

MIGRATION AS ADAPTATION

Population Dynamics in the Age of Climate Variability

Robert Stojanov, Ilan Kelman, Maxmillan Martin,
Dmytro Vikhrov, Dominic Kniveton, Barbora Duží

Global Change Research Centre AS CR, v. v. i.



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**Robert Stojanov, Ilan Kelman, Maxmillan Martin,
Dmytro Vikhrov, Dominic Kniveton, Barbora Duží**

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*Global Change Research Centre,
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MIGRATION AS ADAPTATION?

Population migration is a standard, dynamic process in human society, often being embedded within the cultural patterns and norms. It is used for strategies ranging from individual and collective survival to personal development, excitement, and adventure - with a gamut of reasons including family, education, and fun. Migration can also be seen as a short-term response to a particular situation in life, perhaps temporary or circular migration, or as a long-term adaptation strategy, meaning the aim being permanent. Population migration can also be seen as a coping strategy for a specific situation in life such as job loss, poor harvests, or as a long-term adaptation strategy to a significant change in the environment (such as extreme drought) or loss of housing. There are, of course, many reasons why people migrate, often intertwined and complex. However, an examination of the environmental (including climatic) factors that may affect or cause migration has not been given sufficient consideration in migration discourse and is thus a relatively new research topic.

Global climate change leads to complex dynamic biophysical and landscape changes that have a significant impact on the climate functioning of existing natural and socio-economic systems - and their combinations. Global climate change specifically means changes in the climate system of the Earth, such as temperature, distribution and intensity of precipitation, winds, ocean currents, and extremes. These changes impact the quality of life of individuals, communities, and whole societies.

The authors of this book analyze each case study to see whether environmental factors or climate variability and trends play roles in decisions to migrate and if so, which roles and how. This relationship cannot be understood simply as linear, as evidenced by the analytical work and the results of empirical research presented in this book. An important role is played by the adaptive capacity of the community in question, namely the extent to which the given community is sensitive and vulnerable to fluctuations in weather and what ability it has to adapt to changes. There are examples where migration due to climate change can be understood as a coping strategy, an adaptation strategy, a form of risk management, or a combination. In such cases, a member of the household, usually a male seeks employment, usually in a major city, and sends his family part of his earnings (remittances) to compensate for losses. Sometimes, the entire household moves to find greater security and a more secure / higher source of income.

Although environmental migration is a global phenomenon, there are regions where geographic, economic, social (e.g. political or cultural), and demographic conditions (or combinations thereof) create greater incentives to migrate in the context of environmental change. Such countries include Bangladesh, a poor country with high population density and low elevation over a large part of its territory, and Kenya, with its security problems, growing population, porous international borders, poverty, and poor governance. Low-lying islands, often atolls, and Arctic communities are amongst the most vulnerable areas as well.

The main aim of this publication is to analyze the relationships and dynamics of environmental change, or the impacts of climate change, trends, and variabilities, alongside population processes, in terms of coping with these changes and adapting to evolving conditions. In the book, we will define such concepts theoretically and apply them practically through several empirical studies.

The first chapter deals with concept of the relationship amongst climate change and population movement. It briefly describes impacts of climate change on migration processes, differences between "coping" and "adaptation" strategies, and the general and regional effects of climate change. The third chapter is devoted to the topic of international relations connected with climate change, the vulnerability of island communities, and potentially related population migration. The text gives a number of examples where climate-related hazards should or could have played an important role in resolving international conflicts, but unfortunately that does not happen. That experience might lead to climate-related migration in the future with concomitant political, legal, and ethical challenges.

The next chapters of the book comprise the results of empirical studies. The first one describes the ambiguous nature of the relationship between climate change and migration of the population in Bangladesh. The text focuses on three areas of Bangladesh affected by flooding, river bank erosion, drought, salinization of soil, and coastal inundation, showing how villagers diversify their traditional livelihood strategies, i.e. farming or fishing, or sometimes migrate to find work for various periods of time. The authors conclude that young men from rural areas, in particular, often move away from the livelihoods of their ancestors (farmers and fishermen) through migration to the cities, where they sell vegetables or toys, become rickshaw drivers, or drift among transient opportunities. Migration is thus perceived as a strategy for obtaining a higher income, as well as adaptation to the impacts of climate extremes.

The next two chapters are short, empirical studies from selected regions of Bangladesh and Kenya, where significant climate variability has recently been experienced. In the former case, climate change is clearly perceived by local experts as being one of the main factors of migration of local residents. In the latter case, the hypothesis is far from proven. The text discusses possible causes of these differences.

The book's final case study chapter is an econometric study, this time from the Czech Republic, where the effect of the impacts of climate extremes on population changes at the household level was studied. The text deals with the effects, especially of floods, on the commuting residents of small towns in the middle and lower reaches of the Bečva River in the eastern Czech Republic. The objectives of the research itself were much broader, so this chapter introduces the results of the analysis of activities households affected by floods using commuting as an adaptation strategy. The authors find that the relationship between commuting to work and the effect of flooding is not linear: individuals commute more after the first flood and less after the second flood. The results are attributed to differences in the economic and demographic characteristics of the regions surveyed in both waves.

At the inception of this book, we used comparative and synthetic methods, and an empirical research analysis of the sources, and theoretical approaches to understand interactions amongst climate change, migration, and dealing with both and their combination. The first part of the book has an analytic and synthetic character in which we use mainly secondary resources. For the case studies, primary data collected during each field investigation were used. Specifications of the methods used and ways of obtaining the data are described in each chapter. We hope that this work, covering different methods and disciplines, contributions to the understanding of migration as adaptation, and for other reasons, to better formulate policy and practice for population dynamics in an age of climate variability.

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1. CLIMATE EXTREMES IMPACTS AND MIGRATION AS ADAPTATION?

Many residents are already experiencing the impacts of climate change, especially in terms of increased climate variability and increased incidence of climatic extremes¹ in different regions. Extreme weather events can be divided into temperature extremes (e.g. heat waves), precipitation extremes (in both ways; torrential rain or a significant decline in rainfall), river floods and hydrological drought (related to the previous two categories), tropical cyclones - in terms of changes in the frequency and intensity according to the region (IPCC 2012).

Although extreme weather events are part of the natural variability of climate, their current level of "extremity" lies in the fact that at the regional or local level an increased amplitude of natural climate variability is reflected, including changes to its scope, length, and intensity. This shows, for example, through the occurrence of unusual, extended periods of drought – i.e. number of days without precipitation, there is a higher incidence of extremely hot days or nights, a higher wind speed, faster water cycle, significant changes in seasonal, monthly rainfall totals or the occurrence of extreme precipitation in the form of torrential rains, and in various parts of the world there is an overall shift in the onset of the seasons and seasonal cycles (e.g. monsoon), etc. (see IPCC 2007a; SREX 2012; Hansen, Sato and Ruedy 2012).

These climatic extremes are driving the need to adapt quickly at the level of households, communities and entire countries (Linnenluecke and Griffiths 2012; Etkin, Medalye and Higuchi 2012; Grothmann and Reusswig 2006). Adaptation can be understood from this perspective as a reaction to ongoing climate extremes in terms of the strategies for coping with extreme events or trying to anticipate and adapt ahead of uncertain future risks. This aspect is crucial, for example, in the planning and design of long-term projects, such as transport infrastructure, buildings and human settlements, water projects, flood control or irrigation, planting forests, etc. (SREX 2012).

Individual communities cope with the manifestations of climate change differently depending on which natural and human resources, institutional tools and organizations they have at their disposal and the extent to which a particular community is either resistant or vulnerable to climate change and ultimately whether they are able to adapt adequately to the impacts of climate change. The infrastructure of cities and municipalities should count on climate extremes happening to some extent and be ready for their occurrence and impact, as new weather trends indicate that in the future a higher degree of risk and uncertainty should be expected (IPCC 2007a, 2012; Pelling and Manuel-Navarrete 2011).

In addition to the obvious factors, "qualitative criteria" also play a role, i.e. the cultural specificities, such as local cultural conditions, lifestyles, level of diversity while ensuring the livelihood of the population or a close relationship with the place, as well as the measure of social cohesion or psychological resilience in coping with extreme life events in general (Adger et al. 2012).

Ongoing climate change thus has an impact not only on the environment but it also modifies or threatens existing cultural patterns and ways of living and other cultural and social values that are associated with this dimension. For example, an increase in the areas threatened by drought has an impact not only on the environment but also on the existing methods of grazing animals, which is a typical adaptation for the communities of herders living in semi-arid areas, in themselves characterized by a lack of water resources and precipitation (Adger et al. 2012;

¹ One of the last IPCC special reports, entitled *Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation* (IPCC 2012), focuses on one of the most visible and currently commonly discussed signs of increased climate variability, i.e. the problem of so-called climate extremes or climate and weather extreme events. The report is devoted to the increased risk of extreme weather events associated with global climate change. It also explores adaptive mechanisms in terms of social vulnerability and adaptability including 'uncertainty management'.

Silvestri 2012). Another example could be the negative effects on the operation of agriculture, fishing and other forms of land use in the event of permanent flooding of the area due to sea level rise, etc. If we take into account this specific dimension when examining patterns of migration and their causes, many existing theoretical approaches to migration can be faced with the challenge of reassessment in the case of empirical testing. Research conducted shows that the methods of adaptation to climate change vary in different communities and different groups. One of the strategy adjustments may then become different forms of migration.

Kniveton et al. (2008: 5-6) envisage an increasing interest in climate change and migration in scholarly literature; however, the subject has not been explored empirically in a way that generates conclusive results.

Similarly Black et al. (2011b) point out that researchers in the fields of development, climate and environmental sciences and adaptation need to pay more attention to migration. A better understanding is required of the extent to which migration influences vulnerability and resilience in the face of environmental change. Again, the knowledge must be based on empirical research, and underpinned by longitudinal data on migration flows.

The first results of empirical studies focused on migration in drought affected areas have been published. (Findley 1994, Rain 1999, Henry, Schoumaker and Beauchemin 2004 etc.). Other papers deal with sea level rise on small islands (Locke 2009; Shen and Gemenne 2011), and other studies focus on floods or tropical storm impacts on the population in selected regions (de Sherbinin et al. 2011; McLeman and Hunter 2010). Nevertheless all of the publications emphasize the multi-factor approaches in migration decision processes (Hugo 1996; McLeman 2011; Hugo 2011). Examples of migration due to climate variability from other regions (Mekong delta in Vietnam, the Limpopo River Basin in Mozambique, the Chinese province of Inner Mongolia and others) are given by, for example, de Sherbinin et al. (2011) or McLeman and Hunter (2010).

Black et al. (2011b) view sea level rise and coastal flooding, as well as land and coastal and marine ecosystem degradation as prime significant migration factors. Environmental change has a clear impact upon the environmental drivers of migration, but also has the potential to affect migration indirectly, both through its influence on economic drivers through the effects on agricultural productivity (reducing crop, livestock and fishing productivity) and rural livelihoods (reduction in household incomes), and political drivers through influencing conflict and public policy. The processes can work in the absence of alternative sources of income or the implementation of adaptation strategies. These effects have different impacts depending on local conditions. Whereas sea level rise has clear potential for displacement of the affected population, change in extra-tropical storm frequency or intensity, however, is less likely to be significant for migration because such events have historically generated less displacement than tropical cyclones.

Society's response to climate change: adaptation and coping strategies

Coping strategies according to the Oxford English Dictionary are defined as "the action or process of overcoming a problem or difficulties", or as a way "managing or enduring a stressful situation or condition." The United Nations Office for Disaster Risk Reduction (UNISDR) favours the definition in terms of "ability of people, organizations, and systems, using available skills and resources, to face and manage adverse conditions, emergencies or disasters". Overall, coping focuses on the moment, constraint, and survival (IPCC 2012).

Adaptation strategy is explained in the Oxford English Dictionary as "rendering suitable, modifying". Adaptation strategies (in terms of human response) focuses on the future, where learning and reinvention are key features and short-term survival is less in question (although it remains inclusive of changes inspired by already-modified environmental conditions) (IPCC 2012).

When applying these strategies to the concept of climate change and migration as adaptation it is necessary to define the factors of time and scope. Coping strategies mean the involvement of the currently available skills aimed at coping with ongoing changes. While coping is reactive, adaptation is proactive and innovative. The goal of adaptation is to preemptively prevent negative changes or at least mitigate their course (IPCC 2012). Adaptation strategies also have a wider dimension - in terms of adaptation to natural and socio-economic systems to actual or expected climate change, which aims to mitigate potential damage or take advantage of appropriate opportunities to perform preventive changes (McCarthy et al. 2001: 982). In the following Table 1.1, the approaches are shown in more detail:

Table 1.1: The various dimensions of coping and adapting

Dimension	Coping	Adaptation
Needs	Survival in the face of imminent, serious stress (unusually significant stress)	Reorientation in response to recent events or predicting future changes
Limitations	Survival is foremost and tactics are limited by the available knowledge, experience, or resources. Application of new techniques (reinvention) is secondary.	Attention is focused on modification / adaptation and strategies with respect to future needs and is less constrained by the current limits
Reactivity	Decisions are primarily tactical and are made to protect basic needs and provide security measures after events occur	Decisions are strategic and focused on changes; proactive approach prevails.
Orientation	Attention is focused on the past events that shape the current conditions and restrictions	Attention is focused on the future policies and strategies, past practices are relevant only to a certain extent

Source: adapted from IPCC (2012)

Migration as the population's response to climate change

Migration flows caused by environmental degradation, especially climate change, have a long tradition in human history (e.g. migration of peoples, crisis and falls of individual civilizations). However, the extent and threat of current changes exceed the historical projections and context due to the current high population density and lack of certain natural resources and fertile farmland.

While in 1804, one billion people lived on the Earth with a population density of 6.7 people per km² in 2013 there is a population of 7.1 billion and the average population density of all (including still uninhabited and unused) land on our planet is at a level of 47.6 people per km² (Brown 2012, CIA 2013). As reported by Brown (2012) a result of this population growth is the growth of human consumption of natural resources at the global level, which surpasses the regenerative capacity of forests, fish in the oceans, water resources and agricultural land.

According to Kniveton et al. (2008: 5-6) while there is increasing interest in the concept of the relationship between climate change and migration of the population, there is a lack of empirical studies that would clearly demonstrate this relationship. The results of empirical research at this time have focused primarily on areas affected by drought and less on hurricane-affected regions. All these studies have also found a number of other migratory factors.

Black et al. (2011b) distinguish five basic dimensions of climate change with a potential effect to act as a trigger for migration (see Table 1.2). However, these effects will have different influences depending on the place concerned. While sea-level rise has the potential to cause emigration of the population affected, a change in the intensity and frequency of tropical storms and hurricanes has a relatively low influence on the local population because of the past experiences of local populations with these natural events. For other manifestations of climate change, migration effects are not clear.

According to Hugo (2011) there can be no doubt that the impacts of climate change will add to already increasing levels and complexity of the population mobility. He claims that we cannot be specific about the scale and scope of those impacts but that they will be significant. Moreover, it is extremely important to say that it is possible the migration processes not only cope with these changes but also to harness that population mobility to reduce poverty and enhance economic and social development.

Similarly, Black et al. (2011a) say that environmental change can increase the incentive to move. But it can also limit the capacity to do so, because environmental change should be seen as affecting the many linked drivers of migration. Paradoxically people are as likely to migrate into places of environmental vulnerability as away from them, for instance to rapidly growing megacities in river deltas such as Dhaka and Lagos (Black et al. 2011a) because of better labor opportunities.

Table 1.2: The basic effects of climate change on the population

Milestone	Specific manifestations	Impact on local residents
Sea-level rise	increased risk of flooding of coastal areas	eviction of affected population
	increase in soil erosion in coastal areas	reduction in agricultural production
	increasing salinity of low-lying land	
Changes in the intensity and frequency of tropical storms and hurricanes	increased risk of flooding of coastal areas	low migration effect
	increased damages	
Changing precipitation	increased risk of flooding	change in the frequency of crops
	reduced water availability	reduction in the availability of pasture for cattle
Increased temperatures		low migration effect in the countryside rural
		some city-dwellers will look for a more attractive destination
	increase in temperature extremes	reduction in crops
		reduction and functionality of ecosystem services
Changes in atmospheric chemistry		melting glaciers and resulting increased risk of flooding
	combination of temperature and precipitation changes	unclear impact on crops
		impact on the chemical composition of the oceans
		changes in production of coastal and marine ecosystems

Source: Based on information from Black et al. (2011b), own research

McLeman and Hunter (2010) show that often the approached studies use the concept of vulnerability and its key functional elements: exposure, system sensitivity, and adaptive capacity. And each of the systems of human-environment interactions is adapted to actual climate conditions and their variability (Kates, Travis and Wilbanks 2012). From this perspective migration is one of the ways we can adapt to environmental change, including climate change. In this way Perch-Nielsen et al. (2008) point out that adaptation options can modify vulnerability and thus migration cannot be looked at separately, but must be analysed in the context of its alternatives. This is even more important because in many cases migration is the last of these options to be chosen.

Adaptation and resilience in fact largely depends on the available resources. Hutton and Haque (2004) therefore rightly found an association between the vulnerability of the poor and the existing socio-economic inequalities. Disparity prevails in income, access to jobs, education, health services, land between the majority of rural and urban people and within. This implies that the majority depend on subsistence livelihoods, with little opportunity to protect themselves against extreme events (Eisenack 2009). Either the adaptive capacity of the community/person is totally exhausted so that the reaction to migrate is understandable as a collapse of the system, or the reaction to migrate is perceived as an adaptation strategy that could contribute to alleviation of the degraded environment and migration is framed as a challenge that could contribute to improving livelihood conditions for migrants.

Summary

Migration is thus one of the ways that people can adapt to environmental changes, including climate change. To do this, paradoxically, Heffernan (2012) points out that ten years ago the use of the word 'adaptation ' was inappropriate in the climate discourse.

Migration in this context enables the diversification of its revenue and / or an increase in it. This, however, leads to the need to increase efficiency in migration management and policy, develop financial mechanisms for adaptation funds, increase international cooperation in research and climate change impacts, streamline mechanisms for providing development assistance, and implement economic policies favorable to developing countries (Hugo 2011) .

Factors influencing migration vary from region to region. Research on the relationship between climate change and migration of the population has so far been an under- researched topic. The concept is still evolving and gaining the main outlines, as well as a number of empirical studies being carried out that gain in value after the umpteenth repetition and the opportunity to compare the major trends and changes over time.

However, climatic factors do not always lead to significant migration processes. People are always influenced by other local and cultural conditions (Adger 2012). Even though generally the most vulnerable groups include the poor, who are also the most affected by environmental degradation due to lack of resources to adapt, usually they are the ones who cannot afford to leave, as migration generally requires some financial resources, knowledge and experience and the existence of migration networks. Therefore, there is a clear multi-compliance, which must be taken into account when formulating the conclusions of other research activities on this topic.

2. CLIMATE CHANGE DIPLOMACY, ISLAND VULNERABILITY, AND MIGRATION

Climate change is one of many global challenges affecting humanity today and it has emerged as the most prominent one in many populist circles. Much of the discussion has been highly conflictual at scientific, policy, and practice levels. At the scientific level, the Intergovernmental Panel on Climate Change (IPCC 2013) has dominated the synthesis and assessment of climate change science, selecting the works to be referenced which can cause conflict with those who are excluded. At the policy level, the main flashpoint is the annual international Conference of Parties meetings of the United Nations Convention Framework on Climate Change. Much hope and effort has been placed into lobbying for binding international agreements, but little substance has resulted. The results have led to treaties which do little to address the causes or effects of climate change and which rarely lead to or support international cooperation on the topic.

Meanwhile, many development practitioners have expressed frustration at climate change taking over a long-standing agenda. There is optimism that the funds and attention brought by climate change are injecting action into locations which had previously been neglected. There is pessimism that, in many such locations, climate change is not the main challenge and that those with climate change expertise are taking over the agenda without making the effort to fully understand the development agenda. Root causes of development challenges such as power, equity, and justice are often neglected in the rush to implement climate change mitigation or adaptation activities.

Why is climate change such a polarising topic? Many have discussed aspects of the cultural, political, and scientific differences and conflicts within various aspects of the climate change discussion (Brossard et al. 2004; Dessler and Parson 2006; Hulme 2009). The chapter provides a different framing, that of disaster diplomacy, by examining the topic of climate change induced movement from island communities. No intimation is made that this framing provides a complete or entire explanation. Instead, it is merely one input into the wide debate, which might provide useful insights to explain how and why a major topic such as climate change does not bring people together to solve the problem in tandem. In contrast, it can generate even more conflict, especially over a topic such as migration.

The second part of this chapter describes the disaster diplomacy framework with a focus on the context of climate change diplomacy, providing the background for why disaster-related difficulties and activities rarely bring people together over the long-term. That includes disaster-related actions related to climate change, i.e. climate change diplomacy. The third part of this chapter applies that knowledge and background to climate change related mobility from islands as a disaster diplomacy case study. The final part provides lessons to be applied to wider adaptation and migration actions.

Disaster Diplomacy

Disaster diplomacy² investigates how and why disaster-related activities do and do not influence conflict and cooperation (Kelman 2012). The key phrase is “disaster-related activities”, covering (i) pre-disaster efforts including prevention, preparedness, planning, and mitigation and (ii) post-disaster actions including response, reconstruction, and recovery. With respect to climate change, climate change diplomacy includes all climate change related activities, including mitigation and adaptation. Disaster diplomacy case studies including climate change are not just about what happens when an volcano erupts in a war zone or about humanitarian aid

² For details see <http://www.disasterdiplomacy.org>

from enemies. Questions for pre-disaster diplomacy are whether or not warning systems can lead to further cooperation as well as how vaccinations can lead to temporary but not permanent ceasefires. For climate change, that might be setting up renewable energy systems across international borders of countries which are not on good terms (e.g. Mostafaeipour and Mostafaeipour 2009) alongside the possibilities for cooperation at the international Conference of Parties meetings of the United Nations Convention Framework on Climate Change (Halvorssen 2007-2008).

All evidence so far suggests that, while disaster-related activities do not create fresh diplomatic opportunities, they sometimes catalyse action. Such catalysis occurs only in the short-term, not in the long-term. In the short-term - on the order of weeks and months - disaster-related activities can, but do not always, impact diplomacy. They have the potential for influencing it, for spurring it on, and for affecting it, as long as a pre-existing basis existed for that influence. The pre-existing basis might be culture or trade links or secret negotiations.

One example occurred on 26 December 2004 (Beardsley and McQuinn 2009; Gaillard et al. 2008; Le Billon and Waizenegger 2007) when a powerful earthquake off the west coast of Indonesia led to tsunamis around the Indian Ocean. The two hardest hit areas were Sri Lanka and the Indonesian province of Aceh. Both locations witnessed tens of thousands of fatalities against the backdrop of each having a long-running conflict which had become particularly violent over the previous thirty years. In Aceh, a peace deal was reached months after the tsunami which has so far held. In Sri Lanka, the humanitarian emergency and international aid exacerbated the conflict. Within a few years, Sri Lanka's military had won the war.

Yet the tsunami did not create the peace deal in Aceh. Secret negotiations had started just two days before the earthquake and tsunami disaster (Gaillard et al. 2008) and those negotiations formed the basis for the peace deal (see also Le Billon and Waizenegger 2007). Nevertheless, the tsunami had a significant influence on the peace deal. The devastation provided a space in which peace negotiations could be successful, if both parties wanted it, but other factors had to be in play for both parties to have wanted the peace prior to the tsunami. In particular, in October 2004, Indonesia elected a new President, Susilo Bambang Yudhoyono, whose Vice-President, Jusuf Kalla, had held negotiations in Aceh beforehand and who was committed to peace (Gaillard et al. 2008). Meanwhile, the fighters in Aceh were in military difficulty before the tsunami, providing them with an incentive to negotiate. Both parties had non-tsunami reasons for achieving peace - the Acehnese fighters were suffering military setbacks while those in power in Djakarta realised the harm that the conflict was doing to the country - so they were each able to use the tsunami as one of several excuses to make peace work. The tsunami provided the opportunity to reach peace, but not the cause (see also Enia 2008; Klimesova 2011).

This conclusion is corroborated by Sri Lanka (Wickremesinghe 2006). One rebel commander was facing corruption charges, so had an incentive to keep the fighting going. Many Sri Lankans opposed involving the main rebels in humanitarian aid (Enia 2008; Kelman 2012; Klimesova 2011; Le Billon and Waizenegger 2007). On 17 November 2005, less than a year after the tsunami, Sri Lanka elected a pro-war anti-negotiation President, Mahinda Rajapaksa whose party also won major victories in April 2006 local elections, endorsing Rajapaksa's approach to the conflict. The main parties involved had non-tsunami reasons for keeping the violent conflict going, mainly deeply engrained political antipathy against the other side, so they were able to use the tsunami as one of several excuses to make peace fail. The tsunami provided an opportunity to overcome the root causes of the conflict, but that opportunity was deliberately not grasped so that the violence would continue.

The catalysis effect of disaster-related activities, as seen in Aceh, seems to work in the short-term only, on time scales of weeks and months (Kelman 2012). Over the long-term - such as years - non-disaster factors take over. Examples for perpetuating conflict are a leadership change, distrust, belief that an historical conflict or grievance should take precedence over present-day humanitarian needs, or priorities for action other than conflict resolution and diplomatic dividends (see also Pelling and Dill 2010). That latter two were seen in post-tsunami Sri Lanka. Examples of longer-term influences for overcoming a conflict are a leadership change, conflict weariness, a feeling of military disadvantage, or prioritising peace as a principle. The latter two were seen in post-tsunami Aceh.

These same conclusions are also seen for climate-related case studies. In the context of droughts, storms, and climate, Glantz (2000) details Cuba-USA relations when Fidel Castro led Cuba. Glantz (2000) describes how many opportunities arose for climate-related and weather-related disaster diplomacy between the two countries, but when deals seemed feasible, one or other side came up with an excuse to scuttle the emergent diplomacy. Kelman (2012) extends that analysis to events after 2000 including the 11 September 2001 terrorist attacks in the USA, Hurricane Michelle in 2001, and the 2005 hurricane season including Hurricanes Dennis, Katrina,

and Wilma. Glantz (2000) and Kelman (2012) agree that the reason that disaster diplomacy did not work for the Cuba-USA case study under Fidel Castro is that both sides benefited from having the other as an 'enemy'. Castro needed a monolithic power claimed to be against the Cuban people in order to prop up his regime. American politicians in Washington, D.C. could not engage with Cuba for fear of upsetting the vocal Cuban-American lobby groups who have influence in the key electoral swing state of Florida. With Raúl Castro now leading Cuba, economic advantages are seen in engaging more with the USA and the American President Barack Obama has responded carefully to the overtures. Cuba-USA diplomacy is thawing in the absence of disaster.

The overall conclusion from disaster diplomacy research so far across multiple case studies including climate change (Kelman 2012) is that disaster diplomacy sometimes, but not always, works in the short-term, if the parties involved have non-disaster reasons for collaborating. In the long-term, non-disaster factors supersede the influence of disaster-related activities. This result holds beyond international politics - that is, beyond diplomacy at the bilateral or multilateral level (e.g. Gaillard et al. 2009; Klimesova 2011 for intra-state disaster diplomacy in the Philippines) - and also beyond modern instances (e.g. Segalla 2012 describes a 1959 disaster diplomacy incident between Morocco and the USA over an oil spill).

Since this chapter focuses on the global challenge of climate change and migration across borders, the focus of the disaster diplomacy framing remains at the international level for contemporary times. Consequently, sub-national and historical disaster diplomacy are not detailed, although they are mentioned when relevant.

Explaining disaster diplomacy's failure

Why does disaster diplomacy not work? The principal reason is that people make active choices regarding politics leading to active choices against diplomacy or against enacting disaster-related activities, either before or after a disaster. Reconciliation is not necessarily an important objective, despite the potential for joint life-saving actions, as seen for Cuba and the USA (Glantz, 2000). As Glantz (2000) notes, plenty of scientific and technical cooperation occurs without the politicians knowing about it, such as researching and monitoring hurricanes, but that scientific and technical cooperation most likely occurs because the governments do not know about it and hence do not use the research. Both sides were making active choices not to engage with the other, because the enmity suited their political goals.

Similarly, inertial prejudice, misgivings, and mistrust can overcome disaster diplomacy efforts. On 26 December 2003, an earthquake shattered the World Heritage city of Bam, Iran, killing 25,000 people (for background to this case study, see Kelman 2012; Warnaar 2005, 2013). Iran categorically stated that the country would accept aid from any country apart from Israel. The disaster could not overcome Iran's bias. US aid, however, was accepted and led to suggestions that Iran-US disaster diplomacy might result. Media hype and lack of political forethought derailed possible good intentions. The US State Department's position vis-à-vis Iran had not actually changed, even though the press presented it as being an opening to rapprochement. The US government then tried to send a high-profile emissary with aid supplies to Iran, but it appears as if the US government did not fully clear that desire with the Iranian government beforehand. Iran declined, squashing any hope for disaster diplomacy.

Simultaneously, anti-American Iranians in Iran's government were looking towards their elections in February 2004 while the White House, trying hard to demonstrate its strength in national security, was looking towards their elections (including for President) in November 2004. Each side could use an 'enemy' to bolster their perceived strength with the electorate. Neither side wanted to be seen as giving concessions to the image of the enemy that they had helped to create. Consequently, disaster diplomacy's failure can be insidious, actually harming diplomacy rather than being neutral. Iran's desire to keep disaster diplomacy off the agenda meant that high level connections between Iran and the US faltered.

That approach can harm not only diplomacy, but also dealing with disaster. As Kelman (2012) describes, with lingering memories of the failed 2003 earthquake diplomacy, Iran declined an American offer of aid following the February 2005 earthquake which killed hundreds. Iran stated that the country could handle the disaster domestically, even though aid was accepted from Algeria, Australia, China, Japan, the United Arab Emirates, and several international organizations. Disaster diplomacy became a spectre to avoid at all costs - even at the

cost of humanitarian aid.

The fundamental conclusion from disaster diplomacy is that saving lives is not necessarily important for political decision-making. That is not an innovative or surprising result. Instead, that is a fundamental basis for politics as also seen in climate change diplomacy with the absence of an international, legally binding, enforced treaty which makes substantive contributions towards climate change mitigation and adaptation (see also Helm 2012).

Explaining disaster diplomacy's failure

Given this evidence and analysis, is there any hope for disaster diplomacy, especially for climate change? In one ethical system, extensively debated but followed by many humanitarian relief agencies including the International Federation of Red Cross and Red Crescent Societies, disaster-related activities must be conducted neutrally and impartially, irrespective of political distractions such as diplomatic disagreements. In theory within this ethical system, climate change would be dealt with separately from politics - clearly an impossible ideal to achieve (e.g. Arnall et al. 2014). Many others do not accept that ethical framework, instead recognising that all disaster-related activities including those related to climate change, are inherently political.

In terms of disaster diplomacy including climate change diplomacy, since few successes are seen, a question emerges about whether or not disaster-related activities (including dealing with climate change) should be deliberately used to induce or force cooperation amongst adversarial states? Both possible answers manifest (e.g. Anderson 1999; Ferris, 2011; Fox 2001; Hannigan 2012). Some who claim "no" believe that extensive effort occurs to divorce disasters from politics, such as through neutrality and impartiality. New mechanisms for relating disasters and politics are not needed. Instead, encouraging further separation is preferable. Some who claim "yes" explain how disasters are inherently political and suggest that is naïve to think otherwise. According to this argument, the more positive outcomes from disaster-related activities which could be fostered, the better meaning that such outcomes should be actively pursued.

Given these disparate opinions, converging on the answer "it depends", why does disaster diplomacy enjoy such a high profile, including through climate change diplomacy, especially in the media after a major catastrophe?

As an example of a climate-related situation, the media and humanitarian organizations tried to push drought diplomacy during the Eritrea-Ethiopia war from 2000-2002 (Kelman 2012). The suggestion was that Ethiopia needed food aid due to a drought and that aid could be offloaded using Eritrean ports and then sent to Ethiopia overland through Eritrea. Eritrea agreed, but Ethiopia declined, extolling numerous excuses for why aid should not go through Eritrea. Two examples are Ethiopia's claim that Eritrea would siphon off aid before it reached Ethiopia and that it was more efficient to use non-Eritrean ports, with Ethiopia suggesting that Eritrea wanted the food aid and the business for the ports rather than to help Ethiopia. The charges are not necessarily unfounded since Eritrea struggles with corruption and does need income (Desta 2006) - but that does not necessarily mean that selfishness was the only driver of Eritrea's offer. Fundamentally, both sides felt that they could win the war and so preferred to avoid drought diplomacy - or any form of diplomacy.

In contrast, popular desire can overcome high-level diplomatic hesitancy. From the 1950s to the 1990s, Greece and Turkey were at diplomatic loggerheads with frequent threats of a violent conflict. Within three weeks in 1999, earthquakes hit Turkey and Greece respectively, leading each country to give extensive support to the other and sparking off a media and grassroots frenzy to put aside historical grievances and to help each other during the times of crisis (Ker-Lindsay 2000, 2007). Yet the Greek and Turkish governments had actually been moving towards reconciliation since around 1996 (Mavrogenis and Kelman 2013). Then, the Kosovo war earlier in 1999, before the earthquakes, pushed that agenda forward significantly (Ker-Lindsay 2000, 2007). Until the earthquakes, the diplomats were moving carefully and slowly. They were caught off-guard by the post-earthquake populist demands and it nearly derailed the rapprochement process, partly by losing control and partly by providing a target for detractors. Fortunately, both countries were able to look beyond disaster diplomacy and to stay together on their slow diplomatic track which continues to yield dividends.

These case studies, and others (Kelman 2012), yield bleak prospects for hope regarding climate change diplomacy. In many instances, there is active effort to disaster diplomacy, as with Ethiopia-Eritrea and, described earlier, Cuba-USA. In other instances such as Greece-Turkey and, described earlier, the 2004 tsunami, disaster diplomacy

has strong prospects, but in the end contributes limited value to successes witnessed. Climate change being one hazard amongst many which affects locations facing conflict may not yield anything different to suggest that there should be more hope for disaster diplomacy emerging from climate change.

That is especially the case given that international climate change negotiations commenced in 1995 and still have not yielded substantive results. With disaster diplomacy, a quick fix is sought to solve all disaster and diplomacy problems rapidly. Quick fixes for fundamental human conditions rarely succeed, with climate change being a solid example given that climate change is effectively driven by consumption desires which have proven challenging to tackle (e.g. Ehrlich and Ehrlich 2013). Instead, long-term measures are needed, building and maintaining confidence in peace and in dealing with disasters alongside hazards such as climate change.

Nonetheless, a fundamental tenet in research is that “absence of evidence is not evidence of absence”. Disaster diplomacy case studies so far yield an absence of evidence for disaster diplomacy’s success. That cannot rule out future studies identifying a successful example of new diplomacy based on only disaster-related activities, either from history or in the future. Many possible examples have not yet been thoroughly investigated, so they are undecided regarding disaster diplomacy. As an example with implications for climate change, Dinar et al. (2008) found that variability in precipitation and runoff did display a tendency to increase cooperation surrounding international waterways in some instances, although their analysis did not drill down significantly into prior conditions or root causes. Nonetheless, it provides some hope that climate change affecting weather and weather variability has the potential for supporting cooperation.

In fact, no matter how unsuccessful disaster diplomacy seems to be now in most instances, based on published research, the option always exists of actively pursuing disaster diplomacy, irrespective of the drawbacks and the chances for failure, rather than passively sitting back and watching. What are the prospects for climate change diplomacy in terms of climate change related mobility as a disaster diplomacy case study?

Climate change related mobility as a disaster diplomacy case study

Creeping environmental changes (alternatively called creeping environmental phenomena and creeping environmental problems) include desertification, salinization of water supplies, and climate change (Glantz 1994ab). They significantly impact all spatial scales and frequently cross borders, making them useful cases for disaster diplomacy. Examples are droughts in southern Africa from 1991 to 1993 (Holloway 2000); human-induced changes to the Aral and Caspian Seas (Glantz 1999); and the impact of precipitation changes on Fouta Djallon, the headwaters in Guinea from where the Niger, Senegal, and Gambia Rivers start. Lessons, mirroring other disaster diplomacy work, include how early warning for long-term threats would not necessarily positively impact the diplomatic situation and how a useful form of cooperation with respect to creeping environmental problems occurs through scientific and technological processes, such as basic research and operational forecasting. Additionally, transboundary issues can become prominent even when bilateral or multilateral relations are not the overriding influence on the political or environmental situation.

Contemporary climate change is a global creeping environmental change for which much is caused by anthropogenic influences, namely emissions of greenhouse gases and land use changes such as deforestation (IPCC 2013). The vast majority of emissions have come from larger and more affluent countries (e.g. the Australia, China, India, the UK, and the USA) while much of the land use changes are witnessed in less affluent countries even where activities such as rainforest destruction occur primarily to serve consumer demand in the richer countries (Butler and Laurance 2008). The impacts of climate change affect the entire globe, including the countries which have contributed most to the problem and have the resources to address the problem. In contrast, island countries and communities have not contributed much to any drivers of contemporary climate change, even when size is factored into account such as by looking at rates by GDP or per capita (IEA 2009; Roper 2004), and have limited resources to address the problem.

Yet many of these islands, most notably communities on low-lying coasts, are under severe threat from climate change related sea-level rise, which results mainly from ocean water expanding as it warms up but also with a small component from melting ice from glaciers and polar ice sheets (IPCC 2013). As one example, residents of the Carteret Islands of Papua New Guinea have already left their homes and moved elsewhere, seemingly due to sea-level rise (Connell 1997). Other island communities such as in Alaska are planning moves inland, as they

face increasingly rapid coastal erosion, partly occurring because less ice on the ocean permits more severe storms to occur (Bronen and Chapin III 2014; GAO 2003).

Sea-level is not the only challenge which low-lying island communities face from climate change. Freshwater resources are becoming increasingly taxed in places such as the Maldives, Kiribati, and Barbados (e.g. White and Falkland 2010; Yamamoto and Esteban 2014). The combination of reasons varies depending on locations, with some influences being local and some being non-local. Examples of factors are modern waste contaminating water supplies such as battery acid leaking into groundwater, increasing use such as when showers and flush toilets are installed in communities, sea-level rise and storms salinising freshwater lenses under atolls, increased evaporation due to higher air temperatures, and changing precipitation regimes influencing run-off and freshwater storage.

Linked to freshwater resources is the challenge of food. Climate change is altering environmental variables to the extent that ecosystems are undergoing significant changes on land, in the water (fresh or salty), and in between (e.g. tidal). As with water, the ecosystem changes can sometimes be a result of local or non-local factors not related to climate change, such as harvesting or hunting by locals or non-locals, but there is little doubt that climate change nonetheless represents a major factor in the witnessed changes (e.g. Mercer et al. 2012; Pelling and Uitto 2001). As ecosystems change, food systems change, whether that be alterations to the soil and freshwater influencing livestock, agriculture, and freshwater aquaculture, or ocean changes influencing ocean food resources, e.g. fish and molluscs, and saltwater aquaculture. In some cases, the changes might bring a food boon, but more often, traditional food knowledge is undermined, it becomes harder to manage local food resources sustainably, and hunger along with nutrition deficiencies become more common, increasing reliance on food aid in the short-term and food imports in the long-term.

Coral reefs are a crucial island ecosystem which is most likely to be severely affected negatively by climate change (Anthony et al. 2008; Pandolfi et al. 2011). Warming oceans have been linked to major coral bleaching events leading the large-scale mortality of the corals. Where the warming is temporary, the corals can recover. Where the warming is permanent, recovery is not thought to be likely. Simultaneously, it is unclear how coral reefs will respond to oceans becoming increasingly acidic. Sea water absorbs some carbon dioxide from the atmosphere leading to the formation of carbonic acid and a drop in the ocean's pH which can degrade the coral reefs.

The death of coral reefs could present a major challenge for islands under climate change through coastal erosion not linked to sea-level rise. The corals attenuate wave energy, day-to-day and from storms, which permits sand and shingle to accrue along low-lying island shorelines. Rising seas reduce that attenuation affect and dying corals might obliterate it completely. That might force many island communities to migrate much more rapidly than would be necessary if just considering sea-level rise. While freshwater and food potentially have solutions, such as desalination and crop shifting keeping in mind that they might be expensive or not wholly effective-dealing with coastal erosion might present a challenge which, over the long-term, is neither technically or socially feasible, suggesting migration as the only option for the affected island communities.

Irrespective of the debate of whether migration represents adaptation or a failure to adapt, countries that might need to move their entire population elsewhere due to sea-level rise include Kiribati, the Maldives, and Tuvalu. Such action would require negotiations with other countries over where they should move to and on what terms. The issues which would need to be resolved include locations for resettlement, who would pay for movement and resettlement, and the laws and norms which would govern the people, such as territorial and jurisdictional issues (Gerrard and Wannier 2013; Yamamoto and Esteban 2014). Therefore, this is a relevant case study for disaster diplomacy from creeping environmental changes.

The practicalities of resettling islanders

If decisions are made by or for an island settlement that moving is necessary, then the timing of the migration needs to be decided. Should the islanders move immediately, or as soon as reasonably feasible, rather than waiting until it is necessary to move because the environmental changes are starting to have major impacts? Would it instead be more straightforward to make a clear and definitive decision for moving, perhaps rather rapidly, after a catastrophe has hit, such as a community experiencing widespread flooding? Waiting for a disaster incurs a substantial risk of fatalities along with losing tangible and intangible assets, such as photographs and cultural heritage.

The discussion of catastrophe indicates one problem with longer-term planning: a disaster could manifest at any time forcing more rapid evacuation than is being planned for. A medium in between the two extremes could be considered, such as planning to leave as soon as possible after a catastrophe looms or occurs. The latter nonetheless risks people dying and the loss of intangible assets.

After the timing for moving has been determined, then the climate change diplomacy elements manifest since a location needs to be selected for the settlement. The negotiations over the place to which the islanders will move would be expected to include an element of the sovereignty or autonomy which the resettled islanders would have in their new location. A clash of sovereignty interests could occur in that the islanders' feel that they should have the right to decide if they wish to continue being sovereign while sovereign states naturally have their own right to continue exercising sovereignty over their current land. Few recent precedents exist of a sovereign state being ordered by the international community to give up some land without, at minimum, mutual consent regarding a negotiation process. An example is an arbitration panel demarcating post-war borders, as occurred for the Eritrea-Ethiopia disaster diplomacy case study.

The topic of sovereignty is important to consider now (see also Gerrard and Wannier 2013; Yamamoto and Esteban 2014) because many of the islanders, quite rightly, do not wish to give up sovereignty even if they must resettle. McNamara and Gibson (2009) describe how some diplomats from Pacific island countries are concerned that international discussions might be trying to force them to give up their countries' sovereignty if their peoples must move due to sea-level rise. Keeping sovereignty, but more important ensuring that the islanders retain the right to choose their own sovereignty pathway, might be the aspect that generates the most conflict and therefore becomes relevant to climate change diplomacy. It might even preclude any positive outcomes, demonstrating the main disaster diplomacy conclusion so far that other factors tend to dominate any humanitarian imperative in dealing with disaster, which in this case is the impacts of climate change.

Complications arise in determining to what degree resettled islanders have the right to keep their culture, justice system, language, education system, and identity, whether sovereign or not. The act of migrating naturally changes culture irrespective of the migration process. The islanders might seek islands which are similar to their original homes, yet more secure - a major difficulty since all low-lying areas will experience similar climate change impacts. Meanwhile, many prospective candidates, such as New Zealand's Kermadec Islands or Australia's Great Barrier Reef islands, are already designated - often protected by law - as scientific sites, tourist resorts, or protected areas for environmental or cultural reasons.

While major cultural changes need to be expected, major parts of the islanders' governance and culture might have the potential for being retained despite resettlement. These could be justice systems, currencies, and education systems, since many jurisdictions do not follow national law for all such matters. There is, therefore, the possibility of retaining some level of self-governance and culture, irrespective of resettlement, even recognising that there must be some changes, so the full culture and governance from the original island community could not be retained. Cooperation and compromise between the migrants and the host community/country or the governing country would be necessary - even where the newly settled land is previously uninhabited.

The Spratly Islands in the South China Sea do not have a permanent human population, yet indicate further climate change diplomacy concerns in that six countries are involved in land and sea claims: Brunei, China, Malaysia, the Philippines, Taiwan, and Vietnam. In addition to being sites of strategic military importance, there is hope that the islands or waters around them have fossil fuel and fish resources. None of the claimant countries is likely to easily rescind their claims, so even if one of the countries offers their claimed islands to evacuated islanders (perhaps to try to fend off other claimants or perhaps to try to gain a resource extraction/sharing agreement with the settlers), then that could lead to major conflict with the other claimant countries opposing the settlement of the islands.

An alternative to using existing land would be creating new land. The Spratly island of Layang Layang was artificially created by Malaysia through filling in the shallow sea between two reefs in order to create a tourist resort. Dubai constructed the Palm Islands for a residential and leisure area. Since islands are being built for profit, should resources be allocated to build islands for saving a people, an identity, and a country? Islands could be built which are similar to the islanders' original home islands but which would survive sea-level rise and other climate change impacts. That might be for shoring up existing islands or creating new islands in the island country's territory. The Maldives has started this approach, building the island of Hulhumalé, which is attached to the island of Malé's airport, in order to provide homes and community for people who wish to live around

the capital city area. Alternatively, islands could be constructed in entirely new areas. Kardol (1999) details some legal issues of building artificial island states. Even more difficult, with the potential of being even more legally contentious, would be creating large mobile islands which would sail or drift around the world's seas as mobile sovereign states.

The Montevideo Convention (1933) describes the duties and rights of sovereign states. Article 1 defines a state according to having four criteria: "a) a permanent population; b) a defined territory; c) government; and d) capacity to enter into relations with the other states". Mobile states indisputably possess a), c), and d), but a drifting island could potentially be challenged as a state for not having b). A mobile territory could still be a "defined territory" or, since the state's ocean territory is continually changing, it might be argued as being a "changing territory". Opening accepted international conventions for even small changes is usually fraught with difficulty, because the signatories are worried that bigger modifications will then be proposed, so it would be up to the international legal system to judge any cases and thereby set a precedent.

For constructing territory, many other questions remain. Who would pay for construction and maintenance? How would territorial disputes be resolved, such as territorial water ownership from the construction of static islands and the use of marine resources around mobile islands? Could a culture and a state be viable in a mobile setting or is human culture too dependent on fixed land? Would lessons from nomadic peoples be helpful in establishing mobile island states? For islanders not used to nomadism, significant cultural changes would result as a consequence of trying to create mobile island states.

Questions also remain regarding the abandoned islands. If an island country is entirely evacuated, but the islands are submerged only at the highest tides, who owns the fishing and mineral resource rights in the surrounding seas? Could those rights be sold? Do the answers to those questions change if a sovereign state is disbanded rather than re-created on new territory? Such questions are just starting to be explored, but few answers emerge, with the lack of parallels and precedents (cf. the Sovereign Military Order of Malta) also inhibiting analysis. Gerrard and Wannier (2013) investigate the legal intricacies of territorial concerns, displaced people, and legal accountability emerging from low-lying island states which might need to move as a result of climate change. They provide a toolkit of options, but understandably, none can really be satisfactory for the affected islanders, even if they are the reality. Yamamoto and Esteban (2014) explore the availability and practicality of legal options for low-lying island states under different climate change scenarios. Again, the options are unpalatable yet must be examined.

Despite the reality of this situation and the strong potential for climate change diplomacy, few sources have asked the pertinent questions or sought practical solutions. Even though a clear opportunity exists to create climate change diplomacy, through amity and friendship across borders in the oceans, a usual disaster diplomacy failure is witnessed with no substantive reconciliation appearing. That might yet occur, especially at the international level, but the prospects appear to be bleak.

Climate change diplomacy and migration in practice

This topic of disaster diplomacy from the creeping environmental change of sea-level rise due to climate change, amongst the other influences of climate change, is not unique to islands. Many coastal settlements could suffer similar displacement for similar reasons. Although non-island coastal settlements have an 'inland' to which they can move, some islands also have that option, especially larger hilly islands such as St. Lucia and Guam.

Yet that would still result in significant changes, both for the people who must move and for the people already living inland. As well, people in countries such as Bangladesh might need to - or prefer to - cross borders, namely to India, rather than moving inland within Bangladesh (see Stojanov and Duží 2012a). There are analogies for some of the islands, since customary land rights can prevent movement inland as much as international borders. For many Pacific islands, almost all the land is owned according to tradition (Chapelle 1978), so acquiring some of it for resettlement of coastal peoples, such as on Fiji's largest island Viti Levu, is not straightforward (Clarke and Jupiter 2010). Extensive negotiations and a change in traditional culture would be needed - as intensive as negotiating with other countries for resettlement.

In both the island and mainland cases, disaster diplomacy consequently becomes invoked with the questions and challenges quite similar between the low-lying communities in islands or in places such as Bangladesh. As is evident from the preceding discussion, all this is known. The expectation of migration from these locations due to climate change is well-established, as is the potential need to cross borders or to re-settle on already owned land. Yet there is a basic assumption that these processes will proceed without problem, that somehow when migration occurs, some form of climate change diplomacy will manifest and people will be able to resettle without problem.

Disaster diplomacy work so far demonstrates that this assumption is poor. Without any evidence for successful disaster diplomacy so far, little reason exists to expect climate change diplomacy for migration to succeed. Entirely precluding the possibility would be erroneous; there is a chance that migration from island communities would yield the first successful disaster diplomacy case study so far. With climate change diplomacy so far not being successful, relying on its success for migration might be overly optimistic.

Instead, the reality appears to be that of other forced migration case studies involving environmental influences (e.g. Forced Migration Review 2008): significant action will be taken only once people are forced to migrate. Rather than planning ahead, it appears that islanders forced to migrate due to climate change will suffer the same squalor which so many other have been forced to suffer through temporary shelters and temporary social accommodations because those with the power and resources to prepare in advance actively chose not to do so.

Would there be any way to learn from the past in order to try to prepare for this migration beforehand, while balancing it with the need to expend too many resources in case the migration does not manifest? It appears not. Many island politicians have been raising these concerns since the topic first became politically prominent at the Small States Conference on Sea Level Rise, held from 14-18 November 1989 on Malé, the capital of the Maldives³. Much of the work and declarations from 1989 remain relevant today, suggesting that little changes have resulted, despite plenty of science being published on the topic since then (e.g. Arnall et al. 2014; Gerrard and Wannier 2013; Yamamoto and Esteban 2014).

As with other disaster diplomacy case studies (Kelman 2012), it seems that for climate change diplomacy and migration in practice, real action will be taken only once a migration crisis manifests. Little interest exists in trying to enact diplomacy on the basis of potential migration and little diplomacy is likely to manifest in the face of a crisis. Instead, as with the majority of migration crises, a modicum of aid will be provided once people have migrated and the people affected will suffer in the short-term and then in the long-term as they aim to rebuild their own lives without adequate external support.

4. Lessons and Conclusions

This chapter has reviewed the disaster diplomacy case study of potential migration due to climate change with a focus on small islands. The analysis suggests that this case study will not produce anything different from other disaster diplomacy case studies, so climate change related mobility is a relevant disaster diplomacy case study but is not likely to produce significant results. That conclusion emerges despite the fact that islands, despite their small populations and often remote locations, will create significant inter-state and intra-state resettlement challenges should populations be forced to move due to climate change. International and internal relations can be severely impacted, with the potential for conflict resulting over resettlement locations and land rights.

It is particularly unfortunate for two reasons that little has been achieved at the political level to think in advance of any potential migration crisis. First, a persistent theme in examining this case study is that the migration discussion applies beyond climate change and has precedents, both climate-related (e.g. Nunn et al. 2007) and volcano-related (e.g. Lewis 1979). In fact, island communities have been moved and rebuilt, sometimes involving the evacuation of entire islands or consideration thereof, for a variety of reasons, including tsunamis such as for Aceh with communities being rebuilt on the same island (Kenny 2007), perceived economic viability such as residents of St. Kilda being told to abandon their community (Steel 2011), and criminal charges such as child abuse on Pitcairn Island which raised questions about the community's viability (Marks 2008).

³ For details see <http://www.islandvulnerability.org/slr1989.html>

The second reason that it is unfortunate that so little planning has been pursued and that so little political buy-in exists is the large amount of multi-disciplinary science available on this topic. Disciplines which have examined climate change migration from islands include geography, law, development studies, political science, and migration studies. Dozens of books, special journal issues, and stand-alone papers have been published in the last few years, in addition to decades of prior work going to back to El-Hinnawi (1985) and earlier. Knowledge regarding the topic from multiple sectors exists, but is not being acted upon by those with the power and resources to act.

Of particular importance regarding islander migration in the context of climate change is that climate change discussions do not always fully highlight that migration has always been a life strategy for islanders (e.g. Hau'ofa 1993; King and Connell 1999). Islanders - as with many other peoples - have throughout their history often moved for numerous environmental and social reasons, including responding to short-term and long-term environmental changes, responding to short-term and long-term social changes, education, joining family, adventure, and seeking different or improved livelihoods. The migration is sometimes entirely voluntary, sometimes entirely forced, and most frequently somewhere along the voluntary-forced continuum, exactly as it has been throughout history (Dickinson 2009; Nunn et al. 2007). Despite this long history of migration by islanders for various reasons, that is no justification for forcing islanders to move due to contemporary climate change, since climate change is caused largely by outside forces. The key is having the choice to migrate or not and having the resources to successfully carry out that choice.

Climate change is not in itself a new threat to island communities, but it does have a strong potential for compounding the challenges which islanders face. Additionally, it impacts inter-state and intra-state relations. That is, contemporary climate change in itself does not engender new migration situations which have not appeared before, but climate change migration is a real and present concern which ought to be considered before a crisis manifests. That is unlikely to happen. Disaster diplomacy emerging as climate change diplomacy in the context of migration from island communities remains an option, if decisions are made to pursue that option in advance of a crisis. Unfortunately, thinking ahead of disaster regarding forced migration due to climate change is not likely to occur.

3. CLIMATE AND MIGRANTS IN BANGLADESH: THE FUZZY NATURE OF ENVIRONMENTAL MIGRATION

In a background of social vulnerabilities and exposure to risks, climatic stresses and shocks, including extreme weather events, threaten people's lives and livelihoods (IPCC 2012). While global environmental change in general enhances disaster and impoverishment risks, it is also expected to almost certainly alter human migration patterns in the coming half a century (Foresight 2011). These projected changes warrant a new look at the environment-climate-migration nexus, a much debated idea over the past three decades. Studies projecting staggering figures of climate change-related migration (Tickell 1989; Homer-Dixon and Percival 1996; Myers 2001) have been criticised for their thin empirical basis and inadequate research methods. Instead, researchers have offered a more nuanced view and explained migration as more of a 'survival strategy' with a broad spectrum of causes and consequences, influenced by a set of socioeconomic and political factors (Black 2001; McGregor 1993). Projections suggest that a large part of such migration will be in the Global South, within countries or to nearby countries, including to areas of environmental risk (Foresight 2011).

In this context our study is set in Bangladesh, a country that has gained attention in the above studies as a one of the most vulnerable to climate change. The country is noted for its high population density, high levels of poverty as well as gradual onset climate-related stresses and sudden shocks, including water shortage, cyclone, floods and coastal/ delta erosion (Agrawala 2003). During 1991 -2010, it was among the top 10 countries in terms of exposure to extreme weather events (Harmeling and Eckstein 2012).

In this chapter we explore the linkage between experience of climatic stresses and shocks, perceptions of risk involved in staying put or moving out of places exposed to hazards and the process of migration itself. Then the logical question is to what extent migration is influenced by climatic hazards and the way people weigh risks involved in staying put or moving out. As it deals more with ambiguous ways in which people attribute their migration to the above causes, our research methodology is mainly qualitative data analysis.

The key research questions addressed in the paper are:

a) To what extent the experience of climatic stresses and shocks and perceptions of hazard risk influence villagers' migration decisions in Bangladesh?

To set the background for this question, we take a close look at the context of climate-related migration in Bangladesh. That leads us to a supplementary question:

b) To what extent are the existing migrations patterns in Bangladesh sensitive to climatic stresses and shocks?

In this chapter, the second section that follows this introduction outlines the theoretical framework of our research. The third section describes the methods we used and the fourth looks at the broad migration patterns in Bangladesh and their climate sensitivity. The fifth section examines how people make decisions to stay put or move out of their places and how such decisions are influenced by their experience of climate change and variability and perceptions of the severity of risk. Finally, in the light of the above findings we explore what are the best policy measures to incorporate changes that acknowledge migration as an effective adaptation strategy in the face of climate change.

Theoretical framework

To understand the phenomenon of climate-related migration, we use an integrated approach, in which environmental factors are considered alongside non-environmental influences such as socio-economic and cultural factors and people's perceptions of climate risks and attitude towards the process of migration itself. An integrated assessment includes modelling and other procedures across disciplines, sectors and scales, and representing key interactions and feedbacks (Parry et al. 2007; Black, Kniveton and Schmidt-Verkerk 2011). In terms of migration related to climatic stresses and shocks new research shows that climate primarily influences drivers of migration through overlapping environmental, demographic, political, social and economic pressures and opportunities (Black et al. 2011a; Foresight 2011).

To understand the process of migration decision-making this chapter draws from the behavioural framework, and is influenced by the new economics of labour migration theory (Stark and Bloom 1985) and acknowledges the decision-making process involved in migrating for change (Wolpert 1965). However it moves more towards recognizing the importance of socio-cognitive variables that influence people's motivation, and their decision-making patterns under uncertainty. A growing body of research has shown the importance of the socio-cognitive variables of climate risk perception and perceived adaptive capacity as key determinants of the adaptation decision making process. In this paper the theoretical approach follows Grothmann and Patt (2005), Smith et al. (2010) and Kniveton et al. (2011). These studies built on the concepts in the Theory of Reasoned Action and the Theory of Planned Behaviour.

The Theory of Reasoned Action (Fishbein and Ajzen 1980) proposed that the proximal cause of behaviour is 'behavioural intention', or a conscious decision to engage in a certain kind of behaviour. Making up this behavioural intention is the attitude toward the behaviour and the subjective norm (defined as the belief about a significant other's expectation that one performs the behaviour, and the motivation to please this person). By adding the parameter of perceived behavioural control, Ajzen (1991) modelled the Theory of Planned Behaviour. It included perceived behavioural control, conceptualised as the expected ease of actually performing the intended behaviour. Drawing from Grothmann and Patt (2005), Kniveton et al. (2011) further developed the process-based understanding of decision making with reference to climate-related migration. The latter tested the Theory of Planned Behaviour in an agent based model to simulate future large scale migration behaviour. Such an approach promises a better understanding of societal behaviour, the multi-causality of migration decisions (Foresight 2012) and the complexity and uncertainty involved in making them (Beratan 2007).

We argue that by including attitudes toward migration behaviour, the societal and subjective norm around climate and migration and the perceived behavioural control of migration (as well as the beliefs that make up these components) the Theory of Planned Behaviour can unpack the migration decision-making process. The intention to perform a particular behaviour is treated as a direct antecedent of the behaviour in question, driven by individuals' perceived behavioural control, attitude towards the behaviour, and subjective norms. Attitudes represent an evaluation of the perceived consequences of behaviour and likelihood of outcomes, whereas norms can be thought of as socially accepted standards conveyed by peers, family, community or society (Leviston et al. 2011).

Methods

We adopted a qualitative approach in our research as it offers a closer look through an attitudinal and psychological lens – a peep into people's own perceptions about their vulnerabilities (Miller et al. 2010), livelihood options before them, and the decision-making process involved in staying put or moving on across different stretches of time and space.

The first step in our research comprised a literature review covering two broad themes, climate change and variability, and migration. On the basis of the literature we traced the broad migration patterns in Bangladesh and tested their likely sensitivity to climate variability and change. To further understand how climatic factors affect livelihoods, three districts of Bangladesh were selected on the basis of their exposure to different climate-related stresses and shocks and environmental change. These include drought, floods, cyclones, salinity intrusion and riverbank erosion.

In the first district, Chapai Nawabganj in the northwest region of Bangladesh, four villages in Nachole and Shibganj sub-districts (upazilas) were chosen for the study – two drought-prone highland villages and two villages on



Figure 3.1. Map of Bangladesh with sub-districts (upazilas) covered by our research (by Pedram Rowhani)

were selected. Four of them are flood-prone villages on the river Padma, two of them facing the additional risk of riverbank erosion as well; and the other two villages, on the banks of the river Dholshwari, are also low-lying flood-prone places (see map in Figure 3.1).

The field research conducted during April - July 2012 involved focus group discussion in 14 villages spread across the three hazard prone study districts and 24 in-depth interviews with men and women who have experienced climatic stresses and shocks and/ or migration. The questions focussed on how livelihood, disaster, environment and migration patterns changed over the past 30 years – and the way people perceived changes in these factors. We probed to what extent migration, a socially acceptable behaviour, is shaped by experiences of hazardous events and perceptions of future risk. Based on our theoretical model, we tried to explain how the decision to migrate is mediated by a set of ‘behavioural factors’ that assesses the efficacy of different responses, their socio-cultural acceptance and the ability to respond successfully.

Migration patterns and their climate sensitivity

Historically Bangladesh has seen migration of different forms across time and space on different spots along the forced-voluntary continuum. Migration can be forced - displacement - over short distances, or voluntary - 'economic' - migration from villages to cities, across the border to India, on short or long term contracts to other parts of Asia - Gulf countries or Malaysia - or to western countries such as the UK. Such movements usually follow existing migration routes aided by social networks that recruit and support new migrants with advice, resources and facilitation.

Livelihood shocks, homelessness and internal displacement on account of disasters are common in Bangladesh (IPCC 2012; Zaman 1989; Hutton and Haque 2004; Alam 1994; Chhabara 2008). People often cultivate and live on re-emerged stretches of char. A set of laws and a traditional peasant-landlord system, however, effectively wrest control over accretion land and deprive poor people (Zaman 1989). Claims and disputes are decided upon by considering the local use of the land stretch. Land gained by accretion is annexed to adjoining property, but submerged and re-emerged land does not go back to the owner. So the system often works to the benefit of established land owners, not marginal farmers who lose land (Hutton and Haque 2004).

Disaster-related migration is often short-term and historically involved short distances (Laczko and Aghazarm 2009), 88 per cent of migrant agricultural communities in Bangladesh remaining within two miles of their previous residence following the flooding, erosion and loss of homes (Zaman 1989). Often people migrate to slums in cities like Rajshahi, Khulna, Chittagong and Dhaka. Such movement need not necessarily happen soon after the disaster. Environmental shocks and stresses disrupt or limit opportunities for livelihoods and cities offer better opportunities for income generation.

Climate extremes lead to livelihood stress (IPCC 2012). In the context of Bangladesh, disasters affect over 50 million people every five years on an average. The coasts face a severe cyclone roughly every three years, and a fourth of the country gets flooded in annual monsoon rains (Alam and Murray 2005; ActionAid 2012). Cyclone landfall usually occur in early summer (April-May) or late rainy season (October-November) On an average, a severe cyclone affects the country (with 26-34 per cent inundation area) every three years (GOB. 2009). Bangladesh is also highly prone to flooding due to its flat topography with only a third-of the total land 5 m above sea level, and a huge annual average flow (1,350 billion cubic metres) from the Ganga-Brahmaputra-Meghna basin (World Bank 2010). The worst flood in recent times occurred in 1998, inundating 61 per cent of the country rendering an estimated 45 million people homeless (Alam et al. 2011). In 2007 Cyclone Sidr displaced 650,000 people; two years later cyclone Aila hit the country with more destruction (Akter 2011). While the flood of 1998 caused damages and losses of over \$2 billion worth approximately 4.8 per cent of GDP in agriculture, infrastructure, and industry/commerce sectors (World Bank 2010), Sidr caused damages and losses of \$1.7 billion, or 2.6 per cent of GDP, about half in the housing sector, followed by farms and infrastructure (ActionAid 2012).

The Himalayan rivers that flood Bangladesh also bring huge loads of silt to Bangladesh, changing the contours of river banks, forming new stretches of shores and islands called *chars*. The dynamic river flow patterns sometimes lead to erosion of large stretches of river banks, changed course of the rivers, destruction of farmlands and submergence of farms and common lands and homesteads. Hotspots of such changes include Sirajganj, Chapai Nawabganj and Munshiganj districts. About 2,000 to 3,000 kilometres of riverbanks face erosion annually, making 4.3 million people who live in the chars vulnerable. Annually this process reshapes about 9,000 hectares (ha) of mainland and 5,000 hectares of char and renders 60,000 people landless. Two-thirds of the inhabitants of the Jamuna-Brahmaputra floodplain have experienced such displacement at least once, about 17 per cent thrice and 15 per cent 10 times (Hutton and Haque 2003). People migrating into and out of *chars* (riverine islands made of silt) is a significant form of movement (Haque 1997; Hutton and Haque 2004). Due to changes in river flow, sedimentation and flood patterns riverbanks can shift several metres and sometime kilometres at a time, as our field research in Chapai Nawabganj and Munshiganj shows (Martin et al. 2014).

Studies suggest that there has been a steady flow of people from villages to cities – accounting for two-thirds of total migration in Bangladesh. While village-to-village movements accounted for a tenth of total migration, overseas migration formed 24 per cent (Afsar 2003). More than 80 per cent of income in some villages come from outside the village, with families spending part of the year away (Toufique 2002). Research suggests that internal migration contributes to growth, temporary migrants in Dhaka remitting upto 60 per cent of their earning to family back home (World Bank 2009). A 1600-household survey in northwest of Bangladesh found that 19 per cent of households of different income levels migrated in the lean farming season (Hossain et al. 2003). In both cases, it can be argued that migration contributes to resilience in the points of origin of the migrants.

Studies suggest that rural to urban migration is showing an increase over past four decades, thanks to increasing economic activities in big cities, especially Dhaka, and limited livelihood opportunities in rural areas. Village households have seen a decline in farming income from 59 to 44 per cent between 1987-1988 and 1999-2000 with remittances contributing up to 49 per cent of household income (Afsar 2003). Studies put the annual figure of rural-urban migration in the country at 500,000 (Islam 2012). Inequalities in land distribution and exposure to natural hazards – and subsequent livelihood stresses have also contributed to internal migration to urban areas (Planning Commission 2010). Dhaka's slums, home to 3.4 million people, see about 400,000 migrants arriving each year (World Bank 2009).

Migrants often join the informal economy – often pulling rickshaws, hawking – in cities like Dhaka, where it employs or supports about 2 million people (Kreibich 2012). During the pre-harvest season of food scarcity (September to November) and underemployment called *monga* men and boys often migrate to cities. In 2007 over a third of poor households from greater Rangpur in Sirajganj district migrated on account of *monga*. At least 100,000 people migrate each year from here alone (Khandkar 2012). Such migration is widespread, especially in the drought-prone north-west, from where people often migrate anticipating droughts and seasonal famine (Ramasamy et al. 2007).

International migration from Bangladesh takes three main forms. Cross-border migration to India, migration on short- or long-term contracts to Gulf countries or to Malaysia or longer term movement to European countries, especially the UK, and to the US. India and Bangladesh share 4,096 km of land border and cross-border mobility predates these countries' existence as nation states due to historical links and social network of kinship, marriage, religious affinity and also livelihood opportunities. During the British period landed gentry from East Bengal migrated to Calcutta, while plantation workers moved from Uttar Pradesh in India to Sylhet region of Bangladesh, and "unskilled workers" migrated from Orissa and South India to the urban East Bengal. Agricultural workers migrated from Greater Mymensingh and Sylhet in Bangladesh to Assam in India and railway workers from Maharashtra and Bihar of India to different parts of East Bengal (Martin et al. 2013).

The partition of British India in 1947 was accompanied by large-scale movement of Hindus and Sikhs to India and Muslims to the newly created West and East Pakistan (today's Bangladesh). Following large-scale violence, it was one of the largest refugee flows in history. India's 1951 census recorded 2.523 million refugees from East Bengal (Hill et al. 2005). The 1971 liberation war saw 8 to 10 million refugees moving into India temporarily (Library of Congress 2012). There has been continuous flow of migrants to India since, with for example, the Census of India 2001 counting 3.7 million migrants from Bangladesh (Sarkar 2010), most notably to the states of Assam and Tripura partly due to disasters, scarcity and land degradation (Reuveny 2008; Swain 1996). Farakka barrage over the Ganges in India has contributed to erosion and water stress in Bangladesh (Swain 1996; WARPO 2006). Our research suggests villagers in the border areas of Bangladesh often moved to India for work and trade. Interviews in Chorpka and Durlogpur of Chapai Nawabganj, suggest that such migration was common till 1995 when India tightened border control (Martin et al. 2014).

Though cross-border migration possibly has come down, international migration in general seems to be increasing with about 400,000 to 500,000 workers migrating abroad every year (Planning Commission 2011), though it is unaffordable for poor families that form the majority in villages (Black et al. 2011a). Migration that way is an escape route out of poverty. Bangladesh is the 6th largest recipient of remittances (World Bank 2011), that accounted for about 2 per cent globally and 11 per cent of it in South Asia in 2008. Even during the global financial crisis in 2009 remittances in Bangladesh grew by 24 per cent. Remittances account for 11 per cent of the GDP (Ratha et al. 2010).

International migration is multifaceted. Migrants, mostly from the Greater Sylhet area have joined transnational communities in the UK, the US, South East Asia and West Asia (Gardner 2009). The Gulf countries began to attract migrant labourers during the 1970s. Malaysia is another preferred location of the migrants. Remittances often boost the local economy like in the case of Jalalgaon in Sylhet, where construction and the service sector attracts migrants from elsewhere in the country (Gardner 2009). In turn, migration in such places is often driven by high investments in land, along with reduced land holding size and profitability (Kuhn 2003). Migration patterns are complex, often influenced by a set of economic, environmental, socio-political and demographic factors (Martin et al. 2013).

Our study traces the economic, environmental, social, political and demographic influences on the drivers of migration (Foresight 2011). Rural people, especially the poor, move during the lean season to cities where more informal economy jobs such as rickshaw pulling and garment industry work are available (Afsar 2003). While early

settlers in cities tend to be people with good income and housing independent of their village roots, a second wave comprises people who moved on account of deterioration of village livelihoods and security (Kuhn 2003; Gardner 1995). It follows that migration is an escape route from limited opportunities and poverty. In Manikganj district, where 48 per cent of the families are landless, for instance, less than a third of men are engaged in farming, with about 27 per cent of male migrants working in garment factories and welding workshops or as labourers abroad (Rao 2012).

Though migration is primarily an economic choice, often there is an environmental/ climate angle to it. Livelihood pressures are often exacerbated by climatic stresses and shocks. Or environmental / climate changes sometimes make movements necessary. In Char Nalsonda, a riverine island affected by erosion, the local people resort to short- distance, circular migration when land changes as a result of erosion or accretion of new land. "When a char is lost to the river, people resettle on other chars or on the mainland. When land re-emerges, the original landowners and others will gradually return" (Leine 2000: 124).

Migration into cities are for livelihood, but still such movement is often influenced or triggered by hazards and changes in the environment (Leine 2000; Martin et al. 2014) Such rural-urban migration is often an important coping strategy for villagers, especially after sudden climatic shocks; and migrants share information and resources with would-be migrants through social networks. Slower processes like growing water stress and climate variability also reduce agricultural productivity, driving rural-urban migration. In the northern drought belt comprising Rangpur, Gaibandha, Kurigram, Nilphamari, boys and men migrate to cities and better-off villages for work during the lean season of September (Siddiqui 2009). Frequent cyclones are one of the main drivers of migration. Mehedi (2010), for instance, found that after the cyclone Aila in 2009, many people moved to other towns due to lack of working opportunities in the affected areas. More than half the migrants said they had to move out because they had lost houses, belongings and land. Extremely poor people were forced to migrate because they had lost their opportunity for daily income.

Climate sensitivity of migration is also influenced by demographic patterns. In a country with one of the highest population densities in the world at 1,156 people per square kilometre (CIA 2013), the poor are often forced to live in more marginal low-lying areas that are vulnerable to flooding and storm surges (Paul and Routray 2011). As farming get affected, coastal cities such as Khulna are likely to receive more migrants from villages too, even when net migration to the coast is slower than in many other countries as the lower population growth rate in coastal areas indicates (World Bank 2010). Dhaka floods could be even worse in future with models predicting a wetter future for Bangladesh (IPCC 2007b) and an increase in the city's population fuelled by its growth (Braun and Aßheuer 2011). Though demographic patterns differs other cities prone to water-logging, including Khulna and Chittagong are exposed to the risk of people moving into hazardous environments.

However, tracing the interconnectedness between the different drivers of migration and their sensitivity to climate change and variation is tough. Gray and Mueller (2012) showed that flooding is not a strong driver of the long-term mobility, unlike crop failure, a combined effect of late or untimely rains, and an extreme rain event that follows. Such extreme events are becoming more frequent in the Indian subcontinent (Goswami et al 2005; Rajeevan and Guhathakura 2007).

There are regional differences in migration patterns: on account of development and possibly climatic patterns. Coastal Bangladesh, for instance, is witnessing lower levels of population growth compared with the central regions of the country (BBS 2011). Marshall and Rahman (2013) suggest that it could be due to migration from the coastal area in general, where the economic growth is slower, compared with inland urban areas. Climate-related stresses including water scarcity and salinity and a comparatively increased exposure to floods and cyclones, could also play a role in migration out of coastal areas (Marshall and Rahman 2013; Khan et al. 2013). Our analysis points at a trend of comparatively lesser population growth in the coastal belt exposed to salinity ingress and storm surges. A northward moving salinity line as a result of sea level rise could make the environment even worse (World Bank 2010). Amid such changes, it is likely that more people migrate or people migrate for longer to earn and contribute to the resilience back home. Emerging research suggests that migration is an important adaptation strategy for people to cope with/ adapt to climate change and such migration is likely to increase (Barnett and Webber 2010; Foresight 2011).

In short, it is a grainy picture in Bangladesh with short-term internal migration and displacement appearing to be the most climate sensitive. Rapid-onset disasters lead to temporary displacement to nearby areas as people lack resources to move farther, and many like to return and reconstruct their homes (Piguet et al. 2011). While longer distance and duration migration is less sensitive to increased climate threats it is still affected by changes in livelihood opportunities and the ability to migrate.

Experience of climatic stresses and shocks, perceptions of risk and migration decisions

People we interviewed across all the three study regions said that they could perceive that their climate is changing – this is marked by hotter days, more uncertain rain and water stress. (Martin et al. 2014). All the three regions studied reported irregular rainfall patterns over the past decade. In general the seasonality of rainfall has changed and the amount of rain received in a season appears to have reduced, the villagers noted. ‘Unpredictable, ‘irregular’ and ‘decreased’ are the common terms used to describe the rainfall trends of late. In the villages of Satkhira villagers said that salinisation of water sources and soil –due to floods, cyclonic storm surges and changes in river flow patterns – makes drinking water scarce and farming and, in some extreme cases, aquaculture difficult. In Satkhira all the respondents in the interviews felt that the frequency and/or intensity of cyclones have increased. There were two major disasters in the past five years – Sidr and Aila. Cyclone Aila of 25th May 2009 was the most devastating disaster that villagers had seen. It caused a storm surge that inundated huge tracts of farmlands that still remained saline and unproductive.

Floods are a constant threat that the people reported in Munshiganj and Chapai Nawabganj. Most of the interviewees here felt that the 1998 flood was the worst calamity that they had witnessed. Riverbank erosion is a current and future threat in Munshiganj and parts of Chapai Nawabganj. It makes the impacts of floods even worse. Loss of land is common, leading to loss of livelihood. A 65-year old villager in Munshiganj said: *“I have experienced erosion four times in my life. First in 1990, followed by 1998, 2004 and 2007. I have lost my 165 decimal cultivable land including my homestead... In the past I used to cultivate my own land, but now I am a landless farmer and work in others’ land as a sharecropper, sometimes as a day labourer. The river was 5 miles away from my current home 20 years ago, now it is only 100 meter away.”*

The stresses and shocks described above often made people in the study areas expect environmental conditions to worsen in the coming decades. There is widespread concern about future climate shocks and stresses – especially increased flooding, river bank erosion, and salinisation of water resources. The respondents also felt that the frequency and/or intensity of cyclones have increased in the last few decades (Martin et al. 2014). There is a pessimistic outlook on some of the places, especially in Satkhira district, where frequent cyclones and floods seem to dampen the development prospects. However, most people do not acknowledge such a direct link between hazard risks and a shift from farming livelihoods.

At the same time the respondents appreciated the risk involved in migrating to unfamiliar destinations. Most of the migrants interviewed explained that they could not take their family to destinations due to uncertainties of migrant conditions, the seasonality of migration, and social norms that required women are taking care of home and children. A labour contractor noted three reasons for women to stay back, namely safety risks, social and religious norms and affection to village. Migration to a new destination is seen as risky as migrants usually do not get any formal support and they could end up living in slums and shanties exposed to flooding and other hazards. So migration decisions, as we describe below, often involve weighing the risks involved in staying back in a natural hazard-prone, less remunerative place and in moving into a place that offers better income prospects, but involves uncertainties in terms of services, security and possibly hazard exposure as in the case of urban destinations prone to floods.

Though income generation appears to be the main driver for migration, this desire is set in the context of increasing climatic stresses and shocks, livelihood pressures (Martin et al. 2014). Following up on the section that lists the environmental beliefs, we categorize the behavioural factors involved in migration decision-making broadly into four: a comparative assessment of the benefits and costs of different livelihood choices (behavioural attitudes), the way people see how they could change their lives (migration control beliefs), make decisions, be innovative and influence others (behavioural personal norms); and the extent to which the migrants trust and get influenced by family, friends, peers and those in authority (social norm beliefs).

An examination of behavioural attitudes show that migration decisions are made to ensure a better livelihood – at times they have a direct or indirect link with climatic stresses and shocks, but not always. They can be deliberate, rational choices, sometimes made in a context of climatic stresses and shocks. However government policy, as well as market and business conditions play a role in setting the context for migration. On the whole, migration comes across as an example of the agency of migrants. Some of the reasons that people gave for migrating illustrate this diverse motives: *“...for ensuring constant income...”; “...it is not induced due to climate change events [such as Cyclone Aila] but effects have deeper influence...”; “My eldest son migrated 20 years ago when erosion occurred first time...”; “...the mill was permanently closed. Thus we lost our livelihood”. In some*

cases people express helplessness. "...Riverbank erosion is destroying my land. Cyclone Aila destroyed my trees and resources. Now I do not have any resources."

Even under such grim circumstances, migration often displays a certain can-do spirit. Perceived adaptive capacity, or an individual's belief in his or her own ability to change things within available resources, is as important as objective adaptive capacity, or what can actually be done (Grothmann and Patt 2005). An analysis of migration control beliefs shows that the respondents tend to believe that their success or failure is determined by factors outside their control. 'It is all in God's hands', is how the villagers often put it. However, the planned and calculated adaptive actions taken by them, especially migration, suggests that they have a sense of control over their destinies. The belief that disaster occurrence is in the hands of God does not prevent them from taking preparatory and remedial action. The literature says that faith does not stop people from taking preventive and preparatory action in the face of disasters (Alam and Collins 2010).

A look at behavioural personal norms indicates that although migration is considered something novel in comparison with what the migrants' ancestors did for a living, it is not considered a particularly risky or unique venture. Despite all the risk involved in new destinations – including insecure tenancy, lack of basic amenities and in some cases hazard risk such as exposure to urban floods – there is a 'business-as-usual' sense to migration.

Together these responses suggest that migration decisions are made independently and the migrants are open to new livelihood options and moving to new places. However, the decision-making usually involves a process of consultation with family members, relatives, neighbours and people with prior experience of migration. An example could be the narrative of a 55-year-old woman head of a household: "*Once a neighbour advised me to send my daughter abroad. He had also sent his daughter abroad.... Finally I agreed.*" The migration decisions and actions showed a high degree of trust in social networks, suggesting a strong set of social norm beliefs. Usually information of migration was provided by local people who also work outside village, family members, relatives or their friends. Mostly resources came from family members. For our interview question dealing with social norm beliefs the respondents said that they trusted their fellow households the best, many respondents declaring 'complete' trust in them. NGOs and the National government came next in the trust factor. As a young man informed in Chapai Nawabganj: "*My nephew informed me about the ferry business pattern in Chittagong. He told me that profit depends on the basis of region or locality.*" A 30-year-old man in Munshiganj said the information of migration was provided by "Relatives at grandpa's home" on "*price of land, available working opportunities etc.*"

Conclusions

Our qualitative research gave a clear sense that people are diversifying and changing their livelihoods. While their fathers were farmers and fishers, young men are migrating to become shrimp cultivators, vegetable vendors, rickshaw pullers, toy-sellers and casual labourers. Migrants are ready to access diverse roles in the same year – and in cities it is easy to find jobs. People see migration as a strategy to increase income – but it is also working as an effective adaptation strategy to offset the impact of climatic stresses and shocks. People's belief in this regard is in line with earlier studies elsewhere that showed that households often diversify livelihoods by sending one or some of the household members away to work – for different durations – and thus reduce their vulnerability to climatic shocks and stresses. The link between experience of climatic stresses and shocks as well as perception of risk to migrations, however, is not always clear, straight or coherently attributed. We acknowledge that climatic systems and human cognition and their mutual interactions are both complex and replete with uncertainties such that the concept of an environmental or climate migrant is an a fuzzy identity for many who migrate.

However, on the basis of the data and insights gained from this research we argue that in a range of time and space combinations migration is working as a time-tested coping and adaptation mechanism. Migration decisions are strongly influenced by perceptions, beliefs and cultural and social norms. People often return to their places of origin despite limited livelihood options and safety risks there. Clearly people perceive that climatic stresses and shocks across Bangladesh are increasing. Set against a background of socio-economic vulnerabilities and exposure to risks, they threaten people's lives and livelihoods. As this research highlights, along with local-level adaptation, migration of one or a few members of the household increases the opportunity of people to adapt to climatic and other stresses. Therefore, traditional views that perceive migration as a problem need to be replaced with more positive attitudes of support in terms of increased training for potential migrants to maximize their migrations.

As the migration trends and people's experience of hazards as well as perceptions of risk show there are some apparent ambiguities involved on the reason that people give for their movement. In some cases while moving out of hazardous places, people do not seem to attribute their migration to the environmental or climatic hazards, but to the need to earn better. This is often the case even when climatic stresses and shocks have a direct impact on livelihoods. These apparent contradictions are beginning to be addressed in cognitive anthropology and social neuroscience. New research probes the ways in which people make decisions in complex environments with uncertainties – in terms of climate, environment and livelihood – typical of our study area in Bangladesh (and many other parts of the world). These new framings reject rational decision models of behavior, placing more emphasis on how the human brain functions (Beratan 2007). In these revised understandings, rather than viewing decision making as a purely linear process involving problem definition, delineation of alternatives, and a choice of responses, it is conceptualized as an activity that involves a single pathway emerging from non-conscious cognitive processing. In this process the first steps of decision making involves an idea of a desired outcome (or avoidance of an outcome) arising from the priming of past experiential learning and social discourse. Priming effects arise from a variety of sensory inputs, including verbal and nonverbal human communication and environmental events such as those described above. They are key to the selection of a single pathway from an abundance of potentially relevant stored patterns (Beratan 2007).

The role of social discourse plays an important role in dealing with inherently complex decision-making environments in which multiple social, economic, political, demographic and environmental obstacles and opportunities present themselves. In such a conception, a variety of socially constructed storylines interact with an individual's processing of past experience mediated via priming effects and cognitive biases to produce a preferred behaviour choice to achieve (or avoid) a particular outcome. When asked to explain a decision, an individual may then construct a logical rationale for the decision and consciously reflect on their perceived ability to achieve this behavior. Importantly, the variety of storylines and past experiences amongst individuals from different locations and with different genders can explain why different relationships between climate concern, experience and migration behavior are observed.

Our research shows that migration decisions are strongly influenced by perceptions, beliefs and cultural and social norms. People often return to their places of origin despite limited livelihood options and safety risks there. The cultural aspects of adaptation and migration require better understanding – especially to frame policies that help communities adapt to climate change in ways that they want. Current policies do address the need for international migration, but often implicitly discourage internal migration, seeing it as a failure to adapt within the rural system. Such a bias can restrict migration and trap poor and vulnerable people in risky environments.

Instead, migration should be seen as a time-tested coping and adaptation mechanism and supported by interventions such as advice and skills training for better-paid and formal sector jobs. National and international adaption funding mechanisms can facilitate this process. Meanwhile steps are needed to understand, model, forecast and disseminate information on climate change and variability and their impacts. For example, Bangladesh's existing disaster early warning systems should be extended to cover longer time scales and the information produced effectively communicated to local people. Supported largely by family ties and informal social networks, migration works as an effective adaptation strategy. However the migrants often end up living in slums, exposed to hazards such as floods. The government should take steps to ensure that seasonal and long-term migrants get better support in terms of safe infrastructure, adequate housing with a clean and hygienic environment, healthcare and children's education. Options could include engineering solutions to environmental stresses and shocks, opportunities to diversify livelihoods in-situ and to migrate or get resettled in a new place if necessary. The needs and safety of those who prefer to stay back, especially women, children and the elderly, also have to be addressed.

4. EXPERTS' PERCEPTION OF CLIMATE CHANGE AND MIGRATION. COMPARATIVE ANALYSIS OF BANGLADESH AND KENYA

The following analysis is based on a field survey which was conducted in two target regions: East Africa, specifically the northwestern part of Kenya (western area of Turkana Lake, Lodwar and Kakuma), in 2007, and South Asia, where the research was concerned with Bangladesh (Khulna and Barisal districts) and the Indian state of Assam (Guwahati surroundings) from 2008 to 2009. The predictions for climate change trends vary by region (and depending on the model used and the set of data). However, in a number of studies (see above) the fact that Bangladesh and India are among the most affected countries comes up, mainly because of the large number of people and their civilization pressures on the environment and natural resources. The reason for the choice of the field investigation in northwestern Kenya was the announced impacts of climate change on the lives of local nomadic tribes (such as Planet Ark 2006a, 2006b; KNMI 2006). At the regional level, global climate change manifests itself differently, especially in the distribution of precipitation and the rate of warming. For the target area of this study - Kenya and Bangladesh – there are distinct trends. While in Southern, Southeastern and Eastern Asia, there is increasing precipitation, whereas the precipitation in North Africa, on the other hand, is decreasing, thereby increasing the risk of droughts (IPCC 2007a).

The empirical part of the research was divided into two parts; the first part consisted of field observations of the social and environmental conditions of the area, focusing on the manifestations of environmental change as a result of increased climate variability and occurrence of extreme weather. The field survey was conducted in February and March in Bangladesh and India. The African part of the field observation took place in February 2007 in Kenya. The aim was to identify major environmental issues as potential sources of migration and to find out people's living standards, including the various strategies that they choose to cope with environmental change, including migration options.

The second part of the research was to have anonymous semi-structured and in-depth interviews with experts who were pre-selected based on a combination of purposive selection and a series of personal recommendations with the so-called snowball sampling method. The respondents were mainly local experts, scientists, employees from both the private and public sector, and employees of non-governmental organizations or international organizations (UNHCR, GTZ, OXFAM). The main criterion for selection of respondents was local knowledge, experience and a realistic idea of the extent of the examined problems of the area.

The interviews occurred in capitals (Dhaka, Nairobi, Guwahaty) and in local centres of both countries (Khulna, Lodwar, Kakuma). Some interviews with experts from Bangladesh and India were realized in 2009 in Kathmandu during an international conference, and one via internet communication - skype (for details see Table 4.1). While in Bangladesh nine interviews were conducted, in India and Kenya seven interviews were made in each place. The lower number in Kenya was caused by long-term instability of security and lack of local experts on the issue. Respondents were also confronted with research studies dealing with the relationship between climate change and migration.

Semi-structured and in-depth interviews are some of the data collection techniques that are suitable for describing processes and phenomena, as understood from the respondent's perspective. In addition to describing the social and environmental reality, the aim was also to determine how the problem is perceived and what position they hold towards it. Through interviews the authors thus obtained a mosaic of views on the environmental problems of the region (Guion 2006).

Table 4.1: List and characteristics of interviewed experts

Expert' code	Country	Expertise	Gender	Location	Sector	Job position
B1	Bangladesh	Anthropologist	F	Dhaka	Academy	Lecturer
B2	Bangladesh	Environment	M	Dhaka	Private	Consultant
B3	Bangladesh	Environment	M	Dhaka	Non-profit and non-government	Director
B4	Bangladesh	Climate change	M	Dhaka	Non-profit and non-government	Research Officer
B5	Bangladesh	Social sciences	M	Dhaka	Non-profit and non-government	Research Officer
B6	Bangladesh	Migration	M	Dhaka	Academy	Director
B7	Bangladesh	Environmental hazards	M	Khulna	Non-profit and non-government	Programe offices
B8	Bangladesh	Migration	M	skype	Academy	Research Fellow
B9	Bangladesh	Development studies	F	Dhaka	Public (government)	Research Fellow
B10	Bangladesh	Regional development	M	Khulna	Non-profit and non-government	Director
IN1	India	Environmental geography	F	Guwahati	Academy	Professor
IN2	India	GIS, Land change science	M	Guwahati	Academy	Lecturer
IN3	India	Population Geography	M	Guwahati	Academy	Reader
IN4	India	Migration	F	Guwahati	Academy	PhD student
IN5	India	Geography	M	Guwahati	Academy	Profesor
IN6	India	Population studies	M	Kathmandu	Academy	Lecturer
IN7	India	Development	M	Kathmandu	Academy	PhD Scholar
K1	Kenya	Climate change	M	Nairobi	public	director
K2	Kenya	Climate change	M	Nairobi	public	research fellow
K3	Kenya	Regional development	M	Lodwar	non-governmental	branch manager
K4	Kenya	Migration	M	Kakuma	non-governmental	senior operations officer
K5	Kenya	Regional development, migration	M	Kakuma	non-governmental	deputy project manager
K6	Kenya	Natural development, migration	M	Kakuma	non-governmental	project officer
K7	Kenya	Environment, agriculture and development	M	Kitale	non-governmental	branch manager

The main research objective of the empirical analysis of this text is to illustrate the phenomenon of migration as a means of adaptation to the impacts of climate change in these regions and to compare them. The main hypothesis argues that environmental change (including climate change) acts as one of the major triggers of the migration processes of inhabitants. The research questions were grouped into the following topics:

- What visible environmental changes in the areas of interest are occurring?
- What are the causes of migration over the last twenty to thirty years?
- What is the role of environmental factors when deciding about migration?
- Where do some selected migrants leave from and what are their main destinations? What are the impacts of migration on the destination places?
- Who are the migrants (socio demographic characteristics)?
- Why do most people stay in the affected areas?
- Does migration work as a coping strategy or adaptation?
- What are the future trends of climate change and migration patterns?

The research activities were carried out in two source regions of migration where an occurrence of climate change and or a variability of seasonal climatic conditions had been indicated (see below for details).

Climate change and Bangladesh

Bangladesh is a coastal country located in the Bay of Bengal in South Asia, an area of 144,000 square kilometers. About 161 million people live there, which creates a lot of pressure on natural resources, as Bangladesh has the highest population density - 1120 people/km² in 2012 (for other details see Table 4.2). In addition, much of the land is located in the delta of the Ganges and the Brahmaputra rivers, and so often during the summer monsoons a third of the country is flooded with water from the rivers. For a country where 45 per cent of the population depends on agriculture (CIA 2013), it means that extreme events such as prolonged drought, extreme flooding, natural occurrence of arsenic in groundwater, and the frequency of tropical storms and their intensity pose very serious risks to the economy and to people's livelihood.

According to Mirza et al. (2003: 315), in the context of climate change the most flood- threatened areas are central and northeastern Bangladesh because of the confluence of the Ganges and the Brahmaputra rivers. Due to water erosion during the annual floods caused primarily by the melting Himalayan snow, the islands in the river Brahmaputra are often flooded. Some islands disappear every year, whereas some appear again and people migrate due to these processes. Not always do islands appear again and the inhabitants of those islands which have disappeared must move elsewhere. According to environmental experts every year about 60,000 to 80,000 people are affected by river erosion in this way (Interview with an expert on the environment 2009). Each year, about 65 per cent of the population of Bangladesh is affected by floods of various kinds. Due to a rise in the sea level and climate change this area is expected to get larger (Islam et al. 1994: 20). According to Webster (2013: 17) floods in the river basins of the Ganges and the Brahmaputra in recent years have driven out about 40 million people each year.

Another problem is the increasing sea level. For example, Bangladesh's southwestern province of Khulna records a sea level rise by an average of more than 5.18 millimeters per year since the beginning of the last century. At this rate by 2050 the sea could rise by a total of 85 cm and could permanently inundate a significant part of the region. A World Bank study on the impact of sea level rise on Bangladesh points to the fact that a sea level rise of one metre by the end of this century will result in permanent flooding of 15 to 17 per cent of the country (22 to 26,500 square kilometers), forcing a gradual eviction of about 20 million people (Shamsuddoha, Chowdhury 2007: 11). Because in Bangladesh itself there will no longer be enough space for them, international migration is to be expected for these people.

Table 4.2: Characteristics of Bangladesh in terms of selected indicators

Characteristics	Bangladesh
Geographical position	Coastal state in South Asia in the Bay of Bengal, a large part of the territory lies in the delta of the Ganges and Brahmaputra rivers that flow into the Indian Ocean
Climate / climate	Tropical monsoon climate, the summer monsoon brings humidity, associated with the regular occurrence of floods and hurricanes
Natural Risk	Hurricanes, tsunamis, flooding of large areas in the rainy season, drought, earthquakes ...
Ecological Formation	Delta of the Brahmaputra river, wetlands, mangrove forests
The main source of livelihood in agriculture	The predominant production of crops: rice, jute, sugarcane, tea, tobacco, etc.
Agriculture is for self-supply and sale.	Bangladesh
The arable land	53 per cent (2011)
Number of inhabitants	164 million (2013), 8th place in the world
Population growth	1.59 per cent (2013)
Population density/km²	1156 (2013)
Net migration growth	-0.52 migrants / 1000 inhabitants (2013)
Median age composition	23.9 years (2013)
percentage of the population living in towns	28 per cent (2010)
percentage of urbanization between the years 2010 and 2015	3.1 per cent (average change per year)
HDI (Human Development Index)	0.515 (2012)
Real GDP growth	6.1 per cent / 43rd place in the world (2012)
GDP / per capita according to purchasing power parity	US\$ 2000 /194th place in the world (2012)
Index of the risk of global climate change⁴	4th place in the world: score 20, 834 ⁵

Source: CIA (2013); World Bank (2013); UNDP (2013); Harmeling and Eckstein (2012) and own calculations

Black et al. (2011a) note that the adaptation strategy of migration from rural to urban areas in response to floods is common in Bangladesh. In 2008 about 22 per cent of households affected by major flooding and 16 per cent of households affected by river erosion moved to cities.

⁴ The Global Climate Risk Index (Index risk of global climate change) analyzes the extent to which individual countries are affected by the impacts of extreme hydro-meteorological events (storms, floods, heat waves, etc.). The table shows the data for the period 1992-2011 (indexes are also processed for each year). The index is cumulative and includes several variables, i.e. the number of natural disasters for the period, loss of life and socio-economic impacts on GDP.

⁵ However, if 1991 was counted, the country would be in first place because of the natural disaster which killed about 140,000 people (Harmeling and Eckstein 2012).

And climate change is seen as the next major triggering factor of migration processes at the global level, including the region of South Asia. Bangladesh is an economically poor country, and although its GDP growth is around 6 per cent per year, roughly a third of the population is below the poverty line (daily income of US\$1.25 per person). It is clear that natural disasters bring damage to property and loss of life. In 2007, the tropical storm Sidr and a five-metre tidal wave destroyed hundreds of villages and killed about 10,000 people in southern Bangladesh (Webster 2013 : 17) and another 40,000 people were injured. About 600,000 people had to be evacuated to humanitarian centres or elsewhere. In addition, many houses, crops and seeds were destroyed, livestock killed and the affected residents were dependent on humanitarian aid for a considerable part of the year and farmers even for an entire year. The total damage was estimated at about 450 million USD. Although the consequences of a hurricane in 1991 were worse and caused the deaths of more than 143,000 inhabitants in Bangladesh, the Joint Typhoon Warning Center - JTWC - reported that for the first time ever two Category 5 storms⁶ were recorded in one season in the region of the northern Indian Ocean.

Environmental factors of migration

Based on respondents' statements and field observations in Bangladesh and India, we identified four basic causes of migration (ranked in descending order of importance):

- economic factors, combined with poverty
- environmental factors including climate change
- demographic and geografic factors
- religious and social conflicts within society

The first three migratory factors are a dynamic set of push factors that may intensify the decision of the population to migrate. These concern the lack of jobs and soil, frequent natural disasters, lack of support at home and relatively high population density. All this combined with the cultural and historical context create the condition for the existence of a so-called "permanent migration atmosphere" in this society at the national and international level. If we look in more detail at the respondents' answers on the environmental factors influencing migration, they state mainly floods and fluvial processes in their list of reasons, as well as hurricanes and tropical storms, and they also mention sea-level rise not only as a potential, but as a current problem.

Regarding flooding and river processes (especially erosion), respondents reported them as the main cause of population migration. An expert on the environment (B2⁷) used the term "river nomads" in the context of river processes. According to him, *"the land along the river is constantly changing, new islands emerge and others disappear, people move from island to island. When some people lose their land, they become migrants. It is one of the main causes of migration to the cities, because if they lose their livelihood, it is easiest for them to go to Dhaka or to another big city"*.

An expert on migration (B6), points to the uniqueness of Bangladesh regarding the influence of river erosion, *"Bangladesh is a unique example of a country where a relatively large portion of the country is subject to water erosion. The rivers flowing from the Himalayas pull down the riverbanks, and people lose land. If people lose their land, it is difficult for them. Some choose the strategy of migration to the cities"*. A specialist on migration (B8) considers water erosion and subsequent loss of housing to be a major cause of migration: *"Southern Bangladesh is prone to water erosion. If residents suffer from it, they lose shelter, work and money. River erosion is simply the main reason for the migration of population from these territories"*.

An anthropologist (B1) mentions the important link of population pressure, which forces residents to settle in at-risk areas where there is flood and river erosion: *"The main causes of migration include flooding and river erosion. Flooding has always been here in the past, as has migration. But the main problem now is that the population has grown at an incredible pace, and river erosion affects the people much more severely than in the past"*.

⁶ This category marks the strongest hurricanes based on scale developed by two organizations - The U.S. National Hurricane Center (created the typology of hurricanes to Category 1-3) a Joint Typhoon Warning Center (created the classification of the typology 4 and 5).

⁷ See the codes in Table 5.1.

The answer of an expert on development (B10) points out the relationship between the environmental factors (floods and river) and migration patterns. She gives an example of a specific community she found in Dhaka. They are temporary migrants, who work for several years in the recycling factory, and after a few years (two, five, ten ...) they return to their remaining family members: *"These migrants are primarily farmers ... They were left with nothing and they do not tell you directly that they are coming because their place of residence was destroyed by the river. They say they are fighting for a better life. After some time they admit that the main reason is river erosion and flooding and that they have lost everything"*.

According to most respondents there are also other environmental causes of migration - natural disasters such as hurricanes and tropical cyclones. In these cases it is mainly a matter of temporary migration, in their opinion. A specific problem is the potential rise in sea levels, which will cause irreversible problems (salinization of water, flooding of the land and homes, the pursuit of economic activities becoming impossible, etc.). In such a situation they believe the only solution is permanent migration.

An expert on the environment (B2) points out that Bangladesh is a low-lying country: *"In Bangladesh, a big part of the land is only very slightly above sea level, maybe a few inches. If a tropical storm hits, it is threatened in its activities over a large area, which includes entire villages"*. A geography expert (IN1) points out the risks of climate change and permanent immigration to India: *"In terms of future trends, one of the major impacts of climate change in Bangladesh will be a rise in sea level, due to which an increase in the number of migrants is expected [to India], because migration for them will be the only strategy for survival"*.

Regarding migration patterns, respondents mentioned rural-urban migration as the dominant trend of migration, followed by international migration. Most international migrants (moving to more distant countries than India and Assam, such as the Middle East) come from the middle and higher classes of society. These migrants have a higher income and education, and make use of the opportunity to migrate from a country that is exposed to natural disasters. In contrast, the internal migrants tend to have lower social status and are economically disadvantaged. Poorer people choose closer destinations such as major cities in Bangladesh or neighbouring India as their strategy of migration. This may be temporary migration, or they may make use of migration networks there and try to settle permanently in the cities or in India.

One expert on climate change (B4) describes the strategy of rural-urban migration, *"When you look at the frequency of natural disasters, one of the consequences is the lack of job opportunities in the countryside. So people migrate to cities in search of employment. Often they will choose to move permanently from one place to another"*.

Summing up the situation in Bangladesh, respondents confirmed the relatively strong migration tendencies which take place for various reasons and have different forms. Generally economic reasons were reported as the main factor (both push and pull). Regarding the patterns of migration, migrants choose both short-term and permanent migration according to the situation and cyclical or seasonal migration is quite commonly seen.

Considering other factors, respondents confirmed the growing importance of environmental and demographic factors influencing migration (often in combination with economic ones, but not completely separable). Some respondents mentioned specific regional factors, such as the fact that the north of the country is dominated by economic factors, whereas in the south of the country there are rather environmental factors. The main environmental factors included floods, river processes, tropical storms, and to a lesser degree drought. The sea-level rise was mentioned as one of the factors that will also grow in importance.

Impacts of Migration

A report from the International Organization for Migration (IOM 2005) mentions streams of migrant Bangladeshis who live near the Assam border and who gather daily at the railway or bus stations of Guwahati (Gauhati), the capital of Assam, in the hope that they will find work on Indian farms or in construction. In this way they make up the biggest daily labour market in the region. Indian officials observe this kind of migration with concern and warn that once these people find work and settle there, they will be followed by their families and settle there permanently. They will then begin to require work permits and possibly food stamps, which entitle the family to get all kinds of social assistance.

Similar concerns were expressed about the environmental and ethnic future of Assam by some Indian experts who were addressed. A geographer focusing on demographics (IN3) draws attention to the fact that *"migrants from Bangladesh have a relatively high birth rate compared with the local population"*. Likewise, an expert on the environment and geography (IN1) draws attention to their *"wood consumption in already significantly deforested Assam or reshaping the land for agricultural activities, causing further deforestation. Thus due to immigrants these areas become more vulnerable to floods, river erosion and residents are forced to migrate to cities or other Indian states"*.

According to the repeated answers of several Indian experts on demography, geography and migration (IN2, IN3, IN4) *"Muslims / Bangladeshis account for a third of the population of Assam"*. If this view is compared to information sources, Livernash (1995: 11) estimates from the mid-fifties to the 1990s between 12 to 17 million people migrated from Bangladesh to India. And that 7 million of these migrants reportedly migrated to Assam. However, data from the Indian census (Census of India, 2001) show from a total number of 26,700,000 inhabitants of Assam (of which 23.2 million live in rural areas and 3.4 million are urban residents) only 164,400 were born in Bangladesh.

It is not surprising that various militarist groups are trying to use these moods to their benefit in order to gain the sympathy of the locals. For example, the well-known United Liberation Front of Assam (ULFA), which has been fighting for the independence of this province in India since 1979, have been recently concentrating their attacks on migrants from Bihar (the poorest Indian state) and also from Bangladesh. Local residents, who do not generally seem too interested in talking about this group, consider them to be Mafia who collect so-called protection money. However, recently Muslim militants who allegedly have bases in neighbouring Bangladesh carried out an attack in Assam. The reason given was the protection of the Muslim population. The people of Bangladesh do not migrate only to India but also to the United States, Great Britain, and of course to the Gulf countries, Singapore and Malaysia, where they mainly seek work, but also education. Estimates from the late nineties speak about three million workers abroad, who annually send more than \$1.5 billion to their country of origin.

Despite all the efforts of Bangladeshi governments and development agencies in the implementation of prevention and adaptation programmes it is highly likely that the population migration to neighbouring India and other countries will continue. This trend was highlighted by a number of respondents. A geographer (IN5) stated that *"in the absence of identification cards [passports, identity cards] in both countries there are no accurate statistics to allow determination of the number of migrants crossing the border every day. [...] The border between the two countries is virtually open due to the large amount of river channels from the Brahmaputra river and its tributaries as well as mountain areas, so residents of both states can move almost freely back and forth"*.

The movement of migrants seeking a new place for living and employment is more complex than in the past. At the beginning of the 21st century, the territory of South Asia is not a sparsely populated area that would be suitable for the mass influx of migrants, as it was a few centuries ago. The largest streams of the population of Bangladesh are moving towards India, with which Bangladesh shares most of its common border. The result is a lack of trust between the local population and migrants. The atmosphere in cities sometimes develops into conflicts (BBC 2012) or other *"environmental degradation due to increasing environmental pressures such as deforestation, land, wood consumption etc."*, as confirmed by a geographer (IN2).

In India's Assam there is a huge lack of good agricultural land and according to a descendant of Bangladeshi immigrants with the addition of the words of a geographer (IN2) *"people whose land has been swamped for several years or decades [because of frequent changes in the flow of the river Brahmaputra during the floods] have to rent land in the vicinity of its extinct island for all that time. Moreover, each year they pay tax to the Government of India for the land under water, so as not to lose their property. They wait for the island to rise again, so they will be able to return to it ..."* and to grow crops there again.

Our field research in the area has shown that Bangladeshis mostly end up back in the areas where the Brahmaputra flows, and are therefore increasingly threatened by water erosion, flooding, loss of land and also to seasonal water shortages. Although Bangladeshis are obviously less well-off than Indians (they often cannot afford to purchase the necessary technologies suitable for increasing the efficiency of agricultural production, such as the construction of irrigation mechanisms) and typically work on not very fertile, illegally occupied and thus far unused land, it seems that their adaptation strategy of migration is successful. This is confirmed by their steady increase in number. Staying at home means experiencing greater poverty for them.

The results of the field research have produced a number of findings. Migration of the population from the present state of Bangladesh (formerly East Bengal or East Pakistan) to India has a long tradition, at least from the time of the British Empire. The declaration of independence of Muslim Pakistan and Hindu India in 1947 gave these streams an international dimension.

In the absence of identification cards in both countries there are no accurate statistics to permit determination of the number of migrants crossing the border every day. In addition, the border between the two states is practically open, and in some places there are just a number of river channels of the Brahmaputra river and its tributaries and mountain areas. Residents of both states can move almost freely back and forth. Paradoxically, all Bangladeshis become permanent residents of India, exacerbating tensions between the two nations.

Weaker tensions manifest themselves through different descriptions of the situation at the border. While Bangladeshis speak of everyday shooting of the Bangladeshi migrants by the Indian armed forces (occasionally backed up by reports in the media), Indians complain about the endless streams of Muslim Bangladeshis flooding the Indian border states of Assam, Tripura and West Bengal.

Climate Change and Kenya

Most of East Africa is characterized by two rainy seasons. The longer period usually happens between March and May, and the shorter one between September and November. Based on climatological measurements and models there was found to be a trend of decreasing rainfall during the 20th century in this area over the two rainy seasons (KNMI 2006). Mutai et al. (2011) reported that in Kenya the temperature is increasing, particularly near large bodies of water. Models up to the year 2050 show an increase in temperature of a range between 1.0 and 3.5 degrees Celsius. According to reports from the area (see Planet Ark 2006a, 2006b and 2006c) Kenya is clearly affected by the negative effects of climate change, as evidenced by the analysis of temperature, precipitation, sea level and climate extremes (for other information see Table 4.3).

Northwest Kenya borders with four countries that are involved in a wide range of internal or international armed conflicts, which creates a very explosive atmosphere in the region. The entire region is very unstable and dangerous, and the Kenyan army does not have it under control according to information from local residents, as evidenced by "protectors" armed with automatic guns in each bus in which we were travelling in the area.

Geographically the region can be characterized as semi-arid to arid, and in recent years it has been struggling with the effects of climate variability which causes changes of precipitation (Shongwe 2011), and the resulting problems are drought episodes associated with a lack of available water. This was confirmed by some of the expert respondents. One of the respondents, a climatologist (K1), said that "*climate change already has direct impacts, reducing the availability of water*". An expert on regional development (K3) mentioned a change, or rather an increase in the frequency of droughts in the concerned region: "*In the past, drought occurred every ten years, in the eighties it was every five years and in the nineties every three years*". Another expert on natural resource management (K6) argues that the impacts of climate change lie not only in the intensity of drought, but also in the fact that no-one knows when it will happen: "*Climate change is manifested in the instability of precipitation; no one knows when it will come*".

The nomadic and independent lifestyle of the members of the local Turkana tribe (population about 500,000) is naturally connected with the natural environment. In the absence of precipitation herders are forced to move into grassed areas inhabited by other tribes and their herds⁸. Otherwise, they risk the death of their herds, which has repeatedly happened in northern Kenya, as confirmed by one of the climatologists (K1): "*Changes in water availability have resulted in the death of herders' cattle*". This is a serious problem, especially on the border with Uganda and southern Sudan due to the fact that the borders of these states are not fixed and the regions in these countries are affected in a similar manner.

The Turkana people also contribute significantly to increasing human pressure on fragile arid ecosystems through deforestation (and the subsequent production and sale of charcoal) and excessive grazing of herds of goats. An

⁸ Nomadism is not considered as migration, but a traditional way of life.

expert on natural resource management (K6) told us that "given the state of the environment in the region refugees living in the UNHCR camp⁹ in Kakuma must not keep any cattle or chop down trees and shrubs in the camp and the surrounding area to a distance of 100 kilometres from the camp. These measures were taken after agreement with the Turkana tribe, local residents, the Kenyan government and international organizations representing refugees. But people from the Turkana tribe have the right to use land in the camp for their cattle as traditional land owners".

Table 4.3: Characteristics of Kenya in terms of selected indicators

Characteristic	Kenya
Geographical position	Coastal state in Eastern Africa, bordering the Indian Ocean. Surface is diverse and consists of lowlands, as well as extensive plateaus and the foothills of the Ethiopian highlands. The river network is sparse, the rivers run only during the rainy season, some dry up seasonally.
Climate	Very diverse: tropical monsoon to arid (north) and mild climate
Natural disasters	Recurrent droughts affecting large areas, local flooding during the rainy season
Ecological formation	Savannas, deserts and semi-deserts prevail, mountain ranges to a lesser extent
The main source of livelihood in agriculture	Tea, coffee, corn, sugarcane, fruit picking. Quite a lot of grazing goats and sheep: meat products, milk. Sale of firewood and charcoal.
Farming is for self-supply and sale	Bangladesh
Arable land	9.5 per cent (2011)
Population growth	2.27 per cent (2013)
Population	44 million (2013)
Population density/km²	73 (2013)
Net migration growth	0.23 migrants/1000 inhabitants (2013)
Median age composition	18.9 years (2013)
Proportion of the population living in cities	22 per cent (2010)
Urbanisation rate between 2010-2015	4.2 per cent average change per year
HDI (Human development index)	0.519 (2012)
Real GDP growth	5.1 per cent / 57 th place in the world (2012)
GDP / per capita purchasing power parity	US\$ 1800 /198 th place in the world (2012)
Index of global change risks⁵	81 st place in the world, score 81.67

Source: CIA (2013); World Bank (2013); UNDP (2013); Harmeling and Eckstein (2012) and own calculations

⁹ According to a statement from an expert K4, it was about 80,000 people at the beginning of 2007.

Environmental factors of migration

For the purposes of detailed analysis of the impacts of environmental change on migration in north-western Kenya, there are very few data and research papers available. Most information sources, however, indicate trends that occur over decades in the form of increased climate variability, manifested by a delayed rainy season or lower precipitation. The delayed rainy season in East Africa in late 2005 and early 2006 resulted in a situation where 11 million people were without food. Child malnutrition reached 30 per cent. The lack of rainfall subsequently caused the deaths in 2005-2006 of half the Turkana's herds (confirmed by the respondents, see above). Conflicts were also reported between tribes due to shared grazing and water resources, especially in the areas of international borders (Planet Ark 2006a, 2006b, 2006c). One of the local experts on regional development (K3) affirmed the necessity of "*herders crossing international borders due to lack of water and pasture for cattle*" in the region.

The fact that traditional adaptation strategies of nomads to drought are already not enough under current conditions was confirmed by an expert on regional development (K3): "*This is not enough any more. The rains are not sufficient for the growth of grass. And herdsman are not ready for this situation, and so they always find themselves in the wrong place at the wrong time. They are so 'lost'*".

Mario (2006) states that even though the late and erratic rains in the arid regions of northern Kenya in the first half of 2006 improved the options for short-term grazing, the delay still caused a lack of basic cereals in September of the same year. In addition, in the Oropom region near the border with Uganda, water scarcity caused conflicts between inhabitants at the border.

Mary Kirkbride (2006) notes that while droughts came regularly every four to five years in the past, currently droughts are becoming the norm and the average period of precipitation an exception. Millions of herders in the region are thus faced with cyclical extreme drought. The rain deficit of the seventies continued until the nineties. Although at the end of the 20th century an increase in precipitation was recorded and projection models showed a continuation of the trend over the 21st century (KNMI 2006), nonetheless the situation from the middle of the first decade of the new century was quite different. According to Black et al. (2011a), many residents of Kenya taking care of lower quality land are forced to diversify their income through migration to find work. For example, in 2004-2005, households with high quality soils had 67 per cent fewer members - labour migrants - than families with low quality soil.

While migration processes in relation to climate change in South Asia are quite evident (in combination with other migration factors) in northwestern Kenya such processes were not recorded on a large scale. This is confirmed by the answer of an expert on regional development (K3): "*The migration of nomads into towns is very limited; they are used to their own environment. They rather settle close to the cities and set up small shops with hand-made products*".

The situation is different in southern Kenya, in the Lake Victoria region, where according to the statement of another climatologist (K2), migration of the population from rural to urban or from flooded areas to higher-lying areas has been recorded, "*Floods have always been here, but they are currently more devastating. However, people usually come back, because in cities there are few employment opportunities and in rural areas there is a lack of agricultural land. ... Because of this there are whole areas of deforestation*".

Research in the field has confirmed some, although not mass, urbanization processes, i.e. labour migration to cities from rural areas or migration of young Turkana people seeking another source of livelihood¹⁰. For these population processes environmental factors of migration combined with economic were identified. However, the issue should be further explored as environmental changes or stress will intensify if current trends of changes in the nature of precipitation persist, and thus will play a greater role than ever before in the lives of local people. Impacts of climate extremes in conjunction with the current political instability in Kenya and local safety conditions create great potential for these areas to become unstable at the national and international level in the near future. It is evidently an important research challenge.

¹⁰ The Turkana people retain their traditional dress even after moving to local towns, which makes them look significantly different to the urban population.

Summary

Factors influencing migration vary from region to region, as shown in Summary Table 4.3; our empirical investigation revealed large differences between Bangladesh and Kenya. Although in both countries the occurrence of extreme natural hazards is identified, only in Bangladesh, where there is high population density, and thus pressure on natural resources, are there relatively frequent migration processes.

With regard to the absence of identification cards in both countries there are no accurate statistics to permit determination of the number of Bangladeshi immigrants in India. However couple of experts confirmed the immigration trend from Bangladeshi to India and they estimated that one third of population in Assam were just people from Bangladesh. This situations starts to give rise to some tensions between the nations confessing different religions.

In Kenya, although there is a risk of repeated droughts and problems with the regular seasonal arrival of the rainy season, residents do not migrate to such an extent. Research has identified a relatively low rate of migration of young men from local communities of nomads into towns, or just cyclical movements according to the existing traditional patterns.

We can expect, on the grounds of the mentioned climate variability and its impacts on local population, some conflicts escalation in the region following to some population changes, including migration.

Research on the relationship between climate change and migration of the population is still an under-researched topic. The concept is still evolving and developing its main outlines, as is the number of empirical studies carried out, which gain in value only after they have been repeated several times and there has been the opportunity to compare the major trends and changes over time.

One of the main benefits of this research is the further empirical confirmation of the growing influence of environmental factors that co-determine migration, and they can become the main reason for migration, on specific circumstances. The text also warns about an accompanying problems which may be caused by intense migration flows.

5. COMMUTING FOR WORK AS ADAPTATION TO FLOOD RISK? THE CASE STUDY OF CZECH HOUSEHOLDS RESIDING IN THE BEČVA RIVER BASIN

Empirical evidence shows that climate change does not behave as a gradual process or as changes in mean climate characteristics, but is strongly connected with a series of climate and weather anomalies exceeding natural climate variability due to moistening atmosphere and a speeding up of the hydrological cycle (Frei et al. 2000, IPCC 2012, Deser et al. 2012). Moreover, according to more detailed statistical comparison, Coucou and Rahmstorf (2012) point out that especially the past decade has experienced an exceptional number of unprecedented extreme weather event occurrences.

For our study we chose the case study of middle Bečva River basin. This rural region remains economically disadvantaged in the context of the Central Europe and the Czech Republic as well as. Moreover Christensen and Christensen (2003) and newly Kundzewicz, Pińskwar and Brakenridge (2013) mentioned the Central Europe were severely affected by floods from the European perspective. Researchers and responsible organizations suffer from lack of data (for instance see Borga et al. 2011: 835-836), especially on the households level located by small river basins.

The impacts of climate extremes on the Morava river (main stem for Bečva River) started to be researched recently by Brázdil et al. (2011) and others, whereas the floods impacts on the Bečva river and its tributaries were almost completely under-researched. Our survey showed that lowest part of the municipalities situated in the floodplain of the Bečva river were affected. Quite significant damages were also caused by the high water table, which flooded cellars of homes farther away from the river - depending on the nature of the terrain and other conditions. To the best of our knowledge no study has so far emphasized the inter-relation between the effects of climate change and commuting for work.

This chapter summarizes findings of two waves of data collection in 22 small and medium-sized regions located in flood-affected areas the Bečva river basin in the Eastern part of the Czech Republic. Data from the first wave were collected November-December 2012 in 12 regions located in the middle reach of the Bečva river (see Table 6.1). The findings of the first wave are summarized by Duží et al (2013) and Vikhrov et al (2014). Data from the second wave were collected in March-May 2013 in 10 regions of the lower reach of the Bečva river (see Table 6.1). We emphasized flood insurance, occurrence and effects of draughts, extreme precipitation and resulting soil erosion during 1997-2012.

This chapter researches various determinants of commuting for work. We attempt to quantify the effects of age, education, marital status and past exposure with floods, among other determinants, on individual decision to commute for work. The purpose of this chapter is to verify the hypothesis whether households affected by climate extremes, primarily floods, commute for work more. We research this hypothesis on households residing in the middle and lower reach of the Bečva river and households unaffected by floods, affected by only one flood or more floods. We further wish to confirm the network effect hypothesis, which conjectures that it is easier to commence commuting once there is already somebody commuting in the family.

This chapter employs the methodology of Vikhrov et al. (2014) to analyze the data from the second wave alone and both waves together.

Effects of climate change on population

The literature suggests that floods are devastating for the well-being of affected communities and companies (Kreibich et al. 2007; Kreibich et al. 2009; Thieken et al. 2007; Yeo 2002). Thieken et al. (2007) find that individual responses to the flood in 2002 in Germany differed greatly across individuals and affected areas. Botzen et al. (2009) find that affected households in the Netherlands differently react to the purchase of flood insurance than unaffected ones and undertake more measures to mitigate flood risk. Masozera et al. (2007) and Morrow and Enarson (1996) find that the socio-economic status plays an important role in individuals' ability to recover from a natural disaster. Those with more wealth can afford faster reconstruction of affected property or get access to insurance. Masozera et al. (2007) find that individual access to transportation greatly reduced individuals' vulnerability to the hurricanes.

The underlying idea behind the survey questionnaire is to research whether individuals affected by floods are different from unaffected individuals in terms of demographic characteristics and economic behavior. In this chapter we emphasize one aspect of such behavior – commuting for work. We think of individual behavior that follows the decision tree described in Figure 5.1.

Given an individual in labor force, she first decides whether to work or not; given her decision to work, she then decides whether to work locally, i.e. within the settlement of residence, or commute to work to a nearby, usually larger, town or city. We employ a broad definition of commuting by not imposing any restrictions on commuting distance.

It should be briefly discussed how the decision steps in Figure 5.1 fit practices of the real life. Given relatively high (in terms of local prices) unemployment benefits in the Czech Republic, some people indeed choose not to work. Next, given better employment opportunities and higher wages in large cities, some individuals choose to commute to work. Since commuting is time intensive, commuters get to spend less time with their families and enjoy less leisure. Therefore some individuals choose to work locally. We therefore trust that this decision tree is quite realistic in this particular case study.

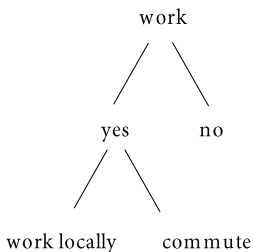


Figure 5.1: Decision tree for an average individual.

The possibility of choice is what makes commuting an economic decision. In this chapter we investigate determinants of commuting to work. The key determinant of interest is the level and intensity of household past exposure to floods. We conjecture that it is related to commuting because floods cause significant damages to household assets and individuals might wish to look for higher paying employment to recover from flood-related losses. Vikhrov et al. (2014) show that the character of this relationship is non-linear: “Individuals affected by one flood commute are by 11.2 per cent more likely to commute, and those affected by at least two floods are by 20.2 per cent less likely to commute; all being relative to unaffected individuals”.

The result points to the existence of the attrition problem of sizeable magnitude: some respondents and their families out-migrate from the risk areas permanently. We are able to identify attrition as an issue, however we do not quantify the magnitude of this problem in this particular study.

Data description

The population of interest is households residing in risk areas of the Bečva river in the Eastern part of the Czech Republic. We stratify the population of interest with respect administrative region and the level of past exposure to floods: badly affected areas (occurrence of at least two floods), moderately affected areas (occurrence of one flood) and unaffected areas (no floods occurred and location within 200 meters from the moderately affected area). Data on distribution of houses across the three risk areas is taken from CHMU (2012). We distribute the total number of interviews proportionally to the population in each stratum. The distribution of interviews across regions is shown in Table 5.1. More detailed description of the sampling frame is given by Vikhrov et al. (2014) and Duzi et al (2013). The survey instrument of the second wave, however, became longer, because respondents were asked about their garden plots, cattle breeding and growing of fruit and vegetable.

This section is written in a way that best underlines discrepancies in observable characteristics between individuals who have not been exposed to floods, individuals with exposure to only one flood and individuals exposed to at least two floods. The latter category includes respondents with repeated exposure to floods, however we are not able to identify more categories due to a relatively small number of observations in each category.

Table 5.1 shows that 602 households and 1570 individuals were surveyed in both waves (October–December 2012 and March–May 2013). An average surveyed family consists of roughly 2.6 individuals, though in wave 1 we encountered families larger in size than in wave 2.

Table 5.1: Distribution of respondents by region.

wave 1			wave 2		
region (obec)	households	individual	region (obec)	households	individuals
Choryně	30	84	Chropyně	48	118
Hrachovec	28	92	Císařov	29	72
Hustopeče nad	12	32	Grygov	30	72
Juřinka	14	33	Ježernice	39	80
Krhová	31	82	Lipník nad	27	70
Lhotka nad	18	51	Plešovec	19	44
Milotice nad	10	30	Rokytnice	31	71
Poličná	32	91	Troubky	20	40
Střítež nad	29	85	Týn nad Bečvou	34	80
Ústí	31	95	Záříččí	21	52
Zašová	31	76			
Zubří	38	120			
Total	304	871		298	699

Table 5.2 summarizes key observable characteristics of individuals depending on their experience with floods. It is easy to notice that individuals aged 30–50 are clearly under- represented in category with at least two floods. The share of males declines with exposure to floods: 50.12 per cent amongst members of households unaffected by floods and 46.57 per cent amongst those affected by at least two floods.

There is also slight variation in education level and employment occupation. Unaffected respondents are more likely to have medium or high level of education (41.1 per cent and 10.69 per cent respectively) compared to the most affected by floods (39.24 per cent and 9.93 per cent respectively). Individuals affected most are less likely to be employed in manual labor and are more likely to be in retirement.

Table 5.2: Summary of individual observable characteristics (in per cent) by category of exposure to floods

variable	no floods	one flood	at least two floods
age[16-30]	14.73	14.6	15.6
age[30-40]	14.49	14.88	10.4
age[40-50]	13.78	15.98	10.4
age[50-60]	15.91	13.5	17.73
age[> 60]	41.1	41	45.86
male	50.12	48.48	46.57
married	64.13	58.81	61.47
educ_low	48.22	52.48	50.83
educ_medium	41.1	38.3	39.24
educ_high	10.69	9.23	9.93
occ_type1	17.58	14.46	11.35
occ_type2	16.15	17.77	15.84
occ_type3	6.18	6.89	8.27
occ_type4	4.03	3.86	2.84
retired	41.33	42.56	46.34
student	5.46	6.89	7.57
unemployed	3.8	3.99	4.92
maternity leave	4.28	1.93	2.6
Total in group, people	421	726	423

One can conclude from table 5.2 that as you move from the unaffected to the most affected category individuals aged 30-50, mostly men with medium or high level of education and employed in manual occupations or entrepreneurs, disappear from the data. This is the attrition problem. We conjecture that the attrition happens due to out-migration of respondents from risk areas.

Earnings and income inequality

When dealing with surveys, information on income and assets is quite sensitive. Such data are usually characterized by a high non-response rate. Respondents are unwilling to answer these income-related questions and often terminate the interview. In this study the response rate to the income question is 41.42 per cent amongst the working age population. Surprisingly, retirees were most open in revealing their retirement income.

Figure 5.2 shows reported income densities for commuters and non-commuters. Commuters make on average more than non-commuters, however their income is more dispersed around the mean.

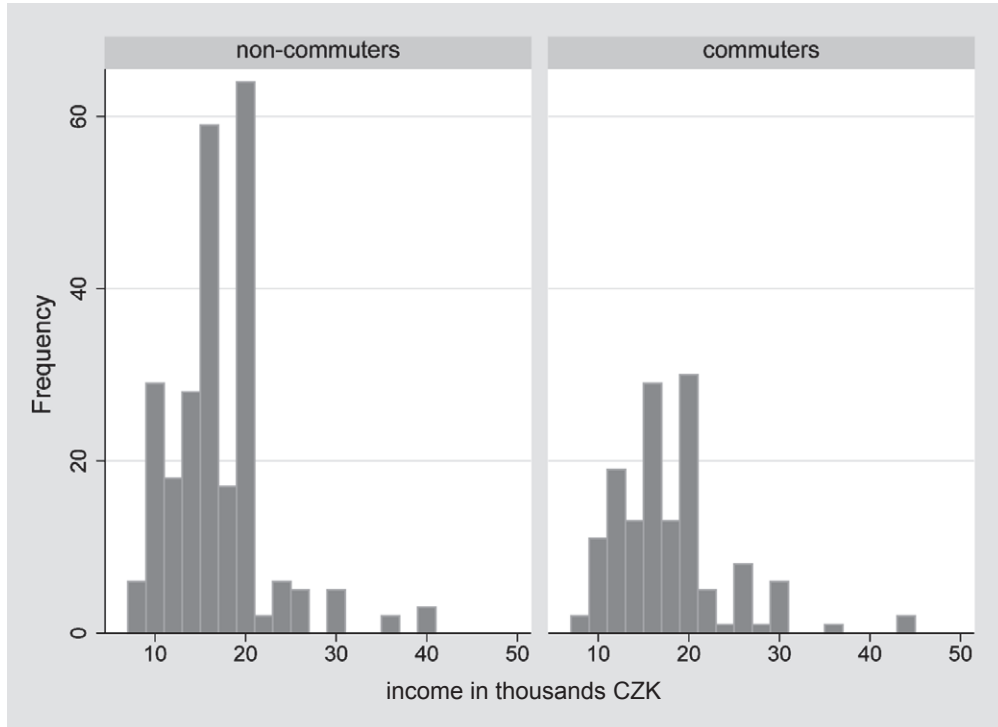


Figure 5.2: Income histograms for commuters and non-commuters.

In the collected sample we computed the Gini index (Dorfman 1979) for the individuals who reported their income irrespective of labor force status (see Figure 5.3).¹¹ Our computed value of 0.23 is slightly below the country level Gini index, 0.26 (OECD 2013). There are several reasons for this gap. Our sample was collected in rural, flood affected areas in the East of the Czech Republic, where the level of economic activity is slightly below the country average. We are also not convinced that our sample provides a picture representative of the overall income patterns of the Czech population. Lastly, as one can see from Figure 5.3 our sample estimate of the Gini index slightly overestimates the Gini index.

To test for the difference in income accounting for individual specific covariates, we estimate the following Mincerian wage regression (Anders and Christian, 2002):

$$\begin{aligned}
 \ln(\text{wage}_i) = & \gamma_0 + \gamma_1 \text{commute}_i + \gamma_2 \text{male}_i + \gamma_3 \text{age}_i + \gamma_4 \text{age2}_i + \\
 & + \gamma_5 \text{educ2}_i + \gamma_6 \text{educ3}_i + \gamma_7 \text{exper}_i + \gamma_8 \text{married}_i + \\
 & + \gamma_9 \text{kids1}_i + \gamma_{10} \text{kids2}_i + \gamma_{11} \text{kids3}_i + \\
 & + \gamma_{12} \text{occ_type2}_i + \gamma_{13} \text{occ_type3}_i + \gamma_{14} \text{occ_type4}_i + D_i' \theta + \mu_i.
 \end{aligned} \tag{1}$$

¹¹ The sample quadratic fit for the Lorenz curve is $\hat{F} = 0.437x + 0.499x^2$, which makes the sample Gini index roughly equal to 0.23.

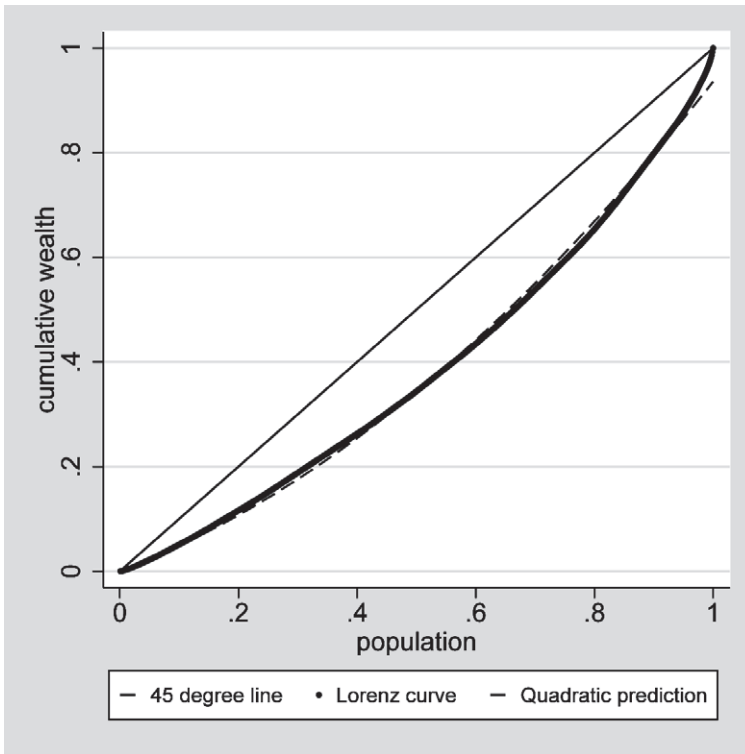


Figure 5.3: Illustration of the Gini Index for the collected sample.

In the above regression $\ln(\text{wage}_i)$ is natural logarithm of reported wage of individual i ; commute_i is a dummy variable for whether a person commutes to work; male_i and married_i are dummy variable for males and married respectively; age_i and age2_i measure respondent's age in years and squared of age; educ2_i and educ3_i denote respective education groups; $\text{kids1}_i - \text{kids3}_i$ are dummy variables for respective numbers of kids; $\text{occ_type2}_i - \text{occ_type4}_i$ are occupation types; D_i are region specific effects which account for the fact that regions might have different productivity levels. Finally, μ_i is a stochastic error term that is assumed to satisfy the classical assumptions (Wooldridge, 2012).

One of the key hypotheses of interest in regression (1) is $H_0: \gamma_1 = 0$ vs. $H_A: \gamma_1 \neq 0$. We estimate regression (1) in two versions: $\ln(\text{wage}_i)$ and wage_i being in LHS. Estimates from the former specification are interpreted as semi-elasticities, whereas estimates from the latter are slope coefficients. Further, we employ two-way clustering of standard errors, by family_id and region_id , to account for correlation of error terms on the family and region levels (Petersen 2009; Cameron et al. 2011). The estimates are shown in Table 5.3.

The estimates suggest that commuters earn 8 per cent higher wages than non-commuters. Alternatively stated, commuters make CZK 1399 (roughly EUR 50) monthly more than non-commuters. Before proceeding some discussion on the endogeneity of variable commute_i seems fit. It is indeed endogenous, because commute_i is a choice variable. Its determinants are not in the RHS of the regression, and hence become part of the error term causing correlation between commute_i and the error term. In the current specification γ_1 measures the difference in mean wages, i.e. the effect we are after. It does not measure the causality – commuting causes individuals to have higher earnings by the estimated amount. For the causality interpretation one would need to use instruments for commute_i .

Table 5.3. Estimates of regression (1). Standard errors are clustered by *family_id* and *region_id*.

	wage			ln(wage)		
	Estimate			Estimate		
commute	1.399	0.797	* 27	0.080	0.041	**
male	4.036	0.819	***	0.222	0.039	***
age	0.829	0.200	***	0.042	0.015	***
age2	-0.010	0.002	***	-0.001	0.000	***
educ2	1.992	0.693	***	0.106	0.036	***
educ3	3.613	0.833	***	0.193	0.038	***
exper	0.033	0.043		0.003	0.002	
married	2.163	0.956	**	0.123	0.046	***
kids1	1.159	0.950		0.054	0.051	
kids2	-0.379	0.695		-0.022	0.044	
kids3	1.216	1.191		0.073	0.060	
occ_type2	2.731	0.859	***	0.166	0.042	***
occ_type3	5.558	0.761	***	0.295	0.038	***
occ_type4	3.352	0.694	***	0.196	0.045	***
cons	-2.853	4.897		1.741	0.325	***
N. obs.	315					
Region FE	yes					

Note: Significance levels: * - 10%, ** - 5%, *** - 1%.

Commuting for work

Since commuting to work or working locally is an economic decision, we wish to learn if and to what extent this decision is affected by individual exposure to floods. The identification of this effect comes from two sources of variation. The first source is the stratification of the population of interest into treatment and control groups. The treatment group are households affected by at least one flood. The control group is composed of respondents not affected by floods. The assignment into treatment and control comes from geographical location. Houses located on hills or further from flood sources are less likely to be hit by rising water. The second source of variation is intensity of commuting before and after a flood event.

We estimate the following regression:

$$\begin{aligned}
 commute_i = & \beta_0 + \beta_1 first_flood_i + \beta_2 second_flood_i + \\
 & + \beta_3 loss_big_ff_i + \beta_4 loss_big_sf_i + \beta_5 cov_more_ff_i + \beta_6 cov_more_sf_i + \\
 & + \beta_7 educ2_i + \beta_8 educ3_i + \beta_9 gender_i + \beta_{10} age30_i + \beta_{11} age40_i + \\
 & + \beta_{12} age50_i + \beta_{13} married_i + \beta_{14} kids1_i + \beta_{15} kids2_i + \beta_{16} kids3_i + \\
 & + \beta_{17} fam_com_i + D_i \beta + v_i.
 \end{aligned} \tag{2}$$

Regressors in regression (2) can intuitively be broken down into three major groups: individual exposure to floods and incurred financial losses, individual employment and family details, region fixed effects.

Variables *commute_i* is a binary variable for whether a person *i* commutes to work; *first_flood_i* is a dummy variable that equals 1 if a respondent was affected by a first flood *prior* to the start of commuting and 0 otherwise; *second_flood_i* is a dummy variable that equals 1 if a respondent was affected by a second flood *prior* to the start of commuting, and 0 otherwise. Variables *loss_big_ff_i* and *loss_big_sf_i* are dummy variables for whether household losses incurred after the first and second floods respectively exceed CZK 50,000 (roughly EUR 2,000). Variables *cov_more_ff_i* and *cov_more_sf_i* are dummy variables for whether insurance covered at least 50 per cent of flood-related losses to individual *i*'s household after the first and second floods respectively.

Variables *educ2_i* and *educ3_i* are dummy variables for whether respondent *i* has complete secondary education or vocational training and Bachelor's degree or above respectively. *gender_i* is a dummy variable for whether a respondent is male and married respectively. Variables *age30_i*, *age40_i*, *age50_i* are dummy variables for respective age groups: [16-30), [30-40), [40-50). *kids1_i*, *kids2_i* and *kids3_i* are dummy variables for respective numbers of kids. Variable *fam_com_i* is a dummy variable for whether any member of the family was already commuting when respondent *i* started commuting. Finally, *D_i* is a vector of region fixed effects which account for the fact that each region is different in economic and geographic characteristics. Under the assumption $v_i \sim N(0, \sigma^2)$ regression (2) is a standard probit model.

One of the key hypotheses of interest in regression (2) is $H_0: \beta_1 = 0, \beta_2 = 0$, $H_A: \beta_1 \neq 0, \beta_2 \neq 0$. We first estimate regression (2) on the subsample of households that were unaffected or affected only once (*i.e.* *second_flood_i*, *loss_big_sf_i* and *cov_more_sf_i* are dropped from the specification). In this case the marginal effect on *first_flood_i* will measure the effect of occurrence of a first flood on the probability of commuting to work (difference in means). Marginal effects are shown in panel one of Table 5.4. We then run the specification on the full sample and show marginal effects in panel two of Table 5.4.

The marginal effects in Table 5.4 confirm two results: after the occurrence of the first flood individuals are more likely to commute to work. This is associated with intentions to cover flood-related losses, because commuting individuals make on average more than non-commuting ones. In wave one respondents commute more on average than respondents surveyed in wave two. When both waves are pooled, the value of the marginal effect is averaged out: after the first flood an individual is by 2.7 per cent more likely to commute. However, those respondents who are subject to the second flood are by 20.2 per cent less likely to commute. This implies that respondents who are unaffected by floods or affected by only one flood are different from respondents affected by two floods. Data description section hints that these groups are different in age, gender, marital status, education and employment details. Further, these two groups are different in commuting patterns.

A logical question at this point is: what drives the difference? We conjecture that poor economic conditions relative to other regions of the Czech Republic cause younger people, particularly medium-educated males aged 30–50, to out-migrate from the risk areas. If these leavers are active commuters – we have an attrition problem.

Further, we confirm the “network effect” hypothesis, which conjectures that it is easier for an individuals to start commuting once there is already somebody in the family doing so. To a large extent it has to do with a decrease in information costs: a respondent is almost by 50 per cent more likely to commute if there is already a commuting member in the family.

Table 5.4. Marginal effects from regression (2)

	panel one			panel two	
first_flood	0.027	0.045		0.027	0.041
second_flood				-0.202	0.048 ***
loss_big_ff	0.015	0.049		0.011	0.043
loss_big_sf				-0.064	0.095
cov_more_ff	-0.087	0.082		-0.088	0.076
cov_more_sf				-0.097	0.079
married	0.033	0.044		0.018	0.035
male	0.051	0.034		0.025	0.027
age30	0.149	0.065	**	0.189	0.053 ***
age40	0.116	0.064	*	0.110	0.049 **
age50	0.063	0.059		0.049	0.047
educ2	-0.040	0.038		-0.053	0.031 *
educ3	-0.041	0.061		-0.012	0.048
kids1	-0.073	0.068		-0.059	0.054
kids2	-0.027	0.058		-0.017	0.044
kids3	-0.027	0.094		-0.005	0.070
fam_com	0.506	0.031	***	0.460	0.022 ***
N		637			495
log-likelihood		-218.99			-256.07
Region FE		yes			yes

At this stage we were not able to find the leavers and ask them if they were active commuters prior to out-migration.

Table 5.5: Numbers of correctly classified cases from estimation of regression (2). Commute equals 1 and work locally equals 0

Classified	True		Total
	1	0	
1	113 (141)	15(25)	128(166)
0	82(81)	285(390)	367(471)
Total	195(222)	300(415)	495(637)

As a measure of goodness of fit we use the percentage of correctly classified cases. For this in Table 5.5 we tabulate the actual data vs estimated prediction from panel one (panel two is in brackets). The percentage of correctly classified 1's and 0's is 80.4 per cent from panel one and 83.4 per cent from panel two.

Summary

This econometric paper introduces one of the possible methodological approaches of examining climate extreme impacts on local populations.

After conducting the two waves of research we can establish two important findings: the relationship between commuting and exposure to floods is non-linear: individuals commute more after the first flood and less after the second flood. Respondents in wave one are more active commuters than respondents in wave two.

If individuals are affected by a first flood they are more likely to commute to work, because they need to cover economic losses caused by the first flood event. On average, these workers earn more money than those who do not commute to work. Individuals affected by one flood are 11.2 per cent more likely to commute, and those affected by at least two floods are 20.2 per cent less likely to commute; all being relative to unaffected individuals.

What causes such a difference? We assume that the main reason rests on the unfavorable economic conditions of the target region, compared with other regions in the Czech Republic. That is why young people, especially men between 30 and 50 years old who finished their education after secondary school, move away from risk regions. We therefore assume that the groups of people who moved away consisted of more active people who originally commuted more often to work than these who decided to stay in the given region. At this stage, we were not able to track down any individuals who had moved.

Further, we confirmed the hypothesis of the “network effect”, which assumes that it is easier for an individual to commute to work if other family members already commute to work. Our results show that respondents are more likely (by nearly 50 per cent) to commute to work if other family members already commute to work.

We can think of two follow-up studies. It would be interesting to research the characteristics of individuals who have permanently out-migrated from the surveyed risk areas. Comparing their characteristics with those of stayers will shed light on the determinants of permanent out-migration. Further, researching the insurance contracts in more detail should unveil a pattern, if any, whether partially settled insurance claims after floods are due to households being under-insured or insurance companies being parsimonious in settling claims.

Table 5.6: Definitions of covariates

variable	definition
<i>commute</i>	= 1 if a respondent started commuting after a respective flood date; and 0 otherwise.
<i>first_flood</i>	= 1 if a respondent experienced only one flood; and 0 otherwise.
<i>second_flood</i>	= 1 if a respondent experienced at least two floods; and 0 otherwise.
<i>loss_big_ff</i>	= 1 if total reported losses after the first flood exceed EUR 2k; and 0 otherwise.
<i>loss_big_sf</i>	= 1 if total reported losses after the second flood exceed EUR 2k; and 0 otherwise.
<i>cov_more_ff</i>	= 1 if the insurance company covered more that 50% of claimed losses after the first flood; and 0 otherwise.
<i>cov_more_sf</i>	= 1 if the insurance company covered more that 50% of claimed losses after the second flood; and 0 otherwise.
<i>age</i>	continuous variable that measures reported individual's age.
<i>age²</i>	age squared.
<i>age30</i>	= 1 if respondent's age is in range (20 30); and 0 otherwise.
<i>age40</i>	= 1 if respondent's age is in range (30 40); and 0 otherwise.
<i>age60</i>	= 1 if respondent's age is in range (50 60); and 0 otherwise.
<i>exper</i>	continuous variable that measures reported individual's work experience.
<i>educ2</i>	= 1 if an individual has complete secondary education or vocational training; and 0 otherwise.
<i>educ3</i>	= 1 if an individual holds a Bachelor's degree or above; and 0 otherwise.
<i>married</i>	= 1 if the respondent is married; and 0 otherwise.
<i>kids1</i>	= 1 if there is one child in the family; and 0 otherwise.
<i>kids2</i>	= 1 if there are two children in the family; and 0 otherwise.
<i>kids3</i>	= 1 if there are three children in the family; and 0 otherwise.
<i>male</i>	= 1 if a respondent is male; and 0 otherwise.
<i>occ_type2</i>	= 1 if respondent's occupation is in the medium-skilled category; and 0 otherwise.
<i>occ_type3</i>	= 1 if respondent's occupation is in the high-skilled category; and 0 otherwise.
<i>occ_type4</i>	= 1 if a respondent is an entrepreneur; and 0 otherwise.
<i>fam_com</i>	= 1 if respondent's family has another commuter who started commuting first; and 0 otherwise.
<i>fam_dist</i>	continuous variable that measures commuting distance (in km) for an individual who started commuting first.
λ_{report}	inverse Mill's ratio, $\lambda = \frac{\phi(\cdot)}{\Phi(\cdot)}$.
λ_{dist}	

CONCLUSION

This book focuses on the relationship between the dynamics of environmental change and migration, which is illustrated in many case studies with particular focus on contemporary global climate change. Based on the analysis of secondary sources and data obtained from empirical studies, the authors conclude that in some regions, environmental changes intensified by climate change act as one of the factors that may play an important role in the decision-making processes of the local population regarding whether to migrate or stay at home. These could thus be perceived as adaptation strategies to these changes. These decision-making processes take place in conjunction with other causes of migration (mainly economic, demographic, social and others), meaning that it is difficult - and not often feasible - to separate the minor and major motivating factors for migration.

In fact, it has been long recognized that changes in the environment can influence human movement patterns and behaviour in different ways in combination with these other factors. A significant body of literature indicates that prehistoric human settlement and migration patterns had strong links to changes in climatic conditions, both shifts in norms and abrupt changes in conditions, although migration decisions were most likely made in conjunction with other reasons similar to today, such as livelihoods, following others, adventure, and fun. That does not deny the influence and impact of contemporary global climate change, but does suggest placing it in context - as long as climate change is still investigated as a motivator and driver of migration.

One example of a serious and often-mentioned climate extreme which impacts societies is floods. River floods have long affected humanity and the projection under climate change is that they will become more intense and more frequent in some locations. Often, seasonal variations will be evident, such as climate change decreasing winter flood frequency due to fewer ice jams and less snow decreasing the volume of spring melt. Since such local trends do not necessarily match global projections, people's migration-related responses to flood risk, perceived flood risk, and actual flooding can be complex. And flood risk is just one aspect which is taken into account by people considering migration and non-migration options. For instance, while flood risk and adaptation have a significant body of detailed theoretical and empirical literature, much more attention and exploration needs to be done regarding droughts.

Considering further weather-related hazards and risks, which are being altered by climate change although not necessarily for the worse, communities are increasingly seeking to apply effective adaptation and coping strategies. That can combine risk analysis, disaster risk reduction, sustainable livelihoods, and resilience buildings - all with their own literature, vocabularies, definitions, and processes. As shown in this book's chapters, these processes separately and in combination influence decisions to migrate (or not to migrate) in ways such as:

- Destroying homes and land, so that people decide it is not worthwhile rebuilding.
- Killing crops and livestock, undermining the basis for livelihoods.
- Disorientating people, especially as traditional knowledge becomes out-dated, weakening or severing the ties between people and their land and environment.
- Leading to higher mortality, or higher rates of mortality, freeing up younger families from caring for elderly relatives or community members and no longer having elderly people as the reason to stay behind.

However, climatic factors do not always lead to significant migration processes. Especially considering climate change, some local areas might gain through less severe environmental hazards or increased agricultural productivity. If changes to the ocean cause some marine species to move, then some island communities might have catastrophic food shortages, while others will experience an abundance.

All these possibilities, and reactions to them, are always influenced by other local and cultural conditions. Even though the poor are generally the most affected by environmental degradation due to lack of resources for adaptation and therefore comprise the most vulnerable groups, usually they are also the ones who cannot afford to leave. The reason is that migration generally requires some financial resources, knowledge and experience, and possibly the existence of migration networks. Therefore, there is a clear multi-factor conditionality which must be taken into account when formulating the conclusions regarding choices or non-choices to migrate.

The chapters here have articulated some of these issues in further details, giving theoretical discussion, original empirical evidence, and connecting the two. This material advances theory and provides framework for considering migration under climate change. It also provides further empirical confirmation of the growing influence of environmental factors that form one of the influences of migration.

But there is a long way yet to go. Much climate change policy with regards to migration is still being formulated and applied on the basis of flawed assumptions - assumptions that have limited theoretical basis and no empirical evidence. The fear of “climate refugees” and “climate change refugees” is one such example. Additionally, not much research from climate change starts from a basis of assuming that people might want to move, which is a standard tenet in migration and mobility studies. There is much to learn about people and their motivations - and climate change has a long way to go to be fully integrated into other disciplines and to factor in the rich history of literature which existed on migration topics long before climate change was seen as being a concern.

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