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SURVIVAL MECHANISMS TO COPE WITH THE 1996 TORNADO IN TANGAIL, BANGLADESH: A CASE STUDY

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SUMMARY

On May 13, 1996, a disastrous tornado ripped through northcentral Bangladesh, killing more than 700 people and injuring at least 33,000 in a 20-minute outburst of destruction. The 125-mph winds of the twister tore through 6 thanas, 16 unions, and 80 villages of the Tangail district. The tornado completely destroyed 17,000 houses and partially 7,000 more. The objective of this report is twofold: to examine the extent of damage caused by the tornado in the study area,

and, to explore and analyze how victims adjusted to the destruction. Data collected from the two study sites clearly show that victims received emergency assistance and other support from people in neighboring and more distant areas, as well as from government agencies and nongovernmental organizations (NGOs). At both sites, NGOs played the leading role in minimizing hardships of victims through extraordinary disaster relief and rehabilitation work and through the provision of financial aid. Because of the support received from the many relief organizations involved, the tornado victims were able to returned to their lives very quickly.

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INTRODUCTION

Bangladesh is one of the most highly disaster-prone countries of the world (Smith, 1996, p. 11). Frequently, the country experiences various natural disasters including floods, tropical cyclones and associated surges, droughts, earthquakes, and tornadoes. Between 1960 and 1996, Bangladesh experienced at least 100 separate incidents of natural disasters of varying intensities. Collectively, these disasters brought immense suffering and misery to millions of people in Bangladesh. They also triggered a whole set of response mechanisms that, in turn, affected the economic and social fabric of daily life (Saeed, 1996).

While tornadoes afflict the country as frequently as do other environmental hazards, and though they destroy crops, livestock, trees, houses, and take their toll in human lives, they have received little attention from either governmental agencies or researchers. In a recent annotated bibliography of social science literature on natural disasters in Bangladesh, Alam (1994, p. 6) listed 156 titles on floods, 54 on tropical cyclones, and 11 focusing on droughts. None, however, dealt with tornadoes.

Unlike tropical cyclones, which usually impact the coastal areas of Bangladesh, tornadoes strike inland areas, particularly the central part of the country. The path of most tornadoes is narrow, confining their effects to a relatively small area. However, their severity in terms of destruction is comparable to that of cyclones. Tornadoes occur most frequently during the afternoon in the months of April, May, and June, prior to the onset of the monsoon rains.

Almost every year, Bangladesh is struck by one or more tornadoes. On May 13, 1996, a disastrous tornado ripped through north-central Bangladesh, killing more than 700 people and injuring at least 33,000 in a 20-minute outburst of destruction. The 125-mph twister tore through 6 thanas, 16 unions, and 80 villages of the Tangail District (1). The tornado completely destroyed 17,000 houses and partially damaged 7,000 more. It snapped telephone lines, uprooted many trees, and was, without a doubt, the most devastating in recent history. The objective of this report is twofold: to examine the extent of damage caused by the 1996 Tangail tornado in the study area, and to explore and analyze how victims of the study area adjusted to the destruction.

CONCEPTUAL FRAMEWORK

A modified version of the conceptual framework developed by Paul (1995) to study drought coping strategies is used here. As shown in [Figure 1](#), responses to natural disasters, such as the tornado, begin at the individual/household level. For example, at this level, it is more likely that the tornado victims would practice both agricultural and nonagricultural adjustments such as resowing of crops or selling land or assets to raise capital for rebuilding, to reduce the aftereffects of the hazard.

Members of the community in which tornado victims live can also help in coping with the impact of the disaster. Commonly, all members of an affected community will not be equally impacted by a tornado. Therefore, those less affected or unaffected community members may provide emergency assistance to tornado victims. Such aid may include providing cash, food, clothing, and labor to reconstruct houses and clear rubble. In addition to physical and financial support, community members may also provide crucial psychological support to those who experience the loss of household members. The local government and various nongovernmental organizations (NGOs) may also intervene to help alleviate the devastation wrought by a tornado.

Beyond the community level, the national government, friends and relatives living outside the affected community, and people in neighboring or even more distant areas can provide financial support and other aid to tornado victims. Local and nonlocal NGOs may also wish to lend their support to mitigate tornado losses. Since the offices of these NGOs and the local government are unlikely to be located in all affected communities, they appear on both sides of [Figure 1](#), which divides the adjustment strategies into two broad categories: the household and community level adjustments and beyond-the-community-level adjustments. Hardships endured by tornado victims can be reduced significantly if the entities listed in [Figure 1](#) respond to the emergency in an effective and timely manner.

RESEARCH DESIGN

Selection of the Study Area and Questionnaire Survey

The data for this study come from a field survey conducted in two tornado-affected areas of the Tangail District of Bangladesh. The first site consisted of three adjacent villages within the Gopalpur thana and the second site consisted of one large village in the Basail thana ([Table 1](#)). These four villages were among those hit hardest by the tornado.

All households in these villages were interviewed using a structured questionnaire. This survey was supplemented by an informal post-interview discussion.

The primary sampling unit in this study was the individual household (2). The household head represented his/her household members as a respondent of the survey (3). Three hundred sixty-four heads-of-household from both study sites were successfully interviewed. Several household heads were not present during the time of the field survey, and could not be included in the survey. Some of these were visiting hospitalized family members injured by the tornado. In addition, in some households only children were present because all adult members had either died in the tornado or were still hospitalized.

Three types of data were obtained through the questionnaire. Loss of life and damages caused by the tornado were recorded first. Support received for coping with the impact of the tornado was then recorded. Finally, respondents were asked to provide some selected family information. Ten trained field investigators conducted door-to-door interviews at both study sites under the general supervision of the principal investigator (PI). The field investigators did not reside in the tornado-affected villages but were recruited from neighboring areas. Almost all of these investigators had previous field experience and some of them had worked previously with the PI. Although 364 heads-of-household were interviewed, 26 surveys were excluded because the questionnaire was improperly completed. Thus, the analysis of this report is based on the responses of 338 household heads.

Selected Characteristics of the Heads of the Households

Several selected characteristics of the heads of the households are presented in [Table 2](#). They are categorized under five occupational groups: farmers, businessmen, service holders, parental occupation, and laborers. Only 56% of the respondents were engaged in agriculture, a much lower percentage than for the country as a whole. The proportion of household heads employed as farmers at the Gopalpur study site was 70%, which is consistent with the national figure. However, only 45% of all heads-of-household at the Basail study site were engaged in farming. These differences can be explained in terms of the religious composition of the two study sites. All the respondents of the Gopalpur study site are Muslim, while Hindus constituted 81% of all Basail site respondents. In Hindu society, occupation is generally based on a caste system. At the Basail study site, 81 (43%) respondents were either fishermen, carpenters, or blacksmiths. All of these respondents were Hindu, and were employed in the same occupation as their parents. As expected, the Chi-square test confirms that the two study sites differ significantly with respect to the occupational characteristics of the head of the household.

In Bangladesh, Hindus are economically better off and exhibit greater educational attainment than Muslims, who comprise the dominant religious group (BBS, 1994a, p. 125). This generalization is also reflected in [Table 2](#). The proportion of landless households was 10% lower in the Hindu-dominated Basail site than the Muslim-dominated Gopalpur site (4). The proportion of households owning medium and large landholdings, however, was similar in both study areas (5). Medium and large landholding size was aggregated because the number of farmers with large holdings of land was small at both sites.

As expected, the literacy rate was higher among the respondents of the Basail site compared to their counterparts in Gopalpur. [Table 2](#) further indicates the percentage of respondents with more than five years of education is much higher at the Basail site than at the Gopalpur site and the Chi-square test confirms this differential.

[Table 2](#) shows that the two study sites do not differ with respect to the membership status of the household head. This characteristic was included to determine whether membership status influences adjustment strategies in the affected households. In the context of adjustments to floods, it has been found that households that were members of institutional groups demonstrated better performance compared to nonmembers (Haque, 1993, p. 384) (6).

RESULTS

Damage

The May 1996 tornado caused the loss of human life and the loss of cattle, as well as the destruction of crops, homes, and other property. In the villages studied a total of 137 people died: 95 in the Gopalpur site and 42 in the Basail site. The greater incidence of deaths at the Gopalpur site may be explained in a number of ways. First, the quality of housing was inferior to that at the Basail site. Secondly, reported tree loss was greater at Gopalpur than at Basail. Undoubtedly, deaths occurred when trees collapsed on houses where people sought refuge from the tornado. Lastly, the intensity and duration of the wind associated with the tornado probably differed at the two study sites.

The survey data shows that 16% of all respondents experienced the loss of cattle due to the tornado ([Table 3](#)). About 71% of the households from both study sites reported the loss of chickens and/or ducks and another 14% lost goats and/or sheep. [Table 3](#) indicates more households in the Gopalpur study site experienced the loss of cattle, poultry, and goats/sheep. Ten (7%) households at this site and 72 (39%) of the households in the Basail site did not experience losses because they did not raise livestock.

The marked difference into loss of cattle, poultry, and goats/sheep between the two study sites can be explained in terms of socioeconomic and religious variations. The poor usually keep poultry as a source of income because poultry do not require a large investment. Although cattle and goats/sheep require more investment and care, they provide an additional source of income for the poor. As noted earlier, Hindus dominate the Basail site, and they are reluctant to keep poultry, and keeping cattle and goats is time consuming. In addition to their parental occupation, farming is usually a secondary occupation for many Hindu households at this site. They have little time to manage cattle and goats/sheep.

The study sites also differ with respect to physiography and agricultural practices. Both study sites are subject to deep flooding, but due to its lower elevation, the flood remains for a longer period at the Basail site than at the Gopalpur site. As a result, a single cropping pattern (Boro rice) is dominant at the former site, while a two-cropping pattern involving Aus-Boro rice is usually practiced at the latter site ([7](#)). The survey shows that 281 (83%) respondents experienced crop damage. The remaining 57 (17%) households were not engaged in farming so they did not experience crop damage because they were landless laborers. Some of the landless farmers experienced crop damage because they cultivated the lands of others as sharecroppers.

More respondents experienced crop losses at the Basail site which, perhaps, reflects a difference in the proportion of landless households. Boro rice was the most affected crop; one hundred seventy respondents from the Basail site and 95 from Gopalpur reported a complete loss of all the boro rice crop. The reason for such widespread damage was that the tornado occurred during the harvest season of the crop. Respondents at the Gopalpur site also experienced the loss of aus rice, jute, and winter vegetables. The percentages of the total acreage of aus and jute damaged ranged from 40% to 100%, with an average near 70%. These two crops were in a mature stage at the time the tornado occurred.

[Table 4](#) shows that the May 1996 tornado completely destroyed the homes of 93% of the respondents and the remaining 7% experienced partial damage. The extent of damage to houses was similar at both study sites, but there were differences in tree loss and in the loss of stored crops. In both cases, more respondents from the Gopalpur site experienced such losses ([Table 5](#)). The differential loss of trees can simply be explained in terms of the variation in ownership of trees between the respondents of the two study sites. The Gopalpur study site had more trees compared to the Basail site ([8](#)). In fact, all trees in the study villages suffered complete or partial damage due to the tornado. Eleven percent of all respondents did not experience tree damage simply because they did not own a tree.

Because respondents in the Basail study site were economically advantaged relative to their counterparts in Gopalpur, it was expected more respondents of the former study site would experience damage to crops stored within their homes. The opposite, however, was found to be true. This is likely because many households in the Gopalpur study site had stored onions, garlic, chilies, potatoes, oilseeds, pulses, and other crops to be sold in the market during the off-season when the prices rise. However, the May 1996 tornado also damaged household items (e.g., beds, furniture, utensils, cash, jewelry, and clothes), and the tools and equipments of farmers, fishermen, carpenters, and blacksmiths of the study villages.

Adjustment

The information collected from the tornado victims indicates that they did not practice any adjustment at the household level to cope with the devastating effects of the tornado. Not a single respondent sold their land or other belongings after the tornado ripped through the study villages. Customarily, assets are sold to offset damaged caused by natural disasters (Haque and Zaman, 1994, p. 74; Paul, 1995). The tornado victims of the two study sites did not need to make adjustments because they received substantial and adequate amounts of aid from various sources.

Contrary to the assumption, the 1996 tornado affected all the people of the study area somewhat similarly. As a result, all supports received by the victims came from sources outside the tornado-affected area. This means that the sources listed on the lefthand side of the conceptual framework ([Figure 1](#)) were the ones involved in providing support to the tornado victims.

The analysis of field data reveals that regardless of socioeconomic conditions, land ownership patterns, and institutional membership status, all respondents of the both study sites received assistance from multiple sources. For convenience, these sources of assistance are grouped into four categories: private, government, NGOs, and other. People not affected by the tornado, including relatives and friends of the tornado victims, constitute the private source. This source provided emergency assistance and other relief to victims primarily through individual initiatives. The governmental source includes both local and national government entities, while regional and national NGOs participated in relief efforts for the tornado victims. Support provided by professional and business associations and other organizations, as well as relief teams organized exclusively for assisting the tornado victims are included in the "other" source.

People from nearby areas responded quickly to the impacted villages immediately after the tornado receded. Initially, they provided first aid and even carried the severely injured to nearby medical facilities. From there, many of the injured were transferred to better-equipped hospitals located in Dhaka, Mirzapur, Mymensingh, and Tangail. They also supplied hot meals to the tornado victims for the first few days after the tornado hit the area and distributed other items such as rice, cereal, wheat, pulses, salt, cooking oil, potatoes, cane sugar, utensil, plates, clothes, lamps, and cash.

It took more than 24 hours for the Bangladesh government to organize relief efforts for the tornado victims. The state radio station informed the country about the tornado on its evening news and initially reported the death toll at 22. Death toll generally reflects the severity of an environmental disaster and a death toll of 22 is not considered extensive (see Smith 1996, p. 11). This was one reason why the government failed to immediately send rescuers and supplies to the tornado-ravaged areas. However, local government authorities and volunteers began distributing rice, wheat, and other goods to the victims immediately after the tornado passed through.

The Bangladesh Army was deployed to the tornado-affected areas of Tangail to clear rubble and bury the dead. The tornado left scraps of tin roofs, broken tree branches, and other debris strewn haphazardly by the strong winds. The army also repaired a considerable number of damaged tubewells, the main source of drinking water for the affected area. They installed tubewells and provided tents for victims, who lived in these tents until they were able to construct new houses. Because of the involvement of the Bangladesh Army in cleaning, burying dead bodies, and installing tubewells, the tornado affected areas did not experience a diarrhea epidemic.

The Bangladesh government distributed eight pieces of corrugated tin to roof houses and a cash disbursement of Taka (Tk.) 500.00 (US \$12.00) to each family affected by the tornado. It also paid families who lost one or more members Tk. 5,000 (US \$120.00) per death. The national government, as well as most of the other organizations involved, sent medical supplies and personnel to assist the affected villagers.

The principal source of support for tornado-torn households in the two study sites were the NGOs. Respondents claimed at least 12 different NGOs were involved in providing support to tornado victims. Relief efforts by the NGOs began on May 14, 1996, one day after the tornado hit. Most of the NGOs were actively distributing relief goods for the remainder of the month. Only three NGOs were still working in the study area at the time of the field survey: Concern, CARITAS, and the Ram Krishna Mission (RK Mission). Furthermore, the latter two NGOs were only working at the Basail study site.

[Table 6](#) shows that nine different NGOs provided relief goods to the Basail study site, while only six assisted at

Gopalpur. The relief efforts of Proshika Manobik Unnayan Kendra (Proshika), CARITAS, Social Development Sangshad (SDS), the RK Mission, the Oxford Famine and Relief Committee (Oxfam), and Rural Development Sangshad (RDS) were limited to the Basail study site. Three NGOs: Concern, Bangladesh Rural Advancement Committee (BRAC), and Bangladesh Red Crescent provided support to both study sites. In contrast, aid from the Society for Social Service (SSS), Association for Social Advancement (ASA), and MSC was confined to villages in the Gopalpur study site.

Nearness to Dhaka, the capital of Bangladesh, might be one reason why the Basail study site received the attention of a larger number of NGOs. In addition, RK Mission's involvement in providing relief to the Basail study site might be associated with the religious affiliation of the victims. The RK Mission works to improve conditions for the Hindu population in Bangladesh. As noted earlier, most of the residents of the Basail site are Hindu (9). The two NGOs (SDS and RDS) have been active in the Basail site for several years. Many members of these two NGOs were also directly affected by the tornado. This may be why they confined their relief activities to only the Basail site.

[Table 6](#) shows that the assistance provided by the NGOs differed between the two study sites. For example, Concern's role in the Gopalpur study site was limited to constructing houses for the affected families, while in the Basail study site, in addition to building houses, Concern also distributed household goods among tornado victims. Another NGO, CARITAS, also provided relief assistance and constructed homes for tornado victims in the Basail site.

The NGOs provided three costly and more long-term types of relief items to tornado-affected families in the study villages: houses, latrines, and hand pump tubewells. Survey data suggest that 291 houses were constructed at the two study sites by Concern and/or CARITAS ([Table 7](#)). Two hundred sixty-six households from both study sites benefited from housing construction provided by the NGOs (10). It seems that families of the Gopalpur study site benefited more from the housing project because 84% of families from this study site had their homes rebuilt while only 75% received such aid in the Basail study site. This difference, however, will disappear in the near future. CARITAS plans to construct 188 additional houses for the tornado victims in the Basail site (Basail TNO, 1996). In fact, both CARITAS and Concern were building houses in the study villages at the time of field survey.

So far, Concern has built more houses than CARITAS ([Table 7](#)). This, even though the former NGO started to construct houses in the Basail study site a bit later than CARITAS began construction. All houses built by the NGOs are of the same size and are built with similar construction materials. Each house has a length of 15 ft. and a width of 10 ft. For these dwellings, corrugated tin is used as roof material and bamboo for the walls. Each house is built with 6 cement and 6 bamboo pillars, and the frame of the house is made of iron. Structurally, the houses built by the NGOs are stronger than most they replace. The newly constructed houses should offer better protection to their occupants from future severe storms than the houses destroyed by the tornado.

Due to the efforts of NGOs, housing conditions at both study sites have improved significantly since the tornado. For example, at the Gopalpur study site, only 28% of households had tin roofs prior to the tornado's devastation. Afterward, however, the percentage increased to 84%. In the Basail study site, the percentage of respondents who owned a house with a tin roof increased from 51% (pre-tornado) to 75% (post-tornado). Only about 49% of all households in Bangladesh have tin roofs (BBS, 1994a, p. 170).

The NGOs did not consider the socioeconomic conditions of households during their housing construction. It seems that the poor, who constitute landless and small farm households, benefited more from the housing project of the NGOs (11). In the Gopalpur study area, the percentage of landless and small farm households owning a tin-roofed house increased from zero before to 91 after the occurrence of the tornado. Similarly, for the Basail study area, the percentage of tin roofs among the poor increased from 12 to 73 ([Table 8](#)).

Before the tornado, only about 5% of the households in the study area had sanitary latrines; another 5% had open pit-type fixed latrines. Most people do not have such facilities and therefore use fields, riverbanks, and ditches for defecation purposes. This practice is one cause for the wide-spread incidence of diarrhea and worms in rural Bangladesh. Due to the installation of additional latrines, the sanitary conditions of the study area have improved significantly during the post-tornado period. The percentage of families having a sanitary latrine in the Gopalpur study site increased from 4% in the pre-tornado period to 49%, subsequently. The Basail study site experienced a

corresponding increase from 6% to 22%. This increase in latrine facilities is attributed to the construction of 98 new sanitary latrines in the study villages by the NGOs ([Table 7](#)). Sixty-six latrines were built in the Gopalpur study site, mostly by MSC. Among a total of 152 families, 62 benefitted from the latrines constructed by MSC. Concern and Oxfam built 32 latrines at the Basail study site and have plans to build more.

Although the NGOs built latrines without regard to the socioeconomic status of the tornado victims, it seems that landless and small farm households benefitted more from their construction than middle and large farm households. This is because the poorer households had no latrine facilities prior to the tornado, and they constitute 85% of the households in the villages studied. [Table 8](#) presents information on the number of sanitary latrines owned by the landless and small farm households before and after the tornado. The table shows that in both study areas, no landless or small farm household owned a sanitary latrine prior to the tornado, but some middle and large farm households did. These new latrines will reduce the incidence of diarrheal diseases and thus improve the health of the people in the study area.

The data collected from respondents indicate that while 22 new tubewells were installed in the Gopalpur study site mostly by MSC ([Table 7](#)), not a single tubewell was installed in the Basail study site. According to a government source (Basail TNO, 1996), Proshika plans to install 14 new tubewells in tornado-ravaged villages of the Basail thana. That number, however, seems to be inadequate. Again, the landless and small farm households of the Gopalpur study site benefitted differentially from the tubewell construction. In the pre-tornado period, none of them owned a tubewell; after the devastation, however, 12% of the landless and small farm households owned one.

DISCUSSION AND CONCLUSION

Data collected from the two sites in the tornado-affected area clearly show that victims received a great deal of emergency assistance from varied sources. People in the adjacent areas responded first to help victims. Their help began to decrease when assistance increased from the other sources involved. Local and national government entities and the various NGOs began recovery operations 24 hours after the disaster. Relief activity peaked during the first two weeks and then started to decline, by which time, most of the victims had resumed their normal daily routines.

Among all sources, the NGOs were the most effective and also demonstrated a leadership role in all aspects of the relief efforts during the aftermath of the 1996 tornado. Their participation did not consist merely of providing immediate relief, but also extended to rehabilitation of the affected population. NGOs responded similarly following the devastating floods of 1987 and 1988, and after the 1991 cyclone (Alam, 1994, p. 1; Haque and Zaman, 1994, p. 74). As noted earlier, a number of NGOs were still working in the study villages at the time of this field survey and planned to continue assistance in the area for several additional months. It is important to note that several foreign NGOs involved in the relief efforts lent their support to national NGOs rather than organize and execute projects themselves.

The national government generally assumes responsibility for rescuing the stranded, providing relief to the affected, and rehabilitating them into their normal activities. As noted above, in recent years NGOs in Bangladesh have taken over the leading role in organizing relief work for the disaster victims. This new trend is hardly surprising since an ever-increasing proportion of foreign relief assistance has been channeled through NGOs. Additionally, the Bangladesh government lacks adequate resources to provide sufficient support to disaster victims and is significantly less efficient in distributing relief items than the NGOs. Although the government in the United States is resourceful and efficient, the government should re-evaluate its role in mitigating the effects of natural disasters. This is particularly relevant because reducing 'big government' has recently become an important issue in the United States. Furthermore, NGOs from the more developed countries should assume greater responsibility in supporting victims of environmental hazards.

However, the amount of support received by the victims of the tornado can be considered adequate. This assistance not only minimized their losses, it also helped them to quickly reestablish their normal lives. It appears that most of the respondent households have benefitted financially as a result of aid received due to the tornado. Without aid, the economy and social conditions of the affected population would have been completely shattered.

Although there was virtually no communication or coordination among the many organizations providing support to the tornado victims, the relief efforts ran smoothly and effectively. Governmental personnel did not interfere in the process, probably because they knew they were not going to be able to meet all the needs of the disaster victims. Relief and rehabilitation have been undertaken with proper objectives and honest intentions. The field survey reveals that no one managed to obtain undue relief and rehabilitation aid. Unlike the past, the tornado did not provide an opportunity for politicians to promote political ends. At the time of the tornado's occurrence, an interim government was in power and the national election was scheduled to be held in June 1996.

The field survey suggests that the tornado victims did not receive support specifically for seeds, cattle, and agricultural implements. Although they can buy these with the cash they received, it would be more helpful to the victims if the government provided agricultural loans to defray the cost of these items to raise the next crop. Fishermen, carpenters, and blacksmiths of the Basail study site did not receive assistance from the government for re-acquiring lost tools and equipment such as boats and fishing yarn.

As noted earlier, many families experienced the loss of loved ones as well as injuries and had a difficult time in their attempt to recover from the disaster. Social and psychological services, which are virtually absent in the study area, are desperately needed for the victims. The tornado uprooted many trees, and as yet no attempt has been undertaken to plant new trees in the affected villages. Lastly, in the wake of this disaster, continuous weather monitoring, tornado forecasting, and the issuing of warnings are now considered essential by most respondents.

Many NGOs in the country have been endeavoring to develop programs on disaster mitigation and management (Alam, 1994, 1). In the absence of any systematic study on tornadoes, the findings of this report will help the NGOs in their attempt to design programs for disaster preparedness. The findings will also be useful to the disaster prevention programs of the Bangladesh government. From an academic point of view, the present study can provide a new dimension to the growing literature on environmental hazards in Bangladesh. The conceptual framework used in this report can also be applied to other countries as well as to other natural hazards.

NOTES

1. A typical village in Bangladesh contains between 30-500 households. Several villages form a union, and several unions form a thana. A thana is the basic administrative unit in Bangladesh, while a district is the second largest administrative unit, consisting of several thanas.
2. A household is a group of people in a housing unit living together as a family and sharing the same kitchen.
3. The head of the household is defined as the person who makes the major economic, social, and household decisions irrespective of age or gender.
4. Landless households do not own any farm land, but they own homes.
5. Following the latest agricultural census of Bangladesh, the landholding size is classified into three categories: small (up to 2.4 acres), medium (2.5-7.4 acres), and large (7.5 acres or more) (BBS, 1994b, p. 158).
6. The institutionalized groups are defined as the registered target groups of government and NGOs such as agricultural cooperatives, credit unions, and women's groups.
7. Three rice varieties (aman, aus, and boro) are grown in three different cropping seasons in Bangladesh. Aus and jute are the crops of kharif season (late March to early September), while aman is grown in haimantic season (August to early December) and boro in rabi or dry season (late November to early April). These seasons partially overlap.
8. This is partly explained in terms of socioeconomic differences between the respondents of the two study sites. In

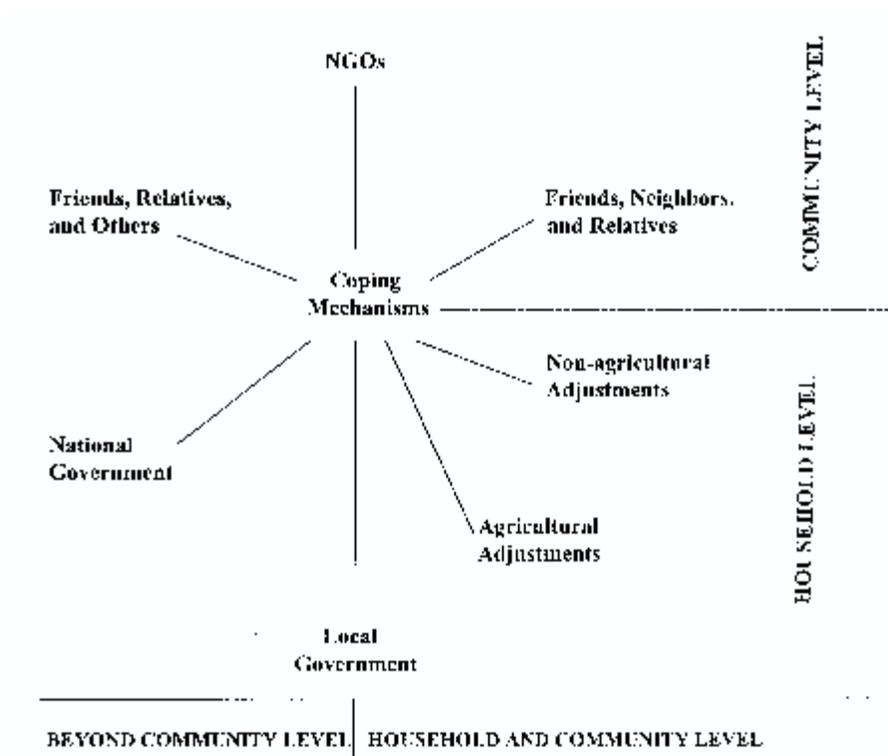
addition to affording privacy and some protection against storms, trees are also a source of family income, particularly for the poor.

9. Regardless of religious affiliation, RK Mission provided relief to all tornado victims of the Basail study site.
10. NGOs built more than one house for some tornado-affected families.
11. Hereafter, the term poor will be used for these two groups of households.

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Figure 1. Conceptual Framework for Coping with Disasters

**Table 1. The Study Sites**

Study Site	Village	Name of Union	Thana	No. of Household Interviewed
Gopalpur	Mantala	Alamnagar	Gopalpur	38
	Baravita	Alamnagar	Gopalpur	76
	Barakhali	Mirzapur	Gopalpur	38
Basail	Mirikpur	Basail	Basail	186
Total				338

Table 2 . Some Selected Characteristics of the Heads of the Households

Characteristic	Gopalpur No. (%)	Basail No. (%)	Total No. (%)
<i>Primary Occupation</i>			
Farming	106 (70)	83 (45)	189 (56)
Business	14 (9)	9 (5)	23 (7)
Service	9 (6)	9 (5)	18 (5)
Parental occupation*	-	81 (43)	81 (24)
Laborer	23 (15)	4 (2)	27 (8)
Total	152 (100)	186 (100)	338 (100)
X2=			
<i>Landholding Size</i>			
Landless	40 (26)	29 (16)	69 (20)
Small	90 (59)	129 (69)	219 (65)
Medium and Large	22 (15)	28 (15)	50 (15)

Total	152(100)	186(100)	338(100)
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$\chi^2 = 6.231$ (d.f. = 2 and $p = 0.05$)

Education

Illiterate	101(66)	114(61)	215(64)
1-5 yrs. of schooling	36(24)	26(14)	62(18)
> 5 yrs. of schooling	15(10)	46(25)	61(18)
Total	152(100)	186(100)	338(100)

$\chi^2 = 7.743$ (d.f. = 2 and $p = 0.05$)

Membership Status

Yes	100(66)	119(64)	219(65)
No	52(34)	67(36)	119(35)
Total	152(100)	186(100)	338(100)

$\chi^2 = 2.651$ (d.f. = 1 and $p = 0.72$)

*Includes blacksmiths, fishermen, and carpenters.

Table 3 . Deaths of Livestock Caused by the Tornado

Study Site	Household Experience Deaths No. (%)
Cattle	
Gopalpur	36(24)
Basail	17(9)
Study Area	53(16)
Poultry	
Gopalpur	139(91)
Basail	101(54)
Study Area	240(71)
Goat/Sheep	
Gopalpur	40(26)
Basail	6(3)
Study Area	46(14)

Table 4 . Damages to Houses

Study Site	Complete No. (%)	Partial No. (%)	Total No. (%)
Gopalpur	144(95)	8(5)	152(100)
Basail	172(92)	14(6)	186(100)
Study Area	316(93)	22(7)	338(100)

Table 5 . Damages to Tree and Stored Crops

Study Site	Damaged No. (%)	Not Damaged No. (%)	Total No. (%)
Tree			
Gopalpur	139(92)	13(8)	152(100)
Basail	163(88)	23(12)	158(100)
Study Area	302(89)	36(11)	338(100)

Stored Crops			
Gopalpur	114 (75)	38 (25)	152 (100)
Basail	112 (60)	74 (40)	186 (100)
Study Area	226 (67)	112 (33)	338 (100)

Table 6 . Activities of the NGOs in the Study Sites

NGO	Study Site		Remark
	Gopalpur	Basail	
Proshika	No	Yes	Distributed relief goods*, repaired and installed tubewells, and provided emergency medical treatments for injuries
Concern	Yes	Yes	Distributed relief goods**, built/building houses and latrines
CARITAS	No	Yes	Distributed relief goods, built/building houses and latrines
BRAC	Yes	Yes	Distributed relief goods
Red Crescent	Yes	Yes	Distributed relief goods, tent, water purification tablets, medical supplies, and sent medical team
SDS	No	Yes	Distributed text books and installed tubewells
Ram Krishna Mission	No	Yes	Distributed relief goods
Oxfam	No	Yes	Distributed relief goods and built latrines
RSD	No	Yes	Distributed relief goods
SSS	Yes	No	Distributed relief goods
MSC	Yes	No	Built latrines
ASA	Yes	No	Distributed relief goods

*Includes items such as rice, flour, cereal, pulses, potatoes, biscuits, cane sugar, clothes, utensils, salt, oil, lamps, water bottle, plastic, tent, and cash.

**Distributed only at the Basail study site.

Table 7. Number of Houses and Latrines Built, and Tubewells Installed in the Study Area

NGO	Gopalpur Site	Basail Site	Total
House			
Concern	151	48	199
CARITAS	-	92	92

Total	151	140	291
Latrine			
MSC	66	-	66
Concern	-	21	21
Oxfam	-	11	11
Total	66	32	98
Tubewell			
MSC	20	-	20
Bangladesh Army	2	-	2
Total	22	-	22

Table 8 . Ownership of House with Corrugated Tin Roof, Sanitary Latrine, and Tubewell by Landless and Small Farm Households

Study Site	Ownership		Total
	Yes	No	
House			
Gopalpur			
Before Tornado	0 (0)*	130 (100)	130 (100)
After Tornado	118 (91)	12 (9)	130 (100)
Basail			
Before Tornado	19 (12)	139 (88)	158 (100)
After Tornado	115 (73)	70 (27)	158 (100)
Latrine			
Gopalpur			
Before Tornado	0 (0)	130 (100)	130 (100)
After Tornado	53 (41)	77 (59)	130 (100)
Basail			
Before Tornado	0 (0)	158 (100)	158 (100)
After Tornado	28 (18)	130 (82)	158 (100)
Tubewell			
Gopalpur			
Before Tornado	0 (0)	130 (100)	130 (100)
After Tornado	16 (12)	114 (88)	130 (100)

*Figures within parentheses indicate percentage.

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