REPORT

RAINFALL, FOOD SECURITY AND HUMAN MOBILITY
CASE STUDY: BANGLADESH

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″Where the Rain Falls″ Project
Case study: Bangladesh

Results from Kurigram District, Rangpur Division

Authors: Ahsan Uddin Ahmed, Selim Reza Hassan, Benjamin Etzold and Sharmind Neelormi

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Glossary

Agrahayon:	*The eighth month of the Bengali calendar (mid-November to mid-December)*
Aman:	*A monsoon rice variety, mainly rain-fed, grown during July/August to December*
Asharh:	*The third month of Bengali calendar (time for harvesting Aus; mid-June to mid-July)*
Ashwin:	*The sixth month of Bengali calendar (mid-September to mid-October)*
Aus:	*A summer rice variety, mostly rain-fed, grown during March till June/July*
BdTk:	*Bangladeshi Taka*
Bhadro:	*The fifth month of Bengali calendar (mid-August to mid-September)*
Boishakh:	*The first month of Bengali calendar (time for harvesting Boro; mid-April to mid-May)*
Boro:	*A post-winter dry season crop, mostly irrigated, grown during December to late-April*
Chala:	*Generally a roof; also refers to a temporary network of ropes for hanging purposes*
Choitra:	*The twelfth month of Bengali calendar (mid-March to mid-April)*
Falgun:	*The eleventh month of Bengali calendar (mid-February to mid-March)*
Gainja:	*A traditional Aman variety that can still grow under certain submerged conditions (very low-yielding, grown only where potential for HYV Aman does not exist)*
Joistha:	*The second month of Bengali calendar (mid-May to mid-June)*
Kaitan-Satao:	*A rainfall episode lasting a few days which is believed to set in winter in rural Kurigram*
Kayam:	*The floodplain adjacent to a river which is not at risk of immediate erosion*
Kartik:	*The seventh month of Bengali calendar (mid-October to mid-November)*
Kaun:	*A lesser-known cereal, generally consumed as ceremonial food*
Khal:	*Rivulet or canal, to facilitate drainage and navigation*
Magh:	*The tenth month of Bengali calendar (mid-January to mid-February)*
Mohajan:	*A moneylender who operates on trust, however charges hefty interest rates in an informal lending arrangement*
Monga:	*Seasonal food insecurity phenomena (observed mostly in north-western region)*
Mushti Chal:	*An amount of rice, which may be held in a human fist*
Poush:	*The ninth month of Bengali calendar (mid-December to mid-January)*
Purdah:	*A religion-based custom that used to keep women out of sight of men*
Sardar:	*The self-proclaimed leader, a middleman who establishes initial contacts for migration in a group*
Srabon:	*The fourth month of Bengali calendar (mid-July to mid-August)*
Thana:	*Erstwhile name of a subdistrict, the Bengali word for police station*
Union Parishad:	*The lowest tier of local government institution and a smaller division of a subdistrict*
Upazila:	*A subdistrict*
US$:	*United States Dollar (1 US$ = 83 BdTk)*

Abbreviations and acronyms

ADP	*Annual Development Fund*
BBS	*Bangladesh Bureau of Statistics*
BCAS	*Bangladesh Centre for Advanced Studies*
BOD	*Biological Oxygen Demand*
bn	*Billion*
BRAC	*Bangladesh Rural Advancement Committee*
BRRI	*Bangladesh Rice Research Institute*
BV	*Base Village*
BWDB	*Bangladesh Water Development Board*
CBA	*Community-Based Adaptation*
CGC	*Centre for Global Change*
CIESIN	*Center for International Earth Science Information Network*
DAE	*Department of Agriculture Extension*
EI	*Expert Interview*
FAO	*Food and Agriculture Organization of the United Nations*
FFWC	*Flood Forecasting and Warning Centre*
FGD	*Focus Group Discussion*
GDP	*Gross Domestic Product*
GOB	*Government of Bangladesh*
hh/HH	*Household*
HYV	*High Yielding Variety*
IOM	*International Organization for Migration*
IPCC	*Intergovernmental Panel on Climate Change*
LDC	*Least Developed Countries*
MOEF	*Ministry of Environment and Forests*
MOF	*Ministry of Finance*
MPO	*Master Plan Organization*
mt:	*Million tons*
NCA	*Net Cultivable Area*
NGO	*Non-Governmental Organization*
PC	*Planning Commission*
PECCN	*Poverty, Environment and Climate Change Network*
PECM	*Poverty, Environment and Climate Mainstreaming*
PKSF	*Palli Karma Shohayak Foundation*
PRA	*Participatory Research Approach*
RA	*Resource Analysis*
REHH	*Remittance Earning Households*
RMMRU	*Refugee and Migratory Movements Research*
SSN	*Social Safety Net*
SV	*Satellite Village*
TAS	*The Asiatic Society*
UNDP	*United Nations Development Programme*
UNFCCC	*United Nations Framework Convention on Climate Change*
UNU	*United Nations University*
UNU-EHS	*United Nations University Institute for Environment and Human Security*
UP	*Union Parishad*
WB	*World Bank*
WFP	*World Food Programme*

Executive summary

Global climate change and induced effects on weather patterns have been causing problems for human systems across the globe, especially for food production and the livelihoods of poor people who directly depend on natural resources. The highly complex relationships between climate change, in particular in terms of rainfall variability and shifting seasons, rural livelihoods, food security, social inequality and migration are, however, not well understood. In a bid to investigate these linkages and to inform policymakers about the implications of climate change on people's livelihoods, food insecurity and migration, the United Nations University Institute for Environment and Human Security (UNU-EHS) and CARE International have jointly carried out empirical research in eight countries across the globe. As a part of this effort, Bangladesh has been selected for a case study, because it is one of the countries that are most severely affected by climate change.

The specific objectives of the study are to:

1. understand the relationship between changing rainfall variability and shifting seasons, rural livelihoods, food security, social inequalities and different forms of human mobility;
2. assess the potential for climate change to become a driver of migration and displacement in the future;
3. enable a range of stakeholders to influence policies, plans and practical interventions about climate change and human mobility.

This report presents evidence from an empirical field study jointly undertaken by CARE Bangladesh and the Centre for Global Change in the Kurigram district in the north-west of Bangladesh. The study applied both quantitative and qualitative methods, blended with secondary sources, to reveal the above-mentioned links. The quantitative data has been collected through a structured questionnaire survey involving 150 households (HHs). Participatory research methods such as focus group discussions (FGDs) as well as expert interviews (EIs) have been employed to develop a deeper understanding of the local people's vulnerability to environmental changes and in particular to rainfall variability.

Rainfall variability

The analysis reveals that the study area has been experiencing no significant change in total monsoon rainfall. However, a distinct increase in rainfall variability throughout the rainy season (April to October) has been found in the area, together with changes in the microstructure of rainfall patterns. The latter is manifested in the bimodal distribution of rainfall occurrence instead of the usual single peak distribution, and a reduction of overall rainfall during an October phenomenon called *Kaitan Satao* involving intense rainfall. The scientific findings clearly provide evidence of changing rainfall patterns in the study areas, which is duly supported by the local people's perception of changes: 93 per cent of the people interviewed noted a decline in overall rainfall, but nonetheless a longer rainy season (98 per cent noted). Three-quarters of respondents mentioned an increase in drought and untimely dry spells, two-thirds (65 per cent of HHs) noted more extreme events, and half reported more heavy rains than normal. An overwhelming majority can no longer distinguish the six seasons that have been common in the past.

Since rainfall plays a significant role for the livelihoods of the poor, such changes disturb the seasonal production cycle of the poor and threaten their livelihood security. Two major livelihood groups are particularly affected. Poor farmers with small land-holdings have difficulty coping with the changes in rainfall

patterns as their food production is further declining, which increases their food insecurity. Similarly, the already weakened livelihoods of fishermen are facing an additional challenge due to changes in rainfall behaviour and flooding.

Food insecurity

The evidence presented shows that people in the Kurigram district perceive climatic variability and change as severe risks to their livelihoods and their food security, in terms of availability, access to, and the utilization of food. Advancements in the rice-based agricultural production system have been achieved in the north-west of Bangladesh in recent years. Such advancements have been complemented by governmental support in the forms of food and employment programmes. Despite these programmes, the poor and the extremely poor HHs have become increasingly vulnerable to food insecurity. Their livelihoods are highly sensitive to changing rainfall patterns and most of them do not have adequate capacity to cope with these changes and overcome their negative effects. While more affluent farmers with a lot of land can cope with erratic or diminishing rainfalls by employing irrigation and can thus achieve an appreciable harvest, the agricultural-based HHs with smaller landholdings cannot afford irrigation and are thus more vulnerable to rainfall variability.

The extremely poor to the lower-middle class are particularly sensitive to seasonal food insecurity (locally known as the *Monga* phenomenon occurring in September and October). HHs with large landholdings do not suffer from seasonal food shortages. Food insecurity among non-agricultural HHs is more prevalent than among agricultural-based HHs, because the wage labourers are hit particularly hard by the lack of employment in the lean season. People in the Kurigram district employ a plethora of strategies to cope with (seasonal) food insecurity: they opt for less expensive (generally, non-protein based) food, they limit their food consumption, some even reduce their food intake to a bare minimum and go hungry and they borrow food items. Almost all such (negative) coping strategies are found to have a detrimental effect on people's nutrition and health. While most food insecure HHs cannot send out a family member to work elsewhere during Monga due to little labour demand at the most important potential destinations, income earning opportunities – mostly in the agricultural sector – increase in the post-*Monga* period.

Migration

People have been migrating from Kurigram since the early 1970s. Since then, both the absolute number of migrants and the rate of participation in labour migration have risen. Members of almost half of the HHs interviewed seek employment in agricultural regions and other cities with a high demand for labour in order to earn a cash-income and thereby diversify their livelihoods. In the study region migration is predominantly male, temporary, internal and rural-to-rural; the latter point being a contrast to other studies on migration and climate change in Bangladesh that focus on rural-to-urban migration. Social inequality in the villages is reflected in the migration patterns: the comparatively most affluent HHs do not have to migrate as they can secure a steady supply of food throughout the year. Some of them, however, do migrate to Dhaka or Rangpur due to better wages in the formal urban economy or to take advantage of higher education or better health care facilities in the cities. The lower-middle class and the poor are particularly dependent on seasonal out-migration. Members of these social groups seek employment as agricultural wage labourers in other regions in Bangladesh, in particular in Munishganj and Feni, as this does not require more than the

farming skills that they already possess. Their lack of technical skills, however, limits their opportunities to earn a higher income. The extremely poor cannot even afford the costs of temporary migration. Most of them also lack the necessary access to migration networks. Comparatively few women from Kurigram have the option to migrate to improve their own livelihoods. Prevalent social norms, women's sense of uncertainty regarding the employment types and destination areas, fear of harassment and social exclusion are the prime reasons for a low rate of female migration.

Migration has distinct social costs. Generally, the male heads of HHs or adult sons migrate in search of employment. It is found that women pay a heavy toll when the men have left. Not only do they have to work harder to sustain their family's food security, they also have to carry out an extra workload to pay off the debts their husbands have left. Moreover, many women and adolescent girls face harassment and even sexual abuse in the absence of the HH's men. Nonetheless, the advantages of seasonal labour migration seem to outweigh its negative effects. The increase in mobile phones, improved road networks and the services of migration entrepreneurs who facilitate migration and provide access to labour in other agrarian regions, have made temporary migration easier in recent years. One might even argue that a distinct agrarian labour migration system or a culture of seasonal migration has emerged.

In northern Bangladesh, climate change, that is, increasing rainfall variability and more frequently occurring natural hazards, affects people's agricultural production and thus their food security. Although most people would like to stay in their ancestral homes, given the growing and increasingly diversified national economy and people's need to cope with food insecurity and the adverse effects of climate change, an increase in seasonal out-migration from the Kurigram district is highly likely. Overall, the case study from Kurigram shows clear links between rainfall variability, food and livelihood security, and migration. Temporary labour migration has the potential to ameliorate the (seasonal) food insecurity of the rural poor and the income earned by the migrants helps to buffer the effects of rainfall variability. The relationships between these variables are, however, nuanced and require careful further analysis.

Policy recommendations

Policymakers at different levels – from the district to the national, and from the regional to the global level – need to be informed of the complex implications of climate change on people's livelihoods, their food insecurity and subsequent migration patterns. In Bangladesh, the successes towards eradicating poverty and hunger that have been achieved in the past two decades are in danger of being counteracted by climate change. Future potential is thus threatened, too. Recognizing the everyday lives of rural people in Bangladesh and reflecting upon the key findings of this study, a number of policy recommendations are formulated. Some of these recommendations may appear generic for the country as a whole, while a few are specific for the case study area.

People's sensitivity to rainfall variability, especially the extremely poor and the poor, needs to be reduced and their food security needs to be enhanced. Efforts must be made to improve the planted crop varieties and agricultural practices in order to protect livelihoods and ensure food security. New varieties of hazard-resistant crops need to be introduced and made available to all local people. Efforts must also be made to develop crops with high nutritional value that are simultaneously "climate safe". It is recommended that newly introduced crop varieties and essential agricultural inputs should be made "fair" in terms of their price. Revised and strengthened incentive packages should be designed and facilitated that enable the poor to enhance their own food production, and thereby also their competitiveness. "Integrated

pest management" should be given incentives so that the excessive use of harmful chemicals does not destroy open water fisheries.

Poor and marginal farmers should be supported in diversifying their sources of living and also finding alternatives to agriculture. More opportunities for gainful employment in the Kurigram district – in particular also for women – will improve the local people's access to food. Their adaptive capacity to live with hazards and rainfall variability should be enhanced. Better early warning and messaging systems need to be developed and implemented. Further efforts must be made to gradually enhance people's adaptive capacity as well as to reduce their sensitivity to sudden-onset climate hazards as well as to variability-related climate risks. The adaptive capacity of the poor can indeed be enhanced by building human capital (through skill enhancement and training), physical capital (by building adaptive infrastructure, etc.), natural capital (by enhancing and creating poor people's access to common property regimes) and through systematic investment in social development processes.

There is need to continue the focus on education and targeting of poor and extremely poor HHs in terms of access to education and social safety-net (SSN) programmes in order to improve their social and economic chances in the future. The respective families require improved incentives to invest in their children's education. Further investments into the existing disaster risk reduction mechanisms are necessary so that – in case of a natural hazard – people's losses can be minimized and the erosion of their assets can be stopped.

It is necessary to facilitate migration rather than fighting it in a bid to provide a better chance for the poor and the extremely poor to avoid hunger. Migration should not be seen as "failure of adaptation" and discouraged, but rather as an "adequate way of adaptation" and supported. Since the extremely poor people's lack of resources is the key barrier to their ability to migrate, micro-credits and available financial instruments could be developed further in order to assist them in migrating. The aspiring poor need to acquire skills so that they can find gainful employment, optimally in the growing urban economy rather than in the agriculture sector, which might be affected by climate change, too. State-run programmes might have to be realigned, with particular focus on the nation's climate change "hotspots" so that the most vulnerable, including women and artisan fishers (who have no other skills), also find better conditions to apply their knowledge and skills elsewhere.

The vulnerability of migrants' HHs must be recognized and reduced at both ends – in the migrants' home villages and at their places of destination. The rights of labour migrants need be strengthened and their working and living conditions must be improved at the destinations. The protection of both female migrants and the women left at home needs special attention. The social costs borne by the female members of the migrants' HHs must be taken care of through the involvement of local government institutions and the strict implementation of legal regimes.

Section 1: Introduction

Bangladesh has become the centre of global attention in recent years for two major reasons: first, it has been recognized by the global community as one of the most vulnerable countries for rainfall variability and a "hotspot" for future impacts of climate change (IPCC, 2007; Huq and Ayers, 2007; World Bank, 2010). Second, the country's methods in addressing abject poverty, high population density and great vulnerability to various environmental risks have been examined.

The country is located in South Asia, covering the major part of the largest delta on earth – the Ganges Delta. Major Eastern Himalayan rivers such as the Ganges, the Brahmaputra and the Meghna and their numerous distributaries criss-cross the country before flowing to the Bay of Bengal. Monsoons dominate the landscape and the hydrology. Also, 92 per cent of the water in the Ganges-Brahmaputra-Meghna system is eventually discharged to the northern Indian Ocean over the low-lying floodplains of the country – the latter occupying only seven per cent of the combined catchment areas of these rivers (Ahmad et al., 1994). There is a marked spatial and temporal distribution of rainfall, which gives rise to "too much water" during the monsoon and "too little rainfall" during the long dry season. The two phenomena, occurring cyclically, often lead to floods and droughts that not only impact the local agriculture and livelihoods of the people, but also their food and human security (Ahmad et al., 1994). The high sensitivity of agricultural-based livelihoods to rainfall variability – as one of the most significant climatic indicators – makes the country an important case for a study of the implications of climate change on people's livelihoods, their food security and their subsequent coping strategies. Migration is one of the people's most important choices in dealing with (climate) risks and insecurity.

This report presents findings from a field study jointly carried out in the Kurigram district in north-west Bangladesh by CARE Bangladesh, the Centre for Global Change and the United Nations University Institute for Environment and Human Security (UNU-EHS). The key objective of this study was to understand the relationship between changing weather patterns, rural livelihoods, food security, social inequalities and different forms of human mobility. The key question was: *Under what circumstances do households use migration as a risk management strategy in relation to increasing rainfall variability and food insecurity?*

1.1 Organization of the report

Section 2 presents a short literature review of environmentally induced migration in Bangladesh in relation to rainfall variability and seasonal food insecurity. Section 3 introduces the qualitative and quantitative methods, such as Participatory Research Approach (PRA) and a household (HH) survey, which have been employed in the study. Section 4 gives a geographical and socio-economic introduction to the Kurigram district. Section 5 then sheds light on the extent and perception of rainfall variability in the region, and Section 6 explains the implications of rainfall variability for the inhabitants of the study areas in terms of livelihoods, well-being and food security. Common coping and adaptation strategies are also addressed in section 6. The local migration systems are described in Section 7. Section 8 then answers the overarching research question of this study by addressing migration as a risk management strategy in the context of rainfall variability and food insecurity. Section 9 briefly summarizes key conclusions from the study findings, and Section 10 presents some reflections for policymakers.

Section 2: Literature review

2.1 Climate change and rainfall variability in Bangladesh

Bangladesh is heavily influenced by the annual monsoon, and therefore also experiences very high rainfall variability. While the north-east receives over 5,000 mm rainfall annually, the central-western region hardly receives 25 per cent of that annually (FAO/UNDP, 1988). June to September is the monsoon season when about 80 per cent of the rainfall occurs (Ahmad, 2000). However, local run-off is overwhelmed by the huge run-off generated in the greater Ganges-Brahmaputra-Meghna basins, to form the second largest outfall into the ocean through the Lower Meghna River.

Bangladeshi society is now confronted with the local manifestations of climate change, in particular an increased frequency of natural hazards such as floods, cyclones and storm surges, drought, river erosion and salinity ingress (Ahmed, 2006; Asaduzzaman et al., 1997, 2011; BCAS-RA-Approtech, 1994; Huq et al., 1996, 1998; IOM, 2010; IPCC, 2007; Pouliotte et al., 2009; World Bank, 2000, 2010). A number of reports have revealed that rainfall patterns have already changed across Bangladesh (Ahmed and Hussain, 2009; Selvaraju et al., 2006). While the *total annual rainfall* of the country has largely remained unchanged (Choudhury et al., 2003; Mondal and Hossain, 2009; Rahman et al., 1997), the spatial and seasonal rainfall variability is likely to be further accentuated to provide more rainfall and run-off during the monsoon and a decline in already scanty rainfall throughout the dry season, leading to increasing water-related risks for food production and livelihoods (Agrawala et al., 2003; IPCC, 2007). For the Kurigram region, insufficient scientific evidence is available regarding the discernible changes in rainfall patterns and its effects on agricultural-based livelihoods and local food security.

In addition to the local distribution of rainfall, the regional flow patterns in the rivers are crucial. As water resources are shared with regional countries, the regulation of the rivers' water volume, pollution and encroachment into rivers and wetlands are major environmental issues that bear the potential for regional conflicts, but also cooperation (Ahmad, 2000; Ahmed and Hussain, 2009; Ahmed et al., 2005; Findlay and Geddes, 2011). Currently, the water in the Ganges is shared between upstream India and downstream Bangladesh under a treaty. Regional rivers such as the headstreams of the Meghna and the Brahmaputra are about to be harnessed unilaterally by India and China, respectively, which has been considered to be detrimental towards maintaining the livelihoods of the farming communities in the downstream areas. Withdrawal of water in these rivers during the dry season or release of water from dams during the peak monsoon might cause severe impacts on the agriculture-dominated livelihoods of the people in Bangladesh (BCAS-RA-Approtech, 1994).

The Government of Bangladesh (GOB) is aware of the potential risks associated with climate change. The GOB devised the "National Adaptation Plan of Action" (NAPA) and the "Bangladesh Climate Change Strategy and Action Plan" (BBCCSAP) in 2009 and set up two funds to deal with climate change (Ahmed, 2010b; MOEF, 2005, 2009). In a recent attempt, the GOB initiated measures to integrate climate change adaptation in development projects, making projects under the annual development plan "climate safe" (PC, 2010). However, it should be noted that although Bangladesh has embraced parliamentary democracy, and democratic elections are being held every five years, corruption, confrontational national party politics and weak governance structures hinder important structural reforms, more effective resource allocation and transparent decision-making (BRAC University, 2009; International Crisis Group, 2008). The allocation of Climate Change Adaptation Funds (CCAF) through government channels is therefore likely to be subject to these same governance challenges. The initiatives by non-governmental organizations (NGOs) and other actors are therefore necessary in order to confront climate change. For instance, during 2002–2005, CARE Bangladesh successfully designed and implemented the first ever community-based adaptation (CBA) project in the world in Bangladesh (Ahmed, 2010c). This project has become a trailblazer for others to engage in CBA projects.

2.2 Poverty and food security in Bangladesh

Poverty and food insecurity are still widespread and the most pressing problems of the nation. Bangladesh is one of the least developed countries (LDC), owing to a weak economy and poor social development indices. Much of the large population is below reproductive age, which presents a challenge for both the current and future prospects of the country. The small land mass (over 147,000 km²) is inhabited by a large population (over 150 million[1]). With a population density of around 1,000 people per km², it is one of the most densely populated countries in the world. Until 1950, the population did not exceed 40 million people and agricultural production from the vast floodplains was adequate to feed them. Since the 1970s, however, the population increased dramatically. As a consequence, cropland became fragmented, the resource-to-man ratio declined, and poverty and food insecurity crept in. Much of the latter changes have been initiated by frequently occurring natural hazards, a few in the past assuming disastrous proportions (Nizamuddin, 2001). The severe floods of 1974, for instance, led to destroyed harvests and grain stocks, then to a rapid price increase for rice, and eventually to a famine in Northern Bangladesh; 30–100 thousand people reportedly died of hunger and malnutrition in 1974/1975 (Sen, 1981). Since independence in 1971, the country experienced rapid urbanization, fuelled by an urban-biased economy. In the cities the service economy grew and the industrial sector thrived, enticing young men and women to the urban centres to find employment, in particular in the informal economy and garments factories in Dhaka.

1 There have been debates around the latest census data (BBS, 2011a), which initially spoke of a population size of about 146 million. However, this figure has been rejected by several ministries and many civil society leaders and experts. At present, the census data is being revised.

Bangladesh made bold strides in social development in the past two decades, and even obtained a Millennium Award from the United Nations for its achievements in arresting the child mortality rate. Although the education rate is still below 40 per cent, the country has achieved about 90 per cent enrolment in primary education – which promises a dramatic improvement in overall education within a decade. In recent years, poverty reduction programmes have been quite successful, owing to increased spending on both economic development and SSNs. At the national level, the incidence of poverty therefore decreased from 50 per cent in 1995 to 31 per cent in 2010; rural poverty dropped from 47 to 35 per cent, while urban poverty rates fell from 50 to 21 per cent. Nonetheless, one needs to bear in mind that almost 47 million people still live in relative poverty, and about 26 million people (18 per cent) live under extremely vulnerable conditions as they are below the nation's lower poverty line (BBS, 2011b). Lack of employment, a further declining resource-to-man ratio and governance failures are among the most important reasons why there is still a high incidence of poverty in the country. As the rural economy largely relies on agriculture, which in turn is dependent on the availability of rainfall – in terms of both quantity and the timing of occurrence (i.e., seasonality) – one can assert that poverty and food security are both directly linked to rainfall variability.

2.2.1 Food security

In the past 20 years, Bangladesh has achieved considerable progress in the agricultural sector. Cereal production, especially rice, quadrupled even before the population doubled. New varieties of crops that are suitable for different agro-ecosystems and seasonal conditions have been developed and duly promoted (Ahmed, 2010a). However, Bangladesh's food production potential is likely to diminish through the impact of climate change, in particular due to water-related stresses and natural hazards (Ahmed, 2005; Asaduzzaman et al., 2011; Karim, 1996; Karim et al., 1999; Warrick and Ahmad, 1996; World Bank, 2010). Nonetheless, overall food availability increased significantly at the macro level. Even in the rural areas there is sufficient food available throughout the whole year and food is exported to urban centres from some of the most food insecure regions (GOB/WFP, 2004; Keck et al., 2013). Nevertheless, the country has been among the top five net food-importing countries and also among the top ten food aid recipient countries since the 1990s (Gill, 2003).

Importantly, food production, processing and trade is the most important sector of employment in Bangladesh, within which almost two-thirds of the labour force work. In rural Bangladesh, 24.5 million people are: producing food through their labour in agriculture and fisheries (55 per cent of all rural employment); processing food (0.8 per cent); trading food (7 per cent); and preparing food for sale in restaurants and street food shops (0.3 per cent) (BBS, 2004)[2]. Moreover, agriculture, fisheries and forestry contribute 18 per cent to the national gross domestic product (BBS, 2011b).

Despite sufficient availability of food, food insecurity is still among the nation's most pressing problems. Families' own subsistence production is often not enough – in quantity, nutritional value and variety – to feed them throughout the whole year, in particular during the so-called *Monga* period (see Section 7.5). Even in rural areas additional resources are necessary to buy food. Food insecurity[3] is therefore also a question of access to food in terms of affordability (purchasing power) and allocation (public food distribution, self-help), and in terms of people's food preferences (Ingram et al., 2010). Food insecurity is thus a manifestation of economic and social inequity in Bangladesh, which exists between the poor and the rich, between men and women, and between the Bengali majority and various ethnic minorities. Despite the national government's anti-poor growth model of development, an increasing proportion of wealth is being accumulated in the hands of the rich. Moreover, women

2 Calculated from the Labour Force Survey 2002-03 (BBS, 2004) and updated for 2009.

3 As a negation of the FAO's definition of food security "food insecurity exists when people do not have adequate physical, social or economic access to food" (FAO, 2009: 8).

are still lagging behind in all economic and social spheres, though numerous initiatives on women's empowerment were implemented (Halim, 2001).

The most food insecure areas of Bangladesh are the north-west region (Rangpur division, northern char islands – where this study was undertaken), the "drought zone" in the west (Nawabjanj, Rajshahi, Noagaon districts), the Sylhet Haor basin (in the north-east), the southern coastal belt and Chittagong Hill Tracts in the south-east (see Figure 1). Due to the interventions of both government and non-governmental organizations, the acute food insecurity of the north-western region has been reduced slightly (CARE, 2005).

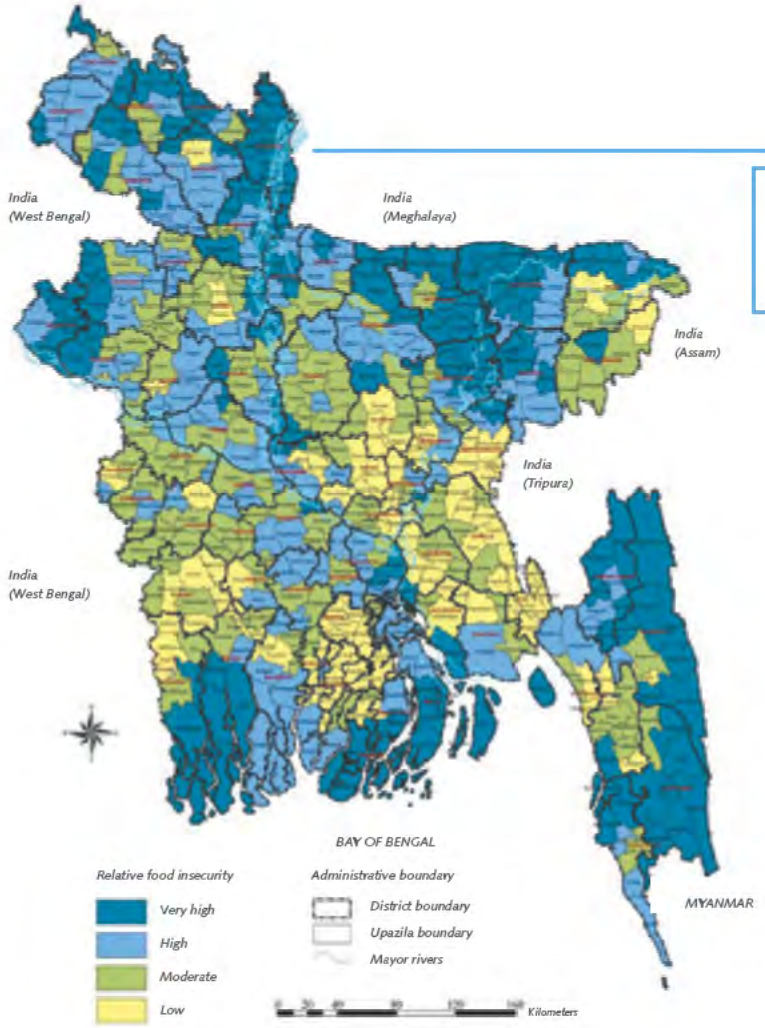
2.3 Migration patterns in Bangladesh

Migration can be simply defined as the change in the place of residence of an individual, a HH or another group of people either by crossing an international border – international migration – or by moving within the country of origin to another region, district or municipality – internal migration (UNDP, 2009). There is a continuum between short- and long-distance migrations; between voluntary and forced migration, in terms of the freedom in the migration decision; between temporary, seasonal and permanent migration; and between the ability and willingness of migrants to return to their place of origin. Migration can be seen as a manifestation of social vulnerability, but also as a successful adaptation strategy. "Migration can help reduce risk to lives, livelihoods and ecosystems, contribute to income diversification and enhance overall capacity of households and communities to cope with the adverse effects of environmental degradation and change" (IOM, 2010: 4).

Migration is a normal part of Bangladesh's recent history and closely connected to its economic and social development. People have been moving throughout the delta for centuries – primarily in search of good harvests and secure lives. With the degradation of land towards the southern reaches of the delta, farmers have migrated and utilized fertile land. In the 1960s the population began to increase quickly and food demand showed a rapid increase also. With urbanization, industrialization and economic growth, resource-poor HH members also began migrating to cities for alternative livelihood opportunities. From the 1970s onwards, more and more resource-poor people migrated from rural areas to find employment. With the advent of an improved transportation network and modern communication technology, migration has now become rather common throughout Bangladesh. Most movements, however, take place within the country and over shorter distances so that people can rejoin family members after a while (Afsar, 2000, 2005; Chaudhury, 1978; Islam, 2005). This pattern is confirmed by a longitudinal study (1994–2010) undertaken by the International Food Policy Research Institute (IFPRI) in 14 districts (including 1,680 HHs) across Bangladesh: 59 per cent of all long-term moves[4] occur within the respective districts, while 39 per cent of migrants move outside the district of origin. Of these long-distance moves, 81 per cent were to urban centres, 13 per cent to international destinations, and only 6 per cent to other rural districts (Gray and Mueller, 2012).

Large-scale *international* migration from Bangladesh only started in the 1980s, when many Bangladeshi began to leave for work in the Middle-East, Japan, Korea, Singapore, Australia, New Zealand, the UK, Germany, Italy, Canada and the USA. Simultaneously, Bangladesh also received international migrants, who largely work in the growing industrial sector. Bangladesh's international labour migrants send home hefty amounts in international remittances (equal to US$ 11 billion annually), which help the country to reduce pressure on the balance of payments. But international migration is investment intensive, and high costs for visas, travel arrangements and job search – all of which are normally organized by specialized agencies and migration entrepreneurs – often cannot be met by poor families, in particular

4 Due to data limitations, the IFPRI-study only considered permanent and long-term moves, but could not investigate temporary migration. In our case study in Khanpara, seasonal or temporary migration, in particular as agricultural wage labourers in other rural districts, was more relevant than permanent moves.



Relative food insecurity map

The people in Kurigram District – the case study site – are among the most food insecure in Bangladesh

Figure 1: Relative food insecurity in Bangladesh. Source: GOB/WFP (2004).

those from more remote rural areas (Afsar, 2009; Rashid, 2009; Siddiqui, 2005). International migration was not relevant in our case study.

Bangladesh's *internal* migration system, in turn, offers more opportunities to diversify and thereby secure one's livelihood, even for poorer HHs who have been struggling to optimize the benefits of migration against the loss of leaving the family behind (Haan et al., 2000; Seely et al., 2009; Siddiqui, 2003). In the literature, most often rural-urban migration is addressed, in particular to the megacity of Dhaka (Afsar, 2005; IOM, 2010; Poncolet, 2010; Poncolet et al., 2010; Siddiqui and Sikder, 2009). Due to uncertainties in the destination involving unfavourable living conditions in slums, economic hardship, social and environmental conditions, in Bangladesh in most cases the male head of HH migrates (Afsar, 2000; Begum, 1999). Despite social and religious norms that restrict the movement of women, out of sheer necessity the number of migrating women seems to be steadily increasing. In rural areas, women are involved in agricultural wage labour. In the larger cities, most importantly in Dhaka, women work in the garments industry (Dannecker, 2002), as domestic helpers (Siddiqui and Sikder, 2009) and as street food vendors (Etzold, 2012).

The latest census of 2011 revealed that against an overall national population growth rate of 1.34 per cent, two southern divisions, Khulna and Barisal, have exhibited a growth of 0.6 and 0 per cent, respectively (BBS, 2011a). This is a clear indicator of large-scale internal migration from Bangladesh's southern coastal zone, which is known to be highly susceptible to climate-induced hazards. Since the early 1980s there have also been significant streams of internal migrants from Bangladesh's North, in particular from the Kurigram, Jamalpur, Mymensingh, Sherpur and Gaibandha districts, which are mostly a consequence of lack of employment opportunities and food insecurity during the *Monga* season. Seasonal migrants contribute crucially to food security in the rural communities by transferring their additional income (remittances) and by providing their own labour at important times.

Environmental factors are not *the* key drivers of mobility in Bangladesh, but rather employment and income opportunities. Nonetheless, there seems to be a distinct "culture of mobility" (Findlay and Geddes, 2011: 149). In particular, temporary migration from the poverty-ridden and *Monga*-affected regions in the north-west are clearly linked to seasonal climate regimes. Recent changes in climatic conditions underscore the need to investigate the link between environmental factors, rainfall-dependent livelihoods, food security and migration.

2.4 Environmentally induced migration in Bangladesh

Migration can be seen as an adaptive response to the slow-onset process of environmental change and/or as a coping strategy in the light of rapid-onset natural hazards (Jäger et al., 2009; Laczko and Aghazarm, 2009; McLeman and Smit, 2006; Warner, 2009; Warner et al., 2010). As the effect of the environment in migration decisions varies significantly, one can distinguish between environmental emergency migrants, environmentally forced migrants or environmentally displaced people, environmentally motivated migrants, and just "normal" migrants (Findlay and Geddes, 2011; Piguet et al., 2011; Renaud et al., 2011). The International Organization for Migration (IOM) has defined environmental migrants as "persons or groups of persons, who for reasons of sudden or progressive changes in the environment that adversely affect their living or living conditions, are obliged to leave their habitual homes, or choose to do so, either temporarily or permanently, and who move either within their country or abroad" (IOM, 2010: 4). Findlay and Geddes (2011: 145) highlight the idea that if we seek to understand environmental migration we have to investigate pre-existing mobility patterns and migration systems, and then assess the "additional burden" that environmental or climate-related risks pose for the lives of people who have to deal with them on a daily basis.

Although climate change cannot currently be considered as *the* major cause for migration in Bangladesh, it has certainly altered the circumstances under which people, particularly in agriculturally dependent rural districts, are pursuing their livelihoods and their coping strategies vis-à-vis these changing conditions. Environmentally induced migration is thus quite common in Bangladesh (Afsar, 2000; Gray and Mueller, 2012; IPCC, 2007). One might best distinguish between different environmental drivers of livelihood changes, food (in) security and human mobility according to the spatiality and temporality of their impact. Sudden-onset events, such as floods and cyclones, reveal different aspects of people's vulnerability compared to slow-onset processes, such as river and coastal erosion, sea level rise, salt water intrusion, glacier melt and rising temperatures (IOM, 2010). Vulnerability to erratic environmental events, such as rainfall variability and drought, has been studied relatively little in Bangladesh and is most difficult to assess.

Ample evidence exists of major natural disasters forcing people to out-migrate from their ancestral homes (Findlay and Geddes, 2011; Gray and Mueller, 2012; IOM, 2010; Islam, 1992; Lein, 2000; Penning-Rowsell et al., 2011; Poncolet, 2010; Poncolet et al., 2010; Warner et al., 2009; World Bank, 2010). Although Bangladeshis are used to "living with floods", excessive floods can become a natural disaster. The floods of 1987, for instance, led not only to the loss of 2,000 to 6,000 lives, the destruction of public infrastructure, private houses and agricultural land, but also to temporary displacement of 45 million people and to persistent migration within Bangladesh (IOM, 2010; Saadi, 2003). Paul (2005) provides evidence that microscale disasters such as a tornado that occurred in north-central Bangladesh has also led to migration. The more recent tropical cyclones Sidr (2007) and Alia (2009) have affected millions of people, but due to improvements in early warning and disaster emergency help, the death toll was far smaller than in the great storms of 1970 and 1991. The cyclones' effects on migration are still unclear: on the one hand, there is evidence that many "survivors" were only temporarily and locally displaced from their homes and quickly returned; but on the other hand, thousands of people seem to have lost their homes and livelihoods and migrated to cities and other areas in search of shelter, employment and secure lives (Findlay and Geddes, 2011; IOM, 2010; Poncolet, 2010). While landless and resource-constrained people in the exposed areas are often most severely affected by natural disasters (Kuhn, 2005), a high susceptibility does not necessarily lead to an increase in permanent migration. Gray and Mueller have pointed out that "although mobility can serve as a post-disaster coping strategy, it does not do so universally, and disasters in fact can *reduce* mobility by increasing labour needs at origin or by removing the resources necessary to migrate" (2012: 4).

While almost everybody is exposed and sensitive to sudden-onset disasters that "hit" a particular area, slow-onset processes reveal a differential vulnerability of the population living in the respective area. Sea level rise and salt water intrusion might first be felt by the farmers in the south-west of Bangladesh, not in terms of complete loss of livelihoods, but in terms of slowly decreasing yields that make it more difficult to sustain agricultural-based livelihoods (IOM, 2010; Pouliotte et al., 2009). Recent water-logging in the south-western region has given rise to out-migration on a large scale, while salinization and subsequent proliferation of the shrimp industry in the greater Khulna region have also driven out many people (Ahmed, 2008). Although slow in its onset, riverbank erosion is a common threat to people living along the major rivers and on the Char island and regularly forces people to migrate (Haque and Zaman, 1989; Poncolet 2010; Poncolet et al., 2010). More than 16,000 people living on the banks of the Jamuna, Ganges and Padma have allegedly been displaced in 2010 alone (IOM, 2010). This shows that acute environmental stress is particularly disastrous, when land is lost completely or the quality of the resource-base of agriculturally dependent communities can no longer be sustained and therefore agricultural land has to be given up. Given the absence

of alternative livelihood options in many rural areas, permanent displacement is then the logical and often the last consequence (IOM, 2010).

Shifting seasons and increasing variable rainfall are changing the circumstances under which people sustain their livelihoods substantially. In Bangladesh, however, the impact of rainfall variability on local livelihoods and subsequent migration patterns has been studied the least – in this sense this study is breaking new ground. Previous research shows that because of highly contrasting spatial and temporal distribution of rainfall, the country often faces a cycle of "too much" and "too little" water. An abundance of water might lead to flooding. In the dry season, excessive temperatures and little or no rain leads to low water levels in the rivers, causing saline ingress along the coastal rivers, and decreasing soil moisture, and thus leads to an agricultural drought (Ahmad, 2000; Selvaraju et al., 2006). Given the normal seasonal hydrological complexity, a good harvest or a crop loss depends largely on the availability of water in the right quantity and quality, and also at the right time. If farmers fail to respond to the variability in rainfall by using irrigation, for instance, they risk losing (parts of) their production. As poor subsistence farmers often cannot afford irrigation, "too little" water during the critical growing period of their crops increases their own food insecurity. If no other employment opportunities are available in the neighbourhood, migration is an option to sustain one's livelihood in the long run and most importantly to secure access to food in the short- and mid-term (Ahmed, 2008; Findlay and Geddes, 2011; IOM, 2010; Poncolet, 2010). The already mentioned longitudinal study also established a positive and significant relationship between crop failures in Bangladesh, primarily driven by rainfall variability, and long-term mobility. However, the propensity to migrate permanently due to crop loss and thus food insecurity differs strongly among rural HHs. In the case of a severe drought, landless labourers, for instance, do not lose their own agricultural production, but rather their work. They are more likely to migrate permanently in search of alternative employment opportunities than members from HHs who have lost a large share of their harvest, but hope to recover from this environmental crisis at their ancestral home (Gray and Mueller, 2012).

Given the prevailing socio-economic trends of population growth, rural poverty and food insecurity, increasing competition for the remaining resources and continued urbanization, it is very likely that migration – and in particular rural-urban migration – will become even more important for Bangladesh's rural population. Bearing in mind the postulated negative effects of climate change (IPCC, 2007; World Bank, 2010) and the environmental deterioration that stems from an unsustainable resource use, it is very likely that the number of migrants moving out from rural areas will increase in the future. Ahmed and Neelormi (2008) have estimated that 250,000 people might be displaced per year as a consequence of climate-induced hazards under a moderate climate change scenario. Such alarmist projections need to be treated with caution. To put things into perspective, if the current economic growth (GDP growth rate of six per cent) continues, the total number of economic migrants, as a consequence of economic diversification, urbanization and industrialization, might far exceed the number of environmental migrants. This, in turn, shows the positive implications of migration: migrants contribute significantly to the growth of the economy, to social transformation and enhanced human security. In the context of global environmental change, also in Bangladesh, the debate of migration should thus be reframed from seeing migration as a "failure of adaptation" to embracing migration as an adequate way of adaptation (Findlay and Geddes, 2011; IOM, 2010). This report therefore seeks to elaborate on the circumstances under which people migrate from the Kurigram district, and to discuss whether migration can be seen as an appropriate response to climate change, i.e. rainfall variability, or not.

Section 3: Methodology

3.1 Objective of the study

Recognizing climate change as one of the most fundamental challenges of our times UNU-EHS and CARE International have taken an initiative to understand rainfall variability and its effects on the livelihoods of people in the Global South. The focus of the study lies on migration as a potential coping strategy to avoid the risk of hunger and as a mode of adaptation to climate change. As a potential hotspot for rainfall variability and its adverse effects, Bangladesh has been chosen as a case study country along with seven other countries. CARE Bangladesh and the Centre for Global Change (CGC) carried out the study in the Kurigram district in order to present evidence of the relationship between rainfall variability, food security and migration. The specific objectives of the study "Where the rain falls – climate change, hunger and human mobility" are to:

1. understand the relationship between changing weather patterns (i.e. rainfall variability and shifting seasons), rural livelihoods, food security, social inequalities (especially regarding gender) and different forms of human mobility. The first key question is thus: *Under what circumstances do households use migration as a risk management strategy in relation to increasing rainfall variability and food insecurity?*

2. assess the potential for climate change to become a driver of migration and displacement in the future. The second key question is: *Under what scenarios do rainfall variability and food security have the potential to become a significant driver of human mobility in Bangladesh in the next two to three decades?*

3. enable a range of stakeholders, including southern civil society organizations, to influence policies, plans and practical interventions in processes such as the United Nations Framework Convention on Climate Change (UNFCCC) climate talks, the United Nations General Assembly (Economic and Financial Committee), and regional discussions about climate change and human mobility. The third key question is: *What policies are needed – and feasible – in order to capitalize on human mobility as an effective adaptive measure to manage risks associated with changing climatic conditions?*

The purpose of the fieldwork in Bangladesh and in the seven other research countries for the "Rainfalls" project is to pursue objective 1 and gather empirical evidence that will support the work of objectives 2 and 3 (see Rademacher-Schulz et al., 2012, for more details about the objectives of the Rainfalls project, the fieldwork approach and the applied methodology).

3.2 Selection of the study area

The research in Bangladesh focused on the Kurigram district, since the livelihoods of the majority of its population are still dependent on agriculture, and the agriculture there is largely dependent on the available rainfall. Moreover, the region is known for its seasonal food insecurity and high incidence of poverty (CARE, 2005; GOB/WFP, 2004; Rahman, 1995; Selvaraju et al., 2006; Zug, 2006). In addition, since Kurigram is an area susceptible to flooding and riverbank erosion, its sensitivity to climate variability and change is likely to be very high. Moreover, the study region was found to be adequate for the development of appropriate adaptive responses that help to foster the security

Figure 2: Map of Kurigram district. Source: TAS (2005).

of people living in the greater Rangpur region. Therefore, the combination of the addressed factors makes the Kurigram district a compelling site for the "Rainfalls" case study. Figures 2 and 3 are maps of the Kurigram district and Kurigram Sadar Upazila, respectively.

Within Kurigram, Kurigram Sadar Upazila has been selected for its locational advantage towards facilitating the research and also because of previous community adaptation work in the study sites. The proponents of the research do have a fair understanding of the area and previous experience of working with local communities. In each of the case study countries, it was decided that four to five villages would be selected for the study: one should be chosen as the Base Village (BV), where more in-depth research would take place; additionally, three Satellite Villages (SV) were selected, where comparative results would be generated. Khanpara was chosen as the base village, while the satellite villages were Khamar Holokhana, Arazi-Kodomtola and Doalipara (see Figure 3).

Efforts have been made to select study areas, including BV and SVs, where both flooding and erosion are observed as climate-induced hazards. The BV Khanpara is a typical agricultural-based village, representative of the Kurigram district. It is slight to moderately vulnerable to flooding. Both Khamar Holokhana and Arazi-Kodomtola are subject to riverbank erosion. Doalipara is quite a stable locality, and does not face severe erosion. More detailed information about the Kurigram district, the BV, where all research methods were employed, and the three SVs, where selected methods were employed to gather evidence, are described in Section 4.

Figure 3: Map of Kurigram Sadar Upazila. Source: TAS (2005).

3.3 Methodology employed

As with all other case study countries for the "Rainfalls" project, the research activities in Bangladesh considered both qualitative and quantitative primary data collection in a bid to find answers to the research questions raised above. Three main methods were employed in the research for objective 1, each of which is characterized below: HH surveys, participatory research and FGDs, and EIs.

The information collected through fieldwork has been complemented with statistical analysis of rainfall data conducted by the United Nations University (UNU) research partner, the Centre for International Earth Science Information Network (CIESIN) at the Earth Institute of Columbia University.

The information presented in this report reflects the primary interpretations of the data received from all three methods. However, further analysis is necessary to obtain a more complete picture of the interrelations of different factors.

3.3.1 Household survey

As part of an effort to generate more representative quantitative data, information from 150 HHs in the four study villages was systematically gathered with the help of a questionnaire survey (see Table 1). The main indicators covered in the questionnaire survey include the socio-economic status of the HHs, land availability and utilization, sensitivity of production system to rainfall variability, major livelihoods and income, aspects of food security, food consumption and coping strategies during stressful times, migration of family members, institutional aspects of migration, and remittances and their influence towards maintaining food security. The HHs were selected randomly, primarily from the list of well-being analysis results of past project efforts by CARE Bangladesh. The collected data was entered into the software Epidata and analysed with the help of SPSS software.

Union	Village name	Total no. of HHs	Total population	No. of surveyed HHs
Holokhana	Khamar Holokhana (SV)	700	3,850	22
Pachgacchi	Arazi-Kodomtola (SV)	135	743	20
Jatrapur	Khan Para (BV)	117	644	65
Jatrapur	Doalipara (SV)	198	1,036	43
Total		1,150	6,273	150

Table 1: Background information of the household survey conducted in Kurigram Sadar Upazila (Kurigram District, Rangpur Division, Bangladesh). Source: Care Bangladesh (2009); Authors.

	Khamar Holokhana	%	Arazi-Kodomtola	%	Khanpara (BV)	%	Doali-para	%	Total
HHs interviewed (% of all interviews)	22	14.7	20	13.3	65	43.3	43	28.7	150
Female interviewees	8	45.5	4	20	15	23.1	2	4.6	29 (19%)
Female head of HHs	0	0	0	0	3	4.6	1	2.3	4 (2.7%)
Average age of interviewees	42		44		44		49		45
Average HH size (persons)	4		5.9		5.2		4.9		5.1
Average years of schooling of head of HH	2		0.8		3.7		4.8		3.3
Average years of schooling of HH members aged 14+	2		3.2		5.3		5.2		4.6
Landless HH	17	77.3	13	65	19	29.2	5	11.6	54 (36%)
Number of land-scarce HH (0.1-0.7 ha)	5	22.7	5	25	38	58.5	24	55.8	72 (48%)
Number of HH *below* international poverty line (i.e., $/day/person)									
Lower poverty line	15	68.2	14	70	24	36.9	16	37.2	69 (46%)
Upper poverty line	22	100	19	95	57	87.7	39	90.7	137 (91%)
HHs with migrants	12	54.5	16	80	21	33.8	16	34.9	65 (43.3)

Table 2: Key characteristics of surveyed households. Source: Household survey (October 2011).

PRA method	Target groups	SVs		
		Char Arazi-Kodomtola	Khamar Holo-khana	BV Khanpara
Transect walk	Men and women	1	1	1
Resource mapping	Men and women	1	1	1
Well-being analysis	Men and women	1	1	1
Livelihood risk ranking	Farmers and fishermen	1		1
	Women's group	1		1
Timeline on events and rainfall patterns	Elders of men's group			1
Trend analysis	Men and women			1
Seasonal calendar on livelihoods, food security and migration	Fishermen's group			1
	Farmers and non-farmers		1	1
	Women's group		1	1
Venn diagram on food security	Farmers and non-farmers		1	1
Mobility map on migration	Men's labour group		1	1
	Women's group		1	1
Venn diagram on migration support	Men's labour group		1	1
Impact diagram and focus group discussion	Fishermen and farmers	1		1
	Women's group	1		1
Ranking of coping and adaptation strategies on rainfall variability	Farmers and non-farmers	1		1
	Women's group	1		1
Focus group discussion on future strategies	Mixed group of young people			1

Table 3: List of Participatory Research Approach instruments used in the study. Source: Authors.

Number of sessions	33	17 in base village, 18 in 2 satellite villages
Total participants	361	141 female, 220 male
Average age (years)	39	

Table 4: Description of Participatory Research Approach participants. Source: Authors.

The survey reveals a quantitative picture of the population in the study area. A total of 768 people are found in 150 HHs, which represents a population size of about 5.12 people per HH. This is slightly higher than the current national HH size (4.8). Infants and children constitute about 34 per cent of the population, with a slight bias towards girls (36 per cent girls, 34 per cent boys). While 47 per cent of the subject population is single, about half are married. Divorcees and separated groups are found to be negligible at 0.3 and 0.1 per cent, respectively. About 97 per cent of the population was present in their HHs while the survey was conducted.

Table 2 contains some key demographic characteristics of the surveyed HHs. The data is arranged at village level. In the BV, Khanpara, most head of HHs are male (>97 per cent). To avoid gender-bias in our findings, in 29 cases either the head of HH or his wife was interviewed (a total of 19 per cent). Before deciding to do this, several villagers and CPC database staff were asked whether wives are usually well informed about HH resources allocation and decision-making. All of them confirmed and some added that wives are often even more informed about HH affairs than the men. For the 25 women selected who were not heads of HH, no formal criteria were used.

3.3.2 Participatory research and focus group discussions

The qualitative data collection processes included FGDs and EIs. A variety of participatory action research tools were employed during the field activities; for instance: transect walk, resource mapping, wealth ranking, well-being analysis, seasonality calendar, livelihood risk analysis, timeline analysis, Venn diagram, mobility mapping and FGDs about coping with and adapting to climate change. A consistent set of such tools from participatory research approach (PRA) were used in the BV, while parts of the set were implemented in the three SVs. During semi-structured EIs the experts (i.e., key informants) expressed and shared their understanding regarding the nexus between rainfall variability, production systems, the livelihoods of common people, food insecurity and migration. The narratives from the EIs have been included in the analysis to reveal the dynamics of the various elements discussed through the objective of the research.

The PRA consisted of group work in sessions of two to three hours where a group of respondents reflected on various aspects of climate (variability and change over a considerable period of time – say up to 30 years), livelihoods, food security, coping and adaptation strategies, migration destinations, etc. Group numbers

ranged from 8 to 15. In the selection of participants for PRA sessions, gender, age, wealth status and occupation (e.g., farmers, fishermen, etc.) were taken into consideration. In three different locations, a total of 33 FGDs have been conducted involving 361 participants (see Tables 3 and 4).

3.3.3 Expert interviews

A total of 21 EIs were conducted, of which three were held at national level, four at district level, five at subdistrict *(Upazila)* level, and nine at community (local) level. The experts were mostly people who worked in organizations and institutions involved in environment, agricultural production and socio-economic development or having vast practical knowledge on the issues covered under the study. Emphasis was given to involve those who had in-depth knowledge of the research site. The interviews were semi-structured. A topic list was used with questions about climate variability, livelihood, food security, human mobility and the interplay between these themes. The EIs were usually held with individuals, on a one-on-one basis at times, which suited the experts' availability. A detailed list of experts interviewed is provided in Annex I.

3.4 Limitations of the study

The research design considered only one focus region in each country, which is why Kurigram Sadar Upazila has been chosen as the study area. However, if the multi-dimensional aspects of rainfall variability in relation to people's livelihoods are considered for the whole of Bangladesh, Kurigram Sadar alone does not fully reveal all important aspects. With a greater budget, more time and a broader geographical scope involving three or four hydro-geophysical hotspots in Bangladesh, the project could have provided better understanding of the research issues. The multidimensional nature and interconnections of variables make empirical research on environmentally induced migration challenging. Even so, the study attempted to gather observations that would help assess relationships between variables, but it did not attempt to establish causality among those variables.

Researchers were obliged to make changes in sites selected for research when they arrived in the field, taking time away from research. A partner NGO of CARE Bangladesh, the latter being the leading organization in the research areas for the case study, facilitated access to farmers. Despite the detailed training (sharing of methodology) prior to the field activities, the personnel of the partner (facilitating) organization took the research team initially to a predominantly erosion-prone area where crop agriculture has been practiced since the mid-1990s. The interviewees as well as FGD participants had little information on local climatology and production systems over a 20 to 30 year period. It took five to six days to figure out that the farmers in that location could provide only limited information regarding the nexus between rainfall variability, agricultural production and food security, and migration. Such a twist in the field research activity took away valuable time, making it difficult for the research team to modify the plan and get things accomplished in time. When the new areas had been identified, there was hardly any socio-economic profiling to guide the study team to follow a stratified sampling and subsequent analysis. However, the poor farmers in those field locations graciously spent valuable time on providing information in a series of interactions, and this enabled the study team to complete both the quantitative as well as qualitative data collection.

The questionnaire had its own limitations. The dry run of the questionnaire highlighted the necessity to change it according to local context. However, for comparability with other country case studies, the research team was unable to make any major alterations in the questionnaire. This was a trade-off across the "Rainfalls" project for the questionnaire; however, adjustments were made as necessary in the FGDs, which provided a flexible way of gathering the evidence needed while still retaining comparability in the HH survey instrument. The implementation of a questionnaire survey on migration at the study sites at one particular

Then-and-now sketch conducted in the village Khamar Holokhana with male farmers

Focus group discussion with women in Khanpara

Seasonality map conducted with women in Arazi-Kodomtola

Expert interview conducted in Khanpara

Picture 1: Impressions from Research in the Kurigram District. Source: Authors.

point in time also has its drawbacks. Self-evidently, only HHs that were still present at the case study sites could be interviewed. Whole migrant HHs might have left the region permanently. Permanent migrants might thus be underrepresented in our data set compared to temporary, seasonal and return migrants. Also, the results might be misleading if those who have not left are asked about the reason for a HH member's decision to migrate (compare Table 20). There were also errors in the process of collecting the destination information of each and every migrant from the HHs interviewed. The information regarding the current destination of 44 out of 89 migrants is missing.

The study team aimed to overcome the methodological problems that had occurred, in particular with implementing the HH survey, through the triangulation of data sources and methods. The combination of PRA methods/FGDs, EIs and the HH survey helped to develop a deeper understanding of the relevant research issues. Moreover, previous research and community-adaptation projects by CARE at the same study sites, in particular Khanpara, and the long-term experience of some of the researchers involved, who have been working in the Kurigram district for many years, not only enabled easier access to survey respondents and participants of PRA sessions, but also provided crucial contextual information.

Section 4: Introduction to the case study area

This section introduces the Kurigram district, which has been chosen for this study as it satisfies the criteria for research site selection (see Section 3.2). In the following, secondary, data on climatic conditions, poverty and livelihoods, food security and migration is referred to, while the primary data on the same aspects is presented in Sections 5, 6, 7 and 8, respectively.

4.1 Kurigram district

The Kurigram district is located in the north-west part of Bangladesh in the reach of the Teesta Meandering Floodplain and is criss-crossed by a number of major rivers, namely the mighty Brahmaputra, Teesta and Dharala (see Figure 2). Typical for this country, Kurigram exhibits a flat topography with little gradient from north to south. The Kurigram district belongs to the recently constituted Rangpur division, and is bordered northward by the Indian states of West Bengal and Assam. It has an area of about 276.45 km^2, which is divided between nine Upazilas (sub-districts), two municipalities, 73 Union Parishads (local government institutions at the lowest tier), 647 Mouzas, and 1,907 villages. Kurigram Sadar Upazile, the sub-district chosen for the fieldwork for this case study, has 11 Union Parishads, one municipality, and 256 villages. The total population of the Upazila, according to the census in 2001, was about 0.26 million, of which 51 per cent were male and 49 per cent female. The population density in 2001 was 935 people per km^2, and has increased to about 1,000 people per km^2. The current literacy rate is believed to be about 40 per cent. Around 30 per cent of the farmers are landless (TAS, 2006).

4.1.1 Khanpara – the base village of this study

Khanpara is a village located in Jatrapur Union, within 0.5 to 1 kilometre from two major rivers: the mighty Brahmaputra and Dharala. The well-being analysis conducted for the study shows that 118 HHs share the village. A paved road connects the village with the nearest urban centre – Kurigram Sadar (district headquarters). Two rivulets connect the wetlands with the major rivers and act as drainage channels. The settlements are mostly along the paved road, the latter being connected by narrow rural roads (see Figure 4). The major road connects the village with Jatrapur Bazar, an important regional trading centre, where cattle, jute, fish and other local products are sold for export.

A remnant of a flood protection embankment is situated towards the south-eastern corner, which is also considered to be the limit of the village. During high floods, the northern as well as southern parts of the village are generally affected. The settlements are mostly located along the road, generally in relatively higher elevation land. The village has a number of facilities in addition to agricultural land and (seasonal) wetland, including a government primary school, a non-government run high school, a college, a mosque and a temple. The Union Parishad (local government body) office is located in the adjacent village. The village has no health care facilities, no post office and no community clinic – as in the majority of the villages in rural Bangladesh. The close proximity to the trading centre (Jatrapur Bazaar) may be a reason for not having such facilities.

The settlements are located in close proximity to each other, and the fields are kept for cropping. According to the FGD respondents, all three types of land are seen in the village: lowland, medium land and high land. The village occasionally goes under water during high intensity floods. The BV is not at risk of riverbank erosion, unlike the three SVs where the study has been conducted.

4.1.2 The satellite villages and erosion-proneness of the area

The general settlement features are similar in the other three satellite villages (Khamar Holokhana, Arazi-Kadamtola and Doalipara). However, the village Arazi-Kadamtola is particularly exposed to riverbank erosion. In 2011, the landscape changed severely through erosion, and many people were forced to resettle (though temporarily) along the embankment, while government as well as non-government service facilities have also been depleted and displaced (see Section 8.2).

4.2 Rainfall and flooding in the Kurigram district

Like elsewhere in Bangladesh, the climate of the Kurigram district is moderate, with the maximum temperature at 32.3 °C and the minimum temperature at 11.2 °C. It receives good rainfall, in the order of 2,931 mm per annum, which is among the highest in the western parts of the country. The typical wet season (monsoon) is between June and September. During each monsoon, several episodes occur of high to very high intensity rainfall events (over 50 to 100 mm rainfall within 24 hours). However, such events are also experienced during the pre-monsoon (May) and post-monsoon (October) seasons, though with much less frequency than in the monsoon months. Section 5 provides more in-depth data and field-based evidence about rainfall variability in the Kurigram district.

Due to its proximity to the big meandering rivers, the Kurigram district has a large number of char islands (riverbed sand bars). Riverbank erosion is a common problem in meandering fluvial systems. As the poor are living particularly close to rivers in Kurigram, they are hit hard by erosion. Many char dwellers have experienced several episodes of riverbank erosion, which further aggravates their acute poverty. In addition to chars, the mainland Kurigram is also vulnerable to natural hazards such as occasional floods. Erratic rainfall patterns have brought in a different dimension of vulnerability. High rainfall variability, with a potential

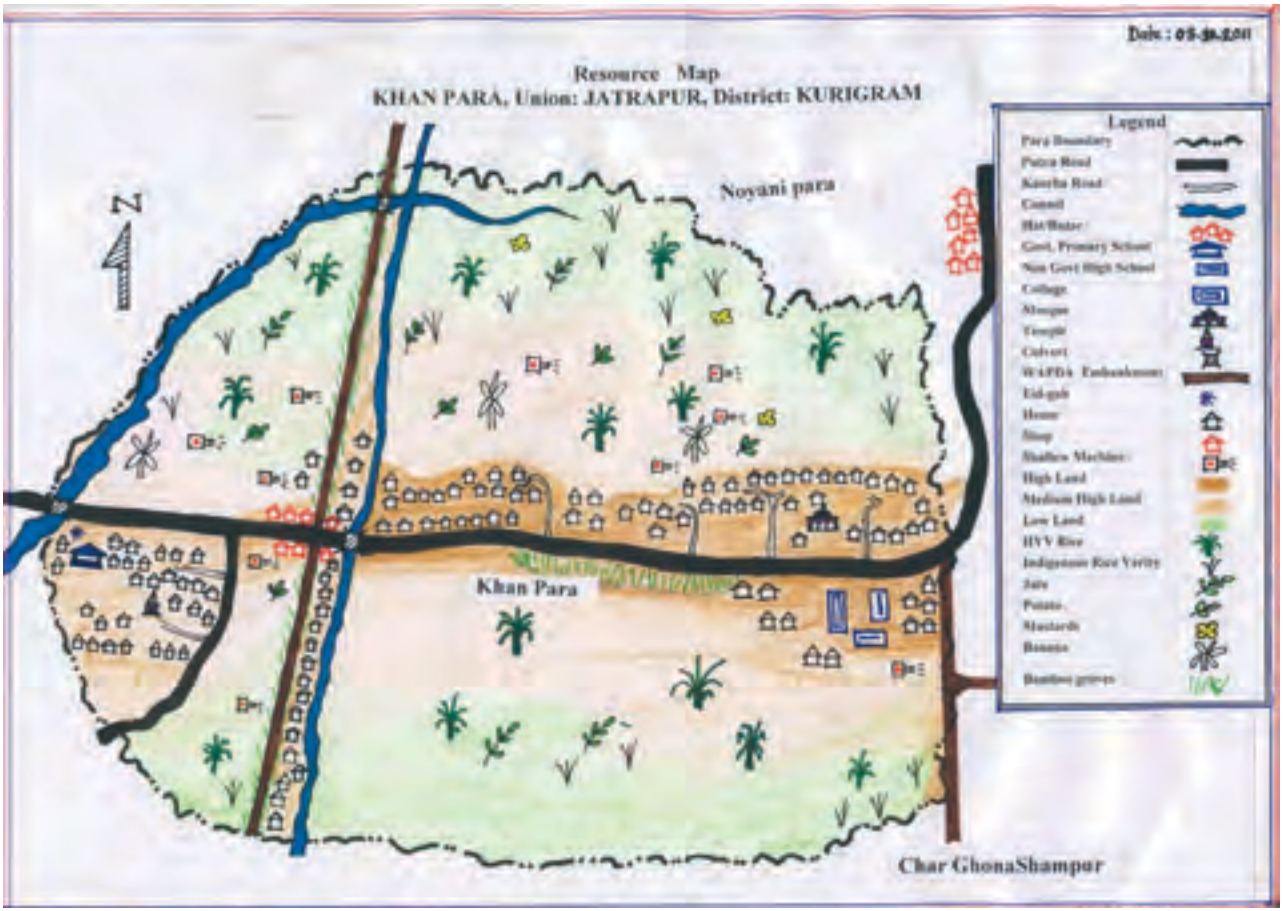


Figure 4: Resource map of Khanpara, the base village.
Source: Fieldwork data.

bimodal shift towards the beginning and end of the monsoon season, complicates and exacerbates the existing livelihood problems of the poor. The introduction of irrigation technologies, such as water use for irrigation and usage involving wetlands for cropping instead of open water fisheries, are remarkable changes in water management. The advent of structural measures towards containing floods by constructing embankments has altered the usual hydrology of the area, modified the risk perceptions of the inhabitants[5], and created opportunities and problems alike.

4.3 Socio-economic aspects and poverty in the Kurigram district

Despite recent developments, the overall socio-economic conditions in the district and in the study villages are below par compared to other areas of the country. Although Bangladesh has done remarkably well among South Asian countries to arrest population growth from more than 3 per cent to about 1.3 per cent over the past 40 years, the population density of Khanpara is still quite high (as elsewhere in Bangladesh). However, due to higher levels of awareness, even among the poor, the average population per HH has come down from about 8 to 5.1 in 30 years (since the early-1980s), as elsewhere in the country (national average: 4.8 persons).

Kurigram is known as a poverty-ridden and highly food insecure area of the country (see Figure 1). More than half of its people live below the poverty line (WFP, 2005). A study conducted by Palli Karma Sangsthan Foundation reveals that poverty in Kurigram is much higher than in the neighbouring areas (PKSF, 2006). National statistics suggest that in 2005, HHs below the poverty line (i.e. HHs where a minimum 2,100 kcal threshold cannot be met per capita per day) was about 25 per cent, and in greater Rangpur it was 43 per cent (BBS, 2005). Figures on the poverty situation in Kurigram Sadar are provided in Table 5.

Union	No. of HHs	Population of total HHs	% of HH extremely poor	% of HH poor	% of HH middle class	% of HH rich	% female head of HH
Bhogdanga	9,790	50,870	36.4	50.0	12.0	1.6	6.7
Ghogadaha	6,753	31,910	20.6	43.1	22.1	14.3	5.8
Holokhana*	7,066	35,330	39.5	26.8	26.3	7.3	3.7
Jatrapur*	3,885	23,314	23.3	48.0	21.2	7.5	13.5
Panchgachhi*	7,130	37,115	49.7	33.7	13.4	3.2	17.8

* Unions in which study villages were situated.

Table 5: Distribution of households in Kurigram Sadar Upazila according to poverty classes. Source: CARE BD (2005).

5 Flood embankments gave a sense of security and the inhabitants used to feel secure. However, a sudden failure in part of the old embankment located just outside south-eastern Khanpara pushed the local people into miserable conditions, as they were no longer prepared for facing such a hazard. The apparently forgotten risk of flooding took a huge toll on the unprepared community.

The EIs revealed that about four decades ago (early 1970s), the incidence of poverty in Kurigram was much higher than it is today. During the 1974 famine, many people were found lying along roadsides begging for a meal. Over the years, the situation has somewhat improved as the level of poverty has, to some extent, decreased (CARE BD, 2005). The growth in the overall economy of Bangladesh over the past three decades (since early 1980s) has played its role in increasing and expanding the local economy in Khanpara. Local small businesses have sprung up in places, the service sector has expanded considerably (people are finding employment in government as well as with NGOs), and institutional ties have been redefined under a structured governance process. The Union Parishad and the mobile phone shops have become important institutions along with micro-credit offered by NGOs. The local economy is now more integrated with a rising national economy, local food production has increased, service provisioning and quality have both increased, and educational arrangements have reached the steps of the very poor. Girls' education is given special attention and books at primary education level are free to every school-going child in the district. Nonetheless, the population in Kurigram has increased significantly, the resource-to-man ratio has thus declined, and growth in local employment opportunities cannot keep up with population growth.

4.4 Livelihoods in the Kurigram district

People are engaged in a host of livelihood activities in the study area, and most are involved in agriculture: 46 per cent of the working population are farmers (on their own land), 30 per cent are agricultural labourers, 3 per cent are wage labourers, 7 per cent are involved in commerce, 4 per cent in services, and 11 per cent in other activities (TAS, 2006). In view of the importance of agriculture for local livelihoods, the following section describes the agricultural structure of the Kurigram district.

Since ancient times, Bangladesh has been a land of agriculture. In the Kurigram district the total cultivable land is about 0.16 million hectares (ha), while only around 19,312 ha are fallow land. Analysis of the HH questionnaires reveals that 72 per cent of the cultivable land is used for cropping, while only 5 per cent is used for a combination of pasture and forestry. About one-third of the cropland is singly cropped, while half of the land yields two rice harvests a year. Due to irrigation, three harvests can be gained from 20 per cent of the land. The resource map (see Figure 4) illustrates three types of cropland in Khanpara; most of the high land is utilized for settlement, while agricultural activities are performed on the medium and lowland. A few types of crop are grown: paddy (rice), jute, potatoes and banana are the major crops, while wheat, *kaun*[6], corn, vegetables, etc. are cultivated, too. The FGDs revealed that farmers generally cultivate *Aman* paddy (monsoon paddy, a staple cereal food), followed by *Boro* paddy (most important cereal crop towards maintaining national food security) in the dry season. Some farmers do grow *Aman*, followed by winter crops such as vegetables, oilseeds (mustard) and potatoes, and then jute in the pre-monsoon season. The main export products from Kurigram Sadar are jute, paddy, peanuts, sweet gourd, potatoes and carrots. Some of these export products, in particular potatoes, require cooling and careful preservation. Therefore, several cold storages exist in the Kurigram district.

Since the 1960s, farmers were predominantly dependent on traditional paddy varieties, which generally accommodated *Aus* paddy in the pre-monsoon season (competing with jute) and Aman paddy in the monsoon season – all being rain-fed crops. Input-intensive agriculture began in the 1980s. During the winter season, when rainfall diminishes and the surface moisture evaporates fast, people use irrigation to cultivate several high-yielding varieties (HYVs) of *Boro* rice. These modern irrigation technologies and the introduction of high-yielding varieties completely

6 Kaun is fine cereal that is particularly used for making food to be consumed during special festivities.

changed the livelihoods of farmers and gave them significantly higher yields from a unit of land. The overall cereal production increased over the years (see Section 6.5.1). *Boro* rice is by far showing the highest yield; however, the crop is investment-intensive (requiring irrigation and chemical inputs for a secure harvest), therefore it is not considered to be particularly suitable for the poor and marginal farmers in Kurigram. The food security of most farming HHs therefore remains largely dependent on *Aman* rice, as the latter crop is the major rain-fed crop that requires no major investment. The agricultural production system and the crop-based livelihoods – the majority of the population in Kurigram – are highly dependent on favourable weather patterns and reliable rainfall, and are very sensitive to long-term changes in the amount of rainfall and its variability.

Orchards are a new phenomenon in the study areas. Since 2007, wealthy investors from outside are leasing land for potato and banana production. Both crops are investment-intensive, beyond the financial capacity of poor farmers. They mostly sell their labour in commercial agricultural production. The investors do assume a high risk of crop failure, invest hefty amounts and, if successful, make much bigger profits than would otherwise be possible for the local landowners. The local farmers could neither afford the high investment for such profit-maximizing cash crops, nor could they easily bear the risks of crop failure. Besides agriculture, livestock management is also a significant economic activity in the district.

Except for the tobacco processing industry, the greater Rangpur region does not offer much industrial employment. In the Kurigram district there are no industries that would offer large-scale non-agricultural employment. The only off-farm employment takes place in brickfields, rice processing, sawmills, earthwork and rickshaw pulling. Part of the problem lies with limited access to natural gas and the national power grid. The Fulbari coalmine, located in the north-western region, might now offer new opportunities throughout the region, though it does not have its own beneficial energy sources. In the near future, however, the economy in the Kurigram district will remain based on agriculture. Rural livelihoods will thus continue to be dependent on rainfall variability.

4.5 Seasonal food insecurity in the Kurigram district

According to national statistics, Kurigram is a food surplus district (GOB/WFP, 2004; Kabir, 2005). Nonetheless, the poor in Kurigram are subject to a seasonal food insecurity phase called *Monga*. The word literally means "food insecurity" and is observed annually throughout the Rangpur division (except in the Bogra and Dinajpur districts) (CARE, 2005). During two months of the Bengali calendar, *Ashwin* and *Kartik* (mid-September to mid-November), there is hardly any employment for the labour class, especially among agricultural labourers. A surplus labour force in agriculture and a lack of local employment opportunities give rise to *Monga*. This period falls between the transplantation and harvest of a rain-fed monsoon crop – *Aman* paddy (Rahman, 1995; Zug, 2006). Traditionally, *Aman* used to be a rain-fed crop and farmers have been reluctant to invest in *Aman* cultivation other than in its seeds, which is why the labour requirement for its cultivation is the lowest. For landless agricultural labourers, *Monga* brings no employment opportunities between transplantation and harvest; therefore, they remain only partially fed. Rahman (1995) described the annual phenomenon as a "routine crisis". Food insecurity during *Monga* is therefore not structured by a reduction in the general availability of food in the region, but rather by a lack of local employment opportunities and reduced or no income for the labourers, that is, by a lack of access to food.

A baseline survey reported that about 54 per cent of HHs in eight Upazilas of Kurigram have been experiencing *Monga*, which is the highest in the greater Rangpur region (PKSF, 2006). The survey also revealed that only 25 per cent of HHs in the Kurigram district can consume three full meals a day during *Monga*. More

than three-quarters of all *Monga*-affected HHs (77.2 per cent) depend on selling day labour for their employment, while only 11.7 per cent of *Monga*-affected HHs are farmers (PKSF, 2006). This clearly reveals the greater susceptibility of day labourers to suffer from food insecurity than those who find employment either in farming or in other activities.

Monga is more prevalent among HHs that fall below the lower poverty line. Suffering during *Monga* is not limited to a small pocket of HHs in the region. Roughly 7 per cent of the total population of Bangladesh (about 9.6 million people) inhabit these *Monga*-affected north-western districts, including Kurigram, and about 5.3 million of those live below the poverty line (GOB/WFP, 2004).

Specific programmes to address *Monga* have been run by both GOB agencies and NGOs alike. A large share of the SSN programmes has been made available for the *Monga*-affected areas every year (BBS, 2009). National experts do state that improved SSNs for the most vulnerable people have indeed been helpful in averting food insecurity. However, all programmes could only make a small dent in the severity of *Monga* in Bangladesh: with an increasing population and still limited local labour markets, the extent of the problem is increasing and the national support system is reaching only a fraction of the affected population.

	Per capita GDP		Per capita GDP of manufacturing sector	
Locations	BdTk	% of national average	BdTk	% of national average
Gaibandha	12,444	67.2	400	14.7
Kurigram	13,757	74.3	341	12.5
Lalmonirhat	13,855	74.8	154	9.3
Nilpharmari	13,292	71.8	163	9.7
Rangpur	14,936	80.7	820	30.1
Total for Bangladesh	18,511	100.0	2,720	100.0

Note: BdTk is the Bangladeshi currency (Taka).

Table 6: GDP of the Monga-affected districts of Greater Rangpur (1999/2000). Source: BBS (2010: 495, 506–568).

The *Monga*-affected region is found to be lagging economically behind the rest of the country. Despite the fact that the country has other poverty pockets, *Monga* areas are particularly known to be sensitive to seasonal unemployment and food insecurity – indicated by very high proportions of extremely poor, malnourished and underweight people, as well as comparatively low agricultural wage rates (see Figure 5 and GOB/WFP, 2004). The comparative disadvantage of the *Monga* regions is also visible in other economic indicators. Table 6 shows that the per capita GDP of *Monga*-affected districts is far below the national average. It becomes clear that Lalmonirhat, Nilphamari and Kurigram fall among the lowest in terms of manufacturing GDP in the country.

4.6 Migration and mobility in the Kurigram district

The mobility of both men and women in the Kurigram district has increased over the past three decades. A trend analysis in Khanpara, for instance, revealed that around 1980 no one from the 25 HHs had ever left the village to live and work in a different place. Thereafter, the number of permanent and temporary labour migrants increased steadily: in 1990, approximately 25 people had left (from 50 HHs); in 2000, 35 people (from 80 HHs); and in 2011, there were 64 migrants in 117 HHs. According to local experts interviewed for this study, the rise in the number of migrants is mostly due to increased (and continued) government investment in infrastructure, improved education and developments in transportation and communication technologies. Increased mobility has created better opportunities for local trade and commerce, and has led to greater integration of the Kurigram district with the national economy, opening up new options for women to engage in various non-farm activities, for example local trade and handicraft. Most significantly, migration networks established and enhanced the employment opportunities for the rural poor in the unskilled labour market, both in urban and other rural areas. It has also become easier for the rural rich to send their children to the major cities' educational centres.

There is no district-based database in Bangladesh to show the distribution of migration, internal or international, from districts. However, both the EIs and the survey-based results have shown that most of the migrations from Kurigram occur within Bangladesh, and are generally attributed to the high incidence of poverty in Kurigram. Though there have been international migrations from across Bangladesh, poor families' inability to pay the high service charges and airfares (as key migration costs) and a lack of contacts that link them with international labour markets have been the key reasons for lower rates of international migration from Kurigram.

National experts also commented that most of the migration is temporary and seasonal in nature, and particularly related to the *Monga* period. The men do not tend to stay for long at their destination. They try to find employment as agricultural labourers, in particular during the work-intensive harvest season, and in agro-processing (in rice par-boiling mills). A few migrants also find employment in the brick making industry, and the transport business, for instance as rickshaw pullers in large cities such as Dhaka. Unless their respective partners or the male head of the HH help them, women usually cannot migrate. This is the most important reason why female participation in migration is rather low in the north-west of Bangladesh. Nonetheless, few young women have migrated permanently to Dhaka or to other cities to work in the growing ready-made garments industry or as housemaids in urban HHs.

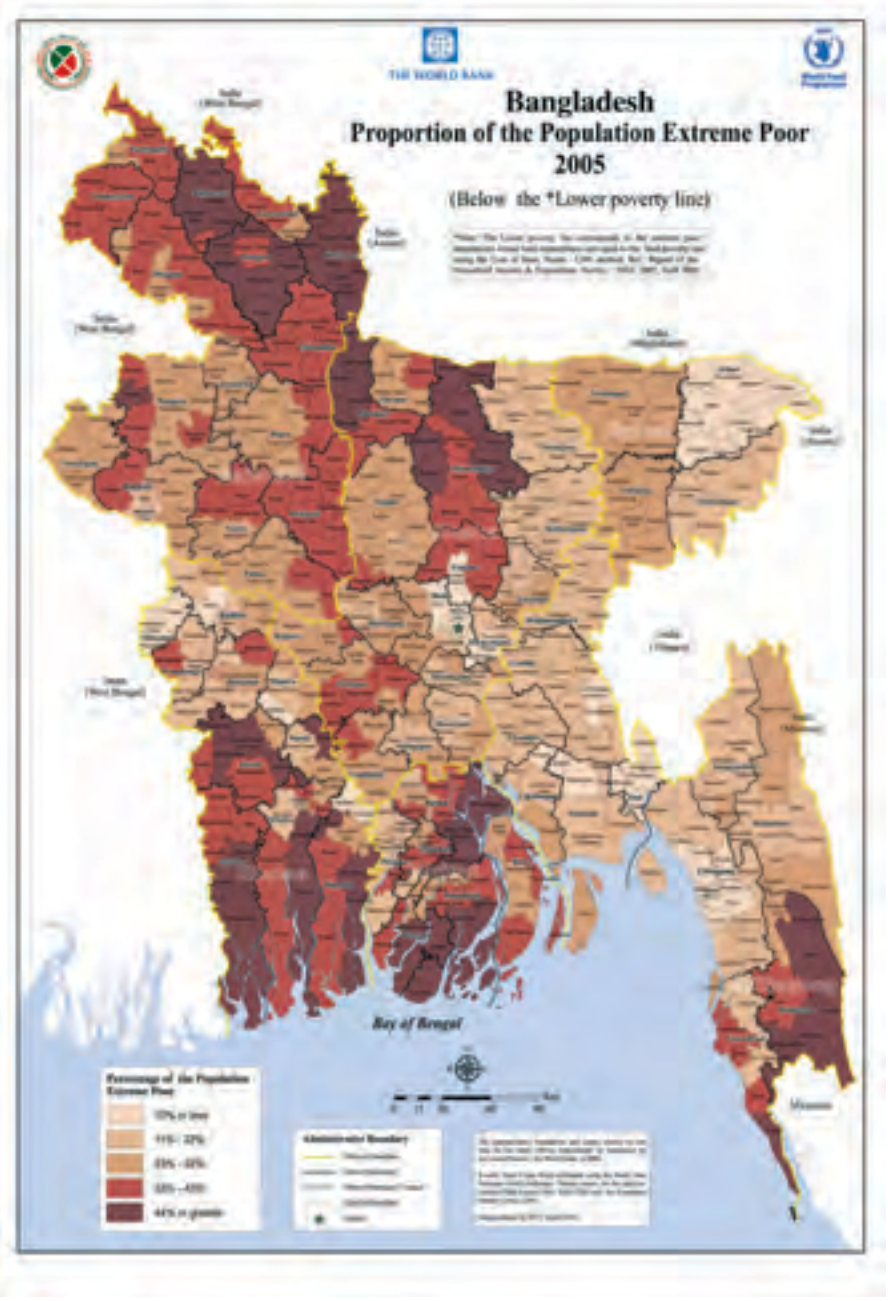


Figure 5: Poverty map, Bangladesh.
Source: World Bank/World Food Programme (2005).

Section 5: Climate variability

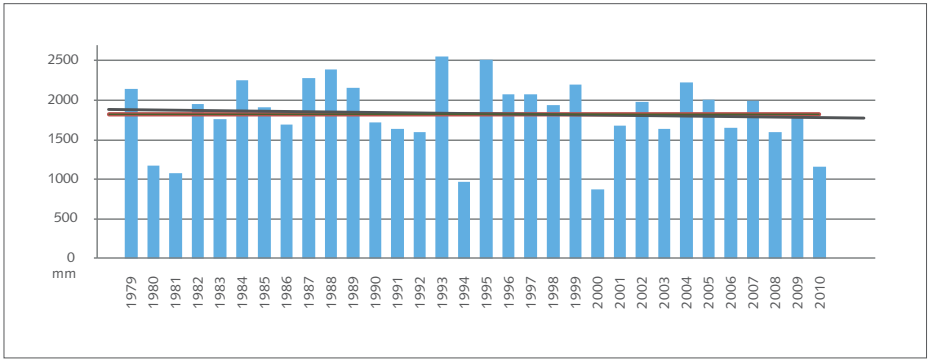
5.1 Changing rainfall patterns in Kurigram

Kurigram has experienced changes in rainfall patterns. The most important changes noted by the people living in the north-west of Bangladesh are excessive rains, both in terms of the absolute amount throughout the monsoon season and single very intensive high-rainfall events. Also, an increase in the variability of rainfall, in terms of "too much" and "too little" rain and its timing, as rain is either absent or comes at unexpected times. Rainfall data collected from local weather stations via the Bangladesh Water Development Board (BWDB) reveals that the total amount of rain during the annual monsoon season (1 June to 30 September) varies significantly, which of course has consequences with regard to flooding or water availability for rain-fed agriculture. While more than 2,500 mm of rain fell in Kurigram throughout the 1993 monsoon, there was only a "normal" flood in that year. In contrast, in 1998 not even 1,940 mm of rain fell in Kurigram, but a heavy monsoon in India and the Himalayas led to a flood of catastrophic proportions in which almost two-thirds of Bangladesh's area was inundated, hundreds of people died and the *Aman* rice production was severely affected, which led to rising food prices and increased food insecurity across the whole nation (Dorosh et al., 2004; World Bank, 2010). Overall, however, the total monsoon rainfall seems to be declining at a rate of about 0.55 mm per year, as shown in Figure 6, on the basis of the daily rainfall time series for Kurigram station during 1979 and 2010.

While the total amount of monsoon rainfall in Kurigram – and thus the change in the absolute amount of rainfall – is only negligibly declining or even increasing[7], both Figures 6 and 7

7 Different data sets reveal a different picture of the changes in rainfall across time. An analysis of three different databases (CPC-Unified, CMAP and APHRODITE) shows that the total monsoon rainfall in Kurigram district has actually slightly increased over time (time series 1980-2001; data provided by the Center for International Earth Science Information Network (CIESIN), Columbia University).

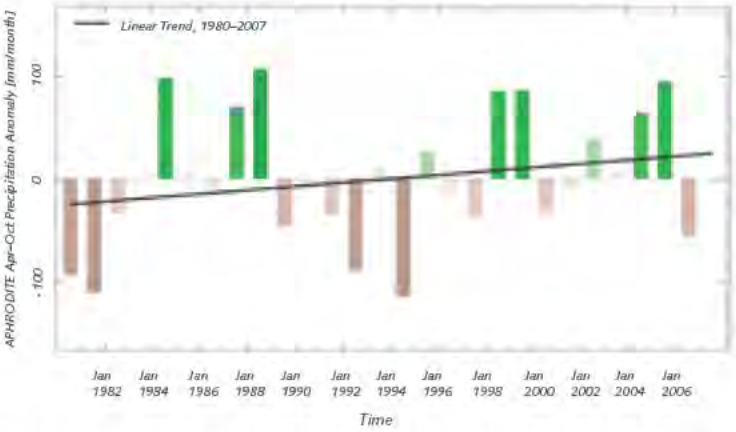
show that the variability of rainfall is increasing. Figure 7 shows the annual precipitation anomalies during the summer monsoon in a 50 km grid that includes the Kurigram district. In the flood year 1998, for instance, throughout the whole rainy season, the absolute amount of rainfall was more than 80 mm above the average of all the monsoons between 1980 and 2007. More recently, excessive rains – also with impressive peaks in terms of single heavy rainfall events – are recorded for the monsoons in 2004 and 2005. In contrast, 1994, 2000 and 2006 were particularly dry years (see Figures 6 and 7).



Note: June to September is monsoon period;
red line = total average monsoon rain (time series 1979-2010);
grey line = linear trend of average monsoon rain
(time series 1979-2010).

Figure 6: Total monsoon rainfall in Kurigram district between 1979 and 2010. Source: Daily rainfall, time series, Kurigram Station, Bangladesh Water Development Board (BWDB). With courtesy of Flood Forecasting and Warning Centre (FFWC), a body within the BWDB, serving under the Ministry of Water Resources (MOWR).

EIs involving people in the study area (mostly living in Kurigram Sadar Upazila) also indicated that there has been a drastic change in *seasonal* rainfall. While the months of *Ashaar* and *Srabon* (mid-June to mid-August) have been known as the wettest months with sufficient rainfall (FFWC, 2011), in the period 2006 to 2009 the rainfall in these months have been far below their respective averages (see Figure 7)[8]. Also, in the 2011 monsoon season, the rainfall recorded at Kurigram station was only 57 per cent of the long-term average in June, and 75 and 87 per cent in July and August, respectively.



Note: April to October is monsoon period; 0 = average across the years 1979-2010; red bars = seasonal average of rainfall below time series average; green bars = seasonal average rainfall above time series average; black line = linear trend of rainfall anomaly (1980–2007).

Figure 7: Variability of monsoon rainfall in Kurigram district between 1980 and 2007. Source: Seasonal precipitation anomalies (5-day average of April–October. Rainfall in mm/month over a 0.5° lat/long grid boxes including Kurigram district); APHRODITE database; CIESIN/Columbia University.

5.2 People's perception of changing rainfall patterns

5.2.1 Changing rainfall

The majority of the people in the study area have identified climatic changes over the last 10 to 30 years (since early 1980s): 96 per cent of all survey respondents noted an increase in dry spells and droughts; 84 per cent reported an increase in extreme weather events such as cyclones; 50 per cent argue there is more heavy rain, while 43 per cent say it is less; and 12 per cent report more floods, while 80 per cent argue there are less floods than before (see Figure 8).

Among those who have noticed changes in rainfall (almost two-thirds of the survey respondents), 99.3 per cent reported that rainfall has declined (80 per cent severe decline, 19.3 per cent slight decline), but 97.9 per cent noted a longer rainy season. Rather high accordance on much decreased rainfall and high accordance on heavy showers clearly highlights the disturbed rainfall patterns in recent decades in the study area.

5.2.2 Changing seasons

The FGDs in three study villages (Khanpara, Holokhana, Arazi-Kodomola) clearly showed that the change in the amount and timing of rainfall is perceived to be due to a significant change in the seasons. In rural Bangladesh, it is widely believed that six seasons exist: *Barsa* or rainy season (June–Aug); *Sarat* or autumn (Sept–Oct); *Hemanto* or late autumn (Oct–Nov); *Seet* or winter (Nov–Dec); *Basanto* or spring (Dec–Feb); and *Grisma* or summer (Mar–May). Folk songs and old records bear testimony to such a claim. This ancestral knowledge has now been disturbed by the changing rainfall pattern. The respondents of the survey can no longer find the six seasons in their annual calendar.

8 While the CMAP and the APHRODITE databases backup this statement, the CPC-Unified database does not show this trend as clearly.

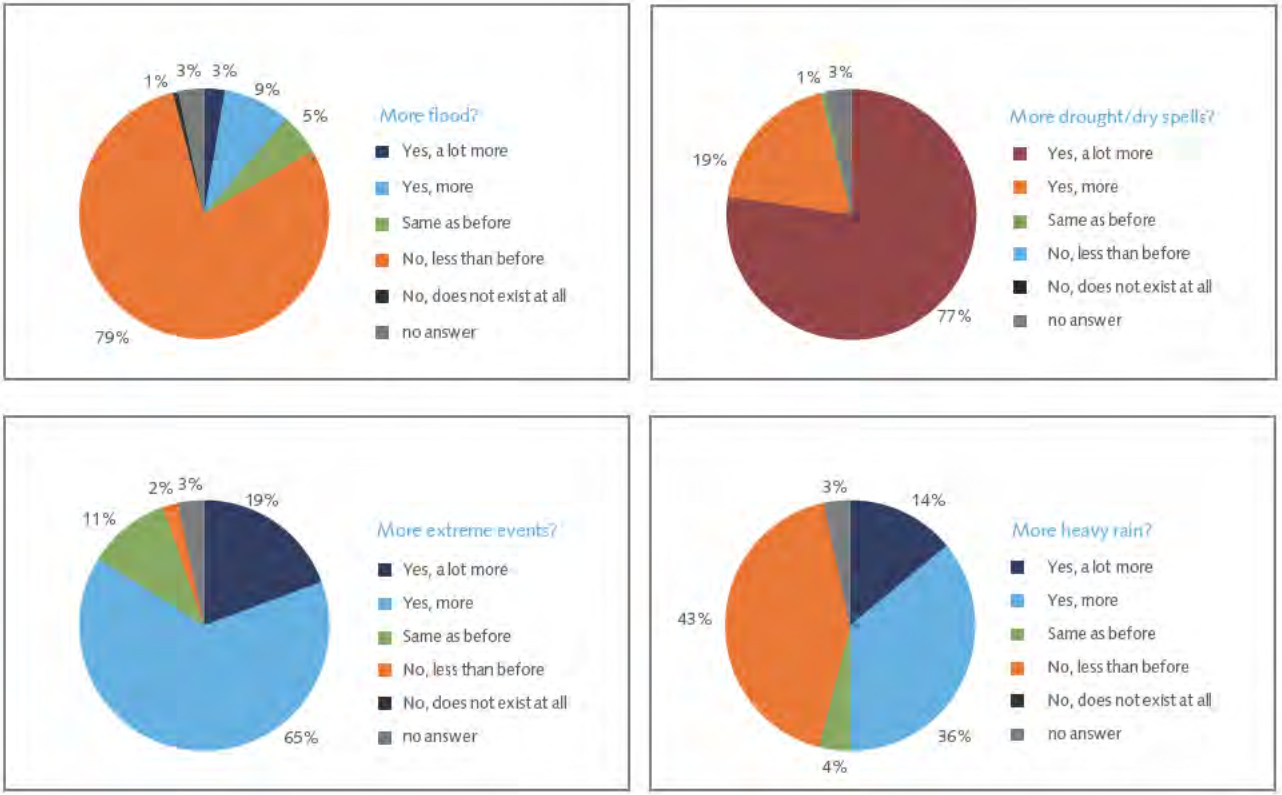
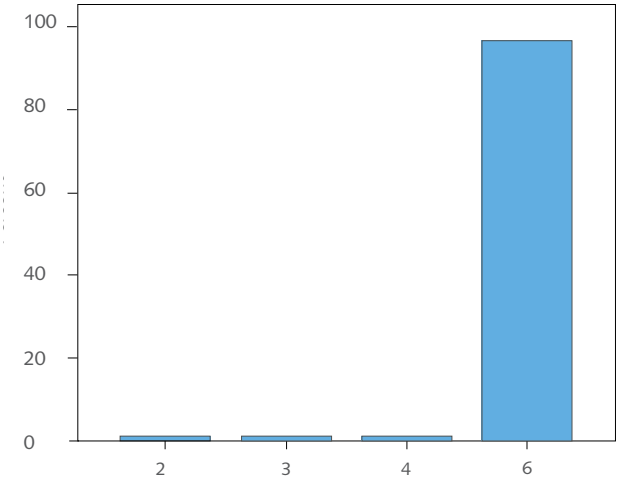
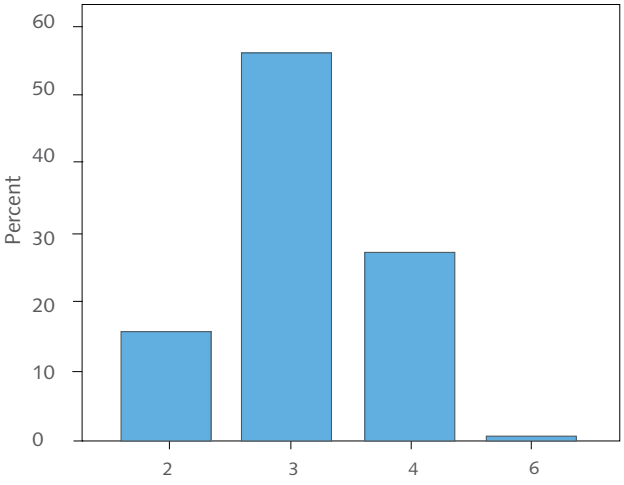


Figure 8: People's perceptions of climatic changes over the last 10 to 30 years. Source: Household survey (October 2011) (n=150).



Q307 Seasons in last 10–30 years



Q306 Seasons in regular year

Figure 9: Changing seasons: Share of respondents identifying the number of seasons in the past (most say six) and present (most say two to four). Source: Household survey (October 2011) (n=150).

In sharp contrast, when the same respondents are asked to identify the number of seasons in the past (compared to the situation 20 to 30 years ago: around 1980–90), an overwhelming majority can recall having six seasons, as presented in the right-hand section of Figure 9.

In addition to the meteorological data sets, the interview results also show the very erratic nature of rainfall in Kurigram. Respondents in the survey and in the FGDs mentioned the more recent increase in prolonged episodes of rainless days even during the peak monsoon period. In a discussion of important events and trends conducted in the BV (timeline in Khanpara, 3/10/2011) the local people, for instance, also argued that in the past there was always sufficient and continuous rain in the *Asharh* (May/June) and *Srabon* periods (June/July), which led to the accumulation of water in low-lying areas. Nowadays, these lowlands remain dry most often. Back then, "clouds gathered in the sky and rain dropped, but now we can see clouds in the sky, but no rain falls". These comments seem to be influenced by people's very recent experience: during the 2011 peak monsoon,

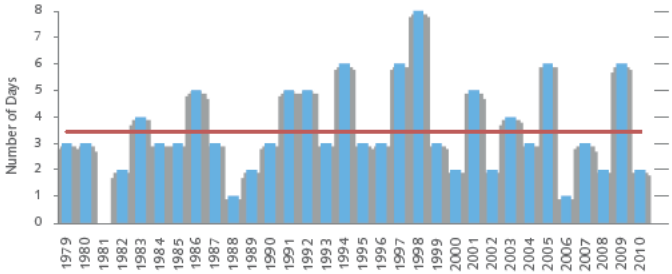
there was no rainfall for more than 24 consecutive days between 16 July and 10 August. The respondents described such rainless periods during the peak monsoon as unprecedented[9]. As these dry spells occur during the most important growing phase of *Aman* rice, they have serious implications for the overall production, and thus for the local livelihoods and people's food security.

Besides these dry spells during the monsoon, in all the FGDs, irrespective of gender and occupation, the local people also highlighted a drastic reduction of the rainfall episode locally known as *Kaitan-Satao*. In previous decades, such an episode with consecutive rainy days used to occur in mid- to late-October. This short period brings rain and also cooler temperatures and thereby indicates the end of autumn and the beginning of winter. According to the FGD respondents, *Kaitan-Satao* episodes have now become less prominent, with a slight reduction in the number of days of rainfall. Figure 10 shows the duration of *Kaitan-Satao* episodes in Kurigram, which normally varies between two and six days. Though people have reported a major decline in the number of days of rainfall in the *Kartik* month (mid-Oct/mid-Nov), the actual change is rather insignificant.

When probed further, in the absence of *Kaitan-Satao*, the FGD respondents unequivocally report that in recent times the occurrence of fog on consecutive days marks the beginning of winter. The winter weather has, however, not changed much.

Overall, local people are very aware of seasonal weather patterns, extreme events and changes in rainfall. This is no surprise, as their livelihoods and food security reflect a seasonal rhythm (see Figures 12 and 13 in Section 6.4).

9 In the data set of the past 40 years (1970–2011), the longest ever previous episode had a duration of 14 days, and occurred in August 1983 (BWDB). The CPC, CMAP and APHRODITE meteorological data sets for the Kurigram district back this statement. They also show significant dry spells that occurred during the monsoons, in particular in more recent years. For further verification, efforts will be made to analyse data from other stations, and to compare the different data sets.



Notes: Kaitan Satao occurs in mid/end-October with consecutive days of significant rainfall. Red line = total average, 3-4 days (time series 1979-2010).

Figure 10: Trend in duration of Kaitan-Satao in Kurigram. Source: Bangladesh Water Development Board (BWDB, 2011).

Section 6: Livelihood and food security

The vast majority of people in Kurigram Sadar depend directly on rain-fed agriculture, either through their own subsistence and/or commercial agriculture or through wage labour on the farms of large landholders. Rainfall variability has a direct effect on the hydrological cycle, on erosion patterns and local food production, and thus on the livelihoods of the local people, whose number is increasing while the available resources are declining per capita (Section 6.1). In order to address the relationship between rainfall variability, poverty and food insecurity, people's adaptive capacities and migration, it is first necessary to assess who are particularly susceptible to climatic changes and how people are living with rainfall variability. This section therefore describes the differential sensitivity of the local people to rainfall variability. It introduces the structure of livelihoods, with a focus on those who are directly rain-dependent (Section 6.2). It addresses the local people's own definition of poverty or well-being (Section 6.3). The section highlights the different dimensions of food security (Section 6.4) and describes the seasonal patterns of livelihood and food security (Section 6.5). On this basis, people's coping and adaptation strategies for different livelihood risks are addressed, most importantly food insecurity (Section 6.5), natural hazards (Section 6.6) and rainfall variability (Section 6.7).

6.1 Population growth and declining resources

Over the past 30 years (sinc-e early 1980s), several trends have been emerging in the study area in Kurigram. First, the population in the BV and the SV is increasing rapidly. In Khanpara, for

example, approximately 200 people were living in about 25 HHs 30 years ago, but their number has increased to about 590 people in 118 HHs at present. This represents a 195 per cent population increase. Second, correlating with the population increase, the resources availability per capita is decreasing: 118 HHs are now using more or less the same amount of land that can be utilized for agriculture in and around Khanpara, which used to be cultivated by about 25 HHs 30 years ago (early 1980s). Therefore, a mere doubling of crop intensity with a tripling of yield potential could not address the inherent dynamics of poverty completely. Per HH, availability of livestock has also declined to 25 per cent compared to what was available previously. As a consequence of population growth and limited alternatives to agriculture, poverty is thus pervasive in the villages where this study was conducted.

6.2 Rainfall-dependent livelihoods

In Kurigram, each HH relies on an average 1.7 sources of income to sustain their lives. Table 7 provides the distribution of occupations in the 150 HHs interviewed under the questionnaire survey. On this basis, five principal group options for income generation can be utilized by individual HHs: the first group contains livelihoods that are directly dependent on the agro-ecological system and are thus very sensitive to rainfall variability (37 per cent of all income sources that were reported in the questionnaire survey), such as agriculture (32 per cent), farm labour (1 per cent), fishing (4 per cent) and raising livestock, which is found to be not particularly relevant in the case study villages. The second livelihood group depends on their skills and the (seasonal) availability of unskilled labour, for instance day labourers (25 per cent) and craftsmen (3 per cent). The third group of local shop owners, traders and businessmen (12 per cent) and other service holders (9 per cent) depend on the availability of goods and local purchasing power (21 per cent). The fourth group is directly dependent on government jobs, such as teaching and community services, and are not represented in the HH survey. The fifth group is largely dependent on transfers, either remittances sent by migrants (13.6 per cent) or government grants for people who fought in Bangladesh's war of independence in 1971, the so-called freedom fighter grants. It is important to note that about 5 per cent of the HHs in the survey had no means of income, which may be common throughout Kurigram during the lean season (*Monga* in October), when the survey was conducted.

6.2.1 Agricultural livelihoods

Although the service sector is increasingly becoming an important source of income, as elsewhere throughout Bangladesh (12 per cent of income sources 10 years ago (2001), and 21 per cent now; see Table 7), about 60 per cent of HHs are reportedly engaged in agriculture, that is, crop production, cattle raising, poultry farming, fisheries and forestry, which is somewhat higher than the national average of about 48 per cent (BBS, 2010)[10]. Except for a few shops in the civic centre (Pourashava) and a number of administrative units in the small city of Kurigram, the entire district has always been agrarian in nature. FGDs suggest that, even 10 years ago (2001), the majority of the population used to depend on crop agriculture, while some 30 years ago more than 90 per cent of the population was dependent on crop agriculture. Livestock and poultry rearing, fishing in floodplains and homestead agro-forestry adequately complemented crop agriculture. Today, people's primary occupation is still crop agriculture; they either work on their own or leased land (31.6 per cent of all income sources) or as farm labourers (1.2 per cent; see Table 7).

10 The actual percentage population dependent on agricultural activities could have been even higher in Kurigram, which indicates higher vulnerability of people's livelihoods to the natural elements. Perhaps the recent erosion forced many heads of households to diversify their economic opportunities, shying away from agri culture, in addition to migrating. This may have influenced the less than anticipated concentration of farming communities in the HH survey representing rural Kurigram. The absence of major industrial activities and limited spread of the service sector made the area, as discussed earlier, increasingly dependent on agriculture. As mentioned, 30 years ago (early 1980s) about 90 per cent was dependent on agriculture.

HH income source	Count – 10 years ago	% of all income source	Count – present	% of all income sources	Change to present (%)
Agriculture	77	33.3	79	31.6	-1.7
Farm labour	6	2.6	3	1.2	-1.4
Fishing	13	5.6	11	4.4	-1.2
Raising livestock	0	0.0	0	0	0.0
Directly dependent on agro-ecological system and rainfall	96	41.5	93	37.2	-4.3
Daily labour	59	25.5	62	24.8	-0.7
Construction work	3	1.3	0	0	-1.3
Carpenter	1	0.4	6	2.4	2.0
Handicrafts	1	0.4	1	0.4	0.0
Tailor	1	0.4	0	0	-0.4
Garments	2	0.9	0	0	-0.9
Dependent on skills and available labour	67	28.9	69	27.6	-1.3
Business/Trade/Retail	20	8.7	30	12.0	3.3
Tea stall	1	0.4	0	0	-0.4
Services	8	3.0	23	9.2	5.7
Services dependent on local purchasing power	29	12.1	53	21.2	8.6

HH income source	Count – 10 years ago	% of all income source	Count – present	% of all income sources	Change to present (%)
Teacher	5	2.2	0	0	-2.2
Community service	2	0.9	0	0	-0.9
Dependent on (local) government jobs	7	3.1	0	0	-3.1
Land rent	1	0.4	0	0	-0.4
Freedom fighter grants	1	0.4	1	0.4	0.0
Remittances	30	13.0	34	13.6	0.6
Dependent on transfers	32	13.8	35	14.0	0.2
Total no. of income sources	231		250		8.3

Table 7: Major sources of income for households interviewed in Kurigram district. Source: Household survey (October 2011) (n=150).

Among day labourers (25 per cent of occupations), 19.4 per cent of HHs identified agriculture as the second most important source of income. Even among remittance-earning HHs, 35.7 per cent identify agriculture as their second most important earning source.

People have, however, expressed deep dissatisfaction regarding the gradual decline of solely agricultural-based livelihoods. Although many cannot escape poverty and perceive farming as a net-loss business, they still continue in agriculture for a number of reasons: (a) their tradition; (b) they do not possess enough skills to diversify their income; (c) they do not have enough means to continue education and enhance their potential for livelihood diversification; (d) they are well aware that although they struggle to maintain their status-quo from agriculture, and many farming HHs also suffer during the seasonal *Monga* period, they can at least secure a basic supply of food for the HH members; and (e) they are aware of the volatility of commodity prices, in particular food, coupled with fairly low wage rates in the region.

All the agricultural-based HHs cultivate paddy (rice) on their land. For about 79 per cent of HHs, paddy is cultivated just for subsistence. Among the agricultural-based HHs, 41 per cent are used to selling part of their produce. Farmers sell their produce in order to purchase other food items (which are not grown on their own land, or items which are only available commercially) and a variety of non-food commodities from local/distant markets. Most of the food producers (46 per cent of HHs) sell an amount that is next to nothing. Only 10 per cent of the responding agricultural-based HHs sell the majority of their products. These are generally peasants with larger farms, whose harvest by far exceeds their own demand. There was, however, no farm HH in the survey that sold 100 per cent of its products and thus solely relied on commercial agriculture.

6.2.2 Raising livestock and homestead forestry

In addition to crop production, people in the study area maintain livestock and also practice homestead agro-forestry. About 68 per cent of HHs maintain some livestock[11]. Women are key towards maintaining livestock and agro-forestry, which provide nutritious milk, animal protein, vegetables and fruits. Timber is obtained from homestead vegetation, while bamboo bushes often provide home repair material. Increasing erosion and decreasing availability of fodder and grazing land are primarily responsible for increasing hardship to maintain livestock. In a FGD involving women in Khanpara, the respondents reported that less people nowadays keep cattle in their courtyard due to the declining availability of land, the latter being utilized just to erect more houses in a shared courtyard.

Among those HHs who keep livestock, 48 per cent are somewhat dependent on the income from livestock, but it was never mentioned as the only source of income, and 38.6 per cent consider the animals as important assets (for future emergencies). For these HHs, livestock is considered to be a means towards maintaining food security. However, the existing animal pool is in poor health. More than 53 per cent of HHs have reported a "declining condition" of raising livestock. About 63 per cent of the agricultural-based HHs maintaining livestock have noticed a decline in livestock over the past five to ten years. Animal diseases (53 per cent of HHs) and lack of capital to maintain the well-being of the livestock (37 per cent) appear to be the top two reasons for the declining conditions in raising livestock. Poor-quality feed, the diminishing trend of pastureland and unavailability of livestock health services are cited as other important reasons contributing to the poor health of the animals.

11 The definition of livestock in the questionnaire includes cows, goats, horses, donkeys, poultry, etc.

6.2.3 Fishing

Fishing is a minor but important source of livelihood in Kurigram. Villagers used to catch fish for their own consumption, while there are fishing communities whose prime and only occupation has been fishing. Two to three decades ago (early 1980s–1990s), Kurigram also used to supply a large quantity of fish. However, fish exports gradually have since declined to a bare minimum. Fish farming today is rather uncommon, and finding a job on such farms is mostly out of the question for the respondents. Fishing is only possible in the river, which is practiced by 43 per cent of HHs in order to have an additional source of food. To 47 per cent of HHs, fishing is not a viable livelihood option. There are a number of "traditional fishing households" in a subsection of Khanpara named "Majhee Para" – a designated habitation for the artisan fisher folks – but fishing accounts for only 4 per cent of all practiced occupations. The traditional fishermen are currently facing poverty and severe hardship due to: (a) a lack of fish stock in open waters; (b) competition from "opportunist" fishermen[12]; and (c) a lack of costly but appropriate fishing gear. Although the current market price for fish has increased considerably, the scanty catch has forced them to think about leaving their ancestral practice and diversifying their income opportunities.

6.3 Poverty and well-being

This sub-section examines the local people's definition of poverty and well-being; it is largely based on a well-being analysis in the base village, Khanpara. Livelihoods and food security play central roles in well-being, yet the fieldwork revealed additional aspects that impact on the resilience and vulnerability of HHs exposed to weather variations that could contribute to migration now and in the future.

In Bangladesh, economic status and well-being are often directly linked to landholding. The most important indicators of wealth or poverty raised by the FGD participants in the BV were:

- land ownership;
- material possessions;
- multiple sources of income and labour relations;
- children's educational prospects; and
- food security.

As defined and reported by the villagers themselves, there are about 117 HHs in the base village, of which 14 per cent belong to a comparatively rich upper class, and 21 and 17 per cent belong to middle and lower-middle classes, respectively. The villagers themselves define poor and extremely poor at about 35 per cent and 14 per cent, respectively. The characteristics of each class, their interdependence, respective occupations and their well-being are fully described in Table 8. It is clear from the table that people's state of well-being depends very much on the prevailing economic conditions, that is, their landholding size, their access to resources, their ability to purchase essential commodities, their access to critical support such as credit and their food security. The poorer the HHs, the less they are able to cope with the effects of a natural hazard or other external shocks. And even more important, the most vulnerable families are not able to recover from such an impact by themselves, which deepens their poverty. Table 8 also indicates people's differential access to migration as a means to diversify their own livelihoods. It shows that most of the migrants, who temporarily leave Khanpara for employment in other places, are from the middle, the lower-middle and the poor classes, whereas the comparatively rich and the most vulnerable families are underrepresented (see Section 6.4.4).

12 Lack of employment opportunities forced many poor people to try their luck at fishing and compete with traditional fishers.

Land ownership, possessions & others	Income sources, labour relations & credits	Children's education	Food security	Migration
Upper class (16 HHs; 14% of all) → Have 1.13 hectares (ha) of own agricultural land (average) → Some buy extra land; some lease out land (share cropping arrangement) → Every HH has a tube well, latrine, mobile phone. Most have tin shed, TV and bicycle. Some have motor cycle, power tiller, sallow pump → Some are arbitrators, some have influence in Union Parishad → Some are local committee members	→ Every HH has alternative income sources → Some employ labourers → Do not take micro-credits, but have savings in bank	→ Children can study up to college/ university level	→ Year-round food security → 3 meals a day with sufficient food and snacks	→ 5 HHs with migrants (31% of rich HHs) → No women → 8 out of 9 migrants are the HH's sons → All to urban areas into different jobs
Middle class (24 HHs; 21% of all) → Have 0.33 ha of own agricultural land (average) → Every HH has tube well and latrine → 15 HHs have mobile phone and 12 HHs have bicycle	→ Every HH has alternative income sources, e.g. servicemen, business-men, earnings from power tiller, pump or cart, moneylenders, etc. → Sometimes employ labourers	→ Children can study up to college level	→ Have 9-10 months food security → Sufficient 3 meals a day	→ 10 HHs (42%) with migrants → 4 women (1 daughter in education) → 15 out of 17 migrants to cities (half in garment industry)
Lower-middle class (20 HHs; 17% of all) → Have 0.20 ha of own agricultural land (average) → Some HHs get land and livestock shared, rare → 14 HHs have mobile phone, 8 HHs have bicycle, 17 HHs have tube well, 18 HHs have latrine, 3 HHs have TV → Daughter's early marriage	→ 13 HHs have alternative income source → 1 HH tailor and 1 HH mason → Some HHs sell their (dependent) labour in peak (harvest) season → Some take micro-credits or loans from money lenders	→ Children can study up to high school level	→ Have 6-8 months food security → Sufficient 3 meals a day	→ 8 HHs (40%) with migrants → 6 of 9 migrants to urban areas (garments and carpentry) → 1 daughter in education → 2 to rural areas for agricultural labour → 5 of 9 migrants are heads of HH

Land ownership, possessions & others	Income sources, labour relations & credits	Children's education	Food security	Migration
Poor class (41 HH; 35% of all) → 29 HHs have only homestead land and 12 HHs have not even homestead land → 10 HHs have average 0.09 ha of own and mortgage in agricultural land → Polygamy is a serious problem → Many daughters are abandoned	→ 19 heads of HH agricultural labourers, 8 van/rickshaw pullers, 7 fisherman → Many women work as maid servants or day labourers (always dependent labour) → Most HHs take micro-credits and loans from moneylenders	→ Most children can not study up to high school level	→ Have 3–4 months food security → 3 meals a day	→ 20 HHs (49%) with migrants → No women → 7 of 29 migrants to cities (all in garments or rickshaw-pullers) → 18 as agricultural labourers to rural areas → 18 heads of HH
Extremely poor class (16 HH; 14% of all) → 10 HHs have not even homestead land. They live beside embankment → Most have no tube well or latrine → 9 HHs are widows or abandoned women → Many daughters are abandoned → Polygamy is a serious problem → heads of HH are disabled	→ They have no daily income security → They do maid/servant work, begging and day labour → They cannot even get micro-credits or loans from moneylenders	→ Most of the children drop out from primary school	→ They are never food secure → They can hardly ever take 3 meals → In *Monga* they face starvation	→ 2 HHs (13%) with migrants → No women → Both migrants are the HH's sons → For others move is too costly, they are not healthy and have no access to networks

Table 8: Household characteristics: Wealth Ranking in Khan-para (117 households). Source: Authors [Well-being analysis (3 October 2011); Migration information assessed on 27 February 2012].

6.3.1 Land ownership

According to the HH survey, almost 40 per cent of the population from the study site is landless, while 35 per cent are smallholders, 18 per cent have intermediate and 7 per cent have large landholdings. Cultivable land per head was 0.10 hectare (ha) around 2005 (TAS, 2006), which has been declining with the increasing population.

According to the HH survey, 64 per cent of respondents have their own land for cultivation. While people found it difficult to specify the parcel size under their ownership, the survey reveals that 24 per cent of those HHs who own land hold large landholdings, while 33 and 43 per cent have medium and small parcels of land, respectively. Not all the land can be cultivated, some is used as homesteads. About 82 per cent of HHs with land can cultivate crops on their land.

As indicated in the characteristics of different classes of HH in the BV, the rich are easily identified as having "large" parcels of land for cultivation and use (around 1.13 ha of land per HH), while the middle class and lower-middle class have diminishing parcels of landholdings (0.33 and 0.20 ha, respectively)[13]. In contrast, the poor have only about 0.09 ha of land on average, and the extremely poor have little or no landholdings at all, which is why they remain under food stress almost all year round.

Of those HHs who own land, 61 per cent have irrigated land, which is highly dependent on *Boro* cropping. One quarter of the land is wetland, and almost the same share is dry land. Only two per cent of land is for grazing, which reflects the difficulties in maintaining cattle. Share cropping is common; 32 per cent of HHs, including 16.7 per cent having no land themselves, share land with others to cultivate. Since the landholding size is limited and becoming increasingly smaller with time, arranging for share cropping is also becoming more difficult. About 30 per cent of families lease cropland for agriculture.

Most of the land owned by farmers is inherited (96 per cent of HHs). The large landowners can sometimes purchase land with their own savings; however, this is becoming increasingly difficult. Only those families that managed to diversify their livelihood, due to tertiary level education and subsequently better access to gainful employment, were able to add land to their existing assets and could then reap benefits from this.

6.3.2 Material possessions

The vast majority (93 per cent) of people are living in houses built from poor-quality materials. About 84 per cent of HHs have one or more huts in the courtyard. Almost two-thirds of respondents have huts as a residence, while only 11 per cent have additional huts. One-quarter have neither a house nor land. These represent the extremely poor in the study areas. The HH survey showed that 78 per cent of houses do not have access to electricity (see Table 9), which is a higher percentage than the national average of 68 per cent. The local people use groundwater for drinking and daily use. Among the agricultural-based HHs, 54 per cent have savings, compared to only 20 per cent of non-agricultural HHs. However, the level of savings is very low, and would enable them to sustain themselves for only one to two months.

6.3.3 Employment relationships and social strata

The members of the lower hierarchy often find employment as well as social support in the rich and middle class HHs. Such bonds, though diminishing gradually, have been a key to averting food insecurity. For instance, the erosion victims of Arazi-Kodomtola did not have to go far away after they had lost their homestead/land due to river erosion, as fellow villagers helped them to reconstruct their houses at other places within the village.

13 In Bangladesh, `decimals´ are often still used to measure land holdings. 100 decimals are equal to 0.41 hectares. The threshold of landholdings as defined by the respondents in the focus group discussion were 280 decimals (1.13 ha) for the richest HH), 82 decimals (0.33 ha) and 50 decimals (0.20 ha) for the middle class and lower-middle class, respectively, and 23 decimals (0.09 ha) for the poor.

		Yes	%
Land property		59	39.3
House	Residential	112	74.7
	Others	17	11.3
Electricity		31	20.7
Drinking water	Piped	0	0
	Nearby source (groundwater)	150	100
Possessions	Motorbike	5	3.3
	Cycle	62	41.3
	Tractor	3	2.0
	TV	3	2.0
	Rickshaw/van	2	1.3
	Irrigation pump	1	0.7
	Hand light	1	0.7
	Mobile phone	1	0.7

Table 9: Land and house ownership, access to electricity and water, and material possessions. Source: Household survey (October 2011) (n=150).

As indicated in Table 8, the poor and extremely poor do find temporary employment in rich and middle class farming HHs. About 52.6 per cent of farmers, most among the rich and a few upper-middle class HHs, do require agricultural labour and thus employ agricultural labourers, especially during land preparation, transplanting, weeding and harvesting. Since they do own land in excess of their own ability to manage all the tasks in relation to cropping, they tend to hire labour within the village and also from the wider neighbourhood. In contrast, about 38 per cent of HHs do not employ agricultural labourers and perform all the work themselves. The lower-middle class does not have the financial means to employ outside agricultural labour. Nonetheless, their average landholding size (around 0.2 ha) is sufficient so that they can harvest enough paddy to secure their own food demand for eight months in a year (see Table 8).

If no adequate measures are taken, it is unlikely that people from the poor and extremely poor classes will get out of poverty in the near future. The first risk is that, if the landholding of the rich is further divided among a number of heirs in the next generation, as has happened in earlier generations, the requirement for "extra agricultural labour" will gradually diminish – putting additional pressure on current wage labour groups. Second, if the "apparently self-sufficient" lower-middle class farmers face climate-induced hazards and somehow fall below the poverty threshold, they will compete for wage labour with the most vulnerable people. A reduced land-to-man ratio, increasing population and greater climate variability and change are, therefore, likely to exacerbate the livelihood issues and food insecurity among the lower-middle class and the most vulnerable groups alike.

6.3.4 Education of children

One other important social aspect that has crucial implications for a family's future is the educational prospects for its children. The HHs of the lower-middle and upper classes can keep sending their children to high schools. The poor HHs, in contrast, cannot do so, and the children drop out from school. The extremely poor HHs just cannot afford to keep their children even in primary school, which not only deprives them of the opportunity to acquire formal knowledge-based skills, it also forces them to join the cheap labour market as wage labour or – at best – agricultural labour and remain perpetually vulnerable to seasonal food insecurity and unstable employment conditions.

Middle class children enjoy better education opportunities. They can go to college – and thus have to move temporarily to Kurigram, the district's central town – which opens up more employment options in the future. The children of rich HHs can do even better. If they study hard, they can complete a university education – in Rangpur or maybe even Dhaka – and engage in an urban-based service sector. If that is not possible, they can still find employment in the service sector or government jobs in the neighbourhood, for example as school teachers, NGO supervisors, etc., or they can engage in local politics. Meanwhile, with the excess wealth they can purchase land from the poor and accumulate assets. One farmer in Khanpara, for instance, owns nearly two ha of land; his children are all well-educated and now engaged in the local service sector. The class-based education opportunities clearly highlight who would have greater chance to prosper in future and who might remain poor as well as food insecure.

6.4 Food security

Food security is primarily met in Kurigram through production or by means of purchasing from the market. Food security in most cases is understood as cereal or even rice security, where availability and access are generally the key determinants. The poor and the lower-middle class struggle to meet food security, if not year round certainly during the seasonal *Monga* phenomenon.

6.4.1 Availability of food

Two completely contrasting features have simultaneously emerged from FGDs and EIs. In the FGDs farmers claimed that crop yields have declined in recent years. About 35 per cent of the survey respondents also indicated that production has declined, if not drastically. Almost half of the farming HHs said that food production has decreased. In contrast, the key informant interviews show a different picture: regional administrators, agricultural specialists, national experts and researchers unanimously report that food production has actually increased in the study area. They tend to claim that the production enhancement has contributed to the reduction of abject poverty in Kurigram. There is no denying the fact that the total yield of certain crops as well as the cropping intensity of the land in the study areas has increased significantly over the past 10 to 20 years (since early 1990s). Figure 11 graphically presents the increasing rate of paddy productivity in Kurigram during 1977 to 2004. The yield has certainly increased at a rate of 5.4 per cent per annum (compared to a lower rate of 4.7 per cent per annum nationally).

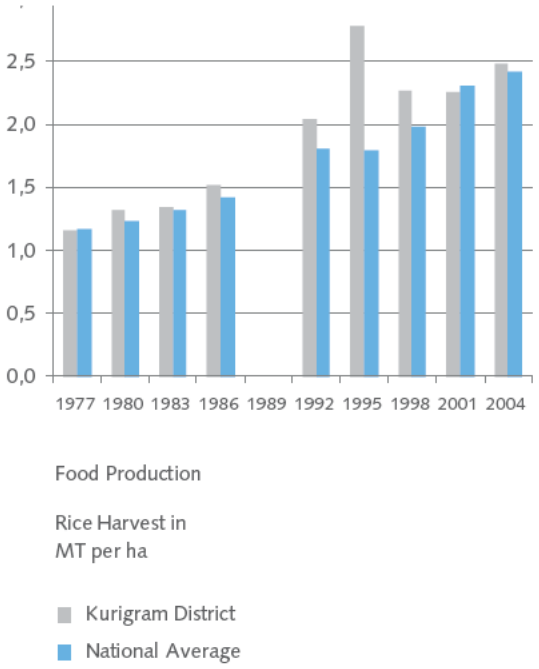


Figure 11: Increase in productivity of paddy/rice between 1977 and 2004. Source: BBS (2005).

The District Agricultural Officer clearly highlighted evidence of increasing food production as well as cropping intensity in the Kurigram area. The farmers, in contrast, claim that natural hazards such as droughts, floods and rainfall variability have contributed to the reported decline in crop production. About 72.7 and 65.5 per cent of respondents attribute production decline to drought and seasonal shift in rainfall, respectively. Despite the rather obvious increase in production, the claims of poor farmers appear inexplicable. Perhaps their "production per capita" has declined in spite of the said increase in yield. Moreover, the inability of the poor and extremely poor producers to pay due cost for high value inputs (e.g., fertilizers, irrigation, etc.) means their gains tend to reduce with any shift in seasonality and extremes. Higher production gains are more common for medium and large-scale farmers, while such gains are not duly realized by the poor and extremely poor.

With an increasing food demand against decreasing landholdings, farmers are finding it difficult to maintain food security from their own production, despite the introduction of HYVs and subsequent good harvests. The situation can become worse if suddenly occurring hazards destroy (parts of) the potential harvest. Moreover, farmers often do not get a fair price for their harvest although the prices for commodities and agricultural inputs are increasing. In such cases, the poor and the extremely poor producers suffer the most. Since rainfall significantly influences agricultural production, changes in rainfall patterns place poor farmers in a precarious food security situation.

6.4.2 Access to food

Food expenditure is an important indicator for food security. The responses to the HH survey showed that people generally spend on average BdTk 1,265 per week on food, though spending varies between BdTk 0 up to BdTk 4,000. However, not all the amount is spent in the formal market. FGD findings suggest that poor people generally spend more than 90 per cent of their income on food alone. The level of spending generally increases with increasing landholding. Only the self-sufficient HHs do not require to spend any amount on food (other than salt and sugar).

About 43 per cent of the responding HHs purchase almost all of their food for consumption from markets. This figure appears very high from the survey results. It may partly be attributed to the response of the erosion victims, who are forced to purchase almost all of their food from the market as their eroded land can no longer support production systems. One-third of all the HHs buy more than 75 per cent of their food requirements. In general, agricultural-based HHs purchase smaller amounts of food from the market. Nonetheless, they depend on market dynamics. Rural farmers, despite being producers themselves, are vulnerable to price hikes of food. Their access to food declined severely in 2008 due to a combination of a loss of *Aman* production following a late flood and price hikes that followed.

From questionnaire survey results, it appears that among agricultural-based HHs, the mean weekly expenditure on food is the highest for farmers with large landholdings (>2 ha), while it is the lowest, as expected, for the smallholders (<0.8 ha), who are thus less food secure. Table 10 gives a comparative analysis.

It is intriguing to find that the level of expenditure per week on food is generally higher for HHs where the primary sources of income are agriculture and service. The expenditure on food is the lowest for fishermen and remittance earners. Low-wage earners such as day labourers and small traders have little purchasing power, which is reflected in their level of expenditure on food items. Table 11 provides a better understanding of the consumption ability of various occupational groups.

6.4.3 Food consumption

People in the Kurigram district mainly consume rice, vegetables and fish curry. Fish consumption has declined sharply compared

to 20 to 30 years ago (1981–1991). The ever-increasing fish prices and substantially lower catch per fishing trip may account for lower fish consumption. The poor and the extremely poor classes cannot afford to eat fish, even if they can catch some from the river. The pricey commodity is sold immediately to purchase a few other things. The middle and upper classes can, however, afford fish, and the upper class consumes it almost regularly. The lower-middle class can seldom purchase and enjoy fish unless they can catch it themselves.

Type of agricultural HH	Mean weekly expenditure (BdTk)	Median weekly expenditure (BdTk)	Range of weekly expenditure (BdTk)
Large landholders	2,094	2,000	1,000 ~ 4,000
Medium landholders	1,406	1,400	500 ~ 3,000
Smallholders	1,389	1,200	200 ~ 3,000

Table 10: Food expenditure of agricultural-based households according to land ownership. Source: Household survey (October 2011) (n=150).

In earlier days (pre-1990), as reported in the FGDs, fish were abundant in the rivers and affordable. *Hilsha* (Ilish), being the most favoured fish species, can no longer be purchased from the market due to its very high price (>700 BdTk per kg). The fish used to be shared with visiting families and neighbours. Even the poor could afford *Hilsha*. Now that the fish has become exorbitantly costly, the lower-middle and extremely poor classes are reportedly forgetting its flavour and texture.

Rice, fish curry and vegetables are also the most common items that people purchase from the market. In addition, they commonly buy salt, edible oil, pulses, spices, etc. Most of the adults in the responding HHs, irrespective of their dominant occupation and caste, consume about three meals a day in a no-stress situation. However, it is quite common for them to face seasonal food insecurity and they are forced to skip a meal or two during *Monga* in September/October.

Intriguingly, local shops now also sell packaged and processed food items, which were considered undesirable by the elders in earlier days. Crisps wrapped in airtight packets are most widely sold and are mostly consumed by the children of the rich and middle class HHs. Sweets, processed savoury items and fried nuts are commonly sold in rural shops.

One of the important findings through the FGDs is that the nutritional conditions have deteriorated for more and more people, in particular for the poor and the extremely poor. They are highly food insecure in the lean season. Moreover, they also cannot afford pricy higher value food items even when those are available in the local market. The women representing such HHs are the worst sufferers. By the age of 35, they become vulnerable to diseases, and are stranded with almost no nutritional intake to fight diseases. Even if they grow fruits and vegetables in their courtyard, they often do not consume them, but rather sell them in the market to earn some extra money.

Occupational groups responding	Mean weekly expenditure on food		Median weekly expenditure on food	
	BdTk	US$	BdTk	US$
Agriculture (all types)	1,550	18.7	1,600	19.3
Fisherman	766	9.2	700	8.4
Carpenter	1,200	14.5	1,200	14.5
Day labour	1,000	12.0	1,200	14.5
Business	1,450	17.5	1,500	18.1
Trader	800	9.6	800	9.6
Service	1,585	19.1	1,500	18.1
Remittance	842	10.1	900	10.8

Note: 1 US$ = approximately 83 BdTk.

Table 11: Spending levels on food items by various occupational groups. Source: Household survey (October 2011) (n=150).

6.4.4 Rainfall variability, food security and migration according to class status

Under what circumstances do HHs use migration as a risk management strategy in relation to increasing rainfall variability and food insecurity? The answer to this question depends on the groups of HHs being considered (see Table 8).

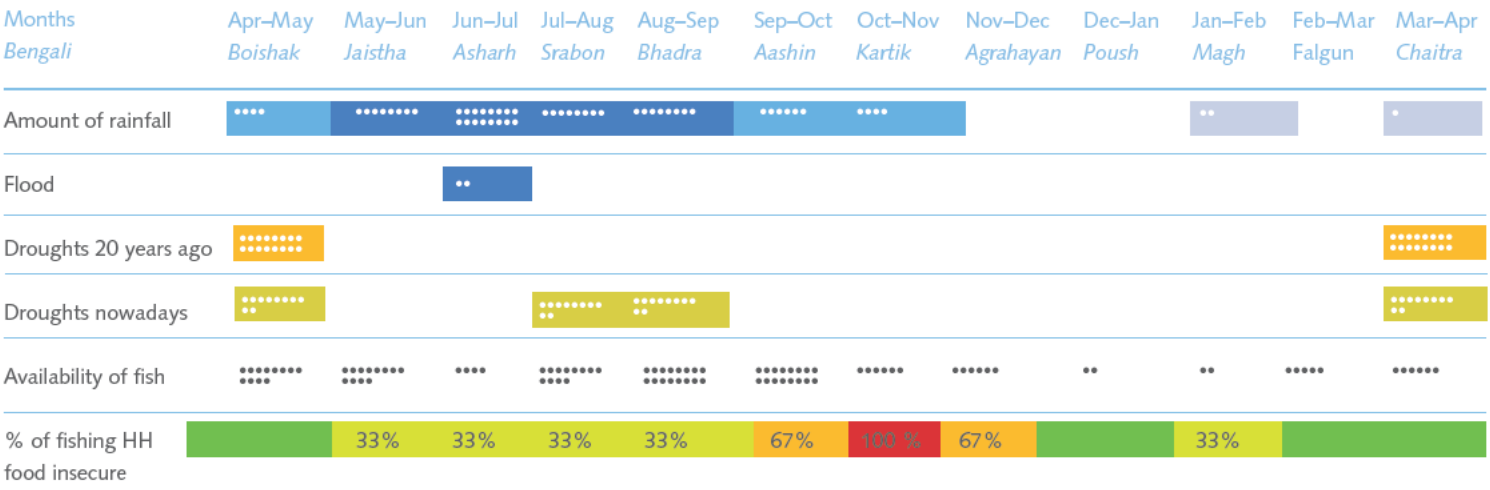
According to the respondents of the well-being analysis in Khanpara, the comparatively "richest" HHs are exposed to rainfall variability, as they have large agricultural farms, but they are not as sensitive to these changes, as they have multiple alternative sources of income outside of farming. As they enjoy good meals and snacks more than three times a day, and this all year round too, they are not subject to seasonal food insecurity. Consequently they do not have to migrate in order to sustain their lives, but rather for educational reasons or to get better-paid jobs in services in urban centres. Overall, only 31 per cent of rich HHs had family members living in other places at the time of the assessment; none of them were women.

Members of the lower-middle class directly depend on rain-fed agriculture and are both exposed and sensitive to rainfall variability. Some have alternative sources of income, while others have not. Some can employ labourers, while most sell their labour during the harvest season. The middle class are not found to be truly food secure all year round, as they are forced to employ coping strategies to deal with occasional food insecurity, especially during the lean season. From the well-being analysis, it can be inferred that the lower-middle class and the middle class are just located on the borderline of poverty and are struggling to cope with the situation. Any stressful condition surpassing their threshold to adapt might push them beyond the tipping point, irrespective of the fact that they still possess some land to produce something and enjoy improved food security compared to the very poor. Around 40 per cent of middle-class HHs had migrants in their family. They move in order to diversify their income and to cope with food shortages during *Monga*. They are more likely to work in the cities' garments industry or its informal economy, rather than as agricultural wage labourers in other rural areas. Only a few middle-income HHs can afford to send their offspring to cities for higher education, which would generally help them to diversify their livelihood and overcome poverty in the longer term. In terms of rainfall variability, however, migration might become an even more important risk management strategy for them.

The poor class is probably the most sensitive to rainfall variability as they are dependent agricultural wage labourers and fishermen. Some of them do also have their own harvest, but the amount they can obtain is too small to meet their overall food demand. Dependent day labourers do not earn enough in the pre-harvest season, and do not have access to sufficient amounts of food during stressful times. Almost half of the HHs in the poor class migrate; they thus constitute the biggest group of migrants from Khanpara. As seasonal migrants, many of them move at least twice a year. During *Monga*, they migrate to cope with food insecurity. Between February and April they move for the high labour demand in other rural areas, in particular in Munshiganj and Feni, where they work temporarily as agricultural wage labourers. Only one-quarter of them temporarily seek employment in the cities as garment workers or rickshaw pullers. Rainfall variability has an impact on their movements. Erratic rainfalls and crop failures mean less work available locally, therefore they are more likely to migrate (Gray and Mueller, 2012). The increasing demand for labour in other places in the country, however, is probably a stronger determinant of this group's migration rather than rainfall variability.

Note: The more points people have assigned to the respective field, the more the amount of rainfall, the more work, the more fish, etc. is noted during that month (the highest possible "score" is 16).

Figure 12: Seasonality of livelihoods: Seasonal calendar of farmers in Khanpara. Source: Authors [Seasonal Calendar, 5 October 2011].



Note: The more points people have assigned to the respective field, the more the amount of rainfall, the more work, the more fish, etc. is noted during that month (the highest possible "score" is 16).

Figure 13: Seasonality of livelihoods: Seasonal calendar of fishermen in Khamer Holokhana. Source: Authors [Seasonal Calendar, 28 September 2011].

The extremely poor families are not that sensitive to changes in rainfall variability, as most of them are not even involved in agriculture. They do, however, have to live with food insecurity all year round as they are hardly ever able to have three full meals a day. During the annual *Monga* they even face starvation. Because they do not have the "starting capital", or because they are not healthy or they do not have access to the necessary migration networks, most of them cannot even migrate – at any time of year. Only adult sons from two HHs in this class could migrate. Although the poor and lower-middle classes are equally desperate to sell their labour in other places and work towards improving the well-being of their families, for the extremely poor, migration is not as important as a coping strategy to avoid seasonal hunger.

6.5 Seasonality and rainfall sensitivity of livelihoods and food security

6.5.1 Seasonal livelihoods

In the Kurigram district, the local people's lives are very seasonal in nature and highly sensitive to changes in rainfall patterns. As shown in the seasonal calendars that were generated with farmers in Khanpara (see Figure 12) and fishermen in Holokhana (see Figure 13), changes in rainfall might disturb seasonal practices that have been learned and applied for generations.

Too much rain might result in excessive, instead of "normal" flooding, whereas too little rain leads to more dry spells (at unexpected times) and prolonged droughts. Variability in rainfall has implications for the sowing-weeding-harvesting cycle of their major crops (*Aman* rice, *Boro* rice, wheat, jute), the amount of food that is produced, the abundance of fish, and thus the local availability of food. They impact on the need and availability of labour, and thus the access to food. Food insecurity is not only chronic but also very seasonal in the north-west of Bangladesh.

Accordingly, there is also a distinct seasonal pattern of migration movements from Kurigram: food security and migration are closely related during the *Monga* season, when people migrate in order to cope with the most severe food shortages in the year ("push factor"). Between February and April, people do not migrate due to their own acute food insecurity, but rather because of the demand for agricultural labourers in other parts of the country ("pull factor").

6.5.2 Seasonal food insecurity – *Monga*

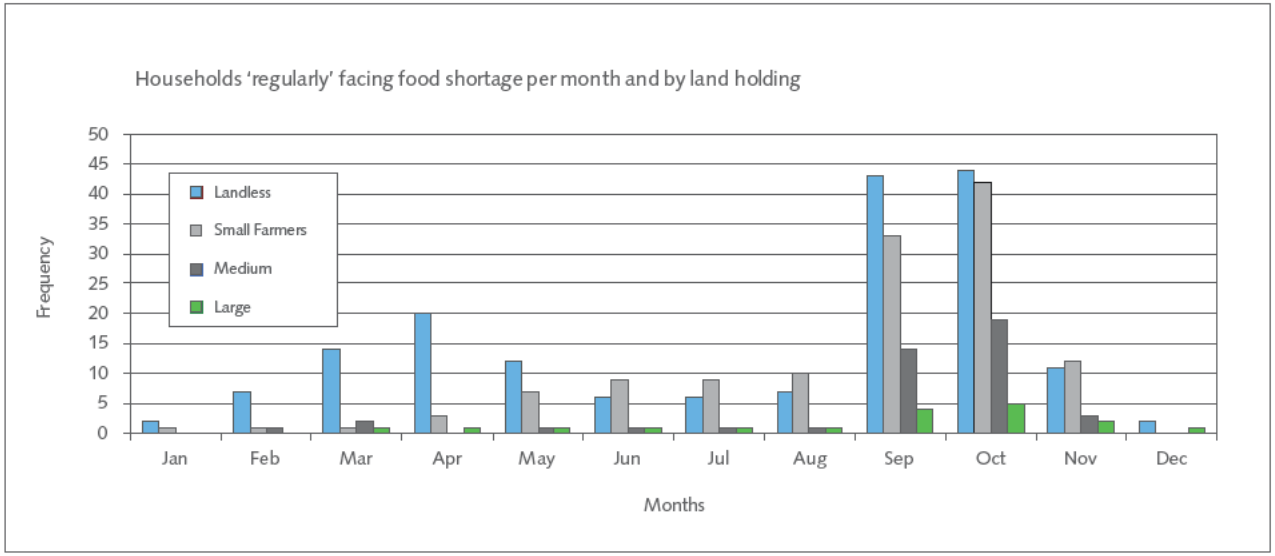
The majority of families in the Kurigram district experience seasonal food insecurity, while landless HHs and small farmers are most severely affected. Every year in September, 63 per cent of all the HHs interviewed face a serious food shortage; in October the number increases to 73 per cent (even 82 per cent of landless HH and 86 per cent of small farmers); and in November, when *Aman* rice is harvested, 19 per cent still suffer from food insecurity. Locally the time between mid-September and end-October is called *mora kartik*, a term that signifies the seasonality of hunger. The most food-secure months are December, January and February, when most HHs have sufficient food and only 2 and 6 per cent of the extremely poor and landless are food insecure.

It is found that susceptibility to *Monga* and subsequent food insecurity is comparatively higher in non-agricultural-based HHs than in agricultural HHs. This may be best understood by plotting the percentage of HHs reporting to have skipped a meal or two during food insecure months, as represented in Figure 15. It is revealed beyond doubt that a greater percentage of non-agricultural HHs are susceptible to *Monga* compared to agricultural-based HHs in both September and October. Intriguingly, many of the non-agricultural HHs find employment in the agricultural value chain, having clear economic ties with agricultural-based HHs.

	Landless	%	Small farmers	%	Medium	%	Large	%	Total	%
Jan	2	3.7	1	2.0	0	0.0	0	0.0	3	2.0
Feb	7	13.0	1	2.0	1	2.9	0	0.0	9	6.0
Mar	14	25.9	1	2.0	2	5.9	1	7.7	18	12.0
Apr	20	37.0	3	6.1	0	0.0	1	7.7	24	16.0
May	12	22.2	7	14.3	1	2.9	1	7.7	21	14.0
Jun	6	11.1	9	18.4	1	2.9	1	7.7	17	11.3
Jul	6	11.1	9	18.4	1	2.9	1	7.7	17	11.3
Aug	7	13.0	10	20.4	1	2.9	1	7.7	19	12.7
Sep	43	79.6	33	67.3	14	41.2	4	30.8	94	62.7
Oct	44	81.5	42	85.7	19	55.9	5	38.5	110	73.3
Nov	11	20.4	12	24.5	3	8.8	2	15.4	28	18.7
Dec	2	3.7	0	0.0	0	0.0	1	7.7	3	2.0

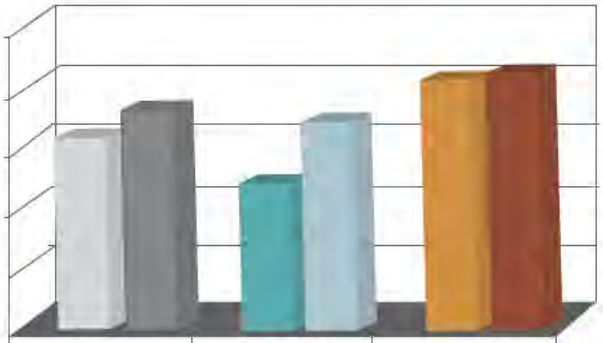
Note: Landless (54 HHs with no land), small farmers (49 HHs, ≤ 0.20 ha, medium (31 HHs, 0.21–1.00 ha) and Large (13 HHs, >1.00 ha of agricultural land); the Monga period is marked in blue.

Table 12: Households "regularly" facing food shortages per month and by landholding. Source: Household survey (October 2011) (n=150).



Note: Landless (54 HHs with no land), small farmers (49 HHs, ≤ 0.20 ha, medium (31 HHs, 0.21-1.00 ha) and Large (13 HHs, >1.00 ha of agricultural land)

Figure 14: Annual pattern of food security according to land ownership of households. Source: Household survey (October 2011) (n=150).



	All hhs	Ag-based hhs	non-ag hhs
September food insecurity	59.4	45.7	80.4
October food insecurity	70	65.7	82.6

Figure 15: Distribution of food insecurity in September and October among agricultural-based and non-agricultural households. Source: Household survey (October 2011) (n=150).

6.5.3 Coping with food insecurity – common adaptive strategies in Kurigram

People in the Kurigram district are neither helpless victims of the vagaries of nature nor do they passively accept their poverty or (seasonal) food insecurity. They actively seek out options to sustain their lives in the longer term in the context of food insecurity, economic challenges, natural hazards and rainfall variability.

People in Kurigram are very experienced in dealing with food shortages and hunger. The survey reveals that more than 80 per cent of HHs have faced food insecurity at some point in the past, and 54 per cent of respondents had to deal with food shortages in the previous week[14]. In the survey, the people were asked whether they relied on the following practices in order to deal with acute food shortages during *Monga*: utilizing less expensive, but also low-quality food; borrowing food from friends and relatives; reducing the consumption of food, for instance by limiting portion sizes; restricting consumption, for example by reducing portions for the elders compared to those for the children; reducing the number of meals per day; or sending one or two family members to eat elsewhere.

The first six coping strategies were employed in different degrees and permutations (see Table 13). Many of the HHs (48 per cent) resort to low-quality low-cost food almost every day, while only 16 per cent of HHs are never required to do so. About 37 per

14 This is no great surprise as the survey was conducted in October 2011 at the peak of the *Monga* season.

	All the time (7 days)	%	Pretty often (4–6 days)	%	Once in a while (2-3 days)	%	Hardly (1 day)	%	Never	%
Less-expensive food	72	48.0	18	12.0	22	14.7	14	9.3	22	14.7
Borrow food	17	11.3	39	26.0	26	17.3	15	10.0	52	34.7
Limit portion size	39	26.0	27	18.0	31	20.7	13	8.7	38	25.3
Restrict consumption	18	12.0	10	6.7	28	18.7	27	18.0	65	43.3
Reduce number of meals	25	16.7	7	4.7	20	13.3	15	10.0	80	53.3
Reduce number of people eating at home	0	0.0	1	0.7	1	0.7	2	1.3	142	94.7

Table 13: Coping with food shortages in the past week (during Monga). Source: Household survey (October 2011) (n=150).

cent of HHs borrow food almost every day or at least every four to six days, while one-third never need to do so. Reducing consumption of food items is another preferred modality. The least preferred option (over 98 per cent HHs never practice) is to send someone to a relatives' house in a bid to reduce the HH food demand.

In the past (early 1980s) food shortages were dealt with in many different ways, especially when HHs could not afford food due to a lack of money. About 69 per cent of HHs used to reduce their food consumption, while 44 per cent used to rely on external help, and 29 per cent would reduce the HH expenditure. The farmers' choice of coping has been somewhat different than those of other groups: 46 per cent of agricultural-based HHs used to modify food production to increase output, while the non-agricultural HHs[15] could not do so. Distress selling of assets is a common mode of coping that is practiced by 15 per cent of the respondents. Farmers tend to do so more than other groups (18 per cent compared to 2 per cent of other HHs).

The permanent migration of HH members is regarded as one of the common strategies to reduce food insecurity in the long run, while temporary labour migration only improves a family's

15 Generally those HHs where the income comes from non-agricultural activities: teaching, government jobs, NGO jobs, small trading, earning remittances, selling day labour for non-agricultural activities, etc.

poverty and hunger situation in the short run. More members representing non-agricultural HHs have migrated to urban areas (half of non-agricultural HHs) than members from agricultural-based HHs (23 per cent). Among the non-agricultural HHs, the male head of the HH is generally the one who migrates, while it is usually the adult sons who migrate from the agricultural-based HHs. Most farming HHs first seek to ameliorate their food insecurity by increasing their own food production, not primarily by migrating. Overall, income diversification has been a successful coping strategy for comparatively few people. Lack of education, investment capital and skills are the most important practical obstacles to potential income diversification. The general backwardness of the Kurigram district in terms of its weak manufacturing sector (see Table 4) is another factor that limits local income diversification.

The people themselves have practiced the above coping strategies during the past 10 to 30 years (early 1980s to present). Apparently worsening conditions for farming have, however, made it more difficult for the poorest small-farm HHs and agricultural labourers to cope with food insecurity. People reported that the social bonds towards addressing food insecurity have been declining fast. Well-to-do HHs no longer support poor HHs to overcome food insecurity. Food is hardly shared with neighbours, as was commonly observed 30 years ago (early-1980s) (Neelormi and Ahmed, 2010). This has reduced the effectiveness of local informal modalities towards addressing food insecurity.

In order to tackle absolute poverty and food insecurity, the Bangladeshi government introduced new agricultural technologies and a plethora of SSN programmes, such as food for work, cash for work and 100 days employment programme, vulnerable group feeding, vulnerable group development support and test relief. Though there are allegations of mismanagement and misappropriation in the implementation of the government's food support programmes, together with NGOs providing micro-credits, support, health services and education they have contributed to a significant reduction in poverty and food insecurity in the Rangpur region. Nonetheless, poverty and food insecurity rates remain comparatively high, in particular in the Kurigram district (see Table 5).

6.6 Living with natural hazards

Food insecurity, low income, ill health and natural hazards figure prominently in people's description of the hardships they are facing. In 2010 and 2011, 40.5 per cent of HHs experienced a reduced income; ill health of family members has affected 38.3 per cent of HHs; and 24.5 per cent had to recover from natural hazards. The most important natural hazards to have affected the respondents in the recent past were floods (mentioned by 65 per cent), droughts (46 per cent), thunderstorms and heavy rains (38 per cent), and riverbank erosion (8 per cent). The HHs who have reportedly been affected by natural hazards state that their house or other properties were damaged (63 per cent), they have lost their livelihoods (51 per cent), crops were destroyed or damaged (47 per cent), and cattle or goats had died due to natural hazards (6 per cent; see Table 14).

In the FGDs, damage to property was reported mostly by HHs in the villages that are highly exposed to erosion (i.e., Arazi-Kodomtola and Khamar Holokhana) (see Section 6.7.1), whereas the loss of or damage to crops was discussed as a result of increasing rainfall variability, in particular in the form of drought dry spells during the rainy season, in the base village Khanpara (see Section 6.7.2).

Two-thirds of agricultural-based HHs reported that natural hazards are the major cause for their hardship; drought being the most damaging one as it directly leads to a decline in food production (63 per cent of respondents noted). In contrast, for three-quarters of non-agricultural HHs, a reduction in income is seen as the greatest threat to their livelihood, as their access to food depends directly on their cash income. These groups also

reported that flooding (78 per cent) and drought (24 per cent) are the most damaging natural hazards. Both groups are sensitive to climate-induced hazards in different ways. Agricultural-based HHs are directly affected through damage to their property and a potential reduction of their own food production. Non-agricultural based HHs, in turn, are directly affected in terms of damage, but indirectly affected through the labour market. As an increase in dry spells, droughts and floods, or more generally greater rainfall variability, is projected in the context of climate change for South Asia (IPCC, 2007), local people will have to seek adequate ways of living with these challenges.

6.7 Implications of rainfall variability and people's responses

The people in the Kurigram district clearly notice increased rainfall variability in the region, in terms of irregular rain, droughts and dry spells at unexpected times and heavy rainfall. While all the local people are exposed to rainfall variability, the agricultural and fisheries-based livelihoods (65 per cent of all HHs) are particularly sensitive to rainfall variability and perceive it as a severe livelihood risk.

Figure 16 shows the results of a FGD with farmers, who mapped the direct and indirect impacts of rainfall variability on their livelihoods, and highlighted the ways in which they are coping with its negative implications. The most important direct effects of rainfall variability were more floods and exacerbated river erosion, both of which were due to more heavy rain and more rapid changes in the rivers' water levels. Floods lead to temporary inundation of homesteads, crop damage, disruption to communication and sanitation and drinking water problems. Riverbank erosion eventually leads to the loss of cropland and permanent displacement from their homes (see Section 6.7.1). The immediate effects of heavy downpours are damage to crops and vegetables. Erratic dry spells or drought leads to staggered growth of crops, a decrease in soil fertility and declining water tables (see Sections 6.7.2 and 6.7.3).

HHs affected by natural hazards	Count	%
Flood	98	65.3
Drought	69	46.0
Storm/wind/excessive rain	57	38.0
Riverbank erosion	12	8.0
Climate change	9	6.0
Other (no specification)	2	1.3
Impact of natural hazards on livelihood	95	63.3
House or other property damaged	76	50.7
Loss of livelihood	71	47.3
Crops affected/destroyed Death of livestock	9	6.0

Table 14: Impact of natural hazards on households. Source: Household survey (October 2011) (n=150).

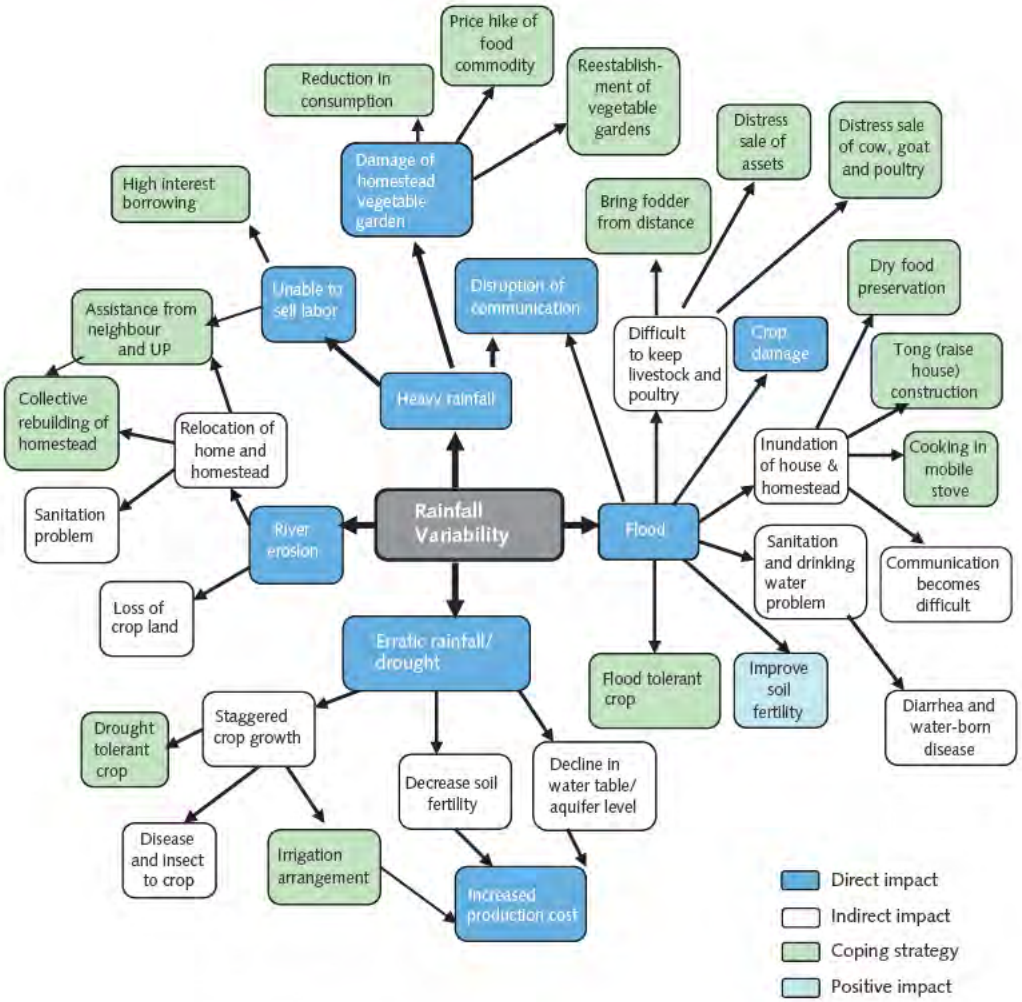


Figure 16: Impact of rainfall variability on farming-based livelihoods and respective coping strategies to reduce vulnerability. Source: Authors [Focus group discussion with impact diagram conducted with farmers in the base village Khanpara, 12 October2011].

All rainfall-related hazards also cause perturbations in the local labour market. Interestingly though, migration was not mentioned by the respondents in the FGD – neither as an indirect impact of rainfall variability, nor as a common coping strategy. The HH survey, in contrast, reveals that migration is the fifth most important coping strategy to deal with rainfall variability (see Table 16).

6.7.1 River erosion and flooding

Erosion is a well-known phenomenon in Kurigram. Both FGDs and EIs, however, revealed that river erosion has been on the rise in the past two decades. Erosion devours land as well as infrastructure. It generally decreases the growth potential of poverty-ridden rural areas such as Kurigram by devouring land mass and damaging critical infrastructure. In 2011 alone, one of the villages (Arazi-Kodomtola) was badly damaged.

With changing rainfall patterns, especially those influenced by the monsoons, the entire seasonality of the hydrological system in the region has started to change. For example, prolonged non-rainy episodes during the peak monsoon season followed by a high intensity rainfall episode forces rivers to swell quickly, resulting in "too much water" in the rivers, beyond conveyance capacity. This culminates in episodes of rapid rise and decline of water levels, resulting in increased erosion. However, due to a lack of continued rainfall, the rapid swelling of rivers does not always lead to moderate inundation – generally a desirable phenomenon which is believed to replenish topsoil with nutrients (Haggart et al., 1994). Erosion of land is often seen as a curse, which brings down affected HHs below the poverty level (Elahi and Rogge, 1990). The high erosion-proneness of the Kurigram district is one of the key attributes that perpetuates abject poverty for those living in the char areas (Baquee, 2001). Char dwellers generally face multiple rounds of erosion in each generation. In each successive erosion spell, they lose almost all the assets they accumulate during the intervening periods. Lack of land ownership and over-reliance on leased land keep them below the poverty line, and force erosion victims to fight chronic food insecurity.

Increased erosion, both in the Kurigram district and in its upstream areas (in India) generally brings in coarse sand instead of fine silt, which in turn contributes to a reduction in the yield potential of the land – especially those located next to a river. Since the density of riverine areas with respect to overall land mass in Kurigram is among the highest in the country, subsequent sand casting is one of the reasons for low growth in agricultural productivity in the study areas.

In the field-based participatory exercises (FGDs, EI, etc.), it was found that a number of SVs such as Arazi-Kodomtola and Khamar Holokhana have been severely affected by riverbank erosion throughout the monsoon. The vulnerability to erosion in Arazi-Kodomtola (one of the "satellite villages" visited during fieldwork) is captured in two resource maps that were prepared in 2010 and 2011 (see Figures 17 and 18). The 2011 map clearly exhibits how approximately one kilometre of land has been completely eroded by the Dharala River during the monsoon of 2011. People were forced to resettle elsewhere, which caused economic hardship, a struggle in livelihoods and even more intensified poverty. Moreover, a number of crucial infrastructures, including a health care clinic and a school, have been completely eroded, along with part of the flood-protecting embankment. On the other hand, people reported that the land belonging to a village on the other side of the river has expanded gradually due to the deposition of sand.

With regard to riverbank erosion, the coping strategies of the local people are rather limited. They can collectively rebuild homesteads and important infrastructure at other more secure places (as the rebuilt houses in purple indicate in Figure 17). The villagers also tried to stop erosion by building a protective barrier using their own means. But this effort, which was facilitated by an NGO leader, proved to be too fragile and the self-made

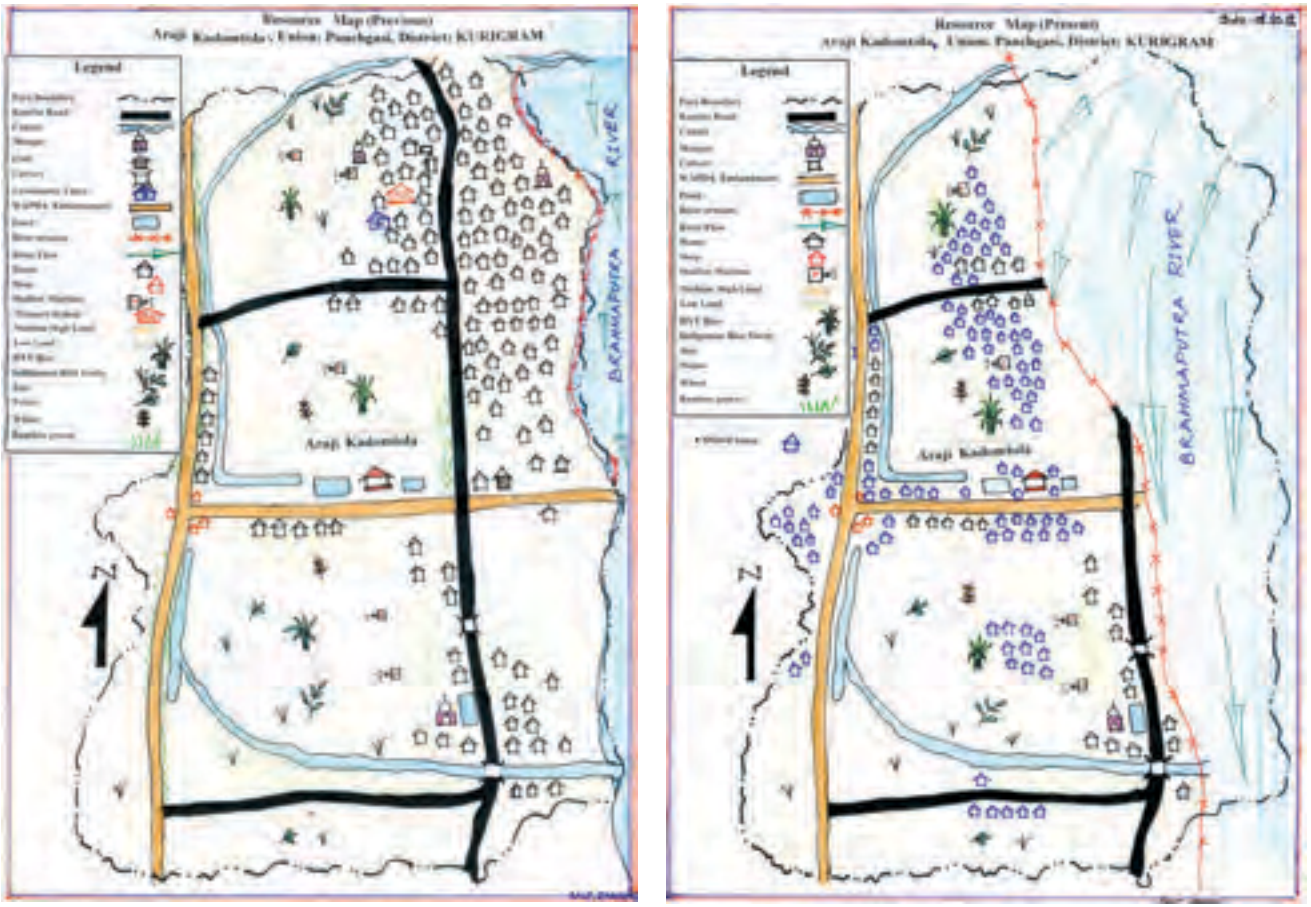


Figure 17: Riverbank erosion affecting the village Arazi-Kadamtola in 2010 (left) and 2011 (right). Source: Resource maps prepared in Arazi-Kadamtola (1 October 2011).

"embankment" was washed away by the strong currents of the Dharala River. The most important coping strategy is to seek assistance from the neighbours and the local government bodies. As the Union Parishad (the lowest tier of political representation in Bangladesh) was recently elected, the villagers of erosion-affected areas contacted the newly elected leaders, informed them about their concerns involving erosion and requested them to take precautionary measures. But their request did not yield significant success.

The erosion victims find it difficult to keep their children in school for long, nor can they send their school-attending children to faraway institutions that are located in relatively stable (non-eroding, known as *kayem*) locations. Moreover, a lack of resources to pay for transportation costs also prevents their access to relatively good health care facilities. River erosion, enhanced by climate variability, thus contributes to reduced agricultural productivity and plays a critical role in defining abject poverty and hunger in the Kurigram region.

6.7.2 Effects of rainfall variability on agricultural-based livelihoods

Impact of rainfall variability on food production

Perhaps the most significant aspect of changing rainfall patterns manifests itself in the local crop production systems. The monsoon crop *Aman* used to be the primary paddy (rice) crop, supporting the livelihoods of the vast majority of local people in the Kurigram district. People responded to the increase in population, which also escalated local food demand: they switched from traditional low-yielding *Aman* rice to HYVs of *Aman*. They utilized the drier cropping season to produce much higher-yielding *Boro* paddy instead of the lower-yielding pre-monsoon *Aus* paddy. Of course, such changes required investment in irrigation systems and initial technical support from government agencies such as the Department of Agriculture Extension (DAE). Overall, the importance of *Boro* paddy has increased dramatically. Yet, the relative importance of predominantly rain-fed *Aman* paddy for local food security has not declined.

The local farmers reported a steady decline in crop production in recent years, which contributed much to their food insecurity. Many experts, especially those serving the government, have nullified such claims. The available statistics reveal that more crops were actually produced in the Kurigram district due to a number of factors, including the extension of HYVs, varieties with shorter crop rotations, use of inputs, etc. This production increase contributed to a greater availability of local food per capita. Thus, there is a sharp contrast in the perception of the local food situation between experts and the local population. The FGDs clearly revealed that the apparent growth in agricultural productivity could not be equally realized by resource-poor farmers. Often the price of such input-driven technological packages, preached by the national extension service, appeared too high for poor and extremely poor farming HHs (see Table 8). Despite an overall increase in productivity in the area, throughout most of the year poor HHs do not have secure access to a sufficient amount of food. Their food security is constantly at risk.

The annual monsoon is supposed to bring in a considerable amount of rainfall, especially before the seedbed preparation for *Aman*. A short spell of rainfall followed by a short dry spell, and the repetition of such a cycle was quite common in the past (before 1990s). This was particularly conducive for HYV *Aman* production, without having to invest in irrigation. The other critical weather-related condition that influences HYV *Aman* production is the ability of the land to drain water within the second week of August. Otherwise, due to heavy inundation, the seedlings cannot be transplanted in time, drastically reducing the potential yield. With unpredictable rainfalls, the farmers do not know whether they can establish the *Aman* seedbeds on time and/or whether the seedlings can be transplanted in due course

Figure 18: Impressions from the village Arazi-Kodomtola. Left: Riverbank erosion. Below: Village huts right at the riverbank. Left below: Some people are shifting valuable tin-sheds from their former hut to build a new home elsewhere. Source: Authors.

for an optimum yield. A late flood can easily ruin the HYV *Aman* production and inflict localized, as well as national, food insecurity. Food insecurity was observed in many parts across Bangladesh in early 2008, which may be partly attributed to a late 2007 flood, and partly to a rapid increase in the price of basic commodities, i.e. rice (Etzold et al., 2011).

On a similar note, a reduction in rainfall during the seedbed preparation – which otherwise is unthinkable in a monsoon-influenced country – can have severe consequences towards maintaining food security. According to agricultural scientists, poor farmers' inability to invest in supplementary irrigation is one of the root causes of lower production rates for high-yield varieties of *Aman* rice. If the monsoon rains are coming too late or they are not steady enough, as has been observed during the past few years, and if farmers are unable to irrigate their land due to a lack of capital, the *Aman* rice production is severely hampered. As a result, food insecurity increases. The monsoon of 2011 can be cited as an example. During the peak monsoon season, there was hardly any rainfall in the Kurigram district. Many farmers could not prepare the seedbeds in time, except those who invested in irrigation. Therefore, their production costs rose. Many poor farmers could not afford the irrigation costs, with subsequent consequences for their own food security. Similarly, the occurrence of *Kaitan-Satao* helps *Aman* during its reproductive stage. Since *Kaitan-Satao* has become erratic and unreliable, the impact on *Aman* production can be quite significant.

High-yield varieties of *Boro* rice are a different case. *Boro* is largely perceived to be an irrigation-dependent crop – also for the poorest farmers. Even if there is no appreciable rainfall and persistent dry spells, all of the farmers rely heavily on irrigation. They are used to investing in irrigation for *Boro* cultivation. Drought therefore is a managed hazard in Bangladesh (Ahmed et al., 2005), which may or may not intensify with decreasing rainfall. Intriguingly, irrigation depends not only on irrigation services, including the timely availability and cost of fuel, but also on groundwater levels. Considering that more than 81 per cent of irrigation is accomplished through pumping groundwater in Bangladesh (BBS, 2010), sinking groundwater levels are an additional risk for the production of *Boro* rice.

Farmers also commented during FGDs (particularly in the base village Khanpara) that a shower in late October/early November generally washes away insects, which otherwise would affect the crop yield. They indicated that the trend towards less frequent showers has forced the farmers to apply chemical pesticides. These chemicals have not only increased the cost of production, especially for poor farmers, but have also contributed to a decline in natural fish stocks in the floodplains.

Farmers' livelihood risk ranking

In a bid to further probe into people's perceptions of rainfall variability as a livelihood risk vis-à-vis other types of risks, a livelihood risk ranking was conducted with farmers (see Table 15) and fisherman (see Table 17). Certainly there is a strong connection between rainfall variability, weather extremes and changes in livelihood risks. Shifts in rainfall patterns have been bothering farming communities in the past two decades. While the urban elites in Kurigram can attribute such phenomena to global warming, the rural respondents can only identify cause-effect relations between dwindling rainfall patterns and crop damage. This is perhaps why, despite having the benefits of improved seeds and varieties, along with institutional support for growing more food, farmers tend to highlight the reduction in food production in recent years.

As presented in Table 15, a lack of rainfall causing moisture stress has been identified as the major hazard for farmers. Most of the hazards identified by the farmers relate to a potential reduction in crop yield. The costs of inputs for cropping and health care costs are also regarded as livelihood risks.

Criteria for risk assessment of agricultural-based livelihoods

Severity	Frequency	Overall damage potential
1. Drought/moisture stress	1. Drought/moisture stress	1. Drought/moisture stress and associated cost for tube well based irrigation
2. Low or no production of Aman due to water logging	2. Water logging in low-lying lands damage *Aman* crop	2. Rainfall not occurring in due time, affecting *Aman* production
3. Increase in price of fertilizers	3. Rainfall not occurring in due time	3. Increase in price of fertilizer
4. Rainfall not occurring at right time	4. Human health (diseases)	4. Water logging in low-lying lands damage *Aman* crop
5. No cultivation in sandy (char) land	5. Increase in price of fertilizer	5. Human health (diseases)

Table 15: Priorities of livelihood risks experienced by farmers. Source: Fieldwork data.

Phenological drought[16] is a reality during the cultivation of *Boro* paddy (Ahmed, 2005; Karim et al., 1999). It is managed through the application of irrigation. All the houses surveyed have access to tube well water (related to NGO activity in the area). Irrigation in agriculture is done through wells (24.7 per cent) and from nearby water sources (36.7 per cent). The response to increasing moisture deficit in the dry season has been "accepted"[17] as a reality among the farmers. For *Boro* production, the farmers must apply irrigation. There is no alternative, no element of surprise. Moisture stress has become an issue of concern when it is related to cultivation of *Aman* – a crop that used to be rain-fed for centuries. The farmers talked about moisture stress that has created problems in the current monsoon season to prepare seedbeds for *Aman*, and later to transplant seedlings. During the full monsoon period, moisture stress should not be a problem at all unless the usual rainfall trends are completely erroneous. In Section 5, prolonged dry spells without rainfall during peak monsoon were reported. In such unexpected conditions, irriga-

16 Bangladesh does observe moderate to strong agricultural drought (phenological) during the *Boro* growing season, which is generally developed through lack of appreciable rainfall during the winter and post-winter dry period (November until the end of March; see the "seasonality maps" in Figures 12 and 13) and excessive evapotranspiration, which in turn develop acute moisture stress down to the root zone of paddy. For further details see FAO/UNDP, 1988; Karim et al., 1999. Such drought is not meteorological drought, the latter being observed widely throughout the western Indo-Gangetic Plains.

17 Accepted as a loss by the poor, who are forced to bear the cost of irrigation to man age the hazard. The cost is partly borne by the government by means of a fuel subsidy.

tion can save crops, but at much higher costs than usual. This in turn hurts the farmers financially. Dependence on rain-fed *Aman* has now become unreliable for poor and marginal farmers (including the lower-middle class in the study areas), which can only be addressed through further investments that are difficult for the poor farming community. The lower-middle class farmers fear that they will become poor as a consequence of prolonged dry spells during the peak monsoons, especially if they continue for too long.

Water-logging, especially in late August when the freshly transplanted HYV paddy seedlings are submerged in a late flood, can adversely affect yields. However, the risk of flooding is now being overcome either by choosing less susceptible varieties in the low-lying lands or by the introduction of two newly developed HYV varieties of *Aman* that can survive about 15 days of continued inundation and still result in a good harvest (i.e., 4.2 to 5t/ha as compared to 3.5t/ha with flood susceptible HYV *Aman* varieties).

How agricultural-based livelihoods manage rainfall-related risks

Climate change-induced rainfall variability has a multitude of far-reaching implications for poor farming communities in northern Bangladesh (see Figure 16). For example, 59 per cent of the respondents to the questionnaire survey indicated that rainfall variability affects their food production, and even 89 per cent saw negative effects of rainfall variability on their own livelihoods. The most significant direct impacts of rainfall variability that were addressed in the survey are an increase in local food prices (as noted by 64 per cent of respondents), declining crop yields (54 per cent), and a reduced catch and sale of fish (7 per cent; see Table 16).

As 60 per cent of the HHs interviewed were engaged in agriculture, the coping strategies that were assessed through the survey largely represent the ways in which agricultural-based livelihoods

Does rainfall variability affect food production?*	Count	%
Yes, a lot	63	42.0
Yes, but only a little	25	16.7
No, it does not affect us	2	1.3
Does rainfall variability affect the HH economy?**		
Yes, a lot	91	60.7
Yes, but only a little	42	28.0
No, it does not affect us	15	10.0
What are the major impacts of rainfall variability?		
Increasing food prices**	96	64.0
Declining crop yields*	81	54.0
Less sales of fish**	10	6.7
Other impacts	8	5.3
Decline in number of animals**	4	2.7
Substitute market products**	1	0.7
Major coping strategies towards rainfall variability		
Reduced HH food consumption***	103	68.7
Rely on external help**	66	44.0
Reduce expenditure**	43	28.7
Modify food production to increase output*	37	24.7
Migration of HH members**	32	21.3
Sell assets (incl. land)**	22	14.7
Increase alternative income**	19	12.7

Note: All coping strategies relate directly to food security in terms of the availability of food (*), access to food (**) and utilization of food (***). Multiple coping strategies were possible answers.

Table 16: Impact of rainfall variability on households and their coping strategies. Source: Household survey (October 2011) (n=150).

react to the impact of rainfall variability. For 69 per cent, reducing the amount of food that is consumed in the HH is the most important coping strategy. Also, 44 per cent rely on external help to gain access to food during these critical times, while 29 per cent reduce their overall expenditure on food and on other items, which enables them to prioritize their spending on basic food requirements. In addition, 25 per cent try to modify their own food production in a way that prevents the loss of harvest or even increases their crop output. And 21 per cent rely on the migration of HH members as a way to diversify their income and secure their food expenditure through the migrants' remittances. Almost 15 per cent sell assets (such as land or jewellery), while 13 per cent seek to increase their income through employment on the local market, if they require money urgently to cope with the effects of rainfall variability. This shows that rainfall variability directly relates to the food security of the affected families. The aforementioned coping strategies directly relate to the different dimensions of food security (see Table 16). In turn, this implies that if people cannot cope (in the short-term) or adapt (in the long-term) to the local effects of rainfall variability, then poverty becomes more deeply entrenched and food insecurity becomes exacerbated in the study area. In this context, migration is one of the most important strategies to secure one's livelihood.

6.7.3 Effects of rainfall variability on fisheries-based livelihoods and the responses of fishermen

Since rainfall has become erratic, lack of rainfall in the pre-monsoon months in specific years can have a devastating effect on fish spawning and breeding. The critical condition for floodplain fisheries is having (local convection-induced) adequate rainfall during the pre-monsoon months (April–May). In any given year, if there is a drastic reduction in pre-monsoon rainfall, the fish trapped in smaller water bodies can be affected in different ways. First, smaller water pools accumulate pollutants (agrochemicals and other pollutants) and their concentration rises with a decrease in water volume, often surpassing critical thresholds to kill brood stock and/or larvae. Second, smaller water bodies cannot meet biological oxygen demand (BOD), which is detrimental to fish and their freshly spawned larvae. Third, since April is the hottest period of the year, a rise in water temperature in a small pool (requiring little latent heat to warm up) beyond 32 °C can have a devastating effect on freshly spawned larvae (World Bank, 2000). In late March to April, many smaller water bodies can dry up completely. Poorer community members who rely on catching fish from such small ponds before the start of the monsoon then do not have an adequate source of protein. Overall, increased seasonal variability of rainfall beyond a particular threshold can have devastating effects on natural fish stocks, which in turn can ruin the livelihoods of fishermen. Indeed, the FGD involving the fishermen identified the relationship between erratic rainfall, dwindling fish stocks, lack of catch and declining livelihood standards. Figure 13 (in Section 6.5.1) represents the salient features of the seasonality map worked out during the FGD involving fishermen in the base village.

There are specific issues concerning fish spawning and the occurrence of thundershowers. The latter phenomenon is observed during the *Boishakh* (mid-April to mid-May), which generally brings a sudden heavy shower over a thunderstorm. A substantial number of fish species in the floodplain wait for such events for spawning. These fish species lay eggs for hatching in fresh streams created by such showers. For the fish species, the apparent "new waters" are the best habitat for freshly hatched larvae. Any change in the occurrence of a thundershower by a few days discourages mother fish from laying eggs, thereby causing a net decrease in the fish population. The livelihoods of fishermen are closely linked with the rainfall variability-induced hydrology of the locality.

As represented in Figure 13, there has been a drastic reduction in available rainfall in a number of months, followed by a decrease in catch over the past two to three decades (since early/mid-1980s). The traditional fishermen, almost all of whom belong to

Criteria for risk assessment of livelihoods		
Severity	Frequency	Overall damage potential
1. Population growth	1. Increase in drought/moisture stress	1. Drought/moisture stress leading to crop loss; post-hazard food price increases
2. Poverty	2. Poverty (restricting/having no means to reduce/avert risks; hunger; not being able to invest)	2. Flood (especially late flood leading to crop loss)
3. Decline in fish production (and catch)	3. Decline in fish production (and catch; as a consequence of over-fishing and lack of rainfall in critical time in hydrological cycle)	3. Weakening of *Kaitan-Satao* phenomenon
4. Competition in fishing with non-fishers	4. Disease burden	4. Hailstorms (which in turn increase food production)
5. Disease burden	5. Population growth (even non-fishers increasing competition, further reducing catch per capita)	5. Norwesters (damage to property)

Table 17: Priorities of livelihood risks experienced by fishermen.
Source: Fieldwork data.

the Hindu minority, have found it difficult to sustain their livelihoods under conditions of erratic rainfall, dwindling fish availability and catch, and increased competition with non-traditional fishing groups (mostly Muslims). The implications of hydrological realities due to much increased rainfall variability have been devastating for their lives and livelihoods.

Fishermen's livelihood risk ranking

Fishermen have also related changed rainfall patterns with specific livelihood risks, such as a reduction in gains from fisheries (see Table 17). In addition to climate-induced hazards (rainfall included), fishermen have identified increases in population and poverty as two critical factors that have aggravated risks to their livelihoods. Climate-related phenomena are also highlighted; however, their relative priorities appear less than non-climatic factors. At the same time, it is also mentioned that climatic hazards appear more frequently than generic poverty-related issues.

In terms of frequency of occurrence, the issue that tops the list has a strong relationship with dwindling rainfall patterns. One fisherman, comments "rainfall has become chaotic these days". Such chaotic rainfall has created trouble in already stressed systems: both in natural and human systems. As a consequence, production is hampered, which in turn affects the poor the most. Fishermen's dependence on the market for purchasing essential food items increases their livelihood risks when sudden price hikes aggravate their food insecurity. Examining the relative damage potential, it is clear that the prioritized phenomena are very much related to changing climatic conditions. Indeed, shifts in climate trends have severely affected the already fragile livelihoods of poor farming and fishermen communities in the study area.

How fishermen manage rainfall-related risks

A reduction in catch means food insecurity in a fisherman's HH. Everybody in the HH suffers. Since fishing is virtually the only source of income, a reduction in income means sacrificing a meal or the quality of food in a meal. In anticipation of good days, many have accepted loans from different sources. A few could repay the money due to increased fish prices. However, even that coping strategy did not help other fishing HHs to come out of a cycle of indebtedness. If a loan is received from a fish trader, they are forced to land their catch to the trader's shop and accept whatever price is given to them (which is generally a much reduced price compared to the market price). Thus fishermen are trapped in a vicious circle of exploitation if they remain indebted to wealthy fish traders. Only one fishing HH surveyed could amass enough cash to change their livelihood from a fisherman to a fish trader in the neighbouring Bazaar.

Even some 20 years ago (early 1990s), fishermen also had larger homesteads where trees could be planted, livestock could be managed and poultry could be raised. With successive generations, the size of homesteads has become smaller and the resource potential has drastically declined. During stressful conditions, they can no longer sell their assets.

Fishing HHs are highly susceptible to commodity price hikes since most of the consumables are bought from the market. Major inflation and subsequent price hikes severely affect them and force them to increase the price of fish to cope. However, the price of fish cannot be increased substantially while selling it to traders. Small fish-traders who benefit more from increases in the price of fish do retailing in the market.

The fishermen know that they are losing the struggle against hunger. They understand that borrowing money will not help their cause much. However, it is still the only viable modality to cope with their situation. They know deep down that someday they will have to leave and accept "any employment" that comes their way and for which they do not have the slightest preparation. Or, they will have to migrate and seek new livelihood opportunities at a distant place, which they cannot even foresee.

Section 7: Migration and human mobility patterns

Migration has been quite common in Kurigram since the mid-1970s. It is seen by the people as a reasonable way to avert seasonal food insecurity. With further deepening of poverty, a diminishing resource-to-man ratio in each successive generation and frequent occurrence of natural hazards, migration has become increasingly important to enhance income and sustain livelihoods, in particular for the poor. This section highlights human mobility and migration in the study area and the social consequences of migration.

The first migrants left from Khanpara, as recollected by respondents, during the food insecurity period of 1974/1975 when crops failed in two successive seasons because of flood and drought, and food distribution was severely impeded due to hoarding, coupled with an extraordinary price hike – resulting in a famine-like situation throughout north-western Bangladesh, particularly in Kurigram. This shows that migration from this region is not a new phenomenon. Even 10 to 20 years ago (since early 1990s), migration was common as a "stress-averting tool" and used by farming and non-farming HHs. However, the importance of migration has increased gradually over the years. Now, respondents evaluate migration as a mechanism to adapt during a period of crisis (79 per cent) and also as a normal income diversifying activity[18] (27 per cent). Local key informants indicated that the major "push factor" for migration in earlier years has been severe poverty.

18 Instead of working on their own land or working for large landowners locally, people sell their labour for better wages away from home. Few respondents considered both answers to be true (multiple entries allowed).

Indicators	Khamar Holokhana	Arazi-Kodomtola	Khanpara	Doalipara	Total	%
HH interviewed	22	20	65	43	150	
HH with migration experience (%)	12 (54.5)	16 (80)	21 (33.8)	16 (34.9)	65	43.3
Total number of migrants	14	24	34	17	89	
Major motivation for migration						
Economic migrants	14	22	27	17	80	89.9
Educational migrants	0	2	7	0	9	10.1
Gender of migrants						
Male	14	24	31	17	86	96.6
Female	0	0	3	0	3	3.4
Average age of migrants						
Education of migrants	37	37	36	41	37	
(years of schooling)	1.5	2.1	5.4	3.2	3.5	
Marital status of migrants						
Single	2	5	3	0	10	11.2
Married	12	19	31	17	79	88.8
Type of migration						
Seasonal	13	20	22	16	71	79.8
Temporal*	1	4	12	1	18	20.2
Migration status						
Current internal	13	18	29	14	74	83.1
Current international	0	0	0	1	1	1.1
Returned internal	1	5	5	2	13	14.6

** When the migrant's stay at the destination is up to three months per trip.*

Table 18: Key indicators for migration from Kurigram.
Source: Household survey (October 2011, n= 150).

The HH survey revealed the following about migration in Kurigram (see Table 18): 43 per cent of all families interviewed have some migration experience; the total number of migrants from the four study villages is 89. Around 11 per cent of the total number of family members in the selected HHs (n=150) is thus involved in migration. About 88 per cent of the overall population have reportedly never migrated in their lifetime, and there is a particularly low migration rate for women, who account for only 3 per cent of all migrants. Also, 98 per cent of migration movements from the study sites are within Bangladesh. About 83 per cent of the migrants were absent due to internal migration, while almost 15 per cent of migrants were present and had returned from migration trips within the nation. International migration from the surveyed villages (only one case) is found to be much lower than what has been cited in the literature[19]. The high incidence of poverty seems to be a detrimental factor for such a low rate of international migration from the locality.

The number of trips per migrant is skewed, ranging from a single trip to as many as 60 to 65 trips in a lifetime. For all the migrants (n=89), the average number of trips per migrant is 21.7, which suggests that the migrants repeatedly migrate from their homes (Figure 19 shows the duration of migration trips). On average, migrants stay away from home for 5.3 months. Seasonal migration (about 80 per cent of cases) is thus quite common, while temporal migration (up to 3 months away from the HH) is also considered by the villagers (about 20 per cent of cases).

The average age of migrants from the villages in Kurigram Sadar is 37 years (at the time of survey). They have a very low educational status with only an average of 3.5 years of schooling. As already indicated, 97 per cent of all migrants are men, compared to 3 per cent of women. However, the advent of improved communication networks and a reduction in stigma associated with women's economic activities outside the homesteads (a social norm that is called *Purdah* in Bangladesh) have created opportunities for women to migrate. An overwhelming majority of migrants (89 per cent) are married and thus maintain "translocal" HHs at least temporarily while the migrant is absent.

In agriculturally dominated areas, the rate of migration is substantially lower (34 per cent in Khanpara and 35 per cent in Doalipara), than it is in erosion-prone areas (80 per cent in Arazi-Kodomtola and 55 per cent in Khamar Holokhana). Severe lack of opportunities to engage in cultivation or related jobs, as well as greater links with migration-facilitating organizations, may account for the relatively higher rates of migration from the latter areas. Migration is common among almost all ethnic groups, though fishermen belonging to the Hindu religion do not tend to migrate much. Despite the fact that their fishing-based economy is on the verge of collapse, they are still hanging around relying upon ancestral skills to salvage their livelihoods.

Table 19 shows some findings from the HH survey about poverty, status of land ownership and migration. Economic migration is more prevalent among smallholders and the landless, whereas education migration is more common in HHs having middle-sized farms than the smallholders and landless classes. Surprisingly, educational migration has not been featured among the HHs having large landholdings (>1 ha). The survey findings clearly indicate that middle income HHs have the ability to invest in education to ensure a better life, which the lower income groups cannot afford and they have little choice but to opt for economic migration to avoid livelihood failure or food insecurity. Economic migration is also seen among HHs with large landholdings, which is due to their ability to find formal employment in distant urban centres, often after completing higher education (above Baccalaureate level).

19 According to Afsar (2005) international migration accounts for 24 per cent of all migration movements in/from Bangladesh, whereas Gray and Mueller (2012) mentioned a share of 13 per cent.

Land holdings	HHs surveyed	% of all HHs	HHs with economic migrants	% of all HHs with economic migrant	HHs with educational migrants	% of all HHs with educational migrants	Total no. of migrants	% of all migrants
Large	13	8.7	9	11.3	0	0	9	10.1
Medium	34	22.7	8	10.0	6	66.7	16	18.0
Small	49	32.7	26	32.5	1	11.1	27	30.3
Landless	54	36.0	37	46.3	2	22.2	39	43.8
Total	150	100	80	100	9	100	89	100

Note: Landless (no land), small farmers (less than 0.20 ha of land holdings), medium (0.21-1.00 ha) and large (>1.00 ha).

Table 19: Migration motivation and land ownership. Source: Household survey (October 2011, n= 150).

Further analysis revealed consistent differences among the four villages that were surveyed. The HHs interviewed in Khamar Holokhana and Arazi-Kodomtola are clearly less well-off in terms of landholding and poverty than the HHs interviewed in Khanpara and Doalipara (see Table 2). The high rates of migration are also exhibited in the former two villages, reflecting close links between landholding status, poverty and migration (see Table 18). Relatively higher rates of migration from those two less well-off villages may also be attributed to higher susceptibility to river erosion. On a similar note, the average years of schooling of HH members aged 14 years or more is found to be the lowest in the two less well-off villages where poverty rates are higher than in the other villages.

7.1 The decision to migrate in the Kurigram district

It is found in Kurigram that seeking economic opportunities is the primary reason to migrate, which also helps in coping with and adapting to prevailing livelihood stresses. Also, 43 per cent of HHs had at least one member of the family who migrated.

As illustrated in Table 2, the higher the incidence of poverty the greater the prevalence of migration. The high rate of migration can thus be attributed to the poor economic conditions and instability of the people (represented by higher susceptibility to erosion, as in Khamar Holokhana and Arazi-Kodomtola), mostly representing the lower-middle class and the poor, who are struggling to eke out a living from all forms of livelihood in the area. For many HHs, their livelihoods are so stressed that they cannot maintain a living other than by migrating elsewhere. In the context of a gradually changing climate and subsequent erratic rainfalls, such factors might worsen food insecurity and thus also lead to increased migration – both in terms of the number of migrants, and the number of temporary labour migration trips.

7.1.1 Migration decision-making

In an overwhelmingly large majority of HHs (71.9 per cent), the head of HH makes the final decision regarding migration. Most of the heads of HH are male, and normally the adult males migrate most often. From agricultural-based HHs, the young men tend to migrate more than the older men. In a poor HH, the head of HH alone is more than enough to cultivate a small parcel of land. In these cases, the young man's additional input in the tiny farm is often deemed redundant. So he is encouraged to migrate and earn money elsewhere, leaving cultivation on the shoulders of the more experienced elder. Consequently, the children and the women are left to maintain the HH and take care of elderly HH members.

In the decision-making process, the head of HH often decides where the migrant should go (71.9 per cent cases). This is partly because the females of the HH have limited or no knowledge regarding the economic and educational opportunities elsewhere, and often they do not even know what might be awaiting the migrants in a proposed destination. The major reason behind the decision regarding choice of a specific migration destination is the potential to increase the HH income, while ensuring payment potential and safety are also important in the decision-making (employment in unsafe ship-breaking yards in Kumira/ Chittagong, for instance, is not favoured by the villagers).

FGDs revealed that migrants do not generally seek neighbours' assistance in choosing the destination; rather they receive information from experienced migrants in the area. However, for the very first migration, information from neighbours helps in making decisions. A few neighbours do share past migration experiences and knowledge regarding destination, contacts, etc.

The questionnaire survey reveals, however, that neighbours' consultation in deciding the destination is "important". About 63 per cent of responding HHs find such suggestions very important, while about 37 per cent find the suggestions of little importance. Approximately 59 per cent reported that they have always decided collectively as a team before embarking on a migration decision. For the majority of the responding HHs, security is the primary cause for collective migration decision-making. They believe that, when they are together, they have a better opportunity to tackle unforeseen hazards and overcome any potential barriers. Moreover, they can take care of each other if they migrate in a group.

Women's migration is limited in the study area. As revealed in the FGDs, women do not like to migrate, unlike their male counterparts. They fear that the society around them will consider this a derogatory act. However, a few often feel that they have become a "burden" to the HH or that there is no other choice but to migrate. In such cases, they start contemplating migration as a viable modality to avoid starvation.

7.1.2 Major reasons for migration

Besides poverty and unemployment, respondents stated that food insecurity, general dissatisfaction with life, the attractiveness of cities, better education prospects and health care elsewhere,

but also natural phenomena are among important reasons for migration. Most respondents noted several reasons. The questionnaire thus encouraged them to attach a degree of importance against each reason for migration, and these have been tallied and ranked. The answers represent the respondents' perception of the importance of each factor (some of which were grouped together) as opposed to individual migrants' exact causes of leaving their homes (since they have been absent during the survey). Table 20 thus provides a ranking of the most important reasons to migrate from Kurigram in descending order of importance. Although the answers show a direct link to both food security and rainfall variability (including drought), unemployment and insufficient local income earning opportunities are included in the most important drivers of migration from Kurigram.

The overwhelming majority of people who migrate from the studied villages in the Kurigram district do so for economic reasons. Taken together, 86 per cent of respondents stated that unemployment (37 per cent), lack of adequate work in Kurigram (37 per cent) and the availability of better jobs in other places (13 per cent) are very important reasons to move away. Almost two-thirds said that not enough money (31 per cent) or too little income from local work (33 per cent) are very important motives, too. General dissatisfaction with their own livelihoods is seen as a very important reason for migration by 29 per cent.

The answers in green indicate a direct relation to food security. A quarter of the respondents, for example, indicated that a decline in crop production is a very important reason for out-migration, while 30 per cent said it is important and 31 per cent argued that it is not important. Increasing food prices – a major indicator for the challenge to access food in sufficient quantity and quality – was seen as a very important factor for migration by more than two-thirds of respondents. The lack of available land for farming (19 per cent), a decline in animal production (7 per cent) and fish catch (6 per cent), and poor soil quality (5 per cent) – each of these answers relate to the local availability of food – were also referred to as "very important".

Also, 88 per cent of the survey respondents noted that the prevailing weather patterns and rainfall variability affect their HHs' economy – whether directly through their own subsistence food production or indirectly through general food insecurity and poverty in the region (see Table 16). When asked for the major motives for migration, the link to rainfall variability could be established too (as indicated by the answers in blue). Longer dry spells, for instance, are seen by 39 per cent as a very important reason to migrate, while 36 per cent noted that more frequent droughts are a very important trigger. Shifts in seasonal rainfall patterns were also mentioned by 27 per cent, while 17 per cent referred to floods, and 11 per cent to heavy rainfall. Although the unreliability of the harvest, which links rainfall variability and food security directly was highlighted by only 4 per cent of respondents as a very important reason, our results show that the potential and actual crop loss due to rainfall variability, for example unexpected dry spells or longer droughts, is clearly an important motive to migrate from Kurigram. Other studies in Bangladesh have also shown a positive and significant relationship between crop failure, primarily driven by rainfall variability and long-term mobility (Gray and Mueller, 2012).

In FGDs, many people also commented that poverty and to some extent rainfall variability influences their decision to migrate. Panna Begum (65) of Khanpara pointed out that "if household income is low and we need to support the family, we do not have choices other than migrating to places where we can earn money". "We need to go to raise income level so that we can maintain our family", said Mr. Yousuf Ali (36) of Arazi-Kadamtola. "What is the benefit of having a small land?" posed Sayaton Begum (65) of Dolaipara. "In any incidence of hazard, if we lose production we have hardly any alternative but to migrate."

Overall it shows that rainfall-induced phenomena have reportedly been affecting livelihoods of lower-middle class to the extremely poor classes in the study areas. These adverse effects, on top of other economic and social factors, are compounding

the problems faced by the poor, often forcing them to migrate. More educated individuals from the upper and middle classes also migrate. However, such migrations are not necessarily forced by economic hardship or compounded by rainfall variability. They deliberately migrate to become more educated, to earn more or to ensure better opportunities elsewhere (including better health care) (see Table 8). Further analysis is therefore necessary to separate out the reasons for migration between these two major groups.

7.2 The migration process

7.2.1 Initiating migration

In addition to information regarding employment potential at the destination, the aspiring migrants require finance and other forms of support before migrating. Financial support is necessary to cover transportation costs. For the migrant HHs, in 71 per cent of the cases family members and relatives have assisted the migrant, and 42 per cent have received help from neighbours. In 72 per cent of cases, the migrants have been assisted in finding a new job, while in 57 per cent of cases financial support has been offered as loans to bear the cost of migration, mainly transportation. In addition, micro-credit or formal credit also plays a role in providing the "starting capital" to almost two-thirds of the responding HHs, especially for first-time migrants. However, as reflected in Table 8, extremely poor people often cannot migrate with equal ease compared to fellow poor and middle class migrants due to their inability to bear the migration costs.

7.2.2 Organizing migration – the role of "migration entrepreneurs"

The migration process is dictated by social norms and practices, rather than by legal documentation. Verbal contracts are regarded as more than enough to engage in a contractual relationship. A few individuals have emerged as migration entrepreneurs and the migrants have found avenues to send remittances safely. In the process of organizing group agricultural wage labour migration, some local leaders known as *Sardars* play a major role in contacting the employer, arranging the contract, liaising with employers in distant places and arranging for accommodation and food for all group members. The social position of *Sardars*, who can be regarded as "migrant entrepreneurs" facilitating (seasonal) wage labour migration (Salt, 2001), is vital. Not only are they required to have good contacts with potential distant employers – even before a mini contract is over – they also need to find other jobs in the neighbourhood of the destination so that team members do not spend time without employment. Labour migrants can earn about 350 to 400 BdTk (US$ 5 to 6 eqv.) per day in excess of living costs. This payment should be compared with the average daily labour cost in the Kurigram region, which is about BdTk 150 per day (US$ 2 eqv.). Weak management might cost the *Sardar* and the team dearly. The *Sardar* must ensure timely payment with the correct amounts. Given his responsibilities, a *Sardar* is not required to do physical work on the field. He nonetheless receives the same amount of money as the other teammates. He also receives extra-money for his role as mediator. While employers often pay him about BdTk 1,000 to 2,000 as a bonus, each of his teammates pay him in the range of BdTk 200 to 400 per season. The early migrants from the SV Arazi-Kodomtola have now become efficient *Sardars*. In a village with 135 HHs, there are now more than 30 *Sardars*.

7.2.3 Temporary or permanent migration?

In Kurigram, 80 per cent of the migrants' moves are distinctly seasonal as they are undertaken during times of high labour demand in other areas or during the *Monga* in Kurigram (compare seasonal calendar in Figure 12). Figure 19 tallies the frequency (number of times) of migration as compared to the duration (by month) of trips, as reported by the questionnaire respondents. The mean duration of each trip is 5.3 months.

Reasons to migrate	Very important		Important		Not important		Score*
	Count	%	Count	%	Count	%	
Longer drought periods	58	38.7	5	3.3	52	1.3	121
Decline in crop production	38	25.3	45	30.0	47	31.3	121
Unemployment	55	36.7	10	6.7	0	0.0	120
Work for my skills not available here	55	36.7	7	4.7	3	2.0	117
Increase in drought frequency	54	36.0	7	4.7	4	2.7	115
Not enough income	49	32.7	10	6.7	6	4.0	108
Increasing food prices	52	34.7	3	2.0	10	6.7	107
Not satisfied with my livelihood	44	29.3	14	9.3	7	4.7	102
No land for farming or grazing available here	28	18.7	46	30.6	56	57.3	102
Shifted seasonal rainfall	41	27.3	20	13.3	4	2.7	102
Too little financial resources	46	30.7	9	6.0	10	6.7	101
Floods	25	16.7	32	21.3	8	5.3	82
Storms	22	14.7	35	23.3	8	5.3	79
Insect plagues	21	14.0	31	20.7	13	8.7	73
Decline in animal production	10	6.6	50	33.3	70	36.6	70
Water shortage	25	16.7	18	12.0	22	14.7	68
Heavy rainfall	16	10.7	36	24.0	13	8.7	68
Better job opportunities available elsewhere	19	12.7	28	18.7	0	0.0	66
Decline in fish production	9	6.0	39	26.0	82	54.7	57
City attracts me	7	4.7	32	21.3	26	17.3	46

Reasons to migrate	Very important		Important		Not important		Score*
	Count	%	Count	%	Count	%	
Poor soil quality here	8	5.3	26	17.3	31	20.7	42
Conflicts over natural resources	13	8.7	15	10.0	37	24.7	41
Better living quality elsewhere	7	4.7	18	12.0	40	26.7	32
Unreliable harvest	6	4.0	19	12.7	39	26.0	31
Insufficient health care	2	1.3	21	14.0	42	28.0	25
No friends here/friends already live elsewhere	2	1.3	19	12.7	46	72.7	23
To be independent/build up one's own life	2	1.3	10	6.7	116	77.3	14
No school for children in the village	4	2.7	4	2.7	57	38.0	12

Note: Some answers were regrouped. The score was calculated by adding the counts (very important 2 + Important 1), following the simplest application of Analytical Hierarchy Process (Saaty, 1984). Answers in blue are related to rainfall variability, and those in green refer to food insecurity.

Table 20: Most important reasons to migrate from Kurigram (in descending order of importance). Source: Household survey (October 2011) (n= 150; multiple answers were possible).

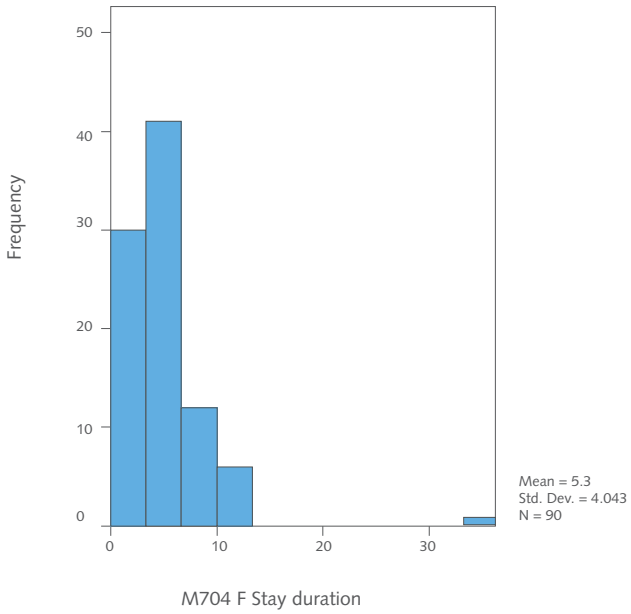


Figure 19: Duration of migration trips. Source: Household survey (October 2011, n= 150).

About 96 per cent of the respondents said that their respective HHs' migrant would come back. Only 4 per cent think otherwise. Having understood the economic realities in the region, more than three-quarters of the respondents think that a return to their respective homes would only be temporary, as against 24 per cent opting for a permanent return. There exists a very strong family bond among members of the migrants' HHs, which is why the migrants want to come back. The families, too, care for social bonds and family ties and would like to rejoin with the migrants. Only about 18 per cent of migrants that have left in the recent past did not come back to unite with their families. The vast majority of the migrants have come back following previous migration experiences. In the Kurigram district, migration is truly seen as a temporary risk management strategy to overcome the loss of employment and/or income, and (seasonal) food insecurity.

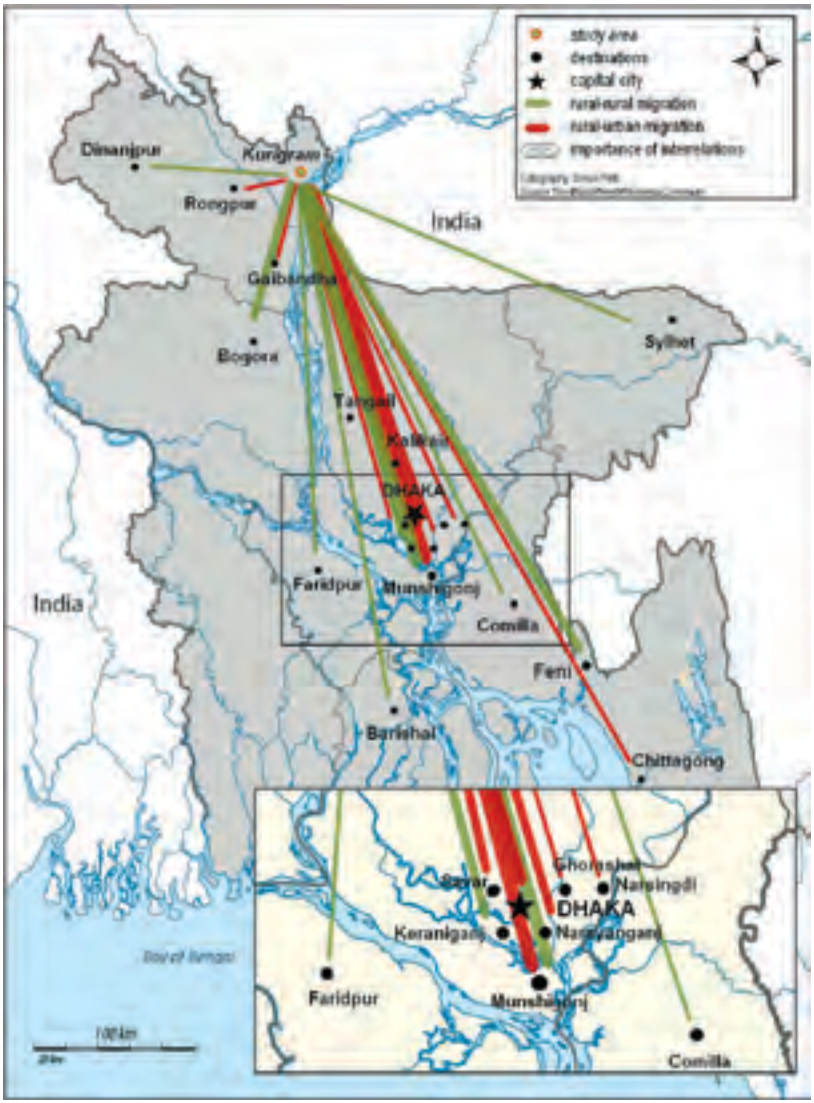
7.3 Migration destinations and labour relations

7.3.1 Migration destinations

Migration from the Kurigram region occurs predominantly, if not entirely, within Bangladesh. Migrants travel to many places within the country in order to work there.

According to a ranking in a FGD in the BV Khanpara, the agricultural regions of Munshiganj, just south of Dhaka, and Feni are the two most common destinations for migrants, followed by the megacities of Dhaka, Tangail and Comilla, then Bogra and Chittagong, and then Rangpur (the nearest divisional town) and Dinajpur, which is another rich rice farming area. Table 21 shows the results from the HH survey with regard to the migrants' preferred destinations. According to this data set, the cities of Dhaka and Bogra and rural Munshiganj are the most important destinations. The people's ranking thus reveals a different preference ranking of the common destinations of migrants in the study area compared to the survey results. This is largely due to not being able to interview the migrant herself/himself in many cases, and partly due to the inability of about 59 non-migrant HH members to comment on behalf of a migrant HH member on their preference of destination (accounting for missing data). Doubts thus remain about the validity of this quantitative data. The responses in the FGDs, in which mobility maps were also prepared by a few migrants (see Figure 20), project a better account of destination preferences for migration.

For educational migration, the general preference is towards established urban centres such as Dhaka and Bogra, where improved educational facilities are available. Ten out of a total 11 educational migrants went to these two cities.



Note: The relative importance of each destination for the people from Khanpara is displayed on the map, not the absolute number or the frequency of migration trips.

Figure 20: Destinations of migrants from Kurigram within Bangladesh. Source: Participatory migration mapping with people in Khanpara, assessed by Atiqur Rahmam (CARE Bd), Serge Birtel and Simon Peth (University of Bonn) on 27 February 2012. Cartography: Simon Peth (University of Bonn).

	Destination	Count	%
DHAKA	(predominantly urban (informal) economy)	11	24.4
MUNSHIGANJ	(mostly rural agricultural wage labour)	10	22.2
BOGRA	(predominantly urban)	10	22.2
FENI	(mostly rural)	4	8.9
COMILLA	(mostly rural)	4	8.9
CHITTAGONG	(in ship-breaking yards)	2	4.4
DINAJPUR	(in rural rice mills)	2	4.4
TANGAIL	(predominantly rural)	1	2.2
RANGPUR	(in urban centre)	1	2.2
Total destination count		45	
Missing values		59	66.3

Note: The destinations have been reported primarily by HH members (respective respondents) available in the HH during the survey. Lack of adequate information about the destinations of the migrant has been reflected in a large number of missing responses.

Table 21: Reported destination of migrants.
Source: Household survey (October 2011).

The reason for choosing Munshiganj and Feni as prime (rural) destinations is simple: something always happens in those areas that match with their skill sets and ensures employment for the aspiring migrants. The cropping intensity of the two areas is increasing, while the availability of labour has decreased in the past decade due to in-country as well as international migration, creating ample "employment space" for aspiring migrants to find work during agricultural peak seasons[20]. The employment is demand-driven, and the demand is at its peak during the sowing and harvesting seasons of certain crops.

For Munshiganj, a prime destination, high wage rates in the cultivation of potatoes draw many aspiring migrants from the study areas. Having worked closely with employers there over several years, some migrants have built strong functional relationships. The *Sardars* have built stable networks with labour suppliers and can thus facilitate the seasonal migration easily. Nowadays, employers contact them prior to the season and invite them to come with a team in order to work there. The payment is also quite good (at least three times the local wage in similar agricultural jobs), compared to the available opportunities in other areas. Moreover, the employers seem to be trustworthy to the migrants. Some even send advance money by electronic transfer to the experienced migrants to spend as passage money. Moreover, the migrants feel confident that they will be able to contribute to the type of work demanded by the employers. Even a direct bus service links Kurigram and Munshiganj. All of these issues contribute to rather strong relationships between Munshiganj and Feni and the Kurigram district, which enable regular and secure seasonal migration.

Women's migration is found to be limited to three major places: Dhaka (the capital), Dinajpur and Rangpur. As revealed in the FGDs, they are mostly engaged in three activities: post-harvest rice processing in the rice mills, mostly in Dinajpur; labour in the garment industries in Dhaka; and as domestic maidservants in both Dhaka and Rangpur. They prefer the latter type of employment due to the greater "sense of security" in a HH.

Out of 89 cases of migration, only one case is found to have migrated internationally. In a country where a significant proportion of the economy is supported by remittances from abroad (about US$ 11 billion; MOF, 2010), such a low concentration of international migration is worth mentioning. This may primarily represent general backwardness of rural Kurigram with a known backdrop of acute poverty, which does not even allow people to amass adequate funds to pay for the service charge of overseas employment agents and airfare. Part of it may be attributed to the remoteness of the area until about a couple of years ago (2009) when a bridge over the river Dharala was finally constructed to facilitate movement in and out of the study area.

7.3.2 Activity at destination of migration

As expected, an overwhelming majority migrate in search of employment (see Table 19). Education and health care are among the other notable reasons for short-term temporary migration, as revealed by the FGDs. The distribution of the types of engagement for "first- time migrants" is shown in Figure 21. It clearly shows that the majority of migrants offer their labour either in various sectors (55 per cent) and/or in agricultural fields (19 per cent). In recent trips, people have been increasingly engaged as day labourers, followed by agricultural labourers. Before migrating for different types of engagement, most of the aspiring migrants were either day labourers or agricultural labourers. A few were reportedly unemployed. Most of the respondents have not changed their employment type, probably because they prefer to rely on their existing skills, for instance in agriculture. Educational migrants do not change their status before and after migration; however, a few of them engage themselves as part-time house tutors.

20 The best times for transplanting and harvesting Boro are Dec–Jan and late April to early May. In Munshiganj, following Aman harvesting (Dec), the same fields are used for potatoes – a labour-intensive crop.

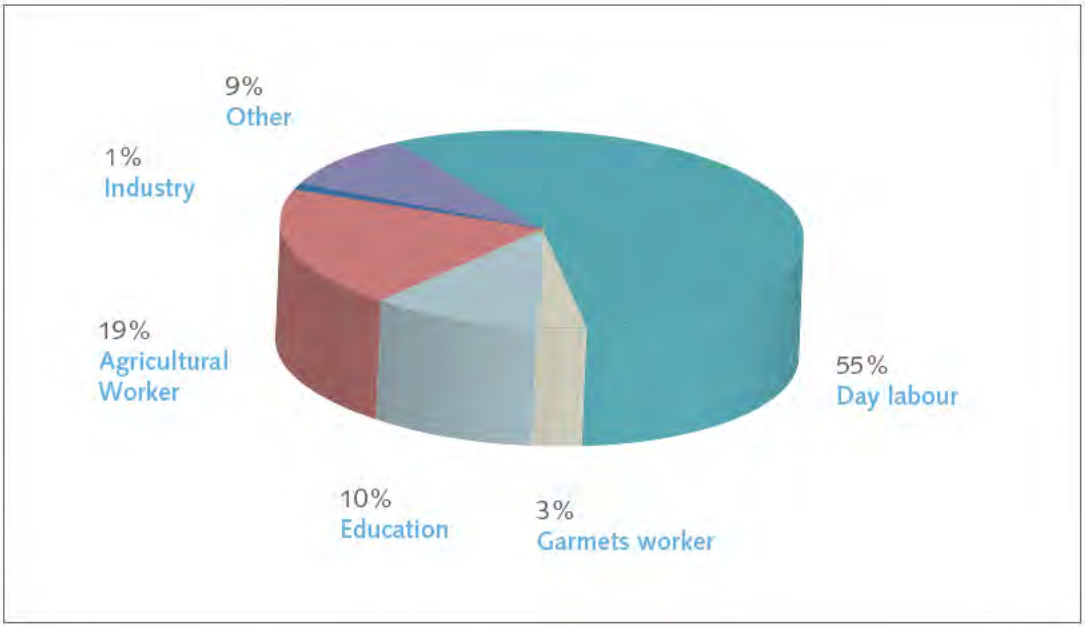


Figure 21: Engagement of "first-time migrants" at their place of destination. Source: Household survey (October 2011).

The responses in the FGD in which mobility maps were also prepared (see Figure 20) should be seen as more reliable as they reflect not only the destinations but also the relevance of the destinations for the people in the study villages.

7.4 Migration and remittances

Out of all the HHs where migration has taken place at the time of the survey, 22 per cent of HHs have two migrant family members and three-quarters have one. There are instances of three or more migrants from the same HH; however, the prevalence is much less compared to single and double migrant HHs (only two and one cases, respectively). All of the latter cases belong to large farming HHs. Own observations show that relatively rapid asset building has taken place in such HHs, which are now completely out of the food insecurity trap. Not only have they diversified their income opportunities, they have also acquired adequate land to cultivate (thus becoming large landowners) and input support to intensify their agronomic practices: they have purchased irrigation equipment to fight dwindling rainfall in order to ensure year-round food security.

The questionnaire survey shows that three-quarters of HHs are receiving money from migrant family members. There is no international remittance since there is only one international migrant included in the sample of the HH survey. In the FGDs, it is revealed that a migrant can make about BdTk 60,000 to 70,000 (eqv. US$ 750 to 875), based on the longest duration of employment (3 to 4 months) outside of their respective villages. Some of this money is generally sent home, often via mobile service[21] or as cash with one of the returning team members. The migrant himself generally brings home the rest of the money he saved. Female migrants usually bring home all the savings. Those working in formal services in cities earn far higher amounts per month and can send home a lot more money than the agricultural migrants. Student migrants, even if they earn small amounts through house tutoring, cannot remit anything. Remittances are generally sent regularly (to 58 per cent of HHs, compared to 39 per cent of HHs who receive occasional remittances).

The contribution of remittances to a HH's overall income appears to be substantial (52 per cent of respondents stated), whereas the contribution is found to be small in 29 per cent of cases. Half of the respondents noted a substantial increase in the contribution of remittances to the HH's income over the past five to ten years (since early 2000s), whereas the other half reported a slight increase. Nonetheless, the remittances did not effectively lead to major changes in rural HHs' consumption patterns. Only 28 per cent of respondents noted "large increases" in their own expenditure due to the money sent back by migrants. The comparatively little effect of remittances on consumption might be attributed to the price hike of commodities, compared to the amount being remitted, or perhaps to the increase in family size over the time period.

Most of the remittance-utilizing HHs spend the largest proportion of the sent money on food (76 per cent of respondents stated), while repaying debts is the other common use made of remittances (17 per cent). This highlights that migrant HHs are either food impoverished or indebted, or perhaps both. One can also argue the other way around: migration – and the remittances received from migrants – plays a crucial role in rural food security. Indeed, the FGD respondents unequivocally said that without the remittances they would not be able to maintain food security and raise their children. Mr. Yousuf Ali of Arazi-Kadamtola said, "How can I feed my young kids without migrating to places?" Intriguingly, remittance-utilizing HHs spend only about 50 per cent more per week on food than service-based and agricultural-based HHs.

21 Sending remittances has become a lot easier, quicker, cheaper and safer with the introduction of e-banking and e-remitting. In minutes, one can now send money to family members via mobile phone operators. The process is efficient, requiring a nominal fee (up to BdTk 60 per 1,000 BdTk remitted), and it has gained popularity even among illiterate migrants.

However, FGDs involving women found them to be less reliant on remittances for food security, although they agree that it plays an important role towards maintaining food security. Since women grow little food in the courtyard (other than paddy), consume much less during stressful times and cope by scavenging for food among common property resources, they rely less on remittances than higher-spending men.

7.5 The social costs of migration from a gender perspective

In Bangladesh, migration has a very strong gender dimension. Migration, once more, is seen as a complex web of social relationships including those who migrate and those left behind. Since mostly men migrate, there are numerous consequences for girls and women left behind, acknowledging that it is usually the woman who moves to her husband's family after the wedding and, thus, has already left her own family. Given this initial departure from their familiar social context, women find themselves confronted with further challenges after their husbands' migration. In pragmatic terms, they have to manage the HH alone and thereby need to prioritize their livelihood risks. In the following, women's coping strategies in the absence of their husbands are illuminated in the first section before the social and psychological consequences of migration are amplified in the second part.

The coping strategies of vulnerable women are manifold and aim to secure their own and their children's livelihoods. Some husbands get married a second time and the women have to accept this due to social norms and the welfare of the children. Despite the existence of polygamy, there is no reliance on legal services, which reflects the patriarchal nature of the society. Henceforth, the women are on their own and often confronted with severe food insecurity. If the family owns a small parcel of land, the woman assumes responsibility to cultivate, clear the weeds, apply fertilizer and/or pesticides and even harvest the crop. A few women even have to offer their labour during the peak harvest season. This is often observed during the harvesting of potatoes, when women make some money to repay debts.

Those who are left behind tend not to eat anything with nutritional substance, unless they produce it themselves. When moisture stress and pest infestation in the paddy fields damage standing crops, women cope with the decreased food availability at home by reducing their own consumption during the stressful months (Neelormi and Ahmed, 2010) and skip a meal or two – as needed. They grow vegetables in the courtyard, collect wild food elements from the neighbouring fallow land and wetlands and raise poultry. However, they tend to feed their children with quality food as much as possible and they never ask them to consume less. In order to cope with a (temporary) reduced access to food, women sacrifice their own food security in order to feed their children and to keep their respective husbands, the migrant earner in the family, happy.

When there is hardly any food in the house, they go to the local shopkeeper/retailer and ask him to provide food on credit. As soon as they receive some remittances from their husbands, they pay back the credit amount. Or, they sell their small produce (some vegetables or a chicken) and pay back in instalments. When they are indebted to NGOs as micro-credit recipients, they make the utmost effort to produce something on a regular basis just to be able to pay back weekly instalments. Sometimes they also borrow money from a neighbour or try to sell labour in an effort to pay the instalment. Many HHs have accepted NGO micro-credits from more than one agency. This is also a coping strategy.

When women belonging to the poor and extremely poor HHs are at risk of starvation, they try their best to obtain a Vulnerable Group Feeding card from the local elected member(s). They are often required to offer a hefty bribe in order to "own" a card, for which they become further indebted. Once the card is in their possession, they receive government support through the channel it provides. They cannot argue even if they are given some 25 per

cent less than the stipulated amount. "At least we are given something, when we are almost dying for not having anything" commented a woman in Khanpara.

Beyond these managerial and livelihood-related coping strategies, there is another important realm in regard to the social costs of migration. For example, adolescent girls not even in their teens, as well as young females, face teasing and sexual harassment in the absence of the dominant male from the HH. Young boys take advantage of such situations. A young unmarried girl who has been sexually harassed is subject to social stigma, for which the parent has to pay a large penalty, often in the form of a dowry, to the potential groom's father. Thus, paradoxically, the head of HH's migration causes further costs and threatens the security of its female family members.

The above-mentioned process has multifaceted implications in the society. A father might arrange a very early marriage for his daughter, in anticipation of obvious problems if he migrates and in order to reduce his debt burden. Young girls in Kurigram are often sent into marriage just following their puberty stage, even before they are ready for marital life and social responsibility. They are often faced with early exhaustion and chronic sickness. Women's early marriage means a quick rotation of generations, which is a significant cause of the doubling of the population throughout rural Bangladesh in less than 40 years (since early/mid-1970s). Kurigram is no exception.

It shows that the social costs of migration are even intensifying the persisting problems and worsening the poverty of women. In Bangladesh, besides the elderly, children and the extremely poor, women account for the largest group among the "trapped population" (Foresight, 2011; Gray and Mueller, 2012; Poncolet et al., 2010: 217; Warner, 2010), that is, those who remain behind as they are unable to migrate out of areas that are of high exposure to environmental changes due to a lack of capital and their particular social status.

Section 8: Linking rainfall variability, food security and migration

The objective of this study is to present evidence from north-west Bangladesh on the complex relationship between climate variability and change, particularly in terms of rainfall variability and shifting seasons, rural livelihoods, food security, social inequalities and migration. The key question was: *Under what circumstances do households use migration as a risk management strategy in relation to increasing rainfall variability and food insecurity?* The evidence presented above shows that the poverty-stricken population of the study area is confronted by multiple impacts of increased variability of rainfall on their livelihoods and food security. Members of almost half of the interviewed HHs are migrating to other places seeking employment in agricultural regions and cities with a high demand for labour in order to earn a cash-income and thereby cope during times of acute food insecurity, to diversify their livelihoods in the long-term, and to buffer the effects of rainfall variability. The following sections summarize the research findings by looking at the key links between rainfall variability, livelihoods, food security, social inequality and migration.

8.1 Rainfall variability and its implications on livelihoods and food security

8.1.1 Increased variability of rainfall – a key indicator of climate change

The people of Bangladesh are confronted by the local manifestations of climate variability and change, in particular an increased frequency of natural hazards such as floods, cyclones and storm surges, more frequent dry spells and drought, as well as river erosion. The high spatial and seasonal variability of rainfall in Bangladesh is likely to be further accentuated. More erratic rainfall patterns include a bimodal shift of the monsoon rains, with two short but sharp rainfall episodes at the beginning and end of the monsoon, and significant dry spells in-between; a potential decline in already scanty rainfall throughout the dry season; and less reliable occurrence of intensive rainfalls during late-October *(Kaitan-Sato)*. For the Kurigram district, data shows that the variability of rainfall is clearly increasing, while there is contrasting information regarding the reduction or increase of total precipitation during the monsoon season. Further analysis of available meteorological data sets is necessary in order to reveal the exact impact of climate change on rainfall variability (see Section 5.1).

The people in the Kurigram district clearly noticed climatic changes over the last 10 to 30 years (since early 1980s). Also, 96 per cent of all survey respondents noted an increase in dry spells and droughts, and 84 per cent reported an increase in extreme weather events such as cyclones. Moreover, the immediate effects of "too much" or "too little" rain at unexpected times, that is, flooding, river erosion, loss of land, crop damage, etc., were perceived by people in Kurigram as severe livelihood risks. Regarding unexpected dry spells during the peak monsoon, one woman remembered, "Back then clouds gathered in the sky and rain dropped, but now we can see clouds in the sky, but no rain falls". Moreover, people have noticed shifting of the seasons: they remembered that 10 to 30 years ago there were always six seasons, but an overwhelming majority says that there are now

only three or four distinct seasons in the year. Overall, this shows that the local people are very aware of seasonal weather patterns, extreme events and changes in rainfall. This is no surprise because their livelihoods and food security reflect a seasonal rhythm. Erratic rainfall patterns have then brought in a different dimension to people's vulnerability, as they complicate and exacerbate the existing livelihood problems of the poor (see Section 5.2).

8.1.2 People's sensitivity to rainfall variability

Peoples' livelihoods in the north-west of Bangladesh largely depend on productivity from agriculture and income opportunities in the agricultural value chain. Two-thirds of the labour force in Bangladesh works in the agriculture and food supply system, which makes it the most important sector of employment for the nation. Moreover, agriculture, fisheries and forestry contribute 18 per cent to the national GDP. In the Kurigram district, agricultural practices mostly depend directly on natural rainfall, as costly irrigation systems are not widespread, so variations in rainfall have direct effects on food production and people's incomes. While local people are thus exposed to rainfall variability, the agricultural- and fisheries-based livelihoods (65 per cent of all HHs) are particularly sensitive to rainfall variability and perceive it as a severe livelihood risk (see Section 6.2).

As rain-fed agriculture dominates overall productivity and employment for most of the rural people in Bangladesh, there is a need to make information available on rainfall patterns at the farmers' level. Adaptive agricultural practices need to be promoted, with the shift in rainfall variability, that the poor and marginal farmers can afford. Access to productivity-influencing technologies and credit are not equal to all. At the same time, the promotion of adaptive agricultural practices needs to be taken into consideration in view of the soil condition due to changes in rainfall variability.

8.1.3 Under the impact of rainfall variability, local food security is at risk

Despite sufficient availability of food, food insecurity is still among Bangladesh's most pressing problems and a manifestation of economic and social inequity. Although yields in northern Bangladesh have increased steadily in the past 30 years, families' own subsistence production is often not enough – in terms of quantity, nutritional value, and variety – to feed them throughout the whole year. During the so-called *Monga* period in September and October, two-thirds to three-quarters of the HHs interviewed face acute food insecurity.

Since rainfall significantly influences local food production, climate change-induced rainfall variability has multiple implications for the farming communities and most importantly threatens poor HHs' food security. Almost 90 per cent of the surveyed respondents noticed negative effects of rainfall variability on their own livelihoods, in general. Rice is the staple food for millions of people in Bangladesh. Food security can then largely be understood as "cereal security" which depends on people's own rice harvest (availability of food), the local availability of labour (to earn cash income to purchase rice) and the market prices for rice (access to food). Since *Aman* rice, one of the two major rice crops in the study area, is grown under rain-fed conditions, too much or too little rain during the monsoon and the *Kaitan-Sato* period can affect *Aman* production severely. Our survey reveals that about 80 per cent of farming HHs cultivates rice for subsistence only. As the poorest families have only very small landholdings, and they cannot afford irrigation or other investments to save their standing crop, a decline in productivity has a direct and severe impact on their food security. Three-quarters of respondents attribute a decline in food production to occasional droughts while two-thirds relate it to shifts in the seasonality of rainfall.

Non-agricultural HHs, in turn, are highly dependent on the local availability of labour and the volatility of commodity markets. Almost two-thirds of all respondents have noted an increase in local food prices when the production is hampered by rainfall variability. In Kurigram, people from the extremely poor, the poor and the lower-middle classes struggle to meet their families' food demand, if not year round, certainly during the annual *Monga* period. Wage-labour dependent HHs, however, are hit harder by seasonal food insecurity than are farming HHs. Any further production loss and food price increase, both potentially related to erratic rainfall, might push the rural poor beyond their respective tipping point ability to cope with food insecurity. Moreover, rainfall variability might deepen or prolong the period of hunger for the poorest (see Sections 6.4 and 6.5).

8.1.4 Coping with irregular rainfall

The coping strategies that were assessed both in FGDs and the HH survey largely represent the ways in which agricultural-based livelihoods react to the specific impacts of rainfall variability. If there is "too much rain" at unexpected times, which results in floods, crop damage, and temporary disruptions to the labour market, the vast majority of HHs (69 per cent) reduce their food consumption as the most important coping strategy. Almost half of respondents rely on external help to gain access to food during these critical times; this might include, for instance, food aid by the government or NGOs. Almost one-third reduces their overall expenditure on food and other goods, which enables them to prioritize their spending on basic food requirements. One-fifth of HHs relies on remittances from migrant family members in order to secure their food expenditure. Others sell assets, such as land or jewellery, and seek to increase their income through employment in the local labour market, if they require money urgently to cope with the effects of rainfall variability. This shows that the immediate effects of rainfall variability directly relate to the different dimensions of food security in terms of the availability of food, access to food and utilization of food. In turn, this implies that if people cannot cope (in the short-term) or adapt (in the long-term) to the local effects of rainfall variability, there is a likelihood of poverty being intensified and food insecurity is exacerbated in the study area (see Section 6.7).

Intervention by the government and NGOs are thus necessary to ameliorate poverty and food insecurity under the conditions of rainfall variability in the region. Despite the extension of high-yielding varieties and modern farming technologies, the resulting increase in production was not enough to ameliorate food insecurity, as the local population is still increasing which increases the demand for food. New "climate safe" rice varieties that are more resistant to dry spells and are flood tolerant during the growing period, for instance, need to be introduced to ensure steady, if not increasing, harvests to reduce farmers' sensitivity to climate risks. Although government spending on SSN support has been increasing, these programmes need to be extended even further in order to relieve the local people of some of the burdens caused by rainfall variability. Moreover, in the context of climate risks, alternative livelihood sources outside of agriculture need to be fostered in the Kurigram district. A diversification of income-earning opportunities, especially through education, skill enhancement and subsequent engagement in the service sector, will help people to improve their livelihoods in the longer term.

Overall, this study shows that there is a clear link between rainfall variability, agricultural systems, the livelihoods of the local people and their food security. Seen in this context, migration is one of the most crucial immediate coping strategies to overcome the worst period of hunger. In the long run, in turn, livelihood diversification through migration is an adequate adaptive strategy that reduces people's sensitivity to shifting seasons and erratic rainfall, and thus reduces their overall vulnerability.

8.2 Climate change and migration

8.2.1 Trends in migration from the Kurigram district

Migration is a normal part of Bangladesh's recent history and closely connected to its economic and social development. It can be seen as a coping mechanism to slow-onset processes of environmental change and/or in the light of rapid-onset natural "events". In north-west Bangladesh, the people see migration as a way to cope during a period of crisis, in particular to avoid or reduce food insecurity (79 per cent noted), but also as a normal income diversifying activity (27 per cent noted). At the time of the HH survey, 43 per cent of HHs had members who have migrated, mostly in search of employment (90 per cent) and a small minority for educational reasons (10 per cent). Most of the migration is temporary and seasonal in nature. The exact timing of migration, however, suggests that it is not a "sudden" response to food insecurity, but rather an anticipated and planned approach to raise a family's income level when faced with seasonal hunger.

Who migrates? Ninety-seven per cent of migrants are men. The minor share of female migration from the study area can be attributed to women's fear of increased uncertainty and risks at the destinations, and a general lack of female mobility due to dominant social norms. Overall, most people (88 per cent of the population) can be regarded as the "trapped population" as they have never migrated at all and are unlikely to do so in the near future, particularly women, the elderly, the extremely poor and Hindu fishermen. Among the "new migrants", more tend to migrate for non-agricultural employment and day labourers in agriculture; these are also the people with no land to cultivate or only having small plots. In contrast, farmers with medium- and large-scale farms are generally less inclined to migrate. They migrate only when a family member finds employment in formal economic sectors or in their quest for quality higher education – both showing much smaller prevalence rates compared to agricultural migration. In agricultural-dominated villages the rate of migration is substantially lower (about one-third each in Khanpara and Doalipara) than it is in the villages that are particularly exposed to riverbank erosion (80 per cent in Arazi-Kodomtola and more than half in Khamar Holokhana) (see Section 7.1).

Most of the labour migration from the Kurigram region is in-country migration. In contrast to most literature on migration in Bangladesh that emphasizes employment opportunities in cities, particularly in the megacity of Dhaka, in this study rural-to-rural migration of agricultural wage labourers was the dominant type

of internal migration, whereas international migration has not been relevant at all[22], which clearly demonstrates that people with limited means and skills tend not to migrate to other countries.

8.2.2 Rainfall variability and migration – under what circumstances do people migrate?

Under what circumstances do households use migration as a risk management strategy in relation to increasing rainfall variability and food insecurity? This has been the central question guiding this study. The most relevant circumstances that affect environmental migration from the north-west of Bangladesh are summarized in the following section. They are, first, a distinct seasonality and thus rainfall-dependency of livelihoods; second, a clear relationship between migration and people's food security; third, people's perception of climatic changes as severe risks to their livelihoods; fourth, social inequality and thus differential sensitivity to rainfall variability; fifth, the emergence of an agrarian labour migration system; and sixth, close social bonds, and yet, high costs of migration for women. The following considers likely migration patterns in the future.

1. Seasonality and rainfall-dependency of livelihoods and migration: In the Kurigram district, the local people's livelihoods are very seasonal in nature and highly sensitive to changes in rainfall patterns. As shown in the seasonal calendars (see Figures 12 and 13), changes in rainfall might disturb seasonal practices that have been learned and applied for generations. Too much rain might result in excessive instead of "normal" flooding, whereas too little rain leads to more dry spells (at unexpected times) and prolonged droughts. Variability in rainfall has implications for the vegetative growth-reproduction-ripening cycle of the major food crops (*Aman* rice, *Boro* rice and wheat), the amount of food that is produced, the abundance of fish, and thus the overall availability of food. Erratic rain also impacts on the need for and availability of labour, and thus access to food. Food insecurity is not only chronic, but also very seasonal in the north-west of Bangladesh (*Monga*). Accordingly, there is also a distinct seasonal pattern of migration movements from Kurigram. Despite the seasonality of hunger, it is worth noticing that migration seems to be driven by "pull factors", rather than "push factors". Most people do not migrate during the peak food insecurity period in order to cope with the most severe food shortages of the year (September–October), since employment opportunities in agriculture are at their lowest in that period. Soon after, however, the opportunities to migrate improve as the *Aman* crop matures in the destination areas (late November and December) and its harvesting requires extra labour. Between February and April, people do not migrate because of acute food insecurity in Kurigram, but rather due to very high demand for wage labourers in agricultural-dominant areas (see Sections 6.5 and 6.7).

2. Food insecurity and migration: According to the results of the HH survey, the major reasons to migrate can be ranked as follows: poverty and lack of employment opportunities in the home region, then food insecurity, followed by rainfall variability. More than half of the respondents indicated that a decline in crop production is a (very) important reason for out-migration. The lack of available land, a decline in animal production, fish catch and poor soil quality – each of these answers relate to the local availability of food – were also referred to. Increasing food prices – the key indicator for people's struggle to access food in sufficient quantity and quality – was in turn seen as an important migration motive by one-third. The extremely poor, despite their dire need to cope with acute food insecurity (almost year-round), often cannot take advantage of migration due to a lack of start-up capital, the "wrong" family composition, ill-health or no access

22 There was only one international migrant in 150 HHs in the survey, and none among the 118 HHs in the wealth-ranking in the BV.

to migration networks. Migration, in turn, plays a crucial role in the gradual improvement of rural HHs' food security. The money received from migrants is largely spent on food (three-quarters of all remittances) and on repaying debts (17 per cent). This shows that most of the HHs of the poor and lower-middle class migrants are both food impoverished and indebted. Indeed, in FGDs, it was unequivocally said that without remittances they would not be able to maintain food security and raise their children. One respondent said, "How can I feed my young kids without migrating to places?" (see Sections 6.4.4, 6.6, and 7.1.2).

3. The link between rainfall variability and migration: People perceive climate variability and change as severe risks to their livelihoods. If there is too little or too much rain a threshold might be reached beyond which people find it hard to cope locally. Chronic food insecurity can turn into acute hunger crises. Eighty-eight per cent of respondents noted that the prevailing weather patterns and rainfall variability affect their HH's economy – whether directly through their own food production or indirectly through higher food prices. Dry spells that might become longer and more frequent with climate change, shifts in seasonal patterns of rainfall as well as floods and storms were each seen by around 40 per cent of HHs as (very) important reasons to migrate. Some respondents also mentioned the unreliability of the harvest, which links rainfall variability and food security as an important factor. But it is not rainfall variability or a natural hazard as such that influence people's decision to migrate, but its immediate and mid-term effects, most importantly crop loss and local unemployment. One elderly woman remarked, "In any incidence of hazard, if we lose [food] production we have hardly any alternative but to migrate" (see Sections 6.4.4 and 7.1.2).

4. Social inequality and migration: The answer to the above question also depends on the poverty status or social class to which a HH belongs (see Sections 6.3 and 6.4.4). According to the respondents' well-being analysis, the comparatively "richest" HHs are exposed to rainfall variability, as they have large agricultural farms, but they are not particularly sensitive to these changes as they have alternative sources of income outside of farming. As they enjoy good meals and snacks more than three times a day all year round, they are not subject to seasonal food insecurity. Consequently, they do not need to migrate just to sustain their livelihood. But they might choose to migrate for education or jobs that guarantee attainment of higher social status through engagement in formal employment.

Members of the (lower) middle class directly depend on rain-fed agriculture and are both exposed and sensitive to rainfall variability. Some can employ labourers, while most sell their labour during the harvest season. The middle class is not truly food secure all year round and have to deal with seasonal food insecurity. The lower-middle class is just above the poverty line and struggling to cope with the situation. Any stressful condition, such as a dry spell during the monsoon, might surpass their adaptive capacity and push them back into poverty and hunger. Many people from lower-middle class families migrate in order to diversify their income and to cope with food shortages during *Monga*. In the context of rainfall variability, migration might become an even more important risk management strategy for them.

The "poor class" is probably most sensitive to rainfall variability as they are dependent agricultural wage labourers and fishermen. Some of them also have their own harvest, but the amount they can obtain is too small to meet their overall food demand. Dependent day labourers do not earn enough in the pre-harvest season, and temporarily do not have access to sufficient amounts of food. Their plight increases during *Monga* when the scope of work in the neighbourhood is rather low (see seasonal calendars, Figures 12 and 13). One-quarter of them migrate, in particular during *Monga*, to cope with food insecurity. If there are erratic rainfalls, less work is available locally. Given a higher demand for labour in other parts of the country, the number of migrants from this group is likely to increase under conditions of rainfall variability.

Extremely poor families are not that sensitive to changes in rainfall variability, as most of them are not involved in agriculture. They do, however, have to live with food insecurity all year round as

they can hardly ever get three full meals a day. During the annual *Monga*, they even face starvation. As they do not have "starting capital" they cannot even migrate – at any time in the year – to improve their situation in the longer term.

5. An agrarian labour migration system: Lack of local level employment opportunities in their home regions and subsequent food insecurity during *Monga* has motivated many poor people to find seasonal employment in distant places. On the demand side, employment opportunities in cities and a few agricultural regions provide a crucial incentive for people to migrate. Most male migrants from Kurigram temporarily move into wage labour in agriculture. They do not move into the informal economies in the urban centres where they might need more specialized skills and where the cost of living is much higher. As agricultural labourers, instead they can then take advantage of their special skills and labour shortages elsewhere throughout the sowing and harvesting season. Moreover, established social relations with employers and "migration entrepreneurs" facilitate a more secure migration. It seems that a distinct agrarian labour migration system from the Kurigram district has evolved that is seasonal in nature (see Section 7.3).

6. Strong social bonds, yet high costs of migration for women: Most migrants from Kurigram come back to their origins. The very high rate of return to the same village, even with cases of second marriages in the destination areas, provides strong evidence that family bonds are rather strong: poverty, food insecurity and unemployment cannot rupture such strong family bonds. Given an opportunity to address climate variability and change through adaptation, and perhaps given employment opportunities in the neighbourhood, people would probably not choose to leave their ancestral roots. Despite the benefits of migration and the existence of strong social bonds, women suffer from the social consequences of migration. In most cases, the dominant male migrates alone. Women who are left behind are not only burdened with the responsibility of maintaining the HH well-being in their respective husband's absence, they are also subject to social harassment. They are often overburdened to pay back debts, repay micro-credits (if any), and even to grow food by working in the agricultural fields – the latter being the last thing rural women are willing to do under normal circumstances. Coping with food insecurity in a migrant male's HH takes a heavy toll on women and their adolescent girls who are also at risk of sexual harassment. Moreover, as polygamy and disloyalty are widespread, in many cases women cannot be sure that the migration of their migrant husbands "pays off" and actually contributes to improving their families' lives in the longer term (see Sections 7.4 and 7.5).

8.2.3 The future of migration from Kurigram

Those who are able to shift from farming to the service sector, trade and other gainful activities – due to the advent of modern technologies and the recent thrust in economy – tend not to remain in agricultural-based livelihoods any longer. For those who have no such means and skills for alternative livelihoods, agriculture alone cannot support their livelihoods any more. For them, agriculture still appears to be important, only requiring supplementary inputs from migration. In Bangladesh, migration has therefore become a major "coping mechanism" to address unfavourable and unexpected environmental conditions, including the local implications of rainfall variability and, more broadly speaking, climate change.

Nonetheless, the future of migration as an adaptation strategy for agricultural labours appears uncertain. If international migrants are forced to come back, and/or if the population growth in the destination areas creates competition, and/or aspiring migrants from other climate hotspot areas compete for the same employment opportunity at a cheaper rate, the poor migrants of the study area will surely lose. Thus, while migration is an apparent solution to fighting growing food insecurity in anticipation of climate-induced threats, the current patterns of migration require further investigation. Climate change might affect the agricultural systems in the destination areas as well. It is a critical question, then, how the food-insecure rural population of Bangladesh can sustain their livelihoods with economic activities that are less vulnerable to changing climatic conditions.

Section 9: Summary and conclusions

Despite the high population density and nagging poverty, Bangladesh has made noticeable strides in economic development over the past two decades (since early 1990s). Surely many poor Bangladeshis have been rehabilitated and mainstreamed in the formal economic sectors, as the economy of about 150 million people has been growing at a rate of about 6 per cent per annum (PC, 2010). The growth, coupled with advancements in social development and governance, will continue to create economic opportunities for poor and extremely poor people to take advantage of migration to improve their livelihoods and their food security. However, the government must create avenues so that people's exposure and sensitivity to climate-related risks are reduced through adequate disaster risk reduction programmes and poverty alleviation strategies. To this end, the adaptive capacities of the poor and extremely poor, not only in the Kurigram district but also across the nation, need to be enhanced through targeted interventions – predominantly by the government and complemented by NGOs and other non-state actors.

Taking note of the evidence presented in this study of the implications of rainfall variability for people's food security and subsequent migration, the development strategy of Bangladesh needs to strengthen people's adaptive capacities and provide more economic opportunities within and outside of agricultural activities. Improved food security and increased welfare for the rural poor can be achieved through structural and policy changes that enhance agricultural productivity, off-farm employment and investment in

productive assets. On the other hand, SSN interventions should be extended and include elements that make rural livelihoods more "climate safe".

Under changing climatic conditions and the nation's prevailing socio-economic structures, providing sufficient and adequate food at all times for all people in Bangladesh remains a fundamental challenge. Given an uncertain future, this study addressed a challenging question: *Under what circumstances do households use migration as a risk management strategy in relation to increasing rainfall variability and food insecurity?* It was shown that the rural poor are already directly affected by the local manifestations of climate change. If the variability of rainfall further increases in the future, local people's lives are likely to be even less secure and they might face times of food shortage and hardship more frequently. In this context, seasonal or temporal labour migration within Bangladesh seems to be an adequate practice that helps affected families to cope with the immediate effects of rainfall variability, such as a reduced harvest and lack of food. Moreover, migration can be seen as an appropriate strategy to adapt to the vagaries of nature by diversifying one's livelihood and thereby reducing one's own dependency on rain-fed agriculture.

Nevertheless, the Bangladeshi people should not be left alone in their struggle to sustain their livelihoods and secure their food security under changing circumstances. Early and necessary adaptation steps need to be taken at the national and regional levels in order to reduce people's vulnerability to rainfall variability and other climate change-related risks. These local and regional efforts, however, need to be complemented in the global political arena by long-due adequate steps towards reducing CO_2 emissions. The farmers and day labourers, the men and women, the elderly and young in the Kurigram district can work towards reducing their own vulnerability. Most of the responsibility, however, lies in the hands of Bangladeshi policymakers and the global leadership.

Section 10: Reflections for policymakers

Bangladesh is at a crossroad in protecting its development gains. On the one hand, efforts to eradicate poverty by means of pro-poor policies and subsequent investments are gaining momentum. On the other hand, the nation is still confronted by an increasing population density, reduced access to resources for the poor, food insecurity and malnutrition and natural hazards – the latter being exacerbated by climate variability and change. The development gains toward eradicating poverty and hunger that have been achieved over the recent past are at risk of being counteracted by climate change. Future potentials are thus threatened, too. Recognizing the everyday lives of rural people in Bangladesh and reflecting upon the key findings of this study, one may come up with a number of policy considerations. Some of these recommendations may appear generic for the country as a whole, while a few are specific for the case study area. The overall aim should be to enable the rural poor to adapt to livelihood challenges induced by climate variability and change. In order to achieve this, however, they require institutional, economic and social support by the GOB, national organizations and international donors.

1. Reduce people's sensitivity to rainfall variability and improve their food security

Develop "climate safe" crops suited to changing hydro-geophysical conditions: Realizing that climate change will continue to affect the agricultural production system, that is, crop production, fisheries, etc., efforts must be made to improve the

planted crop varieties and people's agricultural practices in order to protect livelihoods and ensure food security. New varieties of hazard-resistant crops, such as flood-tolerant *Shwarna sub-1* and *BRRI Dhan-51*, need to be introduced and made available to local people as these varieties have the potential to raise yields significantly. Moreover, in order to nullify the adverse implications of rainfall variability, efforts must be made to develop crops with high nutritional value that are simultaneously "climate safe".

Facilitate sustainable agriculture practices at fair prices: The unsustainable use of chemical inputs in small-scale agriculture should be discouraged, if not totally banned. Alternative practices such as "Integrated Pest Management" should be given incentives so that the excessive use of harmful chemicals does not destroy open water fisheries. Through education, farmers must be made aware of potential harm caused by such chemical inputs. Moreover, as the costs of food production have increased tremendously, newly introduced crop varieties and essential agricultural inputs should be fair in terms of their price. Since the poor do not generally benefit strongly from irrigation, fertilizer, etc., revised and strengthened incentive packages should be designed and facilitated that enable the poor to enhance their own food production, and thereby also their competitiveness.

Provide alternative livelihood opportunities for poor and marginal farmers: Future population growth might lead to a further division of land among siblings, and the gains from agricultural adaptation might not be enough to sustain sufficient food production for a growing population in the area. In order to overcome this crucial challenge to livelihoods and food security, early efforts must be made to help poor and extremely poor people to diversify their sources of living, also away from agriculture. More opportunities for gainful employment in the Kurigram district – in particular for women – will improve the local people's access to food.

2. Enhance people's adaptive capacity to live with hazards and rainfall variability

Develop and employ adequate early warning and disaster risk management systems: Better early warning and messaging systems need to be developed and implemented that can effectively forecast the rainfall probability per cropping season. On this basis, people might have a chance to adapt their agricultural practices swiftly. The advanced application of flood forecasting and warning will help the poor to avoid and promptly react to flood-related risks.

Improve and implement special SSN programmes for the poor: In poverty-stricken areas that are simultaneously highly exposed to rainfall variability, people's adaptive capacity needs to be strengthened with specialized programmes. The SSN programmes of the GOB have shown tremendous growth over the past 10 years, and have the potential to relieve those who have been struggling to ensure their food security. Further efforts must be made to gradually enhance people's adaptive capacity as well as to reduce their sensitivity to sudden-onset climate hazards as well as to variability-related climate risks. The adaptive capacity of the poor can indeed be enhanced by building human capital (through skill enhancement and training), physical capital (by building adaptive infrastructure, etc.), natural capital (by enhancing and creating poor people's access to common properties regimes), and through systematic investments in social development processes. Moreover, the government should place greater emphasis on consistent rural development rather than spending more on SSN following a climate-induced disaster. However, SSN intervention should consider crop insurances for farmers so that they are able to deal with crop failure due to rainfall variability.

Expand education for all citizens: Many children from poor families in the Kurigram district cannot study to the high school level, while children from extremely poor families even drop out from primary school. There is a need to continue the focus on

education and targeting of poor and extremely poor HHs in terms of access to education and SSN programmes in order to improve their social and economic chances in the future. The respective families require improved incentives to invest in their children's education. Moreover, better education and raising awareness will allow citizens to adapt better to future climate-related hazards. Further investments into the existing disaster risk reduction mechanisms are necessary so that – in case of a natural hazard – people's losses can be minimized and the erosion of their assets can be stopped.

3. Enable migration and reduce the vulnerability of migrants and those left behind

Enable migration, instead of fighting it: Local adaptation to livelihood challenges in the context of climate change should be given priority. As migration, however, has the potential to effectively improve people's food security and get them out of poverty in the long run, it should not be seen as "failure of adaptation" and discouraged, rather it should be supported adequately to facilitate an informed and safe migration. Since extremely poor people's lack of resources is one key barrier to their ability to migrate, micro-credits and available financial instruments could be developed further in order to assist them in migrating – so that they can effectively improve their own lives.

Educate for more effective mobility and adaptation in the future: When there is a crisis for employment opportunity, the poor will perhaps have no other choice but to migrate seasonally and to some extent permanently. Insufficient assets, a lack of education and skills are important predicaments that hinder their chances on the national labour market. The poor need support to acquire skills so that they can find gainful employment, optimally in the growing urban economy rather than in the agricultural sector, which might be affected by climate change, too. State-run programmes might have to be re-aligned, with a particular focus on the nation's climate change hotspots so that the most vulnerable, including women and artisan fishers (who have no other skills), also find better conditions under which to apply their knowledge and skills. Moreover, aspiring female migrants should be made aware of potential hazards and social vices that they might face in the process of migration. This will enable women to make informed decisions and to ensure their safety regarding migration. Furthermore, the governments' rural development agencies should try to assist poor people in finding employment opportunities in the nation's most vital economic regions, where there is a lack of labourers.

Address the vulnerability of migrants at their destination: The lower-middle class and the poor use labour migration within the country in order to diversify their livelihoods and to overcome or deal with poverty and food insecurity – not only, but particularly also during the *Monga* season. Vulnerability of migrants' HHs must be recognized and reduced at both ends – in the migrants' home villages and at their places of destination. In Bangladesh, most migrants face precarious employment and living conditions at their destination, whether this is as seasonal agricultural wage labourers in Munshiganj, as rickshaw pullers or garment workers in Dhaka or as domestic maids in Rangpur. Further research needs to probe into migrants' employment relations and assess ways in which they can engage in "decent work".

Address the social costs of migration that women in migrant HHs bear: This study showed that men's mobility could contribute to the further deprivation and risk that women face. Adolescent girls and women, who remain behind when their respective father or husband migrates, need to be provided with greater social protection. The Union Parishad bodies must be empowered to take stern action against sexual abuse and other forms of harassment, in which men take advantage of the absence of migrant males. Moreover, affected women must be given adequate legal protection and families need to be encouraged to complete their teenage daughters' education. Special attention should also

be given to the food security of the "trapped population", the elderly, children and women who remain behind.

4. Support further research on the relationship between rainfall variability, food security and migration

Last but not least, regional, national and international cooperation should be strengthened to undertake further research and analysis on the multi-dimensional relationship between changing rainfall patterns, people's livelihoods, their food security and current migration patterns. This study could only provide a starting point, but more research on environmentally induced migration has to be carried out in different locations in Bangladesh that represent different social, climatic and hydrological conditions. Moreover, more research is needed looking at "migration entrepreneurs", local power relationships and the labour recruitment and journey facilitation processes. The living and employment conditions at the migrants' most important regions of destination, in particular in the booming agricultural regions, also need further attention from academia, NGOs and policymakers.

Annex I:
List of experts who have been interviewed

Local/community level

Ms. Rokeya Khanam, *Union Parishad Member, Jatrapur Union*
Mr. Alhaj Abdul Gafur, *Chairman, Jatrapur Union Parishad*
Mr. Mizanul Huq Khandaker, *Union Social Worker, Jatrapur*
Mrs. Rabeya Begum, *Assistant Teacher, Charkanda Khanpara High School, Khanpara*
Mr. Shahadat Hossain, *Headmaster, Charkanda Khanpara High School, Khanpara*
Mrs. Rahima Khanam, *Housewife, Khanpara*
Mrs. Laila Huda, *elder Housewife, Arazi-Kadamtola, Panchgacchi Union*
Mrs. Sharbanu Khatun, *Housewife, Khanpara, Jatrapur Union*
Mr. Md. Faizar Ali Khan, *elder Farmer, Khanpara, Jatrapur Union*

Upazila level

Mr. Kazi Abed Hossain, *Union Nirbahi Officer, Kurigram Sadar*
Mr. Mohammad Maznur Rahman, *Upazila Agriculture Officer, Kurigram Sadar*
Mr. Md. Abdur Rahman, *Deputy Director, Department of Social Welfare, Kurigram Sadar*
Mr. Mansur Ali, *Sub-Assistant Agriculture Officer, Block - Ghana Shaympur, Jatrapur Union*
Mr. Md. Zahangir Alam, *Sub-Assistant Agriculture Officer, Block - Sitaijhar, Paanchgacchi Union*

District level

Mr. Harun-ar Rashid (Lal), *Director, Solidarity, Kurigram*
Ms. Shubrata Roy, Organizing Secretary, *Bangladesh Mahila Parishad, Kurigram*
Mr. Abraham Lincon, *Advocate, Kurigram District Court*
Mr. Shafi Khan, *President, Kurigram Press Club, Kurigram*

National level

Dr. Sk. Ghulam Hussain, *Member Director, Bangladesh Agriculture Research Council, Dhaka*
Professor Rezaur Rahman, *Institute for Water and Flood Management, Bangladesh University of Engineering and Technology*
Mr. Sardar S. Alam, *Research Fellow, Bangladesh Centre for Advanced Studies (BCAS), Dhaka*

Annex II: Contributors to this report

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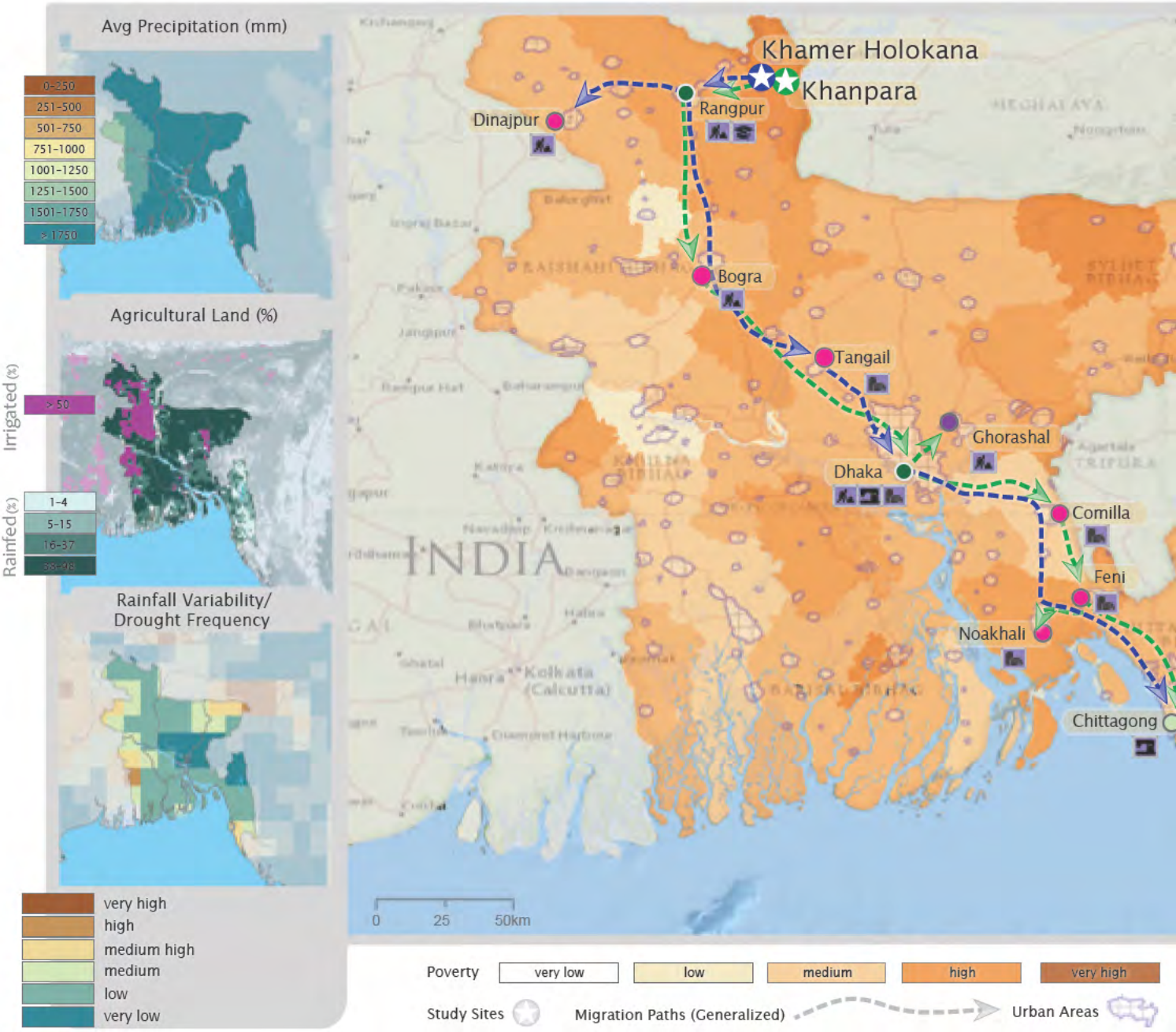
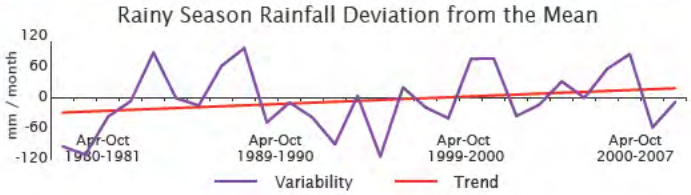
Andrea Milan, *UNU-EHS*
Serge Birtel, *University of Bonn/UNU-EHS*
Simon Peth, *University of Bonn*


Avg Precipitation (mm)
0-250
251-500
501-750
751-1000
1001-1250
1251-1500
1501-1750
> 1750
Agricultural Land (%)
Irrigated (%)
> 50
Rainfed (%)
1-4
5-15
16-37
Rainfall Variability/
Drought Frequency
very high
high
medium high
medium
low
very low
Khamer Holokana
Khanpara
Dinajpur
Rangpur
Bogra
Tangail
Ghorashal
Dhaka
Comilla
Feni
Noakhali
Chittagong
INDIA
Kolkata
(Calcutta)
0
25
50km
Poverty
very low
low
medium
high
very high
Study Sites
Migration Paths (Generalized)
Urban Areas
Migration Periods
Seasonal
~1 Year
Permanent
Mixed
Activity
Farm Hands
Garment Work
Employment
Education
Major Roads



Annex III

The set of satellite images and maps reveal several aspects of the case study in Bangladesh. The study villages are situated in Kurigram District in the north of Bangladesh, both at the banks of major rivers. The village Khanpara, where most of the research was undertaken, is close to the Brahmaputra, while Khamer Holokhana is located near the Dharala.

The people living in Kurigram District are predominantly small-scale farmers who rely on rain-fed agriculture. Their livelihoods are closely aligned to the seasonal rhythms in this riverine ecosystem. The amount and variability of rainfall is highly important for the local people. With more than 1900 mm per year on average over the past five decades, the area receives sufficient amounts of rain, mostly during the annual monsoon (June to September). There is a slight trend towards increasing total monsoon rainfalls. The overall variability of rainfall is low or medium, yet the variability of the annual monsoon seems to be on the rise. Importantly, the local people have noted a shift from the usual single peak distribution to a bimodal distribution of rainfall with heavy rains at the beginning and towards the end of the monsoon. The vast majority of local farmers are also concerned about an increase in droughts and untimely dry spells. Even minor climatic changes have the potential to disturb the seasonal agricultural production cycle and can thus threaten food production in the region and the food security of poor farmers.

The main map shows that Kurigram is among the poorest districts in Bangladesh. There is a high incidence of poverty, which is expressed as a measure of food insecurity here, because most farmers do not have access to an adequate amount of land that could sufficiently feed their family. Moreover there are only few alternatives of employment in the region. Consequently, seasonal and permanent labour migration is highly important for the people of Kurigram district. The migration pathways are indicated on

the map. Members of almost half of the families interviewed in this study temporarily work as farmhands in agricultural regions such as Munshiganj (just South of Dhaka) and Feni or go to the major cities to work in industries or the informal economy. Overall, migration from Kurigram District is predominantly male, temporary, internal and rural-to-rural. International migration does not play an important role for the people.

Note: The maps (and associated rainfall variability graphs) produced for each case study report were developed using data sets from multiple sources. Each map provides the location of each research site along with contextual data on rainfall amounts and variability, poverty and agriculture. For a full list of sources please see chapter 9.2 of the Where the Rain Falls Global Policy Report (Warner et al., 2012.).

Source: CIESIN (2012).

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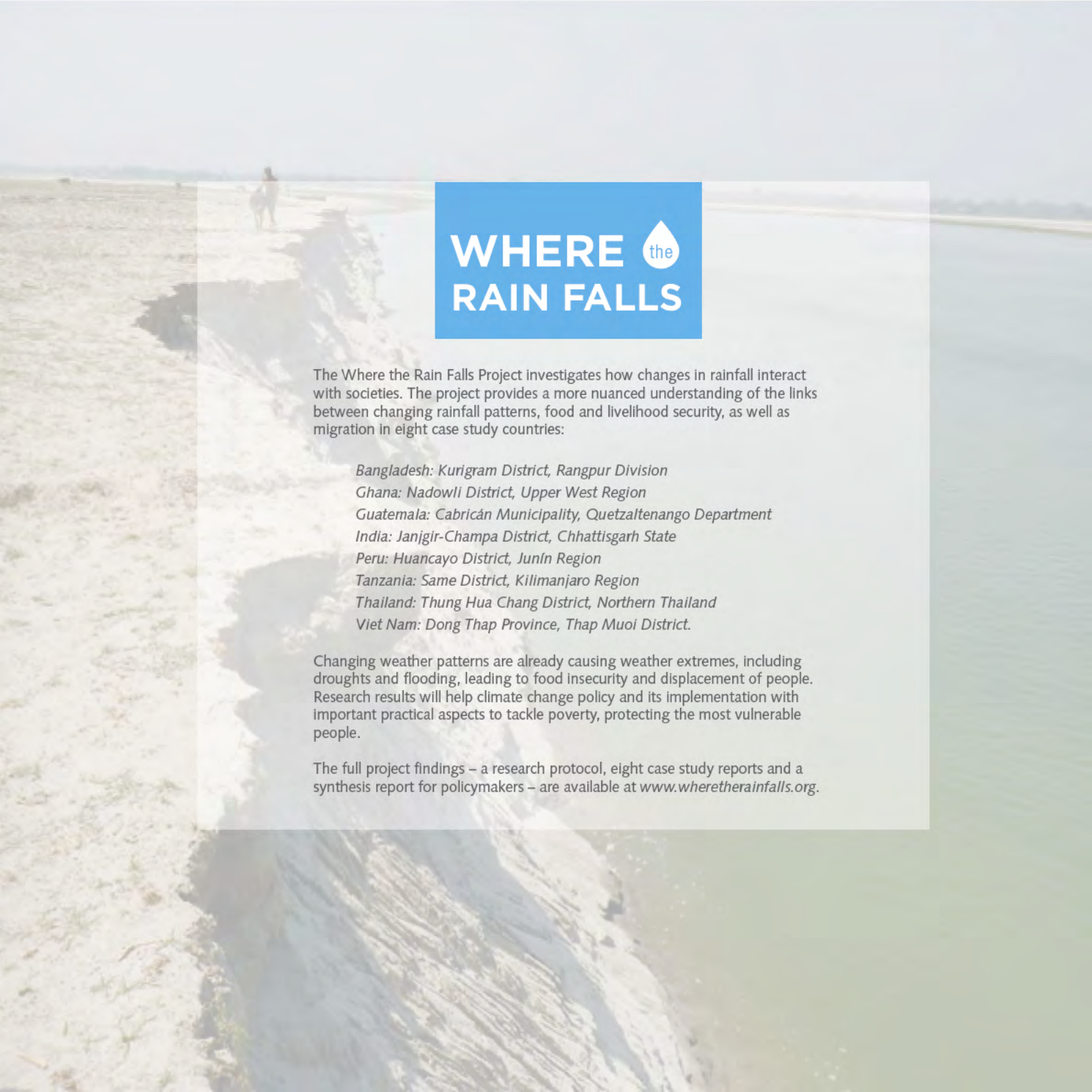

WHERE the RAIN FALLS

The Where the Rain Falls Project investigates how changes in rainfall interact with societies. The project provides a more nuanced understanding of the links between changing rainfall patterns, food and livelihood security, as well as migration in eight case study countries:

Bangladesh: Kurigram District, Rangpur Division
Ghana: Nadowli District, Upper West Region
Guatemala: Cabricán Municipality, Quetzaltenango Department
India: Janjgir-Champa District, Chhattisgarh State
Peru: Huancayo District, Junín Region
Tanzania: Same District, Kilimanjaro Region
Thailand: Thung Hua Chang District, Northern Thailand
Viet Nam: Dong Thap Province, Thap Muoi District.

Changing weather patterns are already causing weather extremes, including droughts and flooding, leading to food insecurity and displacement of people. Research results will help climate change policy and its implementation with important practical aspects to tackle poverty, protecting the most vulnerable people.

The full project findings – a research protocol, eight case study reports and a synthesis report for policymakers – are available at *www.wheretherainfalls.org*.