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Enhancing community resilience to climate change - an investigation of climate impacts and community led adaptation strategies of remote coastal peoples in Bangladesh

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ABSTRACT

Bangladesh is considered one of the most vulnerable countries to climate variability, fluctuation and extreme climatic events. Bangladeshi coastal communities are continuously adopting self-instinct survival strategies in order to cope with changing climatic conditions. Bangladesh is considered one of the most vulnerable countries to climate variability, fluctuation and extreme climatic events. Bangladeshi coastal communities are continuously adopting self-instinct survival strategies in order to cope with changing climatic conditions. This paper discusses the impact of climate change on livelihoods and documents current and future adaptation strategies of the Bangladeshi coastal communities. The findings suggest that climate change effects on local community may

include, but not limited to, livelihood, migration and health in Bangladesh. To offset the effects of extreme climatic events, vulnerable communities are often forced to migrate within the country. The findings of the research conducted in preparing this research indicate that those who migrated to another area were able to secure new places to reside but in locations that made them susceptible to other forms of disaster.

Key words: Climate change; effects; adaptation; community resilience; Bangladesh coast.

1. INTRODUCTION

Climate change is one of the greatest threats to human life and security (Yamin et al., 2005; Burton et al., 2006; IPCC, 2007). Mitigation of the Green House Gases (GHGs) and adaptation to live with the changing environment are considered two anthropogenic ways for tackling climate change (IPCC, 2001; Fussel and Klein, 2006). Climate change adaptation refers to adjustment of the natural or human systems in response to actual or expected climatic stimuli or their effects, which moderate harms or exploits beneficial opportunities (Perry et al., 2007). Building the capacity to adapt to climate change implies that people must protect themselves against inevitable new and exogenous threats to their health and wellbeing (Collins, 2008).

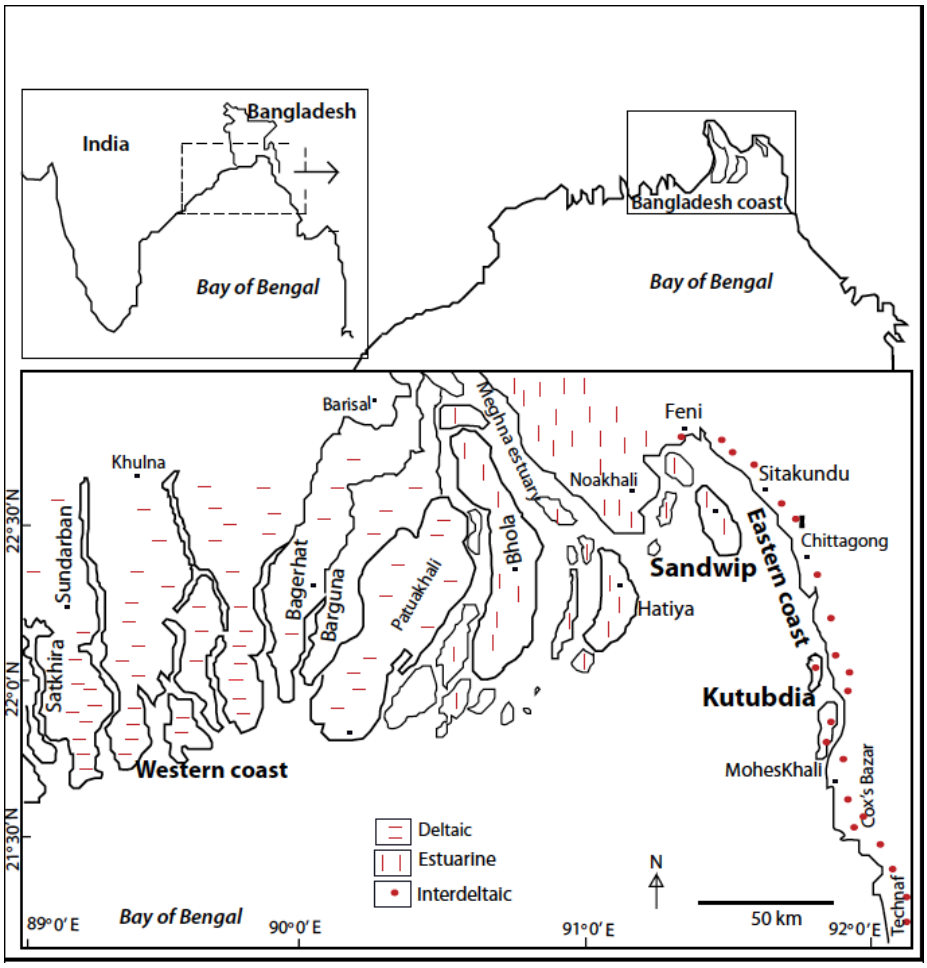

Figure 1 Location of Bangladesh coast and selected study areas for this research

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The U.N. Intergovernmental Panel on Climate Change notes that "adaptation to climate change takes place through adjustments to reduce vulnerability or enhance resilience in responses to observed or expected changes in climate and associated extreme weather events" (IPCC, 2014). Coastal hazards (i.e., tropical cyclones and coastal erosion) are regarded as the greatest threats to human life and security in many countries. Bangladesh, which has a predominantly agricultural economy, a rapidly increasing population and a slow economic growth rate, is currently ranked as one of the most prone to natural disasters (World Bank, 2005). Bangladesh has a coastline over 710 km, joining the vast 47,201 km^2 area of coastal plain with the Bay of Bengal (BBS, 2011). The country has 64 administrative districts (BBS, 2011), 19 of which are considered coastal (Karim and Mimura, 2008). The coastal zone accounts for 32 percent of the total area of the country (Figure 1); and 28 percent of the population lives in this zone. The landward limit of the coastal zone from the shore is between 30 and 195 km.

For this research, resilience means 'the degree to which individuals able organize themselves on the basis of learning from past disasters and continuous climate change adaptation to provide better future human security and improved risk reduction strategies'. It is known that frequent natural hazards coupled with climate change will present complex development challenges for remote rural communities (CRED, 2011; Twigg and Bhatt, 1998; Ayers, et al., 2014). The World Bank (2005) estimates that 97 percent of the total area and 99 percent of the population of Bangladesh are at risk from multiple hazards such as cyclone, flood, drought, earthquake and tornado. From the early history of human settlement on the Bangladesh coast, many people chose to situate their homes along unstable riverbanks or insecure offshore islands located in the northern end of the Bay of Bengal, where living conditions were affordable and livelihood opportunities plentiful. However, many of these offshore communities (e.g., Sandwip, Kutubdia and Hatiya) have been subjected to frequent tropical cyclones (Figure 2). In addition, the local communities on these remote islands have been severely affected by coastal erosion. To offset the impact of disasters, the coastal people are continuously applying adaptation strategies.

Figure 2 Devastation to houses and the type of temporary houses after Cyclone Sidr in 2007 (Source: the author).

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As a signatory of the United Nations Framework Convention on Climate Change (UNFCCC), Bangladesh developed a National Adaptation Program of Actions (NAPA) in 2005. The NAPA identified potential impacts of climate change, vulnerable sectors and geographic areas; and proposed the most important and immediate adaptation actions (Huq, 2011). Three years later, the Ministry of Environment and Forests published the Bangladesh Climate Change Strategy and Action Plan (BCCSAP), a "living document" that aims at developing long-term practical strategies to mitigate climate change risks (MoEF, 2009). Non-governmental organizations (NGOs), too, have been making significant contributions in promoting local residents' health, sustainable livelihoods and mitigating disasters in Bangladesh, notably in significantly reducing waterborne diseases and promoting alternative livelihoods among the Bangladeshi coastal communities. For example, the Caritas Bangladesh and its local partner, *Sushilon*, assisted local communities in southwestern Bangladesh in emptying and cleaning ponds, which are their residents' sole sources of drinking water. The implementation of these programs has markedly decreased the incidence of diarrhea, dysentery and skin diseases, which had been widespread among the local residents (Khan et al., 2011). The hazard-affected communities in Bangladesh are well known to taking their own initiatives (Alam, 2002; Alam and Collins, 2010) to cope with major disruptive events. There is currently a clear absence of grounded research to identify local level climate change and its impacts, and only a limited understanding of community level adaptation and coping even though it is known that rural communities do cope with disaster.

In light of the introduction, this research aims to identify reported effects of climate change on life and livelihood of the Bangladeshi coastal communities and subsequent community led adaptation strategies to live with changing climate extremes. After documenting climate extreme impacts and adaptation strategies, this paper comments on aspects of community resilience to climate change and provides subsequent discussion and conclusions.

2. REPORTED EFFECTS OF CLIMATE EXTREME ON BANGLADESHI COASTAL COMMUNITIES

Climate change effects may include, but not limited to, livelihood, migration and health (Table 1). This paper only reports those effects that peer reviewed journal articles have attributed to climate change. The real cause of migration, food insecurity and health problems or other social problems often attributed to climate change is difficult to determine because some other factors may also cause these to happen. For example, people may wish to migrate from their homes to other areas not only due to climate change and its associated problems but also for some other pull factors (i.e. job opportunity, education, health and etc.). However, it is impossible to dismiss climate change as one of the main push factors (Luetz, 2013). Bangladeshi communities are vulnerable to climate extreme and other hazards due to a variety of socio-cultural and economic factors.

Table 1 Reported effects of climate extreme on Bangladeshi coastal communities

Sectors of effects		Description of effects	Sources
Livelihood	Food security	Decrease of rice production	Ali (2006), Khan et al. (2011), Parvin and Ahsan (2013), Pouliotte et al. (2009), Warner and van der Geest (2013)
	Fishing	Decrease in fish catch in the Bay of Bengal and Bangladesh coast	Islam (2009), Ahmed (2012), Islam et al. (2014)
	Food diversity	Decrease in crop varieties due to intrusion of	Khan at al. (2011),

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		saline water and monoculture	Parvin and Ahsan (2013) Pouliotte et al. (2009)
Migration	Forced migration from the coast to the inland Bangladesh	The inhabitants in the remote island areas of the Bay of Bengal, when lost their habitations due to coastal erosion and storm surge inundation, migrated to adjacent urban areas. They generally formed two types of settlements. These are: (i) slum dwelling within major city areas and (ii) settlements adjacent to the hills.	Black et al. (2011), Kartiki (2011), Alam et al. (2012) Mallick and Vogt (2014) Luetz (2013)
	Forced migration from the coast to adjacent Indian regions	Sea level rise and natural hazard induced displaced people from the Bangladesh coast have taken shelter in adjacent India illegally.	Bose (2013)
Health	Deaths and injuries	Deaths resulting from cardio-respiratory diseases associated with high and low temperatures	Rashid et al., (2013)
	Malnutrition	Higher malnutrition rate among coastal residents due to the reduction of food diversity	Khan et al. (2011)
	Safe drinking water	Rise of tide levels and frequent coastal flooding increase salinity in groundwater. Drinking of saline contaminated water increases eclampsia, and hyper tension among women in coastal areas	Khan et al. (2008), Pouliotte et al. (2009), Khan et al. (2011)
	Gender dimensions of effects	A decrease in women income and stressful social life	Pouliotte et al. (2009) Abedin et al., (2013)
	Increase of climate extreme related disease and sickness	Mosquito-borne diseases, tick-borne diseases (e.g. malaria, dengue) and air pollution related mortality and morbidity	Rashid et al., (2013)

3. COMMUNITY-LED ADAPTATION ACTIONS

Climate change adaptation may be divided into two categories. These are: institution led adaptation strategies and community led adaptation strategies. This research reports three main sectors (Table 2) of adaptations (i.e. livelihood, human habitation and health)

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undertaken by communities, which were adopted as responses to tropical cyclone hazards, salinity intrusion into inland areas and other extreme climatic conditions. Apart from the initiatives taken by the national authorities and by non-governmental organizations, coastal community members have taken it upon themselves to find ways to adapt to the heightened risk of climate-related natural disasters. The review suggests that hazard-affected people have employed a variety of short-term and long-term actions to cope with disastrous conditions (Table 2). However, migration is one of the most common adaptation strategies following a disaster, primarily as a result of lost livelihood and the fear of the recurrence of another such calamity (Brook and Paul, 2003). The review also suggests that many coastal community members—particularly those living on daily earnings who own neither land nor other property—had changed their residence from the offshore islands, which they had judged to be insecure, to areas on the mainland, which they had presumed to be more safe (Figure 3).

Table 2 Community-led adaptation actions of the Bangladeshi coastal communities

Adaptation sectors		Description of adaptation	Sources
(1) Livelihood	Changing rice crop farming to non-rice farming	Farming of different varieties of crops, cultivation of jute, wheat, plum and different types of pulses	Sarkar et al., (2013)
	Migrating to other countries for livelihood purposes	Migrating for jobs mainly to Middle Eastearn countries or other affordable countries (i.e., Malaysia etc.)	Alam et al. (2017)
	Increasing involvement in a variety of income sources	Earning money by wage labour, small business, construction works and livestock farming	Pouliotte et al. (2009), Habiba et al., (2013)
	Selling land and taking loan	Selling land and taking loans (especially poor households)	Alam (2002), Alam (2003a), Pouliotte et al. (2009)
	Gender dimensions	Women are forced to take difficult jobs outside their comfort zone.	Abedin et al., (2013)
	Obtaining support from relatives and social networks	Support by relatives and social networks to offset losses and to cope with devastations	Alam and Collins (2010)
(2) Human habitations	Raising homestead and plinth	Low-lying coastal and island inhabitants often raise homestead and plinth much higher than mainland people to mitigate severe effects of coastal flooding	Alam (2002), Alam (2003b)
	Planting trees	Planting trees around the house to reduce the intensity of storm surge attack	Alam (2002)
	Modifying of houses	Building a special tent-type of shed for those who have lost their houses	Alam and Collins (2010)
	Changing house locations	- The changes of housing locations from the coast of offshore island to inner part of the island or migration to the adjacent mainland - Those people changes house to the adjacent mainland mostly able to manage settlement in unstable slope of hills, non-habited forest hills, coastal and river margins in the adjacent mainland or cities these areas otherwise unused and publicly owned	Alam (2002), Alam et al. (2017)
(3) Health	Adopting household coping strategies	Season specific household levels strategies preventing sickness and diseases from extreme heat, cold and precipitation	Haque et al. (2013)

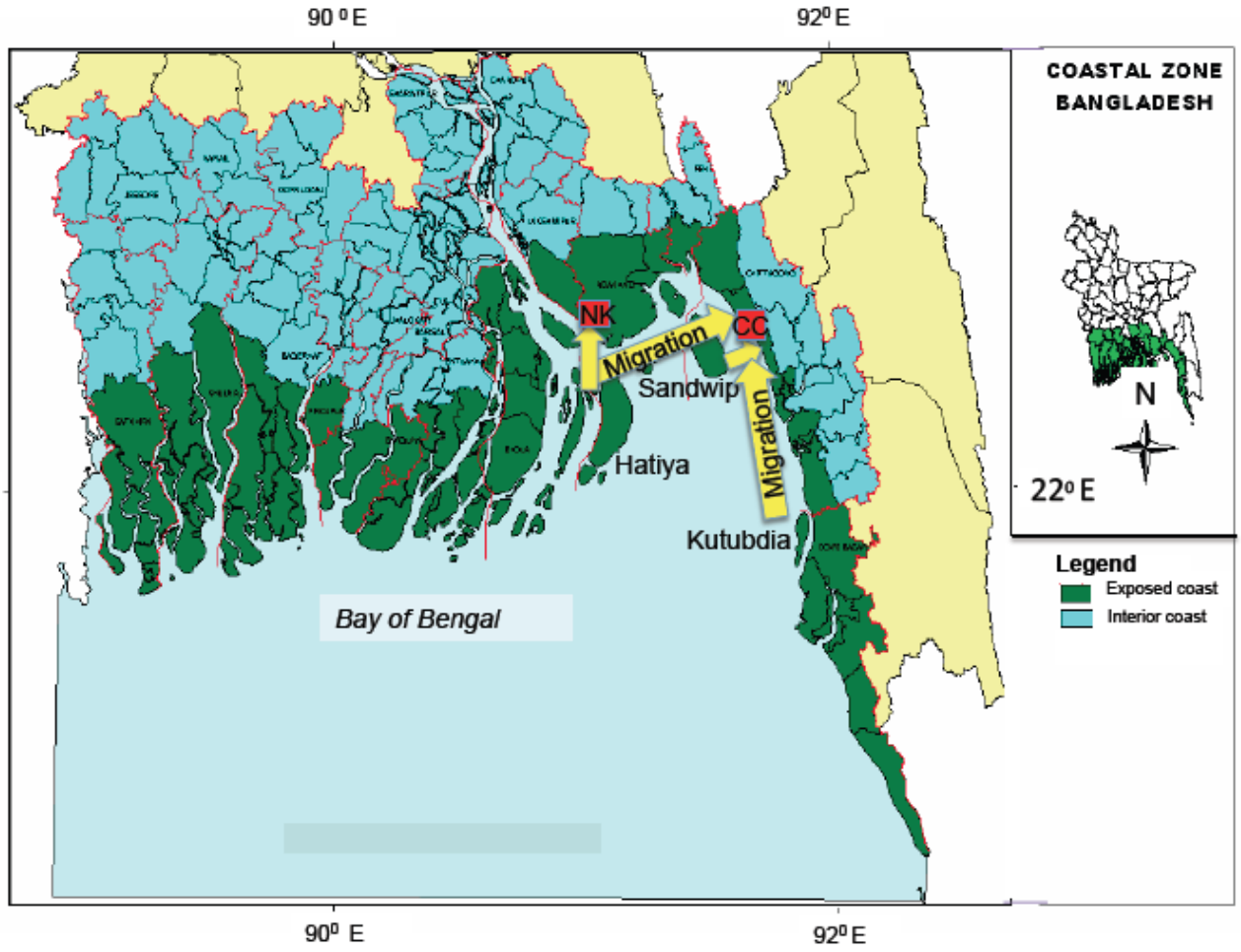

Figure 3 Location of highly vulnerable areas to tropical cyclones. The yellow solid arrows show the flow direction of disaster-induced migration from the offshore islands to the mainland of Bangladesh. CC=Chittagong City, NK=Noakhali.

4. COMMUNITY RESILIENCE TO CLIMATE CHANGE

Community resilience to climate change implies that the return of the functions of life and livelihoods of climatic stress affected community to a normal standard of living with the observed changes in climate and/or future abrupt changes in climate. The concept of resilience needs to be understood in three ways for better policy implications (Tanner et al., 2014). First, it is important to identify its 'contested nature'. The term resilience depends on differential 'social values' we prioritorise and how resources are to be allocated to sustain it (O'Brien and Wolf, 2010). The execution of resilience concept may depend on several factors: (1) types of activities; (2) to whom these to be implemented; (3) agents of decision-making; and (4) cultural context of implementation (Cote and Nightingale, 2012). Second, it needs to be considered how activities and institutions determine political economy of climate change resilience. This allows us to understand who are going to be benefitted by resilience activities, power relation in implementing activities, distribution of benefits, varying access to resources and concurrent inequality in society (Béné et al., 2012; Beymer-Farris et al., 2012). Third, climate resilience should be considered by considering varying level of climate impacts and capacity of different social groups to respond to climate change. The factors of impact and respond to climate change may include "levels of on-the-ground social inequality, rights and unequal access to resources, poverty, poor infrastructure, lack of representation, and inadequate systems of social protection, planning and risk management" (Tanner et al., 2014).

There is less understanding of community resilience to climate change. The reason for this is that the lack of understanding difference between community led autonomous and institution led imposed climate resilience activities. One example of community

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led or autonomous climate resilience activity is that the Bangladeshi coastal communities are by generations used to planting trees around the house to reduce the intensity of storm surge attack. One the other hand, the local communities are also transforming their rice farming land into mango orchard with the support of external organizations. However, in the past it is documented that external programmes did not bring much positive impact on local coping strategies with disasters in Bangladesh (Alam and Collins, 2010; Haque and Zaman, 1993). Although it seems that community led resilience activities in responding to tropical cyclones are more acceptable, it cannot be accepted as panacea.

Indeed, firsthand evidence from coastal Bangladesh—an area frequently affected by tropical cyclones, riverbanks, and coastal erosion—indicates that near-distance and far-distant out-migration is a continuous adaptation action. Some people migrating from the offshore islands form squatter settlements along the unstable hill slopes in and adjacent to the Chittagong City (Fig. 4). Torrential rainfall in the deforested hills in Chittagong City in June 2007 caused landslides that affected 2,680 families and claimed 137 lives. An analysis of the settlement history of the victims of the landslides found that they had migrated from the offshore island areas to the unstable slopes in the Chittagong City hillside. Three-quarters of those who had migrated to these unstable areas had previously lost their houses as a result of the April 1991 cyclone or due to coastal erosion. Of those who perished in the 2007 landslides, the death toll for women and children far exceeded that of adult males (Chisty, 2014).

Figure 4 Houses adjacent to the susceptible hill at Kusumbagh area in Chittagong City (Source: the author, 2007)

5. CONCLUSIONS

The research suggests that the Bangladeshi coastal community is taking continuous adaptation actions to survive the slow onset and sudden changes in climate conditions. Human induced climate change is now undeniable. A growing number of researches from around the world has evidenced symptoms and impacts of climate change (CCC, 2009; Khan et al., 2011; Luetz, 2013). Climate change and its associated impacts are experienced through livelihood changes (i.e. decrease of rice production, fish catch in the Bay of Bengal and Bangladesh coast, decrease in crop varieties due to intrusion of saline water and monoculture, etc.), changes in human settlement (i.e. forced migration from the coast to the inland Bangladesh and to adjacent Indian regions) health and wellbeing (i.e. malnutrition, safe drinking water, a decrease in women income and stressful social life, increase of climate extreme related disease and sickness, etc.) of the Bangladeshi coastal communities. The Bangladeshi coastal communities are adopting self-instinct adaptation strategies to these climatic impacts. These include changing rice crop farming to non-rice farming, migrating to other countries for livelihood purposes, raising homestead and plinth, modification of houses, season specific household levels strategies preventing sickness and diseases from extreme heat, cold and precipitation, etc. Changing location of houses from hazard-prone coastal areas to the mainland is one form of adaptation action the coastal community has undertaken. However, the ongoing research on disaster-induced migration indicates that the migrants were not able to obtain secure land but rather settled in an area that is, itself, prone to another form of disaster. The specific audiences of this research will be research academics and

institutions, Government of Bangladesh, Non-Governmental Organizations in Bangladesh along with other international developmental organizations working on disaster risk reduction, climate change adaptation and sustainable development sectors in Bangladesh and elsewhere in the world.

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