

**Understanding the Effects of Labour Migration on
Vulnerability to Extreme Events in Hindu Kush
Himalayas: Case Studies from Upper Assam and Baoshan
County**

DPhil

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Statement

I hereby declare that this thesis has not been and will not be, submitted in whole or in part to another University for the award of any other degree.

Signature:.....*P Banerjee 23.06.2016*.....

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Summary

The overwhelming focus on causal linkages between environmental stressors and the migration decision making, disagreement among stakeholders regarding the positioning of migration within CCA discourse, and the lack of empirical evidence surrounding the role of migration as adaptation have been major impediments to mainstreaming migration in adaptation policies. There is a growing consensus among migration scholars regarding the potential contribution of migration to the lives and livelihoods of the migrants and their families left behind. However, the extent to which migration can contribute to climate change adaptation (CCA) in migrant-sending households, origin communities, or origin countries is a complex issue and requires further exploration. This thesis attempts to fill some of this knowledge gap by developing a conceptual approach to understand the effects of migration in the context of adaptation to extreme events such as drought and floods. As such, it is not concerned as to why someone migrates, but purely on its effects. This thesis shifts the focus to consequences of migration outcomes. The discourse on migration and adaptation has witnessed the same contestations of structuralism, neo-classical, and pluralist viewpoints with reference to effects of migration on development of migrant-sending households and origin communities. These lessons are pertinent for migration and adaptation discourse, and I use these lessons to build the conceptual framework of this thesis. It attempts to understand how the choices on remittance usage already made by households affects the CCA to extreme events.

This thesis adopts a mixed-methods and comparative approach to validate the conceptual framework, based on case studies from Baoshan County of Yunnan Province in China and Upper Assam in India. A key component of CCA is the reduction of vulnerability of a system to climate change and variability. The vulnerability concept provides a framework to unpack the constituents of vulnerability. A reduction in vulnerability to an extreme event requires a reduction in sensitivity and enhancement of capacity to adapt. This thesis analyses the vulnerability of the remittance-recipient households compared to households that do not have access to remittances. It also characterises sensitivity and adaptive capacity of the remittance-recipient households in context of duration for which a household has received remittances and distance to destination. Results suggest that remittances affect certain sub-dimensions and attributes of vulnerability and these affects vary in different contexts. The mobility patterns and its consequences within a country are shaped by a wide range of policies and institutions. The creation of an enabling condition for adaptation remains a critical function for the governments, thus migration could not be a substitute for public investment in development and adaptation in origin communities. The availability of an enabling environment and reduction in structural constraints would reduce the risks from migration and help remittance-recipient households to leverage remittances for CCA.

Glossary of Acronyms

ADB	Asian Development Bank
AHP	Analytical Hierarchic Process
AR	Assessment Report
CCA	Climate Change Adaptation
CICERO	Centre for International Climate and Environmental Research Oslo
COP	Conference of the Parties
DDMA	District Disaster Management Authority
DFID	Department for International Development
DoES	Directorate of Economics and Statistics
DRR	Disaster Risk Reduction
EBSB	Eastern Brahmaputra Sub-basin
FGD	Focus Group Discussion
GDP	Gross Domestic Product
GoC	Government of China
GoI	Government of India
GSDP	Gross State Domestic Product
HDI	Human Development Index
HICAP	Himalayan Climate Change Adaptation Programme
HKH	Hindu Kush Himalaya
HPG	Humanitarian Policy Group
HRS	Household Responsibility System
HFA	Hyogo Framework for Action
ICIMOD	International Centre for Integrated Mountain Development
IPCC	Intergovernmental Panel on Climate Change
KSB	Koshi Sub-basin
LDHH	Long Duration Household
LDSHH	Long Distance Household
LVI	Livelihoods Vulnerability Index
LPG	Liquefied Petroleum Gas
MCDA	Multi-criteria Decision Making Analysis
MoA	Ministry of Agriculture
MoHA	Ministry of Home Affairs
MoEF	Ministry of Environment and Forest
MPCE	Monthly Per Capita Expenditure
NDRC	National Development and Reform Commission
NELM	New Economics of Labour Migration
NGO	Non Government Organisations
NRHH	Non-recipient Household
PDS	Public Distribution System
PDSI	Palmer Drought Severity Index
PMJDY	Pradhan Mantri Jan Dhan Yojana
PPS	Probability Proportional to Size
RRHH	Remittance Recipient Household
SAPCC	State Action Plan on Climate Change
SD	Standard Deviation
SDHH	Short Duration Household
SDSHH	Short Distance Household

SES	Socio-ecological system
SLA	Sustainable Livelihoods Approach
SMS	Short Messaging Service
SDSI	Society Drought Severity Index
SPM	Summary for Policymakers
SPSS	Statistical Package for the Social Science
TERI	The Energy Research Institute of India
UISB	Upper Indus Sub-basin
UMSSB	Upper Mekong and Salween Sub-basin
UNEP	United Nations Environmental Programme
UN	United Nations
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNFCCC	United Nations Framework Convention on Climate Change
UN-HABITAT	United Nations Human Settlement Programme
UNHCR	United Nations High Commissioner for Refugees
UNU	United Nations University
US	United States
USD	United States Dollar
WG	Working Group
WMO	World Meteorological Organization
YASS	Yunnan Academy of Social Sciences
YDRC	Yunnan Development and Reform Commission

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Chapter 1: Introduction – Climate Change Adaptation and Migration

1.1 Introduction

The impacts of climate change are likely to be most felt by those countries already facing the developmental challenges of widespread poverty and poor governance (IPCC 2001). There remains a pressing need for countries to build their ability to adapt to the impacts of future climate change, particularly in developing countries, where much of the population rely on livelihoods that are sensitive to climate variation. Adaptation will be critical to address livelihood security in context of changes in climatic and non-climatic conditions. Many adaptation strategies by individuals, households and communities are likely to occur in the locations where the impacts of climate change are felt. However, both as an alternative to and as the limits of in-situ adaptation are reached, human mobility could be a potential response strategy of the households affected by climate change stressors. For instance, temporary and seasonal migration enables people to stay in their rural homes over the longer-term when faced by shorter-term environmental challenges (Tacoli 2009). Financial remittances (hereafter remittances) sent by migrant workers contribute to the welfare of the recipient households, and may even support their sustenance during climate shocks and stresses. Human mobility forms one of a number of livelihood strategies already chosen by individuals, and households in response to other transformative pressures and opportunities (e.g. higher wage potentials in urban areas) even without the impacts of climate change.

Migration has been a vital component of adaptation to changes in natural resource conditions and environmental hazards in the past, and this is unlikely to change in the future (McLeman and Smit 2006). There is a growing consensus among scientific and policy stakeholders regarding the potential contribution of migration to the lives and livelihoods of the migrants and families left behind. However, a divergence in opinion among these stakeholders reflects differences in perception of the role of migration in socio-economic development. For example, Adger et al. (2009 as cited in Adger et al. 2009, p. 349) recognised migration as an adaptation, but considered involuntary migration as undesirable for migrants leaving their homeland; a disruption of economic ties, social order, cultural identity, knowledge, and tradition would be detrimental to a successful transition. Others (e.g. Baro and Deubel 2006, Renaud et al. 2007) have argued that migration is a manifestation of a failure of adaptation or a last resort after other response strategies to disasters had failed. Felli and Castree (2012) have criticised the promotion of migration as an adaptation strategy due to the overemphasis

on autonomous actions by individuals or communities and market mechanisms to deal with environmental degradation, rather than on political-economic transformations. Within the migration and climate change adaptation (CCA) discourse, migration has been considered by some stakeholders as a form of adaptation; by others as a failure to adapt or an option of last resort; and a few have considered it to be a mismatched strategy that is unable to address structural determinants of vulnerability to climate change.

This thesis aims to explore the complex relationship between circular labour migration, remittances, and climate change adaptation. The question that this thesis seeks to address is whether the remittances have a role in reducing vulnerability of remittance-recipient households in the origin communities that are exposed to a major extreme event (flood or drought). A conceptual model is developed to explore this relationship and it is applied to study areas in Baoshan County in Upper Mekong-Salween sub-basins (UMSSB) in the Yunnan province of China and Upper Assam in Eastern Brahmaputra sub-basin (EBSB) in India. The first section of this chapter provides a brief overview of the climate change, CCA, and migration. This section discusses the divergence of opinion among scholars about whether migration is an adaptation strategy or a symptom of adaptation failure. It argues that a nuanced understanding of the relationship between migration and CCA will require an understanding of underlying vulnerability and empirical evidence. The second section of this chapter highlights three recent research projects that assessed the relationship between environmental change (including climate variability and change) and migration. These projects had examined the effects of environmental change on migration within the ambit of a global framework. The last section of this chapter highlights the contribution of this thesis to the greater understanding of the role of circular labour migration, remittances, and CCA.

1.2 Climate change, adaptation, and migration

Mirroring the scientific discussions, in its initial years, the climate change and migration discourse (e.g. IPCC, UNFCCC) had focused on how environmental shocks and stressors would induce large-scale displacement and out-migration, identifying potential ‘hot-spots’, and potential destinations of these displaced populations or migrants. For example, the IPCC’s First Assessment Report (AR1) had stated that ‘the gravest effects of climate change may be those on human migration as millions will be displaced’ (IPCC 1990, p. 20).’ A shift in the dominant paradigm in migration and development discourse during the past decade had

returned the focus to the positive impacts of migration on origin communities due to remittances sent back by migrant workers, skills brought back by returnees, and diaspora effects on investment and support (Hugo et al 2012). This paradigm shift in the migration and development discourse had been gradually imbibed in the parallel discourse on migration and climate change. For example, the Cancún Adaptation Framework of 2010 recognised that migration can be used by migrants as an adaptation strategy (Hugo et al 2012). Despite these gradual shifts at the global level, many policy responses at the national and sub-national levels still have a negative perception of migration.

1.2.1 Climate change and adaptation

The direct impacts of climate change are likely to be most marked at high elevations. But these changes are likely to have a greater impact at lower elevations due to the cascading of effects from high to low altitude areas. For example, increased runoff at high altitude is likely to lead to floods and increased sand deposition on agricultural land at lower altitudes (Tsering et al. 2010). At its core, the Hindu Kush Himalayan (HKH) region – in common with other mountain regions – suffers from a lack of data on the state of the environment. Despite this lack of confidence in forecasting, the HKH region is still widely believed to be one of the planet's hot spots of future climate change impacts (Maplecroft 2011). As with other mountain environments there exists a fine equilibrium between snow, ice, and water that effects biodiversity and ecosystem services, such as the regulation of water resources. This equilibrium is particularly sensitive to small changes in temperature and precipitation. The impacts of climate variability and change on rural livelihoods are projected to likely reduce the number of livelihood options and create greater volatility and unpredictability in streams of livelihoods benefits in the short to medium term (Agrawal and Perrin 2008). This will increase the burden of the poor and vulnerable (Yamin et al. 2005). They are dependent on climate sensitive economic sectors. The poor and vulnerable have limited economic, technological and human capacities (IPCC 2001). The responses to climate change can be distinguished between mitigation and adaptation. Mitigation is a preventative approach that aims to limit the source of greenhouse gases (Schipper 2007). Adaptation ranges from action taken by an individual or household to a particular stress, through those adopted by a community to multiple stresses, to that of the global system to all stresses and forces. The scale of adaptation varies in physical, ecological, and human systems. This is motivated by factors ranging from protection of economic well-being to improvement of safety (Adger et

al. 2005, Smit and Wandel 2006). The importance of adaptation strategies aimed at reducing vulnerability and increasing resilience in response to the adverse effects of climate change was recognised in the Copenhagen Accord of 2009 (as cited in Martin 2010, p. 1). Distinguishing CCA decisions from those induced by other social and economic events can be a difficult task (Adger et al. 2005). Even if an adaptation is considered effective for the adapting agent in the short term, it may be less successful in the longer term; it may potentially increase negative impacts on other agents or reduce their capacity to adapt (Adger et al. 2005). Nonetheless, more conceptual similarities exist between adjustments to cope with climate variability and those to adapt to climate change than there are differences between the two (Callaway 2004).

1.2.2 Migration, remittances, and adaptation

Remittances often supplement remittance-recipient household's income from other sources such as agriculture, livestock, daily wage labour, salaried employment, or business. They are used to procure basic needs (e.g. food, housing and healthcare), or are invested in human, social, physical, and natural assets (De Haan 2000, Elis 2003). Migrants bring back ideas, identities, social capital, knowledge, and skills from destination to origin communities (Levitt 1998, Bailey 2010). Migration outcomes are counter-cyclical in nature. During natural disasters, macro-economic or financial crises, and armed conflicts remittances are known to be a relatively stable source of household income (Mohapatra et al. 2009). For example, remittances increased to 13.6% of GDP in 1999 in the aftermath of Hurricane Mitch (Andersen and Christensen 2009, p. 5). Henry et al. (2004) had reported that short-term rural to rural migration to seek income diversification was a common response during major droughts in Burkina Faso. These studies share an underlying assumption that the migrants have the agency to take initiative to assist themselves, their families, and communities in changing their vulnerability to extreme environmental conditions; but also based on experience of such events.

1.2.3 Key issues

The humanitarian aspects of mobility, which is manifested during displacement and emergency response (e.g. Kalin 2015, McAdam 2015), had garnered widespread attention in recent times. The humanitarian approach perceives the displacees as 'hapless victims' of externalities such as an extreme event and failure of the state mechanisms for social

protection. The safety and security of displaced populations is critical, and needs to be addressed. However, the growing dominance of this humanitarian approach within the environmental change and migration discourse increases the risk of ignoring that migration can also be a pro-active strategy in response to impacts of climate variability and change. Ellis (2003) suggests that the act of moving indicates an enterprise to resolve problems. The focus on ‘environmental migrants’ (e.g. definition, identification, numbers, and migration decision-making) within the environmental change and migration discourse has sidelined the contribution of migrants, whose decision to move may not have been influenced by an environmental stressor, but this does not prevent these migrants from contributing towards reduction of vulnerability of their families left behind in origin communities. For example, migrants belonging to a flood affected community are likely to provide assistance towards disaster risk reduction (DRR) of their families in origin communities irrespective of whether their decision to migrate had been influenced by impacts of recurrent floods or not. The influence of environmental stressors on migration decision-making is not the sole criterion that decides whether financial or social remittances will be leveraged to address the impacts of environmental stressors. As such, a wider set of migrants have a potential role in reducing vulnerability to extreme events, and not just environmental migrants.

Despite the growing attention received by migration in climate change discourse at the global level (e.g. IPCC and UNFCCC), the role of human mobility, particularly labour migration and remittances, in CCA has received little attention in adaptation planning and policies across the HKH region. Instead, migration is perceived as a challenge to the development and adaptation goals. Partly this is due to the lack of empirical evidence on the relationship between environmental stressors, migration and CCA. The interrelationship between environmental change, migration, and CCA has been little explored, and remains in the fringe of migration research in the HKH region, where migration research itself exists in the periphery of policy discourse in most of the countries. Recent research (e.g. McLeman and Smit 2006, Black et al 2011a, Hugo et al 2012) had attempted to position migration as an adaptation response to perceived future climate change impacts. Migration outcomes (e.g. financial and social remittances) are context specific as well as depend on the type of migration, financial resources, skill, social networks, origins and destinations, and institutions (Barnett and Webber 2009). There is a lack of clarity in migration studies about the operationalisation of concepts related to climate change (e.g. adaptation, vulnerability, and

adaptive capacity). The disciplinary and ideological position of a stakeholder influences the manner in which migration is perceived in context of climate variability and change. Hence, evaluating the effects of migration on CCA is a complicated process, and the extent to which migration can contribute to CCA among remittance-recipient households requires further exploration. A common criticism of remittances is that they are mainly used on consumption. However, there are knowledge gaps regarding implications of such consumption in context of CCA and DRR. What constitutes consumption? Does the spending on food and clothing have any positive effect on recipient households during or in aftermath of a disaster? There are knowledge gaps in terms of the conditions that make it most likely for social remittances to play a positive role in building adaptation specifically to climate change. For example, there is limited evidence on how farming practices are impacted by migration, at least in terms of how such changed farming practices might build (or reduce) CCA. In both cases, an important research gap relates to the institutional processes and environment that shapes both the scope for migration as adaptation to take place, and the extent to which it will be proactive or reactive (Adger et al. 2005).

1.3 Contribution of recent major assessments

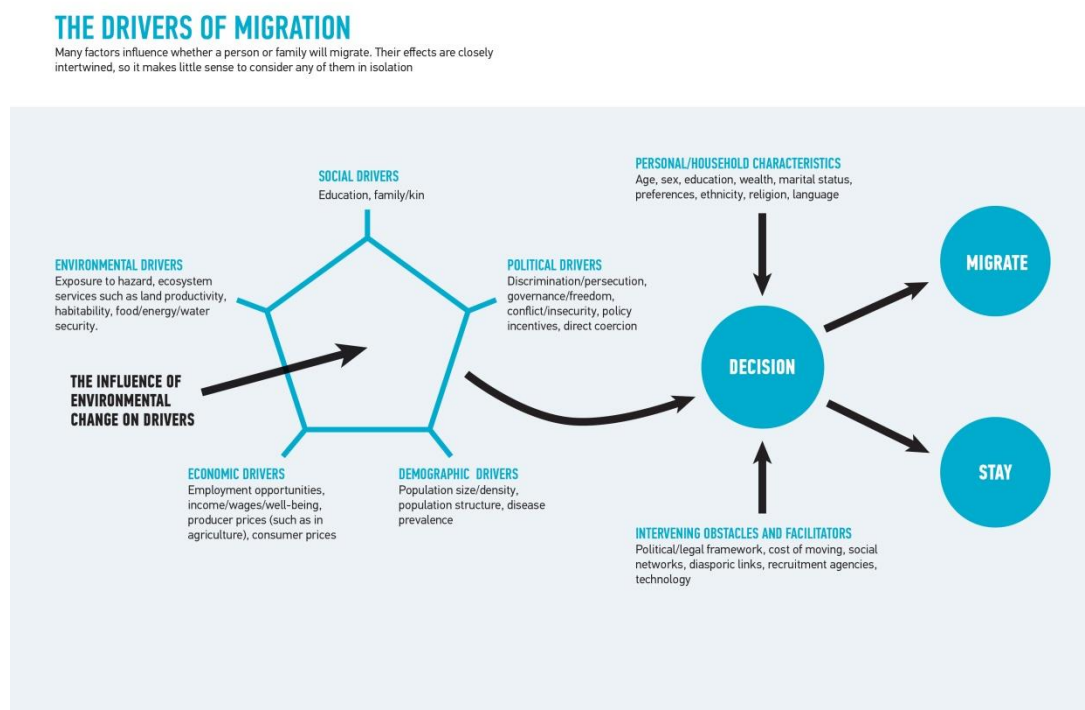
In the past half a decade, three major research projects have explored the relationship between environmental change (including climate change) and migration: The Foresight Project on Migration and Global Environmental Change (see Black et al. 2011a), the ADB's Report on Addressing Climate Change and Migration in Asia and the Pacific (see Hugo et al. 2012), and the UNU's Where Rain Falls Project (see Warner et al. 2012). This sub-section provides a brief overview of the contribution of these research projects.

1.3.1 Foresight project on migration and global environmental change

This Foresight Project aimed to develop future scenario of the effects of global environmental changes on human population movement across the world until 2060, including an assessment of varied opportunities and challenges for migrants and populations in origin and destination communities (Black et al. 2011a). This report analysed international migration (e.g. global level, low-income to high-income countries, and among low-income countries) and internal migration; assessed impact of environmental changes because of climate change, land degradation, and coastal and marine ecosystems degradation; examined the relationship between migration and environmental change in key global ecological regions (i.e. drylands,

low elevation coastal zones and small island states, and mountain regions); and recognised diverse implications for migration influenced by environmental change due to different growth, governance and environmental scenarios.

Figure 1.1: The drivers of migration.



Source: Black et al. (2011a)

Black et al. (2011a) makes the following suggestions: First, an identification of ‘environmental migrants’, either at present or in future, is almost impossible; since migration is a multi-causal phenomenon. The migration decision is influenced by five types of driver (i.e. economic, environmental, demographic, social, and political). The effects of environmental change on migration outcomes are likely to be facilitated through its impact on existing drivers of migration. For example, environmental change is likely to affect rural wages, agricultural prices, exposure to hazard, and provisioning ecosystem services. The economic driver is likely to be most pronounced in most situations. Migration is not an ensured outcome merely due to existence of migration drivers. Rather, a series of intervening factors and personal and household characteristics is likely to determine whether migration occurs or not. To migrate, particularly to international destinations, certain social and human assets are required. Second, when confronted by adverse environmental conditions, migration is a household level income diversification strategy. Cities in low

income countries are likely to continue to attract migrants due to economic, political, and social factors. Many of these cities are vulnerable to environmental change such as low-lying urban areas located in mega deltas or slums in water-insecure growing cities. Third, some people are likely to migrate in illegal, irregular, unsafe, exploited, or unplanned ways because of reduced options for migration and threat to their incomes from environmental change. Fourth, some households are likely to be trapped in locations experiencing a deterioration of environmental conditions because they lack the assets required to move away. Black et al. (2011a) recognises the important role of migration to increase resilience of migrants and those that stayed behind. This report recommends facilitation of migration to broaden the opportunities and maximise the benefits from it; creation of new urban centres that can attract migrants from more vulnerable areas; and potentially the relocation of populations to places that are less vulnerable to environmental change – although none of these options are framed as unproblematic (Black et al. 2011a).

1.3.2 Addressing Climate Change and Migration in Asia and the Pacific

The Hugo et al. (2012) attempted to identify policy and other responses to environmental impacts on human mobility within the Asia and Pacific region.¹ The environmental hot spots, which are at risk of floods, cyclones, typhoons, and water stress, are highlighted in this report. The report concludes that environmental migration should not be distinguished from other flows of migration as a separate category. Migration has multiple causes, which are interlinked and can be influenced by environmental changes. Future migrants, including those displaced by environmental disruptions, are expected to be use existing migration corridors that have been used by family or social network. Internal migration is likely to be the most common flow of migration associated with climate change. The cross-border channels associated with existing labour programmes or family reunification schemes will be the likely form of international migration. The broader trend of rapid urbanisation in this region will influence these migration flows. The accommodation of new arrivals is likely to be a challenge for the mega-cities.

Hugo et al. (2012) recommends that interventions need to support the migrants as well as those left behind in origin communities at risk of environmental stressors. It suggests that the governments should adopt policies and provide financial support to social protection,

¹ The Asia and Pacific region is most natural disaster prone area in the world, both in terms of the absolute number of disasters and of population affected (Hugo et al. 2012).

livelihoods development, basic urban infrastructure, and disaster risk management; since these steps would strengthen community resilience and reduce migration compelled by deteriorating environmental conditions. It considers migration to be a part of the adaptation portfolio mobilised by migrants themselves to cope with climate change as well as a mechanism to reduce poverty and increase resilience in affected area. The financial vulnerability of families and communities living in areas at risk of environmental changes could be reduced if the in-flow of financial remittances could be facilitated. Migration could result in substantial benefits to origin and destination communities as well as the migrants if the process is properly managed. There is a need to strengthen and enforce international protection frameworks with specific arrangements developed for resettlement and relocation. It is suggested that relocation of entire communities is likely to occur as a last resort once adaptation possibilities (e.g. in-situ techniques, temporary and permanent migration) and community resilience have been exhausted. The national development plans, poverty reduction strategies, and National Adaptation Programs of Action need to factor migration-related spending needs. Greater commitment and contributions from governments is necessary to increase effectiveness of existing funding activities that could, in principal, finance activities addressing environmental migration.

1.3.3 UNU's Where Rain Falls Project

The circumstances under which households use migration as a risk management strategy when confronted with rainfall variability and food and livelihood insecurity was the central focus of the UNU's Where the Rain Falls project (Warner et al. 2012). Eight case studies were conducted in Latin America, Africa, and Asia. This research project found that many families have used migration (viz. seasonal, temporary, or permanent) as a strategy to address impacts of rainfall variability and food and livelihood insecurity. Particularly in research sites that have high dependence on rain-fed agriculture (often a single harvest per year) and few local opportunities of livelihoods diversification, rainfall has a more direct relationship with household migration decision. Warner et al. (2012) identifies four distinct household profiles: First group of households, which are less food secure but have access to a wide range of adaptation options, formal and informal institutions and networks, uses seasonal or temporary migration as one of adaptation strategies. Often young single migrants from these households find non-agricultural jobs in cities or internationally. Remittances are invested in education, health, and climate-resilient livelihood opportunities, and risk diversification. The second

group of households are food insecure and land-scarce. They have access to fewer adaptation and livelihood diversification options and institutions. They have low social capital. Head of these households seasonally migrate to other rural areas to seek employment as agricultural labour. Migration helps these households to survive. During the hunger season, heads of the third group of households often move to other rural areas to seek food or work for their families. These households have access to limited number of livelihood options. They are often landless and food insecure. This type of migration is an erosive coping strategy. The fourth group of households are unable to migrate and is referred as the trapped population. Warner et al. (2012) recommend the following: First, participatory national and local plans need to be supported, promoted, and implemented. Second, it is necessary to address transboundary challenges and opportunities associated with adaptation and human mobility. Third, disaster risk reduction, particularly its links with long term development, needs to be strengthened and expanded. Fourth, it is necessary to engage with vulnerable populations.

1.4 Contribution of this thesis

This thesis aims to enhance understanding of the effects of migration on household level CCA. Previous research suggests that remittances tend to be a counter-cyclical shock absorber in times of crisis. But their role in reducing vulnerability of a household by playing a role in building medium-term and long-term assets is little understood. In this thesis, I argue that the contribution of migrants, towards reduction of vulnerability of their families in origin communities has to be assessed irrespective of their reasons to move. This thesis develops a conceptual and methodological approach, which acknowledges a wider set of migrants have a potential role in CCA by reducing vulnerability of the families left behind in origin communities exposed to climate variability and change.

This conceptual and methodological approach is validated through empirical evidence from China and India. The primary objective of this thesis is to enhance understanding of the effects of labour migration on vulnerability to extreme events. First, this research explores the pattern of livelihoods and labour migration in the study areas. What are the major livelihoods? Who are the migrant workers? Where do these workers migrate? What type of jobs do these migrant workers have in destination? In what ways do remittances contribute to household welfare? Second, it attempts to understand the differences in strategies, if any, adopted by remittance-recipient and non-recipient households in response to a climate hazard

(e.g. drought or flood). This includes following questions: What strategies do households adopt in response to climate hazards (e.g. drought and flood)? How do these responses differ in drought and flood affected rural communities? Third, this thesis examines the relationship between remittances and household's vulnerability to extreme events. What are the pathways through which remittances shape a household's vulnerability to drought or flood? Fourth, it aims to characterise household level sensitivity and adaptive capacity in context of a specific extreme event and ascertain the extent to which the outcomes of migration (i.e. remittances) reduced sensitivity or improved adaptive capacity of remittance-recipient households. To what extent do remittances affect a household's sensitivity to drought or flood? To what extent do remittances affect a household's adaptive capacity in context of drought or flood?

Chapter 2 analyses the existing evidence on the relationship between migration and CCA through the evolution in the migration narrative of the IPCC's Working Group II (WG II) reports. The contemporary discourse has been reflected in the migration and adaptation narrative in the IPCC's WG II reports from First Assessment (1990) to Fifth Assessment (2014). The Summary for Policymakers (SPM) of these reports is unanimously agreed by the country representatives, and hence it indicates the common understanding of the governments on various aspects related to climate change. These reports provide a framework to examine progress of this narrative through changes in estimates of environmental migrants and methodology, profile of a migrant, positioning of migration, migration governance, and gender aspects. This discourse has progressively shifted from the the alarmist predictions in the 1980s and 1990s of future mass migration as a result of climate change, to the acknowledgement of low confidence in quantitative projections of changes in mobility in AR5 due to the multi-causal nature of mobility. The AR5 had suggested that there is a need to consider migration as part of the adaptation planning to address future climate change impacts. However, these ARs did not discuss in what ways and to what extent migration could reduce vulnerabilities among populations exposed to extreme weather events, and how these effects are contingent upon the type of migration, migrant's profile, financial resources, social networks, generic development levels in origin and destination, characteristics of household in origin communities, and role of institutions.

Migration can be a pro-active household strategy to address the impacts of environmental disasters. Even publications that aim to assess the role of migration as an adaptation strategy, generally, focus on the causal linkages between environmental stressors and migration

motivation as a precursor to adaptation. In this thesis, I argue that irrespective of the motives of migration, the migration outcomes (e.g. remittances) have a potential role in reducing vulnerability by reducing sensitivity or enhancing adaptive capacity of remittance-recipient household. This thesis argues that the policy debate in HKH countries needs to be informed of the complex relationship between migration and CCA.² Chapter 3 develops a conceptual model that acknowledges the critical role of the government institutions and policies to create an enabling environment for adaptation in general, including facilitating the adaptation potential of migration, which is an autonomous strategy.

Chapter 3 shows that there is a lack of clarity in migration studies about the concepts associated with CCA. The ambiguity about these concepts is a consequence of multiple ways in which these concepts are defined, interpreted, and operationalised by various paradigms, disciplines, and political ideologies. A nuanced comprehension of the relationship between migration and CCA will require an understanding of underlying vulnerability, and ways in which migration shapes vulnerability of remittance-recipient households to climate hazards. Although vulnerability assessments have been widely applied within climate change research to assess vulnerability of different entities, they have been seldom used to explore the differences in vulnerability of remittance-recipient and non-recipient households to climate hazards. This chapter integrates vulnerability and adaptive capacity frameworks with the New Economics of Labour Migration (NELM) and Sustainable Livelihoods Approach (SLA) to explore the role of remittances in reducing vulnerability in remittance-recipient households. I posit that effects of remittances would be different across major components, sub-dimensions and attributes of vulnerability. It will be less likely that remittances influence all or none of the attributes of vulnerability.

The research methodology presented in chapter 4 builds on the conceptual framework described in chapter 3. This chapter also justifies the choice of India and China, and in particular the two study areas (i.e. Baoshan County and Upper Assam) as the research setting. These study areas have similar labour migration patterns: Generally, male household members migrate to urban destinations within the country in search of employment in the informal sector. While floods are common in Upper Assam, Baoshan County has experienced several severe droughts during the past decade. The structural factors (including migration

² The HKH countries are Afghanistan, Bangladesh, Bhutan, China, India, Myanmar, Nepal, and Pakistan.

governance) that shape development and adaptation context differ in these countries. As per the IPCC definition, I conceptualise vulnerability to be a function of three major components: exposure, sensitivity, and adaptive capacity. I adopt a mixed method approach that includes focus group discussions (FGD) and survey. The information gathered during FGDs is used to design the survey tools and build a narrative. The primary data from surveys is used in the vulnerability assessment. I adopt an indicator-based approach to assess vulnerability to extreme events. Since vulnerability is context specific in nature, the weights of major components, sub-dimensions, and attributes would vary from one location to another. Hence, these weights are determined through the analytical hierarchic process (AHP).

Chapter 5 provides an overview of the household characteristics, livelihood practices, extreme events, and disaster responses in rural communities in which fieldwork was conducted. The livelihoods in Upper Assam combine subsistence farming with livestock rearing, daily wage income, and small business. Out-migration of men to seek employment has been steadily growing since early 2000. They migrate to urban destinations within India, and are mainly employed in informal sector. Generally, floods occur in Upper Assam during the monsoon season. The flood destroys standing crops, kills livestock, disrupts transportation, damages houses and infrastructure, and leads to a loss of income. The household level responses during the flood inundation focus on evacuation, rescue, and relief. The specific medium-term flood preparedness strategies are limited to structural changes in the dwelling. The study area in Baoshan County is experiencing a series of drought since 2009. The drought impacts are most prominent in the agricultural sector, and are manifested in parched land, loss of soil fertility, reduction in farm productivity, outbreak of livestock diseases, and shortage of water for household consumption and agriculture. The household level drought responses include changes in agricultural water use, modifications in livestock rearing, changes in farming calendar, and borrowing money. This chapter aims to set the context for chapters 6, 7, and 8, which present the empirical results of this thesis.

The relative effect of exposure of a household to an extreme event is influenced by the household's sensitivity to a stress and capacity to adapt. This sensitivity is shaped by household characteristics, socio-economic conditions, local infrastructure, institutions, and political context. Chapter 6 examines the effects of remittances on household level sensitivity to extreme events. This chapter finds that remittance-recipient households are less sensitivity to extreme events (e.g. drought or floods) than non-recipient households. However, there is a

progressive increase in remittance dependency among remittance-recipient households, and a reduction in income and non-farm income diversification. These increase the household's sensitivity to non-environmental shocks and stresses. A sudden disruption of remittance flow could have an adverse effect on the household's economic and social life. Furthermore, the duration for which a household received remittances (i.e. a proxy for migration cycle) is an important determinant of sensitivity among remittance-recipient households. Overall, long-duration remittance-recipient households (hereafter long-duration households) are better able to manage sensitivity to climate hazards than short-duration remittance-recipient households (hereafter short-duration households).

Chapter 7 characterises household level adaptive capacity in context of a specific extreme event and assess the extent to which the remittances shape adaptive capacity of remittance-recipient households. This chapter finds that the formal credit and insurance markets are contributing little to the adaptive capacity of the rural households in Baoshan County and Upper Assam. There is a growing dependency among remittance-recipient households on remittances as the only source of non-farm income. This chapter reports that remittance-recipient households are less likely to have access to alternative livelihood opportunities in origin community and/or nearby locality. Certain effects of remittances on attributes of adaptive capacity are context specific. In Upper Assam, remittance-recipient households are likely to have better access to communication devices than non-recipient households. This capacity could be critical in context of a climate hazard since information on alerts, evacuation, rescue, and relief are often disseminated through means of mass communication. Major impacts of the drought in the Baoshan County are associated with the agricultural sector. Remittance-recipient households in Baoshan County are more likely to have smaller farm size and less likely to invest in resource intensive farm assets (e.g. irrigation, farm mechanisation). Rather than managing risk from drought by building capacity of the household's agricultural portfolio, remittance-recipient households are downsizing agricultural operations in order to minimise risk. In contrast, long-duration households in Upper Assam have better capacities than short-duration households.

Chapter 8 examines the composition of household level vulnerability among remittance-recipient and non-recipient households to climate hazard (e.g. drought or flood). Vulnerability is context specific in nature. The vulnerability of non-recipient households in Baoshan County to drought is marginally lower than that of remittance-recipient households.

The adaptive capacity of the former is marginally higher than the latter. Among eight sub-dimensions that comprise sensitivity and adaptive capacity to drought, the differences between remittance-recipient and non-recipient households are significant for environmental dependence, natural assets, human assets, and physical assets. In contrast, the differences in sensitivity and adaptive capacity of remittance-recipient and non-recipient households in Upper Assam are not significant. Among ten sub-dimensions of sensitivity and adaptive capacity to floods, the difference between remittance-recipient and non-recipient households is significant only for human assets. These case studies indicate that differences between remittance-recipient and non-recipient households are significant primarily at the attribute level. When these attributes are aggregated into sub-dimensions, and in turn the sub-dimensions are aggregated into major components, these differences between two groups of household tend to disappear. It is likely that different attributes cancel each other upon aggregation at the next higher level in hierarchy. However, an insight about attributes of household level sensitivity and adaptive capacity is no less useful from the perspective of local adaptation planning. This would help to design specific interventions for the households. For example, non-farm income diversification is an attribute of environmental dependence. Local government institutions could organise non-farm skill training opportunities for the youth and women. This would help to diversify the household portfolio, and in turn minimise the risk from extreme events.

Chapter 2: Migration and Adaptation: How has the Narrative Evolved?

2.1 Introduction

This chapter analyses existing evidence on the relationship between migration and adaptation through the evolution of the narrative on migration and climate change impacts of the IPCC's Working Group II (WG II) reports. This chapter does not attempt to present an exhaustive literature review on migration and climate change.³ Rather, it aims to chart the narrative on migration and CCA. The signing of the United Nations Framework Convention on Climate Change (UNFCCC) and the reporting activities of the IPCC led to the use of the term 'adaptation' with respect to migration decision-making and causality in the 1990s (McLeman 2016). The United Nations Environmental Programme (UNEP) and the World Meteorological Organization (WMO) established the IPCC in 1988. Its aim was to enhance understanding of human induced climate change, its potential impacts, vulnerability to these impacts and options for mitigation and adaptation through an assessment of the relevant scientific, technical, and socio-economic information.⁴ Much of the migration and adaptation narrative in the IPCC's WG II reports from AR1 (1990) to AR5 (2014) have mirrored the contemporary deliberations by academia, think-tanks, international organisations, non-governmental organisations, and governments. The summary for policy makers (SPM) is unanimously agreed by the country representatives, and thus indicates the position of the government. Therefore, the WGII reports are an appropriate tome to trace the antecedents of the discussions about migration and CCA relationship. The next section provides an overview of migration and CCA in the IPCC's WG II reports from AR1 to AR5. This is followed by an assessment of the evolution of this narrative through changes in estimates of environmental migrants and methodology, profile of a migrant, positioning of migration, migration governance, and gender aspects.

2.2 Migration and adaptation in the IPCC's WG II report

2.2.1 First Assessment Report (AR1) (1990)

Some notable publications (e.g. El Hinnawi 1985, Jacobsen 1988) in the 1980s provided estimates of people who would move due to environmental change. These early deliberations raised a spectre of large-scale movement of people from rural to urban areas, and developing to developed countries due to climate change related reasons in the future. This was reflected

³ For a literature review on migration and climate change refer to Piguet et al. (2011).

⁴ <https://www.ipcc-wg2.gov/>

in the IPCC's AR1, which was published in 1990. The SPM of AR1 adopted an alarmist tenor regarding environmental change and migration. For example:

A 1m rise by 2100 would render some island countries uninhabitable, displace tens of millions of people, seriously threaten low-lying urban areas, flood productive land, contaminate fresh water supplies and change coastlines. All of these impacts would be exacerbated if droughts and storms become more severe (IPCC 1990, p. 4).

This WG II report emphasised the scale of population movement through the use of phrases such as 'significant movement of people' (IPCC 1990, p. 3), 'large migration of people' (1990, p. 3), 'relocation could be prohibitively large scale' (IPCC 1990, p. 2-22), 'enormous dislocations' (IPCC 1990, p. 5-3), and 'vast numbers of people are moving' (IPCC 1990, p. 5-3). These phrases were supplemented with estimates of potential numbers of people likely to be displaced or relocated due to sea level rise. For example, it projected that tens of millions of refugees could be produced by a modest rise in global sea-levels (IPCC 1990, p. 5-10). These figures were presented without an explanation about the methodology through which these competing figures were estimated.

The IPCC (1990) suggested that the human ability to adapt would be overwhelmed if the rate of change was sufficiently rapid, and in turn a widespread refugee crisis would be triggered. In this narrative of migration, the people had little agency in the migration decision-making, and were perceived as displaced persons, resettled population, and refugees. Migration was seen as a strategy adopted under compulsion due to loss of housing, living resources, or social and cultural resources (IPCC 1990). According to this narrative, a decline in living standards and total loss of livelihoods in rural areas due to land degradation or extreme events would force impoverished people to migrate to urban areas in developing countries, from densely inhabited delta areas to inland areas, and even between countries. The sudden influx of a large population into an urban centre would exacerbate pressure on public amenities (e.g. housing, healthcare, sanitation, and transport) (IPCC 1990).

2.2.2 Second Assessment Report (AR2) (1995)

The IPCC AR2's WGII report was published in 1995. Once again, the SPM suggested that forced internal or international migration was likely to be one of the most destructive effects of climate change on human settlements, particularly in countries with high population densities (IPCC 1995). The SPM suggested that population could be assisted to move away from vulnerable location (e.g. flood plains, steep hillsides, and low lying coastlines) through

effective coastal-zone management and land-use regulation (IPCC 1995), and some grave negative impacts of climate change could be offset and the number of ecological refugees could be reduced through disaster assistance programmes (IPCC 1995). Terms such as massive, significant, large-scale and exodus continued to describe the scale of the population flow (IPCC 1995). This report provided estimates of the population at risk of an environmental stressor. For instance, it suggested that 46 million people per year were at risk of flooding due to storm surges (IPCC 1995, p. 36). This report provided a brief description of the methodology for estimation of population at risk, and acknowledged that these estimates changed under various circumstances (e.g. population growth, and an absence of adaptation measure).

There was an explicit lack of agency in the portrayal of migration in the AR2. For example, sea level rise was expected to flood much of the world's low lying areas, destroying farmland in the coastal areas, and displacing millions of persons from river deltas, small islands and coasts (IPCC 1995). The cited references (e.g. Westing 1994) suggested that migration was inevitable as carrying capacity was reached. The short-term or seasonal out-migration from mountain regions in developing countries or large-scale migration from the Sahel to other parts of the region, which were supplemented by subsistence or dryland agriculture, were considered to have limited effect on ameliorating the growing stress on human carrying capacity (IPCC 1995). This report portrayed migrants as destitute who were responsible for overcrowding the cities, forest degradation, and carrying diseases to new destinations. It contended that most of the migrants in the developing countries did not have the skills required to lead a better life in an urban area. These migrants would live in informal peri-urban settlements with limited infrastructure (IPCC 1995), would 'exacerbate already crowded conditions in the cities' (IPCC 1995, p. 401), or create ethnic tension (IPCC 1995). Based on the 'best thinking' of the epidemiologist community, the AR2 suggested that the economic and environmental refugees could bring new diseases to the temperate-zone human settlements (IPCC 1995, p. 401)⁵. The 'temperate-zone' human settlement was a possible euphemism for developed countries.

This was the first WGII report to suggest that migration of individuals and activities, even across national boundaries, could be an 'adaptation' to climate change (IPCC 1995). Due to

⁵ The report conceded that relevant environmental data were adequate in some cases and 'extremely sketchy' in others (IPCC 1995).

the capacity to adapt through culture, technology, migration, and behaviour, human beings would be less sensitive to changes in climate (IPCC 1995). However in the sub-section 12.5 (Adaptation options), long-term migrants moving between regions and from rural areas to cities in response to relative economic opportunity and 'ecological refugees' from specific natural disaster were considered to be one of the potentially destructive effects from various social and economic perspectives. Measures to reduce economic migration included provision of economic opportunities and 'services of civilization' in origin communities, national and regional economic development, immigration or emigration policies, and decentralisation of government administration to secondary cities (IPCC 1995). This report suggested that the number of ecological refugees could be reduced through economic dislocation programmes (e.g. disaster assistance) and relocation of population from vulnerable locations through effective land-use regulation (IPCC 1995, p. 416).

2.2.3 Third Assessment Report (AR3) (2001)

The SPM of this report posited that climate change will affect human settlements in three major ways: First, the changes in resource productivity or market demand for the goods and services would affect the economic sector. Second, climate change would directly affect some aspects of physical infrastructure, buildings, urban services, and certain industries. Third, extreme weather, changes in health status, or migration might directly affect populations (IPCC 2001). This AR report cited the maximalist literature (e.g. Myers 1993, Kennedy et al. 1998, Rahman 1999) to suggest that the risk of political instabilities and conflicts would increase because of migration of population affected by extreme events or modifications in the resource distribution (IPCC 2001). There was a major shift from past narrative. This report acknowledged the low confidence in prediction of increases in ethnic conflicts in resource scarce regions as a result of climate change due to several intervening and contributory factors of intergroup and intragroup conflicts (IPCC 2001). The assertions about environmental refugees that were common in the AR1 and AR2, was now replaced by presenting them among various other schools of thought. The AR3 cited Meze-Hausken (2000) who had suggested that even though migration is the last of a complex set of coping strategies, there are significant tendencies to adapt to inter-annual variability of climate via migration (IPCC 2001, p. 397). Chapter 18 (Adaptation to Climate Change in the Context of Sustainable Development and Equity) considered displacement to be a failure to adapt (IPCC 2001). The IPCC (2001) conceded that since many of the responses of society to changes in

the climate system were not precisely specified and act indirectly, it was difficult to include these in scenario development. There was little agreement about assigning a monetary value to the non-market impacts of climate change (e.g. forced migration) (IPCC 2001).

The narrative in this report continued to portray the migrants in developing countries as poor, unskilled, and frequently unemployable people. O'Meara (as cited in the IPCC 2001, p. 86) suggested that migrants were responsible for 'explosive' and 'difficult to manage' growth in urban centres, including squatter settlements, sanitation, water pollution, urban floods, crime, and social insecurity. It was more likely to experience climate related food shortages in urban areas due to an increase in migrants from the countryside or loss of agriculture related business (IPCC 2001). In comparison to the WG II report of AR1 and AR2, a more nuanced conceptualisation of migration was observed in the main chapters of the AR3, although some of the region specific chapters of this report persisted with the alarmist tenor of the past reports. For example, chapter 11 (Asia) used phrases such as large-scale and mass migration to describe the potential size of migration due to an increase in incidence and magnitudes of extreme events (IPCC 2001). Chapter 12 (Australia and New Zealand) reported the eventual possibility for New Zealand to accept environmental refugees because of the impacts sea level rise and storm events on its Pacific island territories (IPCC 2001). At the same time, chapter 11 (Asia) acknowledged the multi-causal nature of migration, and that it was not necessarily a manifestation of vulnerability to extreme events at present (IPCC 2001). The cited reference in this chapter (e.g. Connell and Conway 2000) suggested that the sending and host cities or countries had frequently benefitted from immigrant labour (IPCC 2001). This was the first mention of benefits to the destination communities from migration in the WGII reports. Preparing contingency plans for migration in response to sea level rise was identified as one of the potential sector-wide adaptation options for the Temperate and Tropical Asia (IPCC 2001).

2.2.4 Fourth Assessment Report (AR4) (2007)

The critique of the concept of 'environmental refugee' by Black (2001) and Castles (2002) materialised in early 2000s. The inherent implication of a mono-causal relationship between environmental factors and human mobility in the juxtaposition of the terms 'environment' or 'climate' with 'migrants' or refugees had been criticised by migration scholars (Piguet et al. 2011). Since 2001, several migration scholars had explored the multi-causal nature of

migration. Around the same time, McLeman and Smit (2003) described 'migration as adaptation' in a public commentary for the Canadian Security Intelligence Service. This evolution in the knowledge on environmental change and migration relationship was reflected in the AR4's WGII report. The SPM suggested that relocating populations, economic activity, and infrastructure in response to the effects of sea level rise on coastlines and ecosystems, low-lying areas, and river deltas would be an expensive and challenging proposition (IPCC 2007). Based on projections into the mid- to late 21st century, it suggested that the potential for population migration is likely if there is an increase in area affected by drought, intense tropical cyclone activity and incidence of extreme sea level rise (excluded Tsunamis). These projections did not incorporate any changes in adaptive capacity (IPCC 2007).

The AR4 cited references (e.g. Black 2001) that suggested it was highly problematic to disaggregate the causes of migration since individual migrants might have multiple motivations and be displaced by multiple factors (IPCC 2007). In comparison to the previous WG II reports, the AR4's WG II presented an elaborate discussion regarding various mobility pathways. Extreme events displaced a large number of people. If the frequency of extreme events increased then it was likely that the number of migrants and displaced population would increase, their migration might become permanent. One of the likely impacts of temperature induced decline in crop yield and increase in frequency and severity of drought on livelihoods of smallholder and subsistence farming households in the dryland tropics would be out-migration (IPCC 2007). The interaction between climate and other types of stresses on human systems could exacerbate non-environmental stresses. For example, drought induced rural-to-urban migration could combine with population growth to overburden urban infrastructure and increase stress on socio-economic conditions (IPCC 2007). This report highlighted that the spread of communicable diseases could be associated with migration and population displacement, which was frequently induced by stress such as conflict and/or resource constraints (IPCC 2007). The incidence of communicable diseases could increase due to poor nutritional status that resulted from overcrowding, and a lack of safe water, food and shelter associated with population displacement (IPCC 2007). Mendelsohn (as cited in IPCC 2007, p. 736) considered migration and relocation to be necessary but undesirable adaptations to climate change impacts in rural economies. Under certain circumstances, migration would be a feasible climate adaptation strategy. Over the

past several decades, internal migration and resettlement schemes had been common in small islands in the Pacific and Indian Oceans (IPCC 2007). This report cited previous studies on small islands (e.g. Barnett, 2001, Pelling and Uitto 2001) that considered emigration to be a potentially effective adaptation strategy. The temporary or permanent out-migrants sent remittances to families in the home-island. Remittances had a role in the moderating economic risk and augmenting home-island resilience (IPCC 2007).

Chapter 17 (Assessment of Adaptation Practices, Options, Constraints and Capacities) included a Box 17.8 entitled ‘Do voluntary or displacement migrations represent failures to adapt?’ When local environments surpassed a threshold beyond which the system was no longer able to support most or all of the population, migration of individuals or relocation of settlements was considered to be a potential adaptive response (IPCC 2007). However, not everyone could adopt migration as an adaptation strategy (McLeman and Smit 2006). Social capital is considered as an important determinant in the success and patterns of migration as an adaptive strategy. Rather than long-distance migration away from risk prone areas, it was suggested that a strong social network at the local scale could avert migration or lead to local-scale relocation. Long-distance migration was likely if the community had widespread social networks or was a part of a transnational community (IPCC 2007). If large populations were to abandon their long established home territories and move to new places, there would be enormous economic, cultural and human costs (Barnett as cited in IPCC 2007, p. 736). The cited references (e.g. Klinenberg 2002, Wolmer and Scoones 2003) recognised that responses to extreme climatic events in developing countries, particularly among the poor, depend on livelihood diversification, remittances, and other social assets (IPCC 2007).

Some of the region specific chapters of AR4 continued to adopt a pessimistic narrative regarding migration. For example, chapter 9 (Africa) cited Myers (2002) to suggest that a new set of refugees could be created by negative impacts of climate change. These refugees could impose additional demands on infrastructure of host communities (IPCC 2007). Chapter 11 (Australia and New Zealand) alluded towards the probable destabilising impacts of unregulated population movement in the Asia-Pacific region due to climate change (IPCC 2007). Chapter 13 identified poverty and rural migration as the main drivers of increased

vulnerability in Latin America (IPCC 2007).⁶ This chapter reported a figure of USD 38 billion of remittances in 2003 to illustrate the effect of migration on national economies and creation of social dependencies in Latin America (IPCC 2007, p. 595). It suggested that widespread unemployment, overcrowding, and the spread of infectious diseases would result from demographic pressures because of migration to urban areas (IPCC 2007). Chapter 16 (Small Islands) reported that coastal settlement, utilities, and resources were experiencing additional pressure from population growth and internal migration of people, which had created problems of pollution, waste disposal, and housing (IPCC 2007). Voigt-Graf (as cited in IPCC 2007, p. 706) suggested that outmigration of skilled workers from small islands could exacerbate the shortage of human resources required to accommodate, cope with, or benefit from the climate change impacts. Chapter 15 (Polar Regions) recognised that the interaction between human and natural effects would increase the sensitivity to coastal erosion, and inevitably lead to relocation of some coastal communities despite a cultural aversion to moving from tradition sites and large expenditure (IPCC 2007).

2.2.5 *Fifth Assessment Report (AR5) (2014)*

During the period between publication of AR4's WG II report (2007) and that of AR5 (2014), findings from several major research projects on environmental change (including climate change) and migration became available. These included the Environmental Migration and Forced Migration Scenarios Project in 2009, the Foresight Project on Migration and Global Environmental Change in 2011, the ADB's Report on Addressing Climate Change and Migration in Asia and the Pacific in 2012, and the UNU's Where The Rain Falls Project in 2012. Additionally, numerous case studies and reports on climate change and migration were published by various stakeholders during this period. The enhanced understanding of the complexity in the migration and climate change relationship was reflected in the AR5's WG II report. The SPM revealed a major change in the narrative on migration and climate change. It recognised migration as an adaptation strategy. It reported that 'climate change over the 21st century is projected to increase displacement of people (*high agreement and medium evidence*) (IPCC 2014a, p. 20).' Particularly in developing countries with low income, the displacement risk of populations in rural and urban areas that lack the resources for planned migration would increase if they experienced higher exposure to extreme weather events

⁶ Other main drivers of increased vulnerability in Latin America were weather and climate, demographic pressure, unregulated urban growth, low investment in infrastructure and services, and inter-sectoral co-ordination (IPCC 2007:585).

(IPCC 2014a). The SPM clearly stated the vulnerability of such populations could be reduced if opportunities for mobility could be expanded, and migration could be an effective adaptation strategy (IPCC 2014a). It recognised that the dynamic interaction between social, economic, and cultural factors created a challenge to understand future vulnerability, exposure, and response capacity of interlinked human and natural systems. One such factor is migration (IPCC 2014a). The SPM acknowledged that due to the complex and multi-causal nature of mobility, there was low confidence in quantitative projections of changes in mobility (IPCC 2014a).

This report recognised that complex patterns of rural-urban and rural-rural migration are shaped by economic, political, social and demographic drivers. These patterns are likely to be modified or exacerbated by climate events and trends. Therefore, the establishment of a causal relationship between climate change and migration was extremely complex (IPCC 2014a). The findings of Black et al. (2011b) were referred by the AR5 WG II report to explain the difficulty in categorising any individual as a climate migrant because of the complex motivations for migration decisions (IPCC 2014a, p. 24). The AR5 clarified that even when climate change impacts disrupted livelihoods, not everyone would migrate. Particular social structures, state institutions, other broader determinants of human security as well as individual characteristics (e.g. ethnicity, wealth, and gender) influenced the migration outcomes (IPCC 2014a). The loss of place of residence or economic disruption due to extreme weather events resulted in displacement of population in the short-term, which was largely temporary in nature (IPCC 2014a). The risk of displacement would be amplified with an increase in incidence and change in intensity of extreme weather events due to climate change (IPCC 2014a). In response to social and environmental change, mobility was a widely used strategy to sustain livelihoods (IPCC 2014a). Black (as cited in IPCC 2014a, p. 12) suggested that if these opportunities are reduced and constrained, climate change risks could be significant. The cited studies (e.g. De Sherbinin et al. 2011, Biermann and Boas 2012) suggested that various governments were planning to move settlements as part of adaptation to observed climate change and projected changes in resource productivity and risks (IPCC 2014a).

The AR5 projected that the exposure of population and assets would increase due to migration to flood- and cyclone-prone coastal areas, coastal industrialisation, and urbanisation (IPCC 2014a). A combination of social, economic, and institutional factors were

driving these processes. The concentration of new investments and employment opportunities in urban areas had a significant influence on the migration of rural dwellers to urban areas (IPCC 2014a). The AR5's WG II reported that in the absence of protection against increased flooding and erosion, hundreds of millions of people would be affected by coastal flooding, and would be displaced due to land loss by 2100 (IPCC 2014a, p. 3). East, Southeast, and South Asia would account for majority of those affected (IPCC 2014a). The data and computational limitations constrained an assessment of the impacts of relative sea level rise and extreme sea level events by numerical process-based models at regional to global scales (IPCC 2014a).

The AR5's WG II affirmed that there was a complex relationship between vulnerability and migration. Many aspects of the sending and destination areas could be positively or negatively affected by this migration (IPCC 2014a). The in-flow of remittances from migrants could reduce vulnerability in the sending areas (IPCC 2014a). The effectiveness of these strategies as adaptation depended on whether these were undertaken in a sensitive manner (IPCC 2014a). The AR5's WG II report cited McLeman (2009) to suggest that despite being a common strategy to address livelihood risk, migration might only be used as an adaptation of last resort, since movement was costly and disruptive (IPCC 2014a, p. 12). The AR5 moved beyond the financial remittances to highlight that an intensification of migration due to climate change could have positive impact in form of knowledge transfer from and to rural areas (IPCC 2014a). Chapter 22 (Africa) reported that in the western Sahel, migrant social organisations facilitated the transfer of technology and knowledge, along with remittances and resources. This had led to innovations across the region (Scheffran et al. as cited in IPCC 2014a, p. 37).

Resettlement has been portrayed as a failure of adaptation or an option of last resort in the scientific literature (Barnett and Webber 2009, Fernando et al. 2010, Hugo 2011). Learning from past resettlement programmes suggests negative social outcomes for the resettled, psychological stress, community dislocation, and perception of cultural loss (IPCC 2014a). Recent literature (e.g. Black et al. 2011) highlighted the risk from lack of mobility and from migrating into areas that are exposed to extreme weather events. These risks had been previously ignored. The new migrants, particularly if they had low income and were socially excluded, would experience higher risk in destination. These migrants were likely to reside in high density areas, which were often exposed to flooding and landslides. These risks were

likely to increase due to climate change (IPCC 2014a). Local governments have to confront the major challenges from rapid population growth in any urban centre. The capacity of local governments required to manage this in context of CCA has to be developed (IPCC 2014a). The AR5's WG II report recognised that rural development and adaptation, which protects rural dwellers and their livelihoods, would help to limit rural disasters. However, it will not necessarily slow migration to urban areas (IPCC 2014a). Since rural migration existed in many different forms for several non-climatic reasons (IPCC 2014a). The absence of men could increase work-load for women or the difficulty to access resources such as fuelwood and water. Out-migration could disrupt the flow of traditional knowledge, which could increase vulnerability (IPCC 2014a). Due to limited availability of high land in developing island states, it was widely recognised that there were biophysical limitations to adaptation through relocation. Pelling and Uitto (2001) suggested that temporary displacement could eventually turn into permanent human displacement from low lying areas (as cited in IPCC 2014a, p. 37).

The region specific chapters of AR5's WGII report largely reflected the nuanced analysis of the complex relationship between climate change and migration espoused in rest of this report. For example, chapter 21 (Regional Context) affirmed that internal migration was the common spatial dimension of climate-related migration. International migration in response to extreme weather events was less common. If it happened, it tended to follow well established migration routes (IPCC 2014a). This chapter recognised that migration could also be part of the solution if it contributed to adaptation (IPCC 2014a). However, internal migrants could be exposed to increased climate risk even where the predominant motivation for migration was not related to climate (IPCC 2014a). Chapter 23 (Europe) recognised managed retreat from the low lying areas in response to coastal erosion associated with sea level rise, storm surges and coastal flooding as an adaptation option (IPCC 2014a).

The portrayal of migrants as impoverished people persisted in some region-specific chapters. For instance, the chapter 22 (Africa) rationalised the necessity to provide attention to urban and peri-urban areas as part of building pro-poor adaptation or resilient livelihoods in context of multiple uncertainties, since these areas were 'heavily affected by migration of poor people' (IPCC 2014a, p. 5). Chapter 25 (Australasia) expressed concern whether an increase in population movement between neighbouring countries due to climate change impacts in the Pacific would affect political stability and geopolitical rivalry within the Asia-Pacific

region. Building on the theme of national security from the chapter on Australia and New Zealand in the AR4, this chapter envisaged a growing non-combat role for the Australian armed forces in context of increasing climate-driven disasters, disease, and border control. It suggested that the influence of climate change on forced migration and conflict could be moderated through the integration of security into adaptation and development assistance for Pacific island countries (IPCC 2014a, p. 35).

2.3 Evolution of the migration and adaptation narrative in the IPCC's WG II report

2.3.1 Numbers and methodology

The AR1 emphasised the large-scale nature of potential population movement as a result of climate change impacts and cited several estimates of potential number of people likely to be displaced by sea level rise, desertification, or environmental degradation (IPCC 1990). It did not elaborate on the empirical analysis through which these figures had been estimated. The AR2 introduced the concept of population at risk of environmental stressors, and provided a description of the underlying methodology (IPCC 1995). The AR3 conceded that since many of the societal responses to changes in the climate system were not precisely specified and act indirectly, it was difficult to include these aspects in scenario development (IPCC 2001). In comparison to the previous ARs, the efforts to quantify costs and benefits of climate change impacts were more nuanced in the AR4. However, a lack of data, high sensitivity to different estimation methods and high sensitivity to different assumptions were major constraints to these efforts (IPCC 2007). This report considered the estimates of environmental migrants to be 'at best, guess work', and discussed the methodological constraints that plague such estimates (IPCC 2007, p. 365). The SPM of AR5's WG II report recognised that due to the complex and multi-causal nature of mobility, there is low confidence in the quantitative projections of changes in mobility (IPCC 2014a). The narrative in SPM is significant as it indicates the position of governments; unlike rest of the AR report, the text of SPM is unanimously agreed by the country representatives. The AR5 highlighted that alarmist predictions of large-scale movement of 'environmental refugees' and/ or 'environmental migrants' had been questioned by migration scholars.

2.3.2 Profile of a migrant

The predominance of 'forced' migration in the conceptualisation of migration in AR1 led to the portrayal of the migrants as impoverished people from rural areas. These migrants were

considered responsible for overcrowding the cities, expansion of squatter settlements, overwhelming public amenities in the urban centres, and even causing social instability in some places (IPCC 1990). The AR1 narrative had a binary approach that set rural areas against urban areas, and developing countries against developed countries. The AR2 persisted with the same description of the migrants. It suggested that migrants who mainly originated from rural areas in developing countries, lacked skills that would help them to lead a better life in an urban area (IPCC 1995). The AR3 put onus of securing a better life on the migrants (IPCC 2001). The government institutions were not held accountable for their failure to provide requisite level of public amenities and services, and plan for the demands of a growing population.

In contrast, the AR4 admitted that the existing inadequacy of infrastructure and urban planning was exacerbated by the arrival of migrants, and resulted in lack of job opportunities, overcrowding, and spread of infectious diseases (UNEP as cited in IPCC 2007, p. 587). The unease about mass migration from developing to developed countries was observed in the AR4 narrative on migration and climate change. For example, chapter 10 (Asia) suggested that the population movement was expected to affect internal destinations as well as ‘western’ countries (IPCC 2007, p. 488). The mention of western countries manifested the apprehension about the arrival of migrants in the developed countries. It overlooked the fact that international migration was less common than internal migration in response to extreme weather events. Moreover, it ignored the existence of major regional destinations within the developing world. For example, there were 1.5 million Afghan refugees with Proof of Registration cards in Pakistan (UNHCR 2016). The AR5 suggested that the ripple effects from the changes in one part of the world could reach another. For example, migration could be triggered by climate change impacts. These migrants could move to either neighbouring or faraway destinations. The AR5 highlighted the risk from lack of mobility and risk from migrating into areas that were exposed to extreme weather events (IPCC 2014a). These risks had been ignored in previous ARs.

2.3.3 Positioning of migration

The AR1 (1990), including its SPM, reflected the alarmist theme of the maximalist stakeholders of the 1980s. The environmental context was largely envisaged as the impacts of sea level rise, storm surge, drought, flooding, and environmental degradation in developing

countries. This report conceptualised migration to occur upon loss of housing, livelihoods, or social and cultural resources. In this narrative, the environmental migrants were ‘forced’ to leave their country for climate change related reasons. Migration was a reaction to a ‘loss’ and, clearly, an outcome of the failure of ‘in-situ’ response strategies. The AR1 had identified migration and resettlement as most threatening short-term climate change effects on human settlement (IPCC 1990). The AR1 conceptualised migration as a mass movement of displaced population and refugees, and resettled communities. According to this view, these migrants had little agency in the decision to migrate, were victims of environmental stressors and extreme events, and migration involved a permanent change in residence. Even resettlement, which the AR1 perceived as the only solution for many small islands, was envisaged to create considerable new problems for the resettled and host communities. Although sensitisation of government and public opinion was the major aim of these alarmist predictions, it contributed to further stigmatise migrants from less developed states (Piguet et al. 2011).

Though the AR2 (1995) described migration an adaptation to climate change, this description was intuitive, rather than having a basis in the empirical evidence presented in this report. Migration was neither considered beneficial for rural areas nor for urban areas. The conceptualisation of migration still lacked the recognition of agency in the decision to migrate. For example, the inevitability of forced migration was common in the description of migration from low lying areas affected by flooding due to sea level rise (IPCC 1995). The sub-section on Adaptation Options, instead of elaborating on the role of migration and resettlement in adaptation, discussed various measures to curb the incidence of economic migration and ecological refugees (IPCC 1995). One of these measures was the provision of ‘services of civilisation’ in origin communities (IPCC 1995, p. 416). The portrayal of migrants as impoverished masses from rural areas bereft of amenities required to sustain a ‘civilisation’ manifests the urban and elitist biases in this narrative. The inflow of economic migrants and ecological refugees to urban areas was considered to be one of the potentially destructive effects from various social and economic perspectives (IPCC 1995).

The AR3 recognised that extreme weather, changes in health status, or migration might directly affect populations (IPCC 2001). Though this report cited the maximalist literature that predicted an increase in political instabilities and conflicts due to migration of population affected by extreme events or modifications in the resource distribution, it recognised that

several intervening and contributory factors influence intergroup and intragroup conflicts. This acknowledgement was a major shift from the past narrative. It was the first step towards questioning the simplistic linear causal relationship between environmental degradation, loss of access to resources, and migration (including ‘environmental refugees’). The narrative had broadened to include various forms of mobility (e.g. displacement, migration, and resettlement) in context of climate change impacts. Moreover, this report acknowledged that there were significant tendencies to adapt to inter-annual climate variability and considerable variations in household income through migration. The displacement was considered to be a failure to adapt (IPCC 2001). The AR3 included region specific chapters. While a growing nuanced conceptualisation of migration was observed in the main chapters of this report; the region specific chapters persisted with the alarmist theme from the AR1 and AR2. For example, phrases such as large-scale and mass migration were used to describe the potential size of migration in chapter 11 (Asia). It was suggested that the arrival of environmental refugees in urban areas of Latin America would lead to overcrowding, food and water shortage, decline in housing quality, lack of sanitation, increased tension between the new arrivals and host community, and even deterioration of relation among neighbouring countries (IPCC 2001). The potential movement of environmental refugees could not only overwhelm urban infrastructure, but also threaten national security.

The SPM of the AR4 (2007) indicated the ‘potential’ of population migration upon certain changes in drought, tropical cyclone, and sea level rise. The use of the term potential suggested a shift from the definitive assertions of large-scale or mass migration in the previous ARs. This report recognised that climate change effects assumed increasingly strong and complex global linkages. The changes in the relative importance of the elements within a complex livelihood system adopted by many smallholders, and interactions between these elements shaped coping strategies for extreme climatic events (IPCC 2007). Migration is considered to be one of the reactive or *ex-post* adaptation measures to the impacts of weather and natural climate variability on seasonal to interannual time-scales (IPCC 2007). The AR4 acknowledged that multiple motivations of the individual migrants and multiple factors leading to displacement made it highly problematic to disaggregate the causes of migration (IPCC 2007). During extreme events such as floods and famines, temporary migration from rural to urban areas was a common response (IPCC 2007). However, forced migration was recognised as a form of vulnerability (IPCC 2007). Remittance was one of the non-

agricultural strategies within this livelihood system (IPCC 2007). This was the first mention of remittances in a WG II report. It illustrates the overwhelming focus of the environmental change and migration discourse on the causal linkages between environmental deterioration and migration. Additionally, it highlights that previous ARs had not explored the impacts of migration outcomes on origin communities, except the mere suggestion that migration was part of household income strategies. Even AR4 did not explore the effects of remittance on the vulnerability of remittance-recipient households in origin communities. The AR4 recognised that climate change impacts could overwhelm traditional coping mechanisms (e.g. livelihoods diversification, remittances, and social assets) or there were limits to adaptation. The report admitted that the cultural implications of large-scale migration, resettlement, and relocation were not well understood, and could represent significant limits to adaptation. There were often large social costs associated with these processes and unacceptable impacts in terms of human rights and sustainability (IPCC 2007). Some of the AR4's region specific chapters continued to adopt a pessimistic narrative on migration and reflected an inconsistency in positioning of migration vis-à-vis adaptation. The impacts of unregulated population movement in the Asia-Pacific region due to climate change were perceived as an additional challenge to national security of Australia and New Zealand (IPCC 2007). Chapter 9 (Africa) suggested that a new set of refugees created by negative impacts of climate change could impose additional demands on infrastructure of host communities (IPCC 2007). Though yet to be explicitly stated, examples of the context dependent nature of migration consequences, particularly for the sending areas, were scattered throughout this report.

The AR5 WGII recognised that establishing a causal relationship between climate change and migration was extremely complex since multiple motivations influence a migration decision. Though, the migration patterns could be modified or exacerbated by climate events and trends (IPCC 2014a). The SPM projected that population displacement was likely to increase due to climate change over 21st century, particularly in developing countries (IPCC 2014a). The AR5 reported that mobility was a common response strategy to maintain livelihood in context of social and environmental changes (IPCC 2014a). This report had also clarified that even when climate change impacts would disrupt livelihoods, not everyone would migrate. The migration outcomes were influenced by social structures, institutions, ethnicity, wealth, gender, and other determinants of human security (IPCC 2014a). The AR5 attempted to position migration within several conceptual frameworks: vulnerability, adaptation, risk, and

human security. However, it lacked an assessment of how the migration outcomes and impacts were positioned within these frameworks.

The different chapters of an AR are prepared by various teams of authors. The inconsistency in their conceptualisation and understanding of migration in context of environmental change is reflected in the narrative. One manifestation of these differences is in the use of mobility related terminology. There is lack of uniformity in the application of terminology related to mobility, not only among various ARs but within the same AR (Table 2.1).

Table 2.1: Evolution of terminology on migration in the IPCC's WG II reports.

AR1 (1990)	AR2 (1995)	AR3 (2001)	AR4 (2007)	AR5 (2014)
Displace (1990:4)	Enforced migration (IPCC 1995:404)	Environmental migration (p571)	Relocation (p17)	Migration (p20)
Migration (1990:3, 4-19, 5-9, 5-11)	Displaced communities (IPCC 1995:576)	Environmental refugees (p397)	Migration (p18)	Displacement (p20)
Relocation (1990:2-20, 2-22, 7-18)	Environmentally forced migration (Myers cited in IPCC 1995:570)	Displacement (p473)	Environmental migration (p365)	Mobility (p20)
Resettlement (5-9)	Ecological refugees (P416)	Environmental refugees (p596, p719)	Displacement (p91)	Environment induced migration (p45)
Emigration (1990:4-19), refugee (5-3, 5-4)	Relocation (P449)	Emigration (p86)	Remittances (p293)	
Environmental refugees (5-3, 5-8, 5-10)			Resettlement (p736)	
Climate induced population migration (5-21)			Environmental refugee (p395)	

Source: Author

2.3.4 Migration governance

The AR1 suggested that the policy choice of no response to sea level rise in some areas of developed countries might induce the local communities to migrate (IPCC 1990). An elaborate articulation of the potential role of migration governance in context of climate change could be found in the AR2. This aimed at reducing the migration from rural to urban areas. It suggested that economic migration could partly be reduced through national and regional economic development (including rural), immigration or emigration policies, and

decentralisation of government administration to secondary cities (IPCC 1995, p. 416). The AR2 proposed effective land-use regulation to relocate population from vulnerable locations and economic dislocation programmes to reduce number of ecological refugees (IPCC 1995). It suggested that an effective measure to reduce rural-to-urban migration and population growth was rural development (IPCC 1995). The migration governance discourse had moved from 'no response as policy choice' to policies that aimed to regulate migration. The AR3 proposed the preparation of contingency plans for migration in response to sea level rise as one of the potential sector-wide adaptation options for the Temperate and Tropical Asia (IPCC 2001). Since drought (which often turned into a famine) accelerated rural-to-urban migration, the AR3 proposed maintenance of strategic food reserves and development policies that created non-farm investment opportunities in rural area, diversified survival measures, and created rural wealth (De Lattre as cited in IPCC 2001, p. 517). As evident from the recommendation to prepare contingency plans for migration, potential risks from migration continued to overshadow the public policy discourse. The AR4 envisaged a role for governments to support the transitions through direct financial and material support, and creating alternative livelihood options in places that would experience major land use changes, industry location changes, and migration (IPCC 2007). Poor people often moved to fragile and high-risk areas, which are more exposed to natural hazards, because of reasons such as rapid population growth, urbanisation and weak land-use planning (IPCC 2007). Rural-urban migration is also induced by rapid growth of industries in urban areas (IPCC 2007). Prerequisites for reducing the migration of people to cities and coastal areas in most developing countries of Asia were identified to be rural development, networking and advocacy, and building alliances among communities (Kelly and Adger as cited in IPCC 2007, p. 492).

The AR5's SPM stated that population displacement was likely to increase because of climate change over the 21st century. The low income households in urban areas have greater exposure to hazards. At the same time, these households have lower adaptive capacity, limited access to infrastructure or insurance, and fewer possibilities to relocate to safer locations (IPCC 2014a). The SPM of AR5 stated that expanding opportunities for mobility could reduce the vulnerability of populations that were at risk of displacement (IPCC 2014a). Some resources would be required to migrate away from areas exposed to the risks from extreme events. These resources could be unavailable to many of these vulnerable groups,

rendering them immobile (IPCC 2014a). Through climate sensitive disaster risk management, urban planning, and infrastructure investments, the local, provincial and national government are supposed to encourage new investments and migration away from high risk sites. However, the AR5 cited references (e.g. Douglass 2002, Reed et al. 2013) that suggested a weak implementation of these regulations due to the priority given to economic growth (IPCC 2014a). Provision for emergency shelters and services has to be arranged for the displaced or temporarily evacuated, especially for vulnerable residents (IPCC 2014a). The AR5 highlighted the need to include forced migration into international policy making and international refugee policies. Despite the conceptual disagreement over the term environmental refugees, the chapter 21 (Regional Context) suggested the following:

Currently there is no category in the United Nations High Commission for Refugees classification system for environmental refugees, but it is possible that this group of refugees will increase in the future and their needs and rights will need to be taken into consideration (Brown as cited in IPCC 2014a, p. 27, C21).

The same chapter also mentioned that the Nansen Initiative aimed to enhance understanding of cross border movements triggered by climate change, identify best practices, and develop consensus among interested states and relevant actors about a possible protection mechanism (IPCC 2014).

2.3.5 Gender

None of the reports from AR1 to AR4 contains a discussion about the gender aspects of migration in the context of climate change. In contrast, the AR5 explored the effects of male out-migration on women. It suggested that this could increase the vulnerability of women due to an increase in the work load (IPCC 2014a), unsafe working conditions, exploitation, and loss of respect (Pouliotte et al. as cited in IPCC 2014a, p. 13). Displacement due to extreme events could disrupt the social network of women, resulting in a loss of their social capital, and have an adverse effect on their mental health (IPCC 2014a). On the other hand, it could also empower women to revamp traditional roles, increase their access to public decision making forums, and seek new livelihood opportunities (IPCC 2014a).

2.4 Chapter conclusion

This chapter charts the evolution of narrative on migration and CCA through the IPCC's WG II reports, which have mirrored the contemporary deliberations on this issue. The SPM

presents the common understanding of the governments on various aspects related to climate change. The rest of the chapters in an AR is peer-reviewed, and provides an overview of the state of knowledge regarding climate change and its impacts. Therefore, the WGII reports provide an opportunity to trace the antecedents of the discussions about migration and CCA relationship among the scientific and policy stakeholders. An examination of the WGII reports from AR1 to AR5, indicated a progressive shift from the alarmist predictions in the 1980s and 1990s of future mass migration as a result of climate change impacts to the recognition in AR5 that there was low confidence in quantitative projections of changes in mobility due to the multi-causal nature of mobility. The lack of agency and predominance of environmental factors in the conceptualisation of migration decision-making in the AR1 had led to a portrayal of impoverished and hapless migrants. This negative image of migrants had persisted in the AR2 and AR3. In contrast, the AR5 had highlighted that international migration was less common than internal migration in response to extreme weather events. The AR4 had recognised that migrating into areas that were exposed to extreme weather events increased vulnerability of the migrants, and AR5 had highlighted the hitherto neglected risk from a lack of mobility.

The AR1 had identified migration and resettlement as most threatening short-term climate change effects on human settlement. In this narrative, the role of migration was limited to a reaction to a loss and was an outcome of the failure of 'in-situ' response strategies. The AR3 narrative broadened the scope to explore the role of various types of mobility (e.g. displacement, migration, and resettlement) in context of climate change impacts. While displacement was perceived to be a failure to adapt, the AR3 recognised that migration was an important household strategy to adapt to inter-annual climate variability and consequent variations in household income. The AR4 was the first to recognise remittance to be part of the non-agricultural strategies within a livelihood system. Between the publication of AR4's WG II report (2007) and that of AR5 (2014), there was a rapid growth in the knowledge generation on migration and climate change. The growing understanding and nuanced position among the scientific community was reflected among the policy stakeholders. For example, the AR5's SPM stated that the vulnerability of populations in developing countries would increase if they experienced higher exposure to extreme weather events, and this vulnerability could be reduced if opportunities for mobility could be expanded, and migration could be an effective adaptation strategy (IPCC 2014a). Within a quarter of a century, the AR

narrative on migration and climate change had progressed a long way from perceiving migrants as hapless victims of climate change impacts to recognising migration as a means to reduce vulnerability. As evidence in the AR5 had suggested, there is a need to consider migration as part of the adaptation planning to address future climate change impacts. However, the extent to which migration can contribute to climate change adaptation (CCA) requires further exploration. Policy interest in climate change and migration is growing. Therefore, a conceptual and methodological approach is required to design empirical research that addresses the current policy needs. The next chapter will discuss possible approach to answer the research questions of this thesis.

Chapter 3: A Conceptual Approach to Understand the Effects of Labour Migration on Climate Change Adaptation

3.1 Introduction

The previous chapter provided an overview of the migration and climate change relationship by using the IPCC's WGII reports as the framework to trace the evolution of this discourse. This chapter argues that the overwhelming focus on causal linkages between environmental stressors and the migration decision making, disagreement among stakeholders regarding the positioning of migration within CCA discourse, and the lack of empirical evidence surrounding the role of migration as adaptation have been major impediments to mainstreaming migration in adaptation policies. There is a growing consensus among migration scholars regarding the potential contribution of migration to the lives of the migrants and their families left behind. However, the extent to which migration can contribute to CCA among migrant sending households, origin communities, or sending countries is a complex issue and requires further exploration. This chapter attempts to fill some of this void by developing a conceptual approach with which to assess the effects of migration in the context of adaptation to extreme events such as drought and floods. As such, it is not concerned so much as to why someone migrates, but purely on its effects. In order to do this I draw parallels between migration-development and migration-adaptation discourses. The migration and development discourse have witnessed similar contestations regarding effects of migration on development of migrant sending households and origin communities. These lessons are pertinent for migration and adaptation discourse, and I use these lessons to build the conceptual framework of this thesis.

3.2 Migration and climate change adaptation

The reference of migration as an adaptation is two decades old. It had a false start in the IPCC AR2's WGII report in 1995, which had described migration as an adaptation. However, the section on 'Adaptation Options' in the same report had discussed various measures to reduce the incidence of economic migration and ecological refugees. McLeman and Smit (2003) was one of the earliest to conceptualise the relationship between human migration and environment through the adaptation prism. There has been a rise in the publications that refer to migration as an adaptation during the last decade (e.g. Tacoli 2009, Black et al. 2011a, Hugo et al. 2012, Warner et al. 2012, Gemenne and Blocher 2016). These publications by academics, NGOs, and multilateral organisations have shaped the narrative of the IPCC

AR5's WGII report in 2014, which associates migration with vulnerability, adaptation, risk, and human security. At the same time, migration was growing in significance within the UNFCCC process. The Cancun Adaptation Framework signed at COP 16 in 2010 was a watershed moment. Migration was formally considered as a form of adaptation to climate change by the UNFCCC signatories (McLeman 2016). The inclusion of paragraph 14f invited all parties to undertake:

(f) Measures to enhance understanding, coordination and cooperation with regard to climate change induced displacement, migration and planned relocation, where appropriate, at the national, regional and international levels; (UNFCCC 2011, p. 5)

This provided an opportunity to mainstream migration into national adaptation plans. However, this issue has received little attention within the national adaptation discourses across the HKH region in particular. The public policy in this region perceives migration as a challenge to development and adaptation goals. De Haan (1999, p. 30) observes that 'policies often wrongly try to encourage, implicitly or explicitly, a sedentary population, and impose restrictions upon population mobility.' Hugo et al. (2012) suggests that the scattered nature and inadequacy of policy responses and normative frameworks that address climate induced migration is due to the lack of reliable data about the nature and extent of population movements (including those related to environmental changes), limited comprehension of the nature of migration, and little attention received by climate change and migration relationship from public policy until recently.

Previous research (see Adger et al. 2002, Black et al. 2011a) has suggested that migration is a household level strategy that can assist migrants and their families in environmentally vulnerable regions through accumulation of savings and asset creation; livelihoods diversification (e.g. income and sectoral); improvement in access to food across seasons; increase in access to information, acquisition of new knowledge, skill, and resources; or by creating, extending and consolidating social networks across regions; and providing a safety net during crisis. These studies assume that the migrants have the agency to take initiative to assist themselves and their families in changing their vulnerability to extreme events and environmental degradation. It is noticeable that the narrative of migration as an adaptation strategy has many parallels with that over the relationship between migration and development. The discourse on migration and adaptation suffers from the same contestations of structuralist, neo-classical, and pluralist viewpoints as discussed by De Haas (2007) with

reference to migration and development discourse. The ‘migration as an adaptation’ and ‘migration as a failure of adaptation’ approaches have arrived at a normative judgement that mostly focus on drivers of migration, and lacks an in-depth analysis of effects of migration on CCA of the family left behind. The effects of migration on development of migrant-sending households and origin communities have been similarly debated within the migration and development discourse. Several simplistic binaries (e.g. negative versus positive, brain drain versus brain gain, and consumption versus investment) have overshadowed any discussion on migration. It is crucial to move beyond these polarities (De Haas 2012). Similar to the migration and development nexus (see McDowell and De Haan 1997, De Haas 2012), the spatial and temporal scales of analysis and context are essential parameters in the assessment of the effects of migration on CCA. Therefore, the lessons from migration and development discourse are pertinent for migration and adaptation discourse.

3.3 Migration and development discourse

The different forms of migration, theoretical complexity of framing the question about migration’s role in development, and context dependent nature of the causes and consequence of migration implies that there is little consensus about the relationship between migration and development (De Haan 1999). Within the debate on migration and development nexus, De Haas (2007) identifies three perspectives: migration optimists, migration pessimists, and migration pluralists. During the 1950s and 1960s, the migration optimists considered migration to be a conduit of capital-, knowledge- and skill-transfer primarily between the developed and developing countries. It had been suggested that growth in origin and destination countries is stimulated by migration. This proposition could be extended to cover rural-to-urban migration (De Haas 2007, 2012). By alleviating unemployment and providing inputs (such as remittances and skills), migration spurs development, narrows regional disparities, and eventually makes migration unnecessary as per the balance growth approach (McDowell and De Haan 1997). The developmentalist and neoclassical perspectives consider migration to have a positive impact on the development process in sending area, and perceive the migrant as an agent of change (Kindleberger 1965, Beijer 1970, De Haas 2012). According to the neoclassical migration optimists, migration is an essential component of optimal allocation of production factors (De Haas 2012) and factor price equalisation (De Haas 2007). Though consumption accounts for the major part of a migrant household’s expenditure, it enables people to improve their living standards, and largely locally or

domestically procured goods and services could have positive multiplier effects. Migrants have often been criticised for making non-productive investment such as housing. However, migration optimists counter that argument by indicating that decent housing contributes to basic well-being, health, and safety. Employment opportunities and income could be generated due to investment of remittances in construction in origin communities. The migration optimists suggest that migration becomes accessible for increasingly large sections of the population as incomes rise and networks expand (De Haas 2007, 2012).

The economic downturn, industrial restructuring, and increasing unemployment in Europe in the aftermath of the 1973 oil crisis coincided with the rise of pessimistic views on migration and development (De Haas 2012). Accordingly migration, remittances, and return were suggested to not be automatically converted into accelerated development (McDowell and De Haan 1997). Here the structuralist social theory, which is comprised of neo-Marxist, dependency, and world system theory, considers migration to be an expression of the developing world's increasing reliance on the global political-economic systems (De Haas 2007). Migration is not seen as a choice for the poor people. Instead, it is seen as the only option for survival after estrangement from the land (De Haan 1999). Here migration is perceived as disrupting traditional village societies; creating remittance-dependent communities; inducing labour shortages in origin communities due to brain and brawn drain; and changing rural tastes (see Rubenstein 1992, Binford 2003). This framing considers remittances to be a temporary and unstable source of revenue (De Haas 2007), which is largely spent on consumptive uses (Lipton 1980). The exploitation of migrants in destination and sending areas, and the benefits to capitalist production from migrant labour have been highlighted by this literature, which is critical of the neoclassical models (De Haan 1999). This perspective suggests that migration constantly undermines processes of sustained development since entire societies are enmeshed in a structural dependency on migration (De Haas 2012).

The pluralist perspectives shifted the debate on migration and development beyond the binary of optimistic and pessimistic views (De Haas 2012). The nuanced outlook about the role of migration in development processes in origin communities emerged in form of the New Economics of Labour Migration (NELM) and Livelihoods approaches. Depending on the attractiveness of sending countries for investment and return, both positive and negative development consequences of migration were possible (De Hass 2010). Oded Stark and

David Bloom introduced NELM in 1985. According to this approach, the decision to migrate is made at the household level, and involves both the migrating and non-migrating members of the household. The household attempts to overcome constraints to its development because of its limited size by broadening its geographical space through migration of one or more household members in search of work. The costs and returns of migration are shared by the migrant and household (Stark and Bloom 1985, Stark and Lucas 1988). Migration is a risk-sharing behaviour of the household to diversify resources in order to minimise income risks (Stark and Levhari 1982) since remittances serve as income insurance (Lucas and Stark 1985). Since credit and insurance markets are often weakly developed in rural areas (Taylor 1999), and inaccessible to non-elite groups, migration assists the rural households to overcome the market constraint and invest in productive activities and improve their livelihoods (De Haas 2007).

The Livelihoods approaches suggest that the poor actively try to improve their livelihoods within the constraining conditions in which they live (Lieten and Nieuwenhuys 1989), suggesting a role for human agency (De Haas 2007). The Sustainable Livelihoods Approach (SLA) was proposed by Chambers (1987), and was expanded by Scoones (1998) who proposed that a household's asset base is composed of five types of capital assets, namely financial, human, natural, physical and social. The household's livelihood is shaped by these assets. The loss of one asset could be compensated by the use of others. Policies and institutions influence the access to these assets (DFID 1999). The extent to which livelihoods are vulnerable to climate change and variability, and people's responses to these stressors could be examined through the SLA (Kniveton et al. 2008). Previous research (see Vincent 2007, Eakin and Bojórquez-Tapia 2008, Aulong et al. 2012) had used the Sustainable Livelihoods framework to examine household capacities to adapt to climate and economic changes. The advent of this pluralist perspective was closely followed by the enthusiasm with private capital flows as a development tool in the mid-1990s. Kapur (2005) explains that attractiveness of remittances is due to its perception as a 'third way' approach that exemplifies self-help. Remittances from immigrants belonging to poor countries are directly received by their households. The author further points out that the critical differences between foreign aid and remittances are that the latter imposes few budgetary costs, does not require a costly government bureaucracy in developed countries, and has less leakage to rent seeking in the receiving country. These reasons have diminished the high degree of

scepticism about migration and development that had persisted in the policy sector until then (De Haas 2012).

3.4 Migration and adaptation discourse

Indeed the argument about whether migration is an adaptation strategy goes further than merely assessing the immediate outcomes of migration, touching also on perceptions of the political economy of migration as adaptation. In this sense, the question of whether migration can be considered an adaptation or a failure of adaptation mirrors the debate about whether migration aids or restricts development in developing countries. As with the migration-development nexus, the framing of migration as an adaptation can be characterised by pessimist, optimist, and pluralist perspectives. Essentially, pessimists and optimists occupy the two ends of the migration and adaptation continuum. Within the migration and adaptation discourse, the migration pessimists encompass the advocates of environmental refugee rhetoric (e.g. El-Hinnawi 1985, Myers 1993), subscribers of the environmental security research (e.g. Reuveny 2007), proponents who had explicitly conceptualised migration as a manifestation of a failure to adapt (e.g. Adamo 2008, Penning-Rowsell et al. 2013), and researchers who have critiqued the migration as an adaptation paradigm for its perceived neo-liberal bias (e.g. Felli and Castree 2012, Bettini 2014). The droughts and severe storms in the 1970s and 1980s were followed by large scale displacements of people in Asia and Africa. The ‘environmental refugee’ literature and sub-discipline of environmental security research, which had emerged from the NGOs and multilateral organisations in the 1980s and 1990s, perceived migration as an outcome of failure of in-situ adaptation strategies (McLeman 2016). Though this literature from 1980s and 1990s does not explicitly use terminology such as adaptation or adaptive capacity to explore migration in context of climate change impacts, the lack of agency in the conceptualisation of migration decision indicates that these researchers implicitly perceived migration to be a failure of in-situ strategies. It is noticeable that the rise of migration alarmists in this discourse had coincided with the pre-eminence of migration pessimism in the migration and development discourse.

During the 2000s, the strong sedentary bias in the development sector and public policy, lack of consensus on definitions, and context specific nature of causes and consequences of migration have resulted in migration being described as a failure to adapt or a strategy of last resort (e.g. Baro and Deubel 2006, Penning-Rowsell et al. 2013). The concept of adaptation,

which lays the onus of adjustment on the vulnerable household or social group rather than on the social, economic, and political structures causing vulnerability, has been criticised (Ribot 2011). Along similar lines, the notion that migration can be an adaptation strategy has also been criticised (e.g. Felli and Castree 2012, Bettini 2014) for its perceived neo-liberal bias. Felli and Castree (2012) argues that placing the onus on individual and community level actions and market mechanisms to address environmental degradation and climate change, rather than on political-economic transformations, is questionable. Bettini (2014) concludes that neoliberal valuation of migration and adaptation has been strengthened.

In the parallel migration-development discourse, the predominance of migration pessimism was noticeable during the period between 1970s and late 1990s. Even though the migration pluralists had emerged in mid 1980s (e.g. NELM was proposed in 1985), this counter narrative had not gained momentum until the late 1990s; around the same time when private capital flows as a development tool was being enthusiastically promoted by the multilateral organisations. The critique of environmental refugees by Black (2001) and Castles (2002) materialised in early 2000s, and was followed by the work of several migration scholars on multi-causal nature of migration. It is likely that learning from migration and development discourse had been imbibed into the migration and adaptation discourse, and this had left little space for the emergence of migration optimists in the latter discourse. Clemens and Velayudhan (2011) and Clemens and Farrell (2011) adopts an overwhelmingly positive note on using migration as a tool for disaster recovery in the aftermath of the 2010 Haiti Earthquake. Their recommendations for the US government includes modification of the Diversity Visa Lottery to allocate a portion to the victims of natural disaster; admitting Haitians under low skill temporary work visa that could serve U.S. national interest and provide Haitians skills to rebuild their country; and modification of the refugee admission programme to accept disaster affected refugees (Clemens and Velayudhan 2011).

The migration pluralists in the migration and adaptation discourse acknowledge that different types of mobility could have vastly different consequences depending on the context. For example, displacement of entire communities will occur as a last resort once adaptation possibilities (like in-situ techniques, temporary and permanent migration) and community resilience have been exhausted (Hugo et al. 2012). Having been shaped by the NELM and SLA approaches, this perspective conceptualises migration as a household level strategy to spread the risk of environmental stressors, a proactive diversification strategy that could build

household level adaptive capacity (e.g. Tacoli 2009, Black et al. 2011a, Hugo et al. 2012). They propose that migration can be both an autonomous and planned adaptation. Hugo et al. (2012) reported that migration could be considered as a part of the adaptation portfolio mobilised by migrants themselves to cope with climate change as well as a mechanism to reduce poverty and increase resilience in affected area. The migration pluralists also recognised the potential role of the state in addressing vulnerability in context of future environmental change and other consequences of climate change. Black et al. (2011a) and Hugo et al. (2012) had recommended the establishment of new urban centres or capacity enhancement of existing urban and peri-urban areas that by implication draw in migrants from more vulnerable areas where an environmental tipping point could be reached in the future. It has been suggested that such an endeavour in developing countries would require the participation of a diverse array of government institutions and would be guided by the government policies and regulations. In situations where people's lives will be directly threatened or the area will be unable to sustain livelihoods, the pluralists consider planned relocation of vulnerable population to areas that are less vulnerable to environmental change, though problematic, as a last resort (Black et al. 2011a, Hugo et al. 2012).

3.5 Need for convergence between the two discourses

Over half a century a body of evidence has been built around different contestations within migration-development discourse. For example, empirical evidence is available on impacts of labour migration at different scales (e.g. individual, household, community, and country), different contexts (e.g. origin and destination communities), different types of mobility (e.g. labour migration and diaspora), and different migration outcomes (e.g. financial and social remittances). This evidence base has contributed to the evolution of the narrative around migration and development. In many of the sending countries, international labour migration is an important part of development agenda, and receives ample attention from policymakers. Though, similar enthusiasm is seldom noticeable in context of internal migration. In comparison, migration and climate change discourse has been largely concentrated around the narrow narrative of environmental migration with a focus on the potential number of environmental migrants, their likely destinations, drivers of migration, legal protection, and emergency responses (see Black et al. 2011a, Hugo et al. 2012). The deliberations on migration and adaptation have been shaped by the wider discussions on migration and climate change. This has resulted in a process focused normative approach: 'displacement as

a failure to adapt’, ‘migration as an adaptation’, and ‘resettlement as an adaptation of last resort’. It is necessary to build an evidence base surrounding the role of migration in CCA to reorient this discourse as well as inform the policymakers. I argue that the lessons from migration-development discourse could provide a template for studying the relationship between migration and adaptation. In the next section, I present a conceptual framework that aims to enhance our understanding of the effects of labour migration on vulnerability to extreme events.

3.6 Conceptual framework

Migration is a series of exchanges between origin and destinations over a long period (Lucas 2015). Internal migration, mainly from rural to urban areas, has been on the rise. Migration over long distances, particularly across international borders require a number of resources such as savings, insurance, borrowing capacity, networks, marketable skills, visas, permits, and identity documents (Hugo et al. 2012). In contrast, the threshold to enter internal migration flow is comparatively lower, and hence could be more accessible even to the low-income and marginalised rural households. The environmental migrant centric approach has sidelined the contribution of migrant workers (including members of diaspora) – whose decision to move may not have been influenced by the environmental stressors – to CCA among the families left behind. Lack of an environmental stimulus in the decision to migrate does not preclude a migrant from contributing towards adaptation of the family left behind. It is also possible that a migrant whose decision to move has been influenced by impacts of an extreme event may not contribute to the adaptation of family left behind. As such, a wider set of migrants have a potential role in CCA. This thesis aims to understand the role of domestic labour migrants, particularly remittances sent by these migrant workers, in CCA of remittance-recipient households in origin communities.

Within a country, circular migration could be between any combination of rural and urban location (Lucas 2015). It has been suggested that migration is essentially a household level strategy (Stark and Bloom 1985) to improve living standards (Black et al. 2011a) and manage risks (Stark and Levhari 1982) in developing economies. As part of economic growth, the absorption of labour in non-farm sectors results in improvement of living standards (Black et al. 2011a). Established channels of movement or networks and relationships would shape or reinforce the majority of human migration due to climate change impacts (Hugo 2010), and

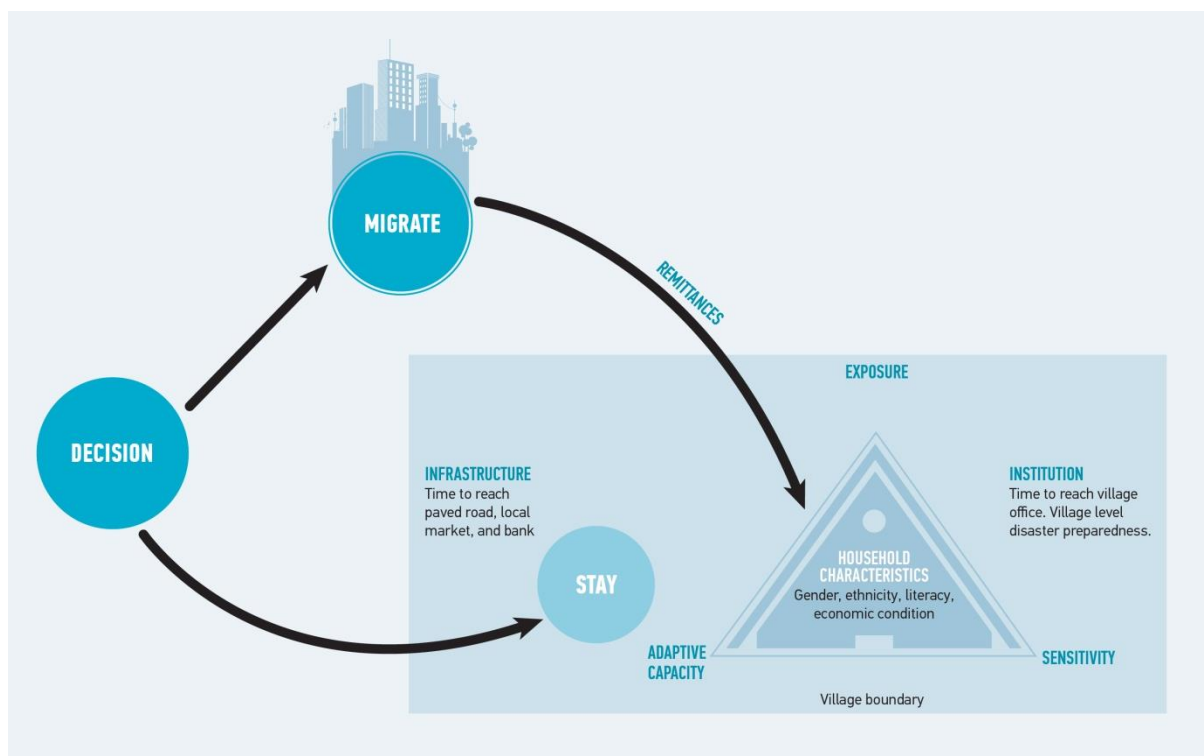
this migration would be to destinations within countries of origin (Hugo et al. 2012). However, new corridors and new scales of migration could also develop since climate impacts could lead to fundamental changes in societal structures. Moreover, the attractiveness of popular destinations could be reduced due to climate change impacts (Hugo et al. 2012).

Past research (e.g. Kniveton et al. 2008, Schmidt-Verkerk 2011) have applied the NELM and SLA approaches to understand the causal linkages between climate stressor and migration behaviour. This thesis shifts the focus to consequences of migration outcomes. It aims to understand how the choices on remittance usage already made by households affects the CCA to extreme events. It, however, does not examine the household level decision-making process on remittance use. The conceptual framework of this thesis is presented in the Figure 3.1. It could be assumed that migrant sending households are using an autonomous strategy to temporarily substitute the perceived or real structural constraints in origin communities (i.e. sending villages), which impede their prospects of risk management and welfare, with perceived and actual structural opportunities in the destination communities (i.e. mainly urban centres). These opportunities in destination could include alternative income opportunity, access to cash income, access to public services and amenities, and expansion of network. Also, the informal sector provides an opportunity to the rural households for sectoral diversification of their livelihoods portfolio. Unlike the formal sector, the threshold to get a job in the informal sector is low, which is opportune for the semi-skilled or unskilled migrant workers from rural areas. On the other hand, the migrant workers could experience a wide range of challenges in the destination: Difficult working and living conditions, low income, lack of access to social protection mechanisms (especially for inter-provincial migrants), negative perception of migration in public policy, exclusionary urban spaces, tensions and conflicts with the host population, and psychological stress of living away from family. Despite these challenges, an 'ex-situ' earning opportunity could permit the family left-behind to manage risks of extreme events, particularly when their frequency and magnitude are like to be modified due to climate change.

Over an extended period of time, migrants continue to maintain strong links with their areas of origin through family and other personal networks (McDowell and De Haan 1997). As illustrated in Figure 3.1, migrant workers send remittances to their families in origin communities. Remittances are largely spent on food, consumer goods, housing, health care, and education. For remittance-recipient families living in high-risk areas, remittance might

increase adaptive capacity and promptly indemnify property damaged due to extreme events (Hugo et al. 2012). In practice, relatively little is known about the specific role of remittances in reducing vulnerability to climate-related stressors. For example, while remittances may be spent on procuring relief in the aftermath of a flood, how is sensitivity of a remittance-recipient household to flood different than that of a non-recipient household? Is there a difference between adaptive capacity of a remittance-recipient and non-recipient household to floods? Does sensitivity and adaptive capacity of a remittance-recipient household to a specific extreme event vary over the migration cycle? This thesis studies effects of remittances on the major components, sub-dimensions, and attributes of vulnerability to a specific extreme event. The answers will help to identify policy and institutional support required by remittance-recipient households.

Figure 3.1: Conceptual framework of this thesis.



Source: Author

The IPCC's AR5 defines adaptation as 'the process of adjustment to actual or expected climate and its effects. In human systems, adaptation seeks to moderate or avoid harm or exploit beneficial opportunities (IPCC 2014a, p. 5).' A key component of adaptation is the reduction of vulnerability of a system to climate change and variability. It is suggested that vulnerability should be examined in context of a specific hazard (Blaikie et al. 2014). The

impacts of rapid onset hazards differ from that of slow onset hazards. The knowledge of actions surrounding past stress events has been used as a proxy for how systems might build and mobilise (or not) their adaptive capacity to prepare for and respond to future climate change (Engle 2011). In this framing, future changes in climate, which will potentially stretch the boundaries of previous extremes, are assumed to be gradual, with societies and institutions able to adapt alongside. It is assumed that these incremental adaptations will buy valuable time to implement more appropriate responses, such as new innovations or paradigm shifts (Cornell et al. 2010).

The vulnerability concept provides a framework to unpack the dimensions of vulnerability.⁷ A reduction in vulnerability to an extreme event requires a reduction in sensitivity and enhancement of capacity to adapt.⁸ This thesis adopts the IPCC conceptualisation of vulnerability as a function of three major components, viz. exposure, sensitivity, and adaptive capacity. Within climate change research, the vulnerability concept has been used to characterise a system's susceptibility to harm and guide a normative analysis of risk reduction strategies (Adger 2006). Environmental stressors and shocks (including climate variability) have to be situated within a pre-existing scenario in specific places at specific times, which have been shaped by human societies, social hierarchies, economic marginalisation, entitlements, institutional capabilities and political systems (Bohle 1994, Hahn et al. 2009, Shah et al. 2013). The major components of vulnerability are comprised of their sub-dimensions, which are in turn comprised of attributes that are constituted by indicators. The extent to which remittances would have a positive or negative role in remittance-recipient households and origin communities is context specific (Barnett and Webber 2009, De Haas 2012). The effects of remittances are likely to be mixed across different major components, sub-dimensions, and attributes of vulnerability. Also, the effect of remittances on any particular constituent of vulnerability is likely to vary from one location to another. Apart from access to remittances, the adoption of strategies or enhancement of capacities by the family left behind, which would reduce its vulnerability to

⁷ The IPCC's AR5 (2014, p. 28) defines vulnerability as '[t]he propensity or predisposition to be adversely affected.'

⁸ The IPCC defines sensitivity as '[t]he degree to which a system or species is affected, either adversely or beneficially, by climate variability or change. The effect may be direct (e.g., a change in crop yield in response to a change in the mean, range, or variability of temperature) or indirect (e.g., damages caused by an increase in the frequency of coastal flooding due to sea-level rise)' (IPCC 2014b, p. 24), and adaptive capacity 'as the ability to adjust, to take advantage of opportunities, or to cope with consequences' (IPCC 2014b. P. 21).

extreme events, would depend on household's characteristics (e.g. gender, ethnicity, and literacy of household head and socio-economic conditions), access to infrastructure (e.g. paved road, local market, and bank), access to government institutions (e.g. village office), and awareness (e.g. village level disaster preparedness) (see Figure 3.1). A description of research methodology, settings, and methods is presented in chapter 4. An overview of sub-dimensions and attributes of sensitivity is presented in chapter 6, and that of adaptive capacity in chapter 7.

In considering migration's role in CCA, it is not my intention to position it as some kind of bottom-up alternative to state led planned adaptation. The mobility within a country is explicitly or implicitly shaped by a wide range of policies and institutions. The Constitution of India, guarantees that all the citizens will have the right to 'move freely throughout the territory of India', 'to reside and settle in any part of the territory of India', and 'to practice any profession, or to carry on any occupation, trade or business' (GoI 1950, p. 8). However, this freedom is constrained by the federal governance structure in India, which differentiates between rights of domiciles and in-migrants within a state. Faetanini and Tankha (2013) suggests that neglect and inaction has created an unconducive and unsupportive environment due to negative perception of migration among policymakers and urban planners. In China, the *Hukou* system limits the access to public housing, residential permit, schooling, and health care among migrant workers in destination (Tao and Xu 2007).

The risk to human being and property cannot be completely averted only by remittances in area of frequent extreme events (Hugo et al. 2012). De Haas (2012) suggests that structural constrains to development in the origin countries cannot be overcome only by migration and remittances. The role of government institutions and public investments in adaptation could not be substituted by remittances. Governments continue to have a vital role in creating enabling conditions for adaptation in general – including enabling the potentially adaptive impacts of migration. Remittance is private capital and may be accessible to certain sections of a society due to highly selective nature of migration. While exploring the migration and development causality, De Haas (2012, p. 19) had said that 'migration was not the factor that triggered development, but, rather that development enabled by structural, political and economic reforms unleashed the development potential of migration.' A large number of migrant workers from rural areas tend to find employment in the informal sector. The

sustainability of these informal sector jobs depend on structural factors such as government policies and regulations, global trade regimes, and market demand.

3.7 Chapter conclusion

The environmental change and migration discourse (of which climate change and migration is a part) has been more focused on the influence of environmental stressors on migration motivations. Within this discourse, the scholarship on the migration decision is much more nuanced than consequences of migration, the former has explored diverse methodologies, and a wide array of case studies have been conducted. In comparison, there is a lack of empirical evidence on the consequences of migration in context of environmental stressors. Previous research has suggested that migrant sending families in environmentally vulnerable regions could benefit from migration in several ways (e.g. access to food, livelihoods diversification, expansion of social networks, and acquisition of skills). The extent to which migration can contribute to CCA among remittance-recipient households is a complex issue. A wider set of migrants, irrespective of reasons for migration, could potentially contribute to the reduction of vulnerability of these households in origin communities. This thesis focuses on the role of circular labour migration within a country and domestic remittances in reducing household level vulnerability to extreme events.

This chapter argues that there is a lack of empirical evidence surrounding the role of migration as an adaptation. The contestations over ‘migration as an adaptation strategy’ and ‘migration as a failure to adapt’ lack an in-depth analysis of consequences of migration in context of CCA of the family left behind. Since similar contestations between migration optimists, pessimists and pluralists have been witnessed in the migration and development discourse, I use lessons from this discourse to develop a conceptual approach with which to assess the effects of migration in the context of adaptation to extreme events. This conceptual framework is not concerned with the causal linkages between environmental stressors and migration motivations. Instead, it focuses on the outcomes of circular labour migration in terms of remittances.

The conceptual framework aims to explore the role of migration in CCA. Internal migration is the major form of migration in China and India. Remittances from migrant workers supplement a household’s income, contribute to its welfare, and are used to procure food in aftermath of extreme events. Little is known about its effects on a household’s sensitivity and

adaptive capacity, which shape the vulnerability of a household. Migration could not be a substitute for public investment in development and adaptation in origin communities. The mobility pattern and its consequences within a country are shaped by a wide range of policies and institutions. The creation of an enabling condition for adaptation remains a critical function for the governments. Migration cannot induce adaptation. Rather the availability of enabling conditions and reduction in structural constraints would reduce the migration risk and help remittance-recipient households to leverage remittances for CCA through reduction in their vulnerability to climate change and variability. The vulnerability concept provides a framework to unpack the dimensions of vulnerability. A reduction in sensitivity and enhancement of adaptive capacity would lead to a reduction in vulnerability to an extreme event. This conceptual framework is validated through a comparative research design that includes a case study in Baoshan County in China and another in Upper Assam in India. Next chapter will provide an overview of research methodology, settings, and methods.

Chapter 4: Methodological Approach, Research Settings, and Research Methods

4.1 Introduction

The previous chapter described the conceptual framework for this thesis. This chapter presents the research methodology, settings, and methods that are used to operationalise the conceptual framework with case studies from Baoshan County of Yunnan province in China and Upper Assam in India. The methodological approach of this research attempts to understand the livelihood strategies of remittance-recipient and non-recipient households in rural settlements affected by a major extreme event (either drought or flood), explore the relationship between remittances and household level vulnerability, and if the duration for which remittance has been received or destination of migration has any effect on the household level vulnerability to drought or flood. This thesis aims to understand how the pattern of labour migration, in particular remittances, has any effect on a household's vulnerability to a major extreme event. The specific research questions are:

- What is the pattern of migration? How does this contribute to household remittances? What is the extent to which households rely on remittance for their livelihoods?
- What strategies are adopted by households in response to extreme events? How does the pattern of household responses to hazards differ in the drought and flood affected rural communities?
- Does pattern of migration, in particular, remittances, determine household level sensitivity to drought and/or flood? What are the pathways through which remittance shape households' vulnerability to drought and/or flood?
- Does pattern of migration, in particular, remittances, determine household level adaptive capacity to drought and/or flood? What are the pathways through which remittance shape households' adaptive capacity to drought and/or flood?
- Does pattern of migration, in particular, remittances, determine household level vulnerability to drought and/or flood? Does the existing framework to measure vulnerability work for flood and drought context in rural communities?

4.2 Vulnerability assessment

One of the central concepts in climate change research and policy is vulnerability. Research on vulnerability of countries, regions, sectors, communities and groups of people has resulted in several definitions of the concept (Hinkel et al. 2010), wide array of terms (Brooks 2003)

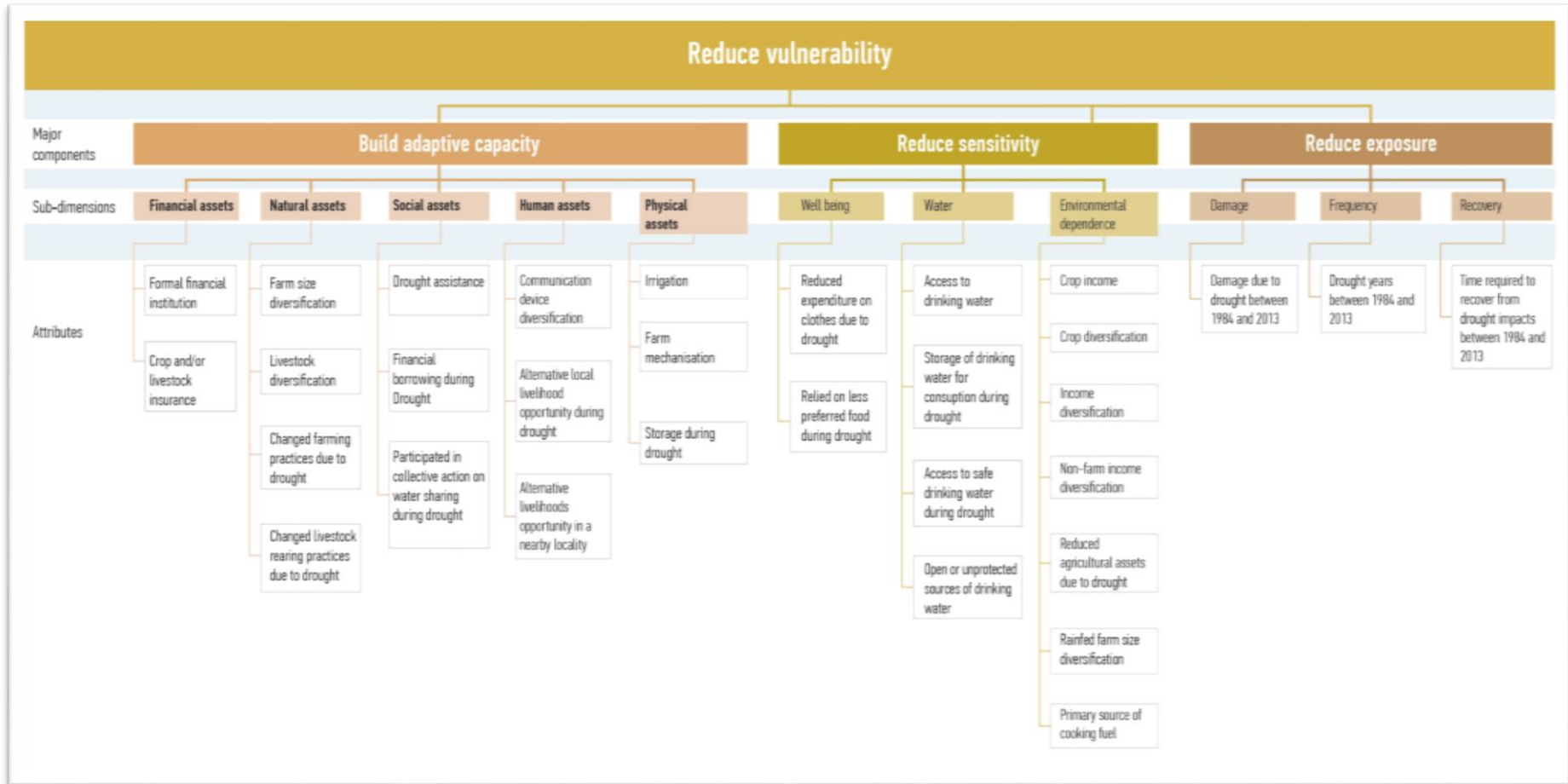
that have overlapping meanings (Gallopín 2006, Hinkel 2008), and a diversity of methodologies to assess vulnerability. These methodologies include simulation models (e.g. Hinkel and Klein 2009), indicator-based approaches (e.g. Vincent 2007), and participatory exercises (e.g. Gupta et al. 2010). Each has been applied to different systems or spatial scales of analysis: district (e.g. Hahn et al. 2009), community (e.g. Pelling and High 2005), particular ecosystem (e.g. Shah et al. 2013), or household (Mahapatra et al. *forthcoming*). Methodologies on vulnerabilities have also used secondary data (e.g. Brooks et al. 2005), or primary data from household survey (e.g. Hahn et al. 2009) or participatory exercise (e.g. Gupta et al. 2010). Though adaptive capacity is one of the major components of vulnerability, some scholars have only focused on an assessment of adaptive capacity. Adaptive capacity is determined by the complex interaction between social, political, economic, technological and institutional factors (IPCC 2001, Yohe and Tol 2002, Adger 2003, Pelling and High 2005) whose interactions vary depending on the scale of analysis (Vincent 2007). Previous research had attempted to assess adaptive capacity at various scales, such as community (e.g. Smit and Wandel 2006), district (e.g. Sharma and Patwardhan 2008), sector (e.g. Eakin et al. 2011), country (e.g. Tol and Yohe 2006), and regional system (e.g. Schneiderbauer et al. 2013).

Despite the terminological and methodological ambiguity with vulnerability and associated concepts (Hinkel et al. 2010), there is a consensus that vulnerability is place-based and context-specific (Cutter et al. 2003). Since models are more readily available for the ecological than for the social component, the simulation-model based approaches focus on the ecological component of the socio-ecological systems (SES) (Hinkel et al. 2010). Given uncertainty about future greenhouse gas and aerosol emissions, lack of data on bio-physical and socio-economic indicators, and highly heterogeneous conditions in the HKH region, it is difficult to develop simulation-based models even at a meso-scale. The indicator-based approaches are comparatively less costly and time-consuming, and could be applied to the micro- and meso-scales (Nair et al. 2013). The impact data is often unavailable in developing nations. Instead, the indicator-based approach has been used in such circumstances (Adger et al. 2004). The indicator-based approach measures the present state of a system in order to assess its vulnerability to a stressor (Hinkel et al. 2010). This thesis has adopted a bottom-up and indicator-based approaches to assess vulnerability of households in Baoshan County and Upper Assam. It has been suggested by the NELM that migration is a household level strategy (Stark and Bloom 1985). In this thesis, the household represents the unit of analysis.

A household occupies a specific geographical location. However, it could be connected to one or more geographic locations through the migrant and/or access to remittance. Circular labour migration can be thought of as an autonomous household strategy to temporarily substitute the structural constraints in origin communities with perceived and/or actual structural opportunities in the destination communities. This thesis aims to explore the role of remittances in reducing household level vulnerability to extreme events such as droughts or floods. Therefore, the indicators selected are those which could be considered autonomous in nature. For example, structural changes in the household to reduce risks from flood are manageable by a household. These indicators of vulnerability were identified during FGDs in the study areas, and were supplemented with inputs from literature review and local experts.

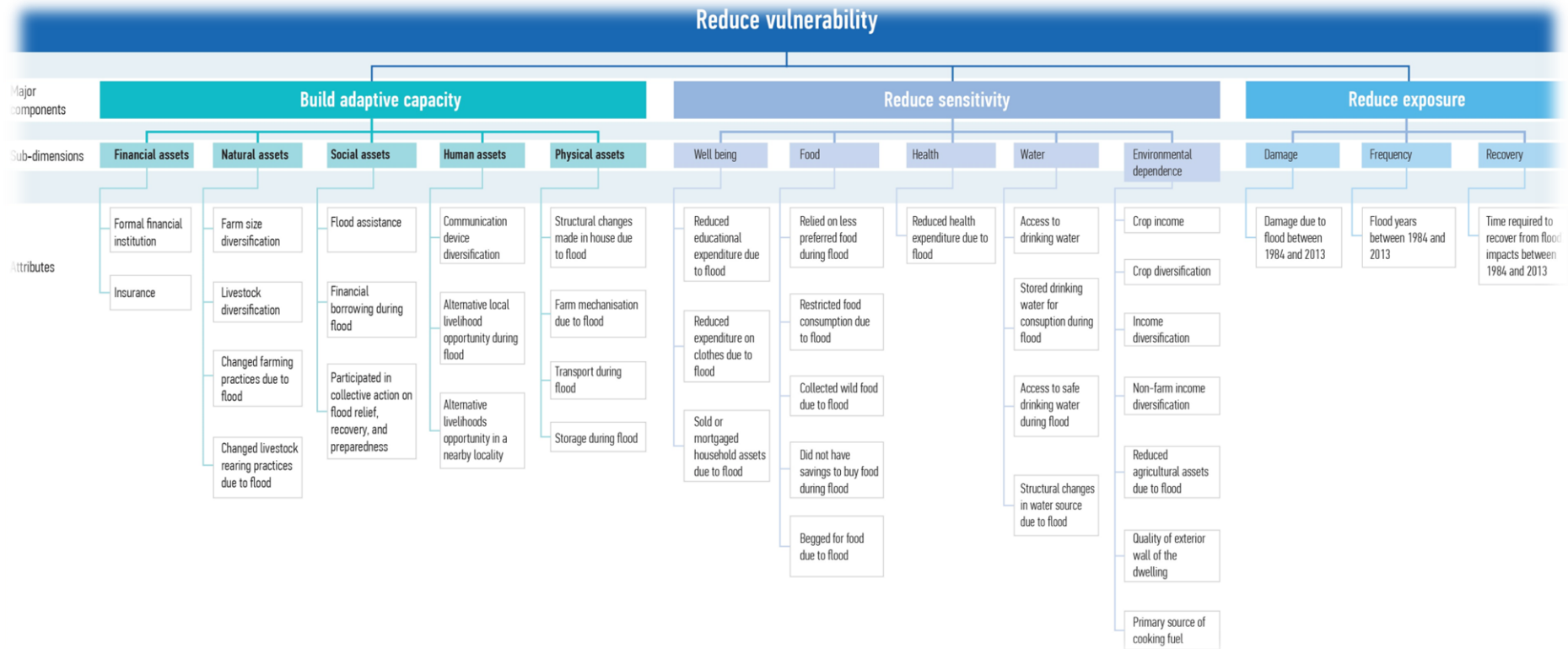
The conceptual framework is used to categorise the indicators within a hierarchy of constituents of vulnerability. Figures 4.1 and 4.2 provide an overview of the major components, sub-dimensions, and attributes of vulnerability to a major extreme event in Baoshan County and Upper Assam, respectively. The selection of these sub-dimensions and attributes are discussed in chapters 6 and 7. Hinkel et al. (2010) identifies expert judgement as the only deductive argument applied for the aggregation of indicating variables. I adopt the AHP, which was developed by Saaty in 1977, to reflect that some major components, sub-dimensions, and attributes of vulnerability have more importance than others in a particular context (Saaty 1980), AHP permits a complex decision making process to be decomposed into a hierarchical structure of sub-problems. Yanhui et al. (2012) uses the AHP to construct the water resource vulnerability evaluation index system for Hani Terrace core area in Yuanyang, Yunnan. Similar AHP based weighting of major components, sub-dimensions, and attributes of vulnerability has not been conducted for either study areas. An expert workshop was organised in Guwahati, Assam, and another in Kunming, China. In these workshops, pairwise comparisons of the major components, sub-dimensions, and attributes of vulnerability were conducted by a group of experts familiar with the respective study areas. These pairwise comparisons were transformed into the ratio-scale numbers, which represent relative local weights and the global weights, through the eigenvector method.

Figure 4.1: Major components, sub-dimensions, attributes, and indicators of vulnerability to drought in Baoshan County, Yunnan, the Upper Mekong-Salween sub-basins.



Source: Author

Figure 4.2: Major components, sub-dimensions, attributes, and indicators of vulnerability to floods in Upper Assam, the Eastern Brahmaputra sub-basin.



Source: Author

4.3 Hazards

In the short term, climate change is likely to influence the frequency and severity of familiar recurrent hazards. It will be critical to have the capacity to adjust to these changes in frequency and severity and to support systems so that they can adapt to the altered levels of hazard (Brooks and Adger 2005). United Nations (cited in Fussel 2007, p. 154) defines a hazard as ‘a potentially damaging physical event, phenomenon or human activity that may cause the loss of life or injury, property damage, social and economic disruption or environmental degradation’. Discreet (also referred as perturbations) and continuous hazards (i.e. stress or stressor) are two distinct categories of hazards (Turner II et al. 2003). The type, intensity and magnitude of the hazard have a significant bearing on the impacts on the exposed population, perception of threat from the hazard, and in turn on the choice of response strategy. Due to the immediacy and explicit nature of the impacts, perturbations are easily perceived and acted upon than stressors, the effects of which are staggered over time. The knowledge of actions surrounding past stress events (e.g. droughts and floods) has been used as a proxy for how systems might build and mobilise (or not) their adaptive capacity to prepare for and respond to future climate change (Engle 2011). This is based on an underlying assumption that future changes in climate will be gradual and their impacts will stretch the boundaries of previous extremes. The incremental adaptations by societies and institutions will buy valuable time to implement more appropriate responses (Cornell et al. 2010). When the risk to a system is expected to change significantly during the time horizon of a vulnerability assessment, it is important to specify the time period of interest (Fussel 2007). This study explores the period from 1984 to 2013, a 30 year period since the average weather for 30 years is climate.

4.4 Circular labour migration

Data on the magnitudes of circular labour migration are scarce. The national surveys and censuses record limited information on migration (e.g. place of birth and current location). The decadal nature of censuses implies that a migration cycle completed between two censuses will not be recorded. The present study addresses this by collecting information about labour migration from a household through a migration schedule. This study will

distinguish circular labour migration from commuting.⁹ The migration schedule documents a brief migration history of each migrant worker in a household. Each migration episode (e.g. duration of migration, destination, and type of occupation) of an individual migrant worker between 1984 and 2013 will be recorded. In this study, a change of destination and/or job marks the culmination of a migration episode. The availability of data about the ‘year of first migration from a household’ and the ‘year in which a specific strategy or capacity was first adopted by a household’ would allow to disaggregate the indicators of specific sensitivity and adaptive capacity into two sub-categories: ‘adopted before first episode of migration from a household’ and ‘adopted after first episode of migration from a household’. The latter sub-category is likely to be influenced by the access to remittances. The migrant workers maintain a connection with the family left behind through remittance transfers and occasional visits to the family. Remittances provide a functional link between the migrant worker and migrant-sending household. A household was considered to be a remittance-recipient household if it had received remittances at any time during the last 30 years from another town or village in the same country or another. Households not conforming to this definition were considered as non-recipient households.

4.5 The methodological approach

This thesis has adopted a mixed-methods approach with a comparative research design. The rationale is elaborated in this section.

4.5.1 A mixed methods approach

Mixed methods research has gained popularity in many disciplines since 1960s. In a single study or a series of studies that examines the same underlying phenomenon, quantitative and qualitative research techniques, methods, approaches, concepts, or language are combined by the researcher (Johnson and Onwuegbuzie 2004, Leech and Onwuegbuzie 2009). Typologies of mixed methods research could be found in Greene et al. (1989), Creswell (1994), Tashakkori and Teddlie (1998), and Leech and Onwuegbuzie (2009). Greene (2008, p. 7) suggests that the pragmatic necessities of social scientists in applied fields had led to the development of conceptual and theoretical ideas about mixed methods in social enquiry:

⁹ A household was considered to be a migrant-sending household if any household member had lived and worked in another town or village in the same country or another continuously for two months or more at any time during the last 30 years. On the other hand, a household member could commute to work in a different town or village within the same country; but, generally, returned home each evening.

These practitioners sought to use various methods because the practical demands of the contexts in which they worked called for both generality and particularity. And they called for defensible patterns of recurring regularity as well as insight into variation and difference. And they called for results that conveyed magnitude and dimensionality as well as results that portrayed contextual stories about lived experiences. And they called for dispassionate neutrality as well as engaged advocacy for such democratic ideals as equity and justice.

Mixed-methods research covers large set of points in the middle of a continuum where either ends are occupied by quantitative and qualitative research (Johnson and Onwuegbuzie 2004). This approach can triangulate findings from quantitative and qualitative data so that these can be corroborated (Bryman 2006). The qualitative and quantitative methods, approaches, and concepts could be combined at different stages of research, such as framing of research objectives and questions, sampling, data collection, data analysis, and/or eliciting inference (Bryman 2006, Leech and Onwuegbuzie 2009). Within a mixed methods study, the researcher could either apply the qualitative and quantitative research methods at approximately the same time ('concurrent') or one after the other ('sequential'). From the perspective of priorities, both the qualitative and quantitative aspects could be given approximately equal emphasis ('equal status') or one aspect could be prioritised over the other ('dominant status') (Leech and Onwuegbuzie 2009). As noted by Greene et al. (1989), there are five major reasons for combining qualitative and quantitative research: (a) triangulation, (b) complementarity, (c) development, (d) initiation, and (e) expansion. Bryman (2006) aimed to ascertain finer details of reasons for conducting multi-strategy research, and had identified sixteen rationales, namely triangulation, offset, completeness, process, different research questions, explanation, unexpected results, instrument development, sampling, credibility, context, illustration, utility, confirm and discover, diversity of views, and enhancement. A mix of qualitative and quantitative methods has been used by past research based on livelihoods approaches (Scoones 1998; Ellis 2000).

4.5.2 A comparative research design

The conceptual framework of this thesis acknowledges the place-based and context specific nature of the consequences of migration on a household's vulnerability to environmental stressors. Past research (Jaeger et al. 2009, Schmidt-Verkerk 2011, Banerjee et al. 2011, Warner et al. 2012) have used a comparative design to study the relationship between environmental change and migration. According to Bryman's (cited in Bryman 2006, p. 103)

categorisation of research designs, if a study involves two or more cases, it is considered to be a comparative design. This approach would reveal the similarities and differences in vulnerability due to the heterogeneity of migration pattern, characteristics of remittance-recipient households, and structural factors in origin communities (e.g. infrastructure, institutions, and policies). This thesis is based on two case studies: Baoshan County and Upper Assam. The Baoshan County of Yunnan province, which is located in the UMSSB, has experienced some of the severest droughts between 2009 and 2013. The region of Upper Assam, which is located in the EBSB, experiences floods on a regular basis. Internal migration is the prominent type of migration in these study areas. The *Hukou* system in China applies certain restrictions upon a migrant's access to government social protection schemes in destination (Tao and Xu 2007). The annual reports on climate change policies and actions by the National Development and Reform Commission of China do not make any reference to human mobility (NDRC 2013, 2014, 2015, 2016). However, the Yunnan Provincial Strategy for Addressing Climate Change of 2008 recognised relocation of population from environmentally fragile areas as a strategy to address environmental stress and alleviate poverty (YDRC 2008). The right to mobility, residence, and practice of any profession within the territory of India is guaranteed by the Constitution of India (GoI 1950). Although, access to government welfare schemes is not portable beyond the boundaries of the sending state (Srivastava and Sasikumar 2003). The inter-state migrant workers often confront hostility from certain sections of the host population. The latter perceive the migrant workers not just as an economic threat but also a risk to the 'local' culture, language or religion (Mahajan et al. 2008). The research agenda of National Mission on Strategic Knowledge for Climate Change identifies impacts of climate change on migration patterns as part of the socio-economic aspects of climate change (GoI 2008, p. 5). The Second National Communication on Climate Change to the UNFCCC suggests that drought, floods, and storms had led to an increase in migration from rural areas to cities (MoEF 2012). The environmental change and migration narrative in Assam is overshadowed by the perceived threat of illegal migration from Bangladesh due to natural disasters and its adverse impacts on the state (see Hazarika 1993, Suhrke 1997).

4.6 Research setting

The selection of these study areas is based on previous research on environmental change and migration in these areas. The International Centre for Integrated Mountain Development

(ICIMOD) had conducted a regional research project entitled ‘Too much water, too little water – Adaptation strategies to climate induced water stress and hazards in the greater Himalayan region’ from 2008 to 2011. This regional research project had covered the Upper Indus Sub-basin (UISB); Koshi Sub-basin (KSB); Eastern Brahmaputra Sub-basin (EBSB); and Upper Mekong and Salween Sub-basins (UMSSB). The first phase of this project identified livelihoods diversification as an important household level response in rural communities affected by rapid and slow onset water hazards (e.g. drought, and flash and riverine floods). Labour migration was identified as one of the major livelihood diversification strategies in the aforementioned sub-basins. The second phase of this research project had assessed the migration patterns in rural communities affected by rapid- and slow-onset water hazards and the effects of remittance on the adaptive capacity of remittance-recipient households (see Banerjee et al. 2011). The ICIMOD’s ‘Himalayan Climate Change Adaptation Programme’ (‘the HICAP’), which was initiated in 2012¹⁰, builds upon the experience of the ‘Too much, too little water’ project, and covers the same river sub-basins. The Baoshan County in the UMSSB and Upper Assam had been part of the study area in the ‘Too much, too little water’ project and is part of the ongoing HICAP. Hence, there selection as study areas for this thesis is based on the aforementioned evolution of the larger research initiative on CCA in ICIMOD.

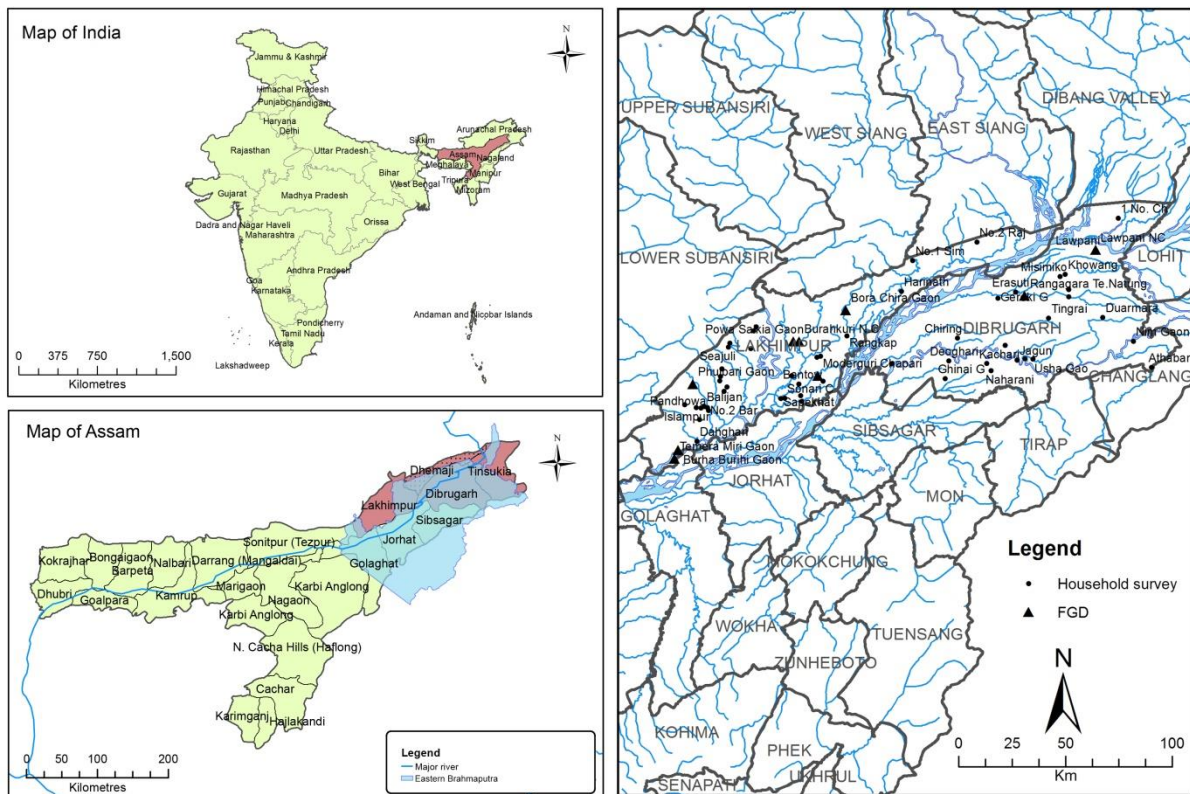
4.6.1 Upper Assam

The state of Assam is located in the middle of the Brahmaputra and Barak river basins in north-eastern India. According to the Census of India of 2011, Assam had a population 31.17 million and a population density of 397 persons per square kilometre (MoHA 2011). Based on the probability of occurrence and the potential to cause significant damage and loss of life, the Disaster Management Plan of Assam of 2005 had identified flooding as a significant hazard (TERI 2011, p. 60). Climate change will pose additional challenges to the existing socio-ecological system. Projections indicate that there could be an increased risk of flooding in the Brahmaputra basin due to difference in seasonal distribution, including increased summer (monsoon) flow, and peak runoff (Nepal and Shrestha 2015). The heavy rainfall

¹⁰ The HICAP is implemented jointly by the International Centre for Integrated Mountain Development (ICIMOD), the Centre for International Climate and Environmental Research Oslo (CICERO), and Grid-Arendal in collaboration with local partners. It aims to conduct empirical and applied research to enhance understanding of vulnerability and opportunities from climate change, and identify potentials for adaptation.

within a short time from June onwards due to the southwest tropical monsoon contributes to the flood

Figure 4.3: Map of the study area in Upper Assam, the Eastern Brahmaputra Sub-basin.



Source: Author

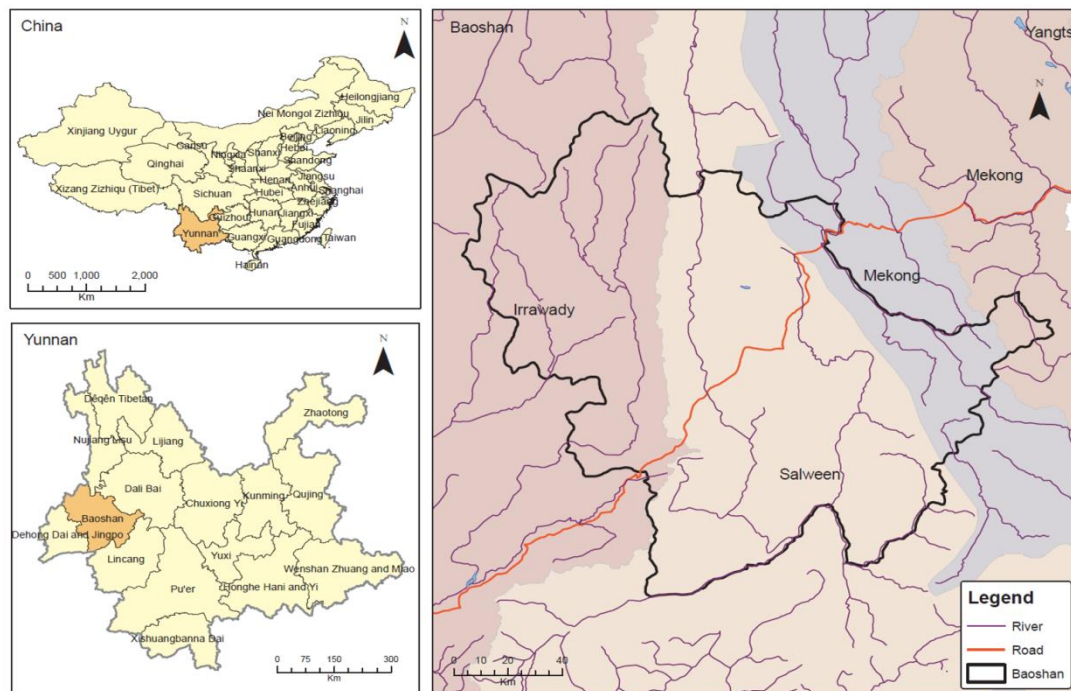
hazard risk. The physiography of the Brahmaputra basin, rise in population in flood-prone areas, the construction of new infrastructure and housing, expansion of economic activities, changes in land use, encroachment of wetland and low lying areas, temporary flood control measures, and poor maintenance of embankments contribute to drainage congestion and frequent occurrences of floods in this region (TERI 2011). The flood impacts differ from one rural community to another because of the nature, frequency, and magnitude of the floods as well as the local vulnerabilities. The fieldwork for this study was conducted in these four districts (Figure 4.3). These floods have direct and indirect effects on the lives and livelihoods of people in the study area. Houses are inundated by flood water, which also leaves behind sediment and debris. In severely affected villages, the household members have to shift to safe locations (e.g. road or embankment), relocate to a relative's house, or take shelter in relief camps that are set up in schools and colleges. The high reliance on natural resource based livelihoods and location in a flood prone river basin, exposes the local population, particularly the poor, to an increased risk of flooding. Annual floods cause

widespread damage to the agricultural sector (Das et al. 2009). Transport disruption is common during the flood season due to inundation or damage to roads and bridges. The repetitive and significant losses experienced by settlements and economy because of flood make it a major concern for Assam (TERI 2011).

4.6.2 Baoshan County

The local socioeconomic, ecological, and political conditions in China have experienced a major transformation due to the national transition from the People's Commune (1960s-1970s) to the Household Responsibility System (1980s-2000s). The People's Commune era was characterised by state-planned centralised agricultural communes. The land use was centrally planned. The farm assets – land, livestock, and machinery – were collectivised. Labour required for farming and infrastructure development was organised collectively by the government. This has been replaced by the decentralised market-driven economy of the Household Responsibility System (HRS). The size of the families and availability of land determine the farm land allocation to individual families. The decisions regarding agricultural production and selling of produce in the market is taken by individual households (Su et al. 2012). The rural redundant labour is permitted to leave land (*litu*) and countryside (*lixiang*) under the HRS. Since the implementation of the HRS absorption of surplus agricultural labour, increase in rural income, and decline in rural poverty have been important functions of rural non-farm and urban sectors (Zhu and Luo 2008). Rural-urban migration has contributed to the poverty in reduction, and its effect was more important in the reduction of rural poverty (Ravallion and Chen 2007) largely due to remittances received by the rural families (Luo and Yue 2010). The large scale migration of workers to the regions with higher productivity has contributed to the rapid growth of the Chinese economy. Between 1980 and 2010, the urban population has increased from 19.4 percent of the total population to 49.2 percent. The National Bureau of Statistics of China had estimated the number of migrant workers to be 260 million in 2012 (Lucas 2015, p. 15). Despite the recent relaxation, the *Hukou* system of registration still limits the access to social protection services (e.g. public housing, health care, and education) only to a family's place of registration, i.e. origin community (Tao and Xu 2007, Lucas 2015).

Figure 4.4: Map of the study area in Baoshan County, Yunnan, the Upper Mekong-Salween sub-basins.



Source: Author

The Yunnan province is located in south-west China. It occupies a plateau with an average elevation of 1,980 m. The mountains are located in the north and west (Wang and Meng 2013). The headwaters of many of China's major river systems are located in this region. Environmental shocks and stresses vary with elevation. Floods and droughts are severe at lower elevation, water availability is limited in mid-elevations, and flash flood and landslide are experienced in higher elevations (ICIMOD 2012). The rural areas accounted for around 64.8 percent of the population (29.78 million) of the Yunnan province (Information Office of the People's Government of Yunnan province 2011 cited in Su et al. 2012, p. 855). The Baoshan County is located in the upper watershed of the Salween River, and is a major agricultural production area of Yunnan (Su et al. 2012). A combination of the Southwest and East Asian Monsoons dominates the climate of Yunnan province with contrasting dry and wet seasons (Wen 2006). Wang and Meng (2013) reported that most regions in the province have experienced a rise in drought severities since 2000.

Wang and Meng (2013) observed an escalation of winter-spring drought in Yunnan since the end of the last century. Based on this observation, they inferred that the large scale drought of 2010 was not an abrupt and occasional event; rather it was a manifestation of the cumulative drying trend. A gradual change in monsoon precipitation had been observed in the Longyang

Township of Baoshan County between 1965-1986 and 1987-2005. The main summer crop growing period is likely to experience a water scarcity (Ma et al. 2009). Based on a comparison between the Palmer Drought Severity Index (PDSI) and Society Drought Severity Index (SDSI), Wang and Meng (2013) concluded that the severity of water shortage in the rapidly developing region has been exacerbated by the meteorological condition that contributes to drought in Yunnan and an increase in societal water requirements.¹¹ By 2050, the average surface temperatures in Yunnan are projected to rise between 1 and 1.5°C (Xu et al. 2009). Generally, the rural population is dependent on agriculture for cash income and subsistence (Su et al. 2012). Despite the rapidly growing mining, manufacturing, and tourism sectors since 1980s, the provincial economy is highly dependent on agriculture and tobacco plantations due to the climate (Wang and Meng 2013). The agricultural intensification and urbanisation during the HRS period has led to an increase in demand for water. The central funding for rural infrastructure and institutional development had experienced a decline due to decentralisation. The production and local livelihoods in rural Yunnan is increasingly impacted by the changes in water availability and the lack of water management infrastructure (Su et al. 2012).

4.7 Research methods

This study adopts a mixed method approach that included focus group discussion (FGD) and household survey.¹² Both the qualitative and quantitative data collection was based on a cross-sectional design. The combination of qualitative and quantitative methods permits to compensate for the weaknesses and extract the competencies of both approaches ('offset'). The qualitative method would be used to gain an understanding of the local context, such as livelihood strategies, impacts of environmental stressors, community and household responses to the impacts of these environmental stressors, and consequences of labour migration in contest of sending households and origin community. In addition, the FGDs with non-migrants enquired about the reason for not adopting migration for work as a livelihood strategy. The FGDs with the migrant workers (including returnees) and women from migrant-sending households would enquire about different forms (e.g. seasonal, circular, and

¹¹ The PDSI helps to identify a meteorological drought. A drought due to inadequacy of the water supply to support appropriate or expected economy and population is revealed by the SDSI (Wang and Meng 2013).

¹² The data was collected by the Yunnan Academy of Social Sciences (YASS) in Baoshan County, and Aaranyak in Upper Assam.

permanent) and streams (e.g. rural-rural and rural-urban) of migration, major destinations and occupations of migrant workers, role of family members, social network, employment agency, labour contractor, and government and non-government institutions in the migration process, living and working condition in destination, and the migration outcomes (e.g. financial and social remittances).

The qualitative methods would help to comprehend the process; whereas, an account of local structures could be gathered through quantitative research. The enhanced understanding of the local context through qualitative methods could lead to the identification of relevant indicators and develop comprehensive and nuanced questions. The design of the survey questionnaires would be informed by the FGDs. For example, the household level responses during a flood, in the immediate aftermath of a flood, and between two flood events were identified through the FGDs. Later, these were integrated into the household schedule of the survey tools to document the extent of their adoption in the study area. The findings from the FGDs and survey would be used to mutually corroborate each other. The qualitative research findings could also help to develop a narrative around the quantitative findings. During the fieldwork, qualitative and quantitative data was collected sequentially. The FGDs were conducted in 12 villages across the study area in Upper Assam and 10 villages in the Baoshan County. Extreme events have different impacts on men and women. Due to differences in nature of their responsibilities, dependency on natural resources, and knowledge or capacities, women and men would be differently affected by the effects of climate change (Roehr 2007). The ability of women particularly that of poor women, to cope with and adapt to a changing climate is constrained by gender specific barriers (Terry 2009). Predominantly male out-migration has been observed in both study areas. In the absence of men, the women are expected to take up new responsibilities in context of farm management, disaster preparedness, and food security (Banerjee et al. 2015). Hence, these gender-disaggregated FGDs aimed to document the potential differences in perception of risks and capacities among women and men. In each village, six FGDs were conducted with migrant workers (including returnees), women from migrant-sending households, men and women from poor and non-migrant households, and men and women from non-poor and non-migrant households. The verbatim transcripts of the FGDs were prepared in the local language. The FGD transcripts from Upper Assam were also translated in the English language. The translated FGD transcripts were coded using the qualitative data analysis software Atlas.ti.

Broad themes (e.g. livelihood strategies, migration, and disaster response strategies) were transformed into the primary codes. Each of the primary codes was composed of secondary and tertiary codes. Once all the transcripts were coded, the outputs were generated for all individual codes. Due to official regulations in China that do not permit sharing of FGD transcripts with foreign nationals, a report based on the FGD findings from Baoshan County was shared by the Yunnan Academy of Social Sciences.

The findings from the FGDs and from the review of existing literature were used to design survey questionnaires. Broadly, the survey tools could be classified into two categories: household- and village-level tools. The household-level survey tools included a household schedule, drought or flood schedule, migrant schedule, and non-migrant schedule. The household schedule would collect information on demographic characteristics, access to social protection programmes, housing condition, access to fuel, electricity, and water, livelihood strategies (e.g. farming, livestock rearing, commuting, and remittances), household level responses to a major environmental stressor in the study area (either drought or flood), expenditure on food and non-food consumption, sources of household income, access to bank and insurance, and household assets. The drought schedule would be used in Baoshan County and flood schedule in Upper Assam. This survey tool would record each instance when a household had experienced a particular extreme event between 1984 and 2013 and corresponding financial damage incurred by the household and the time required by the household to recover during each of these episodes. The migrant schedule would collect information regarding financial costs associated with migration, opportunities for the migrant worker to use skills and knowledge in the origin community, and a brief migration history (1984-2013) for each migrant worker from a household. The non-migrant schedule would inquire about the assistance received from a migrant worker, employment generated by a migrant-sending household, and contribution of migrant workers to the public or community initiative in the origin village. The village schedule would collect village level information about demographic characteristics, access to public amenities and infrastructure, contribution of migrant workers to the public or community initiatives in the origin village, access to community based organisations, development initiatives in the village, occurrence of drought or flood between 1984 and 2013, occurrence of socio-economic shocks between 1984 and 2013, and status of village level disaster preparedness.

Main research objectives are to understand household level vulnerability to drought in Baoshan County and floods in Upper Assam. Similar sampling strategies were used for Baoshan County and Upper Assam. The selection of households involved a two stage process. A list of all drought affected villages in Baoshan County and a list of flood-affected villages in Upper Assam was prepared.¹³ In the first stage, 30 drought affect villages of Baoshan County and 29 flood affected villages of Upper Assam were selected using a systematic random sampling procedure following the Probability Proportional to Size (PPS) approach. The number of households in a village was considered as the measure of size. In the second stage, equal number of households (i.e. 20 households) was selected using systematic sampling within each selected village. Prior to the household selection, a house listing exercise was conducted in each study village to prepare separate lists of the migrant-sending and non-migrant households in the village. From the list of migrant sending households, 10 households were selected through a systematic random sampling procedure. Similar process was adopted to select 10 non-migrant households.

Sample size was calculated to compare the degree of vulnerability among migrant-sending and non-migrant households. In the absence of any prior evidence, it was assumed that 50 percent of households are vulnerable to extreme events. Further, sample size was estimated assuming a 5 percent margin of error with 95 percent confidence interval. The arrived sample size was inflated by 15 percent to accommodate non-response arising due to non-participation or refusal of respondents. Also, the sample size was inflated by a design effect of 1.3 to accommodate the increased variance due to use of complex sampling design. This resulted in a sample size of 574 households. This was rounded off to 600 households in each study area (i.e. 300 migrant-sending households and 300 non-migrant households). The estimated sample size is sufficient to provide a representative estimate of key indicators for migrant-sending households in the study area. At the end of the survey, 608 households had been surveyed in Baoshan County (i.e. 302 migrant-sending households and 306 non-migrant households) and 578 households in Upper Assam (i.e. 289 migrant-sending households and 289 non-migrant households). After the completion of survey, the age-sex structure as well as other key indicators of the sample was compared with secondary datasets such as census and large scale surveys to examine the robustness of results. Such comparison indicated that

¹³ If a village had experienced a riverine flood or flash flood atleast once since 1984 then it was considered as a flood affected village. The non-flood affected villages had not been affected by a riverine flood or flash flood since 1984.

results from this survey were consistent with estimates from other surveys. This suggests that the sample selected is fairly representative of the study population.

The investigators from Aaranyak (for the survey in Upper Assam) and YASS (for the survey in Baoshan County) were trained for 5 days on basic research methods and issues related to climate change, vulnerability, migration and remittances.¹⁴ Field testing of survey tools and mock survey were part of the investigators' training. The data from household and village surveys were collected through the paper based survey tools. These data are compiled using data entry masks designed with the statistical software SPSS. To remove entry errors and inconsistencies, checks were conducted after the data entry. Later these datasets were transferred to the Stata format. Whenever a respondent did not answer a particular question, it was recorded as '999' during the survey. Proportion of missing information was negligible (<1%) in the data. In variables, where such missing cases appeared, either these were excluded from the analysis or included in a category, which does not affect the outcome of the study. Prior to the inclusion of variables in a regression model, multicollinearity between these variables was examined using variance inflation factor. This thesis will present statistical data using uni-variate, bi-variate, and multiple regression analysis. In multiple regression, a linear or logistic regression model has been used. Wherever the dependent variable was continuous in nature, a linear regression model has been used. However, a logistic regression model has been used if the dependent variable was dichotomous or categorical in nature. This analysis was conducted along the following lines of inquiry: First, differences and similarities in household responses and capacities in context of drought and floods were analysed. Second, differences and similarities between remittance-recipient and non-recipient households were analysed. Third, explored differences and similarities among remittance-recipient households based on duration of remittance receipt. Fourth, analysed differences and similarities between remittance-recipient households based on distance to the migrant worker's destination. Fifth, the findings from Baoshan County and Upper Assam were compared. The survey data was analysed using Stata version 13.

4.8 Chapter conclusion

This chapter presents an overview of the research methodology, settings, and methods that were used to operationalise the conceptual framework with case studies from Upper Assam

¹⁴ The investigators' training for Aaranyak was organized in North Lakhimpur town in Assam and that for YASS was organized in Kunming, Yunnan.

and Baoshan County. There is little empirical research on environmental change and migration in the HKH region in general, and in the study areas in particular. The selection of these study areas was based on previous research on environmental change and migration in these areas. The methodological approach attempts to understand the livelihood strategies of remittance-recipient and non-recipient households in rural settlements affected by a major extreme event, explore the relationship between remittances and household level vulnerability, and whether duration for which a household receives remittances has any effect on the household's vulnerability to drought or flood. The household is the unit of analysis. This thesis has adopted a bottom-up and indicator-based approaches to assess vulnerability. The selected indicators are autonomous to a certain extent. These indicators were identified based on the FGD, literature review, and inputs from local experts. This thesis adopts the AHP approach since the importance of different major components, sub-dimensions, and attributes of vulnerability will vary from one place to another. This thesis adopts a mixed-methods approach with a comparative research design. The next chapter will present a description of the study areas in Baoshan County and Upper Assam.

Chapter 5: Livelihoods, Climate Hazards, and Disaster Responses in the Researched Communities

5.1 Introduction

The previous chapter presented the reasons for the selection of the research settings. This chapter provides a description of the rural communities in which the fieldwork was conducted. The first section of this chapter is on livelihood practices. It explores farm, off-farm, and non-farm livelihoods in the study areas, as well as provides an overview of circular labour migration and remittances. The next section is on extreme events. It provides an overview of the impacts of a major extreme event and responses to this extreme event in each study area. This provides a baseline against which chapters 6, 7, and 8 will explore the vulnerability of households to a major extreme event, specifically drought in Baoshan County and floods in Upper Assam.

5.2 Livelihood practices

5.2.1 Farm and off-farm livelihoods

Agriculture is the primary occupation in rural areas of Assam. Among the total workforce, 26 percent were cultivators and 8 percent were agricultural labourers (DoES 2015, p. 15). Between 2005-06 and 2012-13, the contribution of agriculture to the gross state domestic product (GSDP) decreased from 21.4 percent to 17.5 percent (DoES 2015, p. 51). The average size of operational landholding among surveyed households in Upper Assam was 1.17 hectares of land, which is marginally higher than that for the state (1.10 hectare) (DoES 2015, p. 51).¹⁵ A majority of surveyed households in the study area has access to farm land (Table 5.1). The main crops grown in this area include main paddy, early paddy, winter vegetables, winter potato, mustard and cow pea. Paddy is the principal *Kharif* ('monsoon') crop. Since rainfall is scarce during *Rabi* ('winter') season, crops that are less water intensive such as potato, vegetables, and mustard are grown (Mandal 2014). On an average, the sale of crops contributed to the income of nearly one-third of households (30.1 percent). Only one-tenth of households reported the sale of crops as the major source of household income (10.0 percent).¹⁶ Average income from crop sales during the year preceding the survey was estimated to be USD 137. This indicates that the farming is predominantly subsistence in

¹⁵ The average size of landholding for India was 1.15 hectare in 2010-11 (MoA 2014).

¹⁶ An income source that contributes more than 50 percent of a household income is considered as a major income source.

nature, and is an important source of a household's food grain supply. In Upper Assam, households that are engaged in farming tend to own most of their landholding. In contrast, rural land in China is collectively owned at the village level (Tao and Xu 2007). The households in Baoshan County have tenured access to this collective land (Table 5.2). The average size of operational landholding in Baoshan County (0.39 hectares) is lower than national average (0.56 hectare) (National Bureau of Statistics, 2012).¹⁷ Due to demographic changes within a village, the village officials have to reallocate land on an ongoing process (Tao and Xu 2007). Since the implementation of the Household Responsibility System (HRS) in 1979, the household size has become one of the criteria for land allocation. The major crops in Baoshan County are main paddy, summer maize, wheat, tobacco and walnut. Over two-fifths of surveyed households had an income from selling crops (43.6 percent), and nearly one-fifth of households had identified crop income as the major source of household income. Average crop income of households this study area in 2013 was estimated to be USD 1839. This is more than 13 times the average crop income in Upper Assam. The cash crops (e.g. tobacco) generate tax revenues for the local government, therefore, are supported by extension services (e.g. subsidies for nurseries and transplanting) (Su et al. 2012). In 2013, average income from sale of cash crop in Baoshan County was estimated to be USD 2645. Similar subsidies are not provided for other crops grown in this area (Su et al. 2012).

Farming is usually supplemented by livestock rearing. In Upper Assam, common types of livestock include poultry, cattle, and goats. Over half of the households (55.8 percent) in this study area had earned an income by selling livestock or livestock products; but only one-tenth of these households had identified it to be the major source of household income (12.3 percent). Though three-quarters of households in Baoshan County have livestock, less than one-fifth of households earn an income from sale of livestock or livestock products (17.4 percent). Common types of livestock include poultry and pigs, which are mainly raised for household consumption. The sale of herbs and medicinal plants were identified as income sources by almost one-fifth of households.

5.2.2 Non-farm livelihoods

Farming is at risk due to vagaries of weather, cost of agricultural inputs, the volatility of the crop prices, and crop and livestock diseases. Income from non-farm sources supplements that

¹⁷ 1 hectare = 15 mu

from agriculture and is a part of the strategy to spread risk. In Upper Assam, nearly half of households earned a daily wage from non-farm job in the locality (45.7 percent).¹⁸ About one-third of households had reported this to be their major source of income. Small businesses (mainly retail trade) contributed to the income of one-third of households (35.0 percent). Non-recipient households have better access to non-farm income opportunities in the locality (see Figure 5.1). For example, one-fifth of non-recipient households (21.2 percent) and one-tenth of remittance-recipient households (11.8 percent) had access to non-farm salaried income. Daily wage from non-farm sources in the locality contributed to the

Table 5.1: Access to agricultural land, land area, and land ownership among households, Upper Assam, the Eastern Brahmaputra sub-basin, 2013-14.

	Remittance-recipient household	Non-recipient household
Household who have access to agricultural land (%)	69.3	79.5
Total agricultural land area (in hectares), Mean [#]	1.2	1.2
Per capita agricultural land (in hectares), Mean [#]	0.2	0.2
Ownership of land (%) [#]		
Owned	91.0	90.5
Leasehold	5.7	4.3
Share cropped	3.3	5.2
Tenured access to common property	0.0	0.0
Tenured access to collective land	0.0	0.0
Share of land use (%) [#]		
Crop farming	86.9	88.8
Orchard/tree crops	1.6	1.1
Grassland/pasture	0.8	0.0
Kitchen garden	6.6	7.3
Fallow	4.1	2.8
Access to irrigation		
% of household who have irrigated land [#]	2.2	2.0
Crop sales in USD, Mean (SD)	136(431)	138 (329)

[#] Computed among those who have access to agricultural land.

Source: Computed by author from HICAP Migration Dataset.

income of nearly half of non-recipient households (48.0 percent) and over two-fifths of remittance-recipient households (42.9 percent). In comparison to 37.7 percent of non-recipient households, 31.8 percent of remittance-recipient households had an income from small business. The composition of rural household income in China has been modified by

¹⁸ 'Locality' means in the same village or a nearby village or town.

the development of rural non-farm sector and the rural-to-urban migration (Zhu and Luo 2008).

Table 5.2: Access to agricultural land, land area, and land ownership among households, Baoshan County, Yunnan, the Upper Mekong-Salween sub-basins, 2013.

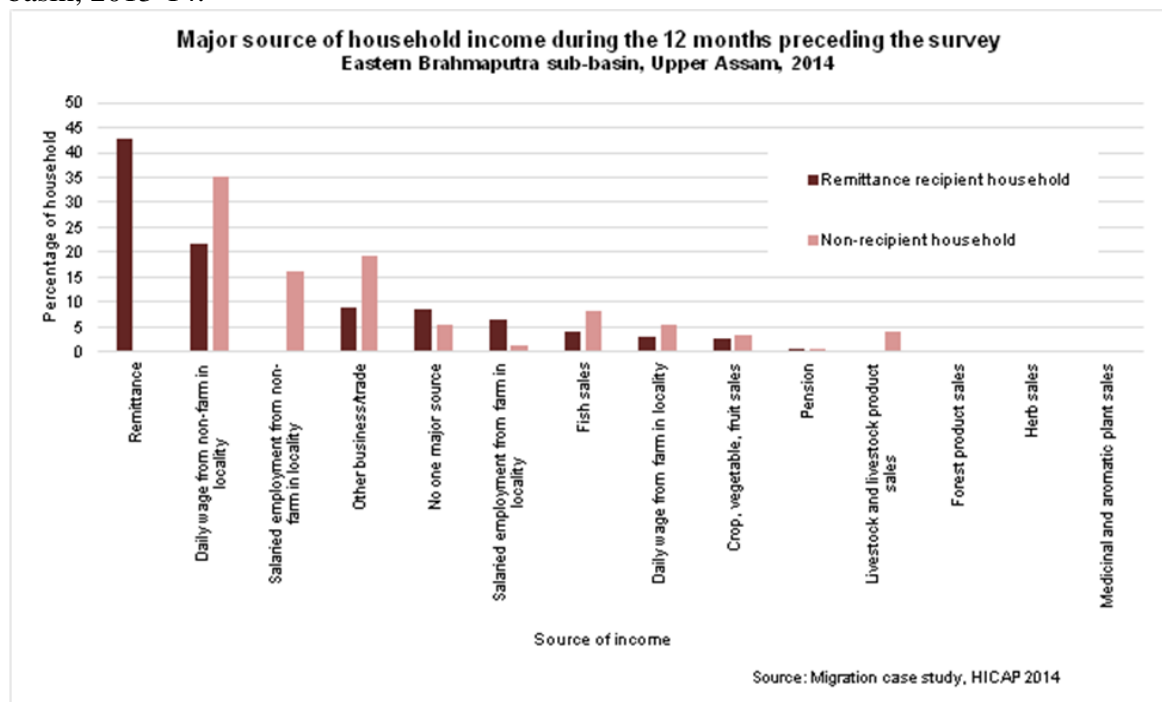
	Remittance-recipient household	Non-recipient household
Household who have access to agricultural land (%)	91.1	85.6
Total agricultural land area (in hectares), Mean [#]	0.3	0.5
Per capita agricultural land (in hectares), Mean [#]	0.1	0.1
Ownership of land (% [#])		
Owned	0	0
Leasehold	6.2	22.5
Share cropped	0	0
Tenured access to common property	0	0
Tenured access to collective land	93.8	77.5
Share of land use (% [#])		
Crop farming	88.3	85.0
Orchard/tree crops	10.5	9.8
Grassland/pasture	0.8	0.3
Kitchen garden	0.3	0.3
Fallow	0.1	0.0
Other	0.0	4.6
Access to irrigation		
% of household who have irrigated land [#]	55.6	45.6
Total agricultural land area (in hectares), Mean [#]	0.1	0.1
Crop sales (in USD), Mean (SD)	793 (1313)	2601 (1815)

[#]Computed among those who have access to agricultural land
Source: Computed by author from HICAP Migration Dataset.

The share of non-farm income to the net per capita income of rural households in China was estimated to be 54 percent (National Bureau of Statistics 2012). Nearly, a third of households in Baoshan County had access to salaried employment from non-farm sources in the locality (32.4 percent). However, it was identified as the major income source by only a fifth of households. Daily wages from non-farm sources in the locality contributed to the income of nearly a quarter of households (23.2 percent) in Baoshan County, and less than one-tenth of households had identified it as their major income source. In Upper Assam, the non-farm income was primarily generated by daily wage employment and small business. In contrast, households in Baoshan County had better access to salaried employment in locality. Like Upper Assam, non-recipient households in Baoshan County have better access to non-farm

opportunities (salaried employment and daily wage) in the locality. In comparison with two-fifths of non-recipient households (40.2 percent), only one-fifth of remittance-recipient households (21.0 percent) had an income from salaried employment from non-farm sources in the locality. About one-third of non-recipient households (29.6 percent) and one-tenth of remittance-recipient households (13.8 percent) had an income from daily wage from non-farm sources in the locality.

Figure 5.1: Major source of household income, Upper Assam, the Eastern Brahmaputra sub-basin, 2013-14.



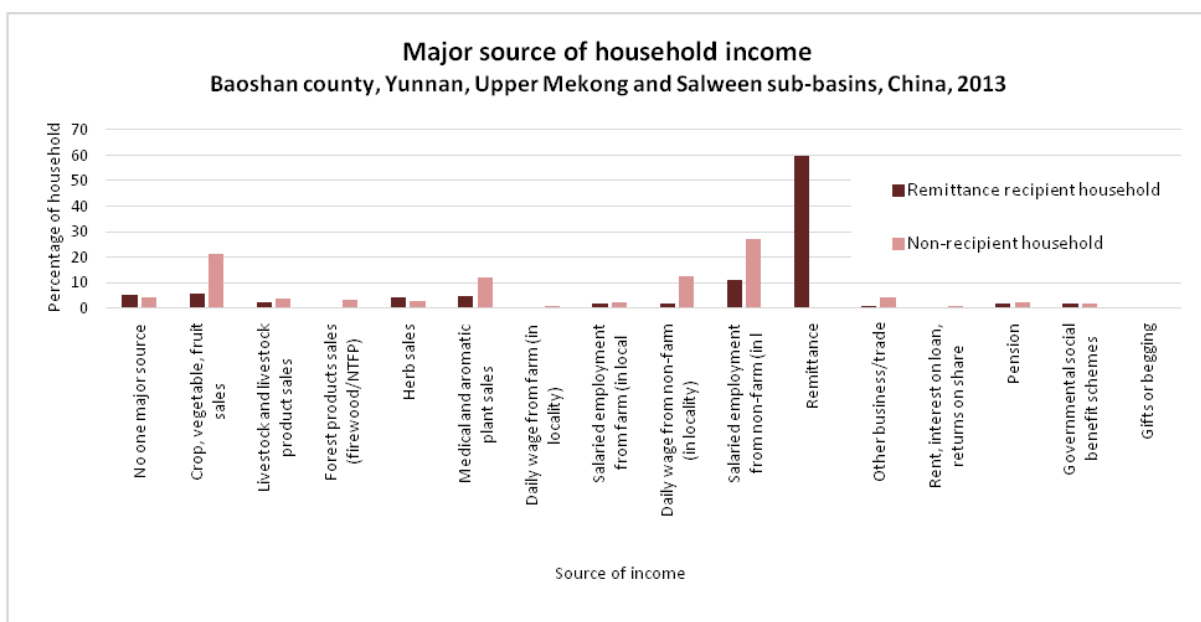
Source: Computed by author from HICAP Migration Dataset.

5.2.3 Circular labour migration

Labour migration is an emerging livelihoods option in Upper Assam. Migrant workers are predominantly men of working age with some form of school education. About three-fifths of the surveyed migrant workers had attended a secondary school (61.0 percent) and nearly one-fifth had also completed a higher secondary level of education (16.8 percent). Migration for work in this study area is predominantly internal and circular in nature, and facilitated by the social network. The agricultural sector is often unable to cater to the ever growing demand of employment that accompanies a rapidly growing population. A shift of workers from agriculture into industry and various services, as well as from rural to urban areas, is a normal outcome. Most industries are located in urban areas due to scale economies and the

availability of infrastructure (Lucas 2015). The household survey had collected information about the destination and occupation for 1,022 migration episodes since 1984. Over a quarter of these migrant episodes were associated with a destination within Assam (28.8 percent), another quarter were of the destinations were located in other north-eastern provinces in India (28.7 percent), with the remaining destinations located elsewhere in India, including the states of Arunachal Pradesh, Kerala, Karnataka, Tamil Nadu, Andhra Pradesh, Maharashtra, and Gujarat (Figure 5.3).¹⁹

Figure 5.2: Major source of household income, Baoshan County, Yunnan, the Upper Mekong-Salween sub-basins, 2013.



Source: Computed by author from HICAP Migration Dataset.

Most of the migration episodes from Upper Assam were oriented towards urban destinations (87.2 percent) with the vast majority (93.64 percent) involving wage employment. Major employers of the migrant workers were the manufacturing (30.0 percent), construction (28.3 percent), and service (11.5 percent) sectors. These migrant workers are mainly a part of the informal sector. Less than one-tenth of surveyed migrant workers received social security benefits (e.g. pensions, provident funds, or insurance) as part of their job in the destination. Only a third of the surveyed migrant workers were entitled to paid leave. This job profile contributes to the circular nature of this migration. The migrant workers based in Assam or Northeast India returned home every few months and during major festivals. Many of the

¹⁹ Other north eastern provinces include Arunachal Pradesh, Meghalaya, Nagaland, Manipur, Mizoram, and Sikkim.

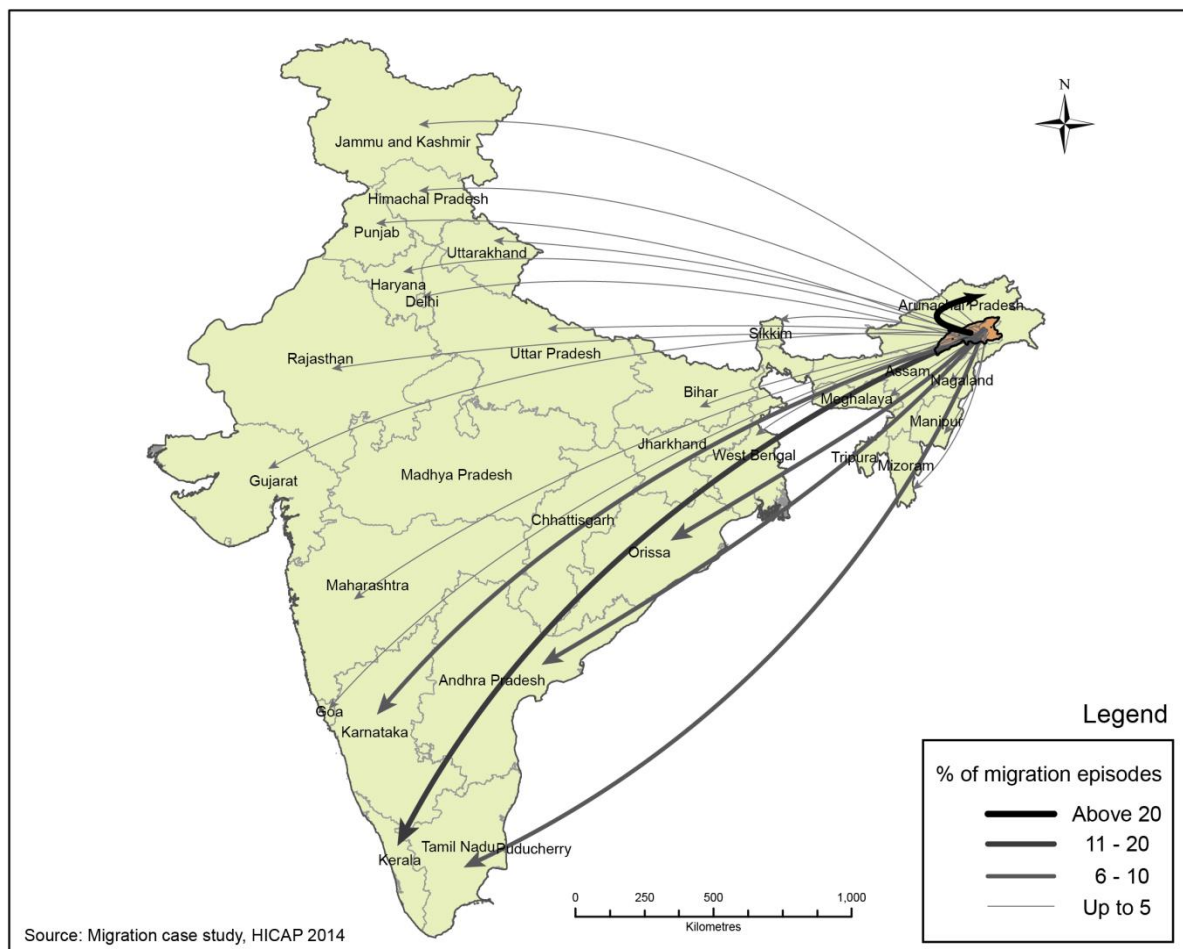
migrant workers who are based in urban centres in the south and west India were able to visit their family in Assam every couple of years. For example, the distance between the town of North Lakhimpur in Assam and Thiruvananthapuram city in the state of Kerala, which is located along the south-west coast of India, is approximately 3,925 kilometres. A one-way trip between these two destinations – mostly on the railways and partly by road – takes a minimum of four days. These migrant workers get a commensurate furlough every couple of years to visit their families in Assam. Remittances were a major income source for two-fifths of remittance-recipient households in Upper Assam. The mean amount of remittances received by remittance-recipient households during the 12 months preceding the survey was estimated to be USD 538. The mean duration of remittance-receipt was estimated to be 40.7 months. Remittances were commonly invested in food, healthcare, community activities, consumer goods, education, and transport. Few households have invested remittances in housing, savings, and loan repayment (Figure 5.4).

There are several similarities between the labour migration patterns in Baoshan County and Upper Assam. For instance, labour migration from Baoshan County was predominantly internal to China, rural-to-urban flow, comprised of men of working age with some form of school education, and a majority of these migrant workers were wage employees in destination. The education level of the migrant workers in Upper Assam was marginally better than those from Baoshan County. Over half of the migrant workers from Baoshan County had attended a secondary school (54.3 percent), and about one-tenth had completed a higher secondary level of education (12.5 percent). The household survey collected information about the destination and occupation for 705 migration episodes since 1984. Unlike Upper Assam where a majority were inter-state migrant workers, about three-quarters of the migrant episodes in Baoshan County were associated with a destination within the Yunnan province (73.3 percent) – intra-state migrant workers.²⁰ Only one-tenth of the destinations were in Guangdong province (9.5 percent). Major employer of these migrant workers was the construction sector (61.9 percent). Other sectors individually employed less than one-tenth of the migrant workers. Remittances were a major income source for almost two-thirds of remittance-recipient households in Baoshan County. The mean amount of remittances received by remittance-recipient households during the 12 months preceding the survey was estimated to be USD 2924 – more than four times the average for migrants in

²⁰ Province and state are synonymous.

Upper Assam. In turn, the mean duration of remittance receipt was estimated to be 80.0 months, double that in Upper Assam. A considerable number of remittance-recipient households in Baoshan County had spent remittances on health care, food, communication, consumer goods, education, and community activities (see Figure 5.5). Employment in non-farm sector, particularly construction, was available closer to the origin communities in Baoshan County. Besides, obtaining an urban *Hukou* in many large and medium-sized cities – which is pre-requisite for access social assistance, public housing, and schools – is still difficult for rural migrants (Tao and Xu 2007).

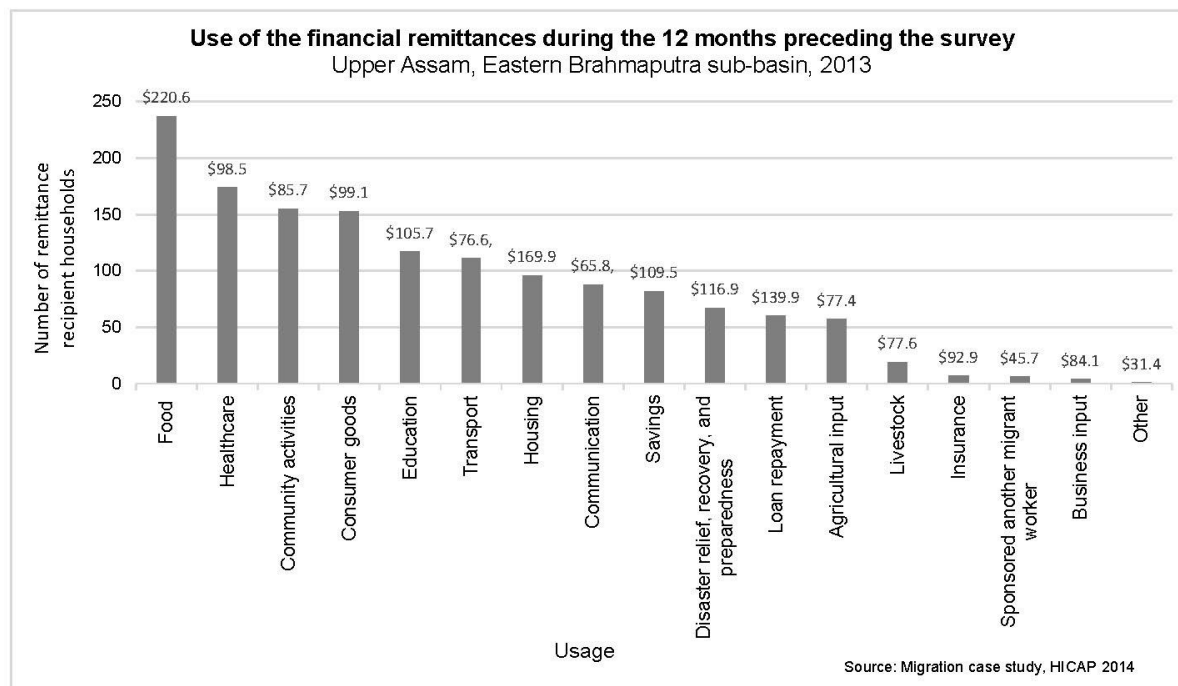
Figure 5.3: Destination of the inter-state migrant workers from 1984-2014, Upper Assam, the Eastern Brahmaputra sub-basin.



Source: Banerjee et al. 2017

In contrast, a significant share of migrant workers from Upper Assam had moved to a destination in south and west India. There is no formal restriction on movement of people within India. The focus group discussions with migrant workers suggest that the jobs in faraway destinations were facilitated by the social network.

Figure 5.4: Use of the financial remittances, Upper Assam, the Eastern Brahmaputra sub-basin, 2013.



Note: Use of remittances during the 12 months preceding survey.
Source: Computed by author from HICAP Migration Dataset

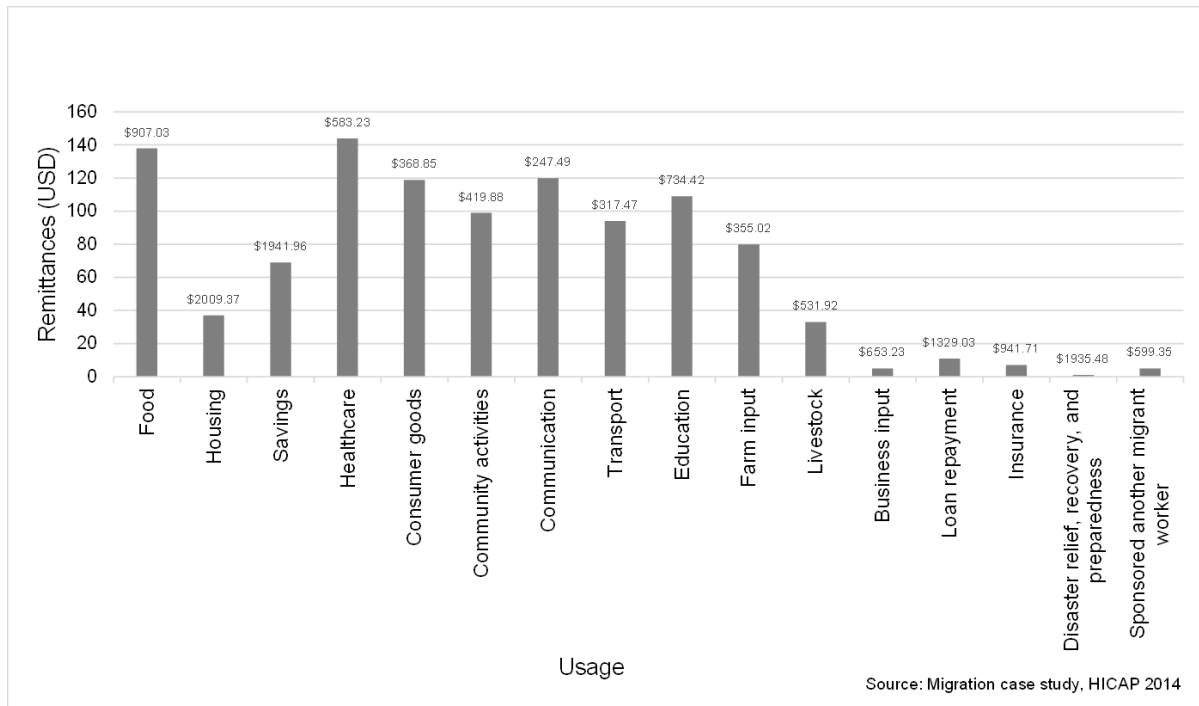
5.3 Extreme events: Impacts and responses

5.3.1 Impacts of extreme events

The monsoon rainfall in Assam is highest from June to August when the floods, usually, occur. As many as four to five flood waves occur in certain years (Goyari 2005). The annual floods could lead to disasters in the flood plain due to the ancillary flood waves accompanying normal annual response of a river system (Dutta and Ghosh 2012). These floods have direct and indirect effects on the lives of people of Upper Assam. For instance, houses are submerged by flood water. The household members shift to safe locations (e.g. road or embankment), temporarily relocate to a relative's house, or take shelter in relief camps that are set up in schools and colleges (Banerjee et al. 2011). Depending on the timing and intensity of floods in a given year, the extent of damage to the crops varies from one year to another (Mandal 2010). The standing crops are destroyed by floods. Most vulnerable among these crops is the winter or *Sali* paddy, the main *Kharif* (monsoon) crop (Mandal 2010). The autumn or *Ahu* paddy is sown in February-March and harvested in July-August. The winter or *Sali* paddy is transplanted in July-August. This period coincides with annual floods. Early flood damages the autumn paddy. The winter paddy is damaged by flood occurring late in the season (Goyari 2005). Besides, strong currents of flood water erode the

fertile top-soil. Flood deposits sand ('sandcating') and other sediments that bury standing crops or render farmland unsuitable for farming in some areas (Das et al. 2009). Usually, insects and pests also appear in the aftermath of floods, damaging crops.

Figure 5.5: Use of the financial remittances, Baoshan County, Yunnan, the Upper Mekong-Salween sub-basins, 2013.



Note: Use of remittances during the 12 months preceding survey.
Source: Computed by author from HICAP Migration Dataset

These floods have adverse effects on crop yield and growth of farm sector as well as a household's food security and income. The recurrent floods have led to decline in paddy production, particularly of winter paddy. Households that do not produce enough paddy to meet their rice needs, have to procure rice from local shops. Rice is the staple food in this area. During the flood season, there is an increase in demand for rice in local market. As the rice stock of the local shops run low (sometimes due to transport disruption by flood inundation), there is an increase in the price of rice. The low-income households are often unable to afford staple food due to this price rise, and have to depend on less preferred food items. As a woman FGD participant from a poor non-migrant household in the Bura-Kuri village of Dhemaji district reported:

When rains start, we have to be alert. We have to arrange the rice. Those who have paddy, make it into rice. Those who do not have enough paddy, buy rice. When shops are closed, we will have to starve.

Livestock may be swept away by the floods (Chahliha 2012), starve to death due to shortage of fodder or forage, or die due to water borne diseases that occur in the aftermath of floods. Moreover, veterinary healthcare is limited in this area, and access to this service is disrupted altogether when flood waters damage roads and transport infrastructure. Flood water contaminates drinking water sources of households (e.g. tube-well and well). Water-borne diseases (e.g. gastroenteritis, diarrhoea, and dysentery) occur among people during the flood season in Assam (Hazarika 2006).

The Yunnan province had experienced five years of drought between 2005 and 2015. Wang and Meng (2013) termed the autumn-spring drought from September 2009 to June 2010 as ‘a once-in-a-century’ severe drought. There was three years of consecutive drought from 2009 to 2012. The adverse effects of drought could last for a few months to even years, and its economic costs could be substantial (Pandey and Bhandari 2009, Conway and Schipper 2011). Large areas of southwest China have the Karst landform, which accelerates infiltration of surface water, thereby exacerbating the drought impacts (Zhang et al. 2012). Millions of residents and livestock found it difficult to access drinking water. The scarcity of rain and irrigation increased the risk of survival of tens of millions of hectares of crops (Ye et al. 2012). During the FGDs in Baoshan County, a shortage of water for household consumption, farming, and livestock rearing was highlighted by the participants.

The adverse effects of droughts are most prominent in the agricultural sector. About 35 percent of annual agricultural losses caused by all natural disasters in China since 1949 are due to droughts (Song et al. 2003). In comparison to 2009, the winter wheat yield in southwest China in 2010 declined by 10.8 percent (National Bureau of Statistics 2010 cited in Zhang et al. 2012). Winter wheat is a major food crop in this area. It requires a lot of water during its jointing and heading stages (Zhang et al. 2012). The lack of water, including soil moisture, also reduces the production of paddy, wheat, maize, tobacco, and sugarcane. Drought increases the frequency and severity of plant diseases and pests. For example, focus groups informed that crop pests have damaged coffee plants in the Xinzhai village of the Xiyi Township in Baoshan County. Farmers have to increase investment in seeds, irrigation, fertilizer and pesticides due to delay of rain. Consequently, this leads to an increase in input costs. The access to a continuous supply of drinking water was the primary concern for the livestock (Ye et al. 2012).

5.3.2 Responses to extreme weather events

Based on the scale of analysis, disaster responses could be broadly undertaken by the government, community, and/or households. On some occasions there may be an active collaboration between some of these stakeholders. For instance, relief material from the state government could be distributed with the assistance of village committee or community based organisation. The major flood response measures undertaken by the Assam government include opening of relief camps, providing relief material and compensation to the affected families, construction and maintenance of embankments and drainage channels, anti-erosion and protection measures, restoration of communication and transport infrastructure, and providing flood warning information (Goyari 2005). These are either short-term emergency responses during flood inundation or large-scale structural interventions aimed to control floods. A huge share of state's resources are being diverted from development programmes every year in order to undertake relief, rescue, and rehabilitation of flood affected population in Assam (Goyari 2005). Social networks and government agencies were the common sources of assistance. Only a tenth of the households had not received flood assistance from any source. However, the village level flood preparedness is limited. Only a fifth of the villages surveyed had a village level flood contingency plan and pre-designated flood shelter for villagers. Only a quarter of villages surveyed had a pre-designated flood shelter for livestock. Less than one-fifth of villages had organised village level meetings about flood preparedness.

Over the years, households in the flood affected rural communities of Upper Assam have developed several flood response strategies. The household level responses to floods can be divided into responses during the flood period (when houses and farms are inundated); the immediate aftermath of the flood (when flood waters have receded), and the periods between two distinct flood events. During the flood, household responses are focused on evacuation and relief. Households move cattle to a safe location (78.9 percent), build raft from banana plants (78.2 percent), move family members to a safe location (67.5 percent), boil or filter drinking water (60.5 percent), buy food on credit (56.7 percent), build a raised platform within the household to take shelter and/or store valuables (59.5 percent), spend savings on food (53.1 percent), help set-up a relief camp (53.1 percent), contact the district administration for assistance (52.4 percent), and contact doctor or health centre (51.7 percent). Though it has been decades since many of these strategies were first adopted by a

household, these are short-term and reactive in nature. Some of these strategies may become less useful and accessible, or more expensive in the future. For example, over three-quarters of surveyed households had built a raft from the banana plant (*'bhur'*). However, recurrent floods have led to a decline in availability of banana plants in some areas, and this situation may become acute in the future. A woman FGD participant from the Temera-Miri village of Lakhimpur district reported:

There are no banana plants in our village because of recurrent flood every year.

We have to procure banana plants from other villages to build a raft.

In the immediate aftermath of a flood, the household level responses are focused on recovery measures. Households seek to repair houses (87.5 percent) and cattle-sheds (58.6 percent); they contact the health care service (70.9 percent), district administration (67.5 percent), and/or veterinarian (50.7 percent); arrange safe drinking water (54.7 percent), prepare for farming (56.3 percent), spend savings on food (54.7 percent), buy food on credit (51.6 percent), and repair local infrastructure (51.0 percent). These strategies are short-term in nature, and help the households to cope during the flood period.

Household level responses to flooding in the periods between two flood events commonly include raising plinth of the house (74.7 percent), granary (46.2 percent), and cattle-shed (42.0 percent); raising height of tube-well (39.8 percent); and repairing local infrastructure (38.6 percent). Some households also mortgage or sell assets to get cash needed to fund the daily household needs as well as its recovery from flood impacts. Others reduce the number of cattle. Cattle are prone to diseases in aftermath of floods, and there is a fodder shortage during this period. Selling the cattle helps the household to supplement their income. Winter paddy is vulnerable to frequent floods. Farmers may adopt a risk-averse strategy, which includes an appropriate combination of crops, to avoid crop losses due to frequent floods. There has been an increase in area of *Rabi* food grains and vegetables (winter crops) and a decline in area under *Kharif* food grains (Mandal 2010). Around one-third of households interviewed had used a tractor to plough the farm, particularly during the winter cropping season. Flood deposits large quantities of debris on the farm. The shortage of fodder and diseases during floods weaken the bullocks, and these are unable to plough through the debris. If a tractor is rented to plough the farm, not only can it cut through flood debris, but its use can support changes in the farming calendar (e.g. early cultivation and quick cropping) to

avoid the flood period. A male FGD participant from a non-migrant household in the Natun Gaon village of Tinsukia district reported:

Some of us are using tractors to plough the farm. We did not use it earlier. Now, we are compelled to use it. We cannot rear bullocks due to the flood. During flood, they either die or are weakened due to lack of food and diseases. Those who do not have bullocks are now compelled to use tractor.

A small number of FGD participants and local experts also pointed to the shortage of farm labour due to outmigration of men as one reason for growing use of tractor for farming. Overall, the households are dependent on *ex post* short-term flood response measures. The number of short-term strategies used by households during the flood or in its immediate aftermath outnumbered the long-term strategies adopted between flood events (Table 5.5). There is a lack of *ex ante* flood preparedness strategies associated with awareness generation, risk pooling, and financial inclusion.

Across the board a set of measures to manage the drought has been developed and implemented in China, including laws and regulations, the management mechanisms, emergency response and implementation plans, and assurance measures. The emergency response mechanism is activated only when the society is affected by drought (Yan et al. 2012). Under the direct leadership of the central government, considerable resources were mobilised in response to the recent droughts (Ye et al. 2012). During droughts, social network and government were again the main sources from which households had received assistance. Although, over a quarter of the households had not received drought related assistance from any sources. Yan et al. (2012) highlight that the drought management in China is based on a no-risk management model and the evolution of extreme events is not considered during the planning stage. In contrast to Upper Assam, over three-quarters of the villages surveyed in Baoshan County reported that there was a village level drought contingency plan. Almost two-thirds of the village surveyed had constructed an irrigation channel or water tank to address the water shortage due to drought. A village level water management plan was reported by over half of the villages. Most villages had organised meetings in their villages to discuss levels of drought preparedness.

Table 5.3: Average number of household level flood responses by MPCE terciles, Upper Assam, the Eastern Brahmaputra sub-basin, 1984-2013.

Background characteristics	During flood		Immediate aftermath of floods		Between two flood events	
	Remittance-recipient	Non-recipient	Remittance-recipient	Non-recipient	Remittance-recipient	Non-recipient
MPCE ¹ terciles						
Bottom	11	11	10	9	5	4
Middle	11	11	10	10	6	5
Top	14	13	12	11	8	7

¹Monthly per capita expenditure adjusted for adult equivalent. Source: Computed by author from HICAP Migration Dataset.

Household level responses to drought can be divided into responses during the first year of drought and responses in subsequent years. During the first year of the drought, the household responses include reduction in the number of cattle (30.4 percent) and poultry (24.7 percent), storing drinking water (28.3 percent), maintenance of irrigation channel (25.8 percent), borrowing money from relatives or friends (21.7 percent), reduction in spending on clothes (11.5 percent), and construction of small water tanks for irrigation (11.5 percent). During the droughts in 2009 and 2010, farmers had invested a large proportion of their capital stock into crop production since at the beginning of the seasons, they were unaware of the coming droughts. There were limited resources – including motor-pumps, irrigation facilities, and other infrastructure – to cope with the droughts (Ye et al. 2012). During the subsequent years of drought common household response strategies include maintenance of irrigation channel (20.1 percent), reduction in the number of cattle (14.8 percent) and poultry (14.5 percent), and reduction in spending on clothes (10.0 percent). Su et al. (2012) suggests that urbanisation and market-driven agricultural intensification is contributing to the growing water demand; while the water supply is constrained by a weakened collective management of large water infrastructure during the HRS. Lack of water for irrigation is an emerging challenge for rural households. Under such circumstances, a prolonged drought increases the risk of losing the entire crop. One of the strategies adopted by households during the subsequent years of drought was a mutual agreement with their neighbours for the use of water for domestic use and irrigation (13.5 percent).

Since the introduction of the HRS in the late-1970s, the rural households have a greater flexibility in selecting the crops to be grown, and paddy had been the primary crop (Su et al. 2012). In recent times, an ever growing number of households in Yunnan province are shifting from paddy to crops that require less water such as maize, beans, and walnut. Su et

al. (2012) points out that the latter fetch a lower price than rice. Few households had modified their farming practices. Only 8.4 percent of surveyed households had reduced area under more water-intensive crops during the first year of drought, and 6.9 percent of households had adopted this strategy during subsequent years of drought. Also, 4.7 percent of households had increased area under less water intensive crops. About one-tenth of the households had made changes in the farming calendar (10.6 percent). These household responses to drought are ad-hoc, and stop-gap in nature. They could minimise risk in short-term and provide a buffer income (e.g. selling of poultry). Based on a study in Lijiang County of Yunnan province, Zheng and Byg (2014) estimates that mean number of coping strategies adopted by drought affected households ranges from 2.2-2.7. This is similar to average number of household level drought responses in Baoshan County (see Table 5.6). There is little difference in average number of strategies adopted by households belonging to different terciles.

Table 5.4: Average number of household level drought responses by MPCE terciles, Baoshan county, Yunnan, the Upper Mekong-Salween sub-basins, 1984-2013.

Background characteristics	During first year of drought		Subsequent years of drought	
	Remittance-recipient	Non-recipient	Remittance-recipient	Non-recipient
MPCE ¹ terciles				
Bottom	2	2	1	1
Middle	2	2	1	2
Top	2	2	1	2

¹Monthly per capita expenditure adjusted for adult equivalent. Source: Computed by author from HICAP Migration Dataset.

5.4 Chapter conclusion

This chapter provides an overview of the rural communities in which fieldwork was conducted. It describes the livelihood practices, impacts of a major extreme event, and responses to these disasters. Farming employs a large number of rural workers in both study areas. While farming in Upper Assam is subsistence in nature; the importance of cash crops are an essential characteristic of farming in Baoshan County. Other livelihood strategies supplement the income from farming. The main non-farm strategies in Upper Assam are daily wage employment and small business. In Baoshan County, non-farm income is generated by salaried employment and daily wage employment. The migration in both these study areas is comprised of rural-to-urban flow of men of working age who are wage employees in secondary or tertiary sectors in destinations located within country of origin.

The mean amount of remittance transferred by migrant workers from Baoshan County is considerably higher than that by migrant workers from Upper Assam. The migration in Upper Assam is comparatively a newer flow than that in Baoshan County. The migrant workers from Upper Assam are still in the early phase of migration cycle. Most of migrant workers from Upper Assam and Baoshan County are part of the informal economy in destination.

The nature and extent of major extreme event have several differences in Upper Assam and Baoshan County have several differences. Floods displace people, destroy standing crops, render farm land unusable, kill livestock, contaminate drinking water, disrupt transportation, damage infrastructure, lead to loss of income, and contribute to an increase in price of food grains. It is evident that floods have adverse of several aspects of life in Upper Assam. On the other hand, the adverse effects of drought in Baoshan County are most prominent in the agricultural sector: Loss of soil fertility, shortage of water for irrigation, and reduction in farm productivity and yield. This has led to an increase in input costs for agriculture and decrease in household income. Besides, the drought has resulted in a shortage of water for household consumption.

The main flood response measures undertaken by the Assam government are short-term emergency responses during flood inundation or large-scale structural interventions aimed to control floods. Most of household level responses during flood inundation and in its immediate aftermath are short-term. These strategies aim to save life, livestock, and property; survive; and recover from the flood impacts. The long-term capacities of flood preparedness are primarily focused on structural changes to the dwelling or outbuildings. Though there are a wide range of measures to manage the drought in China, these measures are not activated until the society is affected by drought. The household responses are mainly focused on the drought induced agrarian crisis and water shortage for household consumption. In comparison to flood responses in Upper Assam, there are fewer drought response strategies in Baoshan County, and these strategies are focused on fewer aspects of life and local livelihoods. There are different implications for well-being, long-term sustainability and subsequent adaptation options from different household choices of *ex-ante* risk management and *ex-post* coping response strategies (Zheng and Byg 2014). The empirical chapters will explore the effects of remittances on vulnerability of households to major extreme events.

Chapter 6: Effects of Remittances on Sensitivity to Extreme Weather Events

6.1 Introduction

This chapter seeks to explore the effects of remittances on household level sensitivity to the drought in Baoshan County and floods in Upper Assam. The objectives of this chapter are to advance understanding of the effects of remittances on household level sensitivity and to characterise the nature and determinants of sensitivity of remittance-recipient households compared to households that do not have access to remittances. The characterisation of vulnerability is essential to the evaluation of the nature and magnitude of the impacts of an extreme event on a system (e.g. a household). It is also necessary for the identification of key sources of vulnerability and planning of strategies to reduce or manage these risks. This chapter is organised as follows; the next section explores the conceptual framework which is followed by a brief overview of research methodology. Next, empirical evidence is presented, which seeks to explore the relationship between remittances and sensitivity of remittance-recipient households compared to non-recipient households. It also characterises the sensitivity of remittance-recipient households in the context of duration for which a household has received remittances and distance to destination. The chapter concludes with a discussion of the implications of the findings.

6.2 Conceptual framework

Vulnerability to climate stress as well as other forms of environmental and societal pressure is determined by the socio-economic and political context within which these impacts occur (Kelly and Adger 2000). The relative effect of exposure on a system is dependent on the latter's sensitivity to stress, and the capacity to respond and adapt. For example, flood impacts would be more adverse on people residing in houses built with weak construction material and a low plinth compared to people living in well-constructed house where height of the plinth is higher than the flood-water line. While a member of remittance-recipient household migrates to work, the household continues to live in the same geographic location. This form of migration is not likely to have a direct effect on exposure of the household to an extreme event. Rather, its effects on exposure will be indirect, through its influence on sensitivity and adaptive capacity. Therefore, chapters 6 and 7 explores effects of remittance on the household's sensitivity and adaptive capacity to a major extreme event in the study areas.

The IPCC AR5 defines sensitivity as ‘[t]he degree to which a system or species is affected, either adversely or beneficially, by climate variability or change. The effects may be direct (e.g., a change in crop yield in response to a change in the mean, range, or variability of temperature) or indirect (e.g., damages caused by an increase in the frequency of coastal flooding due to sea-level rise) (IPCC 2014b, p. 24). At the household level, resource use and dependence of livelihoods on climate-sensitive activities reflect sensitivity to a particular stress (Eakin and Bojórquez-Tapia 2008). Based on learning from the ‘livelihoods’ vulnerability literature (e.g. Vincent 2007, Eakin and Bojórquez-Tapia 2008, Hahn et al 2009, Gerlitz et al. 2016, Mohapatra et al. *forthcoming*), I conceptualise sensitivity to be composed of following sub-dimensions, namely environmental dependence, water, food, well-being, and health. The attributes and indicators that constitute these sub-dimensions vary according to the local context in Baoshan County and Upper Assam (Tables 6.1a and 6.1b). These indicators are identified in consultation with the FGD participants in the respective study areas, and focuses on autonomous responses that could be influenced by an individual household. For example, a household would be able to change the crop variety in response to flood impacts. But it would have little influence on the alignment of an embankment, which is a responsibility of the government institutions. Later, these indicators are categorised into attributes, sub-dimensions, and major components of vulnerability according to the conceptual framework.

6.2.1 Environmental dependence

Livelihood profiles can influence sensitivity to climate change (Eakin and Bojórquez-Tapia 2008). If households are largely dependent on crop income and pursue an undiversified strategy, this dependence could enhance sensitivity of these households to climate hazards and volatility of crop prices in the market (Adger 1999, Eakin and Bojórquez-Tapia 2008). The sub-dimension of environmental dependence includes attributes such as dependence on crop income and crop diversification. An effective means of reducing vulnerability is spreading risk through income diversification (Kelly and Adger 2000). A household with multiple income sources is likely to be less sensitive to climate hazards and market shocks than one that depends on a single income source. Income diversification is an important risk management strategy among smallholder farm households (Ellis 2000). It complements crop income with non-farm and livestock income. Though income diversification reduces the sensitivity of small-scale farmers to shocks, their specific capacities to address climatic stress

may not be enhanced by this strategy (Eakin and Bojórquez-Tapia 2008). Diversifying from farm to non-farm activities could reduce sensitivity to climate hazards (Hassam and Nhemachena 2008). Non-farm income diversification is a proxy for sectoral diversification. The impacts of extreme events could deplete a household's agricultural assets (e.g. farm, livestock, and agricultural implements). The FGD participants in Upper Assam reported that agricultural implements are swept away by flood or farm land are rendered unusable due to sand casting. Sometimes, agricultural assets may have to be mortgaged or sold to urgently meet the requirement for cash, which is required to procure relief material or fund recovery in aftermath of an extreme event. Among the study areas, reduction in agricultural asset is comparatively commonplace in flood affected households than in drought affected communities (refer Table 6.1a and Table 6.1b).

A household will be sensitive to climate variability if it is increasingly dependent on environmental resources like firewood for cooking and heating (Rajesh et al. 2014). Firewood is the primary source of cooking fuel for many households in Upper Assam. The FGD participants reported that access to firewood is often disrupted by floods. It increases the time required to gather firewood or other material that is used as fuel. The scarcity of fuel impedes cooking, which may affect the type of food consumed, number of meals, and nutritional value of food during floods. Hence, dependency on the environment for the primary source of cooking fuel is an attribute of environmental dependence. The quality of dwelling is another crucial attribute of a household's sensitivity to extreme events. The chances of damage to housing stock, and in turn, leading to injury or death of people, would be higher if low quality housing stock is exposed to an extreme event (Sharma and Patwardhan 2008). The environmental dependence sub-dimension for Upper Assam includes an attribute on houses with low quality primary construction material for the external walls. The quality of a dwelling's wall is not a concern for the drought-affected households in Baoshan County, and is not included in its environmental dependence sub-dimension. Rather the FGD participants in this study area highlight the susceptibility of households, which are predominantly dependent on rain-fed farm land, to drought. These households may experience a decline in production of crops due to drought, and a consequent reduction in household income. The rain-fed farm diversification is an attribute of environmental dependence in Baoshan County.

6.2.2 Water

Hahn et al. (2009) considers average time taken by a household member to collect drinking water for a normal day as an attribute of the household's current access to drinking water. If rural households have to collect their drinking water from a long distance, a disruption caused by a drought or flood would make it more difficult for the household to address its requirement. In the absence of a water source within the dwelling, collection of water for domestic consumption is a matter of effort, especially for the women (Das et al. 2009). Access to drinking water storage and potable drinking water are important attributes of sensitivity to extreme events. Su et al. (2012) reports that households in some drought affected villages of Yunnan province have built small water tanks for dry season storage. If a household lacks water storage facilities and does not adopt measures to purify drinking water during an extreme event, the household members could be forced to consume contaminated drinking water, which could lead to water borne diseases. During the floods in Assam, outbreaks of water-borne diseases are common (Hazarika 2006). In Assam, Das et al. (2009) reports that tube-wells and ring-wells are placed above the flood line to prevent flood water from contaminating the drinking water sources. The water sub-dimension in Upper Assam includes an attribute about the households that had not raised height of wall surrounding the well or height of tube-well. While in Baoshan County, dependence on unprotected or open sources for drinking water is an attribute of the water sub-dimension.

6.2.3 Food

Potential disruption of ecological and land use systems due to climate change could compromise food supply (Reed et al. 2013). Bohle et al. (1994) suggests that critical shifts in future food security, particularly among currently vulnerable social groups, would occur even due to modest adverse changes in resources and economies induced by global climate change. The disruption of food supply is a major concern among the flood affected households in Upper Assam. Hence, the food sub-dimension is comprised of attributes associated with flood period such as reliance on less preferred food items, restricted food consumption among adult household members, use of savings to procure food, collected wild food (e.g. fruits, vegetables, and herbs), and begged for food. In response to the severe droughts between January 2009 and April 2010, the Chinese government organised the supply of grains, cooking oil, meat and vegetables to the local markets in order to stabilise food prices (Ye et al. 2012). Hence, access to food is not a significant concern for the drought affected

households in Baoshan County. Only reliance on less preferred food during drought had been highlighted in the FGDs. Other food related attributes discussed during the FGDs in Assam were not identified during the FGDs in Baoshan County. In consultation with the local experts from Kunming ‘reliance on less preferred food during drought’ is included into the well-being sub-dimension.

6.2.4 Well-being and health

Brooks et al. (2005) identifies economic well-being as an indicator of generic vulnerability. Higher insecurity is linked to a lack of well-being, particularly during stress (Gerlitz et al. 2014). Poor people have a higher exposure to risk as they tend to live in marginal and hazardous areas (Adger 1999). The well-being of a household manifests its ability or inability to cope with, recover from, or adapt to a particular stress. In my research, the well-being sub-dimension for the flood affected study area in Upper Assam is comprised of reduction in spending on education, healthcare, and clothes due to flood, and mortgaging or selling of household assets (e.g. jewellery, small animals) due to flood. Reduction in spending on clothes due to drought and reliance on less preferred food due to drought are the attributes of well-being for the Baoshan County. There are many pathways through which climate change may affect health. The climate change stressors could have direct (injuries and mortality) and indirect effects (vector borne diseases, malnutrition) on the population (Haines et al. 2006). The sub-dimension of health is represented by reduction in health spending due to floods.

Table 6.1a: Sub-dimensions and attributes of household level sensitivity in Upper Assam, the Eastern Brahmaputra sub-basin.

Sub-dimensions	Attributes	Measurement of attribute	Survey question	Source
Dependence on environmental resources	Dependence on crop income	Above median income from crop sale (i.e. staple and cash crops)	During the last 12 months, what was the income from the sale of staple and cash crops?	Adapted from Gerlitz et al. (2014).
	Crop Diversification Index	The inverse of (the number of staple and cash crops +1) reported by a household. E.g. A household that grew four crops will have a Crop Diversification Index = $1/(4+1) = 0.20$	During the last 12 months, what types of staple and cash crops did your household grow?	Adapted from Hahn et al. (2009), and Hassan and Nhemachena (2008)
	Income Diversification Index	The inverse of (the number of income sources+1) reported by a household. E.g. A household that has four sources of income will have an Income Diversification Index = $1/(4+1) = 0.20$	What is the percentage contribution of the following sources to the total yearly household income?	Adapted from Hahn et al. (2009)
	Non-farm Income Diversification Index	The inverse of (the number of non-farm income sources+1) reported by a household. E.g. A household that has three sources of non-farm income will have a Non-farm Income Diversification Index = $1/(3+1) = 0.25$	What is the percentage contribution of the following sources to the total yearly household income?	Developed for the purpose of this study.
	Reduction in agricultural assets due to flood	Percentage of households that had leased out or sold farmland, or sold agricultural assets (e.g. tools, seeds, and livestock)	During the last 30 years, did your household lease out farm land, sell farm land, or sell agricultural assets in the immediate aftermath of a flood to deal with its impacts? During the last 30 years, did your household lease out farm land, sell farm land, or sell agricultural assets between two flood events in response to flood impacts?	Adapted from Gerlitz et al. (2014).

	Exterior walls of the dwelling is built from weak construction material	Percentage of households that had used grass/ leaves/ bamboo, wood, mud/ unburnt brick, stone not packed with mortar, G.I. Metal, or asbestos sheets as primary construction material of the exterior walls	What is the primary construction material of the housing unit's exterior walls?	Adapted from Gerlitz et al. (2014).
	Dependence on environmental resources for primary source of cooking fuel	Percentage of households that had used firewood, sawdust, grass, or other natural material as the primary fuel source for cooking	What is the primary fuel source your household uses for cooking?	Adapted from Gerlitz et al. (2014) and Rajesh et al. (2014).
Water	Access to drinking water	Average time taken (in minutes) by a household member to collect drinking water required for a normal day. E.g. average time for a household , which requires 20 minutes during rainy season and 10 minutes during dry season, will be $(20+10)/2 = 15$ minutes	Approximately how much time (in minutes) does it take a member of your household to collect drinking water for a normal day during rainy season?	Adapted from Hahn et al. (2009) Gerlitz et al. (2014).
			Approximately how much time (in minutes) does it take a member of your household to collect drinking water for a normal day during dry season?	
	Storage of drinking water for consumption during flood	Percentage of households that had stored drinking water for use during flood inundation	During the last 30 years, did your household store drinking water for consumption during flood?	Developed for the purpose of this study.
	Access to safe drinking water during flood	Percentage of households that had boiled or filtered drinking water for consumption during and in immediate aftermath of flood	During the last 30 years, did your household boil or filter drinking water for consumption during flood?	Developed for the purpose of this study.
			During the last 30 years, did your household arrange safe drinking water for consumption in aftermath of a flood?	

	Structural changes to the water source in response to floods	Percentage of households that had raised the height of wall surrounding the well or height of tube-well	<p>During the last 30 years, did your household raise height of wall surrounding the well or height of tube-well during flood?</p> <p>During the last 30 years, did your household raise height of wall surrounding the well or height of tube-well between two flood events in response to flood impacts?</p>	Developed for the purpose of this study.
Food	Reliance on less preferred food due to flood	Percentage of households that had relied on less preferred food due to flood	<p>During the last 30 years, did your household rely on less preferred food during flood?</p> <p>During the last 30 years, did your household rely on less preferred food in aftermath of a flood to deal with its impacts?</p>	Adapted from Gerlitz et al. (2014).
	Restricted food consumption among adults due to flood	Percentage of households that had restricted food consumption among adults due to flood	<p>During the last 30 years, did your household restrict food consumption among adult members during flood?</p> <p>During the last 30 years, did your household restrict food consumption among adult members in aftermath of a flood to deal with its impacts?</p>	Adapted from Gerlitz et al. (2014).
	Collected wild food due to flood	Percentage of households that had collected wild food (e.g. fruit, vegetable, and herbs) due to flood	<p>During the last 30 years, did your household collect wild food (e.g. fruit, vegetable, and herbs) during flood?</p> <p>During the last 30 years, did your household collect wild food (e.g. fruit, vegetable, and herbs) in aftermath of a flood to deal with its impacts?</p>	Adapted from Gerlitz et al. (2014).
	Did not have savings to buy food due to flood	Percentage of households that did not have savings to buy food due to floods	<p>During the last 30 years, did your household use savings to buy food during flood?</p> <p>During the last 30 years, did your household use savings to buy food in aftermath of a</p>	Adapted from Gerlitz et al. (2014).

			flood to deal with its impacts?	
	Begged for food due to flood	Percentage of households that had begged for food due to floods	During the last 30 years, did your household beg for food during flood?	Adapted from Gerlitz et al. (2014).
			During the last 30 years, did your household beg for food in aftermath of a flood to deal with its impacts?	
Health	Reduced health expenditure due to flood	Percentage of households that had reduced health expenditure due to flood	Did the household reduce spending on health during flood?	Developed for the purpose of this study.
			Did the household reduce spending on health in aftermath of a flood to deal with its impacts?	
			Did the household reduce spending on health between two flood events in response to flood impacts?	
Well-being	Reduced educational expenditure due to flood	Percentage of households that had reduced educational expenditure due to flood	Did the household reduce spending on education during flood?	Developed for the purpose of this study.
			Did the household reduce spending on education in aftermath of a flood to deal with its impacts?	
			Did the household reduce spending on education between two flood events in response to flood impacts?	
	Reduced expenditure on clothes due to flood	Percentage of households that had reduced expenditure on clothes due to flood	Did the household reduce spending on clothes during flood?	Developed for the purpose of this study.
			Did the household reduce spending on clothes in aftermath of a flood to deal with its impacts?	

			Did the household reduce spending on clothes between two flood events in response to flood impacts?	
Sold or mortgaged households assets due to flood	Percentage of households that had sold or mortgaged household assets (e.g. jewellery) due to flood.	Did the household sell or mortgage household assets in aftermath of a flood to deal with its impacts?		Developed for the purpose of this study.
		Did the household sell or mortgage household assets between two flood events in response to flood impacts?		

Table 6.1b: Sub-dimensions and attributes of household level adaptive capacity in Baoshan County, the Upper Mekong-Salween sub-basins.

Sub-dimensions	Attributes	Explanation of attribute	Survey question	Source
Environmental dependence	Dependence on crop income	Above median income from crop sale (i.e. staple and cash crops)	During the last 12 months, what was the income from the sale of staple and cash crops?	Adapted from Gerlitz et al. (2014).
	Crop Diversification Index	The inverse of (the number of staple and cash crops +1) reported by a household. E.g. A household that grew four crops will have a Crop Diversification Index = $1/(4+1) = 0.20$	During the last 12 months, what types of staple and cash crops did your household grow?	Adapted from Hahn et al. (2009), and Hassan and Nhemachena (2008)
	Income Diversification Index	The inverse of (the number of income sources+1) reported by a household. E.g. A household that has four sources of income will have an Income Diversification Index = $1/(4+1) = 0.20$	What is the percentage contribution of the following sources to the total yearly household income?	Adapted from Hahn et al. (2009)

Non-farm Income Diversification Index	The inverse of (the number of non-farm income sources+1) reported by a household. E.g. A household that has three sources of non-farm income will have a Non-farm Income Diversification Index = $1/(3+1) = 0.25$	What is the percentage contribution of the following sources to the total yearly household income?	Developed for the purpose of this study.
Reduction in agricultural assets due to drought	Percentage of households that had leased out or sold farmland, or sold agricultural assets (e.g. tools, seeds, and livestock)	During the last 30 years, did your household lease out farm land, or sell agricultural assets during the first year of a drought to deal with its immediate impacts? During the last 30 years, did your household lease out farm land, or sell agricultural assets during subsequent years of a drought or between the two drought events to deal with their impacts?	Adapted from Gerlitz et al. (2014).
Rainfed Farm Diversification Index	The inverse of (the rainfed farm size+1) reported by a household. E.g. A household that has three hectare of rainfed farm will have a Rainfed Farm Diversification Index = $1/(3+1) = 0.25$	How much of the household's land is rain-fed?	Developed for the purpose of this study.
Dependence on environmental resources for primary source of cooking fuel	Percentage of households that had used firewood, sawdust, grass, or other natural material as the primary fuel source for cooking	What is the primary fuel source your household uses for cooking?	Adapted from Gerlitz et al. (2014).

Water	Access to drinking water	Average time taken (in minutes) by a household member to collect drinking water required for a normal day. E.g. average time for a household , which requires 20 minutes during rainy season and 10 minutes during dry season, will be $(20+10)/2 = 15$ minutes	Approximately how much time (in minutes) does it take a member of your household to collect drinking water for a normal day during rainy season? Approximately how much time (in minutes) does it take a member of your household to collect drinking water for a normal day during dry season?	Adapted from Hahn et al. (2009) Gerlitz et al. (2014).
	Storage of drinking water for consumption during drought	Percentage of households that had stored drinking water for use during drought	During the last 30 years, did your household store drinking water for consumption during the first year of a drought to deal with its immediate impacts??	Developed for the purpose of this study.
	Access to safe drinking water during drought	Percentage of households that had boiled or filtered drinking water for consumption during drought	During the last 30 years, did your household boil or filter drinking water for consumption during the first year of a drought to deal with its immediate impacts?	Developed for the purpose of this study.
	Dependence on unprotected or open sources for drinking water	Percentage of households that are dependent on unprotected or open sources for drinking water	What is the main source (meaning, the source water comes from immediately before being used) of the water your household uses for drinking?	Developed for the purpose of this study.
Well-being	Reduced expenditure on clothes due to drought	Percentage of households that had reduced expenditure on clothes due to drought	Did the household reduce spending on clothes during the first year of a drought to deal with its immediate impacts? Did the household reduce spending on clothes during subsequent years of a drought or between the two drought events to deal with their impacts?	Developed for the purpose of this study.
	Reliance on less preferred food due to drought	Percentage of households that had reduced expenditure on clothes due to flood	Did the household reduce spending on clothes during the first year of a drought to deal with its immediate impacts?	Developed for the purpose of this study.

6.3 Research methodology

The vulnerability of a household to an extreme weather event could be shaped by household characteristics, access to remittances, local infrastructure, and access to institutions (particularly local administration). The statistical association between various attributes of household level sensitivity and a number of independent variables is assessed through the following model:

Attribute of sensitivity = f(household characteristics, remittance characteristics, infrastructure, institutional access)

with:

Household characteristics = Household head's gender, ethnicity, and literacy; household size; and average monthly per capita expenditure on consumption;

Remittance characteristics = Remittance-recipient household or non-recipient household;

Infrastructure = Time to reach nearest paved road, local market, and bank;

Institutional access = Time to reach the village office and village level meeting on drought or flood preparedness.

According to the NELM, the decision to migrate is made at the household level. The costs and returns of migration are shared by the migrant and household (Stark and Bloom 1985, Stark and Lucas 1988). Migration is a risk-sharing behaviour of the household to diversify resources (Stark and Levhari 1982). Remittances serve as income insurance (Lucas and Stark 1985). This reduces number of individuals that a household supports and establishes a network that could assist potential migration of other family members (Stark 1991). Since rural areas often lack credit and insurance markets (Taylor 1999) and may be inaccessible to non-elite groups, migration assists the households to overcome the market constraints and invest in productive activities and improve their livelihoods (De Haas 2007). Remittance epitomises the functional linkage between the migrant worker in destination and the migrant-sending household in the origin community.²¹ Remittance-recipient status of the household (i.e. recipient or non-recipient household) is the indicator of mobility. Non-recipient household is the reference category. Remittance-recipient status of the household (non-recipient 0, recipient 1), gender of the household head (female 0, male 1), ethnicity of the

²¹ In this study, a household was considered to be a migrant-sending household if any household member had lived and worked in another village or town in the same country or another continuously for two months or more at any time during the last 30 years. Households not conforming to this definition were considered as non-migrant households.

household head (scheduled castes 0, scheduled tribes 1, others 2), literacy of the household head (non-literate 0, literate 1), and meetings organised in the village to discuss drought or flood preparedness (no 0, yes 1) are categorical variables.²² The time required to reach nearest paved road, bank, village office, and local market are recorded in the survey as continuous variables.

In addition, two modified versions of the aforementioned model are used to characterise the sensitivity of remittance-recipient households in the study area. The pattern of remittance use changes over the migrant's life cycle. The life cycle and initial economic resources of the migrant influence the motives for savings (Osili 2005). One of these models uses duration of remittance receipt, which is a proxy of migration cycle, as an independent variable. Duration of remittance receipt is the period between the first and latest instances of remittance receipt by the household. It is recorded as a continuous variable in the household survey. Since this variable does not follow a normal distribution, it is converted into a categorical form with two sub-categories: short-duration (i.e. below median value) and long-duration (i.e. above median value) remittance-recipient households.²³ The second modified model is only used for the Upper Assam case study, and uses type of destination (short-distance and long-distance) as an independent variable.²⁴ For example, the migration destinations in north east India are designated as short-distance destinations. The migration destinations in rest of India are considered to be long-distance destinations.²⁵

Attribute of sensitivity = f (household characteristics, remittance characteristics, infrastructure, institutional access)

with:

Household characteristics = Household head's gender, literacy; household size; and average monthly per capita expenditure on consumption;

Remittance characteristics = Duration of remittance receipt or type of destination;

Infrastructure = Time to reach nearest paved road, local market, and bank;

Institutional access = Time to reach the village office and village level meeting on drought or flood preparedness.

²² Since the sample in Baoshan County is composed of predominantly Han households, ethnicity is not included in the model as an independent variable.

²³ Short-duration remittance-recipient household is the reference category.

²⁴ Since most of the migrant workers in the Baoshan County study sample are based in destinations within the origin province (Yunnan), the regression model with type of destination as independent variable is not used.

²⁵ Short-distance remittance-recipient household is the reference category.

In these modified models, attributes of a household's specific sensitivity are disaggregated into two sub-categories: 'adopted before first episode of migration from a household' and 'adopted after first episode of migration from a household'. The latter sub-category is likely to be influenced by remittances. The year of first migration from a household and year in which a particular disaster response strategy or capacity was adopted by a household are recorded through the household survey. The year of first migration from a household could be identified from the migration history of individual migrant workers from the households, which is recorded in the 'migration schedule' (see Figure 6.2a and migration schedule in the Annex). The year of adoption of a specific response strategy or capacity is available from the 'household schedule' (see Figure 6.2b and household schedule in the Annex). If an indicator of sensitivity was adopted by a household prior to the first instance of migration for work from the same household, it is could not have been influenced by remittance (coded as 0). However, a strategy adopted after the first migration could have been influenced by access to remittances (coded as 1). For example, if a household raises height of the tube-well in response to flood prior to the migration of a household member then this strategy is not likely to have been influenced by access to remittances. On the other hand, if this measure is adopted after the first migration it is probable that access to remittance may have an effect on it.

Figure 6.2a: Migration history of an individual migrant worker during the last 30 years as recorded in migrant schedule.

Starting year	Ending year	Destination					Economic status		Financial cost
		City/ town/ village	Province	Country	Type	Stream	Activity	Occupation	

Source: Author.

To quantify the marginal effect of remittances a number of other independent variables need to be taken into account. Household characteristics have an important role in shaping the sensitivity of a household. The head of a household has an important role in resource allocation, planning and decision making within a household. The gender of the head of the household is a relevant independent variable since traditional social barriers limit women's

access to information, land, and other resources (Tenge et al. 2004). Education of the household head is strongly associated with economic wellbeing (Hunzai et al. 2011). This is represented by the literacy status of the household head. Social entitlement and endowment, which is facilitated by attributes such as ethnicity or caste, play a crucial role in the shaping capacities of a household. For example, the Scheduled Tribes and Scheduled Castes in India are eligible for affirmative action (e.g. access to education, social protection, and government employment).²⁶ Household size is a measure of the capacity for work (Aulong et al. 2012). The economic status of the household is represented by the average monthly per capita expenditure (MPCE) of the households, which comprises food and non-food expenditure. The institutional context – that can either facilitate or constrain – provides the setting within which individual adaptation decisions are taken (Vincent 2007). Research on vulnerability (e.g. Adger 2006) is increasingly recognising that institutions, governance, and management are important determinants of a system’s ability to reduce vulnerability. The time taken to reach the nearest paved road, local market, and bank are indicators of accessibility to infrastructure (Fafchamps and Shilpi 2013, Notenbaert et al. 2013). The time taken to reach the village administration office is an indicator of physical accessibility to government institutions. The village level meeting on drought or flood preparedness is a proxy for information exchange between the local institutions (both government and non-government) and households in the study area.

6.4 Findings

6.4.1 Exploring sensitivity of the remittance recipient and non-recipient households

Regression analysis for remittance-recipient and non-recipient households from the flood affected rural communities in Upper Assam appears in Table 6.3.1a. Remittance-recipient households are 30 percent less likely to earn an above-median income from crop-sales than non-recipient households (Pr=0.056). During the 12 months preceding the survey, one-fourth of remittance-recipient households (25.3 percent) and one-third of non-recipient households (34.0 percent) had reported to have earned an income by selling crops. Farming in the study area is subsistence in nature. During the aforementioned period, average crop income in a non-recipient and remittance-recipient household was USD 139.33 and USD 138.08

²⁶ For further information on the Scheduled Tribes and Scheduled Castes refer to <http://tribal.nic.in/Content/DefinitionpRfiles.aspx>

Figure 6.2b: Flood responses adopted by a household between two flood events as recorded in household schedule.

28.1 During the last 30 years, which of the following things did your household adopt in between the two flood events to deal with their impacts? [<i>“adopted”</i>] [<i>More than one option possible.</i>]		
28.2 In which year, was the practice mentioned in [<i>question 28.1</i>] first adopted by your household? [<i>“year of adoption”</i>] [<i>If the respondent is unable to recall the exact year, please, request him/her to approximate. Put ‘-4’ if used for generations.</i>]		
	Adopted	Year of adoption
Raised plinth of the house		
Raised plinth of the granary		
Raised plinth of the cattle-shed		
Raised height of the wall surrounding the well or height of tube-well		
Raised plinth of the latrine		
Built a raised platform to keep cattle during flood		
Adopted (1)	Not adopted (2)	

Source: Author.

respectively. Among non-recipient households, cash crops accounted for nine-tenths of the crop income (90.9 percent). While a little less than three-quarters of the crop income in remittance-recipient households was contributed by cash crops (71.8 percent). Remittance-recipient households are more likely to have a higher income diversification index than non-recipient households (Pr=0.000). This indicates that remittance-recipient households depend on fewer income sources, and a probable indication of growing dependence of these households on remittances. Over two-fifths of remittance-recipient households (42.9 percent) had identified remittances to be their major source of income during the 12 months preceding the survey. Moreover, remittance-recipient households have access to fewer non-farm income sources in the origin village and its surroundings than non-recipient households (Pr=0.041). Non-recipient households had better access to non-farm wage labour, salaried employment, and small business in the locality (see chapter 5, p. 73 & 74). It is possible that remittances provide recipient households with an access to non-farm income, to which, otherwise, they have a limited access in origin communities.

Regression analysis for remittance-recipient and non-recipient households from the drought affected rural communities of Baoshan County appears in Table 6.3b. Remittance-recipient households are 40 percent less likely to earn an above-median income from crop-sales than non-recipient households (Pr=0.022). During the 12 months preceding the survey, an income from selling crops had been reported by over one-third of remittance-recipient households (39.3 percent) and nearly half of non-recipient households (46.5 percent). During this period, average crop income in a non-recipient and remittance-recipient household was USD 2651.95

and USD 808.67 respectively. Unlike Upper Assam, the farming in Baoshan County has been commercialised. The income from cash crops is the major contributor to the income from crop sale. On an average, non-remittance households had earned USD 3573.48 from selling cash crops. The average income from cash crop sale among remittance-recipient households was about one-third of that of non-recipient households (USD 1275.95).

Like Upper Assam, remittance-recipient households in Baoshan County are more likely to have a high income diversification index than non-recipient households ($Pr=0.000$). Over half of remittance-recipient households (58.7 percent) had identified remittances to be their major source of income during the 12 months preceding the survey. Other major income sources of remittance-recipient households include selling of crops and non-farm salaried employment in the locality. While crop sale, non-farm salaried employment or daily wage in the locality, herb sales, and sale of livestock and livestock products are common income sources of non-recipient households. Non-recipient households are likely to have better access to more non-farm income sources in the origin village or nearby areas than remittance-recipient households ($Pr=0.041$). Non-farm daily wage and salaried employment in the locality were reported as a source of income by 29.6 percent and 40.2 percent of non-recipient households, respectively. About 15.5 percent of non-recipient households had reported an income from pension. Among remittance-recipient households, incomes from non-farm daily wage and salaried employment were reported by 13.8 percent and 21.0 percent, respectively. It is possible that access to non-farm income through the migrant family member means that remittance-recipient households do not feel the necessity or have requisite labour to further diversify the non-farm income base. The size of a rain-fed farm in remittance-recipient households is smaller than that in non-recipient households ($Pr=0.000$). On an average, the size of rain-fed farm in non-recipient households (0.38 hectare) is more than double the size of rain-fed farm in remittance-recipient households (0.15 hectare).

During the rainy season, piped water inside the house was primary source of drinking for most households (85.6 percent). However, there is a decline in the dependence on piped water inside the house during the dry season. Only two-thirds of the households (67.1 percent) had identified piped water inside the house as primary source of drinking water during the dry season. Another one-tenths of households (13.8 percent) were dependent on open water sources (e.g. river, stream, and springs) for drinking water. The dependence on dug well (included protected and unprotected types) doubled from 5.6 percent of the

households during the rainy season to 10.2 percent during the dry season. Besides, there is an increase in time taken to collect drinking water from rainy to dry season. A member of a remittance-recipient household is likely to need less time to collect drinking water needed for the household's consumption for a normal day than the member of a non-recipient household (Pr=0.098). Despite the increase in time to collect water during the dry season, storing of drinking water and purification of drinking water (e.g. filter, or boil) are not common response strategies. Only one-third of the households had stored drinking water during the drought. Less than a tenth of households had purified drinking water prior to consumption during drought. Remittance-recipient households are more likely to purify water prior to consumption during drought (Pr=0.071). Previous research (Black et al. 2011a; Hugo et al. 2012) had suggested that a major share of remittances is used to procure food. Remittance-recipient households in Baoshan County are 50 percent less likely to depend on less preferred food during drought than non-recipient households (Pr=0.063).

6.4.2 Characterising sensitivity of remittance-recipient households

The characterisation of sensitivity among remittance-recipient households suggests that the duration for which remittances is received by a household is an important determinant of household level sensitivity to drought and floods (Tables 6.3.2a and 6.3.2b). There is a positive association between duration for which a household has received remittances and non-farm income diversification index in Upper Assam (Pr=0.076). Long-duration households had access to fewer non-farm income sources in the locality. While short-duration households had better access to non-farm daily wage labour and salaried employment in locality than long-duration households, the latter had a marginally better access to small businesses. The quality of housing stock has an effect on a household's sensitivity to rapid onset hazards. Low quality housing would imply higher likelihood of damage to the dwelling by flood water, which will reduce the possibility of using the dwelling as a shelter not only during the flood; but also in its aftermath.

Table 6.3.1a: Effects of remittances on household level sensitivity to floods in Upper Assam, the Eastern Brahmaputra sub-basin.

		Remittance- recipient households	Non- recipient households	Adjusted odds ratio (Beta coefficient)
Environmental dependence	% of households whose income from crop sales was above median value	38.2	45.0	0.7 (-0.3709*)
	Crop diversification index	0.34	0.35	-0.015
	Income diversification index	0.30	0.27	0.036***
	Non-farm income diversification index	0.41	0.39	0.026**
	% of households that had experienced a reduction in agricultural assets due to flood	40.4	39.8	1.0 (0.033)
	% of households that had exterior walls made of weak primary construction material	77.2	73.8	1.1 (0.129)
	% of households that are dependent on environmental resources for primary source of cooking fuel	88.4	89.6	0.7 (-0.278)
Water	Average time to collect drinking water for a normal day (minutes)	30.8	26.6	3.512**
	% of households that did not store drinking water for consumption during flood	64.9	64.2	1.0 (0.032)
	% of households that did not filter or boil drinking water for consumption during flood	30.5	29.9	1.0 (0.048)
	% of households that did not raise the wall of the well or height of the tube-well in response to flood	58.3	58.9	0.9 (-0.095)
Food	% of households that relied of less preferred food during flood	35.9	38.0	0.9 (-0.070)
	% of households that had restricted consumption of adults during flood	68.7	66.7	1.0 (0.053)
	% of households that collected wild food during flood	34.7	29.0	1.3 (0.259)
	% of households that did not use savings to buy food during flood	54.4	56.1	0.9 (-0.081)
	% of households that begged for food during flood	38.6	34.3	1.1 (0.104)
Health	% of households that had reduced health expenditure due to flood	20.5	19.0	1.1 (0.098)
Well being	% of households that had reduced educational expenditure due to flood	18.9	15.9	1.3 (0.233)
	% of households that had reduced clothes expenditure due to flood	36.3	31.1	1.3 (0.281)
	% of households that had sold or mortgaged household assets due to flood	45.2	44.2	1.0 (-0.011)

Legend: * p<.1; ** p<.05; *** p<.01. Note: Models were adjusted for household head's gender, ethnicity, and literacy; household size; adjusted total expenditure; time to reach nearest paved road, local market, bank or Panchayat office; and village level meetings on flood preparedness. Source: Computed by author from HICAP Migration Dataset.

Table 6.3.1b: Effects of remittances on household level sensitivity to drought in Baoshan county, Yunnan, the Upper Mekong-Salween sub-basins.

		Remittance-recipient households	Non-recipient households	Adjusted Odds ratio (Beta coefficient)
Environmental dependence	% of households whose income from crop sales was above median value	52.0	64.4	0.6 (-0.464**)
	Crop diversification index	0.31	0.27	-0.034
	Income diversification index	0.44	0.32	0.101***
	Non-farm income diversification index	0.71	0.54	0.161***
	% of households that had experienced a reduction in agricultural assets due to drought	4.0	4.2	0.238
	Rain-fed farm diversification index	0.88	0.81	0.059***
	% of households that are dependent on environmental resources for primary source of cooking fuel	52.8	49.6	1.3 (0.231)
Water	Average time to collect drinking water for a normal day (minutes)	6.5	9.7	-2.973*
	% of households that did not store drinking water for consumption during drought	71.7	71.5	1.0 (-0.015)
	% of households that did not filter or boil drinking water for consumption during drought	91.1	95.3	0.5 (-0.643*)
	% of households dependent on unprotected or open water sources	25.9	23.3	1.3 (0.241)
Well being	% of households that had reduced clothes expenditure due to drought	18.6	18.1	1.1 (0.121)
	% of households that relied of less preferred food during drought	6.1	10.0	0.5 (-0.628*)

Legend: * p<.1; ** p<.05; *** p<.01.

Note: Models were adjusted for household head's gender and literacy; household size; adjusted total expenditure; time to reach nearest paved road, local market, bank or village office; and village level meetings on drought preparedness.

Source: Computed by author from HICAP Migration Dataset.

Long-duration households in Upper Assam are 40 percent less likely to have used weak primary construction material to build exterior walls of dwelling than short-duration households (Pr=0.094). Most of remittance-recipient households in Upper Assam identified environmental resources such firewood as primary source of cooking fuel (88.6 percent). Only one-tenth of remittance-recipient households had access to LPG cylinders. Among these households, long-duration households are 50 percent less likely to depend on environmental resources for cooking fuel (Pr=0.089). Though it is still a small share of remittance-recipient households, 14 percent of long-duration households had reported LPG cylinders as primary source of cooking fuel, compared to 7.1 percent of short-duration households.

In Upper Assam, it is rare for a rural household to have a piped water supply in the dwelling. Over three-fourths of remittance-recipient households depend on the tube-well, and another one-fifth households had reported protected dug-well to be their primary source of drinking water. During monsoon season, outbreaks of water-borne disease are common since water in tube-wells and unprotected dug-wells is contaminated by flood water. One response strategy is raising the height of tube-well or height of wall surrounding a well. Long-duration households in Upper Assam are more likely to raise the height of the wall surrounding the well or height of the tube-well than short-duration households (Pr=0.001). Findings from the FGDs suggest that food shortage, consumption of less preferred food items, and restrictions on food consumption among adults are common during flood inundation and its immediate aftermath. These are a consequence of several factors such as decline in the production of main staple crop ('paddy') due to recurrent floods, inability to access local market during flood inundation, an increase in the price of food items due to flood induced supply disruption (e.g. large areas of Dhemaji district is isolated because of flood inundation), and shortage of firewood during flood inundation. In terms of access to food, regression analysis indicates that short-duration households fare better than long-duration households. Long-duration households are two times more likely to rely on less preferred food during flood than short-duration households (Pr=0.085). Former is also twice as likely to restrict adult food consumption during flood as latter (Pr=0.027). The adverse effect of flood on household well-being could be manifested in the mortgaging or selling of household assets. In response to flood impacts, long-duration households are twice more likely to mortgage or sell household assets (e.g. jewellery, livestock) than short-duration households (Pr=0.021).

The characterisation of sensitivity among the remittance-recipient households in the Baoshan County appears in Table 6.3.2b. Households that have been receiving remittances over a long duration are more likely to fewer income sources than short-duration households (Pr=0.022). Over half of long-duration households (59.3 percent) had identified remittances to be their major source of household income. In contrast, only one-third of short-duration households (33.1 percent) had identified remittances to be the major source of household income. Among long-duration households, one-third had reported an income from crop sale (36.5 percent). Other income sources (e.g. salaried employment from non-farm sources, and livestock and livestock sale) had been reported by less than one-fifth of long-duration households. On the other hand, half of short-duration households had reported crop sale, one-third of these

households had access to salaried income from non-farm sources, and one-fifth had been engaged in herb sale. Long-duration households in Baoshan County are likely to have smaller rain-fed farms than short-duration households ($Pr=0.097$). On an average, long-duration households had 0.14 hectares of rain-fed farm compared to 0.23 hectares among short-duration household. Over half of the migrant workers from remittance-recipient households surveyed had formal schooling up to secondary school (53.8 percent). Most of these migrant workers had started to migrate at a relatively young age. Mean age at first migration is 23.9 years. These migrant workers had a short association with the household's agricultural activities. Most of these migrant workers were employed in the non-farm sector in the destination. Longer these migrant workers remain a part of the non-farm workforce, it may further weaken their association, and that of their household, with agricultural activities and allocated land. Over half of remittance-recipient households depended on environmental resources (e.g. firewood) for cooking fuel (52.0 percent), and another two-fifths used electricity (39.7 percent). Long-duration households are 40 percent less likely to depend on environmental resources for cooking fuel ($Pr=0.088$). In comparison to nearly three-fifths of short-duration households (57.3 percent), less than half of the long-duration households (46.9 percent) were dependent on environmental resources for cooking fuel. The inputs from the FGD participants suggest that households that are located in villages far away from the city are likely to use firewood for cooking. The use of electricity for cooking increases with proximity to a city. Unlike in Upper Assam where tube-wells and protected dug-wells are major sources of drinking water, nearly nine-tenths of remittance-recipient households (85.4 percent) had reported piped water supply in the house as their primary drinking water source during the rainy season. However, this decreased to two-thirds (67.2 percent) during the dry season. During dry season, percentage of households that depend on open water sources rises from 3.6 percent during rainy season to 14.2 percent, and there is a marginal increase in dependency on unprotected and protected wells. However, storage of drinking water for consumption during drought is not a common strategy. Only one-third of remittance-recipient households (29.8 percent) had stored water for consumption during drought. Long-duration households are 80 percent less likely not to store drinking water for consumption during drought than short-duration households ($Pr=0.064$). At the same time, long duration households are twice more likely to depend on open or unprotected water sources than short-duration households ($Pr=0.012$).

Table 6.3.2a: Effects of duration of remittance receipt on sensitivity to floods among remittance-recipient households in Upper Assam, the Eastern Brahmaputra sub-basin, India.

		Short-duration household	Long-duration household	Adjusted odds ratio (Beta coefficient)
Environmental dependence	% of households whose income from crop sales was above median value	59.3	62.4	0.7 (-0.305)
	Crop diversification index	0.3	0.4	-0.034
	Income diversification index	0.28	0.30	0.018
	Non-farm income diversification index	0.39	0.42	0.033*
	% of households that had experienced a reduction in agricultural assets due to flood	21.2	33.3	1.4 (0.313)
	% of households that had exterior walls made of weak primary construction material	82.1	69.1	0.6 (-0.509*)
	% of households that are dependent on environmental resources for primary source of cooking fuel	92.9	84.6	0.5 (-0.738*)
Water	Average time to collect drinking water for a normal day (minutes)	30.9	30.0	-0.191
	% of households that did not store drinking water for consumption during flood	95.0	96.3	0.6 (-0.451)
	% of households that did not filter or boil drinking water for consumption during flood	91.4	86.8	1.8 (0.580)
	% of households that did not raise the wall of the well or height of the tube-well in response to flood	89.3	75.5	0.3 (-1.179***)
Food	% of households that relied of less preferred food during flood	2.99	8.1	2.9 (1.071*)
	% of households that had restricted consumption of adults during flood	7.9	16.9	2.5 (0.913**)
	% of households that collected wild food during flood	2.9	0.7	0.2 (-1.350)
	% of households that did not use savings to buy food during flood	94.3	85.3	0.4 (-0.885*)
Health	% of households that had reduced health expenditure due to flood	1.4	4.4	2.7 (0.992)
Well being	% of households that had reduced educational expenditure due to flood	2.9	2.2	0.5 (-0.664)
	% of households that had reduced clothes expenditure due to flood	5.0	6.6	1.5 (0.422)
	% of households that had sold or mortgaged household assets due to flood	7.1	14.0	2.8 (1.023**)

Legend: * p<.1; ** p<.05; *** p<.01. Note: Models were adjusted for household head's gender, ethnicity, and literacy; household size; adjusted total expenditure; time to reach nearest paved road, local market, bank or Panchayat office; and village level meetings on flood preparedness. Source: Computed by author from HICAP Migration Dataset

The characterisation of sensitivity among remittance-recipient households in Upper Assam on basis of distance to destination (i.e. long-distance and short-distance) appears in Table 6.3.2c. The choice of destination reflects the broader social, cultural and environmental contexts within which individual decisions are shaped by the family, the community, and wider social network (Findlay 2011). Given the financial cost incurred during migration, the choice of destination also indicates the financial capacity of the sending household. A household would send a migrant worker to a distant destination if it could afford the financial costs, access travel or work permits, access employment opportunities, and/or have a social network. Davies (2007) suggests that covariate shocks such as floods or livestock diseases, which affect the entire village, needs to be insured further afield (e.g. a household member living abroad or in a large city). Long-distance migration from Upper Assam is primarily driven by social network. Many of these migrant workers are based in urban centres of south, west, and north India.

Table 6.3.2b: Effects of duration of remittance receipt on sensitivity to drought among remittance-recipient households in Baoshan county, Yunnan, the Upper Mekong-Salween sub-basins.

		Short-duration household	Long-duration household	Adjusted odds ratio (Beta coefficient)
Environmental dependence	% of households whose income from crop sales was above median value	55.8	62.5	0.8 (-0.177)
	Crop diversification index	0.29	0.32	-0.002
	Income diversification index	0.38	0.44	0.051**
	Non-farm income diversification index	0.65	0.70	0.037
	Rain-fed farm diversification index	0.85	0.89	0.027*
	% of households that are dependent on environmental resources for primary source of cooking fuel	57.3	46.9	0.6 (-0.436*)
Water	Average time to collect drinking water for a normal day (minutes)	6.2	6.0	0.023
	% of households that did not store drinking water for consumption during drought	60.6	79.4	0.2 (-1.653*)
	% of households dependent on unprotected or open water sources	18.5	30.3	2.2 (0.780**)
Well being	% of households that had reduced clothes expenditure due to drought	70.3	76.5	1.1 (0.134)

Legend: * p<.1; ** p<.05; *** p<.01. Note: Models were adjusted for household head's gender, ethnicity, and literacy; household size; adjusted total expenditure; time to reach nearest paved road, local market, bank or Panchayat office; and village level meetings on flood preparedness. Source: Computed by author from HICAP Migration Dataset

Table 6.3.2c: Effects of distance to destination on sensitivity to floods among remittance-recipient households in Upper Assam, the Eastern Brahmaputra sub-basin.

		Short-distance household	Long-distance household	Adjusted odds ratio (Beta coefficient)
Environmental dependence	% of households whose income from crop sales was above median value	33.7	44.5	1.7 (0.536)
	Crop diversification index	0.37	0.33	-0.129***
	Income diversification index	0.33	0.26	-0.060***
	Non-farm income diversification index	0.44	0.38	-0.051***
	% of households that had experienced a reduction in agricultural assets due to flood	44.4	17.4	0.1 (-2.573***)
	% of households that had exterior walls made of weak primary construction material	75.0	75.7	0.78 (-0.249)
	% of households that are dependent on environmental resources for primary source of cooking fuel	86.8	90.8	1.1 (0.064)
Water	Average time to collect drinking water for a normal day (minutes)	30.2	29.3	-1.549
	% of households that did not store drinking water for consumption during flood	94.1	97.4	0.5 (-0.674)
	% of households that did not filter or boil drinking water for consumption during flood	84.6	94.1	0.3 (-1.145***)
	% of households that did not raise the wall of the well or height of the tube-well in response to flood	76.5	87.5	2.3 (0.830**)
Food	% of households that relied of less preferred food during flood	8.8	2.0	0.2 (-1.471**)
	% of households that had restricted consumption of adults during flood	14.7	9.2	0.7 (-0.309)
	% of households that collected wild food during flood	2.2	1.3	0.4 (-0.903)
	% of households that did not use savings to buy food during flood	84.6	95.4	3.3 (1.195**)
	% of households that begged for food during flood	3.7	2.0	0.6 (-0.450)
Health	% of households that had reduced health expenditure due to flood	3.7	2.0	0.4 (-0.936)
Well being	% of households that had reduced educational expenditure due to flood	3.7	1.3	0.4 (-0.983)
	% of households that had reduced clothes expenditure due to flood	7.3	3.9	0.4 (-0.966)
	% of households that had sold or mortgaged household assets due to flood	14.0	7.2	0.4 (-0.847**)

Legend: * p<.1; ** p<.05; *** p<.01. Note: Models were adjusted for household head's gender, ethnicity, and literacy; household size; adjusted total expenditure; time to reach nearest paved road, local market, bank or Panchayat office; and village level meetings on flood preparedness. Source: Computed by author from HICAP Migration Dataset

Regression analysis suggests that long-distance households are likely to grow more types of crops than short-distance households (Pr=0.000). On an average, short-distance households grew 2.2 crops compared to 2.7 crops reported by long-distance households during the 12 months preceding the survey. This could be partly explained by the fact that average farm size among short-distance households (0.6 hectare) is less than that among long-distance households (1.0 hectare). Long-distance households are likely to have more income sources than short-distance households (Pr=0.000). On an average, short-distance households had 2.5 income sources compared to 3.1 sources among long-distance households. Moreover, long-distance households are likely to have more sources of non-farm income than short-distance households (Pr=0.007). Among long-distance households, income from non-farm daily wage and salaried employment in the origin village or its surrounding were reported by 45.4 percent and 13.8 percent, respectively. Around 34.9 percent of long-distance households had an income from small business or trade. Non-farm daily wage and salaried employment were reported as an income source by 41.9 percent and 10.3 percent of short-distance households, respectively. In addition, 28.7 percent of short-distance households had reported an income from small business or trade. Generally, long-distance households seem to have better access to resources and are better able to manage flood risks. Long-distance households are 90 percent less likely to undergo a reduction in agricultural assets due to flood than short-distance households (Pr=0.002). Former is 60 percent less likely to sale or mortgage household assets due to flood (Pr=0.010). Though long-distance households are twice more likely not to raise the wall surrounding the well or height of the tube-well than short-distance households (Pr=0.010), former is more likely to filter or boil drinking water for consumption during flood than short-distance households (Pr=0.010). Long-distance households are 80 percent less likely to have relied on less preferred food during flood than short-distance households (Pr=0.010). This could be explained by access to larger farm and crop diversification among long-distance households compared to short-distance households.

6.5 Discussion

The extent to which resource-users will be sensitive to climate change will be determined by their dependence on climate-sensitive natural resource (Marshall et al. 2014). The sensitivity of households to climate hazards and volatility of crop prices would increase if these households are largely dependent on crop income (Adger 1999). Findings from Upper Assam and Baoshan County suggest that remittance-recipient households are less likely to depend on

crop income. Remittance-recipient households in Baoshan County have smaller rain-fed farms than non-recipient households.²⁷ This lack of dependency on environmental resources among remittance-recipient households reduces their sensitivity to impacts of climate hazards such as drought or floods. When a household derives income from multiple sectors it is likely to be less sensitive to resource impacts from climate change (Bailey and Pomeroy 1996). Income diversification is an effective strategy to spread risk, manage seasonality, and increase flexibility (Li et al. 2008). Rural livelihoods, which are predominantly dependent on agriculture, pastoralism, or forestry, are highly sensitive to climate variability and change (Leary et al. 2008 as cited in Maiti et al. 2015). Therefore, a diversification from farm to non-farm activities could reduce sensitivity to climate hazards (Hassan and Nhemachena 2008). Most of the migrant workers from the study area in Upper Assam and Baoshan County are based in urban destinations and employed in non-farm sector (e.g. manufacturing, construction, and services). Though access to remittances from these 'ex-situ' household members helps their households in origin communities to spread risks from extreme events, but findings also indicate a growing dependency on remittances. Remittance-recipient households derive their income from fewer sources than non-recipient households. Former households earn an income from fewer non-farm sources.

On one hand, the remittance-recipient household manifest a reduction in dependency in environmental resources. On the other, there is a rising remittance dependency that increases risk from non-environmental shocks and stresses. For example, most of the migrant workers from Upper Assam are wage employees in informal sector. These workers are at risk of a market downturn or social tensions. Due to the global financial crisis of 2008, the export-oriented sectors, domestic-oriented industries, and labour intensive services in India witnessed a sharp rise in unemployment (Ghosh 2009). The labour intensive services are a source of cheap and flexible external labour for the corporate sector, and many among the unemployed were migrant workers with short casual contracts (Ghosh 2009). Once the migrant workers were laid-off, they had become dependent of their households (Ghosh 2009). Chan (2010) reports about the widespread closure of factories in China during the global financial crisis. Migrant workers account for almost all of the factory-floor workers. This group was hit the hardest by the lay-offs, which came without any warning and full payment of wages in many factories. Chan (2010, p. 667) estimates total unemployment rate among

²⁷ The farming in Upper Assam is predominantly rain-fed.

rural migrant workers to be 16.4 percent in early 2009 compared to 1-2 percent in previous years. In 2012, several thousands of migrants from India's northeastern states, particularly Assam, living in the southern cities of Bangalore, Chennai, and Pune had fled home; many of them were students and migrant workers. This return was associated with rumours of revenge attack for clashes between indigenous Bodo tribes and Muslims in Assam. The rumours had been spread through text messages and social media.²⁸

The IPCC AR5's WG II report has high confidence that 'major impacts of climate change in rural areas will be felt through impacts on water supply [and] food security' (IPCC 2014a, p. 3).²⁸ The rural households in Upper Assam are primarily dependent on tube-wells or protected dug wells for drinking water. Remittance-recipient households in Upper Assam take longer to collect drinking water than non-recipient households. The lack of water storage facilities and lack of access to safe drinking water increases the risk of water borne diseases during flood season among the local population in Upper Assam. A large number of rural households in Boashan County have access to piped water supply in their dwellings. Remittance-recipient households in Baoshan County take less time to collect drinking water than non-recipient households. Though access to piped water supply reduces the risk to a household's drinking water supply to some extent, these households are exposed to other risks due to their dependence on open water sources during dry season, lack of water storage facilities, and lack of access to safe drinking water. Ye et al. (2012) provides an overview of government led drought responses in China, which had experienced three severe droughts between January 2009 and April 2010. A state of emergency was declared for each of these disasters. With direct leadership from the senior levels in the central government, considerable resources were mobilised to relieve the drought impacts through local governments. First priority was given to temporary drinking water supply. China has a grain reserve system, which helps to stabilise market supply and grain prices in case of a reduction in grain yield due to natural disasters. Food prices were stabilised through the supply of grains, cooking oil, meat and vegetables to the local markets (Watts 2010, Ye et al. 2012). Due to the importance of basic food availability to overall food security, drought relief for agricultural production was organised and subsidised by the government. Non-farm income was facilitated by local governments for farmers who had experienced severe crop damage (Ye et al. 2012). This

²⁸ <http://www.bbc.com/news/world-asia-india-19292570>

study finds that remittance-recipient households in Baoshan County are less likely to rely on less preferred food during drought than non-recipient households.

The pattern of remittance use varies across the different stages in a migrant's life cycle. The life cycle and initial economic resources of the migrant influence the motives for savings (Osili 2005). Based on a study of Mexican migration to the United States, Massey et al. (1987) suggests that only after basic consumption needs of the families left behind are addressed from migrants' savings, migrant families channel their savings into investment such as the purchase of land, or buying a house or a small business. The duration for which a household had received remittances from the migrant worker is a proxy for the migration cycle, and it could provide a plausible explanation for sensitivity among remittance-recipient households in the study areas. Brooks (2003) considers housing quality to be an important indicator of a community's social vulnerability to extreme events. The chances of damages to housing stock, and in turn injury or death of people, would be higher if low quality housing stock is exposed to extreme events (Sharma and Patwardhan 2008). Present study observes that the housing quality is better among long-duration households than short-duration households in Upper Assam.

Over half of long-duration households in Baoshan County had reported a non-traditional fuel (mainly electricity) as the primary source of cooking fuel compared to the two-fifths of short-duration households. In contrast, most of the households in Upper Assam are still dependent on firewood. In comparison to 14.0 percent of long-duration households, 7.1 percent of short-duration households used LPG for cooking fuel. Rajan (2004) considers the use of non-traditional cooking fuels in Kerala as a manifestation of modern lifestyle. This study finds that long-duration households in Upper Assam and Baoshan are less likely to depend on environmental resources for cooking fuel. FGD participants reports that access to firewood is disrupted by climate hazards (e.g. drought and floods), and increases the time required to gather firewood. The scarcity of cooking fuel affects the type of food consumed, number of meals, and nutritional value of food. Since gender-based division of labour implies that cooking remains a major responsibility of rural women, a reduction in particle air pollution, which generally results from poor combustion of solid cooking fuel (e.g. firewood), will have positive effect on women's health. In Upper Assam, placing tube-wells and ring-wells above the flood water line is one of the strategies to prevent contamination of drinking water sources (Das et al. 2009). Present study finds that long-duration households are more likely to

raise the height of wall surrounding the well or height of the tube-well than short-duration households. A study in Baoshan County by Su et al. (2012) reports that one of the drought response strategies involve building small water storage tank, which is particularly useful during dry season. Long-duration households in this study area are more likely to store drinking water for consumption during drought than short-duration households. However, long-duration household are also more likely to depend on unprotected or open water source for drinking water.

IPCC's AR5 (2014) considers agricultural producers who are net food buyers as particularly vulnerable. In Baoshan County, long duration-households are likely to have smaller rain-fed farms than short-duration households. Farming is a risky proposition due to the vagaries of weather, price, and crop and animal diseases (Lucas 2015). This downsizing of rain-fed farm reduces sensitivity of a household's livelihood portfolio to drought. This also reflects growing connectivity of rural-urban market, and suggests growing dependence of rural households on the non-farm sector for income, and local market for food and other essentials. Although this would increase sensitivity of these households to non-environmental shocks and stresses. Fragmented landholdings, lack of irrigation facilities, lack of modern agricultural technologies, poor transport and communication system, and lack of institutional credit exacerbate the impacts of climate induced hazards in northeast India. These factors contribute to a decline in agricultural production (Das 2009). There will be direct impacts of climate change on food production systems, and indirect impacts on food security (Ravindranath et al. 2011). Long-duration households in Upper Assam are more likely to rely on less preferred food and restricted food consumption among adult household members during and in the aftermath of a flood compared to short-duration households. During the initial stages of a migrant's life cycle, remittance-recipient households are likely to use remittances to address basic consumption needs (including food). Also, these households are likely to be comparatively more engaged in agriculture (or food production system) than households whose migrants' are at a later stage in the migration cycle. The remittance dependence progressively increases with the length of migration. Hence, it is not surprising that short-duration households depend less on less preferred food. Since these households have better access to food-production system, which is primarily subsistence in nature, they will have a better access to staple food items (i.e. rice). This is supplemented by their use of remittances to address basic consumption needs (including food). In comparison, long-

duration households are likely to be more dependent on non-production elements of food security (particularly local market). Findings from the FGDs suggest that floods disrupt physical access to local market, create shortage of staple food items, and contribute to food price inflation. Only one-fifth of remittance-recipient households had adopted food storage as a strategy to address flood impact. Therefore, a household that is dependent on local market to procure staple food items may have to rely less preferred food.

6.6 Chapter conclusion

This chapter explores effects of remittances on household level sensitivity to droughts in Baoshan County and floods in Upper Assam. A household's sensitivity and capacity to respond are determined by household characteristics, socio-economic conditions, local infrastructure, institutions, and political context. The interrelationship between remittances and sensitivity of a household to extreme weather events is complex. The effects of remittances vary across different attributes of sensitivity. On one hand, remittance-recipient households are less sensitive to extreme weather events due to lower dependency on crop income, smaller farm size, and access to an ex-situ income from non-farm sector. Since the study areas experience extreme weather events on a regular basis, a reduction in sensitivity of a household should contribute towards a reduction of vulnerability. However, these benefits for remittance-recipient households cannot be seen in isolation. There is a progressive increase in remittance dependency among remittance-recipient households across the migrant's lifecycle, and a consequent reduction in income and non-farm diversifications. This leads to an increase in a remittance-recipient household's sensitivity to non-environmental shocks and stresses. A sudden disruption of remittance supply could have disastrous consequences for the households' economic and social life. Furthermore, the stage in the migration cycle is an important determinant of sensitivity among remittance-recipient households. Overall, long-duration households are better able to manage sensitivity to extreme weather events than short-duration households. The former are likely to have better housing, be less dependent on environmental resources for cooking fuel, have better access to safe water, and hold smaller rain-fed farms. Also, certain effects of remittances on attributes of sensitivity are context specific. For example, the association between remittances and water storage is significant among remittance-recipient households in Baoshan County; but not in Upper Assam. The vulnerability of a household to extreme weather events is

determined by its sensitivity to the stress and capacity to adapt. The next chapter will examine the effects of remittances on household level adaptive capacity in the study areas.

Chapter 7: Effects of Remittances on Adaptive Capacity to Extreme Weather Events

7.1 Introduction

The sensitivity of remittance-recipient and non-recipient households to the drought in Baoshan County and floods in Upper Assam was explored in chapter 6; this chapter seeks to explore the effects of remittances on household level adaptive capacity in the study areas. The objectives of this chapter are to characterise household level adaptive capacity in the context of a specific extreme event and ascertain the extent to which the migrant outcomes improved adaptive capacity of remittance-recipient households. This chapter is organised as follows. The next section explores the conceptual framework, which is followed by an overview of research methodology. Then findings on the effects of remittances on household level adaptive capacity are presented. This is followed by a characterisation of adaptive capacity of remittance-recipient households in context of duration of remittance receipt and distance to destination. I finish this chapter with a discussion of the implications of these findings.

7.2 Conceptual framework

A key component of adaptation is the development of the capacity of individuals, households, communities, groups, sectors, or institutions to adapt to climate change and variability. The IPCC AR5 defines adaptive capacity as ‘the ability to adjust, to take advantage of opportunities, or to cope with consequences’ (IPCC 2014b, p. 21).’ Based on the adaptive capacity literature (e.g. Vincent 2007, Sharma and Patwardhan 2008, Eakin et al. 2011, Aulong et al. 2012, Gerlitz et al. 2016), and the Sustainable Livelihoods Approach (SLA), I conceptualise household level adaptive capacity to be comprised of five sub-dimensions: Natural assets, financial assets, social assets, human assets, and physical assets. Bebbington (1999) argues that a household can build adaptive capacity by expanding its asset base, including the tangible resources used to maintain livelihoods (such as natural capital and productive resources) and capabilities to do so (including social and human capital). An overview of these sub-dimensions, attributes, and indicators of adaptive capacity in Upper Assam and Baoshan County appear in Table 7.1a and 7.1b, respectively. These indicators of adaptive capacity were identified in the same way as the indicators of sensitivity (see chapter 6, p. 93).

7.2.1 Natural assets

Access to agricultural land and livestock are important components of a rural household's adaptive capacity (Eakin et al. 2011, Aulong et al. 2012), and represent an accumulation of wealth (Vincent 2007). Thornton et al. (as cited in Nair et al. 2013, p.11) suggests that livestock can be considered as a savings measure, which can be sold by the farmers for cash in case of a crop failure due to disaster. The 'farm size diversification index' and 'livestock diversification index' are selected as attributes of a household's natural assets. Previous research (Hassan and Nhemachena 2008, Below et al. 2012) suggests that households modify agricultural practices to address impacts of environmental stressors. For example, modification in farming practices due to floods in Upper Assam includes changes in farming calendar, growing of flood resistant variety of paddy, emphasis on vegetable farming, and reduction in the area under paddy crop. Major impacts of the drought in the Baoshan County are associated with the agricultural sector. The changes in farming practice due to drought includes adoption of improved farming techniques (e.g. use of a greenhouse and use of plastic sheet to reduce moisture loss), an increase in land area under less water intensive crops (e.g. bamboo, walnut, herbal medicine, and fodder), a reduction in land area under water intensive crops (e.g. paddy), or changes in farming calendar. The changes in livestock rearing practices in both study areas involve reduction in the number of cattle, ducks or poultry. Other attributes of this sub-dimension include 'changes in farming practices' and 'changes in livestock rearing practices'.

7.2.2 Financial assets

Thomalla et al. (2006) identifies those with inadequate access to economic assets (credit, welfare) as among the most vulnerable to natural hazards. It is suggested that repeated or catastrophic risks could be managed if households have sufficient savings (Holzmann and Jorgensen 2001). Access to formal financial institution is considered to be an attribute of financial assets in Upper Assam. Since access to a savings bank account is ubiquitous in Baoshan County due to government supported financial inclusion programme, this is not included in the financial asset sub-dimension. Vincent (2007) considers the investment in insurance to protect assets from climate risk as a manifestation of adaptive capacity. Public and private institutions provide various products to insure life, health, crop, or livestock. The investment in insurance to manage risks to life indicates generic adaptive capacity. Only one-third of households surveyed in Upper Assam have a life insurance. None of the households

in the study sample in Upper Assam have a crop or livestock insurance. Hence, 'access to insurance' is identified as an attribute of financial asset in Upper Assam. In contrast, life and health insurances are common in Baoshan County. Hence, access to insurance in Baoshan County is represented by availability of a crop or livestock insurance, which would indicate specific capacity to address drought impacts.

7.2.3 Social assets

Social relationships continually reshape the adaptive capacity of social systems to climate change (Pelling and High 2005) and social capital is one of the resources required to implement adaptation strategies (Brooks et al. 2005). A household that receives assistance from multiple sources (e.g. social network, community based organisations, government institutions, and NGOs) during the floods is likely to have a robust social network. Furthermore, networks are exclusive in nature, and their members have a shared identity. The terms of trade for a network member are likely to be different (possibly better) than those for an outsider. Even in a modern bank, where exchanges should be anonymous in an ideal scenario, reputation or credit rating of the borrower is an important consideration (Dasgupta 2001). Therefore, sources from which a household has borrowed money during flood (e.g. borrowed money from relatives/friends, cooperative/ village fund, or other financial service provider) manifest the capacity of risk pooling within a household's network. Different social actors seldom have same access to a community level participatory process. There is always a possibility that the decision-making process and outcome may be disproportionately influenced by the elite or special interest groups (Bloomfield et al. 2001, Hillier 2003). Therefore, the extent of a household's involvement in the collective action on disaster relief, recovery, or preparedness is a proxy of social cohesion. For example, FGD participants report that collective action in Upper Assam involves setting up of relief camp, repairing local infrastructure, erecting a barrier to slow the speed of flood water, and constructing a raised platform to keep cattle during flood inundation. The sub-dimension on social assets in Upper Assam is comprised of three flood related attributes namely access to flood assistance, access to financial borrowing during floods, and participation in collective action on flood relief, recovery, and preparedness. Access to drought assistance and access to financial borrowing are identified as attributes of social assets in Baoshan County. Findings from the FGDs suggest that in some villages community members have collectively instituted an arrangement on water sharing and use in response to drought. Participation in collective

action on water sharing is the third attribute of social assets sub-dimension in Baoshan County.

7.2.4 Human assets

People would be less vulnerable to hazards, and may even be able to avoid a disaster, if they have better access to information, cash, rights to the means of production, tools and equipments, and social networks (Wisner et al. 2004). ‘The mass media plays a major role in raising disaster awareness (Smith 2013, p. 26).’ Possession of communication devices (e.g. mobile phone, radio, and television) is a proxy for access to information. It indicates the ability of a household to gather information from beyond the geographical limit of the village. Access to communication devices such as radio and television manifests that the household has expanded its capacity to gather information beyond its social network. These communication devices could be a crucial conduit of information between the affected households and local administration during an extreme event. Other attributes of this sub-dimension are ‘access to alternative local livelihood opportunity’ and ‘access to alternative livelihood opportunity in a nearby locality’. A household member who seeks work within the origin community or a non-working household member who starts to work due to a drought or flood indicate availability of requisite skill or labour in a household to pursue alternative livelihoods opportunities in response to the impacts of extreme weather events. In addition, presence of a household member who commutes to work either for business or occupation in a different town or village indicates the availability of requisite skill or labour in a household to pursue an alternative livelihoods opportunity within a wider catchment.

7.2.5 Physical assets

Making structural changes in a house to address flood impacts is a common practice in the flood affected rural communities in Assam (Hazarika 2006, Das et al. 2009). Indicators of structural changes to a dwelling include elevating plinth of the house, toilet, and cattleshed. The structural changes in dwelling are not a response to drought in Baoshan County. Instead many households in Baoshan County rely on water from irrigation channels supplied by reservoirs and natural spring waters for the daily water and agricultural production needs. People continue to benefit from the large and small irrigation facilities constructed during the commune period. The impacts of water shortage on households that are upstream or closer to these irrigation channels are less than others (Su et al. 2009). Different types of irrigation

include water tank, water pump, and irrigation channel. The term ‘mechanisation’ is generally used as an overall description of the application of tools, implements and powered machinery to enhance agricultural production and productivity and reduce drudgery (Clarke 2000). The TERI (2011) report notes a gradual shift towards the *Rabi* crops, i.e. crops sown in winter and harvested in spring. This shift in cropping pattern was one of the ways devised by the local farmers to avoid the flood risk to the *Kharif* or monsoon crops. The FGD findings suggest that use of tractor to plough the farm during the *Rabi* season is required to support this change in cropping pattern. Besides, local experts highlights that a growing shortage of farm labour in Upper Assam is also contributing to a gradual mechanisation of farming activities.²⁹ Farm mechanisation in Upper Assam involves use of tractors to plough the farm during the *Rabi* season. The recurrent droughts in Yunnan between 2009 and 2013 have an adverse effect on the rice production in Yunnan. Ge et al. (2014) reports that mechanised farming of upland rice can increase the yield. In Baoshan County, ownership of tractor, power tiller, or mechanised threshers is the indicator of farm mechanisation.

Water transport is an essential mode of transportation when communities are inundated by floods in Upper Assam. The boat or raft is used for evacuation, transportation, and even shelter during flood inundation (Hazarika 2006, Chahliha et al. 2012). Lack of contact with essential services, work place, or educational centres heighten the vulnerability of households in submerged areas. Furthermore, complete livelihood failures could be avoided if storage is combined with ‘well-constructed infrastructure, low levels of perishability, and high level of coordination across households and social groups (Agrawal and Perrin 2008, p. 6).’ In flood affected areas, storage involves keeping valuables in a safe place (e.g. a raised platform within the house or *Chaang*), storing of firewood, fodder, or food, and granary built on stilts or raised plinth. Whereas, storage in drought affected areas involve storing of firewood, fodder, or food.

Adaptive capacity can be distinguished between ‘specific’ and ‘generic’ adaptive capacity. The capacities that aim to reduce the impacts of a particular hazard are referred as the specific adaptive capacity (Sharma and Patwardhan 2008). For example, specific adaptive capacity of a household to drought or floods include changes in agricultural practices, access to disaster assistance and financial borrowing, participation in collective action, structural changes in the

²⁹ Input received during an expert meeting in Guwahati, Assam, in October 2015.

house, farm mechanisation, and access to irrigation, transport, and storage. The effectiveness of specific adaptive capacity depends on elements of human development, which constitute the generic adaptive capacity (Adger et al. 2004, Sharma and Patwardhan 2008). In this study, generic adaptive capacity of a household includes access to formal financial institution and insurance, farm size, number of livestock, and access to information.

7.3 Research methodology

The research methodology used in this chapter is similar to that in chapter 6. The statistical association between attributes of household level adaptive capacity and a set of independent variables is assessed through the following models. A separate regression is performed from each attribute or indicator of adaptive capacity.

Attribute of adaptive capacity = f (household characteristics, remittance characteristics, infrastructure, and institutional access)
with:

Household characteristics = Household head's gender, ethnicity, and literacy; household size; and average monthly per capita expenditure on consumption;

Remittance characteristics = Remittance-recipient household or non-recipient household;

Infrastructure = Time to reach nearest paved road, local market, and bank;

Institutional access = Time to reach the village office and village level meeting on drought or flood preparedness

To quantify the marginal effect of remittances on adaptive capacity, the same independent variables, which have been used to assess the attributes of sensitivity in chapter 6, have been incorporated the aforementioned model (refer p. 101-102).³⁰ As in chapter 6, two modified versions of the aforementioned model are used to characterise the adaptive capacity of remittance-recipient households in the study area. One of these models uses duration of remittance receipt (short-duration 0, long-duration 1) as an independent variable. Other modified model incorporates type of destination (short-distance 0, long-distance 1) as an independent variable. Most of the migrant workers in the Baoshan County study sample are intra-provincial migrant workers. Hence, this regression model is not applied for Baoshan County.

³⁰ A discussion about the independent variables can be found in Chapter 6.

Attribute of adaptive capacity = f(household characteristics, remittance characteristics, infrastructure, and institutional access)

with:

Household characteristics = Household head's gender, ethnicity, literacy; household size; and average monthly per capita expenditure;

Remittance characteristics = Duration of remittance receipt or type of destination;

Infrastructure = Time to reach nearest paved road, local market, and bank;

Institutional access = Time to reach the village office and village level meeting on drought or flood preparedness

In the two modified models, attributes of a household's specific adaptive capacity are disaggregated into two sub-categories: 'adopted before first episode of migration from a household' and 'adopted after first episode of migration from a household'. Latter sub-category is likely to be influenced by the access to remittances. A detailed discussion of the method involved in this categorisation has been discussed in chapter 6 (refer p. 101).

7.4 Findings

7.4.1 Exploring adaptive capacity of the remittance-recipient and non-recipient households

A better understanding of the determinants that shape the adaptive capacity of remittance-recipient household will be useful to for local level adaptation planning. Regression analysis for remittance-recipient and non-recipient households from the flood affected rural communities in Upper Assam appears in Table 7.3.1a. A system's capacity to develop is reflected by the financial and economic resources (Aulong et al. 2012). Remittance-recipient households are more likely to have a savings bank account (Pr=0.093), which is proxy for access to a formal financial institution. Nearly three-quarters of remittance-recipient households in Upper Assam had a savings bank account compared to around two-thirds of non-recipient households. In a case study of rural livelihood vulnerability in the state of Tamaulipas, Mexico, Eakin and Bojórquez-Tapia (2008) characterises the high vulnerability households as having very low values for insurance and credit indicators. However, none of the households in the study sample in Upper Assam have a crop or livestock insurance. An investment in insurance to manage risks to life indicates generic adaptive capacity. Remittance-recipient households are more likely to have an insurance product than a non-

Table 7.1a: Sub-dimensions and attributes of household level adaptive capacity in Upper Assam, the Eastern Brahmaputra sub-basin.

Sub-dimensions	Attributes	Measurement of attribute	Survey question	Source
Natural assets	Farm Size Diversification Index	The inverse of (farm size +1) reported by a household. E.g. A household that has three hectares of farm will have a Farm Size Diversification Index = $1/(3+1) = 0.25$.	How much land does your household have for agriculture (i.e. crops, grass, trees, orchard, fallow, etc.)?	Adapted from Hahn et al. (2009), Eakin et al. (2011), and Aulong et al. (2012).
	Livestock Diversification Index	The inverse of (number of livestock +1) reported by a household. E.g. A household that has 19 livestock will have a Livestock Diversification Index = $1/(19+1) = 0.05$.	How many of the following animals (i.e. cattle, buffaloes, goat, sheep, horses/ donkey/ mules, pigs, and poultry/ ducks) do your household own?	Adapted from Hahn et al. (2009), Eakin et al. (2011), and Aulong et al. (2012).
	Changes in farming practices due to flood	Percentage of households that did not change farming calendar, grow flood resistant variety of crops, reduce area under paddy crop, or emphasis vegetable farming.	<p>During the last 30 years, did your household make any changes in farming calendar between two flood events in response to flood impacts?</p> <p>During the last 30 years, did your household grow flood resistant variety of crops between two flood events in response to flood impacts?</p> <p>During the last 30 years, did your household reduce area under paddy between two flood events in response to flood impacts?</p> <p>During the last 30 years, did your household increase emphasis on vegetable farming between two flood events in response to flood impacts?</p>	Adapted from Hassan and Nhemachena (2008) and Below et al. (2012).

	Changes in livestock rearing practices due to flood	Percentage of households that did not reduce number of ducks, poultry, and cattle.	<p>During the last 30 years, did your household reduce number of poultry or duck between two flood events in response to flood impacts?</p> <p>During the last 30 years, did your household reduce number of cattle between two flood events in response to flood impacts?</p>	Developed for the purpose of this study.
Financial assets	Access to formal financial institution	Percentage of households that did not have a savings bank account.	Did the household have a savings bank account?	Adapted from Thomalla et al. (2006) and Gerlitz et al. (2014).
	Access to insurance	Percentage of households that did not have any insurance product.	Did the household have any type of insurance?	Adapted from Vincent (2007) and Gerlitz et al. (2014).
Social assets	Access to flood assistance	Percentage of households that did not have access to flood assistance from above median number of sources	During the last 30 years, who of the following assisted the household (e.g. government institutions, social network, community based organisations, or NGOs) to deal with the effects of the flood?	Adapted from Gerlitz et al. (2014).
	Access to financial borrowing during to floods	Percentage of households that did not have access to financial borrowing to deal with flood impacts	<p>During the last 30 years, did the household borrow money from a bank, social network, or community based organisation during flood to deal with its impacts?</p> <p>During the last 30 years, did the household borrow money from a bank, social network, or community based organisation in aftermath of a flood to deal with its impacts?</p> <p>During the last 30 years, did the household borrow money from a bank, social network, or community based organisation between two flood events in response to flood impacts?</p>	Adapted from Dasgupta (2001) and Gerlitz et al. (2014).

	Participation in collective action on flood relief, recovery, or preparedness	Percentage of households that did not participate in setting up a relief camp, repairing local infrastructure, erecting a barrier to slow the speed of flood water, or build a raised platform to keep cattle during flood.	<p>During the last 30 years, did the household participate in setting up a relief camp during flood?</p> <p>During the last 30 years, did the household participate in repair of local infrastructure in aftermath of a flood or between two flood events to deal with its impacts?</p> <p>During the last 30 years, did the household erect a barrier to slow the speed of water or arrest garbage flowing in flood water?</p> <p>During the last 30 years, did the household participate in construction of a livestock platform between two flood events to deal with its impacts?</p>	Adapted from Bloomfield et al. (2001) and Hillier (2003).
Human assets	Communication Device Diversification Index	The inverse of (number of communication device +1) reported by a household. E.g. A household that has three types of communication devices will have a Communication Device Diversification Index = $1/(3+1) = 0.25$	How many of the following items (i.e. radio, televisions, mobile phone, and dish antennae) does your household have?	Adapted from Brooks and Adger (2005) and Gerlitz et al. (2014)
	Access to alternative local livelihood opportunity	Percentage of households that did not have a member who sought work within the origin community or a non-working household member who started to work in response to flood impacts.	<p>During the last 30 years, did a household member seek work within the origin community in aftermath of a flood or between two flood events in response to flood impacts?</p> <p>During the last 30 years, did a non-working household member started to work in aftermath of a flood or between two flood events in response to flood impacts?</p>	Adapted from Gerlitz et al. (2014)
	Access to alternative livelihood opportunity in a nearby locality	Percentage of households that did not have a member who commutes to work either for business or occupation in a different town or village.	Did a household member commute to work either for business or occupation in a different town or village?	Developed for the purpose of this study.

Physical	Structural changes in the house due to flood	Percentage of households that did not raise plinth of the house, cattle-shed, or toilet.	<p>During the last 30 years, did the household raise plinth of the house between two flood events in response to flood impacts?</p> <p>During the last 30 years, did the household raise plinth of the cattleshed between two flood events in response to flood impacts?</p> <p>During the last 30 years, did the household raise plinth of the toilet between two flood events in response to flood impacts?</p>	Developed for the purpose of this study.
	Farm mechanisation	Percentage of households that did not use tractor to plough the farm during the winter cropping season.	During the last 30 years, did the household use a tractor to plough the farm during the winter cropping season?	Developed for the purpose of this study.
	Transport during flood	Percentage of households that did not use a boat or raft during flood, or build or procure a boat between two flood events.	<p>During the last 30 years, did the household arrange a boat or build a raft from banana plant during flood?</p> <p>During the last 30 years, did the household build or procure a boat between two flood events in response to flood impacts?</p>	Developed for the purpose of this study.
	Storage during flood	Percentage of households that did not have above median storage options.	<p>During the last 30 years, did the household store firewood during flood?</p> <p>During the last 30 years, did the household store fodder during flood?</p> <p>During the last 30 years, did the household store fodder in aftermath of a flood to deal with its impacts?</p> <p>During the last 30 years, did the household store food during flood?</p> <p>During the last 30 years, did the household store food between two flood events in response to flood</p>	Developed for the purpose of this study.

impacts?

During the last 30 years, did the household store valuables during flood, in its aftermath, and between two flood events in response to flood impacts?

Percentage of households that did not raise plinth of the granary.

During the last 30 years, did the household raise plinth of the granary between two flood events in response to flood impacts?

Table 7.1b: Sub-dimensions and attributes of household level adaptive capacity in Baoshan County, the Upper Mekong-Salween sub-basins.

Sub-dimensions	Attributes	Measurement of attribute	Survey question	Source
Natural assets	Farm Size Diversification Index	The inverse of (farm size +1) reported by a household. E.g. A household that has three hectares of farm will have a Farm Size Diversification Index = $1/(3+1) = 0.25$.	How much land does your household have for agriculture (i.e. crops, grass, trees, orchard, fallow, etc.)?	Adapted from Hahn et al. (2009), Eakin et al. (2011), and Aulong et al. (2012).
	Livestock Diversification Index	The inverse of (number of livestock +1) reported by a household. E.g. A household that has 19 livestock will have a Livestock Diversification Index = $1/(19+1) = 0.05$.	How many of the following animals (i.e. cattle, buffaloes, goat, sheep, horses/ donkey/ mules, pigs, and poultry/ ducks) do your household own?	Adapted from Hahn et al. (2009), Eakin et al. (2011), and Aulong et al. (2012).

Changes in farming practices due to drought	Percentage of households that did not change farming calendar, increase area under less water intensive crops, reduce area water intensive crops, or adopt improved farming techniques.	During the last 30 years, did your household make any changes in farming calendar subsequent years of drought in response to its impacts?	Adapted from Hassan and Nhemachena (2008) and Below et al. (2012).	
		During the last 30 years, did your household increase area under less water intensive crops during the first year of drought or subsequent years of drought in response to its impacts?		
		During the last 30 years, did your household reduce area under water intensive crops during the first year of drought or subsequent years of drought in response to its impacts?		
		During the last 30 years, did your household adopt improved farming techniques during the first year of drought or subsequent years of drought in response to its impacts?		
Changes in livestock practices due to drought	Percentage of households that did not reduce number of ducks, poultry, and cattle.	During the last 30 years, did your household reduce number of duck and poultry during the first year of drought or subsequent years of drought in response to its impacts?	Adapted from Hassan and Nhemachena (2008) and Below et al. (2012).	
		During the last 30 years, did your household reduce number of cattle during the first year of drought or subsequent years of drought in response to its impacts?		
Financial assets	Access to crop and/or livestock insurance	Percentage of households that did not have crop and/or livestock insurance product.	Did the household have crop and/or livestock insurance?	Adapted from Vincent (2007) and Gerlitz et al. (2014).

Social assets	Access to drought assistance	Percentage of households that did not have access to assistance to deal with effects of the drought	During the last 30 years, who of the following assisted the household (e.g. government institutions, social network, community based organisations, or NGOs) to deal with effects of the drought?	Adapted from Gerlitz et al. (2014).
	Access to financial borrowing during drought	Percentage of households that did not have access to financial borrowing to deal with drought impacts	During the last 30 years, did the household borrow money from a bank, social network, or community based organisation during the first year of drought to deal with its impacts?	Adapted from Dasgupta (2001) and Gerlitz et al. (2014).
			During the last 30 years, did the household borrow money from a bank, social network, or community based organisation during subsequent years of drought to deal with its impacts?	
	Participation in collective action on water sharing during drought	Percentage of households that did not participate in mutual agreement on water sharing in response to drought.	During the last 30 years, did the household participate in mutual agreement on water sharing during subsequent years of drought?	Adapted from Bloomfield et al. (2001) and Hillier (2003).
Human assets	Communication device diversification index	The inverse of (number of communication device +1) reported by a household. E.g. A household that has three types of communication devices will have a Communication Device Diversification Index = $1/(3+1) = 0.25$	How many of the following items (i.e. radio, televisions, mobile phone, and dish antennae) does your household have?	Adapted from Brooks and Adger (2005) and Gerlitz et al. (2014)
	Access to alternative local livelihood opportunity	Percentage of households that did not have a member who sought work within the origin community or a non-working household member who started to work in response to drought impacts.	During the last 30 years, did a household member seek work within the origin community in first year of drought or subsequent year of drought in response to its impacts? During the last 30 years, did a non-working household member starting to work in first year of drought or subsequent year of drought in response to its impacts?	Adapted from Gerlitz et al. (2014)

	Access to alternative livelihood opportunity in a nearby locality	Percentage of households that did not have a member who commutes to work either for business or occupation in a different town or village.	Did a household member commute to work either for business or occupation in a different town or village?	Developed for the purpose of this study.
Physical	Access to irrigation	Percentage of households that did not have access to irrigation.	<p>During the last 30 years, did the household build a new irrigation channel during first year of drought or subsequent years of drought?</p> <p>During the last 30 years, did the household repair an irrigation channel during first year of drought or subsequent years of drought?</p> <p>During the last 30 years, did the household build a small water tank during first year of drought or subsequent years of drought?</p> <p>During the last 30 years, did the household use water tank for irrigation during subsequent years of drought?</p>	Developed for the purpose of this study.
	Farm mechanisation	Percentage of households that did not own a tractor, power-tiller, or mechanised thresher.	<p>How many of the following items (e.g. tractor, power-tiller, or mechanised thresher) does your household have?</p>	Adapted from Gerlitz et al. (2014)
	Storage during drought	Percentage of households that did not have above median storage options.	<p>During the last 30 years, did the household store firewood during first year of drought?</p> <p>During the last 30 years, did the household store fodder during first year of drought?</p> <p>During the last 30 years, did the household store food during first year of drought or subsequent years of drought?</p>	Developed for the purpose of this study.

recipient household (Pr=0.045). The insurance penetration is low in the study area. Only one-third of households surveyed have a life insurance. IPCC (2001) identify information as one of the determinants of adaptive capacity.³¹ Information is a part of the set of resources or adaptive capacity that is inherent in a system (Brook and Adger 2005). The communication device diversification index is negatively associated with remittance-recipient status of a household (Pr=0.012). Households that receive remittances are likely to own more types of communication devices than non-recipient households. This diversification indicates that remittance-recipient households are exposed to more information sources, and thereby different types of information. These communication devices could be used by the local administration to disseminate information on DRR.

Throughout the disaster response process, the poor, the elderly, women headed households and recent residents are at greater risk (Morrow 1999). Remittance-recipient households in Upper Assam are 70 percent more likely to receive flood assistance from fewer sources than non-recipient households (Pr=0.058). Due to gender specific roles, the women and elderly household members from remittance-recipient households may have limited access to social resources during floods in the absence of male household members, who are custodians of a household's social capital. During floods, this could have an adverse effect on rescue, delay access to relief, and hinder access to institutional support for recovery. Commuting enables a household to expand the area within which it sought livelihood opportunities. In this study area, commuting is more common among men. Major employers of the male commuters included construction, wholesale and retail trade, education, and fishing. Female commuters were largely employed in education and agriculture. Remittance-recipient households are two times more likely not to have access to livelihood opportunities in nearby locality (Pr=0.000). The employment pattern among male commuters from remittance-recipient and non-recipient households was largely similar. In comparison to 38.1 percent of male commuters from non-recipient households being employed in construction sector, the same sector employed 47.5 percent of male commuters from remittance-recipient households.

Regression analysis for remittance-recipient and non-recipient households from the drought affected rural communities of Baoshan County appears in Table 7.3.1b. Remittance-recipient households are likely to have smaller farm size than non-recipient households (Pr=0.000),

³¹ IPCC (2001) identify economic resources, technology, information and skills, infrastructure, institutions and equity as the determinants of adaptive capacity.

less likely to have a water tank for irrigation (Pr=0.003), and mechanise farming (Pr=0.003) than non-recipient households. Furthermore, farmers adopt certain strategies to reduce the risk of complete crop failure (Hassam and Nhemachena 2008). Remittance-recipient households are less likely to change farming practice (Pr=0.001) and livestock rearing practice in response to drought (Pr=0.054). Access to alternative income opportunities could reduce risk posed by an environmental stressor on a household's livelihoods portfolio, especially the farming and livestock rearing aspects of it. Remittance-recipient households are less likely to have access to local alternative livelihood opportunities (Pr=0.005) as well as those in nearby localities (Pr=0.003). Nearly half of the male commuters from remittance-recipient households (48.4 percent) and two-fifths of male commuters from non-recipient households (36.9 percent) were employed in construction sector. This implies the importance of remittances in diversifying the livelihoods portfolio of remittance-recipient household. It may also suggest a match between the migrant worker's competence (either skill or labour) and the job profile in destination rather than in origin village or nearby locality.

7.4.2 Characterising adaptive capacity of remittance-recipient households

The characterisation of adaptive capacity of remittance-recipient households in the study area indicates that the duration for which remittances is received by a household is an important determinant of the household level adaptive capacity to floods (see Table 7.3.2a). Previous research (Hazarika 2006, Das et al. 2009) suggests that structural changes in a dwelling are part of the flood response strategies in the flood affected rural communities of Assam. Long-duration households are more likely to raise plinth of the house (Pr=0.000), cattleshed (Pr=0.002), or toilet (Pr=0.006) than short-duration households. The longer the duration during which a household receives a remittance, the more likely it is to have access to a boat or raft during the flood period (Pr=0.020). A boat or raft is an essential mode of transportation during flood inundation. To avoid a complete livelihood failure, access to storage is critical (Agrawal and Perrin 2008). Households that have been receiving remittances over a long duration are more likely to have better access to storage options than households receiving remittances for a shorter duration (Pr=0.001). Among remittance-recipient households who also engage in farming activities, long-duration households are more likely to have raised plinth or height of the granary (Pr=0.067).

Table 7.3.1a: Effects of remittances on household level adaptive capacity to floods in Upper Assam, the Eastern Brahmaputra sub-basin.

		Remittance-recipient household	Non-recipient household	Adjusted odds ratio (Beta coefficient)
Physical	% of households that did not raise plinth of the house	24.7	25.9	0.9 (-0.096)
	% of households that did not raise plinth of the cattle-shed	59.2	56.9	1.1 (0.079)
	% of households that did not raise plinth of the toilet	73.7	76.3	0.9 (-0.132)
	% of households that did not use a tractor to plough land during the Rabi cropping season ^l	59.8	55.2	1.2 (0.200)
	% of households that did not have access to boat or raft during flood	17.8	17.8	1.0 (0.051)
	% of households that did not have access to above median number of storage options during flood [*]	67.9	67.0	0.9 (-0.125)
	% of households that did not raise plinth of the granary	53.6	54.4	1.0 (0.033)
Financial	% of households that did not have a savings bank account	25.1	30.3	0.7 (-0.340*)
	% of households that did not have an insurance	62.9	69.2	0.7 (-0.377**)
Social	% of households that did not have access to flood assistance from above median number of sources [#]	91.1	86.6	1.7 (0.532*)
	% of households that did not have access to financial borrowing during flood	59.5	65.4	0.8 (-0.221)
	% of households that did not participate in collective action on flood relief, recovery, and preparedness	25.5	22.4	1.1 (0.132)
Natural	Farm size diversification index	0.4	0.5	-0.0119
	Livestock diversification index	0.2	0.2	0.0006
	% of households that did not change farming practice in response to flood	67.0	70.2	0.8 (-0.186)
	% of households that did not change livestock rearing practice in response to flood	64.3	66.8	0.8 (-0.166)
Human	Communication device diversification index	0.4	0.5	-0.049**
	% of households with no access to alternative livelihood opportunity in locality	67.6	74.1	0.8 (-0.251)
	% of households with no access to alternative livelihood opportunity in nearby locality	48.6	26.5	2.6 (0.960***)

Legend: * p<.1; ** p<.05; *** p<.01. Note: Models were adjusted for household head's gender, ethnicity, and literacy; household size; adjusted total expenditure; time to reach nearest paved road, local market, bank or Panchayat office; and village level meetings on flood preparedness. Source: Computed by author from HICAP Migration Dataset.

Table 7.3.1b: Effects of remittance on household level adaptive capacity to drought in Baoshan County, Yunnan, the Upper Mekong-Salween sub-basins.

		Remittance-recipient household	Non-recipient household	Adjusted odds ratio (Beta coefficient)
Physical	% of households that did not have a water tank for irrigation	88.4	78.0	2.3 (0.836***)
	% of households that did not have a water pump for irrigation	96.9	97.4	0.7 (-0.292)
	% of households that did not have access to irrigation channel	63.1	57.9	1.3 (0.258)
	% of households that did not own a tractor or power-tiller	82.7	71.2	1.9 (0.660***)
	% of households that did not have access to storage options during drought	67.2	65.1	1.1 (0.111)
Financial	% of households that did not have crop or livestock insurance	85.3	79.9	1.1 (0.108)
Social	% of households that did not have access to drought assistance	27.1	25.5	1.1 (0.087)
	% of households that did not have access to financial borrowing during drought	61.9	62.6	1.0 (0.008)
	% of households that did not participate in collective action on water sharing and use	89.1	84.8	1.5 (0.428)
Natural	Farm size diversification index ⁺	0.8	0.7	0.054***
	Livestock diversification index ⁻	0.1	0.1	-0.009
Human	% of households that did not change farming practice in response to drought	77.8	62.8	2.0 (0.695***)
	% of households that did not change livestock rearing practice due to drought	55.3	47.1	1.4 (0.372*)
	Communication device diversification index	0.3	0.3	0.001
	% of households with no access to alternative livelihood opportunity in locality	89.5	79.8	2.1 (0.741***)
	% of households no access to alternative livelihood opportunity in nearby locality	58.7	39.3	1.7 (0.556***)

Legend: * p<.1; ** p<.05; *** p<.01. Note: Models were adjusted for household head's gender and literacy; household size; adjusted total expenditure; time to reach nearest paved road, local market, bank or village office; and village level meetings on drought preparedness. Source: Computed by author from HICAP Migration Dataset

Previous studies by Goyari (2005) and Mandal (2010) report that farmers in Assam are adjusting the cropping pattern and/or season to minimise production risk due to recurring floods. Long-duration households, which are engaged in farming activities, are more likely to use a tractor to plough the farm during the winter ('*Rabi*') cropping season than a short-duration household (Pr=0.002). This indicates a growing mechanisation of farming among the former. However, this should be contextualised with another finding that the long-

duration households are more likely to reduce the size of their landholding than short-duration households ($Pr=0.008$). The likelihood of mechanising farming activities even while reducing farm size may suggest that this mechanisation is partly driven by labour shortage due to absence of able-bodied young men. Moreover, long-duration households are more likely to reduce number of cattle or poultry in response to floods ($Pr=0.002$). This downsizing of agricultural activities among long-duration households reflects risk aversion nature of these households and suggests a growing dependence of rural households on the local market for food and other essentials.

Access to savings and credit are essential components of a household's capacity to manage risks from recurrent extreme weather events. Long-duration households are more likely to have a savings bank account ($Pr=0.042$) and an insurance ($Pr=0.094$) than short-duration households. However, insurance penetration remains quite low in this study area. The extent of risk pooling within a network could be an important strategy to reduce disaster risks. Mosse et al. (2002) had conducted a study on seasonal migrants from the Bhil tribal villages in India. They found that the social position of wealthier migrant households in origin villages improved due to the income generated from migration. The creditworthiness of these households among local moneylenders increased because of this improvement in the social position; and these households could then borrow large sums of money for major social events such as a marriage. The reputation or credit rating of remittance-recipient households in Upper Assam improves over time. For example, short-duration households are less likely to have access to borrowing during flood than long-duration households ($Pr=0.049$). Participation in community activities is a proxy of social cohesion and access of a household in the village institutions. Over time there is an increased participation of remittance-recipient households in collective action on flood relief, recovery, and preparedness in the study area ($Pr=0.000$).

The characterisation of adaptive capacity among remittance-recipient households in the Baoshan County appears in Table 7.3.2b. In this study area, households that receive remittances over a long duration are more likely to have a smaller farm size than short-duration households ($Pr=0.000$). Given the likely uncertainty in agricultural production due to drought, these long-duration households are less likely to invest in farm mechanisation ($Pr=0.036$).

Table 7.3.2a: Effects of duration of remittance receipt on household level adaptive capacity among remittance-recipient households, Upper Assam, the Eastern Brahmaputra sub-basin.

		Short- duration household	Long- duration household	Adjusted odds ratio (Beta coefficient)
Physical	% of households that did not raise plinth of the house	64.3	35.5	0.3 (-1.211***)
	% of households that did not raise height of the cattle-shed	80.0	42.5	0.2 (-1.762***)
	% of households that did not raise plinth of the toilet	48.5	27.0	0.1 (-1.988**)
	% of households that did not use a tractor to plough land during the Rabi cropping season	62.5	27.7	0.1 (-1.838***)
	% of households that did not have access to a boat or raft during flood	89.9	70.1	0.3 (-1.307**)
	% of households that did not have access to storage options	87.0	68.1	0.3 (-1.139***)
	% of households that did not raise height of the granary	69.1	50.0	0.4 (-0.885*)
Financial	% of households that did not have savings bank account	30.7	19.8	0.5 (-0.605**)
	% of households that did not have an insurance	69.3	56.6	0.6 (-0.443*)
Social	% of households that did not have access to flood assistance	8.57	12.50	1.6 (0.471)
	% of households that did not have access to financial borrowing during flood	73.9	54.7	0.3 (-1.031**)
	% of households that did not participate in collective action on flood relief, recovery, and preparedness	86.7	50.0	0.1 (-1.856***)
Natural	Farm size diversification index	0.5	0.6	0.070**
	Livestock diversification index	0.1	0.1	-0.004
	% of households that did not change farming practice in response to floods	77.3	68.0	0.5 (-0.737)
	% of households that did not change livestock rearing practice in response to floods	79.5	45.0	0.1 (-1.978***)
Human	Communication device diversification index	0.05	0.02	0.6 (-0.472)
	% of households with no access to alternative livelihood opportunity in locality	59.5	79.1	0.7 (-0.302)
	% of households with no access to alternative livelihood opportunity in nearby locality	47.8	47.4	1.3 (0.278)

Legend: * p<.1; ** p<.05; *** p<.01.

Note: Models were adjusted for household head's gender, ethnicity, and literacy; household size; adjusted total expenditure; time to reach nearest paved road, local market, bank or Panchayat office; and village level meetings on flood preparedness. Source: Computed by author from HICAP Migration Dataset

Table 7.3.2b: Effects of duration of remittance receipt on household level adaptive capacity to floods among remittance-recipient households, Baoshan County, Yunnan, the Upper Mekong-Salween sub-basins.

		Short-duration household	Long-duration household	Adjusted odds ratio (Beta coefficient)
Physical	% of households that did not have access to irrigation channel	58.7	69.2	1.1 (0.093)
	% of households that did not own a tractor or power-tiller	76.4	86.2	1.9 (0.675**)
Financial	% of households that did not have a crop or livestock insurance	83.4	86.9	1.1 (0.142)
Social	% of households that did not have access to drought assistance	33.8	18.6	0.4 (-0.942***)
	% of households that did not have access to financial borrowing during drought	43.2	21.4	0.4 (-0.993**)
Natural	Farm size diversification index	0.8	0.8	0.060***
	Livestock diversification index	0.1	0.1	-0.001
Human	% of households that did not change farming practice in response to drought	41.8	17.4	0.2 (-1.759**)
	% of households that did not change livestock rearing practice in response to drought	38.3	23.7	0.4 (-0.874*)
	Communication device diversification index	0.3	0.3	0.005
	% of households that did not have access to alternative livelihood opportunity in nearby locality	59.1	52.8	1.4 (0.333)

Legend: * $p < .1$; ** $p < .05$; *** $p < .01$. Note: Models were adjusted for household head's gender and literacy; household size; adjusted total expenditure; time to reach nearest paved road, local market, bank or village office; and village level meetings on drought preparedness. Source: Computed by author from HICAP Migration Dataset

However, long-duration households are more likely to change farming ($Pr=0.001$) and livestock rearing ($Pr=0.054$) practices due to drought than short-duration households. Among remittance-recipient households, changes in livestock rearing practice are more common than changes in farming practices. Nearly two-fifths of remittance-recipient households had either reduced number of cattle or poultry. Modification in farming practices include changes in crop varieties and crop calendar. These households have adopted less resource intensive strategies to manage the drought impacts. In comparison to short-duration households, long-duration remittance recipient household are likely to have better access to social assets. For example, long-duration households are less likely not to have access to drought assistance ($Pr=0.001$) and financial borrowing during drought ($Pr=0.038$). Among various sources, social network is the popular source for borrowing money to address drought impacts. Nearly

one-third of remittance-recipient households (29.5 percent) had borrowed money from friends or relatives for this purpose. Nearly one-tenth of the households had borrowed money from cooperatives/ village fund due to drought. This source is more popular among short-duration households (38.2 percent) than long-duration households (20.0 percent).

The characterisation of adaptive capacity of the remittance-recipient households in Upper Assam on basis of distance to destination (i.e. long-distance and short-distance) appears in Table 7.3.2c. Farm size is an attribute of generic adaptive capacity.³² Larger farm size among long-distance households may reflect their comparatively better asset base compared to the short-distance households (Pr=0.002). This may have supported the former households to send a household member to a distant destination. This allows the long-distance households to have a wider catchment to source income and expand social network than the short-distance households and non-recipient households. Long-distance households are less likely to have changed their livestock rearing practice (i.e. reduced number of cattle or poultry) as a response to floods than the short-distance households (Pr=0.030). At the same time, the former is less likely to have raised plinth of the cattleshed in response to flood impacts (Pr=0.092). Since this study area experiences flood on a regular basis, it is unlikely that long-distance households do not recognise the risk to livestock rearing from floods. Rather, they may regard an investment in building capacity of the livestock portfolio to provide diminishing return in the long term. Long-distance households are less likely to have participated in the collective action on flood relief, recovery, and preparedness than short-distance households (Pr=0.002). These collective action are labour intensive (e.g. repair local infrastructure; and erect a barrier to slow the speed of flood water) and require organisation skills (e.g. setting up relief camp). Given the gendered division of roles and responsibilities in these villages, it is likely that the organisers of these collective action, generally the *Panchayat* (i.e. village committee), look for young and able-bodied men. Moreover, a household is likely to contribute labour in these activities only after addressing its own requirements of relief or recovery. FGD findings suggest that migrant workers in faraway destinations return home once every couple of years. Whereas, migrant workers based in Assam or other parts of northeast India return home more frequently, and may be able to assist their families and communities during or in aftermath of floods.

³² This study does not distinguish between changes in farm size before and after migration.

Table 7.3.2c: Effects of distance to destination on household level adaptive capacity to floods among remittance-recipient households, Upper Assam, the Eastern Brahmaputra sub-basin.

		Short-distance household	Long-distance household	Adjusted odds ratio (Beta coefficient)
Physical	% of households that did not raise plinth of the house	44.7	54.5	1.3 (0.299)
	% of households that did not raise height of the cattle-shed	51.3	68.8	2.4 (0.884*)
	% of households that did not raise plinth of the toilet	29.9	47.1	1.8 (0.618)
	% of households that did not use a tractor to plough land during the Rabi cropping season	50.0	42.1	0.6 (-0.530)
	% of households that did not have access to a boat or raft	77.1	86.2	1.5 (0.429)
	% of households that did not have access to storage options	68.1	87.2	3.4 (1.231***)
	% of households that did not raise height of the granary	57.9	60.3	1.2 (0.161)
	Financial	% of households that did not have a savings bank account	27.2	23.0
Social	% of households that did not have an insurance	64.7	63.8	0.9 (-0.121)
	% of households that did not have access to flood assistance	7.3	11.8	1.9 (0.653)
	% of households that did not have access to financial borrowing during flood	55.1	71.7	2.4 (0.875*)
	% of households that did not participate in collective action on flood relief, recovery, and preparedness	55.9	79.2	3.0 (1.088***)
Natural	Farm size diversification index	0.6	0.5	-0.085***
	Livestock diversification index	0.2	0.1	-0.006
	% of households that did not change farming practice in response to floods	66.7	74.1	1.5 (0.390)
	% of households that did not change livestock rearing practice in response to flood	50.0	76.6	3.0 (1.107**)
Human	Communication device diversification index	0.4	0.4	-0.033*
	% of households with no access to alternative livelihood opportunity in locality	67.6	74.1	2.3 (0.837)
	% of households with no access to alternative livelihood opportunity in nearby locality	45.0	49.3	1.0 (0.005)

Legend: * p<.1; ** p<.05; *** p<.01. Note: Models were adjusted for household head's gender, ethnicity, and literacy; household size; adjusted total expenditure; time to reach nearest paved road, local market, bank or Panchayat office; and village level meetings on flood preparedness. Source: Computed by author from HICAP Migration Dataset.

Long-distance households are two times more likely not to have access to financial borrowing during floods than short-duration households (Pr=0.055). The major source for borrowing money during floods is relatives and friends. The maximum duration of migration is less than three years in over half of the long-distance households. These migrant workers (or remittance senders) are primarily employed in the informal sector. Unlike the regular visits by the short-distance remittance senders, the ones based in faraway destinations have

visited the origin village only once since their migration. Hence, the lenders in origin communities may not have an opportunity to assess the creditworthiness of these remittance senders, which also reflects on the creditworthiness of their households. Long-distance households are less likely to have a high communication device diversification index than short-distance households (Pr=0.008). These households are likely to own a wider range of communication devices than short-distance households. It indicates that the former will be exposed to a wide range of information sources.

7.5 Discussion

The combination of available assets, resources, policies and institutions shape the adaptive capacity of a system (Smit and Wandel 2006). The adaptive capacity manifests the ability of a system to absorb and recover from impacts of a stressor. There is little contribution of formal credit and insurance markets in reducing income risk and its outcomes in developing countries. Sophisticated risk management (*ex ante*) and risk-coping strategies (*ex post*) are developed by rural and urban households located in risky environments. These strategies include self-insurance through savings and informal insurance mechanisms. Precautionary savings involve building up of savings in ‘good’ years and using the stock in ‘bad years’ (Dercon 2002). Though remittance-recipient households in Upper Assam are likely to have better access to formal financial institutions and insurance than the non-recipient households, few remittance-recipients (1.5 percent) and non-recipient households (2.5 percent) have undertaken targeted savings as a strategy to manage environmental risks. The FGD findings from in Upper Assam suggest that savings are, generally, meant for funding education, wedding, and healthcare emergency. In Baoshan County, nearly all surveyed households have a savings bank account. However, less than one percent of surveyed households have undertaken savings with an aim to reduce income risk due to drought. The insurance penetration remains low in Upper Assam, and is mostly limited to life insurance.³³ In Baoshan County, less than one-fifth of the households have a crop or livestock insurance. While expanding the physical infrastructure of financial institutions into rural hinterland, it is necessary to simplify paperwork and protocols involved in accessing a formal financial institution. Furthermore, awareness raising campaign should be organised among rural beneficiaries, particularly women, about diverse range of financial products and their utility

³³ None of the households in the study sample in Upper Assam reported to have crop or livestock insurance.

in risk management in context of drought or flood. Similar campaign is required among the employees of formal financial institutions, particularly in rural areas.

Chapter 6 highlights the comparatively lower income diversification among remittance-recipient households and the consequent increase in their dependency on remittances over the migration cycle. This chapter highlights that remittance-recipient households in Upper Assam are less likely to have access to alternative livelihood opportunities in nearby locality, and those from Baoshan County are less likely to access to alternative livelihood opportunities in the origin community as well as nearby locality. These findings, largely, conforms the growing dependency on remittances as the only source of non-farm income, and in some cases the only source of cash income. Moreover, it is possible that the informal sector in urban areas, which has a lower threshold for job market entry, provides commensurate and wide ranging employment opportunities for semi-skilled or unskilled rural labour (as well as educated rural youth) than farm and non-farm sector in origin communities. In comparison to the climate sensitive, debt-ridden and volatile farm sector and sloth-paced growth of non-farm sector in rural areas, social network driven employment prospects in urban areas offer perceived and/or actual opportunities (e.g. cash income, better amenities and services) of a better life for the migrant worker and family left-behind. The in-flow of remittances contributes to recipient household's welfare in the short-term. However, it increases the exposure of the recipient household's portfolio to non-climatic shocks and stresses since the informal sector does not provide social security benefits (e.g. pension, provident fund, or insurance) to the labour. In particular, the inter-state migrant workers in India are not able to access the social protection programmes offered by the origin state when they reside in destination in another part of the country, and may not be eligible or have access to similar programmes provided by the receiving state.

Drought is a slow onset hazard. The duration between the onset of a hazard and its realisation by a household is comparatively longer for slow onset hazards since its impacts are staggered over time. It could take months or even years to become a disaster (HPG 2006). Since major impacts of the drought in the Baoshan County are associated with the agricultural sector, most household level responses to drought are focused on this sector. Even under normal circumstances, migrant workers tend to disassociate themselves from the agricultural activities, and their households are less inclined to invest in the farm sector. The drought impacts accentuate this investment pattern among remittance-recipient households. This

indicates that remittance-recipient households are likely to perceive agriculture as a risky proposition. A perception that may have been strengthened by the recurrent occurrence of severe droughts in Yunnan since 2009. Rather than managing risk from drought by building capacity of the household's agricultural portfolio or adopting new strategies to spread risk to agricultural income, remittance-recipient households are clearly downsizing agricultural operations. This risk averse nature of these households is further supplemented by relatively young age of at first migration (23.9 years) and experience of formal school education among the rural migrants imply a lack of experience in agricultural activities. Based on a similar profile of rural migrants in China, Tao and Xu (2007) suggests that unlike the older and the less educated labourers in rural area, young educated migrants would not value farming as much. The latter would tend to disassociate themselves from farming in future. If given an opportunity to migrate permanently, they might even de-link themselves from the agricultural land allocated to them. Building on this argument, one could also suggest that these migrant workers, and in turn their households would be less inclined to invest in agricultural assets (e.g. irrigation system) or farm mechanisation.

Awareness among individuals depends on the household's access to information which in turn is contingent upon access to communication devices (mobile phones, television, and radio). Possession of these communication devices manifests the ability of a household to gather information from beyond the geographical limit of the village or their social network. These communication devices could be a crucial conduit of information between the local administration and residents during an extreme event. For example, a pilot on community-based flood early warning systems in Upper Assam alerts vulnerable villagers downstream about the impending flood through SMS or phone call.³⁴ I find that households that receive remittances are likely to own more types of communication devices than non-recipient households. Only 5 percent of remittance-recipient households did not own a mobile phone compared to 11 percent of non-recipient households. Flood alerts disseminated by government agencies are likely to reach quicker to the households that own a mobile phone. Particularly in context of flash floods, duration between the dissemination of flood alert and arrival of flood water is crucial factor in saving lives and livestock, and minimising damage to property. However, remittance-recipient households in Upper Assam are more likely to

³⁴ http://www.business-standard.com/article/news-ians/community-based-flood-alarms-saving-assam-lives-115072600233_1.html

receive flood assistance from fewer sources than non-recipient households. In aftermath of a disaster, assistance from government and non-government institutions may not always be provided at the doorstep of affected population. Hence, access to assistance may require follow-up with nodal teams of the local administration or major non-governmental organisations. In the absence of male household members, it is probable that the women and elderly household members of remittance-recipient households may have limited access to institutions providing flood assistance. This could have an adverse effect on rescue, delay access to relief, and impede institutional support for recovery.

Recipients tend to use remittances first to meet daily consumption requirements, repay debts incurred to finance migration, and fund education for their children (Lipton 1980). Only afterwards remittances are used for 'consumptive' investment such as land purchase, hiring of labour, or labour saving mechanisation (Lipton 1980) or establishment of grocery shops or small restaurants in an overcrowded sector (Penninx 1982). This pattern of remittance use could be one of the plausible explanations for adaptive capacity among remittance-recipient households in Upper Assam. A characterisation of adaptive capacity of remittance-recipient households indicates that the duration for which remittances is received by a household has a significant and positive association with the structural changes made in the house to address flood impacts, farm mechanisation, access to transportation during flood inundation, savings bank account and insurance, household's access to borrowing (or creditworthiness), and participation in collective action on flood preparedness. Since the migrant workers from Upper Assam are predominantly employed as wage employees in the informal sector, the volume of remittance remains low. Remittances are commonly spent on basic needs (food, healthcare, and education), social events and community activities, consumer goods, and transportation. This reflects a household's prioritisation of expenditure over time. Few households invest remittances in housing, savings, or disaster risk reduction (see chapter 5, p. 79 & 80). Besides, lack of village level meetings in this study area on flood preparedness indicates a lack of information on disaster risk reduction, which could have otherwise influenced a household's expenditure pattern. Like in Upper Assam, long-duration households in Baoshan County are more likely to have access to drought assistance and borrowing than short duration households. However, these long-duration households are more likely to have smaller farm size and less likely to mechanise farming. Rather they are more likely to modify farming and livestock rearing practice in response to drought impacts.

This involves less resource intensive strategies such as reduction in number of cattle or poultry, shifting to less water intensive crop varieties, and modifications in crop calendar. As discussed above, remittance-recipient households are likely to downsize agricultural operations over the migration cycle. Under normal circumstances, investment in agriculture is not a common use of remittances. It is unlikely that remittance-recipient households in Baoshan County would invest remittances in farm sector during the severest droughts in 100 years.

Long-distance households in Upper Assam are likely to have larger farm size and access to more communication devices than short-distance households. But the former is less likely to raise plinth of cattle-shed, change livestock rearing practices, access to storage options, and access to boat/raft. During the monsoon season, many areas in Upper Assam experience flood on a regular basis. For example, it is not unlikely for rural communities in Dhemaji and Lakhimpur districts to experience 1-2 flood waves each year. It could be safely assumed that long-distance households are aware of the risks to their lives and livelihoods from floods. Despite this risk if these households are not building capacity to reduce risk to their livestock, storage and transportation, they may perceive these measures to provide diminishing return in the long term. Moreover, long-distance migration from Upper Assam is a fairly recent migration stream. The maximum duration of migration is less than three years in over half of long-distance households. These migrant workers are still in the early phase of migration cycle, and remittance spending pattern among their households are likely to focus on daily consumption needs, education, and healthcare. Since many of these long-distance migrant workers have only been away for a short duration and are employed in the informal sector, their credit rating among moneylenders is yet to be established, and probably this is why remittance-recipient households are less likely to have access to financial borrowing during floods.

7.6 Chapter conclusion

The development of the capacity to adapt to climate change and variability is an essential component of adaptation. This chapter characterises household level adaptive capacity in context of a specific climate hazard (e.g. drought or flood) and ascertain the extent to which the outcomes of migration (i.e. remittances) shapes adaptive capacity of remittance-recipient households. Presently, the formal credit and insurance markets are contributing little to the

adaptive capacity of the flood affected rural households in the study areas. Remittance-recipient households are less likely to have access to alternative livelihood opportunities in origin community and/or nearby locality. There is a growing dependency on remittances as the only source of non-farm income. The remittance inflow contributes to recipient household's welfare in the short-term. Although, it exposes the recipient household's portfolio to non-environmental shocks and stresses. The informal sector does not provide social security benefits to the labour, and migrant workers have limited access to government funded social protection programmes in destination. Moreover, the capacities of remittance-recipient households are contingent upon the local socio-economic, institutional, and political context, and needs to be facilitated and nurtured by the institutional mechanisms.

The effects of remittances on attributes of adaptive capacity are context specific. In Upper Assam, remittance-recipient households are likely to have access to more communication devices than non-recipient households. This indicates the ability of the group of households to gather information from a wider range of sources. This may be critical during a flood when flood alert or information about rescue, relief and recovery could be disseminated through various means of mass communication. A characterisation of adaptive capacity of remittance-recipient households in Upper Assam illustrates that longer the duration for which a household receives remittances more likely it will be to invest it in different attributes of adaptive capacity. Remittance-recipient households in Baoshan County are less likely to invest in farm assets. These households are more likely to downsize agricultural activities in order to minimise risk from drought. This behaviour is further accentuated by the relatively young age at first migration, school education, and lack experience of agricultural activities among migrant workers.

Chapter 8: Vulnerability assessment

8.1 Introduction

The analysis in this chapter uses the conceptual framework that envisages vulnerability as a function of sensitivity, exposure, and adaptive capacity in chapter 4 (p. 55 and 56). The context (e.g. characteristics of system, type of hazard, region, population group, and time period) is critical to a system's vulnerability to a hazard (Downing and Patwardhan 2004, Brooks et al. 2005). It is necessary to address the following questions for a meaningful analysis of vulnerability: Whose vulnerability? To which hazard? Who is more or less vulnerable? In what ways are they vulnerable? This chapter aims to explore the composition of household level vulnerability in the drought and flood affected study areas in general, and among remittance-recipient and non-recipient households in particular. This chapter adopts the analytical hierarchy process (AHP), which is a multi-criteria decision analysis (MCDA) tool, to assign weights to the major components, sub-dimensions, and attributes of vulnerability. Learning from this vulnerability assessment can have an important role in adaptation planning. The case studies from drought affected rural communities in Baoshan county in the Upper Mekong-Salween sub-basins of China and flood affected rural communities in Upper Assam in the Eastern Brahmaputra sub-basin (EBSB) of India have been used to illustrate the proposed methodology.

8.2 Methodology

8.2.1 Vulnerability index

The capabilities, assets, and activities required for a sustainable living by a household should be explicitly characterised by an index assessing the household's livelihood vulnerability (Chambers and Conway 1992). The present analysis adopts an approach that is both indicator based and empirical that involves focus group discussions (FGD) and surveys (refer to chapter 4). This provides a metric for quantitative analysis of a household's vulnerability to a specific extreme event. The indicator based approach provides a system to characterise vulnerability in the study area, helps to standardise measurement, and permits a comparison between different groups (e.g. remittance-recipient and non-recipient households). Vulnerability is a function of three major components (viz. sensitivity, adaptive capacity, and exposure). The sensitivity of flood affected rural households in Upper Assam includes five sub-dimensions, namely health, wellbeing, water, food, and environmental dependence. Each

of these sub-dimensions are characterised by relevant attributes that are in turn comprised of generic and specific indicators (refer chapter 4, Figure 4.1., p. 55). These indicators have been identified during the FGDs in study areas, and hence internalise the experience of local residents. This is further supplemented by inputs from literature survey and local experts. Later, these indicators are organised into attributes, sub-dimensions, and major components based on the conceptual framework.

This customisation of the vulnerability framework according to the local context implies that there are some variations in the constituents of vulnerability in Baoshan County and Upper Assam. The sub-dimensions of sensitivity to drought in Baoshan County do not include health and food sub-dimensions. The FGD participants did not identify indicators associated with health or food as a major concern due to drought. The adaptive capacity of a household is comprised of five sub-dimensions: financial assets, natural assets, social assets, human assets, and physical assets. An overview of the constituents of sensitivity and adaptive capacity has been provided in chapters 6 and 7, respectively. The exposure of a household to a major extreme event is comprised of three sub-dimensions: number of years between 1984 and 2013 when the household had experienced a particular extreme event (i.e. drought in Baoshan County and floods in Upper Assam), damages to the household in monetary terms during each episode of this extreme event between 1984 and 2013, and time taken by a household to recover from the damages caused during each episode of the extreme event between 1984 and 2013.

Various attributes are measured on a different scale. Some of these attributes are either continuous or count in nature. Each of these attributes are standardised as an index, which ranges from 0 (minimum) to 1 (maximum). Like Hahn et al. (2009), I adapt the equation of the life expectancy index in the Human Development Index (HDI) to standardise these attributes. The difference between the actual value of attribute for a household and minimum value of attribute in the sample is divided by the difference between the maximum and minimum values of the attribute in the sample (see equation *I*).

$$Index_{a_s} = \frac{a_s - a_{\min}}{a_{\max} - a_{\min}} \dots\dots\dots(I)$$

Where a_s is the actual value of attribute for a household s , and a_{\min} and a_{\max} are the minimum and maximum values for each attribute in the sample for the study area. For

example, a household could sell or mortgage household assets during flood, in the aftermath of flood, and between two distinct flood events. The related attribute is a count that ranges from 0 (minimum) to 2 (maximum) in the sample for Upper Assam.³⁵ These minimum and maximum values are used to standardise this attribute. Certain attributes are measured as an index (e.g. crop diversification index, farm size diversification index, and communication device diversification index), and are inverse in nature. For example, a household that grows few crops will have a higher index value compared to a household that grows more crops. A household that grows paddy, mustard, and winter vegetables is spreading their risk to uncertainty compared to a household that only grows paddy. An increase in crop diversification will reduce a household's dependence on environmental resources, and in turn this will reduce its sensitivity to an environmental hazard. A few attributes such as the 'household with exterior walls built from weak construction material' or 'household that did not have access to farm mechanisation' are binary categorical (No 0, Yes 1).

The attributes are averaged using Equation (II), to calculate the value of each sub-dimension:

$$S_h = \frac{\sum_{i=1}^n v_i \text{Index}_{a_s}}{\sum_{i=1}^n v_i} \dots \dots \dots (II)$$

Where S_h is one of the sub-dimensions of sensitivity or adaptive capacity for a household h . v_i is the weight assigned to each indicator; for equal weights, each value of v_i equals to 1 and $\sum_{i=1}^n v_i = n$. For example, household level sensitivity to floods in Upper Assam has five sub-dimensions, and n is the number of attributes in each sub-dimension. Once each sub-dimension is estimated, they are averaged using Eq. (iii) to obtain the major components, i.e. SI, EI, and AI:

$$M_h = \frac{\sum_{i=1}^n w_i S_h}{\sum_{i=1}^n w_i} \dots \dots \dots (III)$$

Where M_h is an IPCC recognised component of vulnerability (i.e. sensitivity, exposure, or adaptive capacity) for a household h , weight w_i is determined by the number of sub-

³⁵ None of the households in the sample had reported selling or mortgaging assets on all three occasions, namely during flood, aftermath of flood, and between two flood events.

dimensions that contributes to a particular major component, and S_h is value of sub-dimensions comprising a major component of vulnerability. After sensitivity, adaptive capacity, and exposure are estimated, the three major components were combined using the following equation:

$$VI_h = (EI_h - AI_h)SI_h \dots\dots\dots(IV)$$

Where VI_h , EI_h , AI_h and SI_h are index values representing vulnerability, exposure, adaptive capacity and sensitivity, respectively, for the household h . The value of these indices ranges from -1 (least vulnerable) to +1 (most vulnerable).

8.2.2 *The analytic hierarchy process*

Previous vulnerability assessments have assigned weights of indicators in two ways: A first method (see Vincent 2007, Hahn et al. 2009) assigns equal weight to all the indicators based on the assumption that all are of equal importance. For example, Hahn et al. (2009) construct a district level Livelihoods Vulnerability Index (LVI) by aggregating a set of theory-driven major components (socio-demographics, livelihoods, social networks, health, food and water security, natural disasters and climate variability). Hahn et al. (2009) applies equal weight to all major components. A second method (see Eakin and Bojórquez-Tapia 2008, Eakin et al. 2011, Aulong et al. 2012) uses a specific methodology to determine relative importance of different indicators. The second method is based on the underlying assumption that importance of an indicator will vary from one place to another depending on contextual factors (e.g. culture, policy, institutions, and infrastructure). The indicator-approach based vulnerability assessments have usually adopted the equal weighted design. Since vulnerability is context specific, the major components, sub-dimensions, or attributes are unlikely to carry equal weight between contexts. However, little attention has been given to the quantitative characterisation of the relative importance of particular indicators (Eakin and Bojórquez-Tapia 2008, p. 112). Eakin and Bojórquez-Tapia (2008) suggest that without an explicit method for comparatively weighting and aggregating household-level variables, it will be difficult to use livelihood analysis to compare households in terms of vulnerability. They use multi-criteria decision analysis (MCDA) and fuzzy logic to assign weights to indicators of rural livelihoods vulnerability in the state of Tamaulipas, Mexico (Eakin and Bojórquez-Tapia 2008). In a study about the South Indian farmers, Aulong et al. (2012) uses

the analytic hierarchy process (AHP), which is a MCDA tool, to organise the indicators of adaptive capacity into a hierarchic matrix. In this thesis, I adopt the AHP to assign weights of the major components, sub-dimensions, and attributes of the vulnerability in the study areas. Based on the pairwise comparisons of criteria that characterise the alternatives under study (Saaty 1980), the AHP permits a complex decision making process to be decomposed into a hierarchical structure of sub-problems.

I have organised the major components, sub-dimensions, and attributes of vulnerability in a 5-tier hierarchy (see Figures 4.1 and 4.2). Overall aim of this analysis is represented at the top level. It is to reduce vulnerability of a household to a specific environmental hazard, either drought or flood. The second tier is comprised of the major components of vulnerability (viz. sensitivity, adaptive capacity, and exposure). To reduce a household's vulnerability to drought or flooding, the aim is to enhance adaptive capacity and reduce exposure and sensitivity. The sub-dimensions of sensitivity, exposure, and adaptive capacity are represented in the third tier. For example, the five sub-dimensions of household sensitivity to flooding in Upper Assam are health, wellbeing, water, food, and environmental dependence of a household's livelihoods. The fourth tier of the hierarchy is comprised of attributes that form each of the sub-dimensions. For example, the water sub-dimension for households in the flood affected study area includes average time taken by a member of the household to collect drinking water for a normal day, storage of drinking water for consumption during inundation, arrangement of safe water for consumption during inundation, and raising the height of the wall surrounding the well or height of the tube-well. The fifth tier consists of indicators derived from the survey; each of these is linked to an attribute at the fourth level of hierarchies. For example, a household could store drinking water for consumption either 'during the inundation' or in 'immediate aftermath of flood'.³⁶ The sub-dimensions and indicators of exposure are arranged in a 4-tier hierarchy.

Expert workshops have been organised in Kunming, China, and Guwahati, India to conduct the pairwise comparisons for the respective study areas in Baoshan County and Upper Assam. The expertise of the workshop participants includes climate change adaptation (CCA), disaster management, rural development, public policy, gender, migration, and livelihoods. These experts are familiar with either the study area in Baoshan County or Upper

³⁶ The lowest tier, which is comprised of indicators, is not presented in Figures 4.1 and 4.2. A description of these indicators could be found in Chapter 6 and 7.

Assam. Eakin and Bojórquez-Tapia (2008, p. 119) considers the process of pairwise comparison a valuable aspect of the research process. It involves experts to deliberate upon the relative contribution of each indicator in influencing vulnerability (Eakin and Bojórquez-Tapia 2008, p. 119). The experts in Guwahati have undertaken 197 pairwise comparisons, and their counterparts in Kunming have undertaken 151 pairwise comparisons. Each expert had to select the most important asset within each pair of attribute, sub-dimension, and major component based on a subjective assessment of their relative contribution in either enhancing adaptive capacity or reducing sensitivity, and in turn reducing vulnerability. This subjective judgement is influenced by the experience and knowledge of an individual expert (an outcome of existing theory, available literature, or key-informant interviews) undertaking the pairwise comparisons.

The actual values from survey are not considered in the AHP (Eakin and Bojórquez-Tapia 2008, p. 117). The attributes, sub-dimensions, and major components are compared in abstract. An illustration of the process involved in such pairwise comparison could be provided by rationale used to compare attributes of the physical assets within the adaptive capacity hierarchy. With the overall aim of reducing the vulnerability of a household to flooding by building adaptive capacity, what is the importance of making structural changes in the house to address flood impacts compared to access to boats or rafts for transport during the flood? The selected asset is assigned a score according to its importance. Saaty (1980) recommends a 9 points scale to assess the relative importance between paired assets. The scores range between 1 (equal importance) to 9 (extreme importance). A score of 1 implies that both assets in a pair are equally important. A score of 9 implies that the selected asset is of extreme importance in comparison to the other asset in the pair (see Table 8.1). These pairwise comparisons are transformed into the ratio-scale numbers through the eigenvector method. The ratio-scale numbers represent the relative local weight and the global weights (Eakin and Bojórquez-Tapia 2008, p. 119). The local weight represents the relative importance of the attributes, sub-dimensions, and major component belonging to a specific nest in the hierarchy to the level immediately above. The relative importance of an attribute, sub-dimension, and major component to the overall goal is indicated by the global weight. These weights are combined with the standardised survey data to generate index values for sensitivity, adaptive capacity, and exposure at the household level.

Table 8.1: Semantic scale of Saaty

Value	Definition
1	Equal importance
3	Moderate importance
5	Strong importance
7	Very strong importance
9	Extreme importance
2,4,6,8	Intermediate value

Source: Saaty 1980

8.3 Results

8.3.1 Findings from the Eastern Brahmaputra river sub-basin, Upper Assam, India

Table 8.2.1a presents an overview of the household level sensitivity to flood among remittance-recipient and non-recipient households in the Upper Assam. The differences between these two groups at the sub-dimension level are not significant. Rather, certain differences between these two groups of household are significant at the attribute level. One of the attributes of the water sub-dimension is average time taken by a household member to collect drinking water required for a household's consumption on a normal day. It indicates a household's access to drinking water (Hahn et al. 2009). A member of remittance-recipient household took longer to accomplish this task (30.8 minutes) than a member of non-recipient household (26.6 minutes) (Pr=0.017). Among the attributes of environmental dependence, the results for crop diversification index (Pr=0.051) and dependence on crop income (Pr=0.025) are significant. Mandal (2010) suggests that farmers in Assam have adopted crop-diversification as a strategy to avoid crop losses due to frequent flood. Remittance-recipient households grew fewer crops than non-recipient households. This is indicated by the higher crop diversification index among remittance-recipient households. The sensitivity of a household could rise if it is predominantly dependent on crop income (Adger 1999). However, the farming in this study area is subsistence in nature. During the year preceding the survey, the average crop income in non-recipient and remittance recipient households was estimated to be USD 108 and USD 95, respectively.

Among remittance-recipient households, the length of time ('duration') for which a household have received remittances from a migrant worker influences a household's sensitivity to floods (see Table 8.2.1b). The median value of duration over which remittance has been received by the households in the study area is used to distinguish between short-

(below median) and long-duration households (above median). At the sub-dimension level, access to drinking water was marginally better among long-duration households than short-duration households ($Pr=0.091$). A large number of remittance-recipient households had not raised height of the wall that surrounds the well or height of the tube-well to prevent drinking water from being contaminated by flood water. Among these households, more long-duration households had adopted this structural modification of the well or tube-well ($Pr=0.001$). The differences between short- and long-duration households are not significant for other sub-dimensions of sensitivity. Although, there are some significant differences between these two groups of households at the attribute level. Poor housing quality and dependence on environmental resources for cooking fuel would increase a household's sensitivity to flood (Sharma and Patwardhan 2008, Rajesh et al. 2014). Among the attributes of environmental dependence, more short-duration households had used weak construction material (e.g. bamboo) to build the external walls of their dwelling ($Pr=0.012$) and were dependent on environmental resources for cooking fuel ($Pr=0.029$). The sensitivity to climate stressors could be reduced through a diversification from farming to non-farming activities (Hassan and Nhemachena 2008). Short-duration households had access to more non-farm income sources than long-duration households ($Pr=0.098$). However, almost twice the number of long-duration households (40.4 percent) reported a reduction in agricultural assets (land, livestock, seeds, or tools) due to floods compared to short-duration households (22.4 percent) ($Pr = 0.057$).

Short-distance households receive remittances from migrant workers in destinations within the northeast India. The households that receive remittances from migrant workers based in other parts of India are referred as long-distance households. Access to water was marginally better among short-distance households ($Pr=0.006$), mainly since more of them had arranged safe drinking water for consumption during flood period ($Pr=0.008$) and raised height of the wall surrounding the well and height of tube-well ($Pr=0.014$). Despite these findings, it should be noted that two-thirds of households in Upper Assam did not have access to safe drinking water supply during flood. The differences between short-distance and long-distance households were significant for several attributes of environmental dependence sub-dimension. Long-distance households grew more types of crop ($Pr=0.0002$) and were more dependent crop income ($Pr=0.007$) than short-distance households. On an average, long-distance households grew 2.1 types of crop compared to 1.3 types of crop among short-

distance households. Long-distance households have access to more non-farm income sources than short-distance households ($Pr=0.003$). More short-distance households had lost agricultural assets due to floods than long-distance households ($Pr=0.013$). Nearly half of short-distance households (44.4 percent) had reported to have lost agricultural assets due to floods compares to one-fifth of long-distance households (21.4 percent).

The attributes of household level adaptive capacity have been framed in a negative manner. For example, financial assets in Upper Assam include two attributes: 'did not have access to formal financial institution' and 'did not have access to insurance'. Therefore, higher the value of a sub-dimension, lower will be the access of a household to that sub-dimension. At the sub-dimension level, the differences between remittance-recipient and non-recipient households are significant for human assets only ($Pr=0.013$). Remittance-recipient households had better access to information. Non-recipient households had access to fewer types of communication devices than remittance-recipient households ($Pr=0.082$). About half of the remittance-recipient households did not have access to alternative livelihood opportunities in the locality or nearby areas, compared to a quarter of non-recipient households ($Pr=0.082$). Among the attribute of natural assets, the farm size diversification index is higher among remittance-recipient households than non-recipient households ($Pr=0.0903$). Also, more remittance-recipient households did not have access to farm mechanisation than non-recipient households ($Pr=0.027$).

As discussed in chapters 6 and 7, migration cycle is an important determinant of adaptive capacity. Households that have received remittances over a longer time period have better capacities than short-duration households. For example, long-duration households have better access to financial assets than short-duration households ($Pr=0.018$). Nearly, one-third of short-duration households did not have access to a formal financial institutions compared to one-fifth of long duration households ($Pr=0.038$). While over two-thirds of short-duration households reported did not have an insurance, only half of long-duration households did not have an insurance policy ($Pr=0.029$). Moreover, access to physical assets is better among long-duration households than short-duration households ($Pr=0.000$). Primarily because more long-distance households had made structural changes in the dwelling in response to

Table 8.2.1.a: Sub-dimensions and attributes of sensitivity by remittance-recipient status of the household, Upper Assam, the Eastern Brahmaputra sub-basin.*

Sub-dimension	Non-recipient households	Recipient households	Attribute	Non-recipient households	Recipient households
Health	0.1339	0.1480	Reduced health expenditure due to flood	0.1339	0.1480
Well being	0.0586	0.0655	Reduced educational expenditure due to flood	0.1246	0.1480
			Reduced clothes expenditure due to flood	0.2077	0.2471
			Sold or mortgaged household assets due to flood	0.3458	0.3359
Water	0.1151	0.1169	Average time to collect drinking water for a normal day	0.1477	0.1712**
			Did not store drinking water for consumption during inundation	0.7975	0.8050
			Did not filter or boil drinking water for consumption during inundation	0.4268	0.4150
			Did not raise height of the wall surrounding the well or height of the tube-well in response to flood	0.5888	0.5830
Food	0.0728	0.0771	Relied on less preferred food items due to flood	0.3068	0.2992
			Restricted food consumption among adults due to flood	0.5327	0.5772
			Collected wild food due to flood	0.2321	0.2780
			Did not spend savings to buy food due to flood	0.4626	0.4556
			Begged for food due to flood	0.2835	0.3224
Environmental dependence	0.0803	0.0798	Above median income from crop sale	0.3489	0.2625**
			Crop diversification index	0.4994	0.5504*
			Non-farm income diversification index	0.3890	0.4089
			Reduction in agricultural assets due to flood	0.3645	0.3784
			Household with exterior walls made of weak construction material	0.7382	0.7722
			Dependence on environmental resources for primary source of cooking fuel	0.8959	0.8842

* The sub-dimensions and attributes have been standardised. Legend: * p<.1; ** p<.05; *** p<.01
Source: Computed by author from HICAP Migration Dataset

Table 8.2.1.b: Sub-dimensions and attributes of sensitivity by the duration status of the remittance recipient household, Upper Assam, the Eastern Brahmaputra sub-basin.*

Sub-dimension	Short duration households	Long duration households	Attribute	Short duration households	Long duration households
Health	0.0071	0.0294*	Reduced in health expenditure due to flood	0.0071	0.0294*
Well being	0.0074	0.0115	Reduced in educational expenditure due to flood	0.0142	0.0184
			Reduced clothes expenditure due to flood	0.0321	0.0404
			Sold or mortgaged household assets due to flood	0.0428	0.0919*
Water	0.1655	0.1586*	Average time to collect drinking water for a normal day	0.1673	0.1623
			Did not store drinking water for consumption during inundation	0.9500	0.9632
			Did not filter or boil drinking water for consumption during inundation	0.9143	0.8676
			Did not raise height of the wall surrounding the well or height of the tube-well	0.8928	0.7353***
Food	0.0290	0.0324	Relied on less preferred food items due to flood	0.0214	0.0551*
			Restricted food consumption among adults due to flood	0.0536	0.0993*
			Collected wild food due to flood	0.0286	0.0073
			Did not spend savings to buy food due to flood	0.9428	0.8529**
			Begged for food due to flood	0.0000	0.0588***
Environmental dependence	0.0835	0.0813	Above median income from crop sale	0.2643	0.2794
			Crop diversification index	0.5598	0.5293
			Non-farm income diversification index	0.3911	0.4228**
			Reduction in agricultural assets due to floods	0.2245	0.4042*
			Household with external walls made of weak construction material	0.8214	0.6912**
			Dependence on environmental resources for the primary source of cooking fuel	0.9286	0.8456**

* The sub-dimensions and attributes have been standardised. Legend: * p<.1; ** p<.05; *** p<.01
Source: Computed by author from HICAP Migration Dataset.

Table 8.2.1.c: Sub-dimensions and attributes of sensitivity by distance of the remittance-recipient status of the household from destination, Upper Assam, the Eastern Brahmaputra sub-basin.*

Sub-dimension	Short distance households	Long distance households	Attribute	Short distance households	Long distance households
Health	0.0220	0.0131	Reduced health expenditure due to flood	0.0220	0.0131
Well being	0.0117	0.0070	Reduced educational expenditure due to flood	0.0184	0.0131
			Reduced clothes expenditure due to flood	0.0441	0.0263
			Sold or mortgaged household assets due to flood	0.0919	0.0460
Water	0.1566	0.1674***	Average time to collect drinking water for a normal day	0.1631	0.1580
			Did not store drinking water for consumption during inundation	0.9412	0.9737
			Did not filter or boil drinking water for consumption during inundation	0.8456	0.9408***
			Did not raise height of the wall surrounding the well or height of the tube-well in response to flood	0.7647	0.8750**
Food	0.0317	0.0294	Relied on less preferred food items due to flood	0.0588	0.0164**
			Restricted food consumption among adults due to flood	0.0919	0.0559
			Collected wild food due to flood	0.0220	0.0131
			Did not spend savings to buy food due to flood	0.8456	0.9539***
			Begged for food due to flood	0.0368	0.0197
Environmental dependence	0.0842	0.0816	Above median income from crop sale	0.2059	0.3487***
			Crop diversification index	0.6174	0.4764***
			Non-farm income diversification index	0.4375	0.3821***
			Reduction in agricultural assets due to flood	0.4444	0.2143**
			Household with exterior walls made if weak construction material	0.7500	0.7566
			Dependence on environmental resources for the primary source of cooking fuel	0.8676	0.9079

* The sub-dimensions and attributes have been standardised. Legend: * p<.1; ** p<.05; *** p<.01
Source: Computed by author from HICAP Migration Dataset.

flood impacts (Pr=0.000), mechanised farming in response to flood impacts (Pr=0.000), and access to boat or raft (Pr=0.001) and storage options during flood (Pr=0.000). The difference in access to social assets between short- and long-duration households is not significant. In context of its attributes, long-duration households had better access to borrowing during flood (Pr=0.048) and collective action on flood relief, recovery and preparedness (Pr=0.000). Among the attributes of natural assets, over three-fourths of short-duration households and nearly half of long-duration households had not made any changes in agricultural practices due to flooding (Pr=0.000).

While long-distance households have better access to natural assets, short-distance households have better access to social and physical assets. Long-distance households have better access to natural assets compared to short-distance households (Pr=0.003) in terms of larger farm size (Pr=0.000) and more number of livestock (Pr=0.017). While half of short-distance households did not make any changes in agricultural practices due to floods, nearly three-quarters of long-distance households had reported to have not made any changes (Pr=0.029). Short-distance households have marginally better access to social assets than long-distance households (Pr=0.015). For example, almost three-fourth of the long-distance households did not have access to borrowing during floods compared to half of short-distance households (Pr=0.082). Fewer short-distance households had not participated in collective action on flood relief, recovery, and preparedness (Pr=0.001). The short-distance households also have better access to physical asset (Pr=0.082). In comparison to three-fifths of short-distance households, nearly three-fourths of long-distance households did not have access to storage during floods (Pr=0.056).

Table 8.2.1.d: Sub-dimensions and attributes of adaptive capacity by remittance-recipient status of the household, Upper Assam, the Eastern Brahmaputra sub-basin.*

Sub-dimension	Non-recipient households	Recipient households	Attribute	Non-recipient households	Recipient households
Financial assets	0.1826	0.1563	Did not have access to formal financial institution	0.3029	0.2510
			Did not have an insurance	0.6916	0.6293
Natural assets	0.1452	0.1528	Farm size diversification index	0.6498	0.6859*
			Livestock diversification index	0.2903	0.2765
			Did not make changes in agricultural practices in response to flood	0.7476	0.7452
Social assets	0.1236	0.1200	Did not have access to flood assistance	0.0934	0.1081
			Did not have access to financial borrowing during floods	0.6542	0.5946
			Did not participate in collective action on flood relief, recovery, or preparedness	0.2243	0.2548
Human assets	0.2827	0.2635**	Communication device diversification index	0.4687	0.4452*
			Did not have access to alternative livelihoods opportunity in the locality or nearby areas	0.7414	0.6757*
Physical assets	0.0872	0.0910	Did not make structural changes in the house due to flood	0.1994	0.1853
			Did not mechanise farming to address flood impacts	0.6106	0.6988**
			Did not have access to boats or rafts during flood	0.1776	0.1776
			Did not have access to storage options during flood	0.6698	0.6795

* The sub-dimensions and attributes have been standardised. Legend: * p<.1; ** p<.05; *** p<.01
Source: Computed by author from HICAP Migration Dataset.

Table 8.2.1.e: Sub-dimensions and attributes of adaptive capacity by duration status of the remittance-recipient household, Upper Assam, the Eastern Brahmaputra sub-basin.*

Sub-dimension	Short duration households	Long duration households	Attribute	Short duration households	Long duration households
Financial assets	0.1850	0.1293**	Did not have access to formal financial institution	0.3071	0.1985**
			Did not have an insurance	0.6928	0.5662**
Natural assets	0.2076	0.1914	Farm size diversification index	0.6860	0.6790
			Livestock diversification index	0.2654	0.2702
			Did not make changes in agricultural practices in response to flood	0.7846	0.4677***
Social assets	0.1282	0.1181	Did not have access to flood assistance	0.0857	0.1250
			Did not have access to financial borrowing during flood	0.7391	0.5472**
			Did not participate in collective action on flood relief, recovery, or preparedness	0.8667	0.5000***
Human assets	0.5480	0.5512	Communication device diversification index	0.9714	0.9853
			Did not have access to alternative livelihoods opportunity in the locality or nearby areas	0.3778	0.2000*
Physical assets	0.1726	0.0944***	Did not make structural changes in the house due to flood	0.2637	0.1192***
			Did not mechanise farming to address flood impacts	0.6364	0.2708***
			Did not have access to boats or rafts during flood	0.8989	0.7013***
			Did not have access to storage options during flood	0.7742	0.5517***

* The sub-dimensions and attributes have been standardised. Legend: * p<.1; ** p<.05; *** p<.01
Source: Computed by author from HICAP Migration Dataset.

Table 8.2.1.f: Sub-dimensions and attributes of adaptive capacity by distance of the remittance-recipient status of the household from destination, Upper Assam, the Eastern Brahmaputra sub-basin.*

Sub-dimension	Short distance households	Long distance households	Attribute	Short distance households	Long distance households
Financial assets	0.1666	0.1484	Did not have access to formal financial institution	0.2720	0.2303
			Did not have an insurance	0.6470	0.6381
Natural assets	0.2147	0.1861***	Farm size diversification index	0.7497	0.6201***
			Livestock diversification index	0.3145	0.2278**
			Did not make changes in agricultural practices in response to floods	0.5333	0.7183**
Social assets	0.0954	0.1388**	Did not have access to flood assistance	0.0735	0.1184
			Did not have access to financial borrowing during floods	0.5510	0.7170*
			Did not participate in collective action on flood relief, recovery, or preparedness	0.5591	0.7921***
Human assets	0.5396	0.5661	Communication device diversification index	0.9669	0.9901**
			Did not have access to alternative livelihoods opportunity in the locality or nearby areas	0.2381	0.3488
Physical assets	0.1250	0.1469*	Did not make structural changes in the house due to flood	0.3928	0.4711
			Did not mechanise farming to address flood impacts	0.5172	0.4138
			Did not have access to boats or rafts during flood	0.7711	0.8617
			Did not have access to storage options during flood	0.6083	0.7218*

* The sub-dimensions and attributes have been standardised. Legend: * p<.1; ** p<.05; *** p<.01

Source: Computed by author from HICAP Migration Dataset

The differences between remittance-recipient and non-recipient households in context of the major components of vulnerability (sensitivity, adaptive capacity, and exposure) are marginal and not significant. The sensitivity of remittance-recipient households is marginally higher than non-recipient households (sensitivity index: NRHH: 0.0170, RRHH: 0.0178). Remittance-recipient households have a marginally higher adaptive capacity than non-recipient households (adaptive capacity index: NRHH: 0.0333, RRHH: 0.0320). The exposure among remittance-recipient households is marginally higher than non-recipient households (exposure index: NRHH: 0.1072, RRHH: 0.1079). The adaptive capacity of long-duration households is higher than that of short-duration household (Pr=0.0000). Although the sensitivity and exposure of long-duration households are a little higher than short-duration household, these findings are not significant. The short-distance households are more exposed to floods than the long-distance households (Pr=0.0027).

Table 8.2.1.g: An overview of vulnerability to floods in Upper Assam, the Eastern Brahmaputra sub-basin.

Criterion	Major component	MCDA		Equal weight	
		Non-recipient households	Recipient households	Non-recipient households	Recipient households
Receipt of remittance	Sensitivity	0.0170	0.0178	0.4115	0.4233
	Adaptive capacity	0.0333	0.0320	0.4770	0.4372
	Exposure	0.1072	0.1079	0.2240	0.2338
Duration of remittance receipt		Short duration households	Long duration households	Short duration households	Long duration households
	Sensitivity	0.0111	0.0114	0.3944	0.3814*
	Adaptive capacity	0.0394	0.0320***	0.6095	0.4672***
Distance to destination	Exposure	0.1103	0.1203	0.2429	0.2537
		Short distance households	Long distance households	Short distance households	Long distance households
	Sensitivity	0.0112	0.0112	0.3872	0.3902
	Adaptive capacity	0.0360	0.0356	0.5252	0.5571
	Exposure	0.1299	0.1036***	0.2807	0.2216***

* The sub-dimensions and attributes have been standardised. Legend: * p<.1; ** p<.05; *** p<.01.

Source: Computed by author from HICAP Migration Dataset.

The household level vulnerability of remittance-recipient and non-recipient households in the study area of Upper Assam is identical (vulnerability index: NRHH: 0.0001, RRHH: 0.0001). This result, however, is not significant. The vulnerability of short-duration households to floods is marginally lower than that of long-duration households (vulnerability index: SDHH: 0.00009, LDHH: 0.00013) (Pr=0.0097). Similarly, the vulnerability of long-distance households to floods is marginally lower than that of short-distance households (vulnerability index: SDSHH: 0.00014, LDSHH: 0.00011) (Pr=0.0879).

8.3.2 Findings from the Upper Mekong-Salween river sub-basin, Baoshan County, Yunnan, China

An overview of the household level sensitivity to drought in Baoshan County is provided in Table 8.2.2.a Among the three sub-dimensions of sensitivity to drought, the difference in environmental dependence of remittance-recipient and non-recipient households is marginal but significant (Pr=0.001). Rain-fed farm size diversification is one of the attributes of environmental dependence. Non-recipient households had larger rain fed farms than remittance-recipient households (Pr=0.000). The average size of rain fed farm in remittance-recipient and non-recipient households is estimated to be 0.1 hectare and 0.4 hectares, respectively. Besides, non-recipient households had access to more non-farm income sources than remittance-recipient households (Pr=0.000). The differences in well being and water sub-dimensions between remittance-recipient and non-recipient households are not significant. However, the differences in context of some of their attributes are significant. A member of a non-recipient household (9.7 minutes) took longer to collect drinking water required for the household's consumption on a normal day than the member of a remittance-recipient household (6.5 minutes) (Pr=0.065). The storage of safe drinking water for consumption during drought is not a common practice in the study area. The difference between remittance-recipient and non-recipient households is marginal (Pr=0.038).

Table 8.2.2.a: Sub-dimensions and attributes of sensitivity by remittance-recipient status of the household, Baoshan County, Yunnan, the Upper Mekong-Salween sub-basins.*

Sub-dimension	Non-recipient households	Recipient households	Attribute	Non-recipient households	Recipient households
Well being	0.0510	0.0409	Reduced clothes expenditure due to drought	0.1053	0.1113
			Relied on less preferred food items due to drought	0.0997	0.0607*
Water	0.1373	0.1353	Average time to collect drinking water for a normal day	0.0365	0.0230*
			Did not store drinking water for consumption during drought	0.7174	0.7165
			Did not filter or boil drinking water for consumption during drought	0.9529	0.9109**
			Dependency on unprotected or open water sources	0.2327	0.2591
Environmental dependence	0.0688	0.0812***	Above median income from crop sale	0.0070	0.0023
			Crop diversification index	0.3891	0.3747
			Non-farm income diversification index	0.5381	0.7140***
			Rain-fed farm size diversification index	0.8107	0.8871***
			Reduction in agricultural assets due to drought	0.0360	0.0405
			Dependence on environmental resources for the primary source of cooking fuel	0.4958	0.5284

* The sub-dimensions and attributes have been standardised. Legend: * p<.1; ** p<.05; *** p<.01 Source: Computed by author from HICAP Migration Dataset

The access to water was marginally better among short-duration households than long-duration households (Pr=0.001). Over three quarters of long-duration households had not stored drinking water for consumption during the drought compared to three-fifths of short-duration households (Pr=0.093). Also, nearly one-third of long-duration households and one-

fifth of short-duration households were dependent on unprotected or open water sources (Pr=0.016). The difference in environmental dependence of long-duration and short-duration households is not significant at the sub-dimension level. However, two of its attributes - rain-fed farm size diversification index and dependence on environmental resources for the primary sources of cooking fuel – are significant. Short-duration households (0.2 hectare) had marginally larger rain-fed farms than long-duration households (0.1 hectare) (Pr=0.053). Nearly, two-fifth of short-duration households were dependent on environmental resources for the primary source of cooking fuel compared to less than half of the long-duration households (Pr=0.070).

Table 8.2.2.b: Sub-dimensions and attributes of sensitivity by duration status of the remittance-recipient household, Baoshan County, Yunnan, the Upper Mekong-Salween sub-basins.*

Sub-dimension	Short duration households	Long duration households	Attribute	Short duration households	Long duration households
Well being	0.2380	0.2812	Reduced clothes expenditure due to drought	0.7027	0.7647
			Relied on less preferred food items due to drought	0.0769	0.4545**
Water	0.0344	0.0551***	Average time to collect drinking water for a normal day	0.0217	0.0211
			Did not store drinking water for consumption during drought	0.6061	0.7941*
			Dependency on unprotected or open water sources	0.1847	0.3034**
Environmental dependence	0.0841	0.0865	Above median income from crop sale	0.0532	0.0509
			Crop diversification index	0.3487	0.3578
			Non-farm income diversification index	0.6511	0.6983
			Rain-fed farm size diversification index	0.8550	0.8876*
			Reduction in agricultural assets due to drought	0.0382	0.0207
			Dependence on environmental resources for the primary source of cooking fuel	0.5732	0.4690*

* The sub-dimensions and attributes have been standardised. Legend: * p<.1; ** p<.05; *** p<.01

Source: Computed by author from HICAP Migration Dataset

Among the five sub-dimensions of adaptive capacity, the differences between remittance-recipient and non-recipient households are significant in context of natural, human, and physical assets. Non-recipient households had marginally better access to natural assets than remittance-recipient households (Pr=0.033). On an average, non-recipient households had access to more farm land than remittance-recipient households (Pr=0.0001). Majority of households in this study area had not made any changes to their farming practices in response to drought. This included two-thirds of non-recipient households and three quarters of remittance-recipient households (Pr=0.002). Non-recipient households had better access to human asset than remittance-recipient households (Pr=0.001), particularly in terms of access to alternative livelihoods opportunities in locality or nearby areas (Pr=0.001). Non-recipient households also had marginally better access to physical assets than remittance-recipient households (Pr=0.010). Although majority of households did not have a tractor, power-tiller, and mechanised thresher. Fewer non-recipient households did not have any of these farm machines than remittance-recipient household (Pr=0.011). Most households did not have access to storage during drought. Comparatively fewer non-recipient households did not have access to storage than remittance-recipient households (Pr=0.003).

The differences in access to natural, social, and physical assets between short- and long-duration households are significant. Long-duration households have better access to natural and social assets than short-duration households. Farm size diversification index was higher among long-duration households than short-duration households (Pr=0.001). These households had reported two major changes in farming practice: Reduction in land area under water intensive crops and changes in farming calendar. In comparison to long-duration households, over twice the percentage of short-duration households had not made any changes in the farming practice in response to drought (Pr=0.032). Similarly, one-fifth of long-duration households had not made changes in livestock rearing practices (e.g. reduction in number of cattle or poultry) in response to drought compared to nearly two-fifths of short-duration households (Pr=0.035). During the drought, long-duration households had a better access to assistance (Pr=0.003) and borrowing (Pr=0.018) than short-duration households. The social network and government institutions were common sources of drought related assistance. Nearly, one-fifth of remittance-recipient households had borrowed money from their social network during drought. Regarding access to physical assets, short-duration

households had better access to farm mechanisation (Pr=0.027), and storage options during drought (Pr=0.033).

Table 8.2.2.c: Sub-dimensions and attributes of adaptive capacity by remittance-recipient status of the household, Baoshan County, Yunnan, the Upper Mekong-Salween sub-basins.*

Sub-dimension	Non-recipient households	Recipient households	Attribute	Non-recipient households	Recipient households
Financial assets	0.1967	0.2056	Did not have access to formal financial institution	0.0083	0.0081
			Did not have a crop or livestock insurance	0.8282	0.8663
Natural assets	0.1526	0.1643**	Farm size diversification index	0.7812	0.8348***
			Livestock diversification index	0.3233	0.2908
			Did not make changes in farming practices in response to drought	0.6787	0.7935***
			Did not make changes in livestock rearing practices in response to drought	0.5540	0.5506
Social assets	0.1719	0.1780	Did not have access to drought assistance	0.2548	0.2712
			Did not have access to financial borrowing during drought	0.6260	0.6194
			Did not participate in collective agreement on water sharing	0.8476	0.8907
Human assets	0.3306	0.3662***	Communication device diversification index	0.3147	0.3201
			Did not have access to alternative livelihoods opportunity in locality or nearby areas	0.7978	0.8947***
Physical assets	0.2316	0.2526***	Did not have access to irrigation	0.5734	0.6113
			Did not mechanise farming	0.7479	0.8340**
			Did not have access to storage options during drought	0.8476	0.9271***

* The sub-dimensions and attributes have been standardised. Legend: * p<.1; ** p<.05; *** p<.01

Source: Computed by author from HICAP Migration Dataset

Table 8.2.2.d: Sub-dimensions and attributes of adaptive capacity by duration status of the remittance-recipient households, Baoshan County, Yunnan, the Upper Mekong-Salween sub-basins.*

Sub-dimension	Short duration households	Long duration households	Attribute	Short duration households	Long duration households
Financial assets	0.1993	0.2059	Did not have access to formal financial institution	0.0127	0.0069
			Did not have a crop or livestock insurance	0.8344	0.8690
Natural assets	0.1050	0.0957*	Farm size diversification index	0.7861	0.8400***
			Livestock diversification index	0.2566	0.2539
			Did not make changes in farming practices in response to drought	0.4286	0.1739**
			Did not make changes in livestock rearing practices in response to drought	0.3789	0.2174*
Social assets	0.1532	0.0801***	Did not have access to drought assistance	0.3376	0.1862***
			Did not have access to financial borrowing during drought	0.4324	0.2143**
Human asset	0.0892	0.0889	Communication device diversification index	0.3181	0.3244
			Did not have access to alternative livelihoods opportunity in locality or nearby areas	0.1143	0.0000
Physical asset	0.2300.	0.2575**	Did not have access to irrigation	0.5185	0.5111
			Did not mechanise farming	0.7707	0.8690**
			Did not have access to storage options during drought	0.5405	0.7778**

* The sub-dimensions and attributes have been standardised. Legend: * p<.1; ** p<.05; *** p<.01

Source: Computed by author from HICAP Migration Dataset.

Among the major components of vulnerability to drought, adaptive capacity of remittance-recipient households was marginally lower than non-recipient households (Pr=0.0007). Among the remittance-recipient households, the adaptive capacity of long-duration households to drought was marginally higher than short-duration households (Pr=0.0989).

Former group of households was also less exposed to drought (Pr=0.0249). The vulnerability of the remittance-recipient households to drought was marginally lower than the non-recipient households (vulnerability index: NRHH: -0.00009; RRHH: -0.00011) (Pr=0.0015). The difference in the vulnerability of short-duration and long-duration households to drought is not significant (vulnerability index: SDHH: -0.00184; LDHH: -0.00130).

Table 8.2.2.e: An overview of vulnerability to drought in Baoshan County, Yunnan, the Upper Mekong-Salween sub-basins.

Criterion	Major component	MCDA		Equal weight	
		Non-recipient households	Recipient households	Non-recipient households	Recipient households
Receipt of remittance	Sensitivity	0.0301	0.0310	0.3626	0.3819**
	Adaptive capacity	0.0402	0.0433***	0.5846	0.6223***
	Exposure	0.1012	0.0965	0.2779	0.2661
Duration of remittance receipt		Short duration households	Long duration households	Short duration households	Long duration households
	Sensitivity	0.3633	0.3544	0.3633	0.3544
	Adaptive capacity	0.0285	0.0268*	0.4820	0.4870
	Exposure	0.1091	0.0982**	0.3027	0.2632***

* The sub-dimensions and attributes have been standardised.. Legend: * p<.1; ** p<.05; *** p<.01Source: Computed by author from HICAP Migration Dataset.

8.4 Discussion

According to the IPCC definition, vulnerability is a function of sensitivity, adaptive capacity, and exposure. I argue that reducing vulnerability to extreme events contributes to CCA. The effects of remittance, duration over which remittance has been received by a household, and distance to destination on attributes of sensitivity and adaptive capacity had been explored in chapters 6 and 7. Therefore, chapter 8 presents an indicator-based vulnerability assessment, which characterises the present state of a system, to assess its vulnerability to a major extreme event (drought or flood). It also compares the characteristics of vulnerability between different groups of households (e.g. remittance-recipient and non-recipient, short- and long-duration, and short- and long-distance). This study builds upon the previous research on vulnerability assessment in following ways. First, it examines the vulnerability of

remittance-recipient and non-recipient households to a major extreme event. Second, the selection of indicators incorporates local knowledge through the FGDs. The characteristics of a system, the type of hazard, the local context, and the time period would shape the vulnerability of a system to a hazard. In this thesis, a household is the unit of analysis. The indicators of vulnerability were identified based on the FGDs in study area. The incorporation of feedback from FGD participants in selection of indicators ensured that the experience and knowledge of the residents is internalised into this vulnerability framework. Third, the local knowledge is supplemented by literature review and expert inputs. The inputs from literature review and experts were used to categorise the indicators within various attributes, sub-dimensions, and major components. The weights of major components, sub-dimensions, and attributes of the vulnerability were determined through the AHP. The pairwise comparisons that form the basis of these weights were undertaken by a group of experts, who belong to different sectors and disciplines, and are knowledgeable about one of the study areas. In this manner, local knowledge about importance of disaster impacts, responses, and capacities was supplemented by the inputs from experts. Fourth, primary data from village and household surveys are used to construct these major components, sub-dimensions, attributes, and indicators of vulnerability. Fifth, the MCDA provides a transparent method for weighting individual variables (Eakin and Bojórquez-Tapia 2008, p. 114). The context specific nature of vulnerability suggests that the importance of major components, sub-dimensions, or attributes, and hence, their weights would vary from one location to another depending on contextual factors (e.g. culture, policy, institutions, and infrastructure).

The effects of remittance are mixed across different levels of this hierarchy and different study areas. For example, the adaptive capacity of non-recipient households in Baoshan County to drought is marginally lower than that of remittance-recipient households. However, the effect of remittances on adaptive capacity in Upper Assam is not significant. The disaggregation of vulnerability into major components, sub-dimensions, and attributes provide an insight regarding household characteristics that shape a household's vulnerability to an environmental hazard (e.g. drought or flood). I have organised the major components, sub-dimensions, and attributes of sensitivity and adaptive capacity in a 5-tier hierarchy. Though the effect of remittances on adaptive capacity to drought is significant, its effects on sensitivity and exposure to drought are not significant. Although the sensitivity and exposure of remittance-recipient households to floods in Upper Assam is marginally higher than that of

non-recipient households, and the adaptive capacity of non-recipient households is marginally lower than remittance-recipient households. However, these differences are not significant. Among the eight sub-dimensions that constitute sensitivity and adaptive capacity to drought in Baoshan County, the differences among remittance-recipient and non-recipient households in terms of environmental dependence, natural assets, human assets, and physical assets are significant. Only the difference between remittance-recipient and non-recipient households in their access to human assets is significant among the ten sub-dimensions of sensitivity and adaptive capacity to floods in Upper Assam.

In both study areas, the effect of remittances is significant for several attributes. For example, the differences between these two groups of households in Baoshan County are significant for several attributes of sensitivity to drought such as average time taken to collect water, storage of safe drinking water, non-farm income diversification, size of rain-fed farms, and reliance on less preferred food items. Among attributes of sensitivity to floods, the differences between remittance-recipient and non-recipient households are significant for the average time it takes to collect drinking water, income from crop sale, and crop diversification.

These findings from vulnerability assessments in Baoshan County and Upper Assam suggest that the effects of remittance are primarily evident at the attribute level. However, when these attributes are aggregated into sub-dimensions, and in turn the sub-dimensions are aggregated into major components, the effects of remittance tend to disappear. It is likely that effect of remittance on different attributes cancel each other upon aggregation at the next higher level. From the perspective of local adaptation planning, an increase in understanding of the effects of remittance on attributes of sensitivity and adaptive capacity may be useful. For example, knowing the differences between remittance-recipient and non-recipient households at the major component or sub-dimension level may be useful from a cognitive standpoint. However, one cannot directly reduce ‘sensitivity’ or ‘environmental dependence’. These major components or sub-dimensions will have to be unpacked into attributes (e.g. size of rainfed farm, non-primary sources of income), which are comparatively easier to address within the ambit of local plans on adaptation, development, and DRR.

The effect of remittance on vulnerability is also influenced by the constituents of sensitivity and adaptive capacity, and type of environmental hazard. For example, major impacts of the

drought in the Baoshan County are associated with the agricultural sector. The vulnerability assessment indicates that non-recipient households have fared better in terms of environmental dependence, natural assets, and physical assets than remittance-recipient households. The indicators that comprise these sub-dimensions and their attributes have been identified through FGDs, literature review, and expert inputs. Several household level responses to drought are associated with farming, livestock rearing practices, and irrigation. Even under normal circumstances, migrant workers tend to disassociate themselves from the agricultural activities, and their households are less inclined to invest in the farm sector (Tao Yang and Zhou 1999). For example, farm inputs (8th) and livestock (11th) did not feature among major uses of remittances in the study area during the 12 months preceding the survey (see Figure 5.5, p. 79). The drought impacts accentuate this investment pattern among the remittance-recipient households. These households in Baoshan County are more likely to have smaller farm size and less likely to invest in agricultural assets (e.g. water tank) and farm mechanisation.

Remittance-recipient households are using migration for work as an autonomous strategy to temporarily substitute the structural constraints in origin communities with perceived and/or actual structural opportunities available in destination. Primarily, the informal sector in urban areas provides an opportunity to the rural households to access non-farm cash income. Unlike the formal sector, it is comparatively easier for the semi-skilled or unskilled migrant workers to secure a job in the informal sector. The job profile of a migrant worker is often dynamic, and keeps changing throughout various stages of the migration cycle. The 'duration for which a household has received remittances' is a proxy for the migration cycle. This is an important criterion for exploring household level vulnerability. In Upper Assam, the vulnerability of short-duration households to floods is estimated to be marginally lower than that of long-duration households. This pattern is observed in Baoshan County as well.

8.5 Chapter conclusion

The case studies of Baoshan County and Upper Assam indicate that differences in vulnerability of remittance-recipient and non-recipient households are context specific. In drought affected in Baoshan County, the differences between these two groups of household manifest across the vulnerability hierarchy (attributes, sub-dimensions, and major components), and are significant. On the other hand, the differences between remittance and

non-recipient households in flood affected Upper Assam is largely significant at the attribute level. The type of hazard, maturity of migration flow, and governance structure has a role in shaping the consequences of migration outcomes. Next chapter will present the contribution of this thesis, summarise the major findings the findings from the two case studies, and explore the policy implications.

Chapter 9: Conclusion

9.1 Introduction

This thesis has aimed to understand the role of migration in CCA. As such, it explores the effects of circular labour migration on vulnerability to extreme events in the HKH region. It posits that the ascendancy of humanitarian approach within the climate change and migration discourse, which envisages migrants as victims of externalities like an extreme event or failure of formal social protection mechanisms, increases the risk of overlooking the possibility that migration could also be a pro-active strategy to address problems. The climate change and migration discourse tends to position environmental migration as a precursor to adaptation. In fact, empirical knowledge regarding the effects of migration outcomes (e.g. remittances) on vulnerability of remittance-recipient households in particular locations is scarce, particularly in the HKH region. The nascent academic and public discourse in this region is more usually concerned with the influence of climate change on migration motivations and estimating size of migration associated with climate change. Migration is perceived by public policy as a challenge or risk to development and adaptation within the national planning processes in this region. There is a lack of awareness and understanding regarding the complex interrelationship between migration and CCA.

This thesis attempts to shift the narrative from the pre-migration (i.e. migration decision making) to post-migration phase (i.e. effects of migration outcomes in origin communities) in the context of climate change and variability. It develops a conceptual and methodological approach for research on the complex relationship between migration and climate change adaptation. The first section of this chapter summarises the theoretical contributions of this thesis to the discourse migration and climate change adaptation. It also summarises the empirical evidence presented in the thesis from the case studies of Baoshan County and Upper Assam, which seeks to explore the effects of remittances on sensitivity and adaptive capacity of remittance-recipient households compared to households that do not have access to remittances. The empirical results assess the role of migration cycle and distance to destination in influencing the sensitivity and adaptive capacity of remittance-recipient households. The third and fourth sections of this chapter discuss the implications of these empirical findings for future research and policies. The final section of this chapter acknowledges the methodological limitations of this thesis, and discusses its theoretical and

empirical contributions to enhanced understanding of the complex relationship between migration and CCA.

9.2 Theoretical contribution of this thesis

This thesis suggests that there are some important gaps in the understanding the relationship between migration and CCA. Chapter 3 identifies the focus on environmental migration in the climate change and migration discourse as a starting point for exploring the effectiveness of migration as an adaptation strategy as one of the reasons for this gap in understanding of this complex relationship. In contrast, this thesis focuses on the post-migration phase, and suggests an approach that attempts to assess the effects of migration outcomes (e.g. remittances) irrespective of the motivation for migration.

9.2.1 Widen the focus beyond environmental migrants

The humanitarian aspect of climate change and migration discourse revolves around the protection of people displaced as a result of environmental shocks and stressors. For example, the Nansen Initiative on Disaster-Induced Cross-Border Displacement identifies the following challenge on their webpage:

Every year around the world, millions of people are *forcibly* displaced by floods, windstorms, earthquakes or droughts. Many find refuge within their own country but some have to go abroad. In the context of climate change, such movements are likely to increase. National and international response to this challenge are insufficient and protection for affected people remains inadequate.³⁷⁻³⁸

This approach perceives displacees as ‘victims’ of extreme events who require urgent attention of relevant government and non-government institutions to address protection gaps. The extent of agency among displacees is a contested issue. However, there is a widespread consensus about the necessity to improve protection measures, even if the type of protection measures, roles and responsibilities of national and international institutions, quality of delivery, and legal and policy mechanisms on protection measures remain deeply debated. Furthermore, a consequence of the widespread pre-occupation with the causal linkage between environmental change and migration motivations between 1980s and early 2000s is the positioning of ‘environmental migration’ at the centre of this climate change and migration discourse. It has been a starting point for further exploration of the complex climate change and migration relationship, including the potential role of migration in

³⁷ <https://www.nanseninitiative.org/>

³⁸ The word ‘forcibly’ is italicised by the author to emphasise.

adaptation (e.g. Laczko and Aghazarm 2009). This focus on humanitarian aspects of climate change and migration nexus (e.g. displacement, emergency response) and environmental migration in the climate change and migration discourse has mostly overlooked the contribution of migrants, whose decision to migrate may not have been influenced by an environmental stressor, towards influencing the vulnerability of their family left behind in origin community. This thesis suggests an approach to understand how migrants could and already do contribute towards vulnerability reduction of remittance-recipient households in communities affected by extreme events. It explores the role of internal circular labour migration and domestic remittances in reducing vulnerability of remittance-recipient households in drought and flood affected rural communities. The empirical evidence presented in chapters 6 and 7 shows that remittances contribute to reduction of a household's sensitivity and builds adaptive capacity to extreme events, and in turn a reduction of their vulnerability to these shocks and stresses.

9.2.2 A conceptual framework

The conceptual framework is presented in chapter 3. The climate change and migration discourse has been overwhelmingly focused on causal linkage between climate stressors and migration. Within this discourse, some stakeholders have envisaged migration as an adaptation strategy; others perceive migration to a failure of in-situ adaptation; and a few have questioned the foundation of positioning an autonomous strategy as an adaptation to vulnerabilities that are essentially structural in nature. One of the major constraints in mainstreaming migration in CCA programmes, particularly in the HKH region, is the lack of empirical evidence on the role of migration in CCA. The 'migration as adaptation' and 'migration as a failure of adaptation' approaches have arrived at a normative judgement that mostly focus on drivers of migration, and lacks an in-depth of assessment of migration outcomes in addressing (or not) vulnerability of families left behind to face environmental stressors. I develop a conceptual approach that neither considers migration an adaptation nor a failure of in-situ adaptation a priori. This approach is also not concerned with multi-causal nature of migration. Rather it shifts the focus to the effects of circular labour migration within a country on the vulnerability of migrant sending households to extreme weather event such as droughts and floods.

The environmental change and migration discourse has come a long way since 1970s. However, this discourse still lacks a consensus on interpretation of CCA terminology. Scholars associated with migration studies have presented an elaborate critique of the linear relationship between environmental stressors and migration and the collective understanding on the multi-causal nature of migration has progressed considerably since 2001. For example, the Black et al. (2011a) focused on the framework on the drivers of migration. Similarly, the last decade has witnessed a rise in the number of publications by academics, NGOs, and multilateral organisations that refer to migration as an adaptation strategy. The narrative of the IPCC AR5's WGII report in 2014, which associated migration with vulnerability, adaptation, risk, and human security, has been shaped by the aforementioned publications. The Cancun Adaptation Framework signed at COP 16 in 2010 formally considered migration as a form of adaptation to climate change by the UNFCCC signatories (McLeman 2016). However, neither these stakeholders nor migration scholars have attempted to deliberate upon the fact that the consequences of migration will be perceived, conceptualised, and assessed in different ways depending on nature of the theoretical framework such as vulnerability, adaptive capacity, adaptation, and resilience. The spatial and temporal scales of analysis are essential parameters in the assessment of the migration effects on CCA.

The reduction of vulnerability to climate change and variability is a key component of adaptation. The knowledge of strategies surrounding past extreme events has been used as a proxy to enhance understanding about a system's vulnerability to future climate change. The impacts of extreme events will differ between covariate and idiosyncratic stressors or shocks. The nature of stressor along with speed of onset, severity, and duration will influence the effectiveness of household capacities and response strategies (Burton et al. 1978, Zheng and Byg 2014). This conceptual framework is operationalised with case studies from flood affected households in Upper Assam in India and drought affected households in Baoshan County in China. The conceptual framework of this thesis draws from the NELM, SLA, vulnerability, and adaptive capacity approaches. It has been suggested by the NELM approach that migration is essentially a household level strategy to minimise income risk (Stark and Levhari 1982) and remittances from migrant workers serve as income insurance for remittance-recipient households (Lucas and Stark 1985). A holistic view of the process through which a household manoeuvres different assets in its portfolio in response to environmental and non-environmental stressors could be provided by the SLA (DFID 1999).

This thesis adopts the IPCC conceptualisation of vulnerability as a function of adaptive capacity, exposure, and sensitivity. The vulnerability and adaptive capacity approaches, which have been developed within the climate change literature, provide a framework to unpack these constituents of vulnerability. These major components of vulnerability are comprised of their sub-dimensions, which are in turn comprised of attributes that are constituted by indicators. This thesis studies effects of remittances on these major components, sub-dimensions, and attributes. The research methodology and methods are presented in chapter 4. It adopts bottom-up and indicator-based approaches to assess vulnerability of remittance-recipient and non-recipient households to extreme weather events. The selected indicators are the ones that could be influenced by the household- at least to a certain extent. These indicators were identified based on the FGD, literature review, and expert inputs. The thesis also adopts a mixed-methods approach with a comparative research design.

It is not my intention to position migration as a bottom-up alternative to state led planned adaptation. The creation of enabling conditions for adaptation and public investments in adaptation are vital roles of the government institutions. Remittances are private capital and are not accessible to all households in a community due to the highly selective nature of migration. Drawing from De Hass's (2012) suggestions on the migration development causality, it can be said that adaptation enabled by economic and institutional reforms, which address structural vulnerabilities, would emancipate the adaptation potential of migration. Migration is not the factor that will trigger adaptation. For example, factors such as access to information, market, government institutions, credit institutions, public amenities and social networks, as well as cognitive capacity will shape the remittance usage behaviour of a household. Migration is only one part of the adaptation solution. It can provide cash and skills, but not the conditions to utilise these induce adaptation.

9.2.3 A new narrative on climate and migration in Assam

The migration narrative in Assam is mainly centred on the issues of identity, ethnic relations, citizenship, and illegal immigration. Hazarika (2000) suggests that the demographic, ethnic, linguistic, and religious profiles of large parts of the Brahmaputra and Barak river valleys have been transformed due to the movement of people for environmental and economic reasons. This has created a perpetual tension between migrants and host communities in

Assam (Hazarika 2000). In post-independence India, the Assamese perception of their distinctness from outsiders, a sense of separation from 'mainland India', and an impression of neglect by the Indian state have been accentuated by a series of events: First, Gopinath Bordoloi, a local Congressman, managed to keep Assam from being incorporated into East Pakistan in 1947 despite the objections from Jawaharlal Nehru and Sardar Ballabhbhai Patel (Hazarika 2000). Second, the Assam government was unwilling to accept large number of refugees from East Pakistan. Prime Minister Nehru failed to gauge the anxiety of local population, and instead threatened to discontinue central government's financial aid to the state (Deka 2005). Third, the national leaders interfered in the state's administration through the bureaucracy (Deka 2005). Fourth, Prime Minister Nehru's radio broadcast after the fall of Bomdila during the Sino-India conflict in 1962 had hurt the sentiments of people in Assam, who felt that the Prime Minister was not concerned about the Brahmaputra valley (Deka 2005).

It has been alleged that the local Congress party, particularly in 1960s and 1970s, had permitted the Muslim Bengali-speakers from border districts of East Pakistan/ Bangladesh to settle in Lower Assam in order to retain political power in Brahmaputra valley. During the movement against foreigners, popularly known as the Assam Movement (1979-85), the concerns with the political, economic, and cultural aspects of the identity crisis were articulated (Dutta 2012) in form of the core demands: Revision of electoral rolls on the basis of the 1951 National Register of Citizens, deportation of Bangladeshis to their country, and 'sealing' of the Bangladesh-India border (Hazarika 2000). The disillusionment with the government, suspicion and fear of migrants, and movement against foreigners would eventually lead to the emergence of militant outfits in the state. To date, the discourse on environmental change and migration in Assam has largely been concerned with the illegal immigration from Bangladesh due to natural disasters, land scarcity, land degradation, and poverty (see Hazarika 1993, Suhrke 1997) and its potential socio-cultural, political, and economic impacts in destination (Swain 1996, Reuveny 2008). This thesis studies the role of intra-state and inter-state migrant workers from Assam, and attempts to understand the effects of remittances on vulnerability of remittance-recipient households in flood affected rural communities. In this process, it presents a new narrative on climate change and migration in Assam that moves away from identity focused and securitised discourse, to a migrant-centred one.

9.2.4 Empirical findings on Hindu Kush Himalayan region

This mixed-methods exploration of migration and climate change adaptation in HKH region is based on empirical data from the Baoshan County and Upper Assam. The study of the nexus between environmental change and migration remains in the periphery of migration studies in most of HKH countries. Previous research (e.g. Massey et al. 2010, Bohra-Mishra and Massey 2011) has primarily focused on enhancing the understanding of inter-linkages between environmental stressors and motives of migration. There is a lack of empirical evidence on migration and CCA relationship across the HKH region. The contemporary narrative on climate change and migration in Assam is focused on the adverse impacts of illegal immigration from Bangladesh due to natural disasters and environmental degradation on identity, ethnic relations, culture, and economy in destination (see Hazarika 1993, Suhrke 1997, Reuveny 2008). The research in China has focused on resettlement of people from their origin villages as a strategy to reduce vulnerability to environmental hazards, alleviate poverty, improve living standards, and restore environment (e.g. Li 2009, Liao 2012, Wang and Chen 2012). There is a lack of empirical studies on migration and CCA based on either mixed-method or quantitative methodology in Baoshan County and Upper Assam. This thesis develops a conceptual approach with which to assess the effects of migration in the context of adaptation to environmental stressors such as drought and floods. The major empirical findings of this thesis are summarised in the next section along with the analyses of their contribution to the theoretical understanding of the relationship between migration and CCA.

9.3 Main findings

The case studies from Baoshan County and Upper Assam contributes to a better understanding of the relationship between migration and CCA. The empirical results reveal the effects of remittances on vulnerability to major extreme weather events. The outcomes have different implications for the sensitivity of households to climatic and non-climatic stressors. These effects are context specific in nature and vary over a migrant's life cycle. Moreover, generic development in study area and institutions has an important role in reducing sensitivity and enhancing adaptive capacity of households.

9.3.1 Sensitivity to climate and non-climate stressors

The dependence of resource-users on climate sensitive natural resources would determine the extent of their sensitivity to climate change (Marshall et al. 2014). The impacts of future climate change are likely to be most severe on those predominantly dependent on natural resources (Burton et al. 2002, Simms et al. 2004) such as people dependent on agriculture, pastoralism, or forestry. The annual runoff in the Brahmaputra river basin is projected to decline substantially by 2050 (Kelkar and Bhadwal 2007), which will adversely affect those dependent on agriculture for daily subsistence and livelihoods (Hugo et al. 2012). The empirical evidence presented in chapter 6 shows that remittance-recipient households are less dependent on environmental resources than non-recipient households. For example, remittance-recipient households in both study areas are less likely to be dependent on crop income. In fact, only one-tenth of remittance-recipient households in Upper Assam had identified income from primary sector (e.g. crops, livestock, fish, forestry, and daily wage from farm) as their major source of income. This is hardly surprising since these households have a migrant member. This contributes to a reduction of their sensitivity to annual floods and volatility of crop prices in the market. If a household is dependent on rainfed farm, it will be highly vulnerable to adverse weather condition such as drought, since farming will be entirely dependent on rainfall for water (Ye et al. 2012). The size of rainfed farm of remittance-recipient households in Baoshan County is likely to be smaller than that of non-recipient households. Rural activities have low marginal labour productivity. A way to diversify the household production in urban sector, and thereby increase income, is migration (Zhu and Luo 2008). Most remittance senders in this study are employed in the non-farm sector (e.g. manufacturing, construction, and services) in an urban destination. Unlike non-recipient households, remittance-recipient households have access to an 'ex-situ' income source in remittances that is hundreds of kilometres away from the origin community. It is less likely that a household's income sources in two distant geographical locations would be adversely affected at the same time. These characteristics of livelihoods portfolio among remittance-recipient households contribute towards reduction of sensitivity to extreme events such as drought and floods.

A household that earns income from multiple sources can better manage risk (Ellis 2000). The findings from the two case studies suggest a growing dependency of remittance-recipient households on remittances over the migration cycle. Remittance-recipient households earn

income from fewer sources than non-recipient households. Furthermore, a household's sensitivity to climate hazards could be reduced through sectoral diversification such as diversifying from farm to non-farm activities (Hassan and Nhemachena 2008). Long-duration households in Baoshan County have access to fewer non-farm income sources than short-duration households. Due to this progressive increase in remittance dependency, remittance-recipient households are likely to be more sensitive to non-climate hazards. Most of the remittance senders in Baoshan County and Upper Assam are wage employees in informal sector. Despite the comparatively easy entry into non-farm jobs in the informal sector for semi-skilled or unskilled workers, these jobs neither provide social security benefits (e.g. pension, provident fund, or insurance) nor job security. The informal sector workers are at risk of non-climate stressors such as sudden termination of employment, market downturn, or social unrest in host community. Any disruption in remittance supply would have adverse effect on remittance-recipient household's welfare.

Such a scenario is not beyond the realm of possibility. The cascading effects of the global financial crisis of 2008 resulted in a large number of factory workers in China and labourers in service sector in India losing their jobs. These migrant workers had suddenly become dependents of their households (Ghosh 2009, Chan 2010). Along with access to cash income from remittances, the livelihoods portfolio of remittance-recipient households are exposed to non-climate stressors in destination. Moreover, the households in Baoshan County and Upper Assam do not undertake precautionary savings to manage risks in general and climate risks in particular. Hence, a disruption of remittance inflow could lead to an indirect increase in remittance-recipient household's sensitivity to climate hazards. Furthermore, migrant workers may be exposed to climate risks in destination. Black et al. (2011a) suggests that people are likely to migrate to increasingly vulnerable locations such as high density urban areas in flood plains or cyclone-prone coastal areas. The existing fragilities in these urban settlements will be exacerbated by future threats from global environmental change, and new urban migrants will continue to be particularly vulnerable. For example, a large number of workers move to Guwahati, the capital of Assam, in search of jobs. Many poor and unskilled migrant workers live in squatter type of settlements. Given their lower incomes, fragile support systems and precarious livelihoods, these marginal population groups will be the worst affected by a natural disaster (Saikia 2005).

9.3.2 Remittance-recipient households adopt different pathways to reduce vulnerability from extreme events

Due to the dependence on natural resources, the agricultural sector in Baoshan County is more sensitive to adverse drought impacts than other sectors of economy. Naturally, many household level responses to drought are focused on farming and livestock rearing practices (e.g. access to irrigation, changes in farming and livestock rearing practices, and access to alternative livelihood opportunities in locality). The empirical evidence indicates that remittance-recipient households in Baoshan County are less likely to be dependent on crop income than non-recipient households. Taylor et al. (2003) finds that the household income from crops in China declines significantly when migrants leave the household. They suggest that a probable explanation for this decline could be the reduction in a family's on-farm labour force during the absence of a labourer (Taylor et al. 2003). One way to address risk from drought in mid-term would be to build the capacity of the household, manage the risk, and enhance flexibility. But the findings of this study reveal that remittance-recipient households are minimising risk from drought by downsizing agricultural operations. These households are risk averse, and more likely to have smaller farm size and less likely to invest in farm assets (e.g. irrigation, farm mechanisation). A rural household in China cannot leave agriculture entirely (Taylor et al. 2003) and agriculture is an option of last resort for most rural migrants (Tao Yang and Zhou 1999).

The agricultural land in an origin community would have to be returned if a rural migrant has to obtain an urban *Hukou*. The urban residence permit for large cities is still difficult to obtain. Due to limited jobs, lower social protection coverage, and quality of public education, smaller towns are less attractive to rural migrants (Tao Yang and Zhou 1999, Tao and Xu 2007). There is also a lack of land rental markets in rural China (Taylor et al. 2003). Rozelle et al. (2002) suggest that even short-term renting out of land by migrant workers may send signals to village cadres and induce land reallocation.³⁹ Most migrants are unwilling to return their rural land, usually, leave their land to relatives without charge (Tao and Xu 2007). Moreover, the relatively young age at first migration suggest that these workers may have a relatively short association with agriculture prior to migration. The young educated migrants are unlikely to value farming as much as the older and less educated labourers in rural areas.

³⁹ According to the Rural Land Contract Law of 2002, a farmer's land tenure security must be maintained for at least 30 years. No land reallocation can be carried out during this period (Tao and Xu 2007).

The young migrant workers have decent income from non-farm employment, and would tend to disassociate themselves from farming in future (Tao and Xu 2007). If remittance-recipient households do not perceive agriculture as a profitable livelihood strategy, are unsure about returns from it due to extreme weather events, and earn a major share of their income from non-farm sources, they would be less likely to enhance capacity of household's farm portfolio. Rather these households would retain the land in origin village as a fall back option to facilitate their return to the village if the foray into urban areas does not meet expectations.

Unlike Baoshan County, where drought impacts and responses are primarily centred on agriculture and water availability, the floods adversely affect lives across the board in Upper Assam (e.g. agriculture, income opportunities, housing, water quality, health, transportation, and food). The agriculture in Upper Assam is subsistence in nature, and selling of crops contributes little to the household income. However, the reduction of vulnerability among remittance-recipient households in Upper Assam is not limited to curtailing agricultural activities. The flood related strategies and capacities of households extend beyond the agricultural sector. For example, these households have better access to communication devices. This mobile phone is essential to receive flood alerts from the district disaster management authority (DDMA) in Upper Assam, which is critical in saving lives, livestock, and property during flood inundation.⁴⁰ The mobile phones permit households to stay in contact with extended family and social network during floods. Also, remittance-recipient households are likely to have better access to formal financial institutions and life insurance, which are essential attributes of generic adaptive capacity. Over the migration cycle, remittance-recipient households improve the housing quality, which could reduce the incidence of injury, death, or displacement due to extreme weather events.

⁴⁰ http://www.business-standard.com/article/news-ians/community-based-flood-alarms-saving-assam-lives-115072600233_1.html

Table 9.1: Major findings from Baoshan County and Upper Assam

	Findings
Sensitivity to climate and non-climate stressors	<p>Remittance-recipient households are less sensitive to climate stressors than non-recipient households. Former:</p> <ul style="list-style-type: none"> • are less likely to be dependent on crop income; • have smaller rain-fed farms; and • have access to an ‘ex-situ’ income source and remittance-senders are employed in the non-farm sector. <p>Remittance-recipient households are more sensitive to ‘ex-situ’ non-climate stressors than non-recipient households. Former:</p> <ul style="list-style-type: none"> • manifest a growing dependency on remittances over the migration cycle; • have fewer income sources (low income diversification) as well as fewer non-farm sources (low sectoral diversification); and • have remittance-senders who are wage employees in informal sector.
Remittance-recipient households adopt different pathways to reduce vulnerability from extreme events	<p>The nature of extreme event and local context influence the pathway adopted by a remittance-recipient households to reduce vulnerability.</p> <ul style="list-style-type: none"> • Remittance-recipient households in Baoshan County are minimising drought risks by downsizing agricultural operations, which addresses sensitivity of a household to droughts. • The vulnerability reduction among remittance-recipient households in Upper Assam depends on enhancement of adaptive capacity. For example, these households have better access to formal financial institutions, insurance, and communication devices than non-recipient households.
Migration cycle	<p>The stage in migration cycle is an important determinant of a remittance-recipient household’s sensitivity and adaptive capacity in context of extreme events. For example, long-duration households in Upper Assam are likely to have better specific adaptive capacities to address flood risks compared to short-duration households.</p>

9.3.3 Migration cycle

The stage in migration cycle is an important determinant of a remittance-recipient household's sensitivity and adaptive capacity in context of major extreme weather events. Over the different periods of a migration cycle, remittance-recipient households tend to use remittances for various purposes. It has been suggested that the basic consumption needs, loan repayment, and children's education are first addressed. Only afterwards, households use the savings from remittances to purchase land or house, hire labour, invest in farm mechanisation, or establish a small business (Lipton 1980, Massey et al. 1987). I use the duration for which a household has received remittances from a migrant worker as the proxy for the migration cycle, and divide remittance-recipient sample into two broad categories: long-duration ('above median duration') and short-duration households ('below median duration'). In Baoshan County and Upper Assam, remittances are commonly invested in food, health care, community consumer goods, education, and transport. Long-duration households in Upper Assam are likely to have better specific adaptive capacities to address flood risks compared to short-duration households (e.g. structural changes in dwelling, access to boat or raft, mechanise farming, access to borrowing, and participation in collective action). The long-duration households in Baoshan County are likely to have better access to drought assistance and modify farming and livestock rearing practices. This manifests a household's prioritisation of expenditure over a time-period.

9.4 Policy implications and recommended policy priorities

The adaptive capacity of a system is determined by available assets, resources, policies and institutions (Smit and Wandel 2006). In certain ways, remittances are analogous to a direct cash transfer programme. Similar to the cash transfers, recipients are the first ones to be affected by remittances, followed by rest of the household and community. Some of the benefits and advantages of the latter would be applicable to remittances. Vincent and Cull (2009) documents positive economic and social impacts of cash transfers in southern Africa. They report that cash transfers promote self-esteem, enhance status, and support empowerment among recipients. The food security and nutrition among recipient households improves since a large portion of cash transfer is spent on food. The cash transfer could improve access to health care and education, assist household to avoid distress sales, and provide some capital for asset

creation (livestock, informal enterprise). The field of public policy has a largely positive perception about the benefits of direct cash transfers. The governments of developing countries are willing to invest resources in expanding direct cash transfer programmes and wait through the initial phases that are affected by ‘teething problems’. In contrast, there is a strong sedentary bias in public policy on migration, and an absence of supportive policies that aim to enable the use of remittances for building medium- and long-term capacities of remittance-recipient households.

9.4.1 Mainstream migration into adaptation programme

Since the recognition of migration as a form of adaptation to climate change in the Cancun Adaptation Framework during COP 16 in 2010, the deliberations on migration have continued in global processes associated with DRR and climate change. The Hyogo Framework for Action (HFA) 2005-2015: Building the Resilience of Nations and Communities to Disasters was succeeded by the Sendai Framework for Disaster Risk Reduction 2015-2030.⁴¹ Following the 2015 Third UN World Conference on Disaster Risk Reduction, the latter was endorsed by the UN General Assembly.⁴² The Sendai Framework suggests that as part of a broader and a more people-centred preventive approach to disaster risk the governments will have to engage relevant stakeholders, including migrants, in the design and implementation of policies, plans, and standard (Assembly 2015). This framework acknowledges that knowledge, skills, and capacities of migrants could be useful in the design and implementation of DRR, which contributes to the resilience of communities and societies (Assembly 2015). The Paris COP 21 was organised later in the same year. The Preamble of the Paris COP21 agreement espouses that parties should consider the rights of indigenous peoples local communities, migrants, children, persons with disabilities and people in vulnerable situations while taking action to address climate change (UN 2015). In paragraph 50 of the COP21 agreement, it is suggested that a task force is established by the Executive Committee of the Warsaw International Mechanism. This task force will develop recommendations for integrated approaches to avert, minimise, and address displacement related to the adverse impacts of climate change (UN,

⁴¹ <http://www.unisdr.org/we/coordinate/sendai-framework>

⁴² Ibid.

2015). The mainstreaming of migration in national and sub-national discourses, policies, and programmes on climate change in the HKH region is a work in progress.

Migration has been briefly mentioned in government documents on climate change, although its positioning within the national climate change discourse in India remains largely ambiguous. The research agenda of National Mission on Strategic Knowledge for Climate Change, which has been established by the National Action Plan for Climate Change in India, consists of socio-economic aspects of climate change including impacts on migration patterns and livelihoods of coastal communities (GoI 2008, p. 5). In 2012, India submitted the Second National Communication on Climate Change to the UNFCCC. This report identifies large-scale migration of people from rural to urban areas as one of the critical demographic indicators (MoEF 2012). It suggests that migration from rural areas to cities have increased due to drought, floods, and storms (MoEF 2012). Also, large numbers of people are migrating towards urban areas due to urbanisation and industrialisation; this leads to the formation of slums. Access to basic services (safe water supply and sanitation) is poor in the slums (MoEF 2012). There could be a substantial rise in losses due to increased migration to the coasts, because of huge investments in coastal infrastructure, settlement, and enterprises (MoEF 2012). This national submission suggests that '[f]lood and climate change migration and adaptation measures will have to be integrated into day-to-day urban development and service delivery systems (MoEF 2012, p. 141).' The State Action Plan on Climate Change for 2012-2017 (SAPCC) of Assam was drafted in 2011 (TERI 2011). However, it has still not been endorsed by the state government. The SAPCC positions migration as a threat that still poses a disturbing and alarming situation in the state. It uses terms such as large-scale and mass to portray unmanageable scale of migration due to livelihood disruption in the wake of irreversible ecosystem changes. It envisages a resilience approach that would help the society to stay flexible to cope with irreversible ecosystem changes. As discussed earlier in this chapter, the discourse on environmental change and migration is overshadowed by the perceived threat of illegal migration from Bangladesh due to natural disasters and its impacts in Assam.

There is little mention about migration in the climate change documents of the government of China. The Second National Communication on Climate Change of the People's Republic of China was submitted in 2012. The only mention of migration in this report is a part of the discussion about impacts of extreme weather events on geological environment being manifested through geological disasters (e.g. mountain collapse, landslide). In 2010, a landslide in Sichuan province almost ruined a newly-built migrants living quarters. About 20 people were reported missing and 1500 people had been affected (NDRC 2012). The annual report on China's climate change policies and actions is published by the National Development and Reform Commission of China. There is no mention of displacement, migration, or relocation in the annual reports from 2013 to 2016 (NDRC 2013, 2014, 2015, 2016). The Yunnan Provincial Action Plan for Addressing Climate Change was prepared by the Yunnan Development and Reform Commission in 2008 (YDRC 2008). This report suggests that the scale of ecological migration could be gradually expanded by encouraging the migration of rural people. The provincial government perceives ecological migration, which involves relocation of population from hazard prone or environmentally fragile areas, as a strategy to address environmental stress and alleviate poverty (YDRC 2008).

In response to climate change, many governments seek to adopt in-situ strategies for adaptation – agricultural practices, management of pastoral lands, infrastructure like dykes and coastal barriers – as ways to reduce migration pressure and let people remain in their origin communities (Martin 2010). But framing migration as a failure or threat results in policies that limit the benefits from migration to those involved (De Haan 1999, De Haas 2007, Kothari 2003). Policies should aim to create conducive conditions that will allow people to choose to stay or move, and if they move how to best benefit from the process. However, policy responses to address climate change through leveraging migration as a form of adaptation remain scattered and often inadequate. The role of migrants and remittances needs to be explored by the government institutions as part of adaptation plans, disaster risk reduction, and sustainable development goals. The policies in China and India overlook the potential of remittances to be an alternative source of finance that could potentially address some of the unmet adaptation requirements of remittance-recipient households.

9.4.2 Financial inclusion and literacy

Policy interventions might reasonably aim to increase the level of remittances flowing back to migrant households through the promotion of financial inclusion and financial literacy, particularly among the poorer households in disaster prone areas. The empirical evidence in Chapter 7 reveals that financial inclusion is likely to be better among remittance-recipient households than non-recipient households in Upper Assam. Moreover, remittance-recipient household's access to formal financial institution improved over a migrant's life-cycle in this study area. It has been estimated that about 30 percent of domestic remittances in China are transferred through informal channel compared to 75 percent in India.⁴³ Savings and safe remittance transfer could be enabled through the increase in access to formal banking facilities for internal migrants (Faetanini and Tankha 2013). The government of India launched the *Pradhan Mantri Jan Dhan Yojana* (PMJDY), a national financial inclusion programme in August 2014.⁴⁴ This programme aims to increase the access to formal financial institution among the unbanked population. This scheme will provide no-frills accounts and interest on deposits; it will also permit easy monetary transfer across India, provide a debit card, relaxes know-your-customer norms, and provide life and accidental insurance coverage.⁴⁵ In 2003, the government of China introduced the rural policy of 'Give More, Take Less, and Liberalise'. Thereafter, all public expenditures in the rural sector are reported under the three rurals (*sannong*): agriculture (*nongye*), rural villages (*nongcun*) and farmers (*nongmin*). Increasingly, subsidies on agriculture, social welfare and public services, and living conditions are being directly transferred to the farmers under the three-rural expenditure. For example, subsidies for grain production are now being paid directly to farmers for adopting improved seeds. Earlier, the government used to pay this subsidy to state-owned grain trading enterprises to offset their losses from subsidising procurement (Lin and Wong 2012). Since these subsidies are transferred through bank account of the beneficiary household, most rural households in China have a bank account.

⁴³ <http://blogs.timesofindia.indiatimes.com/toi-editorials/janata-likes-jan-dhan-the-past-year-has-seen-a-rapid-growth-of-active-pmjdya-accounts-across-all-geographies/>

⁴⁴ <http://www.pmjdya.gov.in/home>

⁴⁵ *ibid*

Dercon (2002) suggests that during the good years households are known to build up savings, which is used during the bad years. Despite the differences in extent of financial inclusion in the study areas, few households adopted precautionary savings as a strategy to manage risks, particularly risks from extreme weather events. The gains from financial inclusion programmes could be reinforced through an effective financial literacy programme among rural beneficiaries (particularly migrant workers and women) about different financial products, their utility in risk management in context of drought or flood, and importance of establishing creditworthiness in formal financial institutions. Though the PMJDY has relaxed the know-your-customer norms in a bank to increase the coverage among unbanked population, focus group discussion in Upper Assam suggests that many rural banks (especially the bank employees) are still applying the erstwhile inflexible norms of establishing a customer's identity prior to the opening of a bank account. Therefore, an awareness raising campaign similar to the rural beneficiaries is also necessary for the employees of formal financial institutions, particularly in rural areas. Policy interventions can aim to increase the level of domestic remittances flowing back to remittance-recipient households through formal financial institutions by the expansion of branchless banking or mobile money transfer, particularly in origin communities. Policy can encourage regular remittance transfer through formal financial institutions through incentives (e.g. better interest rate on savings, easier access to credit, lower premium on insurance, and matching funds). This could be particularly beneficial for low income households in areas vulnerable to the impacts of climate change and variability.

9.4.3 Social inclusion of internal migrant workers

The empirical findings suggest that dependency of households on remittances increases over the migrant's life-cycle. Most migrant workers in these study areas are part of the informal economy (e.g. construction works, factory workers, security guards, plumbers, and masons), which does not provide social security benefits or legal protection. The employers often flout minimum wage rules and do not cater to health, shelter, and other requirements of migrant workers. Migrant worker's access to social protection entitlements in destination are curtailed due to regulations or administrative procedure (Faetanini and Tankha 2013). The Constitution of India recognises the fundamental right of citizens of India to move freely and to reside and settle within the territory of India (GoI 1950). Even though approximately three out of every

ten Indians are internal migrants, the government has accorded low priority to internal migration. This vulnerable group has received little legal or social protection from existing policies of the Indian state. Generally, policymakers and urban planners perceive migration as a challenge, and through neglect and inaction have created an in-conducive and unsupportive environment (Faetanini and Tankha 2013). The federal structure of India limits the portability of social protection entitlements across the administrative boundaries of states. For example, the Public Distribution System (PDS) of the government of India sells essential food items to eligible households at a subsidised price through a network of fair-price shops (Sabates-Wheeler and Macauslan 2007). A beneficiary must present a ration card at the fair-price shop in order to access grain and other supplies. The ration card is issued at the usual place of residence and is not transferable. The PDS system in destination is not accessible to temporary inter-state migrants (Faetanini and Tankha 2013). Migrant workers also are faced with substandard accommodation, lack of formal residency rights ('domicile'), and limited access to state funded health care and education (UNESCO and UN-HABITAT 2012). In China, the right of free migration for residents is restricted by the *hukou* system (Cai 2011). It further restricts a migrant's access to social protection entitlements such as grain rations, public housing, health care and school education (Faetanini and Tankha 2013). Cai (2011) explains that the major motives beyond the *hukou* was to prevent the rural labour force from abandoning agriculture and guarantee basic living and minimum social welfare for urban residents. Policy makers and urban planners would have to perceive migrant workers as a stakeholder in urban planning, and eventually prepare a long-term strategy that basic services are accessible to all citizens and ensure descent working conditions for all workers. It is necessary to ensure portability of entitlements such as access to public distribution system, affordable public or private accommodation, provision of basic services in urban slums, and access to state funded health care and educational institutions. The migrant workers, particularly those in the informal sector, would have to be made aware of their rights and entitlements in destination.

9.4.4 Development of generic adaptive capacity

The development of generic adaptive capacity is a pre-requisite to unleash the potential of remittances in vulnerability reduction, and in turn in adaptation to climate change and variability. Though access to multiple income sources is likely to reduce a household's

sensitivity to climate hazards and market shocks (Ellis 2000), the empirical evidence in Chapter 6 reveals that remittance-recipient households are likely to have fewer income sources (including non-farm income sources) than non-recipient households, and long-duration recipient households have fewer income sources than short-duration recipient households. Moreover, the rural transformation in Yunnan, like the rest of China, is dependent on migration of rural labour to townships. In Assam, the daily wage labour in non-farm sector is the main source of non-farm diversification. For any household with little investment capital, the feasible income opportunities are elsewhere. A conducive environment to promote livelihoods diversification has been created in the study area. This involves improvement in transport and communication infrastructure, better access to market towns, creation of storage facilities, provision of skill training opportunities, and nurturing of rural enterprises in the study areas. The ancillary activities such as transportation, communication, and storage could also generate income opportunities. These interventions should not be aimed to reduce migration. Instead, maximisation of a household's income and reduction of climate and non-climate risks should be the goal.

One aspect of enhancing enabling conditions is the capacity building of local government institutions and community based organisation. This capacity should involve expansion of physical infrastructure and enhancement of human resources. A mere increase in the number of extension service centres or government offices would not be enough if the staff are unaware of the recent developments in CCA and DRR and do not have the flexibility to design plans that use state-of-the-art knowledge to supplement local knowledge. Since vulnerabilities are context specific, one size is unlikely to fit everyone. The role of local administration and village committees should transcend the mere implementation of programmes designed by the provincial administration. The local stakeholders should have the flexibility and capacity to design their own projects based on a template for the province. The awareness of these provincial and local planners would have to be increased about the potential linkages between migration outcomes and adaptation. For example, a community level planning exercise could explore constraints and opportunities of using remittances to provide access to safe drinking water and improving food security. Any existing programmes on facilitating migration could be adjusted to incorporate information on managing environmental risks. In Yunnan, the

Bureau of Agriculture and the Bureau of Human Resources and Social Protection in the county government provides information on availability of non-farm jobs, organises orientation and skill training, and occasionally monitors living and working conditions of migrant workers in destination communities. To raise awareness among migrant workers and their households, modules on impacts of climate change and variability on livelihoods, means of managing climatic and non-climatic risks, and benefits of financial literacy in managing risks could be included in such programmes. However, such changes in the programme design will require approval of relevant government institutions from the national through provincial and county to township level.

9.5 Limitations

Some caveats must however be noted. First, the research presented here attempts to validate the conceptual framework with two case studies. The vulnerability of a household to an extreme event and effect of labour migration on CCA are context specific in nature. These have to be situated within a pre-existing scenario in a specific place at a particular time. A range of factors (household characteristics, social hierarchies, economic conditions, entitlements, infrastructure, institutional capabilities and political systems) shape these scenarios. Therefore, there is a risk of generalising based on evidence from only two case studies. Second, the governance context varies across the HKH countries. Despite the comparative research design, study areas that I have selected are from two completely different governance contexts. In certain ways, these two governance structures are on the opposite ends a governance continuum in the HKH region. The effects of migration outcomes on remittance-recipient households could be enabled or constrained by the generic adaptation context, which is shaped by specific policies and institutions. Moreover, the federal governance framework in India implies that governance context differs from one state to another. Hence, it is possible that effects of remittances on household level sensitivity and adaptive capacity, and in turn, on vulnerability, may vary from country-to-country and from state-to-state. Though emerging evidence from similar a case study in Upper Indus sub-basin (Banerjee et al. 2016), indicates some similarities in the consequences of circular labour migration in rural communities affected by extreme events. Third, this thesis addresses the present vulnerability of the households in the study areas. The choices made by these households are not necessarily

anticipatory in nature. Once the indicators associated with the *ex post* strategies and capacities were identified during the FGDs, I had categorised these into different attributes, sub-dimensions, and major components of vulnerability. The households may have motivations other than vulnerability reduction in adopting these responses or enhancing particular capacities. It will require further exploration of household level decision making process to attribute a particular choice to vulnerability reduction or CCA. Fourth, the participatory exercises could have included more stakeholders. For example, the AHP workshops were not organised at the village level because of resource constraints. In this process, the feedback from a major stakeholder was not incorporated in the estimation of weights of attributes, sub-dimensions, and major components of vulnerability. The AHP workshop with the Chinese stakeholders in Kunming was facilitated through a translator. It is probable that some information may have been lost in translation. Fifth, this thesis is based on cross-sectional data and is unable to explore the long term implications of remittances on the vulnerability of remittance-recipient households. Future research should explore the use of a longitudinal or cohort based research approach. Sixth, the household survey required the respondents to recall the migration history of each migrant worker; financial damage and the time needed to recover from each instance of a specific extreme event may have been difficult for respondents to remember. I sought to ascertain when a specific strategy or capacity was first adopted by the household anytime within the entire time-frame of 1984-2013. This almost thirty year span may have led to some re-call error among the respondents.

9.6 Future research priorities

The relationship between the effects of remittances on CCA is complex, context-specific, and varies over a migrant's life-cycle. This thesis suggests that future research priorities should focus on a holistic understanding of the relationship between migration and CCA, rather than continue to focus on the influence of climate change on motives of migration.

9.6.1 Gender, migration, and CCA

The present discourse on climate change and migration lacks a gender-specific assessment of migration outcomes in context of CCA, even though women are primarily the remittance recipients in origin villages and number of female migrant workers is progressively rising

across the HKH region. A gender perspective on the relationship between migration and CCA is necessary since women have different motivations, risk perceptions, access to institutions and constraints than men. For example, women may have to assume new roles and responsibilities due to the out-migration of men. These could include tasks related to farm management, food security, and disaster preparedness. Since women may not have the same access to markets, government and customary institutions, and extension programmes as men do, the former may be unprepared for these new responsibilities. The women will have to acquire knowledge, skills, and competencies to deal with new challenges (Banerjee et al. 2015). Future research needs to adopt gender sensitive research approaches to examine the impacts of awareness of the rights and entitlements and access to institutions in shaping the remittance usage among women in context of CCA. The working conditions and wage rate is likely to influence the remittance behaviour of female migrant workers. This will determine the income of the family-left behind, and to a certain extent influence the type of risk management strategies adopted by a household. Faetanini and Tankha (2013) reports that female migrants in India are more likely to be self-employed than non-migrant women. These female migrants, particularly those in lower-end informal sector occupations, earn a lower wage than male migrants, do not enjoy any maternity entitlements, lack access to proper sanitation, and are vulnerable to exploitation from illegal placement agencies (Faetanini and Tankha 2013). The female migrant workers constitute 31.2 percent of total migrant workers in China (National Bureau of Statistics 2015). Wang and Cai (2008) finds that female migrants in urban China have unfavourable employment opportunities and wage rate. Irrespective of the performance, employers may pay lower wages to their female employees, who may also find it harder to be promoted. Therefore, knowledge gaps on the effects of remittance behaviour of female migrant workers on CCA of the families left behind needs to be studied.

9.6.2 Social remittances and CCA

There are knowledge gaps in terms of the conditions that make it most likely for social remittances to play a positive role in CCA. It has been suggested that the interactions between migrant and host population in destination and migrant, family, and community in origin, facilitate a flow of information (i.e. what and how to do things) and changes in expectations and preferences of what is acceptable (Kapur 2003, p. 19). Particularly in context of internal

migration, where financial costs of migration are relatively lower than international migration, marginalised social groups could be exposed to new ideas. Migrants return with ideas, changes in behaviour, social capital, knowledge, and skills to origin communities. These are referred as social remittances (Levitt 1998, Bailey 2010). Their role in promoting innovation, entrepreneurship, community and family formation, and political integration is widely documented within migration and development discourse (Levitt 1998, Levitt and Lamba-Nieves 2011). There are knowledge gaps in terms of the conditions that make it most likely for social remittances to play a positive role in reducing vulnerability to climate related stressors. Further analysis could focus on whether the skills learnt by migrants in destination communities assist migrant households in origin communities to manage risks from environmental stressors. There is limited evidence on the role of institutional processes, infrastructure, and market mechanisms in enabling or constraining the potential of social remittances in context of CCA.

9.6.3 Governance, institutions, and policies

The institutional context can enable or constrain adaptation. Individual decisions do not take place in a policy vacuum. In accordance with social norms (class, race, gender), the access to individual or household adaptation opportunities is mediated by this institutional context (Vincent 2007). For example, empirical evidence suggests that insurance penetration in Upper Assam remains low, and is mostly limited to life insurance, whereas life and health insurance is ubiquitous in Baoshan County due to the expansion of government sponsored insurance programme as part of rural sector reforms. However, there is a lack of crop and livestock insurance in both study areas which exposes agricultural sector to income risk from extreme weather events. As discussed earlier, national and sub-national adaptation policies in the HKH region has either paid little attention to the role of migration in CCA or envisaged migration as a challenge to adaptation. Future research could explore opportunities and barriers to mainstreaming of migration in development and adaptation planning across different scales of governance: national, provincial, district, and town and village. Our understanding of multiple narratives around CCA, DRR, and migration needs to be enhanced. How do the stakeholders at various levels perceive migration vis-à-vis CCA and/or DRR? Could there be opportunities for convergence among these multiple narratives? What could constrain the potential convergence

among these stakeholders? How does the flow of information within government institutions or budgetary allocation influence mainstreaming of an issue? A systematic assessment of the stakeholder perceptions and narratives regarding CCA, DRR, and migration is necessary to identify knowledge gaps, policy gaps, and opportunities for mainstreaming migration.

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Annex

Focus Group Discussions for Assam

VERBAL CONSENT:

[Local Greetings] My name is [NAME OF THE INTERVIEWER/ FACILITATOR] and I am working with the [NAME OF THE LOCAL PARTNER INSTITUTION]. We are conducting a study to examine the role played by labour migration and remittances in reducing vulnerability of flood affected households. The information you provide will only be used to learn about the relationship between flood, migration, and vulnerability.

The study is conducted by the International Centre for Integrated Mountain Development (ICIMOD), Kathmandu, and [NAME OF THE LOCAL PARTNER INSTITUTION], [LOCATION OF THE LOCAL PARTNER INSTITUTION].

We would much appreciate the participation of yourself/ your household in this study. We will like to ask you some questions about your household. Participation in this study is voluntary and you can choose not to answer any question or all of the questions.

This activity will take approximately [DURATION IN MINUTES] and will be carried out today or another day you prefer.

The information you provide is totally confidential and your name will not be disclosed to anyone. The data will only be used for research purposes. Your name and other personal information will be replaced with a code that will be used to identify your answers without using your name.

At this time, do you want to ask me anything about this study?

ANSWER ANY QUESTIONS AND ADDRESS PARTICIPANT'S CONCERNS.

May we begin now?

PARTICIPANT AGREES Begin the activity

PARTICIPANT DOES NOT AGREES Allow him/ her to leave

Male migrants

Participants: Minimum 6 persons, Maximum 10 persons

Duration: 3 hours (*Split in three sessions of an hour each*)

[Note: In the beginning, the facilitator will clarify with the participants that the discussion will be about migrant households and migrants.]

Core question	Method
<ul style="list-style-type: none"> • M1 What are the farm based livelihood strategies used by your households? Regarding farm based livelihood strategies, do male and female members of your households have different responsibilities (i.e. gender disaggregated work responsibility)? • M2 What are the non-farm based livelihood strategies used by your households? Regarding non-farm based livelihoods, do male and female members of your households have different responsibilities (i.e. gender disaggregated work responsibility)? 	<p>Focus group</p> <p><i>(Note: This section is about the participant's household.)</i></p>
<ul style="list-style-type: none"> • M3 When was the first time anyone from this village migrated for work? Where? • M4 Where do people from this village migrate for work (<i>i.e. rural/ urban, village/ town/ city, internal/ regional/ international</i>)? Please, specify major destinations of migrants from this village at present. • M5 Who usually migrates (<i>e.g. age, gender, ethnicity/ caste, economic class, educational background, and skilled/ unskilled</i>) from this village? • M6 What are the major occupations in which migrants workers from this village are usually employed in the destination community (<i>e.g. farming, mining, livestock farming, fishery, forestry, trade/ business, retail, etc.</i>)? • M7 What is the usual length of time for which migrant workers are away from this village (<i>e.g. some months, less than a year, 1-5 years, over 5 years etc.</i>)? Is the migration for work from this village seasonal in nature? 	<p>Focus group</p> <p><i>(Note: This section is about the village.)</i></p>
<ul style="list-style-type: none"> • M8 Was your decision to migrate for work an individual or household one? If it was a household decision, which members of your households were consulted? Were women members of your households consulted? If yes, please specify which women members of your households (<i>wife/ mother/ sister/ others</i>) were consulted? • M9 Where did you or other migrants from your households get the information about job opportunities in destination? Did you or other migrants from your households receive job information from newspaper, radio, television, internet, labour contractor, employment agency, friends/relatives, etc.? • M10 How important was the opinion of your <i>friends, relatives, ethnic group, religious group, student union or clan</i> in your decision to migrate for work? • M11 How did your <i>friends/ relatives/ ethnic group/ religious group/ clan/ student union</i> assist you and other migrants from your households during the migration? 	<p>Focus group</p> <p><i>(Note: This section is about the participant's household.)</i></p>

<ul style="list-style-type: none"> • M12 Did you or other migrants from your households take the help of any employment agency/ labour contractor to find a job in the destination? (<i>Note: If not, skip to M17. M14-M17 is to be enquired only if employment agency/ contractors have a presence in this village.</i>) • M13 Where did you or other migrants from your households get in touch with the employment agency/ labour contractor? • M14 Did you or other migrants from your households have to pay the employment agency/ labour contractor? If so, how much was paid? • M15 How did the employment agency/ labour contractor assist in your migration or that of other migrants from your households? • M16 What were the major problems that you or other migrants from your households encountered while dealing with employment agency/ labour contractor? 	
<ul style="list-style-type: none"> • M17 During migration, did you or other migrants from your households take the assistance of any government institution? If so, what kind of assistance was received? • M18 During migration, did you or other migrants from your households take the help of any non-government organisation during migration? If so, what kind of assistance was received? 	
<ul style="list-style-type: none"> • M19 Please, tell us about the working and living condition confronted by you and other migrants from your households in destination. • M20 Was there any association of migrants in the destination? If so, please, specify. • M21 Is there any association of migrants in this village or locality. If so, please, specify. 	
<ul style="list-style-type: none"> • M22 What are the benefits from migration to your households (<i>e.g. income generation for themselves, increase in well-being, access to information/ networking, reduce risk from flooding, etc.</i>)? Please, specify. • M23 Did you experience a change in income after migration how (<i>e.g. considerable or slight increase, considerable or slight decrease, no change</i>)? If so, how? • M24 Had the economic situation of your households changed since your migration? If so, how? • M25 In the past year, how often had your households received remittance? • M26 What was the usual mode of remittance transfer in your households (<i>e.g. hand carry/ hundi/ bank transfer/ bank cheques/ postal orders</i>)? Why was this particular mode of remittance transfer preferred? • M27 How was financial remittance spent in your households (<i>e.g. food, clothes, education, health, housing, consumer goods, repayment of loan, agricultural input, livestock input, savings, business, etc.</i>)? • M28 Had remittance been invested by your households in agriculture, livestock rearing, or business activities? If so, please, specify? 	<p>Focus group (<i>Note: This section is about the participant's household.</i>)</p>

<ul style="list-style-type: none"> • M29 Did you or other migrants from your households bring back new skills or knowledge from the destination (<i>e.g. carpentry, plumbing, electrical repair, electronics repair, driving, farming technique, knowledge of new crops or livestock, livestock rearing technique, language, computers, accounting, etc.</i>)? If so, what were these? • M30 Did you or other migrants from your households have an opportunity to use the above mentioned skills or knowledge in this <i>village or surrounding areas</i>? If so, how? If not, why? • M31 Had the <i>knowledge of new crops, farming or livestock rearing techniques, entrepreneurial skills</i> learnt in the destination ever been applied by you or other migrants from your households in this village or surrounding areas? 	
<ul style="list-style-type: none"> • M32 Does this village benefit from labour migration (<i>e.g. employment generation, demand of local goods and services from migrant households, sport and youth activities, support to village infrastructure and welfare activities, support to religious initiatives, increased access to information, widened networks, better flood preparedness or flood relief mechanisms, etc.</i>)? If yes, how? • M33 Does this village have physical intervention measures to reduce the flood impacts (<i>e.g. embankment, concrete porcupine, boulder, flood warning system, flood shelter, granary on cement stilts, houses on stilts, houses on raised platforms, reinforced concrete houses, all weather road, boats, tube-well on raised platforms etc.</i>)? If yes, what are these? Had your households contributed towards the construction of any of these? If so, how? • M34 Had your households contributed to replace or strengthen knowledge, practice, and attitude (<i>e.g. flood resistant crops, introduction of new farming or livestock rearing techniques, flood response practices, flood preparedness, insurance, and savings</i>) that assist this village to better respond to the flood impacts? Please, specify. 	
<ul style="list-style-type: none"> • M35 Are there risks from migration to (a) yourself, (b) your households and (c) this village? 	
<ul style="list-style-type: none"> • M36 What are the impacts of flooding on your households (<i>e.g. human injury/disease/ death, crop damage, livestock disease/ death, damage to housing, farming disruption due to sand-casting or debris deposition, crop pest, soil degradation, land erosion, disruption of food supply, loss of wage labour, loss of earning days, loss of income, and destruction of flood protection or warning measures, disruption of health, education and transport services, etc.</i>)? • M37 Are key assets of your households such as land, livestock, agricultural input, grains, food supply, and housing generally protected from flooding? If so, please specify. • M38 During flooding and in its aftermath, is assistance from friends, relatives, ethnic/ caste groups usually accessible to your households? • M39 During flooding and in its aftermath, is assistance from government and non-government organisations usually accessible to your households? If so, what did you receive? 	

<ul style="list-style-type: none"> • M40 Are financial services such as bank accounts, savings, insurance, and loans usually accessible to your households? 	
<ul style="list-style-type: none"> • M41 What are the strategies adopted by your households in response to floods (during and in aftermath)? (<i>Use Table M1 to document these practices</i>). • M42 Which of the aforementioned response strategies are adopted at the household- and settlement-levels? (<i>Use Table M1 to document these practices. Household – 1, Settlement – 2</i>). • M43 How useful is these aforementioned response strategies in protecting your households from floods? (<i>Use Table M1 to document these practices. Rank the practices in a descending order</i>). 	Rank in descending order
<ul style="list-style-type: none"> • M44 Are there any barriers to migration for work (<i>such as institutional, legal, social, cultural, and economic</i>)? If so, what are these barriers? 	Focus group

List of occupation

Occupation	Mining and Quarrying (1)	Manufacturing (2)	Electric, Gas & Water Supply (3)	Construction (4)
	Wholesale & Retail trade (5)	Hotels & Restaurants (6)	Transport, Storage & Communications (7)	
	Real Estate, Renting & Business Activities (8)		Financial Intermediation (9)	
	Public Administration (10)	Defence (11)	Education (12)	Health & Social Work (13)
	Other Community, Social & Personal Service Activities (14)			Private Households with Employed Persons (15)
	Extra-Territorial Organisations & Bodies (16)			Agriculture (17)
	Hunting and forestry (18)			Fishing (19)

M1: Response strategies used during or in aftermath of floods

Phase	Response strategies	Scale of use <i>(Household – 1, Settlement – 2.)</i>	Rank the usefulness <i>(Rank the practices in a descending order)</i>
During flood			
Between floods			
Immediate aftermath of floods			

[Note: This table will be recreated on a chart paper and its contents will be translated in the local language.]

In order to save time this session will begin with an updated list of strategies from the previous sessions. Participants will be asked to remove strategies from the list that are not relevant for them or add new ones to it.]

Men from the poor non-migrant households (Below Poverty Level)

Participants: Minimum 6 persons, Maximum 10 persons

Duration: 1 hour 45 minutes

[*Note: In the beginning, the facilitator will clarify with the participants that the discussion will be about poor non-migrant households.*]

Core question	Method
<ul style="list-style-type: none"> • PM1 What are the farm based livelihood strategies used by your households? As far as farm based livelihood strategies are concerned, do male and female members of your households have different responsibilities (gender disaggregated work responsibility)? • PM2 What are the non-farm based livelihood strategies used by your households? As far as non-farm based livelihoods are concerned, do male and female members of your households have different responsibilities (gender disaggregated work responsibility)? • PM3 Have your households ever thought of migration for work as an opportunity? If not, what are the reasons? • PM4 Do your households benefit directly or indirectly from the migration of people of this village (<i>e.g. employment generation, demand of local goods and services from migrant households, sport and youth activities, support to village infrastructure and welfare activities, support to religious initiatives, increased access to information, widened networks, better flood preparedness or flood relief mechanisms, etc</i>)? Please, specify. 	Focus group
<ul style="list-style-type: none"> • PM5 What are the impacts of flooding on your households (<i>e.g. human injury/ disease/ death, crop damage, livestock disease/ death, damage to housing, farming disruption due to sand-casting or debris deposition, crop pest, soil degradation, land erosion, disruption of food supply, loss of wage labour, loss of earning days, loss of income, and destruction of flood protection or warning measures, disruption of health, education and transport services, etc.</i>)? • PM6 Are key assets of your households such as land, livestock, agricultural input, grains, food supply, and housing generally protected from flooding? If so, please specify. • PM7 During flooding and in its aftermath, is assistance from friends, relatives, ethnic/ caste groups usually accessible to your households? • PM8 During flooding and in its aftermath, is assistance from government and non-government organisations usually accessible to your households? • PM9 Are financial services such as bank accounts, savings, insurance, and loans usually accessible to your households? 	Focus group
<ul style="list-style-type: none"> • PM10 What are the strategies adopted by your households in response to floods (during and in aftermath)? (<i>Use Table PM1 to document these practices</i>). • PM11 Which of the aforementioned response strategies are adopted at the household- and settlement-levels? (<i>Use Table PM1 to document these practices. Household – 1, Settlement – 2</i>). 	Rank in descending order

- PM12 How useful is these aforementioned response strategies in protecting your households from floods? (Use Table PM1 to document these practices. Rank the practices in a descending order).

Table PM1: Response strategies used during or in aftermath of floods

Phase	Response strategies	Scale of use (Household – 1, Settlement – 2.)	Rank the usefulness (Rank the practices in a descending order)
During flood			
Between floods			
Immediate aftermath of floods			

[Note: This table will be recreated on a chart paper and its contents will be translated in the local language.

In order to save time this session will begin with an updated list of strategies from the previous sessions. Participants will be asked to remove strategies from the list that are not relevant for them or add new ones to it.]

Women from the poor non-migrant households (Below Poverty Level)

Participants: Minimum 6 persons, Maximum 10 persons

Duration: 1 hour 45 minutes

[Note: In the beginning, the facilitator will clarify with the participants that the discussion will be about poor non-migrant households.]

Core question	Method
<ul style="list-style-type: none"> • PW1 What are the farm based livelihood strategies used by your households? As far as farm based livelihood strategies are concerned, do male and female members of your households have different responsibilities (gender disaggregated work responsibility)? • PW2 What are the non-farm based livelihood strategies used by your households? As far as non-farm based livelihoods are concerned, do male and female members of your households have different responsibilities (gender disaggregated work responsibility)? • PW3 Have your households ever thought of migration for work as an opportunity? If not, what are the reasons? • PW4 Do your households benefit directly or indirectly from the migration of people of this village (<i>e.g. employment generation, demand of local goods and services from migrant households, sport and youth activities, support to village infrastructure and welfare activities, support to religious initiatives, increased access to information, widened networks, better flood preparedness or flood relief mechanisms, etc.</i>)? Please, specify. 	Focus group
<ul style="list-style-type: none"> • PW5 What are the impacts of flood on your households (<i>e.g. human disease/ death, crop damage, livestock disease/ death, farming disruption, crop pest, soil degradation, disruption of food supply, loss of wage labour, loss of earning days, loss of income, disruption of health, education and transport services, etc.</i>)? • PW6 Are key assets of your households such as land, livestock, agricultural input, grains, food supply, and housing generally protected from flood? If so, please specify. • PW7 During flood and in its aftermath, is assistance from friends, relatives, ethnic/ caste groups usually accessible to your households? • PW8 During flood and in its aftermath, is assistance from government and non-government organisations usually accessible to your households? • PW9 Are financial services such as bank accounts, savings, insurance, and loans usually accessible to your households? 	Focus group
<ul style="list-style-type: none"> • PW10 What are the strategies adopted by your households in response to floods (during and in aftermath)? (<i>Use Table PW1 to document these practices.</i>) • PW11 Which of the aforementioned response strategies are adopted at the household- and settlement-levels? (<i>Use Table PW1 to document these practices. Household – 1, Settlement – 2.</i>) 	Rank in descending order

<p>• PW12 How useful is these aforementioned response strategies in protecting your households from floods? (Use Table PW1 to document these practices. Rank the practices in a descending order).</p>	
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Table PW1: Response strategies used during or in aftermath of floods

Phase	Response strategies	Scale of use (Household – 1, Settlement – 2.)	Rank the usefulness (Rank the practices in a descending order)
During flood			
Between floods			
Immediate aftermath of floods			

[Note: This table will be recreated on a chart paper and its contents will be translated in the local language.

In order to save time this session will begin with an updated list of strategies from the previous sessions. Participants will be asked to remove strategies from the list that are not relevant for them or add new ones to it.]

Men from the upper and middle income non-migrant households

Participants: Minimum 6 persons, Maximum 10 persons

Duration: 1 hour 45 minutes

[*Note: In the beginning, the facilitator will clarify with the participants that the discussion will be about upper and middle income non-migrant households.*]

Core question	Method
<ul style="list-style-type: none"> • UM1 What are the farm based livelihood strategies used by your households? As far as farm based livelihood strategies are concerned, do male and female members of your households have different responsibilities (gender disaggregated work responsibility)? • UM2 What are the non-farm based livelihood strategies used by your households? As far as non-farm based livelihoods are concerned, do male and female members of your households have different responsibilities (gender disaggregated work responsibility)? • UM3 Have your households ever thought of migration for work as an opportunity? If not, what are the reasons? • UM4 Do your households benefit directly or indirectly from the migration of people of this village (<i>e.g. employment generation, demand of local goods and services from migrant households, sport and youth activities, support to village infrastructure and welfare activities, support to religious initiatives, increased access to information, widened networks, better flood preparedness or flood relief mechanisms, etc.</i>)? Please, specify. 	Focus group
<ul style="list-style-type: none"> • UM5 What are the impacts of flooding on your households (<i>e.g. human injury/ disease/ death, crop damage, livestock disease/ death, damage to housing, farming disruption due to sand-casting or debris deposition, crop pest, soil degradation, land erosion, disruption of food supply, loss of wage labour, loss of earning days, loss of income, and destruction of flood protection or warning measures, disruption of health, education and transport services, etc.</i>)? • UM6 Are key assets of your households such as land, livestock, agricultural input, grains, food supply, and housing generally protected from flooding? If so, please specify. • UM7 During flooding and in its aftermath, is assistance from friends, relatives, ethnic/ caste groups usually accessible to your households? • UM8 During flooding and in its aftermath, is assistance from government and non-government organisations usually accessible to your households? • UM9 Are financial services such as bank accounts, savings, insurance, and loans usually accessible to your households? 	Focus group
<ul style="list-style-type: none"> • UM10 What are the strategies adopted by your households in response to floods (during and in aftermath)? (<i>Use Table UM1 to document these practices.</i>) • UM11 Which of the aforementioned response strategies are adopted at the household- and settlement-levels? (<i>Use Table UM1 to document these practices. Household – 1, Settlement – 2.</i>) 	Rank in descending order

<p>• UM12 How useful is these aforementioned response strategies in protecting your households from floods? <i>(Use Table UM1 to document these practices. Rank the practices in a descending order).</i></p>	
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Table UM1: Response strategies used during or in aftermath of floods

Phase	Response strategies	Scale of use (Household – 1, Settlement – 2.)	Rank the usefulness (Rank the practices in a descending order)
Between floods			
Immediate aftermath of floods			

[Note: This table will be recreated on a chart paper and its contents will be translated in the local language.]

In order to save time this session will begin with an updated list of strategies from the previous sessions. Participants will be asked to remove strategies from the list that are not relevant for them or add new ones to it.]

Women from the upper and middle income non-migrant households

Participants: Minimum 6 persons, Maximum 10 persons

Duration: 1 hour 45 minutes

[*Note: In the beginning, the facilitator will clarify with the participants that the discussion will be about upper and middle income non-migrant households.*]

Core question	Method
<ul style="list-style-type: none"> • UW1 What are the farm based livelihood strategies used by your households? As far as farm based livelihood strategies are concerned, do male and female members of your households have different responsibilities (gender disaggregated work responsibility)? • UW2 What are the non-farm based livelihood strategies used by your households? As far as non-farm based livelihoods are concerned, do male and female members of your households have different responsibilities (gender disaggregated work responsibility)? • UW3 Have your households ever thought of migration for work as an opportunity? If not, what are the reasons? • UW4 Do your households benefit directly or indirectly from the migration of people of this village (<i>e.g. employment generation, demand of local goods and services from migrant households, sport and youth activities, support to village infrastructure and welfare activities, support to religious initiatives, increased access to information, widened networks, better flood preparedness or flood relief mechanisms, etc.</i>)? Please, specify. 	Focus group
<ul style="list-style-type: none"> • UW5 What are the impacts of flooding on your households (<i>e.g. human injury/ disease/ death, crop damage, livestock disease/ death, damage to housing, farming disruption due to sand-casting or debris deposition, crop pest, soil degradation, land erosion, disruption of food supply, loss of wage labour, loss of earning days, loss of income, and destruction of flood protection or warning measures, disruption of health, education and transport services, etc.</i>)? • UW6 Are key assets of your households such as land, livestock, agricultural input, grains, food supply, and housing generally protected from flooding? If so, please specify. • UW7 During flooding and in its aftermath, is assistance from friends, relatives, ethnic/ caste groups usually accessible to your households? • UW8 During flooding and in its aftermath, is assistance from government and non-government organisations usually accessible to your households? • UW9 Are financial services such as bank accounts, savings, insurance, and loans usually accessible to your households? 	Focus group
<ul style="list-style-type: none"> • UW10 What are the strategies adopted by your households in response to floods (during and in aftermath)? (<i>Use Table UW1 to document these practices.</i>) • UW11 Which of the aforementioned response strategies are adopted at the household- and settlement-levels? (<i>Use Table UW1 to document these practices. Household – 1, Settlement – 2.</i>) 	Ranking in descending order

<p>• UW12 How useful is these aforementioned response strategies in protecting your households from floods? (Use Table UW1 to document these practices. Rank the practices in a descending order).</p>	
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Table UW1: Response strategies used during or in aftermath of floods

Phase	Response strategies	Scale of use (Household – 1, Settlement – 2.)	Rank the usefulness (Rank the practices in a descending order)
During flood			
Between floods			
Immediate aftermath of floods			

[Note: This table will be recreated on a chart paper and its contents will be translated in the local language.

In order to save time this session will begin with an updated list of strategies from the previous sessions. Participants will be asked to remove strategies from the list that are not relevant for them or add new ones to it.]

Women from migrant-sending households

Participants: Minimum 6 persons, Maximum 10 persons

Duration: 2.5 hours (*Split in three sessions*)

[*Note: In the beginning, the facilitator will clarify with the participants that the discussion will be about migrant households.*]

Core question	Method
<ul style="list-style-type: none"> • W1 What are the farm based livelihood strategies used by your households? Regarding farm based livelihood strategies, do male and female members of your households have different responsibilities (gender disaggregated work responsibility)? • W2 What are the non-farm based livelihood strategies used by your households? Regarding non-farm based livelihoods, do male and female members of your households have different responsibilities (gender disaggregated work responsibility)? 	Focus group
<ul style="list-style-type: none"> • W3 Are there opportunities for women of this village to migrate for work? If yes, what are these? Why are women not able to take advantage of these opportunities? 	
<ul style="list-style-type: none"> • W4 Who usually migrates (<i>e.g. age, gender, ethnicity/ caste, economic class, educational background, and skilled/ unskilled</i>) from this village? • W5 Were you or other women members of your households involved in the migration decision making process? If yes, please, specify which women members of your households (<i>wife/ mother/ sister/ others</i>) were consulted? 	
<ul style="list-style-type: none"> • W6 What were the benefits from migration to your households (<i>e.g. income generation for themselves, increase in well-being, access to information/ networking, reduce risk from flooding, etc.</i>)? Please, specify. 	
<ul style="list-style-type: none"> • W7 Had the economic situation of your households changed since the migration of a household member for work? If yes, how? 	
<ul style="list-style-type: none"> • W8 In the past year, how often had your households received remittance? 	
<ul style="list-style-type: none"> • W9 Which member of your households is the formal recipient of the remittance? 	
<ul style="list-style-type: none"> • W10 How was financial remittance spent in your households (<i>e.g. food, clothes, education, health, housing, consumer goods, repayment of loan, agricultural input, livestock input, savings, business, etc.</i>)? 	
<ul style="list-style-type: none"> • W11 Which member of your households takes the final decision on remittance utilisation? Are the women of your households consulted? 	

<ul style="list-style-type: none"> • W12 Did migrants from your households bring back new skills or knowledge from the destination (<i>e.g. carpentry, plumbing, electrical repair, electronics repair, driving, farming technique, knowledge of new crops or livestock, livestock rearing technique, language, computers, accounting, etc.</i>)? • W13 Did migrants from your households have an opportunity to use the above mentioned skills or knowledge in this <i>village or surrounding areas</i>? If so, how? If not, why? • W14 Had the <i>knowledge of new crops, farming or livestock rearing techniques, entrepreneurial skills</i> learnt in the destination ever been applied by migrants from your households in this village or surrounding areas? 	
<ul style="list-style-type: none"> • W15 Did this village benefit from labour migration (<i>e.g. employment generation, demand of local goods and services from migrant households, sport and youth activities, support to village infrastructure and welfare activities, support to religious initiatives, increased access to information, widened networks, better flood preparedness or flood relief mechanisms, etc.</i>)? If yes, how? 	
<ul style="list-style-type: none"> • W16 How did migration of members of your households affect farming activities at the household level (<i>e.g. increase in fallow land, shift to less labor intensive crop, shift to less labor intensive livestock, hire labor, more work for women, Impact on agriculture production, etc.</i>)? • W17 How did migration of members of your households affect non-farm activities? • W18 How did migration of members of your households influenced the distribution of household activities? Who took over the work of the migrant family member? • W19 How did migration of the household member influenced participation in village level activity? Who represented the migrant family member in village meetings? • W20 Does the migration of the husband impacts the mobility of the wife? If so, how? • W21 Does the social status of the wife of the migrant change within the household and the village? • W22 Does the social status of the family of the migrant change within the village? • W23 Are there any disadvantages for wives of the migrants (<i>e.g. physical security, access to medical care, mobility</i>)? 	
<ul style="list-style-type: none"> • W24 What were the impacts of flooding on your households (<i>e.g. human injury/ disease/ death, crop damage, livestock disease/ death, damage to housing, farming disruption due to sand-casting or debris deposition, crop pest, soil degradation, land erosion, disruption of food supply, loss of wage labour, loss of earning days, loss of income, and destruction of flood protection or warning measures, disruption of health, education and transport</i>)? 	

<p><i>services, etc.)?</i></p> <ul style="list-style-type: none"> • W25 Were key assets of your households such as land, livestock, agricultural input, grains, food supply, and housing generally protected from flooding? If so, please specify. • W26 During flooding and in its aftermath, is assistance from friends, relatives, ethnic/ caste groups usually accessible to your households? • W27 During flooding and in its aftermath, is assistance from government and non-government organisations usually accessible to your households? • W28 Were financial services such as bank accounts, savings, insurance, and loans usually accessible to your households? 	
<ul style="list-style-type: none"> • W29 During migration did you or other migrants from your households take the assistance of any government institution? If so, what kind of assistance was received? • W30 During migration did you or other migrants from your households take the help of any non-government organisation during migration? If so, what kind of assistance was received? 	Focus group
<ul style="list-style-type: none"> • M31 Was there any association of migrants in the destination? If so, please, specify. • M32 Is there any association of migrants in this village or locality. If so, please, specify. 	
<ul style="list-style-type: none"> • W33 What are the strategies adopted by your households in response to floods (during and in aftermath)? (<i>Use Table W1 to document these practices</i>). • W34 Which of the aforementioned response strategies are adopted at the household- and settlement-levels? (<i>Use Table W1 to document these practices. Household – 1, Settlement – 2</i>). • W35 How useful is these aforementioned response strategies in protecting your households from floods? (<i>Use Table W1 to document these practices. Rank the practices in a descending order</i>). 	Rank in descending order

List of occupation

Occupation	Mining and Quarrying (1)	Manufacturing (2)	Electric, Gas & Water Supply (3)	Construction (4)	
	Wholesale & Retail trade (5)	Hotels & Restaurants (6)	Transport, Storage & Communications (7)		
	Real Estate, Renting & Business Activities (8)		Financial Intermediation (9)		
	Public Administration (10)	Defence (11)	Education (12)	Health & Social Work (13)	
	Other Community, Social & Personal Service Activities (14)			Private Households with Employed Persons (15)	
	Extra-Territorial Organisations & Bodies (16)			Agriculture (17)	
	Hunting and forestry (18)			Fishing (19)	

Table W1: Response strategies used during or in aftermath of floods

Phase	Flood strategies	Scale of use (Household – 1, Settlement – 2.)	Rank the usefulness (Rank the practices in a descending order)
During flood			
Between floods			
Immediate aftermath of floods			

[Note: This table will be recreated on a chart paper and its contents will be translated in the local language.]

[In order to save time this session will begin with an updated list of strategies from the previous sessions. Participants will be asked to remove strategies from the list that are not relevant for them or add new ones to it.]

Survey in Assam

VERBAL CONSENT:

[Local Greetings] My name is [NAME OF THE INTERVIEWER/ FACILITATOR] and I am working with the [NAME OF THE LOCAL PARTNER INSTITUTION]. We are conducting a study to examine the role played by labour migration and remittances in reducing vulnerability of flood affected households. The information you provide will only be used to learn about the relationship between flooding, migration and vulnerability.

The study is conducted by the International Centre for Integrated Mountain Development (ICIMOD), Kathmandu, and [NAME OF THE LOCAL PARTNER INSTITUTION], [LOCATION OF THE LOCAL PARTNER INSTITUTION].

We would much appreciate the participation of yourself/ your household in this study. We will like to ask you some questions about your household. Participation in this study is voluntary and you can choose not to answer any question or all of the questions.

This activity will take approximately [DURATION IN MINUTES] and will be carried out today or another day you prefer.

The information you provide is totally confidential and your name will not be disclosed to anyone. The data will only be used for research purposes. Your name and other personal information will be replaced with a code that will be used to identify your answers without using your name.

At this time, do you want to ask me anything about this study?

ANSWER ANY QUESTIONS AND ADDRESS PARTICIPANT'S CONCERNS.

May we begin now?

PARTICIPANT AGREES Begin the interview

PARTICIPANT DOES NOT AGREE Leave

Household Schedule 2013

ICIMOD/Aaranyak

Questionnaire number: <input style="width:90%;" type="text"/>	HH code: <input style="width:90%;" type="text"/>	Time _____:_____ to _____:_____ [Indicate 14:30 if it is 2:30pm]
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This paragraph has to be read before each interview. At the beginning of the interview, take the time to present yourself and the aim of the questionnaire to establish trust with the respondent. If necessary, take the time to answer to the respondent's own questions. Clearly, ask if respondent agree to answer these questions. If it is the case, then pursue. If it is not the case, leave the respondent politely and move to a replacement household.

I am a surveyor hired to carry a survey in your village. This survey is part of a research project to better understand the role of migrant workers and remittance as a response to floods. Your household has been selected randomly. I will ask you several questions. The total time of the questionnaire will not be more than 2 hours. All your answers will be kept private, and your name will not appear in any data that is made publicly available. The information you provide will also serve for research purposes.

Do you accept to answer to this questionnaire?

<input type="checkbox"/> Yes (1)	<input type="checkbox"/> No (2) [skip to next household]
----------------------------------	--

Enumerator code: _____	Supervisor code: _____	Date (Y/M/D): 2013/____/____	Province: _____
District: _____	Block: _____	Circle: _____	Village: _____
Altitude (in metres): _____	Latitude: _____	Longitude: _____	

Respondent's age: _____ Respondent's Sex= M (1)/ F (2)

Relation to HH head = head (1)/ husband, wife (2) / son, daughter (3)/ grandchild (4)/ father, mother (5)/ brother, sister (6)/ nephew, niece (7)/ son-, daughter-in-law (8)/ brother-, sister-in-law (9)/ father-, mother-in-law (10)/ other family relative (11)/ servant, servant's relative (12)/ tenant, tenant's relative (13)/ co-wife, co-husband (14)/ other (15)

HH head's name: _____ HH head's marital status= married (1)/ single (2)/ separated (3)/ divorced (d)/ widowed (5)

[only if relation not "1"] HH head's age: _____ [only if relation not "1"] HH head's sex= M (1) / F (2)

[To be completed by the enumerator at the end of the survey]

Results code = Questionnaire completed (1)/ Questionnaire not completed (2) / Household absent (3)/ Household refused (4)

1.1	How many persons have eaten and slept (stayed/resided) in your household for at least six months during the last 12 months? # of household members: <input style="width:40%;" type="text"/>
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1.2	How many of those are females and males of the following age groups: age 5 or younger, age 6 to 14, age 15 to 64, and age 65 and older? [Put "0" if not applicable. Make sure number of persons adds up to total number of HH members in question 1.1.]																
<table border="1" style="width:100%; border-collapse: collapse;"> <tr> <td style="width:25%; padding: 2px;">males age 0-5</td> <td style="width:10%; padding: 2px;"><input style="width:90%;" type="text"/></td> <td style="width:25%; padding: 2px;">males age 6-14</td> <td style="width:10%; padding: 2px;"><input style="width:90%;" type="text"/></td> <td style="width:25%; padding: 2px;">males age 15-64</td> <td style="width:10%; padding: 2px;"><input style="width:90%;" type="text"/></td> <td style="width:25%; padding: 2px;">males age 65+</td> <td style="width:10%; padding: 2px;"><input style="width:90%;" type="text"/></td> </tr> <tr> <td style="padding: 2px;">females age 0-5</td> <td style="padding: 2px;"><input style="width:90%;" type="text"/></td> <td style="padding: 2px;">females age 6-14</td> <td style="padding: 2px;"><input style="width:90%;" type="text"/></td> <td style="padding: 2px;">females age 15-64</td> <td style="padding: 2px;"><input style="width:90%;" type="text"/></td> <td style="padding: 2px;">females age 65+</td> <td style="padding: 2px;"><input style="width:90%;" type="text"/></td> </tr> </table>		males age 0-5	<input style="width:90%;" type="text"/>	males age 6-14	<input style="width:90%;" type="text"/>	males age 15-64	<input style="width:90%;" type="text"/>	males age 65+	<input style="width:90%;" type="text"/>	females age 0-5	<input style="width:90%;" type="text"/>	females age 6-14	<input style="width:90%;" type="text"/>	females age 15-64	<input style="width:90%;" type="text"/>	females age 65+	<input style="width:90%;" type="text"/>
males age 0-5	<input style="width:90%;" type="text"/>	males age 6-14	<input style="width:90%;" type="text"/>	males age 15-64	<input style="width:90%;" type="text"/>	males age 65+	<input style="width:90%;" type="text"/>										
females age 0-5	<input style="width:90%;" type="text"/>	females age 6-14	<input style="width:90%;" type="text"/>	females age 15-64	<input style="width:90%;" type="text"/>	females age 65+	<input style="width:90%;" type="text"/>										

2	What is the religion of the household head? [Select only one option.]								
<table border="1" style="width:100%; border-collapse: collapse;"> <tr> <td style="width:12.5%; padding: 2px;">Hindu (1)</td> <td style="width:12.5%; padding: 2px;">Muslim (2)</td> <td style="width:12.5%; padding: 2px;">Christian (3)</td> <td style="width:12.5%; padding: 2px;">Buddhist (4)</td> <td style="width:12.5%; padding: 2px;">Taoist (5)</td> <td style="width:12.5%; padding: 2px;">Other (6)</td> <td style="width:12.5%; padding: 2px;">Refused to say (-7)</td> <td style="width:12.5%; padding: 2px;">No religion (-11)</td> </tr> </table>		Hindu (1)	Muslim (2)	Christian (3)	Buddhist (4)	Taoist (5)	Other (6)	Refused to say (-7)	No religion (-11)
Hindu (1)	Muslim (2)	Christian (3)	Buddhist (4)	Taoist (5)	Other (6)	Refused to say (-7)	No religion (-11)		

3	What is the caste/ethnicity of the household head? [Put "-6" if not applicable.]					
<table border="1" style="width:100%; border-collapse: collapse;"> <tr> <td style="width:45%; padding: 2px;">Caste, specify <input style="width:95%;" type="text"/></td> <td style="width:10%; padding: 2px;">Tribe, specify <input style="width:95%;" type="text"/></td> </tr> </table>		Caste, specify <input style="width:95%;" type="text"/>	Tribe, specify <input style="width:95%;" type="text"/>			
Caste, specify <input style="width:95%;" type="text"/>	Tribe, specify <input style="width:95%;" type="text"/>					
[Select only one option. Scheduled caste can be from only Hindus, Sikhs, and Buddhists and not from any other religion. Scheduled tribe can be from any religion]						
<table border="1" style="width:100%; border-collapse: collapse;"> <tr> <td style="width:25%; padding: 2px;">Scheduled castes (1)</td> <td style="width:25%; padding: 2px;">Scheduled tribes (2)</td> <td style="width:25%; padding: 2px;">Other backward castes (3)</td> <td style="width:25%; padding: 2px;">Other (4)</td> <td style="width:20%; padding: 2px;">Refused to say (-7)</td> </tr> </table>		Scheduled castes (1)	Scheduled tribes (2)	Other backward castes (3)	Other (4)	Refused to say (-7)
Scheduled castes (1)	Scheduled tribes (2)	Other backward castes (3)	Other (4)	Refused to say (-7)		

4	What is the highest completed level of education of the household head? [Select only one option.]																				
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5	How many female and male members of your household age 6 and older can read and write a letter? [Put "0" if not applicable. Make sure number of persons adds up to total number of HH members.]												
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6	Does any member of your household have a BPL ration card?		
<table border="1" style="width:100%; border-collapse: collapse;"> <tr> <td style="width:50%; padding: 2px;"><input type="checkbox"/> Yes (1)</td> <td style="width:50%; padding: 2px;"><input type="checkbox"/> No (2)</td> </tr> </table>		<input type="checkbox"/> Yes (1)	<input type="checkbox"/> No (2)
<input type="checkbox"/> Yes (1)	<input type="checkbox"/> No (2)		

7.1	Does any adult member of your household have a MGNREGA card (or a Job card)?	
	Yes (1)	No (2) [skip to question 8.1]
7.2	During 2012 how many days had the following household members worked in any MGNREGA activity? [Put "0" if not applicable.]	
	males age 6-14	males age 15-64
	males age 65+	
	females age 6-14	females age 15-64
	females age 65+	
8.1	Do any adult female and male members of your household commute to work (either for business or occupation) in a different town or village within the country ?	
	Yes (1)	No (2) [skip to question 9]
8.2	During the last 12 months, how many adult female and male members of your household had commuted to work (either for business or occupation) in a different town or village within the country ? [During the 12 month preceding the survey. Put "0" if not applicable.]	
	males age 15-64	males age 65+
	females age 15-64	females age 65+
	[If no one from this household had commuted to work then skip to question 9]	
8.3	During the last 12 months, in what kind of occupation was the commuter employed? [During the 12 month preceding the survey. Put "0" if not applicable]	
	male commuters:	#1 #2 #3 #4
	female commuters:	#1 #2 #3 #4
	Occupation	Mining and Quarrying (1) Manufacturing (2) Electric, Gas & Water Supply (3) Construction (4) Wholesale & Retail trade (5) Hotels & Restaurants (6) Transport, Storage & Communications (7) Real Estate, Renting & Business Activities (8) Financial Intermediation (9) Public Administration (10) Defence (11) Education (12) Health & Social Work (13) Other Community, Social & Personal Service Activities (14) Private Households with Employed Persons (15) Extra-Territorial Organisations & Bodies (16) Agriculture (17) Hunting and forestry (18) Fishing (19)
9	[Information to be collected by enumerator while in the household (ask only if unable to determine answer visually). The following question concern the main house of the household, please consider the main house as the house where household members sleep.] What is the primary construction material of the housing unit's exterior walls ?	
	1. Grass/ thatch/ bamboo	2. Plastic/ polythene
	3. Mud/ unburnt brick	4. Wood
	5. Stone not packed with mortar	6. Stone packed with mortar
	7. GI/ Metal/ Asbestos sheets	8. Concrete
	9. Burnt brick	10. Other
10	[Information to be collected by enumerator while in the household (ask only if unable to determine answer visually). The following question concern the main house of the household, please consider the main house as the house where household members sleep.] What is the primary construction material of the housing unit's main roof ?	
	1. Grass/ thatch/ bamboo/ wood/ mud	2. Plastic/ polythene
	3. Handmade tiles	4. Machine made tiles
	5. Burnt brick	6. Stone
	7. Slate	8. Metal/ GI/ Asbestos sheets
	9. Concrete	10. Other
11.1	What is the primary source of light your home uses?	[Do not read out all options. Just ask questions and select the appropriate ones.]
		1. Electricity from local grid
		2. Electricity from national grid
		3. Electricity from a generator
		4. Electricity from solar cells, wind turbine or small, hydroelectric dam
		5. Liquid fuel [petrol, kerosene]
		6. Gas fuel [methane from tank, biogas]
		7. Coal or charcoal
		8. Vegetable or animal based fats or oils
		9. Candle, paraffin wax, or battery-powered source
		10. Wood, sawdust, grass or other natural material
		11. Animal dung
		12. Other, specify:
		-2. None
		-3. Heat not needed in region
11.2	What is the primary fuel source your household uses for cooking?	
11.3	What is the primary fuel source your household uses for heat?	
12	What type of toilet facility does your household usually use? [Do not read out all options. Just ask question and select the appropriate one.]	
	None (open defecation) (1)	Open pit (2)
	Enclosed pit (3)	Enclosed improved-ventilation pit (4)
	Enclosed pour-flush (5)	Enclosed flush (6)
	Compost or biogas (7)	Public toilet (8)
	Other (9)	
	"Open" means there is no structure, or a structure with no roof. "Enclosed" means there is a structure with any sort of roof.	

13	What is the main source (meaning, the source water comes from immediately before being used) of the water your household uses for drinking?				
	During the rainy season		During the dry season		
	No rainy season in our area (-2)		No dry season in our area (-3)		
	<i>[Do not read out all options. Just ask questions and select the appropriate ones.]</i>				
	1. Unprotected dug well	2. Protected dug well	3. Tubewell/ Borewell		
4. Unprotected spring	5. Protected spring	6. Pond/ river/ stream/ canal			
7. Public standpipe	8. Piped water inside the house	9. Piped water inside the community			
10. Rainwater collection	11. Vendor provided/ bottled water	12. Water tanker			
13. Hand pump	14. Tank	15. Other			
14	Approximately how much time (in minutes) does it take a member of your household to collect drinking water for a normal day? <i>[If water is collected from a piped supply in the household record "1" minute]</i>				
	During the rainy season		During the dry season		
	No rainy season in our area (-2)		No dry season in our area (-3)		
15	Does your household have access to land for agriculture?				
	Yes (1)	No (2) <i>[Skip to question 21]</i>			
16	How much land does your household have for agriculture (for crops, grass, trees, orchard, fallow, etc.)? <i>[Enumerator to convert local measurement to hectares. Put "0" if not appropriate]</i>				
	Crop farming		Orchard/Plantation		
	Home garden		Fallow		
17	How much of the household's land is irrigated or rain-fed ? <i>[Enumerator to convert local measurement to hectares. Make sure that total land in question 17 is equal to the same in question 16. Put "0" if not appropriate.]</i>				
	Irrigated		Only rain-fed		
18	What kind of ownership does your household have for your land? <i>[Enumerator to convert local measurement to hectares. Put "0" if not appropriate.]</i>				
	Owned		Leasehold		
	Tenure access in common property resource			Tenure access in collective land	
19	During the last 12 months , what kind of staple and cash crops did your household grow ? <i>[During the 12 month preceding the survey. Do not read out all options. Just ask question and select the appropriate one. Record up to 5 crops per category. Put "-6" if not applicable.]</i>				
	Staple crops:	#1	#2	#3	
	Cash crops:	#1	#2	#3	
	Early paddy (1)	Main paddy (2)	Upland paddy (3)	Wheat (4)	
	Summer maize (6)	Millet (7)	Barley/ Highland Barley (8)	Buckwheat (9)	
	Soybean (11)	Black gram (12)	Red gram (13)	Grass pea (14)	
	Horse gram (16)	Pea (17)	Green gram (18)	Coarse gram (19)	
	Other legumes (21)	Winter potato (22)	Summer potato (23)	Sweet potato (24)	
	Other tubers (26)	Mustard (27)	Ground nut (28)	Linseed (29)	
	Other oilseed (31)	Sugarcane (32)	Jute (33)	Tobacco (34)	
	Chillies (36)	Onions (37)	Garlic (38)	Ginger (39)	
	Cardamom (41)	Coriander Seed (42)	Other spices (43)	Winter vegetables (44)	
	Summer vegetables (45)	Orange (46)	Lemon (47)	Lime (48)	
	Other citrus (50)	Mango (51)	Banana (52)	Guava (53)	
	Lichee (56)	Pear (57)	Apple (58)	Plum (59)	
	Other fruit (62)	Tea (63)	Thatch (64)	Fodder trees (65)	
	Apricot (68)	Walnut (69)	Other trees (70)	Opium (71)	
	Longan (73)	Watermelon (74)	Coffee (75)	Rubber (76)	
	20	During the last 12 months , what was the income from the sale of staple crops and cash crops? <i>[Record the income from sales in local currency. Put "0" if not appropriate.]</i>			
		Staple crop		Cash crop	
21	Does your household own livestock?				
	Yes (1)	No (2) <i>[skip to question 24]</i>			

22	How many of the following animals do your household own? <i>[Put "0" if not appropriate.]</i>		
	Cattle	# of	
	Buffaloes	# of	
	Yak/Naks/Dzo	#of	
	Goat	#of	
	Sheep	#of	
	Horses/Donkeys/Mules	#of	
	<i>[Count female and male animals together. Put "0" if not appropriate.]</i>		
	Pigs	# of	
Poultry/Ducks/Pigeons	# of		
Other livestock	# of		
23	Which is the main grazing system followed by your household? <i>[Select only one option.]</i>		
	Extensive grazing (pastoralism/ ranching) (1)		Intensive grazing (cut-and-carry for stall feeding/ improved pasture) (2)
	Agro-pastoralism (on crop residues) (3)		Silvo-pastoralism (in forests/ shrublands) (5)
24.1	During the last 30 years, have you observed any changes in your environment which have not occurred before?		
	Yes (1)	No (2) <i>[skip to question 25.1]</i>	
24.2	What kind of events have you observed which had not occurred in your village before? <i>[More than one option possible. Do not read out all options. Just ask question and select the appropriate one. Put "-6" if not applicable.]</i>		
	Drought	Dry spell	Flood
	Erratic rainfall	Frost	Hail
	Snow or blizzard	Avalanche	Landslide/erosion
	Earthquake	Volcanic eruption	Typhoon/hurricane
	Tornado	Strong wind	Dust storm
	High temperatures	Low temperatures	Subzero temperatures
	Wildfire	Insect attack	Crop pests
	Soil problems	Livestock disease	Irrigation problems
	Occurrence of new plant species	Occurrence of new animal species (e.g. mosquitoes)	
Other, specify:			
		Observed (1)	Not observed (2)
25.1	Overall, would you say that the temperatures patterns in your village have changed over the last 30 years?		
	Yes (1)	No (2) <i>[skip to question 25.3]</i>	
25.2	How has the temperature patterns changed in your village over the last 30 years? <i>[More than one option possible. Just ask question and select the appropriate one. Put "-6" if not applicable.]</i>		
	Annual temperature	Increased (1)	No change (2) Decreased (3)
	Summer temperature	Became hotter (1)	No change (2) Became cooler (3)
	Winter temperature	Became colder (1)	No change (2) Became warmer (3)
	Length of summer	Increased (1)	No change (2) Decreased (3)
	Length of winter	Increased (1)	No change (2) Decreased (3)
	Frost	More frequent (1)	No change (2) Less frequent (3)
	Heat wave	More frequent (1)	No change (2) Less frequent (3)
	Cold wave	More frequent (1)	No change (2) Less frequent (3)

25. 3	Overall, would you say that the precipitation patterns in your village have changed over the last 30 years ?			
	Yes (1)	No (2) <i>[skip to question 25.5]</i>		
25. 4	How has the precipitation patterns changed in your village over the last 30 years ? <i>[More than one option possible. Just ask question and select the appropriate one. Put "-6" if not applicable.]</i>			
	Annual amount of precipitation	Increased (1)	No change (2)	Decreased (3)
	Amount of summer precipitation	Increased (1)	No change (2)	Decreased (3)
	Amount of winter precipitation	Increased (1)	No change (2)	Decreased (3)
	Timing of precipitation	Advanced (1)	No change (2)	Delayed (3)
	Number of rainy days	Increased (1)	No change (2)	Decreased (3)
	Number of snowfall days	Increased (1)	No change (2)	Decreased (3)
	Precipitation intensity	Increased (1)	No change (2)	Decreased (3)
	Hail storms	More frequent (1)	No change (2)	Less frequent (3)
	More erratic precipitation	Increased (1)	No change (2)	Decreased (3)
25. 5	Overall, would you say that the flood patterns in your village have changed over the last 30 years ?			
	Yes (1)	No (2) <i>[skip to question 26.1]</i>		
25. 6	How has the flood patterns changed in your community over the last 30 years ? <i>[More than one option possible. Just ask question and select the appropriate one. Put "-6" if not applicable.]</i>			
	Frequency of flood	Increased (1)	No change (2)	Decreased (3)
	Area of inundation	Increased (1)	No change (2)	Decreased (3)
	Duration of inundation	Increased (1)	No change (2)	Decreased (3)
	Intensity of sand casting	Increased (1)	No change (2)	Decreased (3)
	Timing of flood	Advanced (1)	No change (2)	Delayed (3)
	Flood damage	Increased (1)	No change (2)	Decreased (3)
	Change in river course	More frequent (1)	No change (2)	Less frequent (3)
	Frequency of flash floods	Increased (1)	No change (2)	Decreased (3)

26.1	During the last 30 years , which of the following things did your household do during the flood to deal with its immediate impacts? [<i>“adopted”</i>] [<i>More than one option possible.</i>]		
26.2	In which year, was the practice mentioned in [<i>question 26.1</i>] first adopted by your household? [<i>“year of adoption”</i>] [<i>If the respondent is unable to recall the exact year, please, request him/her to approximate. Put ‘-4’ if used for generations.</i>]		
		Adopted	Year of adoption
Moved cattle to the higher ground (e.g. embankment)			
Moved family to a safer location (e.g. embankment)			
Built a raised platform inside the house (<i>Chang</i>)			
House was built on concrete stilts			
Relied on less preferred food			
Bought food on credit			
Begged for money or food			
Spent savings on food			
Collected wild food			
Reduced proportions/number of meals			
Restricted consumption of adults			
Skipped day without eating			
Stored fodder in a safe place			
Stored valuables in a safe place			
Stored firewood			
Collected and sold firewood/NTFP			
Stored harvest in a safe place			
Stored drinking water in drums (emergency water supply)			
Stored food items (emergency food stock)			
Granary on stilts			
Collected water in <i>Naora</i>			
Boiled or filtered drinking water			
Built stove using tin			
Arranged a boat			
Built a raft from banana plant			
Borrowed money from bank			
Borrowed money from relatives/ friends			
Borrowed money from cooperative/village fund			
Borrowed money from other financial service provider			
Helped set-up relief camp			
Contacted district administration for relief			
Contacted doctor or health centre (emergency health care)			
Erected a barrier to slow the speed of flood water			
Used bamboo poles to prevent garbage from flowing in flood water			
Got drinking water from elevated tube-well or well with raised foundation			
Reduced spending on health			
Reduced spending on education			
Reduced spending on clothes			
Other, specify:			
Adopted (1)	Not adopted (2)		

27. 1	During the last 30 years , which of the following things did your household do in the immediate aftermath of the flood to deal with its impacts? [<i>“adopted”</i>] [<i>More than one option possible.</i>]																																																																																																															
27. 2	In which year, was the practice mentioned in [<i>question 27.1</i>] first adopted by your household? [<i>“year of adoption”</i>] [<i>If the respondent is unable to recall the exact year, please, request him/her to approximate. Put ‘-4’ if used for generations.</i>]																																																																																																															
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Arranged safe drinking water																																																																																																																
Collected and sold firewood/NTFP																																																																																																																
Prepared for farming (e.g. clear debris, weeding, planting etc.)																																																																																																																
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28.1	During the last 30 years , which of the following things did your household do in between the flood two flood events to deal with their impacts? [<i>“adopted”</i>] [<i>More than one option possible.</i>]		
28.2	In which year, was the practice mentioned in [question 28.1] first adopted by your household? [<i>“year of adoption”</i>] [<i>If the respondent is unable to recall the exact year, please, request him/her to approximate. Put ‘-4’ if used for generations.</i>]		
	Raised the plinth of the house	Adopted	Year of adoption
	Raised the plinth of the granary		
	Raised the plinth of the cattle-shed		
	Raised the plinth of the well and tube-well		
	Raised the plinth of the latrine		
	Built a raised platform to keep cattle during flood		
	Raised the height of embankment surrounding the pond		
	Built a raised platform (Chaang ghor)		
	Made changes in the farming calendar (e.g. farm ahead or behind of schedule)		
	Grew flood resistant variety of crops (e.g. Bao paddy)		
	Reduced the area under paddy crop		
	Emphasised vegetable farming		
	Leased out farmland		
	Sold farmland		
	Sold or mortgaged household assets (incl. small animals, jewellery)		
	Sold agricultural assets (tools, seeds, livestock)		
	Reduced the number of ducks and poultry		
	Reduced the number of cattle		
	Stored food items and drinking water (emergency food stock)		
	Built or procured boat		
	Built bamboo porcupine to stop debris and slow down the speed of flood water		
	Used water pump for irrigation during the <i>Rabi</i> season		
	Used tractor for ploughing during the <i>Rabi</i> season		
	Repaired local infrastructure (e.g. bridge, road, community prayer hall)		
	Saved in a bank to be used during flood		
	Saved with other financial service provider to be used during flood		
	Borrowed money from bank		
	Borrowed money from relatives/ friends		
	Borrowed money from cooperative/village fund		
	Borrowed money from other financial service provider		
	Reduced spending on health		
	Reduced spending on education		
	Reduced spending on clothes		
	Non-working household (HH) member started to work		
	HH member sought work in same community		
	HH member sought work elsewhere (migration)		
	Sent children to work outside the HH		
	Other, specify:		
	Adopted (1)	Not adopted (2)	

29	Who of the following assisted the household to deal with the effects of the flood ? <i>[Read out all possibilities and ask if help was provided. More than one option possible.]</i>			
	Family/ Relatives		Friends	People of the community
	Insurance company		Financial institution	Local government
	Provincial government		National government	Local NGO
	IO (e.g. WFP, FAO)		Community organisation	Women SHG/cooperative
			Has assisted (1)	Has not assisted (2)
30	During the last 12 months , for how many months did you have sufficient food to feed all members of your household? <i>[Record answer in months (for example, 1 years = 12 months).]</i>			
Months=				
31	Whether purchased, home produced, or received in-kind: What is the total value of the following food items consumed by your household in the last 30 days ? <i>[Put value in local currency. Total value=what HH would have to spent on the local market. If respondent is unsure ask for approximation. Put "0" if not consumed.]</i>			
	Grains & cereals (rice/wheat/maize/millet...)		Pulses, lentils, beans	
	Cooking oil, ghee, butter		Meat, eggs, fish	
	Milk, curd, cheese, other milk products		Vegetables, potatoes	
	Fresh fruits & nuts		Spices & condiments (salt/masala/garlic...)	
	Sugar, honey, sweets, tea, soft drinks		Alcoholic beverages	
	Cigarettes, bidis, other tobacco products		Meals taken outside home	
	Bread, biscuits, noodles		Miscellaneous other food expenditures	
32	What is the total value of the following non-food items and services purchased or received in-kind by your household during the last 12 months ? <i>[Put value in local currency. Total value=what HH would have to spent on the local market. If respondent is unsure ask for approximation. Put "0" if not spent on an item.]</i>			
	Medical expenses, health care		Education (school fees, books, uniforms)	
	Clothing, shoes, other apparel		Personal care items (soap/cosmetics...)	
	Fuels & electricity (cooking/lighting)		Transportation & communication	
	Agricultural tools, seeds, fertilizers, hiring labour		Veterinary expenses, animal fee/fodder	
	Celebrations, social events, rituals		Miscellaneous non-food expenditure	
33	What is the percentage contribution of the following sources to the total yearly household income ? <i>[Fill in approximate percentage. Put "0" if not applicable. Proceed until it adds up to 100%.]</i>			
	Crop, vegetable, fruit sales	%	Livestock & livestock product sales	%
	Fish sales	%	Forest products sales (firewood/NTFP)	%
	Herb sales	%	Medical & aromatic plant sales	%
	Daily wage from farm (in village/area)	%	Salaried employment from farm (in village/area)	%
	Daily wage from non-farm (in village/area)	%	Salaried employment from non-farm (in village/area)	%
	Remittances	%	Other business/trade income	%
	Rent, interest on loan, or returns from share	%	Pension	%
	Governmental social benefit schemes	%	Development aid projects	%
	Gifts or begging	%		%
	Total % column 1		%	Total % column 2
Total column 1 + column 2				%
34	Does your household receive remittance ?			
Yes (1)		No (2) <i>[skip to question 40]</i>		
35.1	What was the total value [in local currency] of remittances, cash and in-kind , that your household has received during the last 12 month from people within the country ? <i>[Enumerator to remind respondent that all responses are confidential. Put "0" if not applicable.]</i>			
	Value of remittances			
35.2	What was the total value [in local currency] of remittances, cash and in-kind , that your household has received during the last 12 month from people outside the country ? <i>[Enumerator to remind respondent that all responses are confidential. Put "0" if not applicable.]</i>			
	Value of remittances			

35.4	During the last 30 years , has your household spent remittances on the following items and services ? [<i>“usage”</i>]		
35.5	During the last 12 months , what is the percentage of the remittances that your household has spent on the following items and services ? [<i>“percent”</i>] [<i>Fill in approximate percentage. Put “0” if not applicable. Proceed until it adds up to 100%.</i>]		
	Items, assets, and services		Usage Percent
	Food		%
	Housing	Built a new one	%
		Improved an existing one	%
	Communication (telephone, mobile phone, internet, bills)		%
	Transport	Used public transport (tempo, boat, bus, railways)	%
		Hired motorised transport (lorry, tempo, jeep, car, motor bike, boat)	%
		Bought motorised transport (lorry, tempo, jeep, car, motor bike, boat)	%
		Bought non-motorsied transport (cycle, pack animals, boat)	%
	Bought consumer goods (clothes, shoes, jewellery, cosmetics)		%
	Agriculture	Bought rural assets such as land/irrigation equipment	%
		Improved farming techniques (seeds, fertilisers, pesticide)	%
		Bought or hired draught animals (ox, male buffalo)	%
		Bought or hired labour saving machinery (tractor, harvester, tresher)	%
		Hired farm labour	%
	Animal husbandry	Bought livestock	%
		Availed extension services (medical checkup, vaccination)	%
		Hired labour to look after livestock	%
	Healthcare		%
	Education	School expenses	%
		Higher education expenses (college, university, etc.)	%
	Business venture (started a new one or invested in an existing one)		%
	Savings		%
	Disaster relief, recovery, and preparedness		%
	Bought insurance, bond or share		%
	Repaid loans		%
	Sponsored another migrant worker from the household		%
	Community activities (festivals, sports, infrastructure)		%
	Other, specify:		%
	Total		%
	Usage=	Yes (1)	No(2)
36	[Ask only if the household had mentioned using remittances for ‘disaster relief, recovery and preparedness’ in question 35.5.] During the flood , had your household spent remittances on the following items, assets and services? [<i>“usage”</i>]		
	Flood risk reduction	Items, assets, and services	Usage
	Relief during flood	Food	
		Shelter	
		Healthcare	
		Transport	
	Recovery in the aftermath of flood	Rebuild livelihoods	
		Reconstruct house	
		Buy household items and assets lost during the flood	
	Flood preparedness	Improve housing quality	
		Invest in hazard resistant crops	
		Invest in hazard resistant livestock	
		Invest in non-farm ventures	
		Savings to be used during flood	
	Usage=	Yes (1)	No(2)
37	How long have your household been receiving remittances irrespective of the source? [For example, record 27 months as 2 years 3 months. Put “0” if not applicable.]		
	Years:	Months:	

38	In what forms were remittances received by your household during the last 30 years ?			
	Cash	<input type="text"/>	Consumer goods	<input type="text"/>
	Direct payment of rent	<input type="text"/>	Direct payment of educational expenses	<input type="text"/>
	Direct payment of healthcare expenses	<input type="text"/>	Cheque, draft, money order	<input type="text"/>
	Other, specify:	<input type="text"/>		<input type="text"/>
	Yes (1)	<input type="text"/>	No (2)	<input type="text"/>
39	During last 30 years, where was the major share of remittances spent by the household?			
	In own village (1)	<input type="text"/>	In another village (2)	<input type="text"/>
	In an urban community other than destination (3) <input type="text"/>			
40	Does your household have an insurance policy that covers the following risks?			
	Property damage	<input type="text"/>	Crop damage	<input type="text"/>
	Health	<input type="text"/>	Death (Life insurance)	<input type="text"/>
	Yes (1)	<input type="text"/>	No (2)	<input type="text"/>
41	Does anyone in your household have a bank account ?			
	Yes (1)	<input type="text"/>	No (2)	<input type="text"/>
42	How many of the following items does your household have? <i>[Put "0" if not applicable.]</i>			
	# of televisions	<input type="text"/>	# of tractors/ power tillers	<input type="text"/>
	# of dish antennae	<input type="text"/>	# of mechanised thresher	<input type="text"/>
	# of radios/ transistors	<input type="text"/>	# of sewing machines	<input type="text"/>
	# of mobile phones	<input type="text"/>	# of drinking water storage pots (metallic)	<input type="text"/>
	# of other kind of telephones	<input type="text"/>	# of drinking water storage pots (clay)	<input type="text"/>
	# of computers/ laptops	<input type="text"/>	# of motorised two wheelers (scooters, bikes)	<input type="text"/>
	# of motorised four wheelers (cars, jeeps, buses)	<input type="text"/>	# of refrigerator	<input type="text"/>
	# of non-motorised vehicles (carts, bicycles etc.)	<input type="text"/>	# of washing machine	<input type="text"/>

Non-migrant Schedule 2013

ICIMOD/Aaranyak ²⁶¹

Questionnaire number:

HH code:

Date (Y/M/D): 2013/ /

Enumerator code:

Supervisor code:

[To be completed by the enumerator at the end of the survey]

Results code = Questionnaire completed (1)/ Questionnaire not completed (2)/ Household absent (3)/ Household refused (4)

1.1 Had your household members received any **assistance** about jobs, amenities and services from a **migrant worker** who belongs to this village? *[More than one option possible.]*

Financial assistance (e.g. loan, grant, etc)	<input type="checkbox"/>	Supported in case of a mishap	<input type="checkbox"/>
Assisted in paperwork (e.g. bank, reservation etc)	<input type="checkbox"/>	Information about job opportunity	<input type="checkbox"/>
Arranged a job in this village	<input type="checkbox"/>	Information about educational opportunity elsewhere	<input type="checkbox"/>
Arranged a job elsewhere (commuting)	<input type="checkbox"/>	Information about healthcare elsewhere	<input type="checkbox"/>
Assisted to organise transport	<input type="checkbox"/>	Information about amenities and services elsewhere	<input type="checkbox"/>
Information about accommodation elsewhere	<input type="checkbox"/>	Other, specify:	<input type="text"/>
Done (1)	<input type="checkbox"/>	Not done (2)	<input type="checkbox"/>

2.1 Had any member of your household been **employed** by another household from this village whose members had **lived and worked in a different town or village within the country or in another country**?

Yes (1)	<input type="checkbox"/>	No (2) <i>[skip to question 3]</i>	<input type="checkbox"/>
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2.2 In what **type of occupation** was a member of your household **employed** as mentioned in *[question 2.1]*? *[Select only one option. Put "-6" if not applicable.]*

Occupation	Mining and Quarrying (1)	Manufacturing (2)	Electric, Gas & Water Supply (3)	Construction (4)
	Wholesale & Retail trade (5)	Hotels & Restaurants (6)	Transport, Storage & Communications (7)	
	Real Estate, Renting & Business Activities (8)	Financial Intermediation (9)		
	Public Administration (10)	Defence (11)	Education (12)	Health & Social Work (13)
	Other Community, Social & Personal Service Activities (14)			Private Households with Employed Persons (15)
	Extra-Territorial Organisations & Bodies (16)			Agriculture (17)
	Hunting and forestry (18)			Fishing (19)

3 Had migrant workers from this village contributed to public/ community initiatives in terms of financial donation, knowledge, skills labour, and leadership skill? *[More than one option possible.]*

Provided labour in a public/ community initiative	<input type="checkbox"/>	Provided leadership in a public/ community initiative	<input type="checkbox"/>
Particular skill was used in a public/ community initiative	<input type="checkbox"/>	Role model for village youth	<input type="checkbox"/>
Trained people involved in a public/ community initiative	<input type="checkbox"/>	Created demand for services from local people	<input type="checkbox"/>
Helped to design a public/ community initiative	<input type="checkbox"/>	Had been a conduit of information for the villagers	<input type="checkbox"/>
Helped change certain traditional norm or practice in this village	<input type="checkbox"/>	Participated in the election for a public office	<input type="checkbox"/>
Introduced a new farming practice in this village	<input type="checkbox"/>	Introduced a new crop type or variety in this village	<input type="checkbox"/>
Introduced a new livestock rearing practice in this village	<input type="checkbox"/>	Introduced a new livestock type or variety in this village	<input type="checkbox"/>
Introduced a new livelihood practice in this village	<input type="checkbox"/>	Introduced a new technology (e.g. phone, dish antennae)	<input type="checkbox"/>
Employed people from the village in a non-farm business	<input type="checkbox"/>	Employed people from the village in a farm based business	<input type="checkbox"/>
Financial donation in a public/ community initiative	<input type="checkbox"/>	Supported cultural and sport activities	<input type="checkbox"/>
Others, specify:	<input type="text"/>	Yes (1)	No (2)

Any remark or observation by the enumerator *(include feedback from participants)*:

4.1	Please provide the following information of _____ [Name of the Migrant #1 (optional)] Sex = M (1)/ F (2) Migrant #1's age at first migration: _____ Migrant #1's present age: _____																																																																																																																																																						
4.1	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th colspan="4">Migrant #1's highest completed level of education</th> </tr> <tr> <td style="width: 25%;">Class 1 (1)</td> <td style="width: 25%;">Class 2 (2)</td> <td style="width: 25%;">Class 3 (3)</td> <td style="width: 25%;">Class 4 (4)</td> </tr> <tr> <td>Class 5 (5)</td> <td>Class 6 (6)</td> <td>Class 7 (7)</td> <td>Class 8 (8)</td> </tr> <tr> <td>Class 9 (9)</td> <td>Class 10 (10)</td> <td>SLC (11)</td> <td>Class 12/ Intermediate level (12)</td> </tr> <tr> <td>Bachelor level (13)</td> <td>Master level (14)</td> <td colspan="2">Professional degree (15)</td> </tr> <tr> <td>Literate (non-formal education) (16)</td> <td>Illiterate (17)</td> <td colspan="2">Don't know (-9)</td> </tr> </table>	Migrant #1's highest completed level of education				Class 1 (1)	Class 2 (2)	Class 3 (3)	Class 4 (4)	Class 5 (5)	Class 6 (6)	Class 7 (7)	Class 8 (8)	Class 9 (9)	Class 10 (10)	SLC (11)	Class 12/ Intermediate level (12)	Bachelor level (13)	Master level (14)	Professional degree (15)		Literate (non-formal education) (16)	Illiterate (17)	Don't know (-9)																																																																																																																															
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4.2	Which of the following persons were involved in the migration decision making process by the migrant? <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td>Consulted no one</td> <td><input type="checkbox"/></td> <td>Non-migrant members from this HH</td> <td><input type="checkbox"/></td> <td>Another migrant member from this household</td> <td><input type="checkbox"/></td> </tr> <tr> <td>Friends/ relatives</td> <td><input type="checkbox"/></td> <td>Another migrant not from this HH</td> <td><input type="checkbox"/></td> <td>Other , specify</td> <td><input type="checkbox"/></td> </tr> <tr> <td>Yes (1)</td> <td><input type="checkbox"/></td> <td>No (2)</td> <td><input type="checkbox"/></td> <td></td> <td></td> </tr> </table>	Consulted no one	<input type="checkbox"/>	Non-migrant members from this HH	<input type="checkbox"/>	Another migrant member from this household	<input type="checkbox"/>	Friends/ relatives	<input type="checkbox"/>	Another migrant not from this HH	<input type="checkbox"/>	Other , specify	<input type="checkbox"/>	Yes (1)	<input type="checkbox"/>	No (2)	<input type="checkbox"/>																																																																																																																																						
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4.3	Please, provide the migration history of [Name of the Migrant #1] for the last 30 years starting with the latest episode. <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th rowspan="2">Starting year</th> <th rowspan="2">Ending year</th> <th colspan="5">Destination</th> <th colspan="2">Economic status</th> <th rowspan="2">Financial cost</th> </tr> <tr> <th>City/ town/ village (specify)</th> <th>Province</th> <th>Country</th> <th>Type</th> <th>Stream</th> <th>Activity</th> <th>Occupation</th> </tr> </thead> <tbody> <tr><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td></tr> </tbody> </table> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td>Starting year: Record as 'yyyy'</td> </tr> <tr> <td>Ending year: Record as 'yyyy'. If the migration episode is ongoing then record it as '-8'.</td> </tr> </table> <p>“Financial cost” includes the investment by the household in transport, accommodation, and living expenses of the migrant worker.</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td>Destination type: Internal (1)</td> <td><input type="checkbox"/></td> <td>International (2)</td> <td><input type="checkbox"/></td> </tr> <tr> <td>Destination stream: Rural (1)</td> <td><input type="checkbox"/></td> <td>Urban (2)</td> <td><input type="checkbox"/></td> </tr> <tr> <td>Activity status: Self-employed (1)</td> <td><input type="checkbox"/></td> <td>Helper in household enterprise (2)</td> <td><input type="checkbox"/></td> <td>Wage employee (3)</td> <td><input type="checkbox"/></td> <td>Student (4)</td> <td><input type="checkbox"/></td> <td>Unemployed (5)</td> <td><input type="checkbox"/></td> </tr> <tr> <td rowspan="7" style="vertical-align: middle;">Occupation</td> <td>Mining and Quarrying (1)</td> <td>Manufacturing (2)</td> <td>Electric, Gas & Water Supply (3)</td> <td>Construction (4)</td> </tr> <tr> <td>Wholesale & Retail trade (5)</td> <td>Hotels & Restaurants (6)</td> <td colspan="2">Transport, Storage & Communications (7)</td> </tr> <tr> <td colspan="2">Real Estate, Renting & Business Activities (8)</td> <td colspan="3">Financial Intermediation (9)</td> </tr> <tr> <td>Public Administration (10)</td> <td>Defence (11)</td> <td>Education (12)</td> <td>Health & Social Work (13)</td> </tr> <tr> <td colspan="3">Other Community, Social & Personal Service Activities (14)</td> <td colspan="2">Private Households with Employed Persons (15)</td> </tr> <tr> <td colspan="3">Extra-Territorial Organisations & Bodies (16)</td> <td colspan="2">Agriculture (17)</td> </tr> <tr> <td colspan="3">Hunting and forestry (18)</td> <td colspan="2">Fishing (19)</td> </tr> </table>	Starting year	Ending year	Destination					Economic status		Financial cost	City/ town/ village (specify)	Province	Country	Type	Stream	Activity	Occupation																																																																																	Starting year: Record as 'yyyy'	Ending year: Record as 'yyyy'. If the migration episode is ongoing then record it as '-8'.	Destination type: Internal (1)	<input type="checkbox"/>	International (2)	<input type="checkbox"/>	Destination stream: Rural (1)	<input type="checkbox"/>	Urban (2)	<input type="checkbox"/>	Activity status: Self-employed (1)	<input type="checkbox"/>	Helper in household enterprise (2)	<input type="checkbox"/>	Wage employee (3)	<input type="checkbox"/>	Student (4)	<input type="checkbox"/>	Unemployed (5)	<input type="checkbox"/>	Occupation	Mining and Quarrying (1)	Manufacturing (2)	Electric, Gas & Water Supply (3)	Construction (4)	Wholesale & Retail trade (5)	Hotels & Restaurants (6)	Transport, Storage & Communications (7)		Real Estate, Renting & Business Activities (8)		Financial Intermediation (9)			Public Administration (10)	Defence (11)	Education (12)	Health & Social Work (13)	Other Community, Social & Personal Service Activities (14)			Private Households with Employed Persons (15)		Extra-Territorial Organisations & Bodies (16)			Agriculture (17)		Hunting and forestry (18)			Fishing (19)	
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Activity status: Self-employed (1)	<input type="checkbox"/>	Helper in household enterprise (2)	<input type="checkbox"/>	Wage employee (3)	<input type="checkbox"/>	Student (4)	<input type="checkbox"/>	Unemployed (5)	<input type="checkbox"/>																																																																																																																																														
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4.4	Does the migrant enjoy social security benefits or paid leave in the present job? <i>[In case of return migrants, ask about the last job in destination.]</i> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td>Social security benefits (pension, provident fund, insurance cover)</td> <td><input type="checkbox"/></td> <td>Paid leave</td> <td><input type="checkbox"/></td> </tr> <tr> <td>Yes (1)</td> <td><input type="checkbox"/></td> <td>No (2)</td> <td><input type="checkbox"/></td> </tr> </table>	Social security benefits (pension, provident fund, insurance cover)	<input type="checkbox"/>	Paid leave	<input type="checkbox"/>	Yes (1)	<input type="checkbox"/>	No (2)	<input type="checkbox"/>																																																																																																																																														
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Yes (1)	<input type="checkbox"/>	No (2)	<input type="checkbox"/>																																																																																																																																																				

Please provide the following information of _____ [Name of the Migrant #2 (optional)]

Sex = M (1)/ F (2) Migrant #2's age at first migration: Migrant #2's present age:

5.1

Migrant #2's **highest completed** level of education

Class 1 (1)	Class 2 (2)	Class 3 (3)	Class 4 (4)
Class 5 (5)	Class 6 (6)	Class 7 (7)	Class 8 (8)
Class 9 (9)	Class 10 (10)	SLC (11)	Class 12/ Intermediate level (12)
Bachelor level (13)	Master level (14)	Professional degree (15)	
Literate (non-formal education) (16)		Illiterate (17)	Don't know (-9)

5.2

Which of the following persons were involved in the migration **decision making process** by the migrant?

Consulted no one	<input type="checkbox"/>	Non-migrant members from this HH	<input type="checkbox"/>	Another migrant member from this household	<input type="checkbox"/>
Friends/ relatives	<input type="checkbox"/>	Another migrant not from this HH	<input type="checkbox"/>	Other , specify	<input type="checkbox"/>
Yes (1)	No (2)				

5.3

Please, provide the migration history of [Name of the Migrant #2] for the **last 30 years** starting with the latest episode.

Starting year	Ending year	Destination					Economic status		Financial cost
		City/ town/ village (specify)	Province	Country	Type	Stream	Activity	Occupation	

Starting year: Record as 'yyyy'

Ending year: Record as 'yyyy'. If the migration episode is ongoing then record it as '-8'.

“**Financial cost**” includes the investment by the household in transport, accommodation, and living expenses of the migrant worker.

Destination type: Internal (1) International (2)

Destination stream: Rural (1) Urban (2)

Activity status: Self-employed (1) Helper in household enterprise (2) Wage employee (3) Student (4) Unemployed (5)

Occupation	Mining and Quarrying (1)	Manufacturing (2)	Electric, Gas & Water Supply (3)	Construction (4)	
	Wholesale & Retail trade (5)	Hotels & Restaurants (6)	Transport, Storage & Communications (7)		
	Real Estate, Renting & Business Activities (8)		Financial Intermediation (9)		
	Public Administration (10)	Defence (11)	Education (12)	Health & Social Work (13)	
	Other Community, Social & Personal Service Activities (14)			Private Households with Employed Persons (15)	
	Extra-Territorial Organisations & Bodies (16)			Agriculture (17)	
	Hunting and forestry (18)			Fishing (19)	

5.4

Does the migrant enjoy **social security benefits** or **paid leave** in the present job?

[In case of return migrants, ask about the last job in destination.]

Social security benefits (pension, provident fund, insurance cover) Paid leave

Yes (1) No (2)

Please provide the following information of _____ [Name of the Migrant #3 (optional)]

Sex = M (1)/ F (2) Migrant #3's age at first migration: Migrant #3's present age:

6.1

Migrant #3's highest completed level of education			
Class 1 (1)	Class 2 (2)	Class 3 (3)	Class 4 (4)
Class 5 (5)	Class 6 (6)	Class 7 (7)	Class 8 (8)
Class 9 (9)	Class 10 (10)	SLC (11)	Class 12/ Intermediate level (12)
Bachelor level (13)	Master level (14)	Professional degree (15)	
Literate (non-formal education) (16)		Illiterate (17)	Don't know (-9)

6.2

Which of the following persons were involved in the migration **decision making process** by the migrant?

Consulted no one	<input type="checkbox"/>	Non-migrant members from this HH	<input type="checkbox"/>	Another migrant member from this household	<input type="checkbox"/>
Friends/ relatives	<input type="checkbox"/>	Another migrant not from this HH	<input type="checkbox"/>	Other , specify	<input type="checkbox"/>
Yes (1)		No (2)			

6.3

Please, provide the migration history of [Name of the Migrant #3] for the **last 30 years** starting with the latest episode.

Starting year	Ending year	Destination					Economic status		Financial cost
		City/ town/ village (specify)	Province	Country	Type	Stream	Activity	Occupation	

Starting year: Record as 'yyyy'
Ending year: Record as 'yyyy'. If the migration episode is ongoing then record it as '-8'.

“Financial cost” includes the investment by the household in transport, accommodation, and living expenses of the migrant worker.

Destination type: Internal (1) International (2)

Destination stream: Rural (1) Urban (2)

Activity status: Self-employed (1) Helper in household enterprise (2) Wage employee (3) Student (4) Unemployed (5)

Occupation	Mining and Quarrying (1)	Manufacturing (2)	Electric, Gas & Water Supply (3)	Construction (4)	
	Wholesale & Retail trade (5)	Hotels & Restaurants (6)	Transport, Storage & Communications (7)		
	Real Estate, Renting & Business Activities (8)		Financial Intermediation (9)		
	Public Administration (10)	Defence (11)	Education (12)	Health & Social Work (13)	
	Other Community, Social & Personal Service Activities (14)			Private Households with Employed Persons (15)	
	Extra-Territorial Organisations & Bodies (16)			Agriculture (17)	
	Hunting and forestry (18)			Fishing (19)	

6.4

Does the migrant enjoy **social security benefits** or **paid leave** in the present job?

[In case of return migrants, ask about the last job in destination.]

Social security benefits (pension, provident fund, insurance cover)	<input type="checkbox"/>	Paid leave	<input type="checkbox"/>
Yes (1)	No (2)		

7.1 Please provide the following information of _____ [Name of the Migrant #4 (optional)]
 Sex = M (1)/ F (2) Migrant #4's age at first migration: Migrant #4's present age:

Migrant #4's highest completed level of education			
Class 1 (1)	Class 2 (2)	Class 3 (3)	Class 4 (4)
Class 5 (5)	Class 6 (6)	Class 7 (7)	Class 8 (8)
Class 9 (9)	Class 10 (10)	SLC (11)	Class 12/ Intermediate level (12)
Bachelor level (13)	Master level (14)	Professional degree (15)	
Literate (non-formal education) (16)		Illiterate (17)	Don't know (-9)

7.2 Which of the following persons were involved in the migration **decision making process** by the migrant?
 Consulted no one Non-migrant members from this HH Another migrant member from this household
 Friends/ relatives Another migrant not from this HH Other , specify
 Yes (1) No (2)

7.3 Please, provide the migration history of [Name of the Migrant #4] for the last 30 years starting with the latest episode.

Starting year	Ending year	Destination					Economic status		Financial cost
		City/ town/ village (specify)	Province	Country	Type	Stream	Activity	Occupation	

Starting year: Record as 'yyyy'
 Ending year: Record as 'yyyy'. If the migration episode is ongoing then record it as '-8'.

"Financial cost" includes the investment by the household in transport, accommodation, and living expenses of the migrant worker.

Destination type: Internal (1) International (2)

Destination stream: Rural (1) Urban (2)

Activity status: Self-employed (1) Helper in household enterprise (2) Wage employee (3) Student (4) Unemployed (5)

Occupation	Mining and Quarrying (1)	Manufacturing (2)	Electric, Gas & Water Supply (3)	Construction (4)	
	Wholesale & Retail trade (5)	Hotels & Restaurants (6)	Transport, Storage & Communications (7)		
	Real Estate, Renting & Business Activities (8)		Financial Intermediation (9)		
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	Extra-Territorial Organisations & Bodies (16)			Agriculture (17)	
	Hunting and forestry (18)			Fishing (19)	

7.4 Does the migrant enjoy **social security benefits** or **paid leave** in the present job?
 [In case of return migrants, ask about the last job in destination.]
 Social security benefits (pension, provident fund, insurance cover) Paid leave
 Yes (1) No (2)

Any remark or observation by the enumerator (*include feedback from participants*):

Flood Schedule		ICIMOD/Aaranyak																																																																																		
Questionnaire number: <input style="width: 100%;" type="text"/>	HH code: <input style="width: 100%;" type="text"/>	Date (Y/M/D): 2013/____/____																																																																																		
Enumerator code: <input style="width: 100%;" type="text"/>		Supervisor code: <input style="width: 100%;" type="text"/>																																																																																		
<i>[To be completed by the enumerator at the end of the survey]</i>																																																																																				
Results code = Questionnaire completed (1)/ Questionnaire not completed (2)/ Household absent (3)/ Household refused (4)																																																																																				
1.1	During the last 30 years , when had your household been affected by the flood ? [<i>“year of event”</i>][Repeat the flood events mentioned in the Flood Schedule from the Village Survey. Put “-6” if not applicable.]																																																																																			
1.2	Following each of the flood events mentioned in [question 1.1], how much financial damage [in local currency] did it cause your household? [<i>“damage”</i>] [Take into account all events mentioned in question 1.1. Put “0” if not applicable.]																																																																																			
1.3	Following each of the flood events mentioned in [question 1.1], how many months did it take your household to recover to a satisfactory situation? [<i>“recovery”</i>][Take into account all events mentioned in question 1.1. Record answer in months (for example, 1 years = 12 months). Put “0” if not applicable.]																																																																																			
<table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <thead> <tr> <th style="width: 20%;">Year of 1st Event</th> <th style="width: 20%;">Damage</th> <th style="width: 20%;">Recovery</th> </tr> </thead> <tbody> <tr><td>Year of 2nd Event</td><td>Damage</td><td>Recovery</td></tr> <tr><td>Year of 3rd Event</td><td>Damage</td><td>Recovery</td></tr> <tr><td>Year of 4th Event</td><td>Damage</td><td>Recovery</td></tr> <tr><td>Year of 5th Event</td><td>Damage</td><td>Recovery</td></tr> <tr><td>Year of 6th Event</td><td>Damage</td><td>Recovery</td></tr> <tr><td>Year of 7th Event</td><td>Damage</td><td>Recovery</td></tr> <tr><td>Year of 8th Event</td><td>Damage</td><td>Recovery</td></tr> <tr><td>Year of 9th Event</td><td>Damage</td><td>Recovery</td></tr> <tr><td>Year of 10th Event</td><td>Damage</td><td>Recovery</td></tr> <tr><td>Year of 11th Event</td><td>Damage</td><td>Recovery</td></tr> <tr><td>Year of 12th Event</td><td>Damage</td><td>Recovery</td></tr> <tr><td>Year of 13th Event</td><td>Damage</td><td>Recovery</td></tr> <tr><td>Year of 14th Event</td><td>Damage</td><td>Recovery</td></tr> <tr><td>Year of 15th Event</td><td>Damage</td><td>Recovery</td></tr> <tr><td>Year of 16th Event</td><td>Damage</td><td>Recovery</td></tr> <tr><td>Year of 17th Event</td><td>Damage</td><td>Recovery</td></tr> <tr><td>Year of 18th Event</td><td>Damage</td><td>Recovery</td></tr> <tr><td>Year of 19th Event</td><td>Damage</td><td>Recovery</td></tr> <tr><td>Year of 20th Event</td><td>Damage</td><td>Recovery</td></tr> <tr><td>Year of 21st Event</td><td>Damage</td><td>Recovery</td></tr> <tr><td>Year of 22nd Event</td><td>Damage</td><td>Recovery</td></tr> <tr><td>Year of 23rd Event</td><td>Damage</td><td>Recovery</td></tr> <tr><td>Year of 24th Event</td><td>Damage</td><td>Recovery</td></tr> <tr><td>Year of 25th Event</td><td>Damage</td><td>Recovery</td></tr> <tr><td>Year of 26th Event</td><td>Damage</td><td>Recovery</td></tr> <tr><td>Year of 27th Event</td><td>Damage</td><td>Recovery</td></tr> </tbody> </table>				Year of 1 st Event	Damage	Recovery	Year of 2 nd Event	Damage	Recovery	Year of 3 rd Event	Damage	Recovery	Year of 4 th Event	Damage	Recovery	Year of 5 th Event	Damage	Recovery	Year of 6 th Event	Damage	Recovery	Year of 7 th Event	Damage	Recovery	Year of 8 th Event	Damage	Recovery	Year of 9 th Event	Damage	Recovery	Year of 10 th Event	Damage	Recovery	Year of 11 th Event	Damage	Recovery	Year of 12 th Event	Damage	Recovery	Year of 13 th Event	Damage	Recovery	Year of 14 th Event	Damage	Recovery	Year of 15 th Event	Damage	Recovery	Year of 16 th Event	Damage	Recovery	Year of 17 th Event	Damage	Recovery	Year of 18 th Event	Damage	Recovery	Year of 19 th Event	Damage	Recovery	Year of 20 th Event	Damage	Recovery	Year of 21 st Event	Damage	Recovery	Year of 22 nd Event	Damage	Recovery	Year of 23 rd Event	Damage	Recovery	Year of 24 th Event	Damage	Recovery	Year of 25 th Event	Damage	Recovery	Year of 26 th Event	Damage	Recovery	Year of 27 th Event	Damage	Recovery
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