

The Bangladesh Cyclone of 1991

On April 30, 1991, Cyclone Marian swept across the southeastern coast of Bangladesh, lashing the area with winds up to 210 kilometers per hour and gusts up to 235 per hour. A storm surge of over six meters submerged coastal areas and small offshore islands, causing massive loss of life and destruction. Approximately 13.4 million people lived in the affected areas. As sea waters receded and more bodies were uncovered, the death toll rose to almost 139,000, with an equal number of injured. On Kutubdia, an offshore island with a pre-cyclone population of 110,000 people, more than 20,000 died. An aerial survey of the island by USAID staff revealed that 80 percent to 90 percent of all structures were destroyed and all livestock lost. Entire populations were wiped out on some of the smaller islands.

Many of the storm's survivors remained marooned without shelter or in overcrowded temporary shelters for days after the storm. Continuing rain and rough seas hampered relief efforts. The lack of a safe water supply and proper sanitation caused a dramatic rise in the incidence of diarrhea and dysentery, with as many as 2,000 associated deaths during the first three weeks following the cyclone.

Damage was widespread and severe in all sectors. According to Government of Bangladesh (GBD) estimates, 780,000 homes were destroyed, 9,300 schools damaged or destroyed, and 655 health centers damaged or destroyed. Power, water, and communications lines to the affected areas were cut, and train, road, and air service was disrupted. More than 190 kilometers of coastal embankments were destroyed and 940 kilometers damaged. Numerous tubewells were damaged or contaminated. In many areas, surface water was salinized, including ponds used for bathing and cleaning. Almost all industries in the port area of Chittagong suffered heavy damage, and the port itself was left in shambles.

The agricultural sector sustained serious disruptions. About 247,000 tons of cereal crops and 35,000 tons of vegetables, tubers, and other crops were lost. Damage to coastal embankments, high salinity in some areas, and a shortage of tools, seeds, and fertilizers made the prospects for the main rice crop (June-October) bleak. About 224,000 head of cattle, 218,000 goats, and 2.4 million head of poultry were estimated to have perished in the cyclone. Surviving livestock were in poor health and lacked adequate feed. Losses in the fisheries sector were just as calamitous, with extensive damage to 31,000 hectares of shrimp farms as well as to fish processing plants, vessels, and stocks. The forestry sector suffered considerable losses of fuel wood and timber, and coastal mangrove plantations were damaged, increasing the possibility of serious coastal erosion in the future. These losses were expected to be serious obstacles to the affected population's ability to return to its prior means of livelihood. Cyclone Marian was one of the worst rapid onset disasters of the late twentieth century.

The cost of reconstruction and rehabilitation was put at \$1.78 billion by an UN task force that investigated the cyclone's impact. The Bangladeshi government and the international community launched a major response to the cyclone disaster. The US government alone gave almost \$28,000,000 to the disaster response and recovery efforts, including \$4.7 million for OFDA-funded relief efforts, \$1.9 million for the purchase and transport of 9,850 metric tons of P.L 480 wheat, and \$14.3 million for Department of Defense expenses under "Operation Sea

Angel,” a Section 506A activity which allowed for the draw-down of articles and services from DOD stocks for disaster relief and rehabilitation. Operation Sea Angel activities included transporting relief items from Dhaka to Chittagong, repairing roads, and fielding preventive medical and water purification units. All activities were fully integrated into the Government of Bangladesh’s relief operation. ⁱ

Lessons Learned – Operation Sea Angel Relief Operationⁱⁱ

- The U.S. joint task force (JTF), attempted to maximize the civilian population's participation in the operation - coordinating all its activities with the Bengali government and various nongovernmental organizations. The coordination facilitated the military withdrawal as the situation transitioned from relief to rehabilitation.
- The JTF also sought to maximize the impact of the operation’s activities on the devastated civilian population. Civilians were encouraged to trust the military force's ability to provide safe, reliable supplies (such as filtered water). Because of the massive devastation throughout Bangladesh, the operation minimized the military footprint and the burden placed on civil society by military demands.

Lessons Learned – Disaster Preparedness and Mitigation

- **A credible warning system is essential.** After the cyclone, there was a recognition that many vulnerable people had either not received the warning that a major cyclone was imminent or had not believed or responded to the warnings, and many attempts to improve warning systems followed. A survey conducted several years after the cyclone struck found that half of the affected population did not believe it had received enough warning. Over 75% said that the messages were not believable. Warning systems were improved in the years between the 1991 cyclone and another cyclone in May 1994; 81% of surveyed residents felt that the warning system in 1994 was better than the warning system in 1991. Still, not all households took preparatory actions for the 1994 cyclone, reinforcing the necessity of convincing people to take appropriate actions before a cyclone hits. In addition, in 1994 it was found that the system for numbering cyclones was a source of confusion. A numbering system that more closely corresponded to people’s perceptions of cyclone danger would have been valuable. ⁱⁱⁱ
- **Adequate shelter must be available and accessible, and residents must not delay in seeking shelter.** Some of those who attempted to respond to the warnings in 1991 could not find appropriate shelter. Investigations afterward found that the number of shelters was not adequate for the number of people at risk. Casualties were significantly lower in areas where people had made use of existing cyclone shelters. In the years immediately following the cyclone, there were many attempts to improve and increase the number of shelters. Following the 1994 cyclone, 90 percent of surveyed residents felt that there was more shelter space than there had been in 1991. When the May 1994 cyclone struck, a majority of residents in the affected areas sought shelter, with 80% ending up in shelter outside their homes. About 73 percent of residents from Kutubdia, which had been hardest hit by the 1991 cyclone, sought shelter in a form cyclone shelter. Many residents

in another affected area, however, did not leave for shelter until after their homes had collapsed, a delay that put them in greater danger. Although people felt that there was more shelter space in 1994 than in 1991, the major complaint of those who went to a cyclone shelter was that there was not enough room to move. The increase in shelter numbers and capacity was not enough, and continued efforts were needed. One suggestion was that shelters that can also serve as schools and community centers be built, so that the buildings are put to use during non-cyclone periods. In 1994, one of the main complaints people had in getting to the shelter was that the roads were bad.^{iv}

- **Good preparation helps disaster recovery and reduces damage; education is important.** Household level preparations such as burying food and water, removing handles from pumps, and moving livestock to higher ground can significantly aid recovery and reduce damage. Three years after the 1991 cyclone, preparedness activities were still not well established. This showed that there was a need to explore introducing a cyclone preparedness instruction into the curriculum of formal and non-formal primary education in cyclone-prone areas.^v
- **Coastal embankments, though not without costs, can help protect communities exposed to flooding.** Coastal embankments reduce saline flooding from high lunar tides and storm surges. However, in the case of cyclones, there must be cyclone shelters to provide protection from the high winds and rain. The costs of such embankments are high, as well as highly variable, depending on the slope of the accreted land to be embanked. Great care needs to be taken to ensure that adequate drainage for rainfall runoff is provided and that the embankment location takes into consideration the location of saline water shrimp activities. Embankments need to be designed, constructed, and managed in a multi-purpose way in order to maximize their benefits as places of residence, economic production (from forestry), and transport. One major negative impact is the effect on the movement of migratory fish species. In addition, in cases where settled land has to be acquired for construction purposes, significant conflicts can arise. Careful planning is needed to reduce disruptions to navigation. Embankments often give a false sense of security to some people who wrongly imagine they can take refuge on them.^{vi}
- **Afforestation in coastal areas and sustainable forest management can help mitigate the effects of cyclones.** The GBD implemented coastal mangrove planting projects, and the impacts of forestry planting in the coastal areas were nearly all found to be positive. Planting coastal areas with appropriate mangrove species for cyclone protection assists in land stabilization and dissipation of wave energy. Maintaining productive use of the land is also important. Such a policy would need to be managed in a sustainable way, including thinning and cutting the mangroves at suitable times and carrying out forest planting and management activities with the full participation of local people. Appropriate vegetation that do not cause damage to coastal areas is needed (bananas are particularly problematic). The use of species with a splayed root system, which assists in stabilizing the earth, is ideal. Disputes over rights to previously accreted as well as new land can make the execution of an afforestation policy difficult. The planting of forests may be in competition with the use of land for grazing, however with careful and

sensitive management both can co-exist. One negative result of planting forests is an increased risk of malaria, which forest habitats create by providing a suitable breeding ground for mosquitoes.^{vii}

ⁱ Brilliant, Franca, *et al* (1992) *OFDA [Office of Foreign Disaster Assistance] Annual Report FY 1991*. Arlington, VA: Labat Anderson, Inc. and Washington, DC: USAID Office of Foreign Disaster Assistance.

ⁱⁱ Adam Siegel, "The Minimize -Maximize Continuum and the Civil Military Operations Mission," *Special Warfare*, Summer 2000, (http://www.findarticles.com/p/articles/mi_m0HZY/is_3_13/ai_72765194)

ⁱⁱⁱ Helen Keller International (1994) *How Ready Were We? Results from the HKI/UNDP Post-Cyclone Study*. Dhaka: HKI and the UN Development Programme.

^{iv} *Ibid.*

^v *Ibid.*

^{vi} Karim, Nehal (no date) *Options for Cyclone Protection: [The] Bangladesh Context*. Dhaka: University of Dhaka, Department of Sociology.

^{vii} *Ibid.*