavily populated by squatters who had built their houses within the old riverbeds. As the majority of the squatters are immigrant, tackling the immigrant issue would reduce squatting in the hazardous flood zones.

2.4 Inadequacy of low cost housing

Notwithstanding the immigrant problem, a significant proportion of squatters are also Malaysians. The very presence of Malaysian squatters is an indication of the inadequacy of low-cost housing in the State. Hence, there is an urgent need to provide adequate low cost housing to the poor, especially in rural areas. Even immigrants who are working legally should be provided with decent and safe quarters. Currently, it is estimated that only less than 50 % of the demand for low cost housing is met.

2.5 Disaster management is reactive

Despite being affected annually by monsoon and other types of flooding, landslides and the occasional severe tropical storm, disaster management in the country is largely based on a reactive approach. There is a need now to concentrate more on a proactive and preventive approach, while not totally discarding the reactive approach which the people are familiar with. The official flood disaster responses system under the National Security Council is a re-active rather than pro-active tool in disaster management. Officially, the government is responsible for flood management and many strategies have been employed to reduce the impacts of flooding, with a certain degree of success. However, official response to floods is limited by a reactive approach based on evacuation, relief and rehabilitation, the low salience of floods on government agendas, the lack of interaction and cooperation amongst government agencies dealing with floods, the bureaucratic nature of government agencies, and the victims' reluctance to relocate. The Malaysian Government has developed and employed a Flood Disaster Response Mechanism (FDRM) as a reactive strategy to reduce flood losses. This mechanism is generally bureaucratic and slow (Chan, 2000).

2.6 The need to incorporate local adapting mechanisms to official response systems in disaster management

Malaysians have lived on floodplains and hazard-prone areas for generations. There are a rich plethora of hazard experience which can be drawn upon. One of the commonest failures in disaster management concerns the lack of understanding (often by governments) of the social and cultural/traditional mitigation measures of the local community. Currently, disaster management in the country has not fully taken advantage of this local experience. In fact, over-dependence on government relief and rehabilitation is slowly eroding away this experience. Malaysians living in floodplains are accustomed and well-adapted to floods. Most riverine and floodplain dwellers have developed traditional adaptations and responses to reduce the effects of flooding. These responses have been effective but their extent is generally limited because they are fragmented and uncoordinated. However, by incorporating these traditional systems into official systems would greatly reduce flood losses. Realising this, the Malaysian government is currently moving towards

a comprehensive approach involving the people and incorporating their traditional knowledge and systems into the modern sophisticated systems of flood management.

One area where traditional response to flood hazard reduction is most effective is in traditional flood warning and evacuation systems (FWESs). Informal FWESs of the traditional kind have been practised by floodplain inhabitants in Malaysia for centuries and are still an important part of seasonal response to monsoon floods (Chan, 2000). Formal FWESs (run by government agencies) were only established fairly recently. More interestingly, formal FWESs have incorporated many of the practical aspects of informal FWESs. As such, the scope for individual action and self-determination is expected to be greater when responding to warning and evacuation than would, say the choice to live in flood zones. Effective FWESs can help reduce flood loss and damage or alternatively increase damage-savings. This is an area where individuals are expected to play a more active role as they are not expected to be constrained by structural or other contextual forces. Because of this freedom and greater scope for action and self-determination, individuals are expected to take advantage and develop/play active roles in informal FWESs and heed official advice by responding more positively to formal FWESs.

2.7 The need for inter-ASEAN cooperation in disaster forecasting, warning and fighting

The Philippines are experienced in forecasting tropical storms as Indonesians are well versed with volcanic and earthquake predictions. Malaysia can draw upon these experiences. Perhaps, the effects of Greg could have been minimised if there had been a warning from the Philippines who monitor tropical storms in the South China Sea. Some recent developments in international co-operation have been the setting up of ASEAN Specialised Meteorological Centre (ASMC) based in Singapore, the Joint Malaysia-Indonesia Fire Fighting Force (during the haze in 1997) and the ASEAN Haze Committee. More of such bodies should be set up so that countries can share each other's expertise and learn from one another. Besides, joint efforts in managing disasters would have a better chance as resources can be pooled.

2.8 The need for education and public awareness

Many people get caught in disasters because they are either unaware of the hazard, are poorly informed or respond ineffectively. Hence, there is a need to create greater awareness of disaster-prone areas and to educate the public on the proper way to respond before, during and after a disaster. Ultimately, disaster victims have to help themselves in order to survive. In the field of public awareness and education, Government can use campaigns via the mass media effectively. Here, the Information Ministry's role is all-important. The DID's "Love Our River" campaign is also helpful in teaching people not to dump all sorts of rubbish into

rivers (Ahmad Darus and Abd. Razak Mohd. Noor, 1999). "River watch" programmes run by NGOs, in which communities appoint "flood wardens" to monitor river levels and their cleanliness are good examples. Awareness programmes include advertisements to be aired on the national TV on flood preparedness, response, evacuation and rehabilitation procedures. Given the expensive nature of air time, the Government should have a regulation on all TV channels specifying a certain number of such educational "advertisements" in between the large numbers of "market oriented" commercial advertisements now being aired. Naturally, weather warnings of strong winds and heavy rains should be aired over the radio and TV whenever necessary.

2.9 Global climate change is changing local climate elements

The world's climate is warming and changing (Intergovernmental Panel on Climate Change, 1995). Jones et al. (1996) have concluded that the climate is changing and extreme events such as tropical storms are increasing. Chan and Kung (2000) demonstrated that El Nino which has previously not affected Malaysia is now having profound effect on the country's rainfall. No longer can Malaysians, especially those in Sabah, say that they are safe from tropical storms. Sabah used to get the tail-end effects of these storms but global climate change has changed that. As proven in Greg, North Sabah can be very susceptible to such storms. There is therefore a need to incorporate storm disaster management into the government agenda.

2.10 The need for sustainable forest management

Malaysia has often been accused by western media over the exploitation of our forest resources. This remains debatable. What is not is that Sabah is rich in forest resources and has a bad record of illegal logging and over-exploitation. While it has not been proven that logging was responsible for much of the flooding that occurred in the aftermath of Greg, there is consensus that logging may be partly responsible as it has significantly changed hydrological regimes (Chan et al., 2000). Hence, there is a need for sustainable management of Sabah's forest resources so that logged areas are replanted and mitigation measures put in place to minimise soil erosion and sedimentation of streams. Chan, Kung and Wan Ruslan (2000) have shown that the hydrological system is an extremely sensitive system which can have disastrous effects even with small changes caused by human activities. Deforestation can cause surface runoff to increase many folds. Consequently, hydrological elements must be protected from human misuse. In the case of the areas around Keningau, it has been suggested that deforestation in some areas may have affected the natural hydrological system resulting in disruption and imbalance. For example, runoff has increased significantly as a result of human activities, which change the land use from forest to impermeable artificial surfaces. As a result of human action, many hydrological processes are disturbed, culminating in the devastating floods on the wake of Greg. Consequently, efforts to control runoff are needed. Logging needs to be

controlled and carried out sustainably. Reforestation should be carried out to protect land surfaces. Drainage systems in urban areas need to be improved and be free from blockage such as inadvertent rubbish disposal and siltation. In the early stages of earth works, retention ponds must be constructed to control sedimentation and siltation. Drains and flood channels should also be maintained to ensure that free flow is not restricted.

3.0 Conclusions

Like all disasters, Tropical Storm Greg brings with it many lessons to be learnt. The lessons on display were the inadequacy of the forecasting and warning system; a need to relocate communities in hazardous zones; the illegal immigrant issue; inadequacy of low-cost housing; the reactive nature of disaster management; the need to incorporate traditional coping mechanisms into official systems; the need for international co-operation amongst ASEAN countries in disaster management; awareness and education of flood-prone communities; a changing climate; and the sustainable management of forest. Losses have been estimated to be in tens of millions of ringgit. However, what cannot be valued are the lives that have been lost. In order to avoid future loss of life and damage to properties, the authorities should pay attention to the lessons on display. Some actions have been taken but they have not be totally effective as proven by the fact that the majority of the victims have already moved back into their homes and started to rebuild them (and their lives). The debate is not whether this can be allowed but whether or not the authorities have the political will to address this problem. Unless these flood-prone areas are completely free from squatters, disasters like Tropical Storm Greg will continue to happen in future. When it happens again, one can say that those in charge as well as the victims have learnt nothing from the bitter experience of Greg.

4.0 References

Ahmad Darus and Abd. Razak Mohd. Noor (1999) *"Love Our Rivers" Campaign.* Paper presented at the National Conference on "Rivers '99 - Towards Sustainable Development", Universiti Sains Malaysia, Penang.

Chan, N. W. (1995) "Choice and Constraints in Persistent Floodplain Occupancy: The Influence of Structural Forces on Residential Location in Peninsular Malaysia", *Disasters* 19 (4), December, 287-307.

Chan, N. W. (1998) "Chapter 54 - Flash and monsoon flooding". In Sham Sani (ed) *The Encyclopedia of Malaysia - Volume I Environment.* Editions Didier Millet, Singapore, 112-113.

Chan, N. W. (2000) *Management of Flood Disasters in Malaysia: Combining Official and Traditional Flood Mitigation Systems for Effective Flood Loss*

Reduction. Paper presented at the International Conference on Disaster Management "Lessons To Be Learnt", April 29-30, Kuah, Langkawi.

Chan, N.W. and Kung, H.T. (2000) *The 1997/98 El Nino and Water Resources Management in Malaysia.* Paper presented at the "Southeastern Division Association of American Geographers (SEDAAG) 2000 Conference". 19 – 21 November 2000, Chapel Hill, North Carolina, USA.

Chan, N.W., Kung, H.T. and Wan Ruslan Ismail (2000) *Hill Land Development, Soil Erosion and Sedimentation as Factors Affecting Water Resources and Downstream Flooding in Malaysia.* Paper presented at the "Southeastern Division Association of American Geographers (SEDAAG) 2000 Conference". 19 – 21 November 2000, Chapel Hill, North Carolina, USA.

Hj Keizrul Abdullah (1999) *Keynote Address "Rivers '99: Integrated River Basin Management".* Paper presented at the National Conference on "Rivers '99: Towards Sustainable Development", 14-17 October 1999, Universiti Sains Malaysia, Penang.

Intergovernmental Panel on Climate Change (1995) *Climate Change 1994*. Cambridge University Press, Cambridge.

Jones, A.A.A., Liu, C.M., Woo, M.K. and Kung, H.T. (1996) *Regional Hydrological Response to Climate Change and Global Warming*. Kluwer Academic Publishers, The Netherlands.

Kukreja, A. K. (2000) *Storm Greg*. Paper presented at the International Conference on Disaster Management "Lessons To Be Learnt", April 29-30, Kuah, Langkawi.

Parker, D. J., Nabiul Islam and Chan, N. W. (1997) "Chapter 3: Reducing vulnerability following flood disaster: Issues and practices". In A Awotona (ed) *Reconstruction After Disaster*. Avebury, London, 23-44.

Wan Abdul Halim bin Othman (1982) *Squatter Communities in the Federal Territory*, Monograph Series No. 6, Centre for Policy Research, Universiti Sains Malaysia, Pulau Pinang.

Ngai Weng Chan is Associate Professor at the Universiti Sains Malaysia in Penang, Malaysia. He teaches physical geography and his area of expertise is water resources and environmental hazard management.

Hsiang-te Kung is Professor and Chair of the Department of Geography, The University of Memphis. He specializes in water resources and urban hydrology.