

**Impact of Climate Change and Regional Vulnerability:  
Analyses Using Cross-sectional Data of Household  
Surveys in Bangladesh**

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## ABSTRACT

Since the 2000s Bangladesh has witnessed the rapid economic growth is called the economic boom in south Asia and likely to remain robust. However, this growth would not be so exciting if it could not reach the poor. Despite the worst climate change impact on agriculture made Bangladesh suffer severely for poverty of farm household. Widespread poverty is the most serious threat and social problem that Bangladesh faces. Regional vulnerability to climate change threatens to escalate the magnitude of this poverty. It is essential that projections of poverty be made while bearing in mind the effects of climate change. The current study analyses the two sets of cross-sectional data of farm household's surveys in Bangladesh.

In the first study we used, high-quality plot-level agricultural production and practice data under the nationally representative survey by International Food Policy Research Institute (IFPRI). The objective of this study is to evaluate the regional characteristics, to project the poverty into the impacts of climate change on crop production and provide possible coping techniques. We used an analytical approach where included analysis of variance, cluster analysis, decomposition of variance, and log-normal distribution to evaluate the economic situation and regional characteristics and to assess the potential climate change impact on farm production and poverty under newly developed representative concentration pathways (RCPs) and other climate scenarios in Bangladesh. To estimate the parameters of income variability that ascertain vulnerability and help us to understand the poverty levels that climate change could potentially incur.

The main purpose of this study is to investigate the agrarian sub-national regional analysis of climate change vulnerability in Bangladesh under various climate change scenarios and its potential impact on poverty. This study is relevant to socio-economic research on climate change vulnerability and agriculture risk management and has the potential to contribute new insights to the complex interactions in household income and climate change risks to agricultural communities in Bangladesh and South Asia. This study analyzed regional characteristics of farmers' income, based on statistical analysis of farm survey data, about regional vulnerabilities to climate change, coping strategies, and techniques. From the income share in income source sectors, farmers in Mymensingh and Rangpur are largely dependent on agriculture. Of these regions, Mymensingh is one of the regions, which has the highest poverty rates. The income share in income sources revealed that income category shares across the various regions of Bangladesh are far from uniform. Income share comparison and

cluster analysis classified the regions into three groups as follows. (1) In some regions, which are Rajshahi, Khulna, and Dhaka, income from agriculture is important, and these regions receive relatively high income. (2) In other regions, which are Mymensingh, Rangpur, and Barisal, agriculture income is important, but the regions receive relatively low income. (3) The other regions, which are Comilla, Chittagong, and Sylhet, are not strongly dependent on agriculture, and Comilla region strongly rely on income from remittance. Principal target of agricultural research for poverty reduction is considered to be group (2). Variance decomposition of income showed that agricultural income in Mymensingh and Rangpur is the main cause of income difference. Moreover, large variance of agricultural income in the regions is induced by gross income from rice production. This implies that rice yield can have large impact on income level. Therefore, research and development, and technical support for farmers to realize high and stable rice yield in these regions is important.

This research, modeled to predict crop yield changes by different aspects of climate change under drought, flood, flash flood, sea level rise, and Representative concentration pathways (RCPs) scenarios. We account for some uncertainty on crop yield and resulting the reduction of per-capita income of farm household. We use lognormal distribution to project the poverty rate and find the vulnerable region. The future projections of poverty rates on assumption that *boro* High Yielding Variety (HYV) and *aman* High Yielding Variety (HYV) rice yields decline in each farm, showed poverty rate increases in different region. Different climatic events are occurring in Bangladesh in different region. Dependency on agriculture with high variability of annual rainfall has made the northwestern parts is highly risky to droughts and makes the high poverty rates compared to other parts of the country. Extreme flood can increase the poverty rate in Rangpur, Mymensingh, and Khulna region. Kishorganj district is the utmost vulnerable on poverty (8.8% increase) if sudden flash flood occurs in northeastern part of the country. Due to the sea level rise, coastal areas will face the poverty.

Coping strategies and techniques to climate change for the regions where small-scale farmers are largely dependent on agriculture are important challenges. In the negative consequences of climate change impact, subsistence farmers are suffering more from the vulnerability like extreme poverty or hunger. However, adaptation techniques in agriculture is a vital tool to avoid the adverse impact of climate change. Given the complex nature of drought, flood, flash flood, sea level rise as a phenomenon, development of drought tolerant, short maturing, and salt tolerant varieties are of critically important.

Based on the household survey data in the second analysis this study tried to know the economic situation of farm households in coastal areas and find the determinants of early cropping technique to avoid the impact of extreme climatic event such as Cyclone by using the binary logistic regression model. Cyclone is regarded as one of the greatest climatic challenge for the southern people of Bangladesh. The coastal zone of Bangladesh is particularly prone to the risks of extreme climatic event cyclone with storm surges and face more than one cyclone of various velocities every year. They generally occur in early summer during April-May or late rainy season during October-November. Due to tropical cyclones agricultural crops, especially *boro* and *aman* rice are always in danger on harvesting time. In the cyclone prone coastal zone of Bangladesh, engaging in early cropping of rice may

potentially enable farmers to reduce cyclone risks and reshape their livelihood by changing their income status. A binary logistic regression analysis is used to identify determinants for early cropping and finds that households with more educated household head, credit facility, and farms relatively in the south and middle of koyra upazila tend to adopt early cropping. The result implies that even if the early cropping can reduce the cyclone risk, it may be difficult for famers with less education and credit access to continuously adopt this technology. The repercussions of tropical cyclones for agricultural production in coastal zones will continue to be severe if the concerned stakeholders do not take the necessary and prompt actions to prevent such losses. Therefore, adopting the concepts of early cropping would be a useful strategy to promote sustainable agriculture in the cyclone risks areas.

More general our results focused on farm income and poverty including regional vulnerability due to climate change impact on agricultural production. In recent years, climate change impact plays the vital role for increasing the poverty rate and income variability among farm households in Bangladesh. Extreme environmental hazard is facing by farmers in this country and their net farm production decreases drastically, which increase the poverty rate while changes in weather condition has not so severe problem for farmers due to their involvement in other income activities. This study focuses to reveal the comprehensive impact of climate change on farm production and which crops are the most important for per capita income difference across the country that enhance the poverty rate by using the decomposition of variance and lognormal distribution method.

This study has attempted to bridge the gap between academic research and professional practices in the context of potential impact of extreme climatic events on crop production and poverty. As the assessment of cropping technique and regional vulnerability due to climate change, it is hoped that the study in general will assist in guiding authorities in terms of those interventions aimed at climate change risk reduction in Bangladesh.

**Key Words:** income distribution, cost distribution, poverty, vulnerable region, cyclone, early cropping, adaptation measures, Bangladesh