

CHAPTER 13

Loss and Damage from Droughts and Floods in Rural Africa¹

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'Loss and Damage' refers to the adverse effects of climate variability and climate change that occur despite efforts in global mitigation and local adaptation. This chapter reports on five case studies on loss and damage as a result of drought and floods in rural areas in Burkina Faso, Ethiopia, Kenya, Mozambique and The Gambia using a questionnaire survey (N = 1,973) and participatory research tools. The research goes beyond existing knowledge on adaptation and coping mechanisms by examining the limits, constraints and residual impact of household measures to cope and adapt. Only 28% of the households surveyed successfully avoided loss and damage from drought or floods but those that introduced agricultural adaptations, such as planting drought-resistant crop varieties, or diversified their livelihoods with non-farm activities were significantly more successful than others. Migration, on the other hand, was associated with the failure to avoid loss and damage. The chapter uses examples from five case studies and is structured around three 'loss and damage pathways' to illustrate the consequences of not being able to cope and adapt adequately. The findings presented here indicate that climate-related losses and damage are already a reality in many rural African communities.

Introduction

African agriculture is extremely vulnerable to climatic stressors because most of the continent's crop cultivation is rain-fed and natural climate variability is

1 The data presented in this chapter were gathered in the context of the Loss and Damage in Vulnerable Countries Initiative. As part of this project, the United Nations University conducted nine case studies in collaboration with national research institutes. In addition to the five African case studies presented here, fieldwork was also done in Bangladesh, Bhutan, Micronesia and Nepal. Funding came from the Climate and Development Knowledge Network (CDKN). The Africa Climate Policy Centre (ACPC) also funded three case studies (in Ethiopia, Burkina Faso and Mozambique). The authors wish to thank Fatima Denton and Tom Owiyo of ACPC for coordinating the work. A special thanks goes to the national researchers – Denis Opiyo Opondo, Sidat Yaffa, Alemseged Tamiru Haile, Ange-Benjamin Brida and Seydou Traore – and their teams for gathering the case study data. For more information on the project, see www.lossanddamage.net

high (Boko *et al.* 2007; Roudier *et al.* 2011). Institutional support to farmers and access to crop insurance are also limited (Warner *et al.* 2012a). Drought and floods regularly cause havoc for African farmers and impact on farming systems, as do pests and plagues, volatile commodity prices, poor access to markets and storage facilities, and high levels of poverty that all act as constraints on adaptive capacity. Climate change and increasing climate variability are compounding these challenges (Thornton *et al.* 2011; Hertel *et al.* 2010). With current trajectories for greenhouse gas emissions, it is unlikely that global temperature increases can be kept within the aimed 2°C range and this could have serious consequences in the future (Meinshausen *et al.* 2009; van Vliet *et al.* 2012). The impact could severely affect water availability, agriculture and food security in Africa (Boko *et al.* 2007; Fung *et al.* 2011; Thornton *et al.* 2011).

Regional predictions of precipitation changes in Africa are still uncertain and vary between regions (Boko *et al.* 2007; Foresight 2011). Moreover, correlations between rainfall and crop yields are not straightforward, especially in sub-humid areas (Zaal *et al.* 2004). Recent studies using statistical, econometric and process-based predictions have found that some areas are at risk of severe declines in crop yields, while others will benefit from climatic changes that may improve conditions for agriculture (Müller *et al.* 2011). Still, of all the continents, the largest drought-induced yield decreases are expected in Africa (Li *et al.* 2009) and the same applies to second-order impacts on food prices and poverty (Hertel *et al.* 2010). While the focus of these studies is mostly on increased drought risk, higher flood risks can be equally devastating (Tschakert *et al.* 2010; Di Baldassarre *et al.* 2010) and temperature rises are also of concern due to crop sensitivities to heat and increased evaporation (Müller *et al.* 2011; Roudier *et al.* 2011). The most serious impact of climate change can be expected in regions that are currently situated at the limits of crop cultivation. In an area currently populated by 35 million people in the West African Sahel and parts of East and Southeast Africa, crop cultivation is projected to no longer be viable in the future (Jones & Thornton 2009). If these projections became reality, such areas would become increasingly uninhabitable and anyone living there would face the risk of crossing interacting boundaries of biophysical impacts of climate change and the social dimensions of adaptation limits (Adger *et al.* 2009; O'Brien & Wolf 2010; Warner *et al.* 2013).

While natural and human systems will continually change and adjust to stressors (Adger *et al.* 2003), adaptation deficits, barriers and limits exist and can undermine livelihood sustainability, impede sustainable development and compromise human well-being (Burton 2009; Preston *et al.* 2013; Kates *et al.* 2012). A key question, and also the focus of this chapter, is what patterns of loss and damage emerge in human systems, such as African agriculture and rural livelihoods, when efforts to adjust are insufficient?

The following definition of loss and damage was used for the community-based field research discussed in this article: loss and damage refers to the negative effects of climate variability and climate change that people have not been able to cope with or adapt to.

Households incur loss and damage when they are not able to respond adequately to climate-related stressors and when adaptation and coping measures have costs or adverse side-effects. Costs and effects can be both economic and non-economic. The underlying causes of loss and damage are social vulnerability – exposure to climatic stressors and lack of adaptive capacity – but are also related to inadequate efforts to reduce global emissions of greenhouse gases. Losses and damage from climate change depend to a large extent on the intensity of climatic disruption that, in turn, depends on global mitigation efforts.

The empirical research reported in this chapter aims to enhance an understanding of how the interaction of climate-related stressors with agricultural livelihoods and social vulnerability is creating particular patterns of loss and damage today in rural African communities. The case studies gathered data in four research domains:

- (i) ***Climate stressors:*** Manifestations of climate variability and climate change that may involve either extreme weather-related events or more gradual changes. The focus in these case studies was on drought, floods and longer-term climatic changes, particularly in rainfall patterns.
- (ii) ***Societal impact:*** The adverse effects of climate-related stressors on people's food production, income sources, health, physical assets and other aspects of well-being depend to a large extent on vulnerability, which is determined by exposure to climatic stressors and coping capacity. Special attention is devoted to the impact on agriculture in this chapter.
- (iii) ***Responses:*** What is being done to cope with the impact of drought and floods? And what is being done to adapt to changing rainfall patterns and changes in drought and flood risk? The study explicitly distinguishes 'coping' from 'adaptation', as they are different types of responses to different types of stressors (van der Geest 2004; Birkmann 2011). Coping strategies are short-term responses to the impact of specific events, such as drought and floods. Adaptation involves longer-term responses to changing conditions. Adaptation measures are often adopted in response to a mix of climatic and non-climatic changes (Moser & Ekstrom 2010) and can be proactive and reactive (Berrang-Ford *et al.* 2011).

- (iv) (*Residual*) *loss and damage*: These are the negative effects of climatic stressors that people have not been able to cope with or adapt to. Loss and damage occurs when people cannot respond to climate stressors at all; if their coping and adaptation measures are not efficient enough; if these measures have costs; and if they have adverse long-term effects on livelihood sustainability (Warner & van der Geest 2013). Costs and adverse effects include non-economic losses, which often elude quantification but can cause severe harm to human well-being and undermine sustainable development (Morrisey & Oliver-Smith 2013).

Though data were gathered on specific climatic events (drought and floods) as well as slow-onset changes (in rainfall patterns), this chapter focuses primarily on the impact of drought and floods on livelihoods and the coping strategies adopted in response. In line with the overarching theme of this volume, additional attention is given to agricultural impacts and adaptations.

Research Methods

The research presented here generated primary data providing a people's perspective on loss and damage. Research was conducted in five African countries – Burkina Faso, Ethiopia, the Gambia, Kenya and Mozambique – in districts that are vulnerable to the impact of climate-related stressors. National research teams from each country gathered quantitative and qualitative data in household surveys ($n = 1973$) and during more than 100 focus-group discussions, expert consultations and in-depth interviews with some of the people affected. Researchers also compared meteorological data with local perceptions of climatic stressors. Table 13.1 provides an overview of the study areas and climate stressors on which each of the case studies focused.

The survey instrument (sample size: 304 to 465 households per case study) assessed the impact of drought and floods on crops, livestock, other livelihood activities and assets; household strategies to deal with these; and the extent to which the measures adopted were successful in avoiding loss and damage. A template questionnaire was designed and later adapted for each case study to suit the characteristics of local livelihood systems and environments. The first section of the survey instrument enquired into household socioeconomic and demographic characteristics and sources of food and income. The information gathered in this section aimed to identify what household characteristics contribute to vulnerability and resilience to droughts and flooding. The following

TABLE 13.1 *Overview of the case studies: research area, climate stressors and sample size*

Country	District/Region	Climate-related stressor	Sample size
Burkina Faso	Sahel	Drought	465
Ethiopia	Gambella	Flooding	431
Gambia	North Bank	Drought	373
Kenya	Budalangi	Flooding	400
Mozambique	South & Central	Drought and floods	304

sections dealt with extreme weather events and slow-onset processes with a focus on impact, coping, adaptation and residual loss and damage. Open questions were combined with closed questions to optimize the balance between listening to the voices of rural people and being able to quantify how widespread different impacts and coping and adaptation responses were.

The selection of study sites was based on criteria such as the presence of climatic stressors, their predominantly agricultural livelihoods and access to communities through existing contacts. Within the study sites, the survey households were selected randomly using different sampling techniques based on the local situation. Households in Burkina Faso, The Gambia and Mozambique were selected randomly from a list of all households provided by local authorities and spatial sampling methods were used in Kenya and Ethiopia based on survey maps and community maps.

The research objective and methods have several limitations. Firstly, the attribution of local climatic changes and extreme events to global warming² is beyond the scope of this research. Climate systems in Africa have always been characterized by occasional droughts and floods are not just caused by heavy rainfall but also by local human drivers, upstream land conversion and deforestation. While this research on climate-related loss and damage contributes to knowledge-building on the impact of climate change and limits to adaptation, the climatic stressors examined could also have occurred without anthropogenic global warming. Secondly, no attempt was made to estimate total losses and damages in monetary terms at local, national or global scale. And finally, the local case studies are not representative of entire countries. These studies should be treated as a point of departure for further research on loss and damage in vulnerable communities.

2 See Huggel *et al.* (2013) and Wrathall *et al.* (in press) for a discussion of 'the attribution problem'.

Overview of Survey Findings

This section considers the quantitative findings from the questionnaire survey and the following one discusses three 'loss and damage pathways', which are illustrated with examples from the field.

The survey findings reveal that the impacts of drought and flooding are widely experienced in the African study sites. The proportion of households reporting adverse effects on their household economy was very high (>97%, see Table 13.2). The questionnaire asked specifically about impacts in eight different domains: crop cultivation, livestock keeping, fishing, trees, trade, food prices, houses/properties and 'other'. The three areas that were most affected in each study site are listed in Table 13.2. In all five study sites, the main domain impacted was crop cultivation, with over 90% of households affected in each site. In four out of the five research areas, food prices came second. Most respondents were small-scale farmers. Although over 50% of the households also engaged in non-farm activities, this mostly involved low-yielding activities such as petty trade. Given their low cash incomes, households that experienced harvest failure often had difficulty accessing food, especially as food prices rise in the aftermath of a drought or floods, which further aggravates the problem.

In the study areas that had experienced droughts, severe impacts on livestock were common and many respondents reported damage to physical assets, particularly houses, in the flood-affected research areas. The Ethiopian

TABLE 13.2 *Impacts of climate-related stressors (% of households)*

Country	Climate stressor	Experienced impact (%)	Impact sector 1 (%)	Impact sector 2 (%)	Impact sector 3 (%)
Burkina Faso	Drought	97	Crops (96)	Food prices (90)	Livestock (87)
Ethiopia	Flood	100	Crops (94)	Health (92)	Assets (79)
Gambia	Drought	100	Crops (98)	Food prices (89)	Livestock (75)
Kenya	Flood	98	Crops (98)	Food prices (95)	Physical assets (66)
Mozambique	Both	99	Crops (100)	Food prices (83)	Livestock (35)

Note: The percentages for 'impact sector' (Columns 4, 5 & 6) were calculated for the households that experienced impacts (Column 3).

case study, which looked at floods, added an impact domain to the questionnaire, namely health. This was a useful addition as 92% of households affected reported health impacts, particularly water-borne diseases (Haile *et al.* 2013).

For each impact domain, respondents were asked – in an open question – to specify how droughts or floods had affected their households. In the case of agriculture, the impact process differed between droughts and floods but the outcome was the same: loss of harvest as a first-order impact, followed by second-order impacts such as food insecurity, low income, a lack of seeds, impoverishment and indebtedness. With regard to the biophysical impact process, crops were mostly swept away, with farmers often losing their entire harvest in flood-affected study areas. Less commonly, farmers reported that field crops rotted after standing in flood water for too long. One farmer in Budalangi District in Kenya complained because he had, for the first time ever, invested in expensive maize seeds and fertilizer for his farm. He did not therefore only lose his harvest but also a major investment for which he had taken out a loan. With no income from his farm and needing to buy food for his family against soaring prices, this farmer had clearly entered a cycle of indebtedness and impoverishment.

In the case of drought, total harvest loss was less common. Participants in focus-group discussions in The Gambia explained that total crop failures were extremely rare there because of risk spreading in traditional subsistence agriculture. When crops planted in upland areas fail because of long dry spells, lowland fields may still produce a harvest. Farmers vary not only the locations of their fields but also crop types, sowing dates and seedbed types. These measures help reduce the impact of drought on agricultural production but are not enough to avoid very poor yields and associated second-order impacts.

The majority of survey respondents across the study sites (93%) indicated that they adopted coping measures to deal with the impact of droughts or floods (see Table 13.3). In the flood-affected study areas in Ethiopia and Kenya, many households tried to cope by relying on aid and support from the government and NGOs, while households in areas affected by drought in Burkina Faso and The Gambia tried to cope by selling livestock so they could buy food when their harvests failed. Across all the study areas, households tried to cope by relying on other sources of (mostly non-farm) income to buy food when their primary, more climate-sensitive livelihood activity was affected by drought or floods. Reliance on social networks was also a key element in people's portfolios of coping options. Migrants were often the people who provided financial support for food and other essentials when their relatives at home were hit by a drought or floods. Using migration as a coping measure was least common, but still in 23% of the sampled households at least one person migrated to

cope with the impact of climate-related stressors. They moved to safer areas or places that provided opportunities to earn an income so they could buy food when their own harvests failed. In the Kenyan case study, a much higher proportion of households (62%) migrated, mostly short distances to camps or to relatives living on higher ground, in the aftermath of floods.

In the questionnaire, household members were also asked whether they had modified their food consumption pattern in response to drought or flood impacts. When designing the questionnaire, this was considered a coping strategy but one could question whether reducing one's number of meals per day or portion sizes is really a 'coping' strategy or a sign that all the other available options have failed. The number of households that indicated they had to modify food consumption was very high (78.5%), which indicates that other coping strategies were not effective enough to avoid food insecurity.

Among those who adopted coping measures, most indicated that they were not successful in preventing residual impacts (72%, see Table 13.3). This was either because the measures were insufficient or because they had costs or other negative consequences attached. In four of the five study sites, the figure was between 66% and 72%. The situation in Ethiopia was even more severe: up to 96% of households reported that their coping measures in response to flooding had not prevented residual losses and damage.

TABLE 13.3 *Coping measures and residual impacts (% of households)*

	Adopted measures (%)	Relied on other income (%)	Relied on aid (%)	Sold assets (%)	Relied on social network (%)	Household or members migrated (%)	Had residual impact (%)
Burkina Faso	79	33	51	79	29	41	72
Ethiopia	98	58	76	42	50	18	96
Gambia	97	57	49	56	48	23	67
Kenya	98	40	80	20	34	62	73
Mozambique	93	67	45	34	31	12	69
Median	93	57	51	42	34	23	72

Notes: Percentages for specific coping measures (Columns 3, 4, 5, 6 & 7) were calculated for households that adopted at least one coping measure (Column 2). The last column ('residual impact') shows the percentage of households whose coping measures did not prevent loss and damage.

Figure 13.1 compares the ability of adopters and non-adopters of different coping strategies to avoid residual loss and damage. Only the data for Kenya and The Gambia are shown.³ The diagram should not be interpreted as an evaluation of the effectiveness of each of the coping strategies because respondents were asked only if the combination of coping strategies they adopted had helped them to avoid residual impacts. It does, however, show that certain coping strategies are associated with success in avoiding loss and damage and others with failure. For example, households that relied on food aid and other types of relief were more likely to incur residual loss and damage. A negative interpretation would be that government and/or NGO support to affected households did not work well or had adverse side-effects. On the other hand, it could equally be that food aid and other types of relief were used in the most dire cases where the stressor and impacts were most severe. Households that migrated or that sent individual household members away were also less likely to avoid loss and damage, but the difference was quite small and not significant statistically.

Households that tried to cope with drought and flood impacts on their main source of food and income (mostly crop cultivation) by relying on other sources of income were most likely to avoid loss and damage (though still not more than about 33%). Selling assets, mostly livestock, was also positively associated with success in avoiding loss and damage. As highlighted earlier, only findings from Kenya and The Gambia are presented in figure 13.1 and Table 13.4.

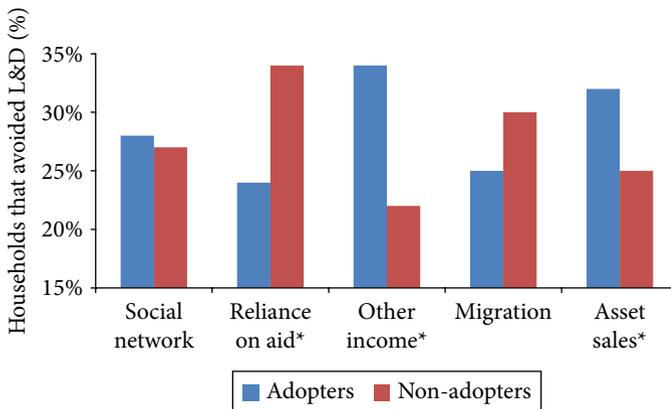


FIGURE 13.1 Ability to avoid loss and damage in The Gambia and Kenya (by coping measure).

Note: *indicates significant differences ($p < 0.05$) between adopters and non-adopters; Figure based on data from The Gambia and Kenya only.

3 The three other case studies – in Burkina Faso, Ethiopia and Mozambique – were funded by the African Climate Policy Centre and the authors of this chapter had only limited rights to use the data generated by these studies.

TABLE 13.4 *Uptake of adaptation measures in The Gambia and Kenya*

	Any adapta- tion (%)	Agricultural change (%)	Livelihood diversifica- tion (%)	Migration (%)	Other (%)
Gambia	77	55	47	23	8
Kenya	77	42	38	47	8

Besides *ex-post* coping measures, the study also inquired into *ex-ante* preventive measures and adaptation to (perceived) changes in drought and flood risk. Only findings from Kenya and The Gambia are presented here. In both study sites, 77% of the surveyed households adopted such measures. Most adaptation and *ex-ante* risk management occurred in agriculture, followed by livelihood diversification into non-farm activities and migration. Agricultural adaptations primarily involved planting early maturing, drought-resistant or water-tolerant crop cultivars, shifting to horticulture in small irrigated gardens and going into fruit-tree cultivation. Respondents in Kenya also mentioned that they shifted the location of their farms to reduce the risk of harvest losses.

Figure 13.2 compares the ability of adopters and non-adopters of different adaptation measures to avoid residual loss and damage. Separate figures for The

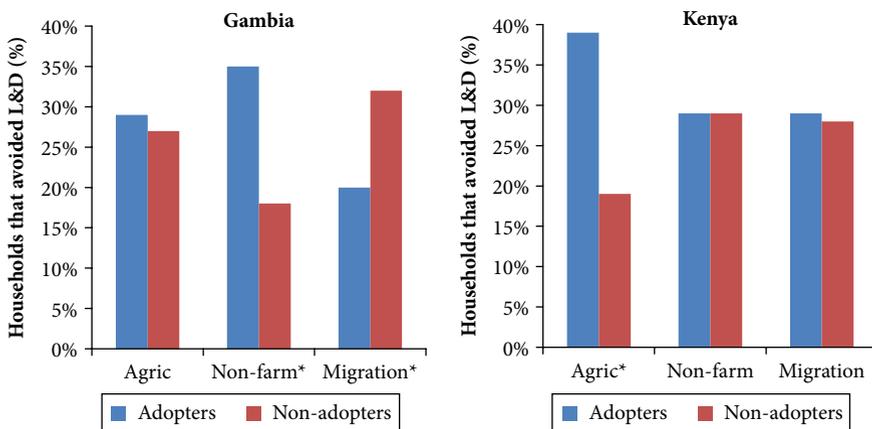


FIGURE 13.2 *Ability to avoid loss and damage in The Gambia and Kenya (by type of adaptation measure).*

Note: *indicates significant differences ($p < 0.05$) between adopters and non-adopters.

Gambia and Kenya are shown because the findings differ markedly in the two case-study areas. Households in The Gambia that were most likely to avoid loss and damage from drought adapted by diversifying into non-farm activities. By contrast, households that relied on migration were less likely to avoid loss and damage. No significant ($p < 0.05$) differences in ability to avoid loss and damage were found between adopters and non-adopters of agricultural adaptation measures. In the Kenyan case study, households that adapted by implementing agricultural changes were most 'successful' in avoiding loss and damage.

The findings on adaptation highlight the importance of local assessments of household strategies in dealing with climatic stressors. What works in one place does not necessarily work in another. The next section presents more qualitative and site-specific findings on how households incur loss and damage.

Pathways to Loss and Damage

The community-based case studies in the Loss and Damage in Vulnerable Country Initiative revealed four pathways where vulnerable people incur loss and damage (Warner & van der Geest 2013). Despite efforts to adapt and cope with the impact of drought and floods, many households across the research sites were not able to avoid adverse effects. Residual impacts occurred when:

- measures to cope or adapt were *insufficient* to avoid loss and damage
- measures involved economic, social or cultural *costs* that were not regained
- measures were *erosive* in the longer term and made people more vulnerable
- *no measures* were adopted at all.

The first three pathways were most common in the African case studies. The fourth pathway was less common as almost all the households (93%) adopted at least one coping measure to deal with the impact of drought or floods and 77% adopted preventive or adaptive measures. In some of the non-African case studies that were conducted in the context of the same project, the focus was more on adaptation to slow-onset processes, such as a rise in sea level or changing monsoon patterns. In these locations, more households indicated that they had not adopted any coping or adaptation measures because they simply did not know what to do or because they lacked the resources to respond adequately (Rabbani *et al.* 2013; Monnereau & Abraham 2013; Kusters & Wangdi 2013).

Measures are Not Enough to Avoid Loss and Damage

The vast majority of households across the five study sites adopted coping and adaptation measures to prevent or deal with the impact of drought and floods. However, these measures were often not enough to avoid loss and damage to household economies, livelihoods, health, and cultural assets. Examples from the five case studies are given below to demonstrate how the loss and damage pathways play out in real life.⁴

The case study in The Gambia (Yaffa 2013) looked at the drought-prone area of the North Bank Region. Long-term rainfall data from the area follow a similar pattern as in other parts of the Sahel that suffered severe consecutive droughts in the 1970s and 1980s, followed by a partial recovery with high variability and occasional years of drought (Hulme 2001; Dietz *et al.* 2004). The North Bank Region experienced a severe drought in 2011 with farmers seeing their yields decimated. Of the households surveyed, 98% were affected by drought despite the preventive measures they had adopted, such as planting drought-resistant crop cultivars and taking measures to spread the risk of crop failure, for example by growing different crops, spreading sowing dates over a longer period of time and farming upland as well as lowland fields. The most common way to cope with harvest failure was to 'look for money' to buy food, either through local non-farm activities or by sending household members to urban centres to engage in informal economic activities. However, due to scarce supplies, food prices increased in the aftermath of the drought and, with many households in the same situation, money was scarce, which made it more difficult to cope. About half of the households surveyed received some food aid and many sold livestock to buy grain. For most households, these measures were only partly successful: 64% of respondents reported that despite all their efforts to cope with the drought and harvest losses, they could not access enough food to feed their households. Buying cheaper, less nutritious food was one way of dealing with this situation but most households had to reduce their portion sizes or the number of meals they had as well (Yaffa 2013).

Haile *et al.* (2013) studied loss and damage due to flooding in the Gambella Region in Ethiopia. The research area floods very frequently but the degree of flooding is usually moderate. This case study paid special attention to the measures households adopted to prevent flood impacts and assessed their effectiveness in preventing loss and damage. Most commonly, households dug ditches or erected boundary walls around their houses and farms to keep the

4 Some of these examples were used in Warner *et al.* (2012b, 2013).

water out. Others tried to prevent any impact by moving household property, and especially livestock, to higher grounds. The study found that these preventive measures minimized flood impacts in most years when floods were moderate. However, when the area was hit by extremely high water levels in 2007, virtually none of the households were able to avoid losses and damage to their farms, houses, property, livestock and granaries (Haile *et al.* 2013).

Measures have Costs that are Not Regained

The measures that households adopt to cope with the impacts of extreme weather events often have costs themselves, which can be either monetary or non-monetary.

In the study areas in Mozambique, households had to deal with the double threat of drought and floods (Brida *et al.* 2013). Many of the households surveyed had been resettled from lowland areas to higher ground after severe flooding in 2001 and 2007. This adaptation made them less vulnerable to rising water levels but it came at significant cost. In the upland areas, many people are unable to produce enough food for their families because the upland soils are less fertile and crop yields are thus significantly lower. Some households moved their fields back to more fertile lowland areas, while still living in upland areas as this gives them better yields, but valuable time and energy are then wasted commuting the large distances between the upland and lowland areas. Moreover, when a flood hits, households still risk losing their entire harvest from their lowland farms (Brida *et al.* 2013).

The study area in Burkina Faso showed clear signs of cultural losses. Many former pastoralists have lost their herds in recurrent droughts and have since had to take up other occupations. Besides any material losses, the loss of their cattle is shameful for many of these former herdsmen and ceasing to be a herder brings a loss of cultural identity and lifestyle. Their experience and skills are highly specialized and learning to make a living in another profession and building up a new life and livelihood in an urban centre can often be a challenge for them (Traore *et al.* 2013).

Erosive Coping: Short-Term Merits, Adverse Long-Term Effects

Coping measures are 'erosive' when they jeopardize future food and livelihood sustainability (de Waal 1989; van der Geest & Dietz 2004). Households that have to deal with the impacts of climatic stressors will prefer to first adopt

'non-erosive' coping measures, such as drawing on buffers. When non-erosive coping options are not – or are no longer – available, people are forced to adopt erosive measures, such as selling productive assets, consuming seeds that have been reserved for the next agricultural cycle or taking their children out of school so they can find work to support the household. Across the five African case study sites, researchers found that many households were being forced to employ erosive coping strategies that would enable them to survive in the short term but that ultimately make them more vulnerable in the longer term.

Opondo (2013) examined the coping strategies that households adopted after the River Nzoia in western Kenya broke its banks in December 2011 and caused havoc in Budalangi Division, a low-lying area on the shores of Lake Victoria. Floods have become more frequent and intense in recent decades but those in December 2011 led to people and livestock drowning, crops being washed away and severe damage to houses, and they also spawned an outbreak of water-borne diseases. Some of the coping strategies that people adopted to gain access to food or to reconstruct their houses have had severe implications for their future livelihood security. For example, some households were forced to sell their bullocks to buy food after the floods washed away their crops. The following season, these bullocks were then not available to plough their fields and the households' situation became even more precarious. And able-bodied household members had to invest a great deal of their time in non-farm activities or migration to urban centres to resolve their urgent food needs. This meant that they had much less time to spend on their household farm, which undermined food security in the next cultivation cycle. In addition, some households withdrew their children from school so they could help generate income, mostly through non-farm activities.

The case study in The Gambia, which focused on the impact of droughts, yielded similar findings (Yaffa 2013) and in Ethiopia it was found that when preventive measures are not enough to avoid severe impacts, households often rely on their social networks for survival. However, repeated floods erode this social capital, overburden social networks and leave affected households in a more vulnerable position with each subsequent flood (Haile *et al.* 2013).

Conclusions and Policy Implications

This study defined loss and damage as the 'negative effects of climate variability and climate change that people have not been able to cope with or adapt to'. The findings presented in this chapter show that loss and damage from climate-related stressors is already a reality for rural households in Africa. Almost

all the households that were interviewed for this research ($N = 1973$) had adopted coping strategies to deal with the impact of drought and floods. In over 70% of these households, their efforts were, however, not sufficiently effective to avoid loss and damage.

The case-study findings suggest that some of the most notable current impacts are on household food production and livelihoods. A minority of households in these study areas have been able to cope with the impacts of droughts and floods and to adapt to climatic changes in ways that enhance their resilience. Of concern, however, are the numerous vulnerable households that have not been able to cope and adapt successfully. To survive when a drought or flood strikes, they have often been forced to use erosive coping measures that can trap them in a downward spiral of declining well-being and security. Such households are experiencing diminishing coping and adaptive capacity, and increasing losses and damages.

The chapter went a step beyond earlier research by evaluating which household coping and adaptation measures are associated with success and failure when it comes to avoiding loss and damage. Levels of success were generally low, but households that adapted through agricultural adaptations, such as planting drought- or water-tolerant crop varieties or by diversifying their livelihoods with non-farm activities, were significantly more likely to avoid loss and damage. Migration, on the other hand, was associated with failure to avoid loss and damage.

Vulnerable countries, like those studied in this research, are at the frontline of loss and damage realities. This chapter originated from a first generation of local-level research that is systematically assessing loss and damage from climate-related stressors. The case studies serve as a point of departure for further research to understand how climate variability and climate change are affecting vulnerable households today, and the consequences of adaptation shortfalls for livelihood security, sustainable development and human well-being in the future.

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