

Fornicating Frogs

Local Knowledge of Climate Change in Bangladesh?

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The scientific consensus is that we face accelerating climate change with epic environmental effects. The consequences of this will vary between regions. Among those predicted to be at risk of large detrimental impacts are parts of South Asia, particularly if sea-level rises are of the order that some forecast.¹ Bangladesh, one of the world's most densely populated countries, is frequently mentioned as being at peril of devastating flooding due to its situation on the large delta of the Ganges/Padma, Brahmaputra/Jamuna and Meghna Rivers (Brammer 2009, 2014; Hanlon, Roy and Hulme 2016). In addition to the increase in flooding induced by sea-level rises, the delta is also sinking, due to excessive groundwater extraction, floodplain engineering and the trapping of sediments in dams. While flooding of the Ganges-Brahmaputra-Meghna delta occurs annually and is an accepted part of life incorporated into the region's farming-fishing cycle, with up to two-thirds of the land area inundated in some years, the projected increases are unprecedented and catastrophic, and would put large areas permanently under water. According to the United Nations' Intergovernmental Panel on Climate Change (IPCC), 'Bangladesh is ranked as one of the most climate-vulnerable countries in the world. It is at extreme risk of floods, tropical cyclones, sea level rise and drought' (Carabine et al. 2014: 18). The panel reported that temperatures have increased throughout the twentieth century, as have the frequency of heatwaves, and projections suggest average annual temperatures increasing by 2°C or more. Rainfall trends vary markedly, with more extreme rainfall events predicted to increase, particularly during the monsoon and dry-season droughts. Sea-level rises, according to

climate-change models, will continue through the twenty-first century, increasing between 26 and 98 cm (Carabine et al. 2014: 3, 10).

Some authorities warn that global warming is accelerating and predict ever-worsening environmental outcomes. According to a World Bank report, for instance, a 2.5°C rise in temperature by the second half of the twenty-first century will result in sea levels increasing in the Bay of Bengal by a predicted 65 cm and the flooded area in Bangladesh by an estimated 29 per cent, resulting in the loss of 40 per cent of productive land across the country's southern region (Adams et al. 2013: 123). The report also warns of a possible 4°C temperature increase above pre-industrial levels by the century's end, with even larger sea-level rises bringing more catastrophic floods and, paradoxically, extreme droughts too. A 1.5 m rise will inundate current coastal and inland areas, affecting 22,000 km² and some 18 million people (GRID-Arendal 2009). Those predictions that incline towards the most extreme possible future climate-change scenarios are open to considerable dispute, which encourages some scepticism (Dunlap and McCright 2010; Rudiak-Gould 2013), particularly when they match nothing in current experience.

We need to consider not only international- and national-level climate-change discussions, but also local experiences of associated environmental changes, as has been argued for other Asian communities (see, for example, Byg and Salick 2009; Lebel 2013; Suthirat and Takashi 2013; Vedwan and Rhoades 2001). While people have reflected on the climate for millennia and have long-standing weather lore (the ancient Vedas, for instance, mention meteorological issues – see Dove (2015)), it has become a matter of urgent concern with the advent of global warming. Local experiences can tell us what is actually currently happening on the ground and serve as a reality check against climate-change models. It is necessary to calibrate official discourse against local knowledge of climate-cum-environmental change, so as to avoid promoting scepticism with predictions that seem out of touch with lived reality. It is with respect to their experiences and perceptions of the current situation that people the world over assess climate forecasts and initiatives. If the climate-change predictions do not match people's experiences, to some degree, they will promote disbelief and resistance to policy proposals for tackling the problem. This is a major challenge facing those who advocate the need for urgent action over climate change, as many people do not sense the need, given their own current experiences. For them, the climate-change warnings seem like so much additional hot air, as this volume's Introduction notes, pointing to today's Western climate-change deniers.

The Hakaluki Region

The Hakaluki region is a complex wetland ecosystem of approximately 180 km², comprising over 200 interconnecting *beel* (small permanent bodies of water)² that merge in the monsoon floods to form a single *haor* (a large seasonal body of water) (Figure 4.1).³ The Kushiya and Sonai-Bardal Rivers bound the *haor* basin, in the eastern part of Sylhet adjacent to the Indian (Assam) border, which straddles the Moulavibazar and Sylhet districts.⁴ It is Bangladesh's largest *haor* and is one of the large wetlands of South Asia that has diverse fen habitats that are home to a range of animal and plant communities (Sumon and Islam 2013: 188), including some rare endangered species. This has prompted the government of Bangladesh to designate it an 'Ecologically Critical Area'. In considering the inland Hakaluki region, this chapter also addresses another shortcoming in the current climate-change debate, as addressed locally, which focuses largely on coastal regions predicted to suffer total inundation and devastating cyclones, and pays less attention to increasingly flood- and drought-prone inland areas. While agencies recognize wetlands such as the *haor* as threatened ecological zones that demand conservation, they overlook the impacts of climate change as a major issue (IUCN 2006; Riadh, Chowdhury and Ishtiaque 2012). The only major weather-related issue that is considered is flash flooding, which many in North Bengal rank alongside droughts as the region's most pressing problem and that is dealt with in isolation from other critical issues, such as environmental degradation due to human actions. Otherwise, environmental work in the Hakaluki *haor* basin focuses on ecological conservation, natural-resource management and people's socioeconomic status (Khan and Islam 2005; Khanum 2013; Sarma 2010).

Some 190,000 people live in the Hakaluki region. In the monsoon, villages become islands, and people put vegetation around the banks to protect their homesteads from *afal* (large waves). Livelihoods depend largely on fishing and farming, which often compete over control of water levels that dictate what areas are available for fish or crops. There is heavy dependence on remittances from migratory labour. In the past thirty years, the area under grass (used for dry-season cattle grazing) and reed swamps has fallen considerably, with the use of *low-lift-pump irrigation* to cultivate paddy (largely high-yielding varieties) in the *boro* season.⁵ Many Muslim families practise both fishing and farming, engaging in fishing for one part of the year (from mid-*Baishakh* until *Kartik*)⁶ and farming for the remainder. With irrigation, the dry *boro* season now provides the main crop, and subsidiary cropping comes from rain-fed *aman*- and *aus*-season⁷ cultivation of transplanted rice together with

some vegetables (e.g. pulses, potatoes and mustard) on higher ridged bank soils, and from deep-water *aman* rice around basin margins. The Hindu families depend more on the fisheries and resort to a range of livelihood strategies during the *boro* season, such as rickshaw pulling, day labouring, road repairing, carpentry and so on. They manage *khanja* (pits) in low-lying areas where water remains all year, with plentiful

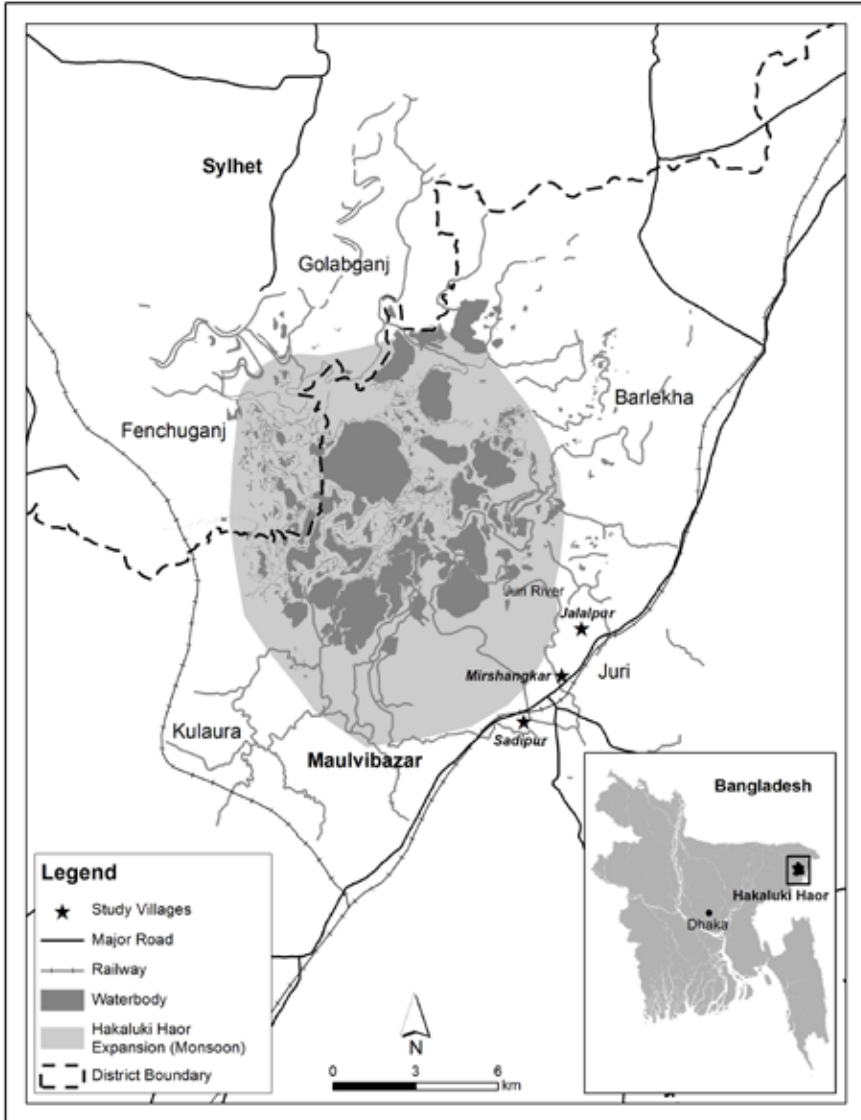


Figure 4.1. The Hakaluki region (© Paul Sillitoe and Mahbub Alam)

aquatic plants to supply shelter for fish to spawn and conserve stocks. The principal fish species of the *haor* are *kalibaus* (*Lebeo kalbasu*), *ru* (*Labio rohita*), *boal* (*Walago astlu*), *pabda* (*Ompok pabda*), *ghagot* (*Gagata cenia*) and *chapila* (*Gonialosa manmina*), with migratory species swimming up the Kushiya River to arrive in the *haor* basin. Some engage in the fish trade as *paikar* (middlemen), buying directly from boats to sell on in local markets.

The Hakaluki Survey: Local Knowledge of Climate Change

A survey offers a way to assess the range of, and variability in, knowledge of environmental and climate changes held locally by a population. We administered a semi-structured questionnaire, largely comprising open-ended questions (see Appendix), to a random sample of 101 persons in the Hakaluki Haor region, representing 1.9 per cent of all the residents of the three villages of Mirshankar (80 per cent of respondents), Sadipur (12 per cent) and Jalalpur (8 per cent). The first two villages are larger and are made up of Muslim households that practise farming and fishing, and the third smaller village comprises Hindu households that depend on fishing eked out with menial seasonal labour. Table 4.1 gives the gender, age and religion of the respondents.

While one of us (Mahbub Alam) had conducted some in-depth ethnographic enquiries in the region, and we had arranged focus group discussions and individual interviews, the Bangla dialect spoken in the Hakaluki region is difficult for outsiders to understand, so two colleagues from the neighbouring district of Moulvibazar helped administer the survey and subsequently cross-check data.⁸ Even with their assistance, some people thought that we worked for the government or a nongovernmental organization (NGO) focused on natural resources, and wanted to take the opportunity not to discuss environmental issues, but to complain about political matters, notably abuses by some powerful persons that made it difficult to access nominally common property resources, as they were seen to have usurped the land – themes that featured in the survey returns.

Table 4.1. Composition of survey sample (percentage of respondents) (data collected and analysed by the authors with Mir Yousuf Ali and Iffat Ara Nipa)

Gender		Age (years)					Religion	
Male	Female	20–29	30–39	40–49	50–59	>60	Muslim	Hindu
63	37	17	35	21	11	16	88	12

We structured the questionnaire so as not to predispose people to think of climate-related issues. It asked them initially about any environmental changes they had noticed in their region, and the reasons for them, before introducing the idea of *jalobayu paribartan* (climate change). There was near-unanimity that changes had occurred in the environment, with only two respondents thinking that there have been none (one man and one woman in their thirties). There was less agreement over the changes (Figure 4.2). Nearly half the responses referred to declining fish populations, with deforestation following close behind. Nearly a quarter specified declining water levels and the silting up of the *haor*, and similar numbers referred to the related issues of decreasing rainfall and flood levels. About a fifth of respondents thought that animal numbers were down and considerably fewer mentioned other changes. (There is no significant variation according to gender, age, religion or village, other than men mentioning water-level issues more often.) While several responses referred to weather-related issues, it is notable that none referred directly to climate change. Nonetheless, it is evident that local people observe that something is happening in their

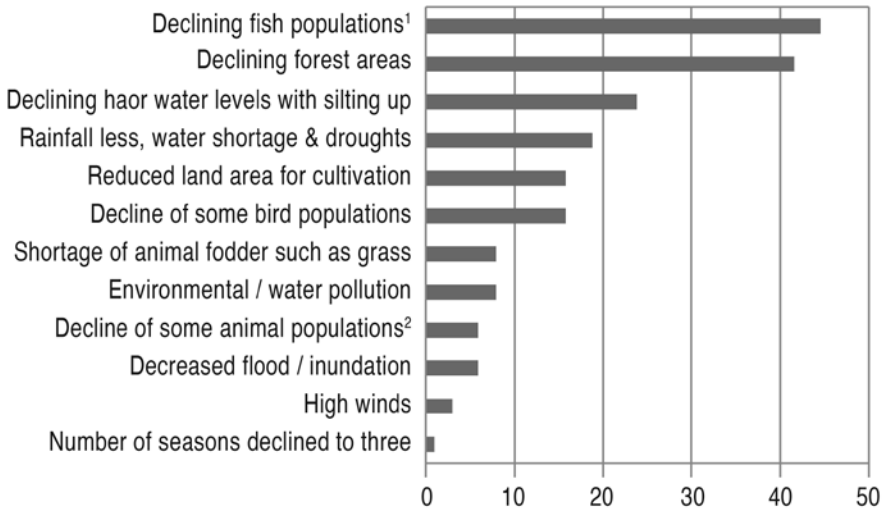


Figure 4.2. Changes observed in the natural environment (percentage of responses) (data collected and analysed by the authors with Mir Yousuf Ali and Iffat Ara Nipa)

¹ Fish mentioned: RangaChanda (*Chandaranga*), NamaChanda (*Chanda name*), Boisa (*Labeopangusia*), Balichura (*Awaousguamensis*), Ritha, (*Rita rita*), Chital (*Chitalachitala*), Rani (*Dario dario*) and Baghair (*Bagariusbagarius*).

² Forest areas declining because trees taken for timber, medicine etc.

³ Animal populations in decline include snakes, domestic and wild animals.

environment – given changes in rainfall patterns, sedimentation rates, animal populations, land under forest and cultivation – albeit that they make no direct link to climate change.

The decreasing depth of the *haor* is a particular feature of environmental change locally, and people attribute declining fish populations partly to it. Thirty or so years ago, the water was 15–25 hands⁹ deep in the monsoon months of *Ashar* and *Srabon* (June–August),¹⁰ whereas today it reaches no more than about 10 hands, which villagers say is unprecedented. They speak of ocean-like *afal* (waves) previously, and the skill needed to manage boats when fishing far out on the *haor* during the monsoon. They attribute the fall in water depth to increased sedimentation, pointing to the increased frequency of flash floods from the north, resulting from excess rain in the hills and the large volumes of stone and sand that the rivers such as the Juri transport and deposit.¹¹ They attribute the damaging flash floods in part to the changing pattern of rainfall. Previously, it would rain steadily for three to four months, from *Chaitraya*¹² until the middle of *Baishakh*; however, nowadays, *boro tufan* (big storms), where it rains heavily for several days continuously before stopping abruptly, are more common. Associated thunder and lightning have also increased in frequency, with lightning strikes killing more people, as often graphically reported in the press. But the overall volume of rain has declined, contributing to a decline in water levels.

When asked the reasons for these changes, the responses showed even less agreement than, and overlapped considerably with, the previous ones about observed changes (Figure 4.3). Over a quarter cited falling *hoar* water levels as responsible for environmental changes and a similar number said that logging is a cause for declines in forests. A fifth mentioned infrastructure developments, notably roads, house-building and population growth as reducing cultivable land areas. The declines in fish and animal populations were likewise attributed to human activities such as inappropriate fishing methods, distorted access to water bodies and polluting farming practices. Again, it is notable that while many of the cited changes in the environment were attributed to human activities, none of the responses directly implicated climate change, other than, perhaps, the mention of logging and, by one person, wood-fired brick kilns. Barely 4 per cent of respondents referred directly to the climate-related issues of less rainfall and increased temperatures. Women were more often concerned about forest and land loss, and men with water issues and pollution, with older persons mentioning the latter more than younger (otherwise, there was no noticeable variation according to gender, age, religion or village). While respondents made no direct reference to climate change, they did refer to some issues and

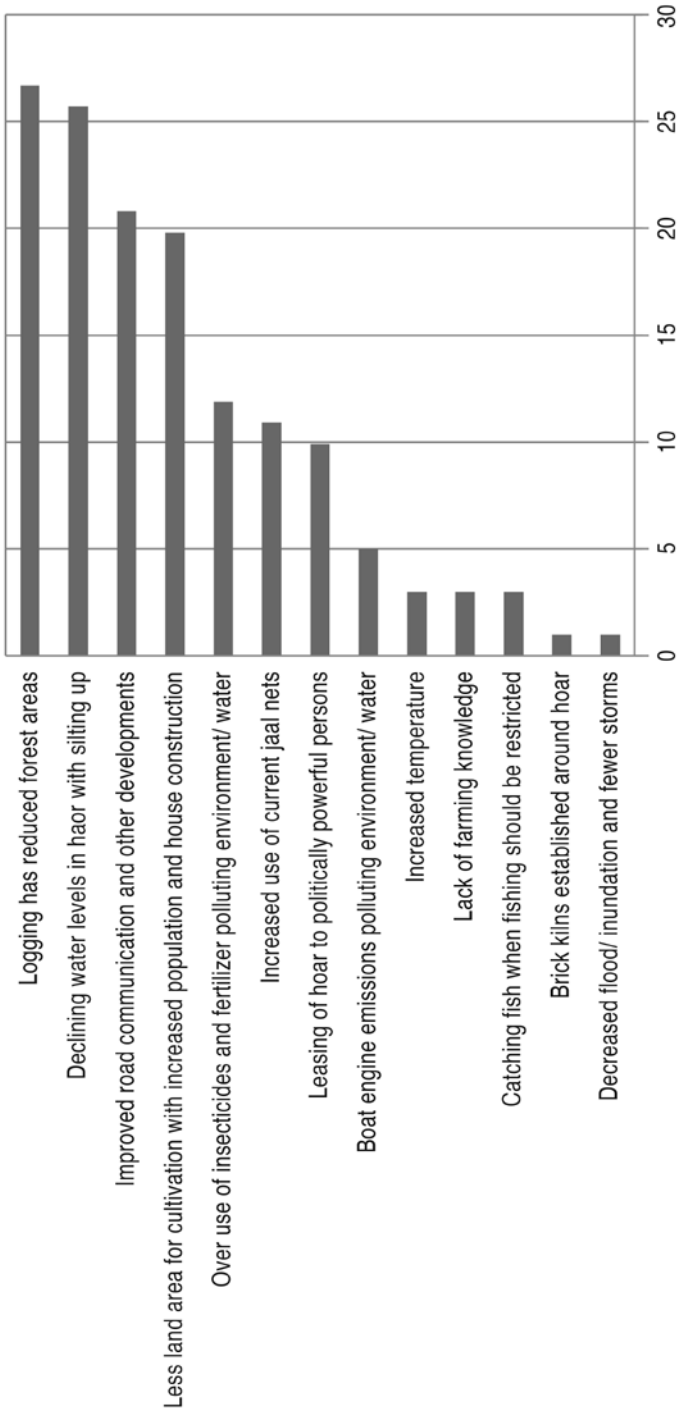


Figure 4.3. Reasons for environmental changes (percentage of responses) (data collected and analysed by the authors with Mir Yousuf Ali and Iffat Ara Nipa)

experiences that point to its possible impacts, which they assessed in their own way.

With regard to human activities that impact on *haor* ecology, deforestation figured prominently in people's minds, particularly the clearing of forests for tea gardens in the surrounding hilly regions. The reduction in vegetation cover increases rates of soil erosion and so contributes to the silting up of water bodies. It also contributes to the frequency and ferocity of flash floods. The clearance of natural vegetation around the *haor* also featured, along with the planting of exotic species by the Forest Department that people said had a negative impact on the soil, such as acacia and eucalyptus.¹³ The cultivation of hybrid-rice varieties, encouraged by multinational companies offering agrotechnological support and by associated changes in market conditions, has made matters worse, due to over-extraction of groundwater using deep-tube wells and environmental pollution with unregulated use of pesticides and insecticides further damaging *haor* ecology. Other human interventions that have consequences for the *haor* environment include road-building and the construction of embankments.¹⁴

While few respondents referred directly to weather-related issues when asked about observed changes in the environment, 92 per cent of them said that they had heard about climate change, with Hindus somewhat less informed in this respect than Muslims. When asked what they understood by climate change, people gave a range of sometimes contradictory replies (Figure 4.4). Nearly one-third thought that it referred to increased heavy rainstorms and flooding, while a few thought the reverse – that it referred to declining water levels and drought. Over two-fifths of respondents mentioned changes in the seasons, about a half thought summers are warmer and winters colder and wetter, while the other half thought the reverse, with warmer winters coming earlier. About one-fifth mentioned changes in temperature and strong winds, while others gave replies that suggest they were less sure about climate changes. Women were more likely to refer to increased rainfall and flooding, men referred more often to changes in the seasons (otherwise, there was no significant variation according to gender, age, religion or village).¹⁵ While the government and NGOs draw on the scientific debate over climate change and may introduce local people to it, this process is not particularly evident in the Hakaluki region. This may reflect the fact that development workers and community activists are largely focused on the impacts of predicted sea-level rise on the coastal zone.

When asked about climate-related changes in their region, respondents gave similar answers to those they gave for the previous question, which suggests that they were not well informed about climate-change

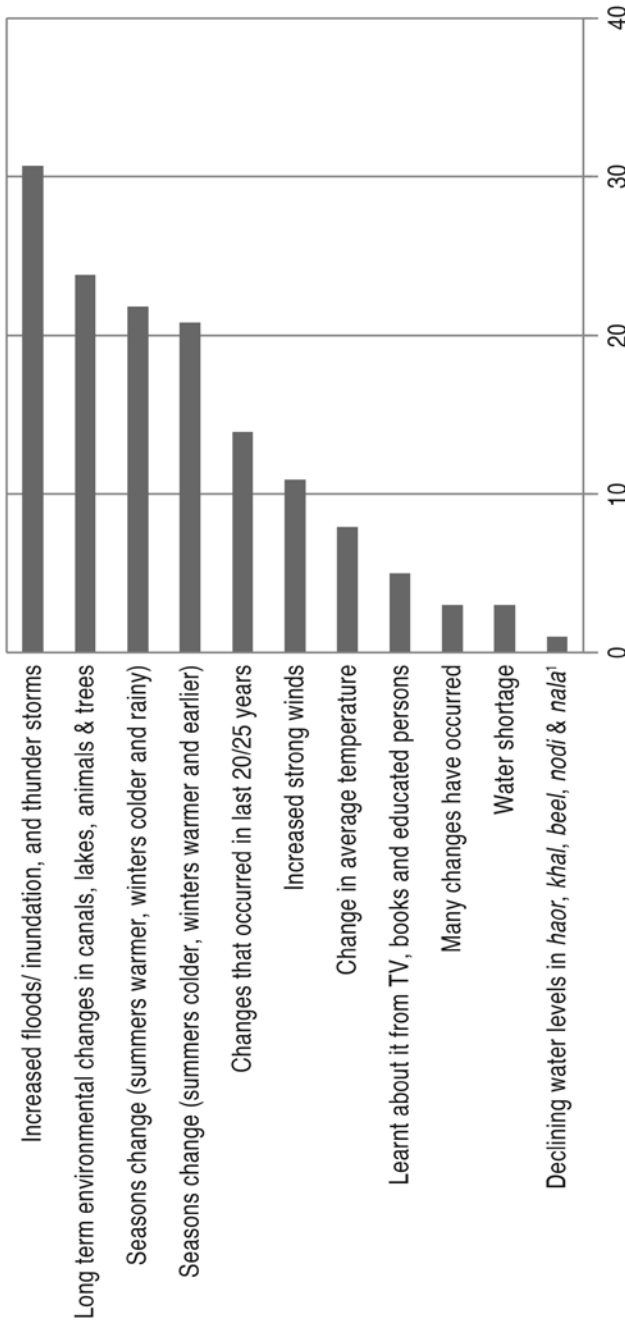


Figure 4.4. What is climate change? (percentage of responses) (data collected and analysed by the authors with Mir Yousuf Ali and Iffat Ara Nipa)

¹ Haor (large lake), khal (canal), beel (lake), nodi (river) and nala (marsh).

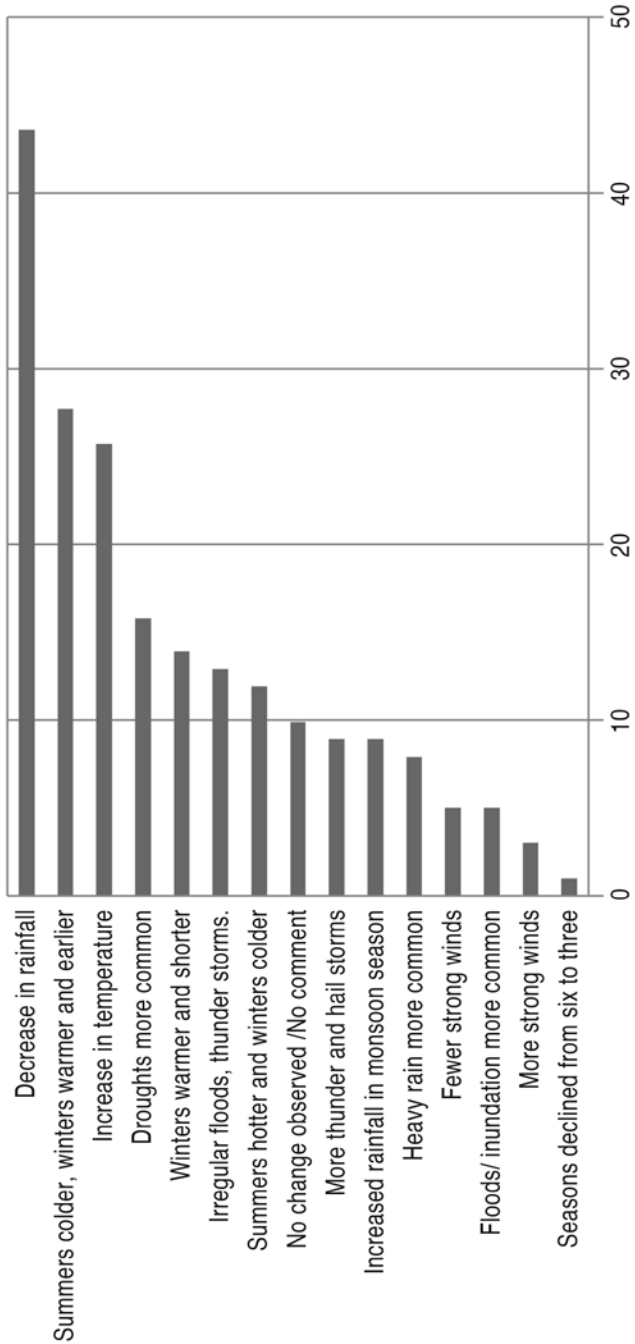


Figure 4.5. Climate change in the Hakaluki region (percentage of responses) (data collected and analysed by the authors with Mir Yousuf Ali and Iffat Ara Nipa)

discussions per se and that they interpreted the term *jalobayu paribartan* according to their own local experiences (Figure 4.5). There was general agreement that some changes to the seasons have occurred: that they have become less predictable, with unseasonable cold or hot spells in summer and winter. The signs of seasonal change do not necessarily occur at the expected time of year, with the seasons merging more than previously. The weather is now often misty, which was not the case before. Otherwise, the responses again showed considerable contradictions, with two-fifths of those surveyed, for instance, referring to increased rainfall and flooding, while another two-fifths mentioned decreased rainfall, with some adding that the summer drought period may be longer, with late and less rainfall. Similarly, one-eighth said summers are hotter and winters colder, while two-fifths thought the reverse. A few respondents said strong winds are more common, but others that they were less frequent. It is difficult to account for the contradictory variations in the responses. We might anticipate some age-related aspect to these, reflecting differing life experiences over different periods of time, but a review of the responses according to age does not reveal any noticeable pattern (similarly, there was no noticeable variation according to gender, religion or village).

A comparison of local people's views of changes in their region's climate with rainfall and temperature records from nearby meteorological stations at Sylhet and Srimongal¹⁶ suggests why there was such variation in respondents' views (Figure 4.2). While Srimongal is consistently warmer and Sylhet wetter, the temperature and rainfall trends over fifty years show scant further regularity. They fluctuate up and down, with no clear trend for temperature or rainfall increasing or decreasing over time. Given this, when pressed to state what climate changes they have observed in their region, respondents' answers may have varied depending on which years they have in mind as benchmarks. So the variability in responses actually confirms our expectations that people's observations of weather phenomena should match up with meteorological data (what is seen and experienced 'out there' being the same for us all), though local knowledge and explanations of these observations may differ from the scientific ones. The meteorological data suggest that, like most of the world to date, the region has not experienced any locally noticeable warming trend – although analysis of further data by Islam and Neelim (2010) shows otherwise¹⁷ – impeding attempts to examine local perceptions of climate change. Nonetheless, the local population's experiences of differences in weather patterns indicate (like such differences from the norm elsewhere) that atmospheric changes due to global warming are affecting them.

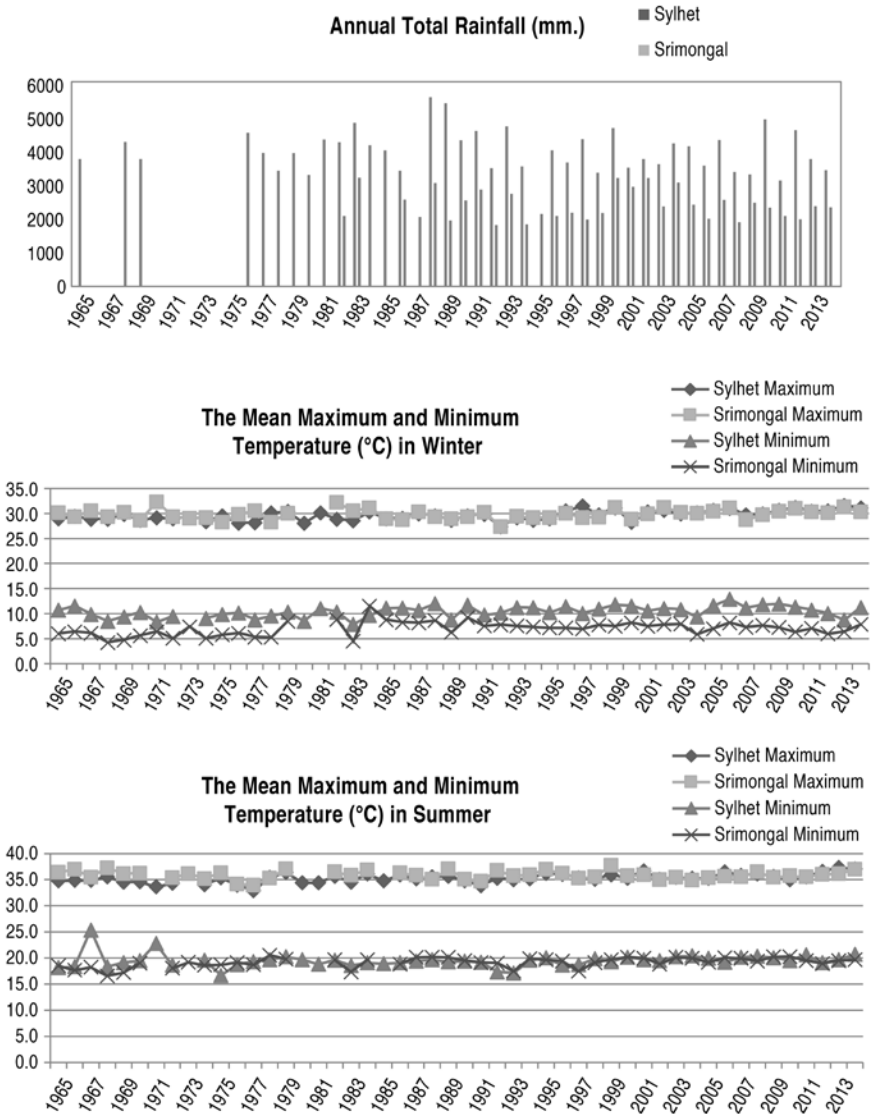


Figure 4.6. Meteorological data (Sylhet and Srimongal stations) (official data analysed by the authors)

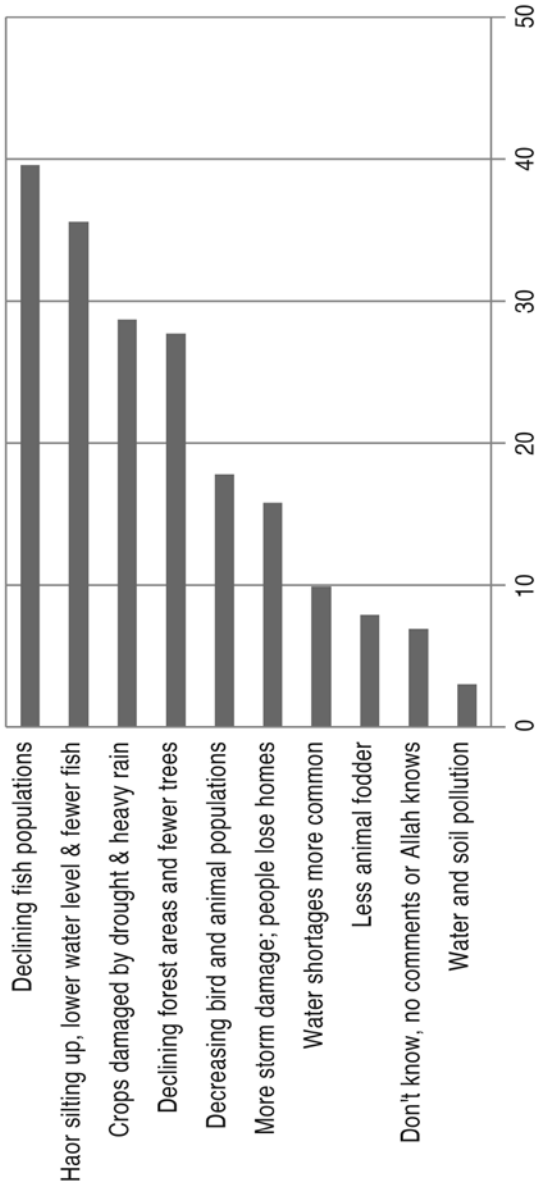


Figure 4.7. Effects of climate changes on the local environment (percentage of responses) (data collected and analysed by the authors with Mir Yousuf Ali and Iffat Ara Nipa)

When asked what their experience of the effects of these climate changes have been (Figure 4.7), people's responses reflected those they gave in answer to the previous question about the changes they have observed in their region's natural environment (Figure 4.2), which indicated that they made scant distinction between environmental change generally and that attributable to the climate. Declining fish populations were again a major concern, according to two-fifths of respondents, followed closely by the silting-up of the *haor* water bodies that was also associated with fewer fish. Over one-quarter again mentioned decreasing forest areas. A similar number mentioned crop damage due to droughts or heavy rain, which was not specified previously, and this proportion increased to over one-third when we include falls in fodder supplies. Nearly a fifth of respondents again thought that animal numbers were down. Men again showed more concern for water and fish issues, and women for crops and fodder, which somewhat reflects their different livelihood responsibilities. (Otherwise, there was once again no significant variation according to gender, age, religion or village.)

Adaptation in Bangladesh

The survey responses suggested that climate change per se is not currently an issue locally, as opposed to certain environmental aberrations. It appears that government organizations and NGOs are depending on, and reacting to, international warnings, notably with respect to predicted impacts. According to the IPCC: 'There are clear signs that the impacts of climate change are already being felt' (Carabine et al. 2014: 5). The consequences of predicted climate trends are grim. The World Bank (Adams et al. 2013) reports that climate change will particularly affect Bangladesh, as it is a potential 'impact hotspot' threatened by extreme and variable weather events that will negatively impact infrastructure and livelihoods, and increase poverty with a 'high risk of inundation in areas with the largest shares of poor populations' (Adams et al. 2013: 110). It talks of some places being under water and of others not having enough water for drinking and irrigation. The Asia Foundation points to 'disasters including drought, extreme temperature, floods, and storms. These events have killed hundreds of thousands of people, destroyed homes and livelihoods, and cost approximately \$16 billion in damages' (Asia Foundation 2012: 14). The projected impacts include destruction of infrastructure and settlements (e.g. homesteads swept away), degradation of the natural environment and ecosystems (e.g. droughts leading

to wetlands drying up), increased incidence of disease and malnutrition (e.g. waterborne intestinal infections), crop failures and food shortages (e.g. flash floods across paddies), lower livelihood security and lower incomes, displacement of communities and mass migration (e.g. to urban areas), and economic development reversals, all of which will impact disproportionately on, and increase the vulnerability of, the poorest households (Practical Action n.d.: 2). There is also likely to be an increasing incidence of water shortages, exacerbated by inefficient water use concomitant with rapid urbanization and industrialization, and penetration of saltwater from the Bay of Bengal 100 km or more inland along tributary channels during the dry season.

The predicted impacts of climate change take up a considerable part of international and national level policy deliberations, and relate to the second principal dimension of the debate: responses to climate-change forecasts. These comprise, in climate-change-speak, adaptation and mitigation measures, or risk preparation and emission reduction. It is adaptation that features centrally in Bangladeshi policy discussions, which is unsurprising, given the alarming nature of the foregoing predictions and fading hopes that global temperatures will remain within safe limits. The second, mitigation strand scarcely concerns poor rural communities across the delta, as they contribute trivially to CO₂ emissions that are responsible for climate change. The World Bank urges action to enhance resilience to the impacts of climate change through multidonor-funded adaptation interventions and disaster-preparedness improvements (Adams et al. 2013). The government of Bangladesh has an action plan that comprises six pillars (Ministry of Environment and Forests 2009: 27–29). The adaptation measures that are recommended include reducing risks to agriculture through the adoption of crops adapted to watery conditions, implementing water supply and sanitation programmes, building health systems to handle new diseases, strengthening early-warning systems, managing the country's changing hydrology, constructing infrastructure to protect vulnerable areas, monitoring impacts on ecosystems, devising a climate-proof development plan and building government capacity to manage adaptation. Some NGOs flesh out these skeletal policy generalizations with practical suggestions, such as diversifying livelihood options, breeding local crop varieties resilient to climatic extremes, establishing seed banks to supply varieties after disasters, raising water pump levels to avoid drinking water contamination, building up house plinths above floods, dredging rivers and planting vegetation to protect banks from erosion (Practical Action n.d.: 10). For *haor* regions in particular, adaptations should include breeding quicker-maturing rice varieties for shorter seasons, establishing fish sanctuaries

and instituting more efficient common-pool resource arrangements (Sumon and Islam 2013).

While, on the one hand, such dire forecasts represent disconcerting dark black clouds on the horizon for most Bangladeshis, on the other hand, they present a certain silver lining for some. They lead to burgeoning international funding to assist poorer nations, such as theirs, in preparing for predicted climate changes and challenges. A virtual industry has emerged locally, as the government and parts of the nongovernmental sector have latched onto forecasts of climate change, encouraged by the large sums of development assistance pledged to help them. What are these bodies doing to prepare for the predicted changes, whatever they turn out to be? While institutions such as the World Bank recommend urgent action and economic development to encourage adaptation and build resilience to the risks facing farming communities, urban infrastructure and water resources (Adams et al. 2013), there is more talk than action. A cursory review indicates a plethora of policy recommendations and a lack of practical actions (e.g. Ministry of Environment and Forests 2009; Asia Foundation 2012: 23–32; Practical Action n.d.). The dilatory responses are arguably understandable, given the uncertainty about what is happening and the implications of observed climate and environmental variations, or, worse, they may suggest to some the attitudes of sceptics or deniers. The dubiety of the long-term climate-change predictions notwithstanding – no one is sure what the future holds – the flow of resources prompts bodies to plan endlessly, and generates copious policy-related documents and advice.

Local Approaches to Adaptation

One way to break out of endless policy discussions about probability-modelled scenarios and internationally driven predictions is to assess what is actually going on across the country. Local people may offer information that broadly matches the debate as framed by climate change. First, they can report on any changes they observe in the environment that may be due to climate change, as discussed above, even though they may be unaware of the debate itself. Second, they can say what they are doing (or could do) to cope; that is, they can articulate local preparedness and scope for adaptation to the consequences of the forecast climate change. A rolling review of possible local coping strategies is necessary, as much of the burden for adapting to any changes will likely fall directly on local communities. They may have to depend heavily on local resources and ingenuity. These may seem inadequate, given the scale of the challenges, particularly from the international metropolitan

perspective that informs policy debates. The limited resources available to local innovators, in contrast to foreign experts, in part constrain the potential for grassroots action.

The increasing cultivation of 'floating gardens' (Irfanullah et al. 2011; Sen, Paul and Lamin 2011: 46–56) illustrates the potential for drawing on local practices that make effective and imaginative use of limited resources. These comprise beds of water hyacinth (*Eichhornia crassipes*) and paddy straw, several metres long, held together with bamboo poles, which support a layer of soil and compost in which farmers plant crops that include a range of vegetables and spices, such as okra, gourds, aubergines, beans and ginger. The *kachuripana* (water-hyacinth beds) can float on any depth of water, going up and down with flooding, and may be tended from boats and even moved by punting. These have been common in low-lying southern areas of the country for generations and their use is gradually spreading to other regions, with help from some NGO projects. According to one source, 'floating gardens have been successfully employed to allow vegetables to be produced in waterlogged areas, protecting the poor from malnutrition and providing a source of income during the post monsoon and peak rainy seasons' (Practical Action n.d.: 9–10). While such coping strategies may seem paltry to outsiders, as the only mitigations to climate-induced environmental changes that many local communities have, they merit serious consideration by policy-makers.

At first sight, other responses may seem of even less relevance or help. When rivers and ponds dry up, people talk of the wrath of nature and may supplement prayers for rain with rites presumed to have roots in the deep past. During prolonged drought periods, some communities arrange a 'frog marriage' rite (Pial 2015). They catch a male and female *sona bang* (frog – *Hoplobatrachus tigerinus*)¹⁸ and tie them together on a *kula* (rice-winning fan). While boys and girls carry the frogs' fan-bed on their heads around the village, women pour water over it from pitchers. They also present the children with some rice at each homestead they visit. As they process around the village, the participants sing to attract the attention of Megh Raja, the 'Cloud King', who is associated with rainfall.

The song heard by one of us as a child in Brahmanbaria was the following:

Cloud King! You are my own brother.

Our doorsteps are drying up due to no rain.

Although it is raining it is not enough.

Our Prophet is true; Please Allah, give us rain.

The marriage of frog's daughter is arranged with a medal made of gold.

So, the female frog gives some rain.

The mustard seeds were eaten by insects when rice grains were eaten by people.

Male and female frogs, both of them are sitting on the bank of the river.¹⁹

People comment that by tying female and male frogs together, they encourage them to fornicate, mimicking their activity during the *Ashar* (start of the rainy season), when frogs commence their spawning, croaking loudly in the monsoon rains. This represents their wish that nature's Cloud Raja sets the frogs croaking with rainfall. In some parts of the country, communities conduct the rite beyond the customary months of *Joyshtra* (May–June) into *Srabon* (July–August), when heavy monsoon rains normally fall, a sign of increasing weather variation. It is an indication of how local people perceive the weather and how they may respond, in part, to climate change. These songs are constantly evolving and incorporating new aspects.

These practices likely strike many as being of scant relevance to climate-change concerns, yet they scarcely differ in their ineffectiveness from meteorological science, which cannot control the weather either, though it may forecast it more accurately.²⁰ In fact, the science is arguably doubly impotent, having exerted negligible leverage, to date, with regard to the climate-change crisis that it predicts, in the face of a political deadlock, internationally, on appropriate action. Although environmental scientists may dismiss such practices, they tell us something about local perceptions of change. And to dismiss them may be to misconstrue such rites, which are more to do with subliminal communication and the shared expression of anxieties, than with belief in actually determining the weather, which is regarded as being in the hands of Allah and fate.

Even though local adaptation strategies may seem limited, they warrant consideration, not only because they are often the only option realistically available, but also because any interventions to cope with the predicted impacts of climate change need to be in tune with residents' experiences in order to be effective. Local people will respond to adaptation and mitigation recommendations according to what they can accommodate and make sense of. Policy formulated in a national- or international-level vacuum may prove unhelpful locally, as was illustrated by the World Bank-funded 'Flood Action Plan', which made life more difficult for many, particularly poor people (Sillitoe and Alam 2012). The plan was to control the annual monsoon flood and protect the

floodplain through the construction of costly flood defences comprising embankments and sluices (Brammer 2004). The consequences of these engineering interventions illustrate the dangers of imposing solutions on people without a full understanding of their situation and knowledge (Rasid and Haider 2003). In interrupting the monsoon flood, the interventions devastated fisheries and made farming more vulnerable to shocks. This prompted desperate farmers, to the chagrin of development experts, to dig holes in the newly constructed embankments that were stopping floodwaters from draining away and that were preventing them from cultivating their inundated plots in a timely way. This illustrates how the failure to accommodate local perceptions and practices in formulating policies may lead people to resist them if they do not match their understanding of their problems and needs. There is a lesson here concerning possible proposals for even more engineering interventions to meet the challenges of climate-induced environmental change, for further polder-like mistakes that impede natural water flow could undermine communities' adaptation options.²¹

The experience of the Flood Action Plan shows the hubris of high-tech approaches that assume they can contain and manage natural forces. It points to the need to learn from local people how to live with the delta rather than attempting to dominate it (Rasid and Haider 2003), in accordance with arguments made for some decades now about considering local knowledge in development (Hornidge 2012; Sillitoe 1998, 2000; Sillitoe, Bicker and Pottier 2002; Sillitoe, Dixon and Barr 2005). The challenges posed by accommodating local perceptions and practices in formulating climate-change mitigation and adaptation strategies are considerable. There is a sociocultural and epistemological gulf between the contrasting philosophies of living with, or dominating, nature. It is necessary to beware of interpreting and testing local experience and knowledge according to our scientific approach, distorting their understanding. Instead, we need to devise ways to exchange knowledge between the different worldviews. There is a place for outside technical and other kinds of assistance. Rapid and extensive environmental change may render local knowledge less effective or even inadequate, as the extensive flood-prevention engineering schemes illustrated by disrupting local understandings of aquatic resources. But outsiders need to be sensitive to the local context, as some NGOs recognize in their advocacy of community-based adaptation projects: 'Identifying communities' own priorities and needs, and valuing their knowledge alongside science-based knowledge is key to developing sound adaptation strategies' (Practical Action n.d.: 8).

The Hakaluki Survey: Local Adaptation to Climate Change

The responses to the question about the effects of environmental-cum-climate changes on people's occupations and livelihoods indicate that these are already substantial and that they are at some risk. There are two principal effects evident: declining fish catches and fewer employment opportunities, both of which result in falling incomes and more hardship, particularly for the poorer households (Figure 4.8). Four-fifths of responses related to the decline in the number of fish caught and over two-thirds of them referred to the worsening employment situation. Population growth together with environmental change is probably contributing to employment problems. There is a tendency for fishing problems to concern Hindus and men more, and for occupational issues to affect Muslims and the under fifties more (otherwise, there was no significant variation according to gender, age, religion or village). The fish catch has fallen dramatically with the decline in the depth of the *haor* and with the monsoon flood waters draining away faster than previously. The decline in fish diversity and numbers are connected to changes in *haor* ecology. Furthermore, some irresponsible fishers use fishing gear that does not allow small fish fry, such as those of *puti* (*Puntius chola*), *taki* (*Anebas testudineus*), *khalisha* (*Colisha fasciatus*) and *chang* (*Channa orientalis*), to escape and ensure the conservation of future stocks. These unsustainable fishing methods are locally thought to exacerbate any climate-change-induced problems (Figures 4.3 and 4.12). The numbers of those fishing have also increased across the *haor* region.

The change in rainfall patterns (not totals), from gentle rain over long time periods to sudden heavy storms of short duration that damage crops, impacts negatively on farming practices. Moreover, the occurrence of flash floods, particularly during the *Baishakh* month harvest period, can wash entire crops away. It affects both local rain-fed deep-water rice varieties that grow with the gradually rising monsoon flood waters and the introduced deep tube-well irrigated ones, which are susceptible to irregular and unexpected heavy rain and flood damage. These weather events also disrupt the supply of fodder for animals, and households may resort to collecting less nutritious but ubiquitous *kachuripana* water-hyacinth foliage to cope. Other aquatic plants that supply edible foliage and roots that poor families collect during the lean fishing period, and sometimes sell in the market, such as *shapla* (*Nymphaea nouchali*), *shaluk* (Nymphaeaceae) and *singra* (*Trapa bispinosa*), have decreased with the changing *haor* ecology, depriving people of much-needed food and income.

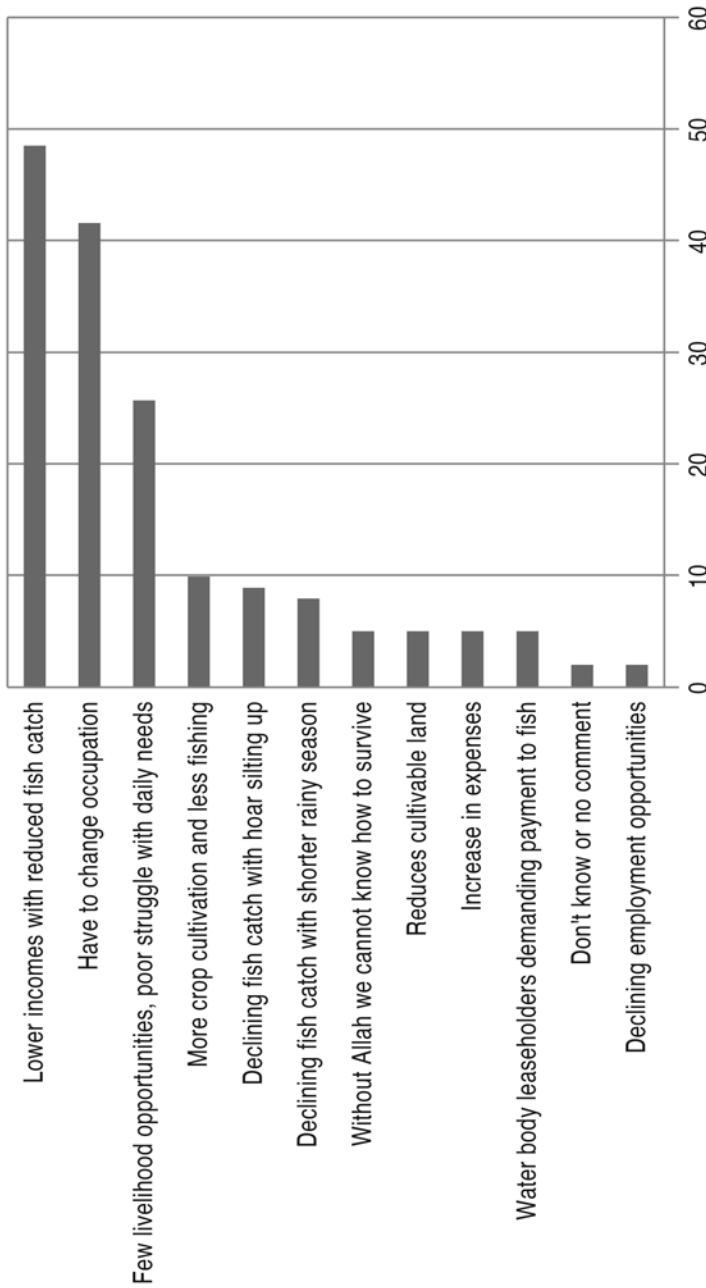


Figure 4.8. Effects of climate change on occupations/livelihoods (percentage of responses) (data collected and analysed by the authors with Mir Yousuf Ali and Iffat Ara Nipa)

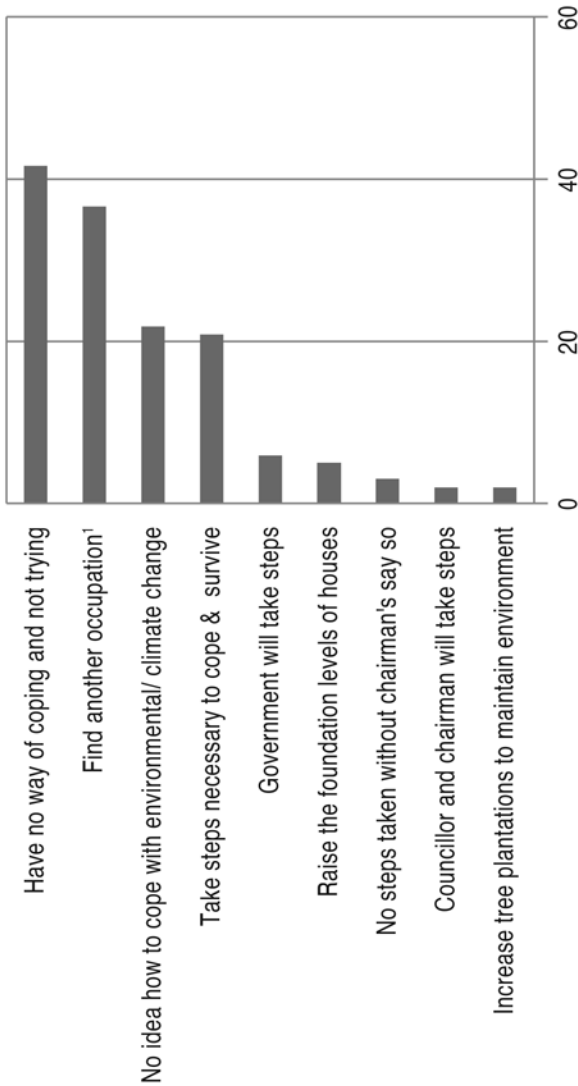


Figure 4.9. Steps taken to cope with environmental/climate change (percentage of responses) (data collected and analysed by the authors with Mir Yousuf Ali and Iffat Ara Nipa)

¹ Such as farm labourer, local shopkeeper, brick kiln worker, rickshaw puller etc.

The responses to the question about the steps people take to cope with environmental-cum-climate change were discouraging with respect to the capacity to deal with these issues locally. Some are endeavouring to meet the challenges as best they can. Some farmers in the *haor* region, for instance, have established a network that allows them to hire large numbers of day labourers quickly, to help save crops during destructive heavy storms and flash floods. But nearly two-thirds of replies indicated that they had no plans, or means, for coping with the changes, with a further one-tenth saying that they were looking to those in authority to do something to help them (Figure 4.9). The more positive among them (over one-third of respondents) said that they would find another occupation if environmental changes cause their current livelihoods to become untenable. (There was no noticeable variation in responses according to gender, age, religion or village.)

The implication of finding other work is that they may go elsewhere to seek employment, probably in Bangladesh, but some may go overseas, notably to the Middle East, if they can arrange it. Several poor families migrate temporarily to the neighbouring districts of Sunamganj and Mymensing in search of work during the lean fishing period (a movement facilitated by the improved communications network). There they pull rickshaw vans, for instance, or work as day labourers in the brickfields. Migration is a common response to difficult situations locally and has become increasingly associated with climate-change pressures, as Mallick and Etzold note in their edited volume on the topic: 'climatic risks and environmental change have certainly ... been a significant factor contributing to people's migration' (2015: 8). People's dependency on natural resources in the *haor* region has been reduced by environmental changes, and they deploy a diverse range of strategies to survive, though some of these are barely adequate. As fish stocks have declined in the *haor*, many fishermen have given up their traditional occupation and are trying to adopt new livelihood strategies: some successfully, as can be seen from the construction of small brick houses that are a mark of relative prosperity, which have been built largely with overseas migrant labourers' cash remittances to their families.

Predictably, when asked about the effectiveness of steps they can take to cope with environmental-cum-climate change, respondents' comments were similarly discouraging, with nine-tenths of them making a disparaging or helpless comment (Figure 4.10). No one suggested that there might be steps they could take locally. Those with a more optimistic outlook pinned their hopes on the government or local politicians doing something effective. Women were somewhat more pessimistic than men (see also Cannon 2010; Shaw 2014), and Hindus and Jalalpur village

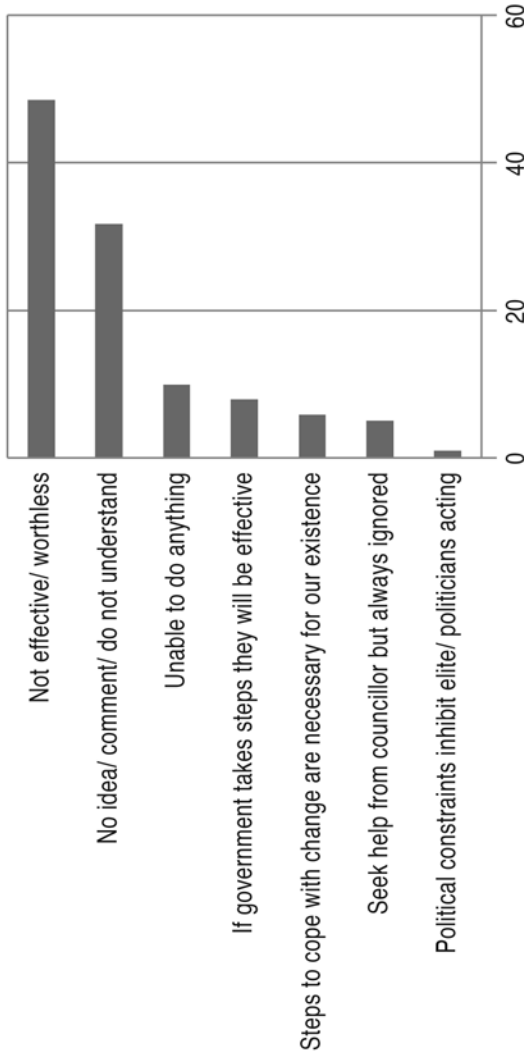


Figure 4.10. Effectiveness of steps taken to cope with change (percentage of responses) (data collected and analysed by the authors with Mir Yousuf Ali and Iffat Ara Nipa)

residents were more likely to feel helpless or not understand the question (otherwise, there were no significant variations according to gender, age, religion or village).

Opinions on the effects of environmental-cum-climate change on the respondent's socioeconomic status were uniformly pessimistic, particularly from poorer households (Figure 4.11). While we should approach responses to a question about people's economic standing with caution, as they may exaggerate their problems in the hope of some assistance or minimise their difficulties out of shame or pride, the consistency of the negative comments suggests that there is a genuine increase in hardship and poverty. It is noteworthy that none of these responses referred to environmental or climatic conditions, although the question assumes them. Instead, the respondents referred to economic conditions *per se*, and these had a marked political dimension to them, mirroring the responses to the previous question.

While a few people mentioned environmental measures, when asked what information and support could help them cope with changes (Figure 4.12), somewhat over half of the respondents expressed a wish for education about what they might do, which correlates with the majority having pessimistic views about their capacity to manage locally. Other comments (about one-third) again had a political dimension, with the issue of access to fishing waters featuring relatively prominently. Women more often expressed a wish for some education, while men voiced politically related concerns and mention environmental issues. Individuals aged over sixty were less concerned about education, as were Muslims, while no Hindus or Jalalpur residents referred to environmental issues (otherwise, there was no significant variation according to gender, age, religion or village).

Policy and Politics

While many survey responses mentioned the need to tackle environmental problems, a substantial number referred to politics as a particular concern. Political issues are often interconnected with environmental ones, as, for example, in the problems with the gerrymandered leasing of water bodies. So, rather than ecological and climatic responses to questions framed around environmental topics, many answers focused on political concerns – as was the case, for instance, with 32 per cent of the replies to question 9: 'What information and support might help you cope?' Political issues are commonly prominent with regard to environmental problems in rural areas (Brouwer et al. 2007; Sillitoe and Alam 2012: 167–72).

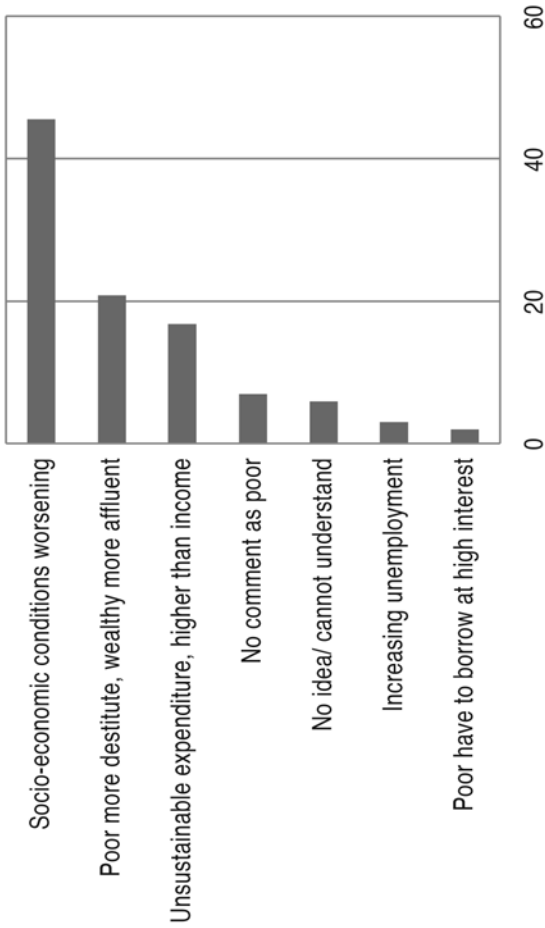


Figure 4.11. Effects of changes on socioeconomic position (percentage of responses) (data collected and analysed by the authors with Mir Yousuf Ali and Iffat Ara Nipa)

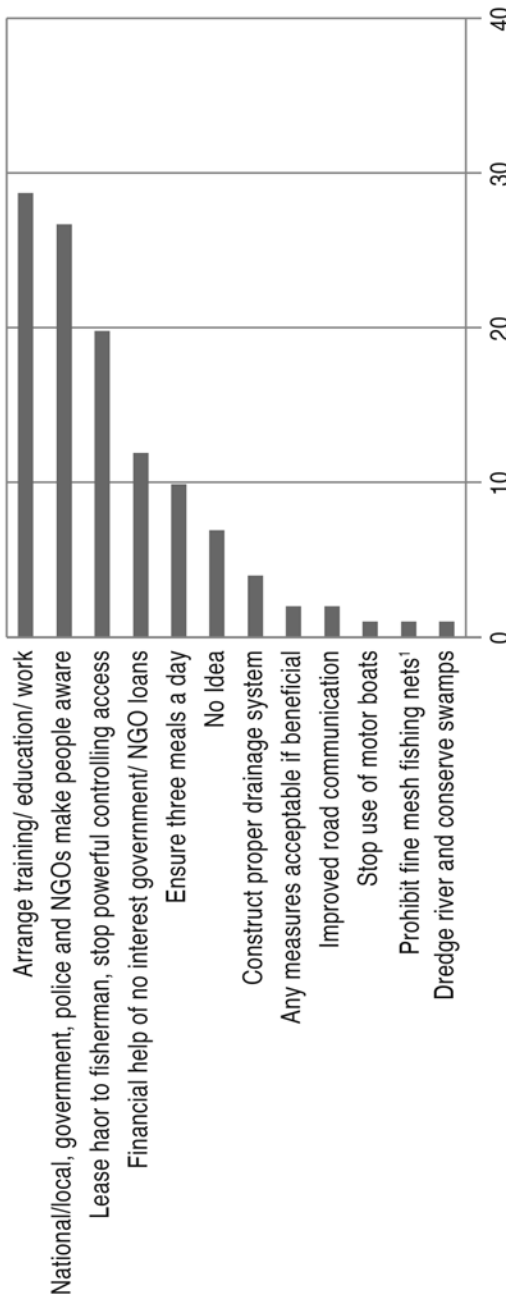


Figure 4.12. Information and support to help respondents cope (percentage of responses) (data collected and analysed by the authors with Mir Yousuf Ali and Iffat Ara Nipa)

¹ Such as *kapri* and current nets.

The political concerns relate to the hierarchical structure of rural communities, where many people, notably the poor, expect to depend on others. This results in a mindset where clients think that they are unable to sort things out for themselves and depend on the patronage of those above them, notably wealthy politicians, businessmen and bureaucrats, who often employ thugs to intimidate and enforce their views. This is evident in the survey returns where, when asked what they can do in the face of climate-associated environmental changes, large numbers replied that they did not know or that they could do nothing. For instance, 89 per cent responded to question 8, 'Are you able to cope with these changes?', that they could not cope or could not do so without outside assistance.

A fatalistic outlook reinforces the hierarchical order, prompting people to think that they are inadequate to do anything without patron leadership. A frequently heard answer to questions about what the future holds and how people might respond is the Arabic phrase, commonly used throughout Islam, that it is *Insha'Allah*, 'God's will'. This underlines that activities such as the fornicating frog rite, which no one mentioned in the survey, are not thought of as coping strategies. Similarly, none of the Hindu respondents mentioned the *ganga puja* (worship of the Ganges) ritual, easily interpreted as a coping mechanism protecting fishermen from misfortune, with its focus on the sacred Ganges and its flooding that is central to fishermen's livelihoods. It is arguable that a fatalistic mentality is a realistic approach to the weather (and, by extension, climate change), as it acknowledges that humans are unable to control it and even have problems predicting it, as noted earlier,²² unlike those seeking to control it by such means as engineered flood-control measures. In contrast, this attitude could be seen as characteristic of people living with nature. Consequently, the more dire the climate-change predictions, the more likely the local response is to be forlorn, not because of scepticism, but because such forecasts make it seem increasingly improbable that they can do anything in the face of such a fate.

The survey responses raise the question of what to do in such a hierarchical sociopolitical situation, where people are conditioned to depend on and follow their superiors, a view reinforced by a fatalistic philosophy of life. The prevalent attitude in communities, that they are unable to cope with any environmental changes without the assistance of patrons, thwarts participation and stymies the argument that people should be encouraged to draw on their local knowledge in responding and adapting to change. What can we do? One answer is that we need to promote education, to inform people of predicted climate-change induced environmental changes and to encourage them to think about how they might respond, drawing on local resources and knowledge. Education is

recognized locally, with 55 per cent of respondents referring to the need for it, and governmental organizations and NGOs promote a range of educational programmes:

Mass awareness raising on the impacts of climate change and how to cope with the challenges can be carried out through a variety of means, such as the distribution of posters or leaflets, running discussion sessions with different groups such as NGOs, Upazila level officials (agriculture, disaster management unit), or setting up school and college environmental clubs that can arrange discussions on local issues. (Practical Action n.d.: 10)

Anthropology might contribute to such efforts by promoting culturally relevant alternative approaches to such education, informed by local ways of passing on knowledge. This includes identifying and possibly modifying educational schemes, and deploying media that effectively reach people – play acting, shadow puppets, folk singing and so on. There is considerable research on this to draw on.

There are contradictions here, as with any political concerns. Culturally framed education, which is sensitive to local political arrangements, will probably comply with these arrangements, when it is arguably necessary to free people from hierarchical domination to liberate local inventiveness and ingenuity. Another option is education that is aware of cultural context, but that nonetheless seeks to empower people to understand climate-change issues and come up with their own adaptation strategies. However, such education is arguably tantamount to political interference in local affairs because it challenges current patronage power structures by reducing people's ignorance and impotent attitudes, as the self-evident 'knowledge is power' argument underscores. It might also arguably challenge people's religious beliefs by seeking to overturn the fatalistic attitude that Allah preordains what happens in the future. Perhaps it is for local people themselves to make political changes rather than interfering outsiders, as the 'decolonial' argument advocates.

However, this outcome would seem unlikely, given that the local powerful elite, including government and NGO employees, have vested interests in the status quo. This fact would suggest that any education programme also needs to target the rural and urban elite, particularly governmental and nongovernmental officials with the power to inform any interventions. This becomes particularly pressing in the climate-change context, which demands urgent action. But it is also a question of national-level political issues and policy debates. Those engaging in policy formation are from the wealthy elite, few of whom intend to reduce their own political power, as will be necessary if local people are to engage with climate-change issues meaningfully. In short, the elite

need to beware of climate politics seeming a cynical charade, appearing to debate climate change and turning out policies endlessly so as to access resources available internationally.²³ The policy analysis and recommendations, without the action, also perhaps suggests some scepticism about scientific predictions of climate change, to which the *Insha'Allah* 'god-willing' fatalism of Islam may also arguably incline people. After all, what can Bangladesh do about the global atmospheric CO₂ crisis, which is largely the fault of industrial nations and not underdeveloped ones (Hanlon, Roy and Hulme 2016)? Any local mitigation measures will have a minimal impact, as noted, and so concerns instead focus largely on adaptation, which so far as it involves poverty-stricken communities is not perhaps a political priority, providing no subsequent unrest threatens the position of the elite, which may be a concern with empowerment schemes that seek to encourage communities to manage matters for themselves in the face of predicted climate changes. The dilemma is that in protecting their privileged status, by failing to empower local communities now to advance their own adaptation measures, the powerful may find resulting unrest and chaos threatens them more gravely later.

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Appendix

জলবায়ু পরিবর্তন বিষয়ক প্রশ্নমালা

Climate Change Questionnaire

Department of Anthropology, Durham University
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উত্তরদাতার বিবরণ: (Respondent details:)

নাম: (Name:)

লঙ্গিগ: (Sex:)

বয়স: (Age:)

গ্রামঃ: (Village:)

পাড়াঃ (Para location:)

ইউনিয়নঃ: (Union council:)_

আপনার পেশা কী: (What is your occupation?:)

১। আপনার অঞ্চলে পরিবেশে কোন পরিবর্তন কনিজরে পড়ছে? (Have there been changes in the environment?)

হ্যাঁ (Yes)

না (No)

২. হয়ে থাকলে পরিবেশে কী কী পরিবর্তন হয়েছে? (If yes, what changes have there been in the natural environment?)

৩। এ সব পরিবর্তনের কারণ কী? (What are the reasons for these changes?)

৪। আপনি কি জলবায়ু পরিবর্তনের কথা শুনছেন? (Have you heard of climate change?)

হ্যাঁ (Yes)

না (No)

৫। শুনতে থাকলে জলবায়ু পরিবর্তন বলতে কী বুঝেন? (If yes, what do you understand about climate change?)

৬। আপনার এলাকায় জলবায়ুর কী কী পরিবর্তন দেখা গেছে? (What changes in climate have occurred in your region?)

৭। জলবায়ুর পরিবর্তন পরিবেশে উপর কী কী প্রভাব ফেলেছে? (What are the effects of climate changes on the environment?)

৮। জলবায়ুর এই পরিবর্তন সমূহ আপনার জীবিকার উপর কী প্রভাব ফেলেছে? (How does climate change affect your occupation/livelihood?)

৯। পরিবেশ ও জলবায়ু পরিবর্তনের সাথে খাপ খাওয়ানোর জন্য আপনারা কী কী প্রয়াস নহিয়েছেন? (What steps can you take to cope with environmental/climate changes?)

১০। জলবায়ু / পরিবেশ পরিবর্তনের সাথে খাপ খাওয়ানোর এই প্রয়াস কতটুকু কার্যকর? (How effective are these steps to cope with environmental/climate changes?)

১১। এই পরিবর্তনের সাথে আপনার গৃহস্থালীর আর্থ-সামাজিক অবস্থা কীভাবে প্রভাবিত হয়েছে? (How does environmental/climate change affect your socioeconomic position?)

১২। আপনি কি মনে করেন এই পরিবর্তনের সাথে মানিয়ে নিতে পারেন? (Are you able to cope with these changes?)

১৩। মানিয়ে নেয়ার জন্য কী ধরণের তথ্য ও সহায়তা দরকার? (What information and support might help you cope?)

Notes

1. The IPCC currently predicts sea level rises of 0.4 to 0.67 m by 2100 (Church et al. 2013: 1201).
2. All of the terms in this chapter are standard Bengali words.
3. The *beel* cover an area of 4,635 ha and the important ones are Baghalkuri, Balijhuri, Barajalla, Chatla, Chinaura, Dulla, Haorkhal, Lamba, Pinlarkona, Pioula, Sakua, Tekonia and Tural (CWBMP 2006).
4. It comprises five *thana* 'administrative areas': three in Moulavi Bazar (Kulaura, Juri and Baralekha) and two in Sylhet (Golapganj and Fenchuganj).
5. The *boro* season extends from January to May, which is the dry season when farmers cultivate an irrigated rice crop.
6. *Baishakh* is the first and *Kartik* is the seventh month of the Bengali Calendar (mid-April to mid-November).

7. The *aman* rice crop (transplanted and broadcast) is usually cultivated in December–January, and the *aus* crop in July–August.
8. We acknowledge our debt to Mir Yousuf Ali and Iffat Ara Nipa, and thank them for their help. We also thank Independent University, Bangladesh for a grant to cover their work.
9. One hand is approximately 45 cm.
10. *Ashar* (mid-June to mid-July) is the third Bengali month, when the rainy season begins, and *Srabon* (mid-July to mid-August) is the fourth rainy season month.
11. The same process has happened in neighbouring Tural Haor and Nagur Haor, where the waters are now so shallow that it is reportedly hardly worth fishing anymore.
12. *Chaitraya* is the last month of Bengali year (mid-March to mid-April) and is dry and hot.
13. *Acacia auriculiformis*, locally called *akashmoni*, and several species of Eucalyptus trees.
14. See Camelia Dewan’s chapter in this volume on embankments in the Sundarbans and their socioecological impacts.
15. For a discussion of gender issues in relation to flooding, see Cannon (2010) and Shaw (2014).
16. The meteorological stations of Sylhet (30 km northwest) and Srimongal (40 km southwest) are the two nearest to the Hakaluki region.
17. The analysis of meteorological data by Islam and Neelim (2010: 26, 28, 35, 57, 58 and 64) for Sylhet (over a longer timeframe) indicates that the mean maximum temperature for winter and minimum temperatures for winter and summer have increased, but rainfall shows no change.
18. They distinguish *benga* (‘male frogs’) and *bengi* (‘female frogs’) by their different croaks.
19. *‘Megh Rajare tui amar suddor bhai
Ek guri Megher laiga duar bhijjya jai
Duar bhijjya jaite jaite monai dilo fal
ek ushtha da falai demu kochu kheter file
Benger zhiyer biya shonar medel diya
alo bengi megh diya ja
Megh dila jemon temon duar bhijlona
nabi shotto Allah keno megh dilaina
Houra khailo poke dhan khailo loke
mega megi boiya roise ganger kule.’*
20. Regarding indigenous weather forecasting, our enquiries suggest that there are no consistently held indicators, but a varying range, often informed by individuals’ experiences and observations. They include the following predictions. Cold winters follow warm winters and also hot summers. If there is much continuous rainfall in the months of *Chaitraya* (March–April) through to *Bhadro* (August–September), it will be a hot summer and cold winter. If it is foggy in the mornings and evenings during *Chaitraya*, this signals delayed rains and a hot summer; whereas if the rains start at the end of that month, it will be cool. And if the rain comes and goes, the winter will be warm. If the wind carries the warm smell of cloud during the *Chaitraya* (drought period), this is a sign of coming rains. In some years it rains in the month of *Magh* (January–February) and not *Kartik* (October–November), and this signals cool weather. Frequent dark clouds in the middle of the month of *Falgun* (February–March) signal no rain and hot weather, whereas rain at this time indicates that it will be cool.
21. See Dewan’s chapter in this volume for discussion of the ‘Flood Action Plan’ that featured the construction of embankments, dykes and polders to control seasonal floods.
22. A fatalistic outlook with regard to climate-change predications has been noted elsewhere in Asia – for instance, in rural Thai communities, where it is associated with Buddhist beliefs (Kittipongvises and Mino 2013; Suthirat and Takashi 2013).

23. For an indication of the sums of money involved, see, for example, Global Climate Change Alliance+ (2012) for the funds made available from the European Union from 2011 to 2017 for projects in Bangladesh.

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