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Climate perception and flood mitigation cooperation: A Bangladesh case study

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ABSTRACT

Bangladesh is vulnerable to climatic changes, so there has been a serious debate about the occurrence and relationship with frequency of flooding. For example, in Dhaka division, further flood controls are claimed to be necessary due to a change in climatic patterns and more frequent flood events. Despite the importance of this topic, it has received little research attention. Thus, we examine (i) whether a temporal change in climate variables is occurring, (ii) local people's perceptions to climate and (iii) cooperative attitudes toward flood controls. We conducted face-to-face surveys with 1011 respondents of different socio-demographic strata and with seven experts in Bangladesh. Using these data, we first derive a temporal trend of climate variables and analyze how closely people's perceptions align with climate data. Second, we examine the willingness to pay (WTP) for flood controls as a proxy of cooperative attitudes, and characterize the determinants in relation to perceptions to climate as well as socio-economic characteristics. We obtain the following principal results. First, some climate variables are identified as exhibiting clear upward or downward trends, but most people correctly perceive such temporal trends. More specifically, people's perceptions and our statistical analysis are identical in the qualitative changes of climate. Second, people who correctly perceive climatic changes tend to express a higher WTP than those who do not. Overall, these findings suggest that accurate climate perceptions are key to increasing cooperation in managing climatic change and related disasters.

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1. Introduction

Bangladesh is one of the most disaster-prone countries in the world because of its geographical setting (Brouwer et al., 2007). Only 10% of Bangladesh is above 1 m the mean sea level and one-third is under tidal influence. Global sea levels have risen through the 20th century, and are expected to accelerate upward through the 21st century and beyond because of global warming (Nicholls and Cazenave, 2010). Most countries in South, Southeast, and East Asia appear to be highly threatened by the sea level rise because of the widespread occurrence of densely populated deltas (Parry et al., 2007). Due

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to such climatic changes and the associated sea level rise, Bangladesh is predicted to suffer from extensive economic damages by more intense and frequent flood events in the foreseeable future (Schiermeier, 2011a,b).

There is a rich body of literature on climatic changes and its potential impact on society. Some research claims that humans are a main cause of altered climatic patterns (Stern, 2006; Cline, 2007; Schiermeier, 2011b). For instance, Rockstrom et al. (2009) suggest that we have already exceeded the planet's "safe operating space" in the climate system, and that a warmer world is therefore being subject to more extreme rainfall occurrences. This is because the amount of water vapor that the atmosphere holds is increasing rapidly with temperature. Rainfall data also reveal significant increases of heavy precipitation over much of northern hemisphere land and the tropics. Overall, these tendencies of climate are reported to increase the frequency of floods (Parry et al., 2007; Pall et al., 2011; Min et al., 2011).

Understanding people's perceptions and their attitudes to climatic changes is claimed to be important, because it is directly linked to the formulation of policies (Tobler et al., 2012b,a). Several studies demonstrate that abstract explanations of climatic changes without actual experiences of these "changes" are ineffective in conveying what is actually occurring and in changing people's mind sets and behaviors (see, e.g., Spence et al., 2011). The greatest barrier is the difficulty of cultivating correct perceptions of temporal trends and the natural variability of climate, especially among people whose daily life is not dependent upon weather or climate (Hansen et al., 1998; Balling and Cerveny, 2003; Hansen et al., 2012).¹ The motivation of this study is therefore to examine people's perceptions and attitudes to climatic changes. When the perceptions and attitudes are studied, public policies can be better directed toward mitigating the negative impacts of natural disasters associated with climatic changes.

Numerous studies have examined people's perceptions and understanding of climatic changes in developed countries, claiming that highly educated people understand climate, and express their knowledge in surveys (Viscusi and Zeckhauser, 2006). Moreover, people who are more confident about the issue tend to be more cooperative in preventing the adverse effects of climatic changes (Semenza et al., 2008; Akter and Bennett, 2011; Akter et al., 2012; Spence et al., 2011). In contrast, other studies show that some socio-cultural and psychological factors impede preventive actions for climatic changes, even when people are knowledgeable about the issue (Henderson-Sellers, 1990; O'Connor et al., 1999; Leiserowitz, 2006; Dessai and Sims, 2010; Osbahr et al., 2011). In developing countries, there have been relatively few studies on this subject, although there are some works that have used surveys to examine local people's understanding of climatic changes (Vedwan and Rhoades, 2001; Adelekan, 2005; Vedwan, 2006; Mertz et al., 2009). These previous studies have found that people in developing countries demonstrate less understanding of climatic changes compared to people in developed countries. More specifically, people tend to qualitatively misperceive the temporal changes of key climate variables due to several constraints, such as local customs, the lack of education and information.

Few previous works have examined local people's perception and their cooperative attitudes toward climatic changes in a single framework. Therefore, the relationship between climate perception and cooperation remains unsolved (Sanchez-Cortes and Chavero, 2011; Crona et al., 2013). Given this gap in the literature, we examine whether local people correctly perceive climatic changes and to what extent this perception is related to their cooperative attitudes to flood controls (being climate-induced events). In doing so, we take Dhaka, Bangladesh as being representative of a developing country and conduct questionnaire surveys of 1011 respondents and seven experts to elicit their perceptions and cooperative attitudes. First, we address how local residents in Bangladesh correctly perceive climatic changes by comparing climate data taken from weather stations with people's perceptions elicited in surveys. Second, we identify how correct perceptions and other socio-economic factors are related to cooperative attitudes by using a "willingness to pay" (WTP) for flood controls as a good proxy for the degree of cooperation.² With this approach, our research specifically addresses the following questions: (i) Is a temporal change in climate occurring in Dhaka? (ii) How close do people's perceptions of climate align with the climate data obtained from weather stations? (iii) How do correct perceptions of climatic changes and other factors affect the WTP?

2. Study area and data collection

The Meghna basin area of Bangladesh was selected as a study field because it is vulnerable to climatic changes and frequent flooding. Within this basin, the administrative upazilas of Narsingdi Sadar and Raipura were chosen. These two upazilas are characterized by different production potentials (Fig. 1). Raipura has relatively higher agricultural potential, whereas Narsingdi Sadar has lower agricultural but higher industrial potential. The household is chosen as the unit of analysis, given it is the livelihood decision-making unit where the senior and earning male is usually the decision maker. The survey was conducted in 2011 and 2012.

The climatic conditions in Raipura and Narsingdi Sadar are characterized by relatively uniform temperatures, high humidity and heavy rainfall which usually occurs from June to September. The average annual temperature ranges from 13 °C to 35 °C. The rivers in the upazilas are the Meghna (the most important), the Old Brahmaputra, Arial Khan and Kakan.

¹ Weather is defined to be the physical condition or state of the atmosphere such as rainfall or temperature over any short period of time, whereas climate is defined to be the composite weather condition that characterizes the patterns or cycles of weather changes over a considerable period of time (Merrett, 2008).

² It is likely that most Bangladeshi people have difficulty reaching a common understanding of the terminology for climatic changes, so we avoid using this terminology to assess cooperative attitudes.

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