



# Vulnerability to Climate Change: Adaptation Strategies and Layers of Resilience



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## Mainstreaming Grassroots Level Adaptation and Building Climate Resilient Agriculture in SAT\* Bangladesh

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### Background

Global climate is likely to change further and faster over the coming decades, resulting in adverse impacts on ecosystems, peoples' livelihood and economy. There are evidences that climate change has affected global weather patterns, disrupted climatic trends and has resulted in aggravated occurrences of climate related extreme events such as heavy rainfall, drought, flood, cyclone, storm surge, etc, claiming thousands of lives, destroying billions of dollars worth of properties and disrupting livelihoods of hundreds of millions of people.

Bangladesh is globally considered to be one of the countries most vulnerable to climate change<sup>1</sup>. The Third Assessment Report of the IPCC (IPCC 2001) ranked Bangladesh high in the list of most vulnerable countries. According to the Fourth Assessment Report of IPCC (IPCC 2007), several evidences of climate change and its impacts are already visible in Bangladesh: (i) average temperature has increased by about 1°C in May and 0.5°C in November during the 14-year period from 1985 to 1998; (ii) annual mean rainfall exhibits increasing trends; whereas the decadal rain anomalies were found to be above long term averages since 1960s; (iii) serious and recurring floods have taken place during 2002, 2003 and 2004; the intensity of cyclones originating from the Bay of Bengal has increased since 1970; (iv) frequency of monsoon depressions and cyclone formation in the Bay of Bengal has increased; (v) salt water from the Bay of Bengal has penetrated 100 km or more inland along tributary channels during the dry season; and (vi) the precipitation decline and droughts has resulted in the drying up of wetlands and severe degradation of ecosystems.

As a consequence of changes in climatic characteristics, most of the districts of Bangladesh have already encountered severe incidences of extreme events such as droughts and floods, and the situation is assumed to be

aggravated in the coming days (Karim et al. 1996, BCCSAP 2009). Frequent droughts in the northwest region and intense floods are adversely hampering agriculture and other sectors of the country. It is claimed that the agriculture sector is the most vulnerable sector to climate change in Bangladesh, mainly due to incidences of droughts and floods along with sea level rise, and impulsive weather patterns. Therefore, it is important for the country to prepare appropriate and effective adaptation strategies to mitigate negative consequences of climate change on agriculture.

A study was conducted by Centre for Policy Dialogue (CPD), Bangladesh in collaboration with ICRISAT through a project "Vulnerability to Climate Change: Adaptation Strategies and Layers of Resilience" funded by the Asian Development Bank (ADB) to capture the grassroots level responses and to understand the adaptation measures that the farmers are practicing across semi-arid regions of Asia especially in Bangladesh, India, Peoples Republic of China (PRC), Pakistan, Sri Lanka, Thailand and Vietnam. The results from the semi-arid tropics (SAT) of Bangladesh form the basis of this brief.

### How equipped is the Bangladesh government against climate change?

Climate change manifests itself in its entire dimensions especially in the agriculture sector of Bangladesh. The Bangladeshi Government, together with other non-government sectors has taken some initiatives to reduce the impact of climate change by addressing various vulnerability issues.

A revised 'Bangladesh Climate Change Strategy and Action Plan 2009' aims to build the country's capacity and resilience to meet the challenges of climate vulnerability.

Bangladesh Climate Change Resilience Fund (a multi-donor trust fund) with contributions of about USD170 million

\*SAT – Semi-Arid Tropics

<sup>1</sup> In various international fora, including the 15th meeting of Conference of Parties (COP 15) of United Nations Framework Convention on Climate Change (UNFCCC) held at Copenhagen (2009), Bangladesh was identified as the most vulnerable country due to climate change impacts.

grants is now operational to support the implementation of the Bangladesh Climate Change Strategy and Action Plan (BCCSAP). In addition, the government has committed USD 300 million of its own revenue budgets to implement BCCSAP. Climate Investment Fund endorsed an amount of USD110 million for climate resilient development in Bangladesh under the Pilot Program for Climate Resilience (PPCR).

## Trends in climate of SAT Bangladesh

The analysis of the long term annual rainfall distribution of Bangladesh reveals that different parts of the country have experienced diverse rainfall patterns throughout the last few decades. The spatial analysis of rainfall indicates that the west and west-central parts of the country have the lowest amount of rainfall ranging from 1564 mm to 1799 mm over 1971 to 2008. Conversely, the north-eastern and south-eastern parts of the country experienced maximum annual rainfall of about 3000 mm to 5775 mm over the same period. The central parts of the country experienced moderate rainfall of 1800 mm to 2999 mm in the last few decades. Analysis showed an increasing trend in rainfall and atmospheric temperature. There have been instances of increased occurrences of extreme events such as floods and droughts. This indicates that average annual rainfall is likely to be uncertain, which will hamper agricultural activities of the SAT regions (Figure 1).

## SAT Bangladesh – An epi-centre of climate change threat

Using Patnaik and Narayanan (2005) method, overall vulnerability and five different sources of vulnerability indices were computed separately for six agro-ecological zones of Bangladesh. Sub-indicators were identified in each of the vulnerability sources such as i. Demographic, ii. Climatic iii. Agricultural, iv. Occupational and v. Geographic. Overall, vulnerability index is computed based on sub-indicators. In recent years, there has been

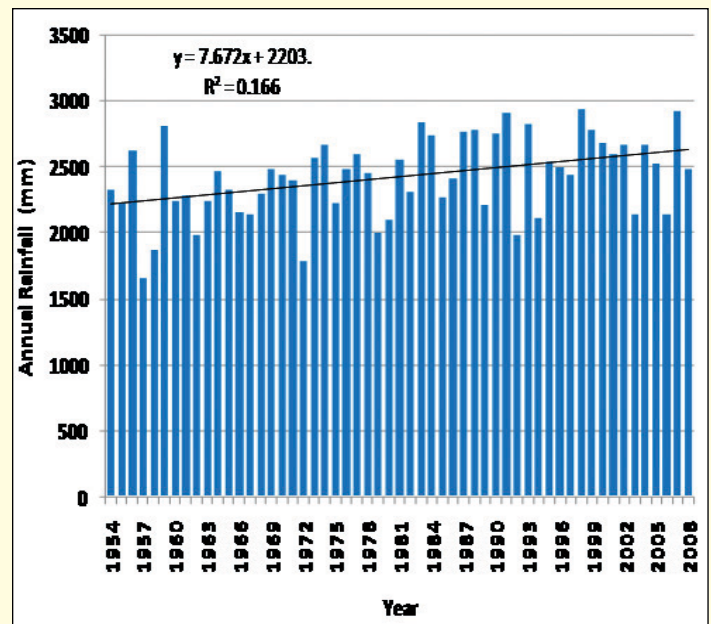


Figure 1. Trend in Annual rainfall in Bangladesh. Source: ICRISAT (a).

a significantly reduced state of vulnerability in both the mixed and flood-prone zones compared to other zones. These changes can be explained in terms of significant improvements in the livelihood activities across these ecological zones, which include access to better irrigation and agriculture inputs. On the contrary, the tidal surge and non flood prone zone are gradually more prone to vulnerability due to increasing incidences of cyclones, salt intrusion in the coastal belts and incidences of drought-like situations in the non flood prone zone where many of the river ecosystems are gradually losing their natural flows (Table 1).

## Adaptive capacities of SAT farmers of Bangladesh

Vulnerability of a system does not depend on the possible external impacts of climatic variability only, but also

Table 1. Changes in agricultural vulnerability by ecological zone in Bangladesh.

Ecological Zones	Year				
	1974	1981	1991	2001	2006
Not flood prone	Moderately vulnerable	Highly vulnerable	Moderately vulnerable	Moderately vulnerable	Moderately vulnerable
Low flood prone	Moderately vulnerable	Moderately vulnerable	Moderately vulnerable	Moderately vulnerable	Moderately vulnerable
Flood prone	Vulnerable	Vulnerable	Vulnerable	Vulnerable	Vulnerable
Drought prone	Highly vulnerable	Highly vulnerable	Moderately vulnerable	Moderately vulnerable	Moderately vulnerable
Tidal surge	Very Highly vulnerable	Highly vulnerable	Highly vulnerable	Highly vulnerable	Highly vulnerable
Mixed	Moderately vulnerable	Moderately vulnerable	Moderately vulnerable	Highly vulnerable	Highly vulnerable

Source: ICRISAT (c)

depends on factors such as demography, socio-economic condition and infrastructure. These factors, defined by the term adaptive capacity<sup>2</sup>, represent the current ability of the country or regions to respond to or cope with the impacts. This implies that, formulation of adaptive measures and mainstreaming climate policies will critically hinge on the characterization of vulnerability. Dolan and Walker (2003) discussed the concept of vulnerability and presented a multi-scaled, integrated framework for assessing vulnerability and adaptive capacity.

Determinants of adaptive capacity in Bangladesh included access to and distribution of wealth, technology, access to information, risk perception and awareness, social capital and critical institutional frameworks to address climate change hazards. These are identified at the individual and community levels across SAT Bangladesh. Local and traditional knowledge is considered as a key to research design and implementation of different adaptive measures, and allows for locally relevant outcomes that could facilitate more effective decision making, planning and management in SAT regions (ICRISAT b. In press).

## How efficiently does the Bangladesh farmer adapt?

A number of field surveys, focus group discussions and personal interviews conducted during 2009 revealed some significant constraints that the SAT farmers are facing while adapting to climate variability. Different types of constraints at different levels, ie, at field, farm, institutional, technological, social and economic levels were found across the SAT farmers of Bangladesh. Understanding constraints for efficient adaptation for SAT farmers is essential to forecast the upcoming climatic variation and future vulnerability, and to marginalize these constraints effectively for the country's practical policy purposes.

## Government support programs on adaptation

Recently, numerous government and non-government programs have been designed and implemented to reduce the negative impacts of climate change, improve rural economic structure and enhance development. Efficient implementation of policies needs to be done but this is found to be lacking. Studies indicate that many of these programs launched often end up helping the better-off farmers due to lack of initial capital and poor access to credit among the smallholder and marginal farmers. Poor households get benefitted mostly from food and nutritional security programs and rural employment schemes such as Vulnerable Group Development (VGD), Vulnerable Group Feeding (VGF), etc. Land and water resources together

## Constraints to efficient adaption

### Field level

- Increased input costs such as irrigation, fertilizer

### Farm level

- Access to integrated information is low and costly
- Limited scope for crop diversification and crop rotation
- Low level implementation of farm mechanization
- Decreased cultivable land

### Institutional level

- Low and inefficient market access to the smallholder and marginal producers
- Lack of efficient cordination among different government authorities

### Technological level

- Inefficient use of ground and surface water
- Low availability of climate resilient crop varieties (eg, flood, drought, salinity tolerant) and other services and production technologies

### Social level

- High level population growth

### Economic level

- Prevalence of chronic poverty
- Low access to agricultural credit provided by Government.

with other natural resources are depleting and deteriorating. Government policies should aim at inclusive accessibility to cater to all and should percolate to the lower levels in the community.

## Need to strengthen grassroot resilience capacity – Policy perspective

Climate change is a reality and cannot be denied. Globally, Bangladesh is considered as one of the most vulnerable countries to climate change. Adaptation occurs at the local level. Building capacity at various levels enables the rural community to adapt to climate variabilities and extremes irrespective of their socio-economic strata. Fine tuning the existing policy and the delivery mechanisms of the existing developmental programs to cater to the needs of climate variabilities and extremes can be a first step. Policy integration to address further needs of farmers to address issues at Field, Farm, Social, Technological, and Institutional levels is important. Undertaking agro-ecologically appropriate adaptation measures may significantly reduce its vulnerabilities and create opportunities for the country's large population. Thus, there is a need to mainstream climate adaptation policies into national development strategies to address issues of all agro-ecological zones of the country.

<sup>2</sup> Adaptive capacity is defined as capacities, resources and institutions of a country or region to implement effective adaptation measures (IPCC 2007).



## Policy recommendations

- Intensify research capacities for innovating drought, flood, saline and submergence tolerant crops that are essential for the changed climatic condition.
- Need to develop eco-region specific adaptive knowledge (including indigenous knowledge) to cope with climate variability so as to enhance adaptive capacity.
- Strengthen the existing data base of all natural resources by expanding its network for preparation of plans at micro level.
- Strengthen partnership with international agricultural research and development organizations (such as IRRI, ICRISAT, CIMMYT, FAO) and other SAARC countries in areas of agricultural research and development.
- Create awareness among the farmers about climate change and related issues by conducting training and campaigns for managing climate associated risks.
- Need to adopt a pragmatic strategy to transform the northern drought-prone region into a non-rice crop growing zone, particularly in the dry season.
- To mitigate the climate change driven adversities, Bangladesh needs to design a comprehensive climate adaptation plan for both short and long term perspectives, which will clearly define appropriate implementation strategies.
- Need for adequate investment in gradual move towards use of biotechnology, GIS, remote sensing and ICT for generation and dissemination of technology.
- Need to develop and pursue agro-ecological zone-wise development strategies to reduce the levels of all possible sources of vulnerability, increase their resilience capacity in the fight against adverse impact of climate change and raise coping and adjusting power.
- Design adaptation measures that will address local micro-climatic issues supported by appropriate institutional and other required measures.

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