SANDEE
South Asian Network for Development and Environmental Economics

POLICY Brief

Number 49-10, November 2010

Natural Barriers, Public Investments and Private Expenditures – Coping with Storm Damages in Bangladesh

Tsunamis, hurricanes, tidal bores and other large storms threaten many coastal communities in Bangladesh. With climate change, the frequency of such natural disasters is expected to rise and it is becoming increasingly difficult for the country's government to support enough public initiatives to properly protect coastal communities. In an attempt to find solutions to this problem, a SANDEE study has looked at some of the key factors that affect how coastal communities protect themselves.

The study is the work of Sakib Mahmud and Edward B. Barbier from the University of Wyoming. The study finds that public protection programs and the presence of mangrove forests influence the amount that people spend to defend themselves from the impact of extreme storms. However, considering uncertainties surrounding the capacity of mangroves to protect life and property against tsunami-type storm surges and the government's own capacity to cope with disasters, the study recommends that the government take more steps to encourage collective and individual participation in storm protection activities. One option is to subsidize housing construction costs so households can convert mud houses to brick. Any policy measures that help diversify post-storm household income would also enhance the ability of households to cope with disasters.

BANGLADESH'S COASTAL REGION UNDER THREAT

The coastal region of Bangladesh is subject to disastrous cyclones every year, due to the unique geographical characteristics of the coast. Between 1877 and 1995, over 50% of the world's tropical storms with a death toll of 5,000 or more have taken place in the country. These large storm-inflicted casualties are caused by high population densities and the poor socio-economic conditions that exist along the coast of Bangladesh.

Given the scale of the problem and a lack of government resources, policy makers are looking at how they can encourage individuals and communities to do more to protect themselves. To help in this process, the study examines two key issues that influence the way in which communities protect themselves from storms and to minimize the impact of any damage that storms produce.

PROTECTION THROUGH GOVERNMENT PROGRAMS AND NATURAL BARRIERS

The first issue the study assesses is the impact of public disaster relief efforts and rehabilitation programs. It is thought that individuals have a tendency not to insure themselves against natural disasters when they believe help will be available from outside sources, either via public-sponsored programs or private charities. Hence, it is thought that public protection programs have the potential to partially or fully crowd out private storm protection actions. This behavioral pattern is termed the 'charity hazard'.

The second issue the study assesses is the impact of living in close proximity to mangrove forests. There is considerable debate on whether mangroves play a significant role in protecting life and property against cyclones and other severe storm and wave damage. Despite this

This policy brief is based on SANDEE working paper No. 54-10, 'Are Private Defensive Expenditures against Storm Damages Affected by Public Programs and Natural Barriers? Evidence from the Coastal Areas of Bangladesh' by Sakib Mahmud and Edward B. Barbier, University of Wyoming (UW). The full report is available at: www.sandeeonline.org

uncertainty, it is thought that the government often invests less in storm protection measures in areas that have dense mangrove forests. This, in turn, may mean that households living close to a mangrove forest will invest more to protect themselves against storm damage, because they have low expectations about the government protection they will receive.

Table: Accessibility to Public Goods in the Study Area

Sl. No.	Variable Name	Protected Area (obs.)	Non-protected Area (obs.)
1.	House located inside embankment (%)	34.56 (217)	81.43 (280)
2.	Cyclone shelter close to house (%)	44.19 (215)	61.73 (277)
3.	Planning to migrate in future (%)	50.91 (220)	18.25 (274)
4.	Reasons for future migration (%)		
	Unemployment	41.96	36.54
	Floods	37.50	65.38
	Cyclone & storm surge	73.21	59.62
	Lack of opportunity	71.43	46.15
	Poverty	39.29	30.77
5.	Access to relief (%)	90.00	88.53
6.	Access to rehabilitation (%)	64.68	46.35

EXAMINING THE IMPLICATIONS OF CYCLONE SIDR

This study was carried out in November 2008 in 35 villages that lie along the southwest coastal area of Bangladesh. This area falls in a high cyclone risk zone. Indeed, it suffered a severe cyclone-induced storm surge event in November 2007, when Cyclone Sidr hit. Researchers were able to talk to 500 households less than a year after they had been affected by this economically damaging severe storm event. They were able to get information based on both public records and individual recollections of the event.

The area was also chosen because Cyclone Sidr affected both households that did not have a natural storm protection barrier and households that were located behind the Sundarban mangrove forest (which acted as a natural storm protection barrier). Households in the study area also had different levels of access to public programs such as embankments and cyclone shelters.

SELF PROTECTION AND SELF INSURANCE IN PROTECTED AREAS AND NON-PROTECTED AREAS

Using GIS mapping, the study area was divided into two: areas that are located behind the Sundarban mangrove forest (defined as protected coastal areas) and areas without mangrove forest (defined as non-protected areas). Random area sampling was used to select the specific survey locations in the protected and non-protected areas.

To find out exactly how government protection measures and mangrove forests affect the storm protection measures that individuals and communities take, the study examines how much households spend on defending themselves from storms. The study assesses two types of household expenditures: Firstly, investments that reduce the probability of storm surge risks, called “self-protection”; and secondly, expenditures that reduces the impact of damage if a storm hits, called “self-insurance”.

Examples of ‘self-protection’ include converting a mud-built house to a brick-built house, raising the height of the homestead, moving the house inside the embankment, and taking refuge in a neighbor’s house. ‘Self-insurance’ is usually in the form of opportunities for households to diversify post-disaster income, options to increase borrowing through different formal and informal sources, and the possibility of receiving private transfers through remittances and charities.

Researchers also collected information on the demographic and socio-economic characteristics of the study households. Meteorological information was gathered on Cyclone Sidr along with geophysical information about the Sundarban mangrove forest.

THE COST OF CYCLONE SIDR AND DIFFERING PREVALENCE OF PUBLIC PROTECTION

The study finds that the average cost of the damage caused by Cyclone Sidr to households in the non-protected areas was around Tk. 102,000 (US $1480). These costs were higher than for those households located in protected areas – the average costs to such households was Tk. 91,588 (US $ 1,329). This suggests the possibility that the Sundarban mangrove forest played a role in reducing the impact of the cyclone Sidr.

The majority of the households that suffered Cyclone Sidr-inflicted damages had yearly incomes below Tk. 100,000 (US $1450). Among the households that took ex ante private defensive strategies, low-income households in all areas spent a higher portion of their income (more than 50%) to prevent storm damage (before storms hit) than more affluent households (who spent 20% of household income). Thus, the burden of storm protection is higher on the poorest of households.

Extent of damage to mangrove forest due to Cyclone Sidr

As hypothesized, households from non-protected areas have better access to public programs than households from the protected areas. For example, over 80% of the households in the non-protected areas live inside a protective embankment; while only 35% of the households from the protected areas live inside such an embankment. Similarly, 62% of households in the non-protected areas live close to a cyclone shelter, as compared to only 44% in the case of households in the protected areas.

HOW HOUSEHOLDS INVEST IN STORM PROTECTION

One of the key findings of the study is that public disaster relief and rehabilitation programs lead to households investing more in self-insurance but less in self-protection. Interestingly, less than 50% of the households in all of the study areas had made any changes to their dwellings to reduce exposure to storm surges. This was despite the fact that more than 50% of these people believed that their houses could be potentially damaged by storms due to the fact that they are located at low elevations.

The study also finds that households protected by mangroves (i.e. in the protected areas) spend more on before-the-event self-protection and less on after-the-event self-insurance, than those in the non-protected areas. This implies that households in the non-protected areas have higher expectations of facing future cyclone-inflicted damage than households in the protected areas. Their higher investments may also reflect lower expectations about government relief services after an event.

In the study, household income and the size of household assets showed a strong influence on a household's choice of self-protection but not on self-insurance. However, the study also reveals that the middle-income households were more likely to participate in both self-protection and self-insurance activities in comparison to low-income and rich households as well. This is probably because middle income households perceive that they have more likely to lose from storm-inflicted damages since they are neither in a position like the low- income households, where there is nothing to lose; nor are they in the position of richer households who can rely on their assets and access loans to cope better against storm-inflicted damages.

ENCOURAGING PRIVATE STORM PROTECTION MEASURES

It is possible that the government of Bangladesh may not be able to support enough storm protection programs in the future due to a lack of resources and because of an increase in the frequency of storms. In light of this challenge, and in response to its findings about the impact of public storm protection measures, the study recommends that the government should focus its programs in both protected and non-protected areas and encourage more collective and individual participation in storm protection measures.

In addition, it recommends that the government refrain from planting mangroves in inappropriate environmental settings as this may reduce long-term ecological sustainability (as revealed in post tsunami analyses in Sri-Lanka). Instead, it should promote sensible coastal development and disaster preparation programs delivered through individual and collective participation. These programs should enhance the long-term capacity of people to cope with and adapt to future storm-inflicted damage.

Recent reports on climate change show that the severity of cyclones due to climate change is increasing on a global scale. This means that many poor coastal communities around the world will be facing similar challenges to those in Bangladesh. This makes the finding of this study of general interest to policy makers across South Asia.

CYCLONES AND MANGROVES

Meteorologists and researchers consider Cyclone Sidr, which made landfall on the southwestern coastal areas of Bangladesh on 15th November 2007, to be the most severe storm event to strike

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Bangladesh in recent times. It had a diameter of nearly 1,000 km and sustained wind speeds of up to 240 km per hour. The cyclone was accompanied by a maximum tidal surge height of 5.2 meters in some affected areas. Although early warning systems contributed to the successful evacuation of coastal people and helped many people escape, a total of 3,406 people died due to Cyclone Sidr. About 1,000 were declared missing and over half a million sustained physical injuries. There was also extensive damage to houses, livestock, crops and trees. According to a report by the World Bank and the Government of Bangladesh, the cyclone affected around 2.3 million households to some degree and about one million households very seriously. This report estimates total damages and losses at about US $1.7 billion.

The Sundarban mangrove forest suffered extensive damage when Cyclone Sidr hit. Studies have estimated that the cyclone severely affected approximately 30,000 acres of forest resources and partially affected another 80,000 acres. Located along the southwest coast of Bangladesh, the Sundarban mangrove forest is considered to be the world's largest mangrove forest, spanning 2,316 square miles or around 6,000 square km. It is also a world natural heritage site. Some 3.5 million coastal people depend directly or indirectly on resources from these forest for their livelihoods. These resources include timber, grass, honey, wax, fish and shrimp fry.

The mangrove forest was a particular focus for the study because, according to many scientists, coastal areas with dense mangrove forests suffer less storm damage compared to areas where mangroves have either been completely destroyed or have been converted to other land uses. Studies have found that waves can be reduced in energy by 50% by a mangrove forest. However, there is still debate on whether such forests play a significant role in protecting life and property against very severe cyclones and other large storm surges. As Bangladesh is faced with the prospect of increasingly severe tropical cyclones due to climate change, it is of paramount importance to know whether the current capacity of the Sundarban forest can provide households with an effective safeguard against future storm-inflicted damage.

This policy brief is an output of a research project funded by SANDEE. The view's expressed here are not necessarily those of SANDEE's sponsors.

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