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Climate change perceptions and local adaptation strategies of hazard-prone rural households in Bangladesh

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ABSTRACT

Adaptation is a key strategy that can alleviate the severity of climate change impacts on agriculture and food production. Adaptation strategies are unlikely to be effective without an understanding of the farmers' perceptions of climate change. This paper explores the local knowledge of adaptation in response to the perceived impacts of climate change and climatic hazards using a survey of 380 resource-poor riverbank erosion-prone households in Bangladesh. The results indicate that the respondents' perceptions of changes in the climate and of extreme climatic events are similar to the observed climate data. Households have recognized the impacts on their livelihood and resources, resulting in an increased sense of vulnerability. To build resilience, households have undertaken a range of farming and non-farming adaptation strategies, which vary significantly among the farming groups. The important adaptation strategies include adopting new crop varieties, changing planting time, homestead gardening, planting trees and migration. Improved access to finance and to information about appropriate strategies appears to be crucial to support adaptation processes locally and thus to enhance the resilience of vulnerable households.

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1. Introduction

The livelihood of resource-poor rural households in developing countries such as Bangladesh depends largely on agriculture but this economic sector is most vulnerable to climate change and variability. The capacity of households to adapt to the influence of climate change, which can affect households' resources and resilience, is uncertain due to poor socio-economic conditions (Wood et al., 2014; Lobell et al., 2008; IPCC, 2007; Adger and Vincent, 2005). Therefore, adaptation strategies are crucial to help the local communities to cope with extreme weather conditions and associated climatic variations (Alam, 2016; Niles et al., 2015; Gandure et al., 2013; Rosenzweig et al., 2013; Adger et al., 2003). The strategies are, however, unlikely to be effective without an understanding of the farmers' perceptions of climate change. Adaptation strategies are context specific and change over time, from area to area and even within particular societies (Malone, 2009; Smit and Wandel, 2006). This paper focuses on local level knowledge of adaptation in Bangladesh: such knowledge is important for enhancing vulnerable households' resilience in the face of hazards and for coping with climate change and variability. The United

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Nations Intergovernmental Panel on Climate Change (IPCC) has placed local knowledge of adaptation at the centre of discussions to formulate adaptation strategies (IPCC, 2007).

Bangladesh, only 1,47,570 km² of deltaic land in South Asia with a population density of about 936 persons/km² and more than 31% people living below the poverty line (income less than US\$2/day), is regarded as most vulnerable to climate change (World Bank, 2013; GoB, 2011; IPCC, 2007). The country experiences extreme climatic events frequently: flood, drought, cyclonic storm surges, riverbank erosion, salinity intrusion and water logging cause large-scale loss of life, damage to infrastructure and economic assets, adversely impact on food, water, health and energy security, and affect the lives and livelihoods of many people, the poor in particular (Alam et al., 2017; Alam, 2016; Jordan, 2015; Thomas et al., 2013; Pouliotte et al., 2009; Huq and Ayers, 2008; IPCC, 2007; Choudhury et al., 2005).

Riverine households are the most susceptible to the impact of climate-driven hazards which contribute to the loss of land and other natural resources resulting in an increased vulnerability to food insecurity and a reduced ability to alleviate poverty (Alam et al., 2017; Alam, 2016; IFAD, 2013; GoB, 2010; Lein, 2010; Hutton and Haque, 2003). Riverbank erosion, a common problem in Bangladesh, is considered to be the most damaging hazard in terms of economic losses (Alam, 2017; Penning-Rowsell et al., 2013; Makenro, 2000). About 20 of the 64 districts in the country are prone to riverbank erosion (Alam, 2016; CEGIS, 2012; GoB, 2010). Despite government efforts to reduce riverbank erosion, mainly through erosion protection structures along the bank, it remains the major problem for floodplain residents in the country (GoB, 2010). Approximately 8700 ha of homestead and farming land are lost annually due to riverbank erosion which displaces approximately 200,000 people (CEGIS, 2012; GoB, 2010).

One aspect of climate change, unpredicted monsoonal flows, contributes greatly to the sediment capacity flow and the morphologic dynamics of the rivers resulting in increased erosion along the Ganges-Brahmaputra-Meghna river basin (Gain et al., 2013; Huq et al., 1998; Warrick and Ahmed, 1996). Moreover, recent models of hydrological impacts of climate change in different climatic zones have shown this to be true across Asia (Eregno et al., 2013). Concomitantly, riverine households are also likely to be affected by other climatic hazards such as flooding and water logging due to their proximity to the river, and this contributes to their vulnerability (Alam et al., 2017; Alam, 2017). Given the severe climatic hazards, a crucial policy for Bangladesh is to identify and to understand possible adaptation strategies, particularly for marginalized riverine communities, which could mitigate the adverse climate effects.

However, limited research on adaptation has been carried out in Bangladesh (see Section 2). This study, using survey data from the two most riverbank erosion-prone districts in Bangladesh, aims to provide information on local adaptation strategies and household perceptions of climate change and variability to address the vulnerability of the community locally. The research questions investigating this are: (i) what are the perceptions of hazard-prone rural households to climate change and variability?; (ii) what are the perceived impacts of riverbank erosion and other aspects of climate change on one's livelihood; and (iii) what local adaptation strategies can the resource-poor households adopt to enhance their resilience?

The paper is structured as follows: Section 2 presents a review of the literature; Section 3 describes the study areas, the data collection procedure and the analysis of the data; the results are presented and discussed in Section 4; and Section 5 provides a summary and some policy guidelines.

2. Review of literature

Research on household perceptions of climate change and adaptation strategies is outlined briefly in this section. Adaptation to climate change refers to adjustments in the human-environment system in response to actual and/or anticipated different climatic conditions in order to avoid or to mitigate the associated risks or to realize potential opportunities (Wheeler et al., 2013; Smit et al., 2000; IPCC, 2001). Climate change affects countries, regions and communities in different ways and thus they differ in terms of their adaptation strategies (Alam, 2016). The factors responsible for the variation in adaptive responses across regions are the agro-ecological system, socio-economics, climatic impact, and existing infrastructure and capacity (Alam, 2016; Brulle et al., 2012; Fraser et al., 2011; Adger et al., 2009; Berry et al., 2006).

Perception and adaptation strategies are the two key components of the adaptation process (Maddison, 2007). Farmers first need to perceive the impact of changes in the climate to take appropriate adaptation strategies in order to mitigate their vulnerability and to enhance the overall resilience of the agro-ecological system (Bryan et al., 2009). Misleading perceptions can cause inappropriate adjustment measures (Taylor et al., 1988). Farmers who perceive potential consequences from climate change are more likely to support policies and programs that aim to address it (Niles et al., 2013; Gordon et al., 2013).

Much research has indicated the importance of understanding how climate variability is perceived by farmers and what shapes their perception to elicit adaptive behaviours (Zampaligré et al., 2014; Weber, 2010; Mertz et al., 2009; Slegers, 2008; Shisanya and Khayesi, 2007; Maddison, 2007). Adaptive capacity is influenced by many factors such as knowledge of and perceptions about climate change, and access to appropriate technology, institutions and policies (Alam et al., 2016; Brulle et al., 2012; Haden et al., 2012; Hisali, 2011; Mertz et al., 2009; Adger et al., 2003). The significant link between perceptions of climatic variability and adaptive processes has been examined in several countries; for example, in the USA (Mase et al., 2017; Gordon et al., 2013), Canada (Bryant et al., 2000), Australia (Wheeler et al., 2013), Vietnam (Dang et al., 2014; Schad et al., 2012), India (Dey et al., 2017; Vedwan and Rhoades, 2001), Malaysia (Alam et al., 2012), Sri Lanka (Esham and Garforth, 2013), The Philippines (Predo, 2010), Nigeria (Apata et al., 2009), Tanzania (Kangalawe et al., 2016; Slegers, 2008), Tunisia (Mertz et al., 2009), Zambia (Mulenga et al., 2017), Ethiopia (Tesfahunegn et al., 2016; Deressa et al., 2011) and South Africa (Elum et al., 2016; Gandure et al., 2013).

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