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Chapter 8

Vulnerability, Coping and Loss and Damage from Climate Events

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ABSTRACT
"Loss and damage" is an emerging concept in the fields of climate-change adaptation and disaster risk reduction. It results from inadequate efforts to reduce greenhouse gas emissions and insufficient capacity to adapt to climatic changes and cope with impacts. This chapter uses original data from study sites in four African and Asian countries that were surveyed in the context of the first ever multisite study of loss and damage in vulnerable communities. National researchers conducted fieldwork in rural areas, looking at impacts of drought (Gambia), floods (Kenya, Nepal), and cyclones (Bangladesh). Methods included a household survey (n = 1,431) about climate-related stressors, vulnerability, impacts, coping strategies, and residual loss and damage. The survey data are used to investigate how rural households attempt to cope with impacts of climatic stressors and how successful they are in avoiding loss and damage. A multidimensional vulnerability index (MDVI) is created to analyze differences between more and less vulnerable households in the uptake and effectiveness of seven types of coping strategies. The study reveals that vulnerable households used a more diverse portfolio of coping measures. They were more likely to reduce expenses, modify food consumption and rely on social networks to cope with impacts of climatic stressors. No significant differences were found between more and less vulnerable households in the uptake of migration, asset sales and reliance on relief. The impacts of climate-related stressors in vulnerable communities are beyond the majority (69 percent) of households' capacity to cope. This is especially true for more vulnerable

1. The data presented in this chapter were gathered in the context of the Loss and Damage in Vulnerable Countries Initiative (www.lossanddamage.net). The Climate and Development Knowledge Network (CDKN) funded this project. The authors wish to thank Dr Sidat Yaffa in the Gambia, Denis Opiyo Opondo in Kenya, Dr Golam Rabbani in Bangladesh, and Dr Prakash Korala and Dr Kenneth Bauer in Nepal for their great efforts in conducting the household survey on which this chapter is based.

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households, but over half the households with a low MDVI also experience losses and damages.

8.1 INTRODUCTION

8.1.1 Loss and Damage

"Loss and damage" is a new concept in the fields of climate-change adaptation and disaster risk reduction. Loss and damage results from inadequate efforts to reduce greenhouse gas (GHG) emissions and insufficient capacity to adapt to climatic changes and to cope with impacts of climate change-related events. The topic emerged in climate negotiations after the establishment of a work program on loss and damage at the 16th UNFCCC Conference of the Parties in Cancun, Mexico in December 2010. The concept has gained further interest from 2012 onward, as a mandate was given to establish institutional arrangements to address loss and damage. At COP19 (November 2013), the Warsaw International Mechanism was established to promote "implementation of approaches to address loss and damage associated with the adverse effects of climate change…in a comprehensive, integrated and coherent manner" (UNFCCC, 2014). The mechanism creates a policy space to discuss and address the negative consequences of climate change if society's efforts to mitigate and adapt are not sufficient. An important question that needs to be answered over the next few years is what can be done to support vulnerable people, communities, and societies who are already feeling the negative consequences of climate change (Kates et al., 2012; Warner, 2013; Roberts and Huq, in press).

Loss and damage is already a significant—and in some places growing—consequence of inadequate ability to adapt to changes in climate patterns across the world (Warner et al., 2012, 2013; Huq et al., 2013). It undermines sustainable development and can impede progress in improving human well-being. Yet, there is currently a lack of empirical evidence of the circumstances under which households manage climatic stressors, the resulting societal impacts, and the loss and damage that results from not being able to adjust sufficiently. Policymakers and practitioners need better information about both the challenges and the potential solutions.

Although a tendency exists among legal scholars, in the media, and among some parties in the climate negotiations to reduce the topic of "loss and damage" to compensation and liability, the authors of this chapter link loss and damage more explicitly to adaptation limits and constraints. The authors acknowledge that some losses and damages are unavoidable, and that these need to be addressed with a separate set of policy measures (social protection, safety nets, resettlement, etc.). However, we emphasize that much loss and damage could be avoided if efforts to reduce GHG emissions are boosted, if more adaptation funding becomes available, if more effective

TABLE 8.1 Avoidable and Unavoidable Loss and Damage

Nature of Loss and Damage	Ways to Address Loss and Damage
Avoidable	• Reduction of greenhouse gas emissions • More effective adaptation • Improved disaster risk reduction • Increased resilience and coping capacity
Unavoidable	• Social protection and safety nets • Resettlement without undermining resilience
Unavoided	• Removing constraints to adaptation

adaptation policy is designed, if sustained progress in comprehensive climate risk management is achieved, and if people's resilience and coping capacity increases (Table 8.1).[2] A third category is unavoided loss and damage, which concerns impacts of climate-related stressors that can be avoided through mitigation and adaptation, but which have not been avoided because the appropriate measures were not adopted due to financial, technical, or other constraints (Verheyen and Roderick, 2008). This category moves the concept from an insecure future to present-day realities of vulnerable people. The way to address such losses and damages would be to understand and remove the constraints to actions required to avoid loss and damage.

Definitions of the term "loss and damage" vary. For this research project, a working definition of loss and damage was used that includes households' inability to respond adequately to climate stressors and the costs and adverse effects associated with the adaptation and coping measures themselves:

Adverse effects of climate-related stressors that households have not been able to avoid through adaptation.

In our working definition, we used the term households because these were our units of analysis. However, the term "households" can be replaced by "actors" (e.g., companies, governments, communities, etc.) to widen the applicability of the definition. The working definition for our local case studies does not explicitly mention reduction of GHG emissions because this was less relevant for the empirical work in vulnerable communities. However, we do recognize that emission reductions play a crucial role in avoiding dangerous climate change and its impacts.

2. For discussions of avoidable and unavoidable loss and damage, see Huq et al. (2013) and Pinninti (2014).

The working definition we used links the concept of loss and damage firmly to the emerging research field of adaptation limits and constraints (Burton, 2009; Adger et al., 2009; Dow et al., 2013; Preston et al., 2013), which for the first time has a chapter in the Fifth Assessment Report of the Intergovernmental Panel on Climate Change (Klein et al., 2014). Loss and damage from sudden-onset events as well as slow-onset processes have been examined, but the focus in this chapter is on concrete events and less on gradual changes. Household measures to avoid loss and damage include risk reduction, coping strategies, and adaptation (Figure 8.1). The focus in this chapter is on the coping measures that households adopt in the aftermath of climate-related events. The climate-related events include droughts (Gambia), floods (Kenya and Nepal), and cyclones (Bangladesh). A multi-dimensional vulnerability index (MDVI) is used to study differences in the uptake of coping strategies between more and less vulnerable households. The next section introduces a framework connecting the key concepts used in the study.

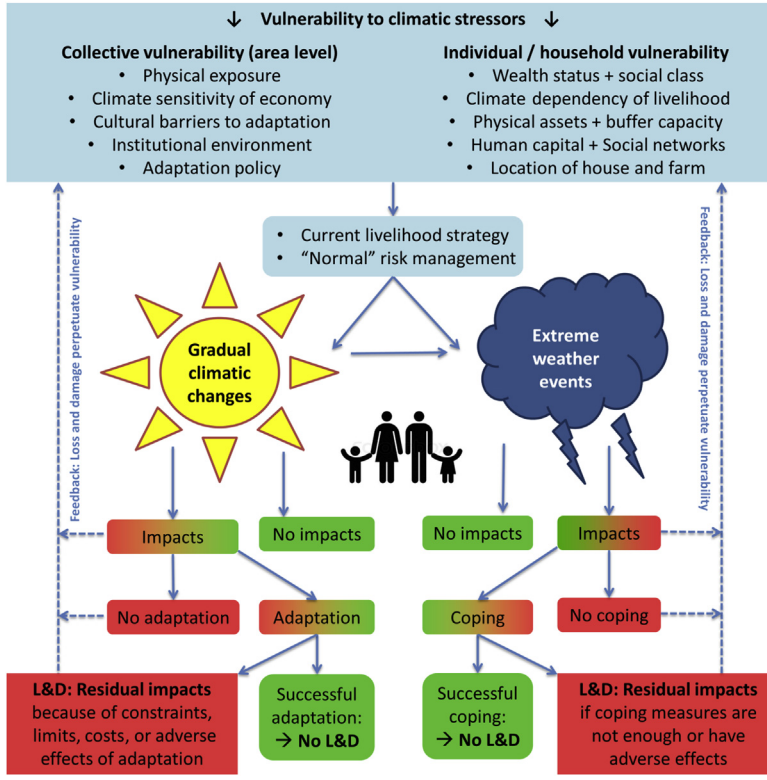

FIGURE 8.1 Conceptual framework: linking loss and damage (L&D) to vulnerability, risk management, and adaptation.

8.1.2 Conceptual Framework

The framework discussed in this section connects loss and damage from climate-related stressors to vulnerability, risk management, impacts, coping strategies, adaptation, and limits and constraints of adaptation (Figure 8.1). The framework results from progressive insights of working on loss and damage in vulnerable communities in the past 2 years (Warner et al., 2012, 2013; Warner and van der Geest, 2013) and previous work on impacts of and adaptation to climate change in dryland West Africa (van der Geest, 2004, 2011; van der Geest and Dietz, 2004). This work, in turn, builds on a longer tradition of studying livelihoods in risk-prone environments that emerged in the 1990s (Chambers, 1989; Davies, 1996; Blaikie et al., 1994; Scoones, 1998; Ellis, 1998).

The blue box in the upper part of Figure 8.1 shows the vulnerability context of households and communities that shapes households' livelihood strategies and the measures they put in place to reduce the risk of being adversely affected by climatic and other stressors. The framework distinguishes collective vulnerability—resulting from area-level variables that are the same for all households in a given community—from individual or household vulnerability (Adger, 1999). When a region experiences changes in the climate or when extreme weather events hit, some households will experience impacts (such as a crop failure or damage to properties), although others may not. This depends on their vulnerability profile—particularly their exposure—and household risk management. When the household experiences no impact, no loss and damage occurs (hence the green color of the "no-impact box"). When the household is affected by the climatic stressor, it may incur or avoid residual loss and damage depending on whether effective measures are adopted to adjust (hence the red-green color of the impact and coping/adaptation boxes). If there is nothing the household can do to adjust, it will incur loss and damage (hence the red color of the no-adaptation and no-coping boxes). If coping or adaptation measures are adopted, these may or may not be effective in avoiding residual loss and damage, depending on the household's adaptive capacity and the magnitude of the climatic stressor (or in other words adaptation constraints and limits[3]). If measures are insufficient, costly, or "erosive" in the longer term, households incur loss and damage (Warner and van der Geest, 2013). Lastly, a feedback loop connects loss and damage back to the household's vulnerability profile. This is because the losses and damages incurred render the household more vulnerable in the face of ongoing climatic changes and future extreme events.

3. IPCC's Fifth Assessment Report defines adaptation constraints as "factors that make it harder to plan and implement adaptation actions" and adaptation limits as "the point at which an actor's objectives… cannot be secure from intolerable risks through adaptive actions" (See also Dow et al. (2013).).

The framework distinguishes two types of household responses to climate-related stressors: "coping" and "adaptation." Many studies use these terms synonymously (Birkmann, 2011). This is problematic because they involve different types of responses to different types of stresses (van der Geest and Dietz, 2004). Coping strategies are short-term responses to the impacts of sudden or unusual events. By contrast, adaptation refers to longer-term adjustments to more permanent changes in the climate.[4] Besides coping and adaptation, a third type of response involves the preventive measures (risk reduction) that households adopt in response to normal characteristics (including variability) of the climate and environment and *in anticipation* of unusual events.[5]

The three groups of climatic stressors and household responses are shown in Table 8.2 with some nonexclusive examples. There are multiple linkages between different types of household responses to climatic stressors. Firstly, the success of ex-ante preventive measures determines the need for and success of ex-post coping strategies. Secondly, short-term coping measures can evolve into more permanent livelihood adaptations when they become recurrent. Thirdly, when households change their preventive measures in response to changes in perceived risk, they are adapting.[6]

8.2 METHODS

The case studies of the Loss and Damage in Vulnerable Countries Initiative (www.lossanddamage.net) focused on the losses and damages that climate-related stressors are already causing in vulnerable communities. Researchers in Bangladesh, Bhutan, the Gambia, Kenya, Micronesia, and Nepal conducted a total of 2,068 household interviews and over 100 focus groups and key informant interviews. They looked at a wide range of climate-related stressors such as droughts, floods, changing rainfall patterns, sea level rise, cyclones, salinity intrusion, and coastal erosion. Each case study looked at extreme weather events as well as slow-onset changes. The overall *research question* was how does the impact of climate-related stressors lead to loss and damage among households in vulnerable communities.

For this chapter, household data from four of the case studies are used (Bangladesh, the Gambia, Kenya, and Nepal). Findings from the Bhutan case

4. For the more elaborate definition of adaptation we used in the case studies, see Moser and Ekstrom (2010). Their definition recognizes that adaptation measures are often adopted in response to a mix of climatic and nonclimatic changes and aim to meet more than climate goals alone.
5. The relationship between preventive strategies, coping, and adaptation is described in detail in van der Geest (2004: 20–29).
6. For an overview of linkages between prevention, coping, and adapting, see van der Geest and Dietz (2004). The framework is inspired by the early work of Susana Davies (1996) on "adaptable livelihoods" in Mali.

TABLE 8.2 Different Climatic Stressors Require Different Household Responses

Climatic Stressor	Household Response
Climate variability • "Normal" uncertainties • "Normal" risk of extreme weather events	Preventive measures • Physical protection • Risk spreading • Creating buffers • Building safety nets
Climate-related events • Floods • Droughts • Cyclones/storms	Coping strategies • Rely on social networks • Food aid and other relief • Alternative income • Selling assets
Climatic changes • Changes in "average" conditions • Changes in risk of extreme weather events	Adaptation • Agricultural change • Livelihood diversification • Migration • Changes in "normal" risk management

study are omitted because the study yielded data of limited use with regard to impacts of climate-related *events*. The study looked at glacier lake outburst floods (GLOFs), which had affected only very few households in the area. Besides looking at GLOFs, the study also investigated impacts of longer-term changes in monsoon patterns on rice production, which did yield insightful findings (Kusters and Wangdi, 2013). However, these results are beyond the scope of this chapter. The Micronesia case study looked at loss and damage from coastal erosion and storm surges. Findings are omitted here because the study area was very different from the other four cases in terms of socioeconomic development. Household incomes were about 10 times higher, and most households did not depend on natural resources for their livelihood activities (Monnereau and Abraham, 2013).

Table 8.3 shows the study areas included in this chapter. The sites had diverse ecologies (coastal, floodplain, dryland savannah, hill), but crop cultivation was the main economic activity in all the four areas. In Bangladesh and Nepal, rice was the main crop, whereas farmers in the Gambia and Kenya mostly cultivated millet, maize, and sorghum. The sample size for the household questionnaire varied between 300 and 400 households per study area.

8.2.1 Fieldwork

The research presented here generated original data from the perspective of vulnerable people who experience climate-related stressors, using a systematic

TABLE 8.3 The Case Study Areas

Country	District/ Region	Ecological Zone	Main Crops	Stressor	Sample Size
Bangladesh	Satkhira	Coastal	Rice, vegetables	Cyclone	360
The Gambia	North Bank	Savannah	Millet, groundnut, maize	Drought	371
Kenya	Budalangi	Floodplain	Maize, sorghum, beans	Flood	400
Nepal	Udayapur	Hill, valley	Rice, maize, mustard	Flood	300

assessment approach that employed a variety of methods, including a household survey, focus group discussions, in-depth interviews with a selected number of questionnaire respondents, and expert interviews. In addition, local meteorological and other relevant data were gathered and compared with local perceptions of changes in climatic stressors. Household data were gathered in the following domains: experience with climate-related stressors, impacts in households, the current adaptation and coping measures, and residual loss and damage.

The principal data source for the current chapter is the questionnaire survey that was conducted in the case study sites. A template questionnaire, designed by the project's science coordinator at United Nations University Institute for Environment and Human Security, was used, but national research teams adapted the template for each case study to suit its thematic focus and the characteristics of local livelihood systems and environments. The questionnaire had 10 pages, and interviews usually took 45 min to 1 h. The questionnaires had four sections. The first section focused on socioeconomic and demographic characteristics of the household and their sources of food and income. The information gathered in this section was used to distil multidimensional vulnerability indicators. Second and third sections of the questionnaire focused on impacts of extreme weather events and slow-onset processes, household responses (coping and adaptation), and residual losses and damages. Open questions were combined with closed questions to optimize the balance between listening to the voices of vulnerable people and being able to quantify how widespread different impacts and responses are. Fourth section contained open questions about differences in vulnerability between households in the communities, between men and women, and between children and adults. In this section, respondents were also asked to share their ideas about ways to address loss and damage.

Climate-related losses and damages usually have nonclimatic causes as well. Floods, for example, can be caused by extreme rainfall, whereas at the

same time, deforestation and unsustainable land use practices can contribute to the severity of floods. Droughts can become more frequent because of regional climatic changes but are also part of the natural system of climatic variability. It is usually not possible to attribute losses and damages entirely to climate change (Huggel et al., 2013; Wrathall et al., in press).[7] That was also not the objective of the research project this chapter reports on. Rather, the objective was to explore situations in which households face adaptation constraints and lack coping capacity, and to assess the consequences for people's livelihoods and sustainable development pathways. The study and its methods should be treated as points of departure for further research on loss and damage in vulnerable communities.

8.2.2 Analysis

The results of this research project presented so far[8] have been mostly descriptive. By contrast, the analysis presented in this chapter goes beyond the descriptive to study how household vulnerability influences the uptake of different coping strategies in the aftermath of climate events and the ability of these measures to avoid loss and damage.

An important step was to determine for each household in the sample whether it incurred loss and damage or not. No attempt was made to quantify loss and damage in monetary terms. In line with the conceptual framework in Figure 8.1, households incurred loss and damage when

- climate-related stressors affected them and they did not/could not adopt any measures to mitigate the effects and
- the measures that they adopted to mitigate the effects of climate-related stressors were not enough to avoid loss and damage or had adverse effects.

The next step was to assess the effect of two groups of independent variables on household loss and damage: (1) a group of multidimensional vulnerability indicators and (2) the coping strategies that people adopted in the aftermath of climatic events.

The conceptual framework for this study distinguished collective vulnerability (area-level) and individual vulnerability (household-level). To measure household vulnerability, we used an index that builds on the Alkire Foster method for measuring the multiple dimensions of poverty (Alkire and Foster, 2011). The method was originally developed by researchers at the Oxford

7. See Allen (2003), Lott et al. (2013), and Otto et al. (2013) for discussion of and attempts to estimate the "fraction of attributable risk" of climatic events to external drivers of climatic change such as GHG emissions (Poster presentation by Rachel James at CCDA-3, Addis Ababa).
8. Warner and van der Geest (2013), Warner et al. (2012, 2013), Bauer (2013), Kuster and Wangdi (2013), Monnereau and Abraham (2013), Opondo (2013), Rabbani et al. (2013), Yaffa (2013).

Poverty and Human Development Initiative to measure deprivations in health, education, and living standard based on household surveys. To adjust the multidimensional poverty index to an MDVI, household variables were selected that represent household vulnerability to climate-related stressors (see Section 4).[9] Another departure from the Alkire Foster method is that instead of using just two vulnerability options (vulnerable and nonvulnerable) for each indicator, we used a five-point scale on each of the 10 indicators we identified.

8.3 DESCRIPTIVE CASE STUDY FINDINGS

Across the research sites, it was found that households struggled to manage impacts of climatic stressors on their livelihoods, assets, and culture. Despite their efforts to cope with the impacts of extreme weather events and to adapt to slow-onset climatic changes, many could not avoid incurring residual impacts. Some of the most notable impacts were on household food production and livelihoods, raising questions about the ability of adaptation measures, both formal and informal, to stem the interacting negative impacts of climate change and vulnerable societies.

Results from the case studies revealed four different "loss and damage pathways" (Warner and van der Geest, 2013). Loss and damage from climate-related stressors occurs when

- measures to cope or adapt are not enough to avoid loss and damage,
- measures have costs (including noneconomic) that are not regained,
- despite short-term merits, measures are erosive and undermine longer-term livelihood sustainability, and
- no measures are adopted or possible at all.

Each of the case studies has a different story to tell, but all point to the same key finding: Loss and damage is happening now, despite adaptation efforts.[10]

Satkhira, a coastal district in Bangladesh, faces the threat of sea level rise and cyclones. Both result in saltwater intrusion, which severely impacts rice cultivation, the mainstay of the local economy. To adapt, farmers have planted new saline-tolerant rice varieties. This worked well until 2009, when cyclone Aila hit and caused a sudden and drastic increase of salt content in the soil. Almost all farmers lost their complete harvest that year.

The North Bank Region of the Gambia experienced a severe drought in 2011, affecting almost all farmers in the area, many of whom lost their entire harvests. They tried to cope by looking for additional income (e.g., sale of property) to buy food. However, the majority had to reduce their food intake,

9. See, e.g., Hahn et al. (2009) work on the livelihood vulnerability index.
10. These excerpts of case study findings have earlier been published in a blog of the Thomson Reuters Foundation. See http://www.trust.org/item/20131120115704-706cv/.

for example, by changing from three to two meals a day because their coping measures were insufficient.

In December 2011, River Nzoia in Western Kenya broke its dikes and wreaked havoc in Budalangi Division. Crops were washed away, livestock drowned, houses were severely damaged, and there was an outbreak of waterborne diseases. For survival, many households were forced to adopt erosive coping strategies such as the sale of productive assets and taking children out of school to earn a meager income in the informal sector. Erosive coping measures have severe implications for future livelihood security.

Nepal is particularly susceptible to climate-related disasters such as floods, landslides, and debris flows. In the Udayapur district, floods have become more severe over the past two decades, destroying crops and damaging houses. In addition, the study found that food prices increased sharply in the aftermath of floods. Although households expend much effort on preventive and coping measures, these have not been enough to counteract adverse effects.

8.4 VULNERABILITY

To measure household vulnerability, we used an index that builds on the Alkire Foster method for measuring the multiple dimensions of poverty (Alkire and Foster, 2011). Based on the household survey data, 10 multidimensional vulnerability indicators were defined, including, for example, education level, land and livestock ownership, livelihood diversity, income, house quality, and food security. For each variable, four thresholds were chosen, dividing the sample population in five vulnerability groups on each indicator. For example, for education, the groups are "no formal education," "attended literacy classes," "primary school," "secondary school," and "tertiary education." For quantitative indicators (e.g., land size, livestock ownership, and total income), the sample population for each case study is divided, based on quintiles, and household scores are assigned accordingly.[11] The vulnerability indicators selected for the analyses in this chapter are listed and described in Table 8.4.

Each household in the sample has a score of 1−5 on each indicator. The overall vulnerability is calculated as the average score and ranged from 1.2 to 4.7. A higher score on the index indicates high vulnerability to climatic stressors. For the whole sample, the average score is 3.02 with a standard deviation of 0.64. The distribution closely resembles the normal curve (see Figure 8.2). The MDVI is used in the following sections to relate the uptake of coping measures to households' vulnerability levels.

Figure 8.3 shows vulnerability profiles for the four case study areas. The multidimensional vulnerability indicators illustrate that different study areas

11. The upper and lower bounds of quintiles for each country are listed in the appendix.

TABLE 8.4 Vulnerability Indicators

Indicator	Description and Thresholds
1. Education	Level of education of household head: none = 5; literacy training = 4; primary = 3; secondary = 2; tertiary = 1.
2. Dependency ratio	(Dependent household members (aged <18 and >65)/adult household members (aged 18–65)) × 100 (score based on quintiles; see appendix for threshold values).
3. Land ownership	Size of land owned by the household (score based on quintiles).
4. Livestock ownership	Expressed in tropical livestock units (score based on quintiles). See appendix for conversion factors.
5. Nonfarm income	Most vulnerable (5) if household has no nonfarm income activities at all; less vulnerable (4–1) according to amount of nonfarm income (score based on quartiles).
6. Livelihood diversity	Number of the following livelihood sources: crop cultivation, livestock keeping, fishing, trees, farm labor, nonfarm income, remittances, other (mostly pension, rent).
7. Total cash income	Total amount of cash income from all sources.
8. House quality	Based on floor material (vulnerable if earth, mud, cow dung) and own perception of house quality (better, average, worse). See appendix.
9. Sanitation	Based on household access to clean drinking water and private toilet facilities. See appendix.
10. Food security	Based on months of food shortage in the past year and years of food shortage in the past decade.
Overall vulnerability	Average score on the 10 indicators, allowing for one missing value.

Note: More details and threshold values for quantitative indicators in appendix.

are vulnerable for different reasons. For example, households in the Gambian study site were well endowed in terms of land and livestock but had low levels of education and poor access to nonfarm income. Selling livestock to buy food is an important way to deal with drought-induced crop failures. Hence, having a good stock of domestic animals made households less vulnerable. By contrast, relatively few households in the Gambian case study area had viable nonfarm activities to fall back on when their harvest failed. In the densely populated Asian study sites (Bangladesh and Nepal), land scarcity was a key problem, limiting households' possibility to attain self-sufficiency in food production. However, food insecurity was less common here because more households had reliable nonfarm income sources.

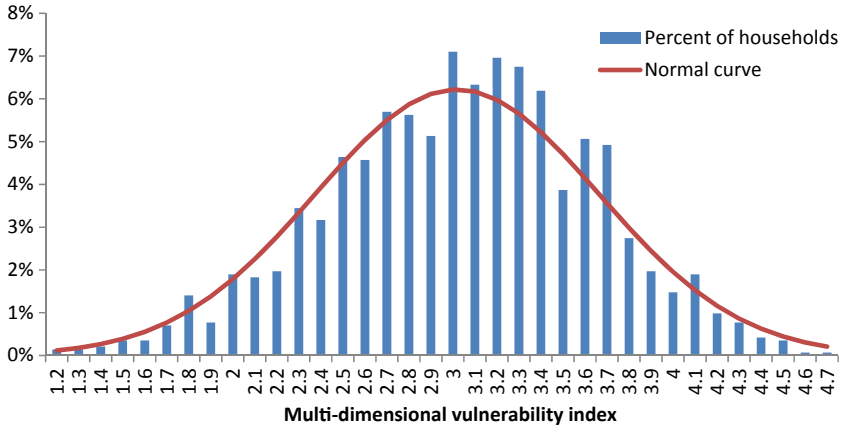

FIGURE 8.2 Distribution of household scores on the multi-dimensional vulnerability index. Note: Normal curve based on an average of 3.02 and standard deviation of 0.64.

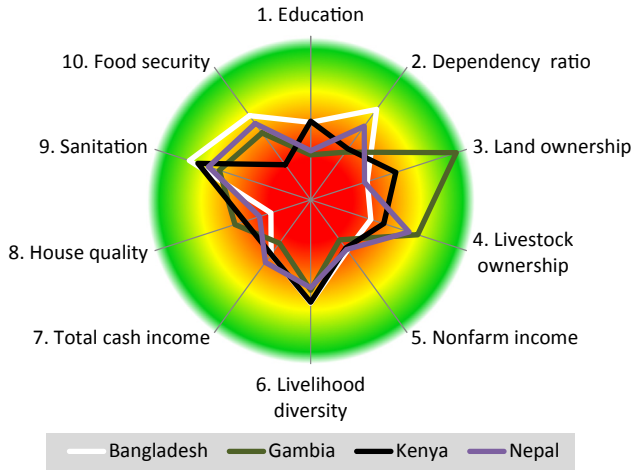

FIGURE 8.3 Household vulnerability profile by indicator and country. Note: The closer to the center of the radar (red), the more vulnerable.

8.5 IMPACT OF CLIMATE EVENTS

Each of the four study sites had been hit by climate-related events in the past years. In the North Bank Region of the Gambia, a severe drought hit in 2011; the Kenyan study site, at the shore of Lake Victoria, experienced extreme flooding that same year when River Nzoia broke its dike; a cyclone (Aila) caused havoc in southwest Bangladesh in 2009; and households in Udayapur district in Nepal had to deal with recurrent floods over the past decade. We asked respondents whether their households had been affected by these events, and if so, whether they would qualify the impacts as "moderate"

or "severe." In a follow-up question, respondents were asked about impacts on specific aspects of their household economies such as crop cultivation, livestock, fishing, trees, trade, food prices, housing, properties, and other.

The first graph of Figure 8.4 shows the proportion of households reporting "moderate," "severe," and "no impacts" of climate stressors (y-axis) and relates this to the household scores on the MDVI (x-axis). The graph shows that the majority of households reported severe impacts, and only very few indicated that they did not experience any impacts at all. Vulnerable households were significantly ($p < 0.01$) more likely to report "severe" impacts. It could be argued, however, that the more unexpected finding is that approximately two-thirds of the *least* vulnerable households also reported severe impacts. The second graph of Figure 8.4 shows the proportion of households reporting impacts on specific household activities and assets. Almost 90 percent of surveyed households experienced adverse effects of climate-related events on their crops. Over 80 percent reported that they were affected by high food prices, which made it more difficult to cope with crop losses and attain food security. Qualitative information about the "other" category revealed that it would have been worthwhile to add a separate category for health impacts, which included waterborne diseases in the flood-afflicted study sites, skin and reproductive health problems in Bangladesh, and problems related to undernutrition in the Gambia.

8.6 COPING STRATEGIES

This section looks at the coping measures households adopted to deal with impacts of climate-related events. It shows which measures were most

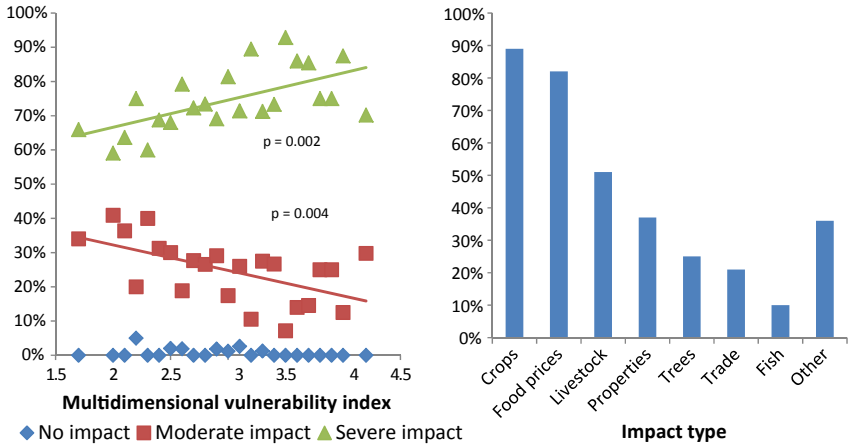

FIGURE 8.4 Impact of climatic events by household vulnerability (left) and impact type (right)—percent of households. Note: The questionnaire used in the Nepal case study did not distinguish moderate and severe impacts. Hence, the graph is based on data from the Gambia, Kenya, and Bangladesh only.

common across the four study sites and investigates whether there is a relation between vulnerability levels and the uptake of certain coping measures. As explained in the conceptual framework section, we differentiate coping strategies and adaptation. Coping refers to short-term responses to the impacts of events. By contrast, adaptation refers to longer-term adjustments to more permanent changes in the climate. The focus here is on coping measures. A cross-country analysis of adaptation measures made less sense because these differed much more widely. To adapt to increasing flood risks requires very different measures than to adapt to drought. This is different for coping measures. It does not differ so much whether households lose their harvest in a flood or a drought; to gain access to food and survive, similar measures are adopted. The survey instrument inquired about eight different types of coping measures (see Table 8.5).

Figure 8.5 relates the uptake of coping measures to household scores on the MDVI. More vulnerable households were more likely to cope by reducing expenses ("economize"), modifying food consumption, and relying on social networks. No significant differences were found between more vulnerable and less vulnerable households in the uptake of migration, asset sales, and reliance on relief. Reliance on nonfarm income was slightly more common among less vulnerable households, but the relation was not statistically significant ($p = 0.15$). "Other" coping measures were more often used by less vulnerable households. A qualitative analysis of this category revealed that most of these households borrowed money to deal with impacts of climate-related events.

Figure 8.6 shows the number of coping measures households adopted in the aftermath of climatic events. Most commonly, households used three to five different types of coping strategies. The figure further shows that less vulnerable households needed a less diverse set of coping measures to deal with impacts of droughts, floods, or cyclones.

8.7 LOSS AND DAMAGE

This section looks at households' ability to avoid loss and damage and relates this to vulnerability levels and the types of coping measures households adopted. As explained in the methods section, households incurred loss and damage when

- climate-related stressors affected them and they did not/could not adopt any measures to mitigate the effects and
- the measures that they adopted to mitigate the effects of climate-related stressors were not enough to avoid loss and damage or had adverse effects.

Figure 8.7 shows that across the four study sites, over two-thirds (69 percent) of households incurred loss and damage from climatic events. The proportion ranged from 62 percent in Nepal to 76 percent in Kenya. The

TABLE 8.5 Coping Measures and Their Uptake

Coping Measure	Uptake	Description
Reliance on social networks	48%	Asking food or other support from relatives, friends, or neighbors.
Reliance on support from organizations	54%	Food aid, camps, medical care, etc.
Engaging in other income-generating activities	50%	The climate-related stressors mostly affected crop production. A way to gain access to food and income was to (temporarily) intensify nonfarm activities or engage in new ones.
Migration	37%	This could involve temporary migration of individual household members, usually aimed at earning an income to support the family, or the movement of entire households (displacement), mostly in response to floods.
Asset sales	33%	Selling properties, mostly livestock, to buy food to deal with crop losses.
Reducing expenses	69%	When food is scarce because of harvest losses, people can avoid spending money on nonfood items such as school fees, health care, house maintenance, investments, etc.
Modifying food consumption	73%	Eating cheaper or less nutritious food, reducing the number of meals, reducing portion sizes. It is debatable whether this is a coping measure or a sign that other coping measures are failing.
Other	18%	Respondents were asked whether they had done anything else to deal with impacts of climatic stressors. The most common "other" measure was reliance on loans.

figure further shows that there is a clear and significant relation between households' score on the MDVI and their likelihood of incurring loss and damage. More vulnerable households are—as one would expect—more likely to experience impacts of climate-related events that are beyond their coping capacity. However, even households with a very low MDVI are more likely than not to incur loss and damage.

Figure 8.8 looks at the relation between the uptake of different coping measures and households' ability to *avoid* loss and damage. As most households adopted several coping measures, the graphs cannot be interpreted as assessments of the effectiveness of individual coping measures. A low bar in the left graph indicates that relatively few households that

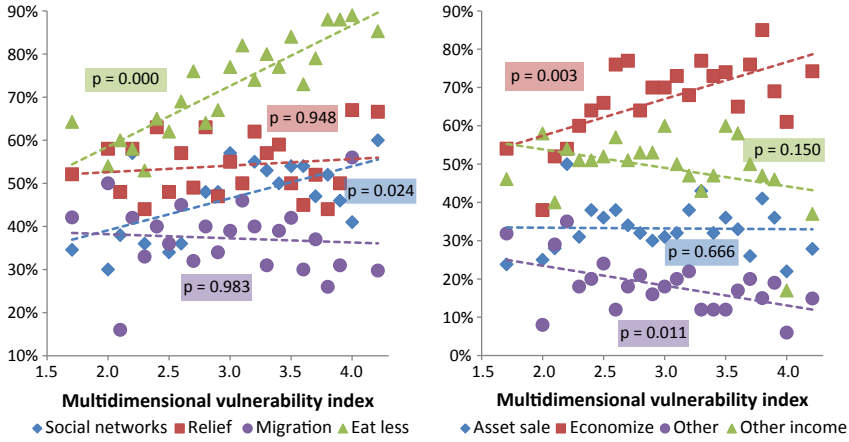

FIGURE 8.5 Uptake of coping measures by vulnerability—percent of households. Notes: (1) The coping measures were plotted in two separate graphs because of layout considerations. (2) The lower the p-value, the more significant the relation between uptake and households' multidimensional vulnerability index score.

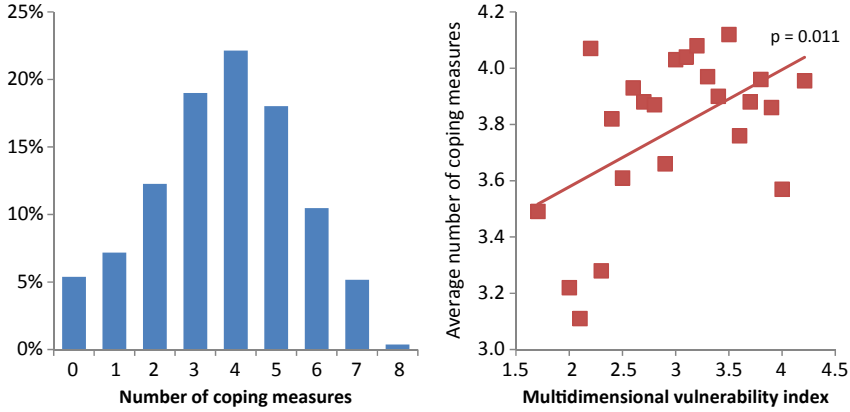

FIGURE 8.6 Number of household coping measures by vulnerability.

adopted that measure were successful in avoiding losses and damage. This was the case for reliance on relief, migration, and modification of food consumption ("eat less"). By contrast, households that relied on nonfarm income, reducing expenses, and "other" measures (mostly taking loans) to cope with climatic events were more likely to avoid losses and damages. However, the differences are quite small. The graph on the right looks at more vulnerable and less vulnerable households separately (threshold set at MDVI = 3.0). It shows that the association of coping measures with households' ability to avoid loss and damages differs between more

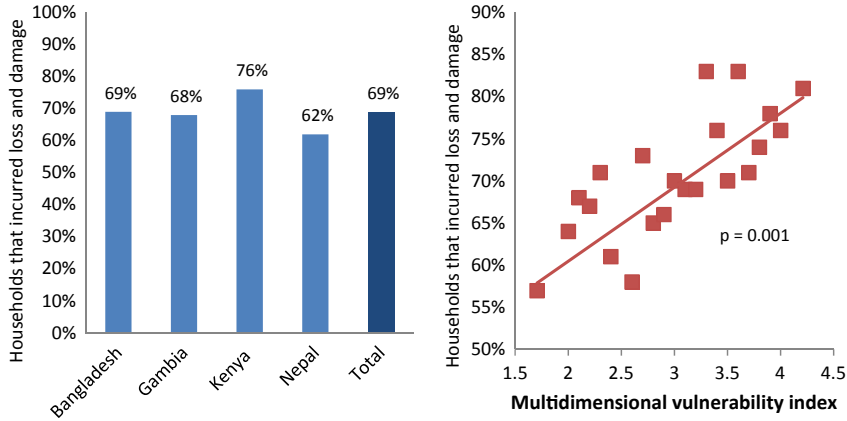

FIGURE 8.7 Loss and damage by vulnerability.

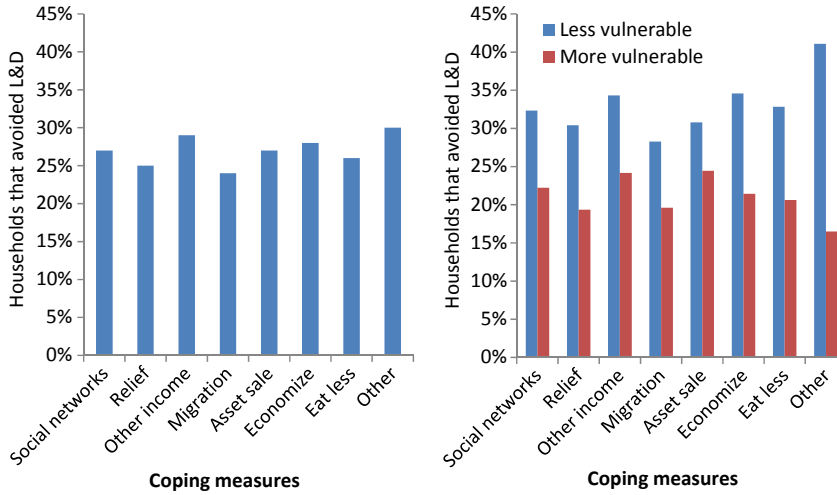

FIGURE 8.8 Coping measures, vulnerability, and the ability to avoid loss and damage (L&D). Notes: The cutoff between more vulnerable and less vulnerable households was set at multidimensional vulnerability index = 3.0.

vulnerable and less vulnerable households. This is clearest in the category "other," which mostly consisted of taking loans. Less vulnerable households that adopted this coping measure were most likely to avoid loss and damage, while the contrary was the case for more vulnerable households, many of whom indicated that the loans helped them to deal with short-term impacts, but had erosive effects in the longer term because they had great difficulties in paying back the loans.

8.8 CONCLUSIONS

'Loss and damage from climate change impacts' is an emerging theme in the international climate negotiations and associated fields of research. It results from inadequate efforts to reduce greenhouse gas emissions and insufficient capacity to adapt to climatic changes and cope with impacts of climatic events. Empirical research about the climate-related losses and damages that actors across the world are experiencing is still very limited. This chapter uses original data from study sites in four African and Asian countries that were surveyed in the context of the first ever multi-sited study of loss and damage in vulnerable communities.

The study uses a multi-dimensional vulnerability index (MDVI) to analyse differences between more and less vulnerable households in the uptake and effectiveness of measures to cope with impacts of climatic events. The results show that virtually all households surveyed experienced adverse effects of climate-related stressors, but more vulnerable households reported 'severe' impacts more often. Over 95% of surveyed households adopted at least one coping measure in response. Most commonly, households used 3 to 5 different types of coping strategies. Vulnerable households needed a more diverse set of coping measures to deal with impacts of droughts, floods or cyclones. Some coping measures, such as reducing expenses, modifying food consumption and relying on social networks were significantly more common among vulnerable households. By contrast, reliance on non-farm income and taking loans was more common among less vulnerable households. No significant relation was found between household vulnerability and selling assets, migration and reliance on relief to cope with climate impacts.

Over two thirds (69.4 percent) of surveyed households were not able to avoid residual loss and damage because their coping measures were not efficient enough, costly or erosive in the longer term. The percentage was highest among households that relied on migration, relief and modifying food consumption to cope with impacts of climatic stressors. A strong and significant relation was found between households' score on the multi-dimensional vulnerability index and their ability to avoid loss and damage. More vulnerable households are - as one would expect - more likely to experience impacts of climate-related events that are beyond their capacity to cope. However, even in the group of least vulnerable households over fifty percent incurred loss and damage.

APPENDIX: THRESHOLDS FOR VULNERABILITY INDICATORS

1. Education

Same for all countries: education level of the household head.

1 = Tertiary

2 = Secondary
3 = Primary
4 = Literacy course
5 = None

In "other" category: technical/vocational = 2; madrasa/monk = 4.

2. Dependency Ratio

Calculated as: (dependent household members (aged <18 and >65)/adult household members (18–65)) × 100. The higher the dependency ratio, the more vulnerable the household.

	1	2	3	4	5
Bangladesh	0–20	22–33	38–63	67–100	>117
Gambia	0–63	64–91	100–136	138–200	>206
Kenya	0–43	50–83	100–150	157–233	>250
Nepal	0–22	25–50	56–88	100–140	>150
All	0–32	33–65	67–100	108–178	>180

3. Land Size

Size of owned land (hectares).

	5	4	3	2	1
Bangladesh	0–0.07	0.07–0.20	0.20–0.34	0.35–0.74	>0.80
Gambia	0–3.00	3.5–5.00	5.50–8.75	9.00–13.5	>14.0
Kenya	0–0.28	0.3–0.40	0.45–0.73	0.81–1.21	>1.42
Nepal	0–0.05	0.07–0.17	0.20–0.34	0.36–0.68	>0.71
All	0–0.14	0.14–0.40	0.40–0.87	0.89–3.75	>4.00

4. Livestock

Livestock owned, expressed in tropical livestock units. Conversion factors: horse, 0.8; cow, 0.7; donkey, 0.5; pig, 0.2; sheep/goat, 0.1; poultry, 0.01.

	5	4	3	2	1
Bangladesh	0–0.07	0.08–0.26	0.27–0.90	0.92–1.76	>1.80
Gambia	0–0.75	0.80–1.77	1.80–3.05	3.06–5.00	>5.02
Kenya	0–0.01	0.02–0.43	0.44–1.76	1.80–3.05	>3.15
Nepal	0–0.47	0.50–1.61	1.64–2.50	2.52–3.63	>3.65
All	0–0.13	0.14–0.90	0.92–2.00	2.04–3.47	>3.50

5. Nonfarm Income

Total income derived from nonfarm-income-generating activities in the past 12 months, expressed in US$. The category of most vulnerable

households (5) has no nonfarm activities (NFA) at all. Category 4 is populated by households that have very low-yielding or occasional NFA. This includes households with zero income from these activities in the past 12 months.

	5	4	3	2	1
Bangladesh	No NFA	12–245	270–441	444–736	>854
Gambia	No NFA	10–81	97–161	193–387	>406
Kenya	No NFA	0–88	94–228	234–527	>527
Nepal	No NFA	0–147	170–452	475–1,130	>1,220
All	No NFA	0–129	129–293	294–687	>702

6. Livelihood Diversity

Same for all countries: Number of livelihood sources out of the following list: crop cultivation, livestock keeping, fishing, trees, farm labor, nonfarm income, remittances, and other (mostly pension, rent).

1 = 6–8 sources
2 = 5 sources
3 = 4 sources
4 = 3 sources
5 = 0–2 sources

7. Total Income

Total cash income over the past 12 months, expressed in US$. Calculated as the sum of income from all sources mentioned under Livelihood Diversity.

	5	4	3	2	1
Bangladesh	0–208	209–449	453–753	770–1,242	>1,245
Gambia	0–147	148–316	319–568	574–1,081	>1,084
Kenya	0–211	215–410	415–716	722–1,334	>1,337
Nepal	0–136	139–525	565–1,028	1,051–1,865	>1,876
All	0–170	171–407	410–736	737–1,355	>1,356

8. House Quality

Same for all countries: Based on floor material (vulnerable if earth, mud, or cow dung) and own perception of house quality (better, average, worse).

	Is Floor of the House Made of Earth, Mud, or Dung?	
Own Perception of House Quality	**No**	**Yes**
Better	Vulnerability = 1	Vulnerability = 3
Average	Vulnerability = 2	Vulnerability = 4
Worse	Vulnerability = 3	Vulnerability = 5

9. Sanitation

Same for all countries: Based on household access to clean drinking water and private toilet facilities.

Source of Drinking Water	Does House Have a Private Toilet or Latrine? Yes	No
Tube, pump, borehole	Vulnerability = 1	Vulnerability = 3
Surface water/well + other sources	Vulnerability = 2	Vulnerability = 4
Only surface water/well	Vulnerability = 4	Vulnerability = 5

10. Food Security

Same for all countries: Based on months of food shortage in the past year and years of food shortage in the past 10 years.

Months of Food Shortage in Past Year	Years of Food Shortage in the Past Decade: 0	1–3	4–12
0	Vulnerability = 1	Vulnerability = 2	Vulnerability = 3
1–3	Vulnerability = 2	Vulnerability = 3	Vulnerability = 4
4–12	Vulnerability = 3	Vulnerability = 4	Vulnerability = 5

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