
Impact of
climate related shocks and stresses on nutrition and food security
in selected areas of rural Bangladesh
WFP
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Investing in rural people

Executive Summary

Background

With a population over 156 million people, 80 percent of whom live in rural areas, an average density of 940 persons per km2 (the 9th most densely populated country in the world) and 70 percent of land area five meters or less above sea level, environmental hazards such as floods, cyclones, salt water intrusion and river erosion are expected to have massive destructive impacts in Bangladesh. In effect it is estimated that 30 to 50 percent of the country is affected by severe climatic shocks every year (WFP 2012a). These events have killed hundreds of people and injured thousands, ruined thousands of hectares of crops and washed away large areas of cultivable land, homes, and productive assets, amounting to huge human and economic losses.

In Bangladesh, undernutrition has long been recognized as a problem of significant magnitude, with 24% of women underweight and 13% of short stature, 41% of children under five years of age stunted in 2011, and 36% underweight (BDHS 2011). Undernutrition rates in Bangladesh are already among the highest in the world (NDRI 2010). In this context, a legitimate question is whether these described extreme events that are continuously affecting Bangladesh contribute significantly to the situation of undernutrition. One hypothesis is that the impact of climate related shocks and stresses on food security and nutrition in Bangladesh could be particularly severe given the reliance of a majority of poor rural households on agricultural livelihoods.

In March 2012, the World Food Programme (WFP) therefore conceptualized a study to "develop an improved knowledge and understanding of the impacts of climate change on food security and nutrition" in Bangladesh and more specifically to determine how climate-related shocks and stresses exacerbate the already high levels of food insecurity and undernutrition in the country.

The present report is the result of this study. It brings together the efforts of a multi-disciplinary team of researchers from Helen Keller International (HKI), the Bangladesh Centre for Advanced Studies (BCAS), and the Institute of Development Studies (IDS) to look at the impact of extreme events (what we refer to as climate-related shocks and stressors) on the food security and nutrition status of communities in rural Bangladesh. Funded by the International Fund for Agricultural Development (IFAD) and WFP, the study uses existing quantitative data and collected qualitative data, to attempt to address the current gap in knowledge related to these climate related shocks and stresses in relation to food security and nutrition in Bangladesh.

80% people of the population over **156 million**, live in rural areas of Bangladesh

Methods

The quantitative analyses combine the Nutrition Surveillance Programme (NSP) dataset collected by HKI and a compilation of environmental and disaster-related data. The NSP provides data that are statistically representative of rural Bangladesh. Rounds of data collection take place every two months to capture seasonal changes in nutrition, health, household demography, socioeconomic status and distress, and local food prices. For nutrition, children's z-scores of length/height for age and weight for length/height were calculated. Children with z-scores more than -2 standard deviations below the reference median were classified as stunted or wasted.

Although other household-level datasets exist (e.g. the Household Income and Expenditure Survey (HIES) or the Child and Mother Nutrition Survey (CMNS)), the NSP is the only long-time series that provides data at a frequency (bi-monthly) that permits the capture of potential changes in nutrition and food security indicators following the impact of shocks.

Various data sets were used to identify the occurrence of shocks and stressors. Six different types of climate-related events were initially considered: flood and flash flood, drought, cyclone, river bank erosion, and salinity intrusion. For flood and flash flood, the daily water level recorded by the Bangladesh Water Development Board (BWDB) was used to identify flooding events. The daily rainfall data also recorded by the BWDB was used to identify drought events. Salinity intrusion was estimated through the Program Soil Salinity data collected by the Soil Resource Development Institute (SRDI). For cyclone the International Best Track Achieve for Climate Stewardship (IBTrACS) dataset was used to generate a map of the different cyclones and tropical storms that affected Bangladesh over the period 1995-2008. Finally for river bank erosion it was initially planned to use the River Cross Section dataset collected by BWDB. However this dataset was later discarded due to the absence of a clear methodology on how to correlate the data with the occurrence of specific river erosion events.

The conceptual framework used to structure the research derives from the UNICEF 1990 Strategy for improved nutrition of children and women in developing countries framework, the IDS/DFID sustainable livelihood framework, and incorporates some recent thinking around resilience to shocks in the context of food security. The analytical framework identifies a series of variables and interactions which are important to consider if one aims at assessing the food security and nutrition status of communities exposed to climate-related extreme events but also the specific resilience strategies that are adopted by households and communities as a response to these shocks.

In order to test as rigorously as possible the potential impact of specific events on household food security and child and maternal nutrition, a quasi-experimental approach was followed. Wherever possible, a difference-in-difference

(DiD) protocol was adopted to compare the values of a particular indicator (nutrition or food security) obtained for two groups of communities: one group affected by a specific event (treatment), and one group not affected by the same event (control). The comparison was run with data collected before and after the period when that specific event occurs.

For salinity intrusion –for which the chronic nature of the event made the DiD approach non-applicable - a difference in means (DiM) approach was used instead. In addition, for salinity and for river bank erosion - for which it was not possible to match the NPS data with the river datasets - two qualitative investigations were implemented instead, one in Gaibandha in the north-west of the country where river bank erosion and floods are common and one in Satkhira in the southern coastal area where saline intrusion is now a recurrent problem. In both areas, key informant interviews, focus group discussions, and in-depth interviews were conducted.

For the quantitative analyses, three types of models were used: (i) individual-event models where specific shocks (e.g. the 1999 drought in Naogoan, or the 1996 flood in Manikganj) were tested individually using the DiD protocol; (ii) joint-event models where all the shocks of same type (e.g. all the cyclone events or all the droughts) were pooled together and tested using the DiD protocol; and (iii) combined-event models where drought and flood, and cyclone, flood and salinity events were pooled together and tested using the DiD protocol. This analysis allowed us to disentangle the impact of different types of event as many areas experience multiple events in the same year.

The analysis presents some limitations. First, not all the variables that were identified through the framework as potentially important in relation to the food security and nutrition status of the communities were available, or it was not possible to identify adequate proxies. This eventually limited our ability to explore some aspects related to resilience. Second, only households still living in the affected areas were surveyed and any individual or family that would have migrated somewhere else (e.g. neighboring town, provincial capital, or even Dhaka) as a consequence of past events were therefore not included in the analysis. Finally because it explores the potential interaction between different types of shocks and stressors and incorporates them into one single framework, the analysis is relatively complex and data intensive. Like any complex analysis it has to be considered with caution.

Main findings

This study is the very first one that includes a comprehensive analysis of (initially) 6 different types of climate-related shocks and stresses: drought, flood and flash flood, river bank erosion, cyclones and salinity intrusion, and proposes to analyse the impact of these different types of events over a long period (1998-2006), relying on a rigorous, systematic and replicable approach that combines household-level food security and nutrition data with environmental time-series while controlling for household and community characteristics. It is also unique in that it is the first analysis of this type which, in addition to single types of events, also tested multiple events of the same types and combined types of events: drought and flood together; and cyclone, flood, and salinity together.

The very first conclusion that emerges is that working on identifying possible impacts of climate related shocks and stresses on household food security and child and maternal nutrition is both data-demanding and complex. A few of the results that emerged were challenging, counter-intuitive or even difficult to interpret. For others, coherent and more robust conclusions were reached only after comparing and combining the results of several individual tests or after triangulating the quantitative and qualitative analyses. The importance of combining several events in order to reach robust conclusions also means that one needs to resist the temptation of cherry-picking single cases in order to 'demonstrate' what we think are the 'coherent' findings.

Flood

A series of robust and coherent 'stories' emerge from this analysis. The first one relates to flood. Our analysis shows with strong statistical evidence that the prices of a food basket in communities affected by flood events are higher than in the control communities, and that this effect lasts for up to 9 months after the flood. This is consistent with the findings of the qualitative analysis which reveals that, while most food items are available in local markets, their prices are higher than in a normal period. The evidence that communities affected by flood take more food loans or have a higher share of their expenditure allocated to food than control communities is not clear. In terms of nutrition the analysis demonstrates with strong statistical evidence that the weight for height z score amongst children who live in communities affected by flood is lower (i.e. wasting rate is higher) than in the control communities, and that this 'peak' of acute undernutrition occurs around 5 months after the flood event. The analysis failed however to find any robust evidence that flood contributes to chronic undernutrition (stunting), or affect maternal body mass index. Finally the data suggests some strong positive impact on dietary diversity.

Drought

The second relatively solid story is about drought. Our analysis shows some relatively strong evidence that prices of food are higher after a drought and that this effect lasts for up to 9 months after the events. The analysis also suggests that as a response to the price peaks, communities increase the share of their total expenses allocated to

food and that they do so (at least partially) by undertaking food loans. These strategies don't seem sufficient however to prevent chronic undernutrition amongst the children living in these communities. Our analysis found degree of evidence that drought events are associated with lower children's length/height-for-age z-score (higher stunting rate) around 5- and 9-months after the drought event started. On the other hand, no robust or consistent effects of drought on level of children's acute undernutrition (wasting) were found. Likewise the analysis did not find any robust evidence that drought events negatively affect the mother's body mass index, or the children and maternal dietary diversity indexes.

Cyclones

The third solid story relates to the impact of cyclones. First the analysis of food price indicators provides strong statistical evidence that communities hit by cyclones also have to face higher food prices. These price peaks can last up to 7 months for the most severe cyclone events but are generally less for lower intensity storms. Data also show that households take (statistically) higher food loans only for these more severe events. On the other hand data shows that affected households spend statistically less on food than households in control (i.e. not affected) communities. One possible explanation for this counter-intuitive finding could be that households affected by storms and cyclones spend a larger portion of their total expenses on covering the costs of rebuilding assets, and thus reduce their food expenses. Possibly this strategy explains also that cyclone events are statistically strongly associated with occurrence of lower weight for height z-score (suggesting high level of acute malnutrition); and that the impact seems to increases with the severity of the event. The analysis also indicates that cyclones may have some negative impacts on both the maternal and the child dietary diversify indexes with a lag of 5 to 7 months after the event. On the other hand the evidence of the potential impact on maternal body mass index is not clear.

Saline intrusion

The last main robust story relates to the impact of saline intrusion on the food security and nutrition status of the population living in the coastal belt. While the analysis is relatively inconclusive regarding the possible association of salinity with the price of food in these regions, the statistical models provide robust evidence that communities affected by high salinity are characterized by higher food loan rates and food expenditure levels than control communities in non-affected areas, thus suggesting some degree of food insecurity. In that context it is not surprising that the analysis also indicates that both child acute and chronic undernutrition levels are statistically higher in these saline-prone areas than in the rest of the country. More surprising is the correlation between saline intrusion and higher dietary diversity indexes Child dd and Maternal DD. The findings concerning the maternal body mass index of women is more inconclusive.

Some puzzling results

As part of these analyses, our research also reveals some more counter-intuitive results such as higher child and maternal dietary diversity indices in communities affected by floods and saline intrusions; and a lower stunting rate amongst children who live in cyclone-prone areas than in control areas.

Qualitative research results

In addition to these results which derive essentially from the quantitative analyses, other important information emerges from the qualitative research. First, the importance of rice and starchy foods. Given the emphasis on rice and potatoes in the diet, the absence of these two items would pose a challenge to local rural populations. Rice and potatoes are some of the cheapest and most filling items in the market, hence their ubiquity in the diet in normal times, but also just after a shock: these appear to be the most affordable following a disaster event.

Second, the key role of fish in both normal and disaster periods. While fish (along with eggs) is the only source of animal protein which is consumed with regularity during normal time, interviews indicate that its importance in the diet is even more pronounced during crisis. During flooding events, for instance, fish become a renewed source of nutrition and more fish are consumed during this time than in other times. This, combined with the fact that in the wake of disasters, sources of animal protein (other than fish) are not available for several months, makes fish an absolutely critical element in the food security and nutrition of populations affected by these shocks and stresses.

Third, saline intrusion makes everything worse. Salinity intrusion has been a recurrent and increasing issue in the southern coastal belt, affecting literally every aspect of people's life, livelihood, farming activities, human and livestock health, on a daily basis. Residents recognize shrimp farming as being the primary cause of high salinity levels, but they see the occurrence of climate-related events (cyclones, flood, drought) as aggravating the problems on a temporary or seasonal basis, adding hardships to an already very difficult life.

Observations on Nutrition

Children's nutrition is protected at the detriment of the mother. Coping strategies, such as eating fewer meals per day, eating less at each meal, skipping meals, eating less preferred foods, and decreasing dietary diversity were consistently listed as post-disaster coping strategies employed to bridge the household to better times. But the respondents also made clear that children are usually given preferential treatment to ensure their health and survival, being given the most nutritious food and being the last to make sacrifices in relation to meals. Women, on the other hand, make the biggest sacrifices, being the most likely to go hungry and not eat.

Nutrition was not considered a priority by the respondent after disaster. During an extreme event (cyclone, flood, river erosion) people experience significant hardship in terms of economic losses due to destruction of property, livestock, gardens, and other assets, and the absence of income. Our data indicates that diets are also significantly altered in the wake of a disaster and that nutrition is not identified by the respondents as a key-factor considered in consumption-related decision-making after a climate event. Because money and jobs are scarce, the primary concern is price of food, with quality and shelf-life being secondary concerns. Nutritious food is available in the market not long after, but access is hindered by lack of money to purchase nutritious food. In sum, optimal or even adequate nutrition is not regarded as a priority in the immediate period right after an event, but can be considered once economic and food security permits the luxury of making decisions around eating for nutrition instead of eating for hunger.

Recommendations

A series of recommendations emerge from these different findings.

Policy Recommendations

Integrating food security and nutrition into climate sensitive programmes

Although our analysis suggests that the pathways are shock specific and vary in nature and in intensity, the main finding of this research is that climate-related shocks (droughts, floods/flashflood, river erosion, cyclones) or induced stressors (salinity intrusion) have negative impacts on the food security and nutritional status of households living in affected areas.

Following these findings, a first recommendation for governments and international development agencies is to ensure that food security and nutrition interventions are better integrated into climate change focussed programmes. One way to ensure this stronger integration would be to make sure that nutrition indicators are part of the indicators included in the initial targeting mechanisms of climate change or resilience programmes and in their M&E systems.

The key role of markets in post-disaster recovery period

The major other result stressed by this research is the critical role that markets, and in particular food price dynamics, seem to play in the aftermath of disasters. While the exact impact pathway between high food prices and the final outcome measured in terms of nutritional indicators is still unclear (see recommendation below on the need for in-depth quantitative and qualitative studies) data suggests that there is a strong link between nutritional status of the communities affected by shocks and the peaks in the food prices which follow these shocks.

The ensuing recommendation that follows is that national governments and disaster relief agencies should prioritize market price stabilization mechanisms as a critical component to be established rapidly in the aftermath of (or perhaps in preparation to) shocks, in order to reduce as much as possible the possible lagged effect of these shocks on the food security and nutrition of affected communities.

Implications for disaster and rehabilitation programmes

The lagged effects observed in most of the models developed in this study open up new vista of phase-wise in-depth assessment of impacts at different stages of the disaster relief and rehabilitation process. In particular, the higher food prices after droughts, floods, and cyclones – and their prolongation up to 9 months after the event – urge us to review our conventional disaster response and rehabilitation approach.

As immediate response after a disaster, strategies like specific focus on available nutrient rich foods and communicating key messages about food sources that are plentiful could be very useful. Women's increased burden during disasters (see below) should also be made a center point in household level response. In addition, more research is needed on the cyclical effects of

coping strategies and the impacts of repetitive events on households. This knowledge will allow programmes to encourage coping strategies that promote food and nutrition security in both the near and far terms.

Importance of fish and fishing activities in post-disaster recovery period

The analysis reveals that while fish (along with eggs) is the only source of animal protein which is consumed with regularity during normal times, its importance in the diet seems to be even more pronounced during and after disasters.

Recognizing the critical importance of fish in the food security and nutrition of populations affected by extreme events/shocks, a recommendation for the national government and its partners is to continue to foster the ecological sustainability of the inland fisheries resources of the country and to ensure that the governance and management mechanisms at both national and local levels recognize and protect the role of fish as an essential source of protein and micronutrient during both normal and recovery time.

Protecting both children and women

While direct accounts from respondents suggest that children are usually given preferential treatment to ensure that their health and nutrition are protected, women, on the other hand, consistently make the biggest sacrifices. Data suggests also that this altruist (but mal-adaptive) behaviour is for a large part dictated by social rules.

On the basis of these findings, interventions such as behaviour change communication (BCC) programmes need to be put in place by the government in collaboration with its international and local partners to protect children but also specifically women's food security and nutrition in the aftermath of shocks.

Strengthening the resilience of households to climate-related events

Although the household resilience mechanisms could not be explored thoroughly through this study, it is clear that strengthening the capacities of the local populations affected by climate-related events and help them respond more appropriately to the impacts of these events (in particular by reducing their propensity to adopt detrimental short-terms responses) would go a long way in reducing the negative effects of climate-related events on the nutrition and food security of the local populations.

The authorities in charge of disaster management (both at national and provincial/district levels), along with international organizations working on the same agenda, should invest in improving their understanding of the types of strategies that households and communities adopt in response to the various shocks and stressors that they face and identify ways to strengthen the capacities of the local population and local authorities in developing and adopting adequate responses which have long-term non-detrimental impact on the wellbeing of households members, in particular women and children.

Research recommendations

The critical importance of high frequency data surveys

Because it was collected every two months, the NSP data could capture and reflect the dynamics of sudden or progressive changes in food security

and nutrition indicators following extreme events/shocks, thus providing essential information to understand the way shocks affect households, and how these households respond to those effects, just after and in the months following the event. Without these high-frequency surveys, such analysis would not be possible.

The related recommendation is that governments, international development agencies, and research organizations will need to support existing, or invest in new, high-frequency, comprehensive household surveys if they want to be able to integrate more appropriately the question of the impact of shocks in their planning and policy decision-processes.

The need for in-depth quantitative and qualitative studies

Identifying the potential impacts of climate change-related shocks and stresses on household food security and child and maternal nutritional status is complex and data demanding. We still know very little and many of the current findings remain working hypotheses which need to be explored/tested more thoroughly. What seems clear however, is that households' responses are shock specific. In that context, applying a blanket/generic post-disaster approach is likely to generate/trigger mal-adaptive responses, which could eventually slow down or even jeopardize the recovery process. Unfortunately too many interventions are still being based on a partial and incomplete (or even incorrect) understanding of the situation.

Following these remarks, a recommendation for governments, international development agencies, and research organizations is to continue supporting research and investigations around these issues. In Bangladesh more analyses should be conducted with the NSP data-sets. In all cases the use of mixed methods and combined models that incorporate different types of shocks should be prioritized over cherry-picking analyses based on an individual-event.

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