

**Loss &  
Damage**

# Loss and damage from flooding in Udayapur District, Nepal

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## List of Acronyms

CDKN	Climate and Development Knowledge Network
COP	Conference of the Parties
DDC	District Development Committee
DDT	Dichlorodiphenyltrichloroethane (insecticide)
DRR	Disaster Risk Reduction
GLOF	Glacial Lake Outburst Floods
HH	Household
ICIMOD	International Centre for Integrated Mountain Development
IDS-Nepal	Integrated Development Society, Nepal
INGO	International Non Governmental Organisation
IPCC	Intergovernmental Panel on Climate Change
LAPA	Local Adaptation Programme of Action
LDC	Least Developed Countries
NAPA	National Adaptation Programme of Action
NGO	Non Governmental Organisation
NR	Nepalese Rupee
NTFP	Non Timber Forest Product
UNDP	United Nations Development Programme
UNFCCC	United Nations Framework Convention on Climate Change
UNU-EHS	United Nations University Institute for Environment and Human Security
VDC	Village Development Committee

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## Executive Summary

### Background

Nepal is particularly susceptible to climate-related disasters. This country experiences frequent landslides, debris flows, and floods because of its varied topography and geological characteristics, together with torrential rain during the monsoon season. The UNDP estimates that flooding in Nepal has on average killed almost 200 people, affected hundreds of thousands of lives, and caused \$35 million worth of damage every year since 1980. In addition, demographic factors such as rapid population growth and unsustainable land use and forest clearing as well as migration from rural uplands to lowlands, infrastructural underdevelopment, and gender inequality all contribute to the effects of these disasters.

*This case study examines household vulnerability and responses to flooding*

### The research

This case study examines household vulnerability and responses in relation to flooding in Udayapur District, Nepal. It describes how communities in this region deal with flooding and asks to what extent their preventive, coping, and adaptation measures have been successful in avoiding loss and damage. A 300-household survey, along with open interviews and focus group discussions, revealed a wide range of strategies that families adopt in relation to flooding. *In situ* measures – such as the construction of sand embankments,

stonewalls, and bamboo fences – are frequently used to control floods and prevent impacts.

*Despite high adoption rates, preventive and coping measures did not avoid loss and damage.*

The most common coping strategies in Udayapur District are outmigration for labour and reliance on non-food income, social networks, and external support. The results show that despite high adoption rates, preventive and adaptation measures are, for a majority of the households, not enough to avoid loss and damage. This study is particularly relevant to district- and national-level planners developing long-term policies to address climate change, especially since Nepal's adoption of a National Adaptation Programme of Action (NAPA) in 2010. Place-based research like this will also hopefully inform and ground global negotiations and discourses around the impacts of climate change, especially in vulnerable communities.

### Loss and damage from flooding

A rapid onset event like flooding can wipe out years of a household's work as well as broader community development achievements (e.g., washed away bridges and roads). Because of flooding, households are forced to expend time and effort in preventing, coping, and adapting to these destructive climate events. For example,

families farming along riverbanks must rebuild the walls of their fields even as they attempt to rehabilitate soils damaged by flood events. Adaptive capacity in our study site is limited: 50% of our respondents noted that, despite the preventive measures they had taken, there were still “severe negative effects” from flooding. Almost a quarter (22.7%) of the households we interviewed had sold property including homes, livestock, and heirloom possessions to cope with these effects. It should be emphasized that this does *not* include loss and damage to other types of personal property in floods. Additionally, close to forty percent of interviewed households had reduced expenses (e.g., school fees, health care, productive investments, etc.) and food consumption in the aftermath of floods.

*Policy should go beyond short-term disaster relief in the aftermath of floods; long-term support and planning is needed*

**Policy options<sup>1</sup>**

Rather than simply reacting to extreme events (e.g., disaster relief after floods), the government needs to provide substantive long term support to, and investment in, households suffering from slow onset processes like soil erosion and sedimentation. Management of community forests to protect watersheds through improved grazing

regimes, fodder plantations, and dissemination of biogas units will reduce impacts on forest resources. With continued population growth and limited opportunities to convert additional lands (e.g., forests) to productive agricultural use, it is imperative for residents of flood-affected areas like Udayapur District to expand and diversify their income in order to lessen their reliance on natural resources and to be able to cope with the vicissitudes of a climate that is shifting. For example, support for fishpond construction and large-scale bamboo and cane plantation could stimulate cottage industry and the creation of non-farm opportunities. Yet, in 2012-13, the Udayapur District office of the Agriculture Ministry was allocated just NRs 200,000 (approximately 1500 Euros or US \$2000) for these kinds of activities, which raises serious questions as to what can be practically expected from relevant government agencies in terms of developing alternative sources of income in rural farming areas.

*District authorities currently lack resources to reduce vulnerability to flooding*

The Government of Nepal has other important roles to play in helping communities vulnerable to climate disasters, e.g., through agricultural extension activities that enhance the adaptive capacity of vulnerable communities and by improving infrastructure so that rural communities are able to reach outlets for inputs such as fertilizers, improved seeds, etc. and markets for their agricultural goods. While very few of the

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<sup>1</sup> Appendix 1 outlines the institutional framework for disaster management and climate change planning.

households interviewed (6.9%) had made changes in agricultural production to prevent the impacts of floods, future adaptations may need to include changes in crop patterns including varieties and species better suited for emerging conditions.

Beyond adapting agricultural production to the realities of climate change, the government has an opportunity to help its citizens leverage the remittance money they earn regionally or abroad. Today, remittance money is typically invested in the construction of houses and properties, often in flood-prone areas. With better information and access to safe investment opportunities, these funds could be used more profitably and sustainably.

*The government should play an active role in promoting adaptation in agriculture and resilience-enhancing uses of migrant remittances*

Community-based disaster management for facilitating climate adaptation has already been initiated by several communities in the study site, including the construction and provision of emergency shelters and rudimentary early warning systems; however, much remains to be done to prepare these communities for flood disasters. Beyond addressing the immediate needs that arise from climate-related emergencies like floods, disaster management must be coordinated with rehabilitation planning and insurance schemes. Likewise, land use policies can help

reduce loss and damage if the District Development Committee is able to control land use and prevent unsustainable resource exploitation such as the unregulated removal of sand, especially in riverine zones prone to flooding.

*Community-based disaster management exists in the study area, but there is much scope for improvement*

In order to facilitate coordinated responses to disasters like these, it is incumbent upon the government as well as international partners to build the capacity of relevant District- and Village Development Committee-level offices. In 2013, the Government of Nepal created a budget for climate-related adaptation. In order to request funds from this budget, however, the DDC must identify programmes and activities that they will implement to mitigate the adverse impacts of climate change *distinct from* ongoing development activities. While the Udayapur District government has initiated community-based disaster management, the capacity of local and regional administrators to anticipate and plan for coordinated short- and long-term responses to flooding is still limited.

## 1. Introduction

### 1.1 project background: the loss and damage framework

There is increasing awareness in academic and policy circles that not all impacts of climate change are or can be addressed by current and future mitigation and adaptation efforts. Vulnerable people in developing countries suffer disproportionately from the adverse impacts of climate change and their capacity to cope with extreme weather events and adapt to slow-onset climatic changes is often limited (Warner et al., 2013). The impact of climate change beyond coping and adaptation has come to be known as Loss and Damage. In 2010, during the 16th Conference of the Parties of the United Nations Framework Convention on Climate Change (UNFCCC), it was recognized that joint international efforts were needed to better understand and address such loss and damage.

*Vulnerable people in developing countries suffer disproportionately from the adverse impacts of climate change*

This case study is part of the Loss and Damage in Vulnerable Countries Initiative, which was initiated by the Government of Bangladesh and is funded by the Climate and Development Knowledge Network. The research is coordinated by the United Nations University's Institute for Environment and Human Security (UNU-EHS). The case studies aim to support Least Developed

Countries (LDC) in climate negotiations by providing scientific insights about real-life experiences of loss and damage in vulnerable regions. Currently, there are still critical knowledge gaps on the impacts of climate extremes and slow-onset processes to which communities in LDC are not (yet) able to cope or adapt.

*Little is known about the impacts of climate change to which vulnerable communities are not (yet) able to adapt*

The case studies took place in diverse countries – Nepal, Bangladesh, Bhutan, Micronesia, Kenya, the Gambia, Ethiopia, Burkina Faso, Mozambique – and examined different manifestations of climate change such as changes in rainfall patterns, droughts, floods, glacial lake outburst flooding, cyclones, sea-level rise, salinity intrusion, and coastal erosion (Warner et al., 2012, 2013). Given their respective environmental matrices and subsistence-oriented economies, these countries were identified as especially vulnerable to loss and damage from climate variability and climate change. Each case study employed the same survey template for household questionnaires, but each focused on different climatic stressors and societal impacts. Research questions were adapted for each case study according to the particular characteristics of local livelihood systems and environments (Warner and van der Geest, 2013).

## *Loss and damage is about what happens when people face constraints and limits to adaptation*

Loss and damage considers the consequence of peoples' inability to adapt to changing climate conditions. This includes the costs (economic and non-economic) and adverse effects associated with the coping and adaptation measures. Loss and damage can result from an inability to respond to climate stressors, insufficient coping and adaptation measures, the costs associated with coping and adaptation strategies, and the adverse long-term effects of adopted measures. These costs and consequences often elude quantification but cause deprivation and can impede sustainable development. The loss and damage framework recognises that the short- and medium-term effects of climate change are locked in, given the emissions we have already accumulated in our atmosphere. Loss and damage accounts for the potential costs of climate change, which will in turn depend on the intensity of future climatic disruptions and global mitigation efforts.

## *Loss and damage often eludes quantification, but causes deprivation and impedes sustainable development*

As loss and damage is a new concept in climate change research, no commonly accepted definition is available yet. However, to inform our research questions and methods, we used the

following working definition: Loss and damage refers to negative effects from climate change and variability that people have not been able to cope with or adapt to (Warner and van der Geest, 2013). Loss and damage includes the *inability to respond to climate stresses* (i.e., the costs of inaction) and the *costs associated with existing coping and adaptive strategies*. The terms 'coping' and 'adaptation' in relation to climate change are often used synonymously. This is problematic because they involve different types of responses to different types of stressors. In the CDKN loss and damage case studies, coping strategies are defined as *short-term responses to the impacts of sudden events*; adaptation is defined as *longer-term responses to more gradual changes* (Warner and van der Geest, 2013). Loss and damage can involve direct costs, but it can also involve longer-term effects on the viability of livelihoods. Such costs can be economic or monetary, but also social and cultural.

## *Though often used synonymously, coping and adaptation are distinct responses to climate stressors and impacts*

Around the globe, funding is being directed towards initiatives to enhance the adaptive capacity of communities facing increasing uncertainties amidst climate change (Ireland and McKinnon 2013; Møller and Nielsen 2013). In response, CDKN is working with countries like Nepal to gain wider recognition of the specific challenges facing vulnerable populations, who are often excluded from, and have limited access to,

the strategic collectives that produce knowledge and policies around climate change initiatives.<sup>2</sup> In partnership with public, private, and non-governmental institutions, CDKN supports local and global decision-makers in designing and delivering development that is compatible with climate change by combining research, advisory services, and knowledge management. CDKN partners are working together to understand and plan for the societal impacts of climate change on food production, livelihood security, health, built and human capital, etc. Generating evidence-based knowledge can assist LDCs in developing a common understanding about Loss and Damage and thereby create a unified platform when they discuss these issues in global climate negotiations.

*Generating evidence-based knowledge can assist LDCs in developing a common understanding about loss and damage*

Efforts to assess loss and damage from climate change have typically focussed on material damage – usually expressed in quantitative terms – and loss of life or displacement resulting from extreme weather events. By contrast, the case studies in the Loss and Damage in Vulnerable Countries Initiative take a people’s perspective on loss and damage, with close attention to local perceptions and real-life experiences. Moreover,

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<sup>2</sup> CDKN is funded by the UK Department for International Development (DfID) through 2015, with additional funding from the Dutch Ministry of Foreign Affairs.

they expand the narrow focus on impacts of extreme events to include impacts of slow-onset climatic changes. This case study takes a people-centred perspective on loss and damage, even while acknowledging that losses and damages are occurring at larger scales (Becken et al., 2013).

*This case study takes a people’s perspective on loss and damage, with close attention to local perceptions and real-life experiences.*

## **1.2 climate change and water-related disasters in nepal**

Although the world’s so-called “least developed countries” (LDC) have contributed little to global warming, they are bearing some of the heaviest impacts of anthropogenic climate change (Adger *et al.*, 2006). Global climate change models anticipate that, among the many effects of climate change, *flooding will intensify* as precipitation regimes change and temperatures rise.<sup>3</sup> A key challenge in evaluating the current and future impacts of climate variability is to downscale global data and to infer from broad scale models what may occur in a handful of villages in eastern

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<sup>3</sup> Mean annual temperatures are projected to increase between 1.3-3.8°C by the 2060s and 1.8-5.8°C by the 2090s, and this warming is expected to occur more rapidly during the dry months (December-May). Winters are projected to be drier and monsoon summers wetter, with some sources estimating a threefold increase in monsoon rainfall.

Nepal (Antle, 1996). While nations throughout the world will have to address the potential intensification of flooding, countries like Nepal view these anticipated changes in the suddenness, frequency, and magnitude of these extreme climate events with particular alarm (IPCC, 2007).

*Least developed countries have contributed little to global warming, but are bearing some of the heaviest impacts*

Nepal's climate is as diverse as the country's topography, which extends from the highest mountains in the world to the rim of the Gangetic plains, almost at sea level. Complex natural conditions make Nepal one of the 20 most disaster-prone countries in the world (NRRRC, 2011). Nepal's varied topography makes it susceptible to climate-related disasters and the country experiences a range of natural hazards, some of which occur yearly (e.g., floods and landslides) whereas others occur less frequently (earthquakes) (UNDP, 2009). Given its vertiginous topography and active geology – together with torrential rain during the monsoon season – Nepal experiences frequent water-related disasters including landslides, debris flows, and floods.

*Nepal is particularly vulnerable to flood impacts because of high exposure and low coping capacity*

Between 1971 and 2007, more than 2,500 floods killed at least 3,000 people, caused more than a billion dollars' worth of damage, and damaged some 150,000 buildings. In the 1990s, one flood alone killed over 1,000 people (UNDP, 2009). Flooding also has significant effects on Nepal's economy: a single flash flood in 1993 knocked out half of the country's electricity production for several months (NCVST, 2009).<sup>4</sup> A general lack of effective response mechanisms for and strategies to deal with natural disasters exacerbates the consequences of floods. Not surprisingly, Maplecroft's Index, which evaluates the vulnerability of human populations to climate-related change over the next 30 years, ranks Nepal 4<sup>th</sup> of 170 countries (CCVI, 2011).<sup>5</sup> According to the Disaster Vulnerability and Risk Assessment Study Report by the UNDP, Nepal ranks 30<sup>th</sup> in terms of water-induced hazards such as floods and landslides, of which Udayapur is no stranger. The World Risk Index ranks it 99 out of 173 countries (6.2%) in terms of overall risk – scoring 'very high' in terms of vulnerability

<sup>4</sup> For more data related to human and economic losses from disasters that have occurred between 1980 and 2010, see the Prevention Web's Nepal-specific disaster information, URL

<http://www.preventionweb.net/english/countries/statistics/index.php?cid=121>

<sup>5</sup> The Climate Change Vulnerability Index (2011) combines the risk of exposure to climate change and related extreme events (drought, cyclones, landslides, flooding and sea-level rise), with the degree of current sensitivity to that exposure and the ability of the country to adjust to, or take advantage of existing or anticipated stresses resulting from climate change.

(61.7%) and 'high' in terms of susceptibility (50.7%), lack of coping capabilities (81.8%) and lack of adaptive capacities (52.5%); the country is ranked twelfth out of 162 in terms of risk of flooding (World Risk Report, 2011). The choice of Nepal, then, as a site to engage with questions of vulnerability, adaptation, and residual loss and damage in relation to flooding is appropriate.

### 1.3 Research objectives and focus

The objectives of this case study are to investigate the effects of flooding in Udayapur District, Nepal, and to examine the range of adaptations that households adopt in relation to this climatic risk. Additionally, this research is concerned with the residual effects of climate variability and change – i.e., the loss and damage – which local communities in the study sites have not been able to avoid. Why do these coping and adaptation mechanisms still result in loss and damage? What happens to a household when its coping strategies are not effective enough to avoid or manage the impacts of extreme climatic events? What are the limits and costs of adaptation, particularly for vulnerable or marginal populations, to climatic change? These are the questions that drive this case study.

*This study looks at the residual effects of floods that households have not been able to avoid with their preventive, coping and adaptation measures*

The extent to which households, communities, and societies incur loss and damage from climate change varies according to their level of vulnerability and resilience. Vulnerable communities are systematically disadvantaged in terms of accessing resources, which exposes them to increased risks during disasters and in the wake of climate-related events. These risks include marginalization, exclusion from decision-making, physical dislocation and psychological trauma, loss of survival resources, and catastrophic harvest failure, among others (Wisner *et al.*, 2003, Swim *et al.*, 2009). Moreover, the communities that are already economically, socially, and politically disadvantaged will likely face the greatest loss and damage resulting from shifting climate patterns.

*The extent to which actors incur loss and damage varies according to their level of vulnerability and resilience*

This is the context into which this case study fits. Specifically, in a set of communities located in lowland eastern Nepal, we investigated the adaptive actions undertaken – proactively or reactively – to manage the impacts of floods as well as the costs of not being able to adapt to these climate stressors. In order to address these concerns, we collected data on: (1) local perceptions of weather variability and climate patterns; (2) flood impacts; (3) household vulnerability to flooding in terms of livelihoods and health; (4) local measures adopted to cope with and adapt to climate stressors; and (5)

residual losses and damage in spite of these coping and adaptation measures.

At the household and community level, we examined both the impacts of and responses to floods when they occurred (i.e., coping) and the things that local households had done to prevent and reduce the impacts of future floods (i.e., preventive strategies). Such proactive measures can also shift to long-term practices (adaptation). This study provides evidence of some of the

barriers and limits that households in this part of eastern lowland Nepal face in their efforts to cope with and adapt to floods, including residual loss and damage. In doing so, it provides a context for discussing the consequences of exceeding the limits of adaptation. In order to understand patterns of loss and damage, we framed our research in terms of four domains, as seen in Box 1-1

### **Box 1-1 Research domains**

- 1) *Climate threats*: The climate threats we focus on are the increased risk of flooding, which causes both long-term, slow onset changes as well as extreme, sudden onset events. This research uses social science methods to study the impacts of these climate threats.
- 2) *Societal impacts*: Given their immediate dependence on the natural environment, rural populations are more likely to experience the impacts of climate variability and change. In this study we focus on the societal impacts of flooding and its concomitant effects, including loss of agricultural land and changes in agricultural productivity.
- 3) *Responses*: We study how people have coped with climate-induced disasters including changes to agricultural regimes, out-migration, and mitigation efforts.
- 4) *Loss & Damage*: Loss and Damage refers to the effects of flooding and changing climate patterns that people have not (yet) been able to avoid. This includes: (i) the inability to cope with flooding; (ii) the inability to adapt to flooding; and (iii) costs associated with existing coping and adaptive strategies.

## **1.4 Methods**

In order to elicit a wide variety of empirical data on the impacts of floods, we used a mixed methods qualitative approach. We adopted a semi-structured survey instrument that had been developed by UNU-EHS for the case studies of the Loss and Damage in Vulnerable Countries Initiative (c.f. Warner and van der Geest, 2013).

The survey instrument was designed to elicit information about demographics, educational attainment, agricultural production, and livelihood strategies. A series of questions asks about the specific effects of flooding in terms of loss and damage as well as the coping and adaptation measures that households have adopted.

The first section of the survey records socioeconomic and demographic data and tracks sources of food and income. The next sections of the questionnaire deal with vulnerability, the ways that households cope with and adapt to floods, and the residual loss and damage associated with this climate stressor (see Appendix 2 for full questionnaire). For the Nepal study, questions were adapted as necessary to fit the cultural context (e.g., ethnicity designations) and specific climate related risk (i.e., flooding). On average, interviews lasted between 40 minutes and one hour.

### *The survey questions addressed not only material and economic losses but also social and cultural impacts*

It is important to note that our questions about loss and damage did not address these effects only in material or economic terms. There were numerous opportunities for respondents to describe non-economic impacts, particularly in the open-ended questions of the survey. Indeed, loss and damage may also be experienced in other registers, for instance, in psychological stress, social dislocation, conflict or loss of social cohesion and identity (c.f., Monnereau and Abraham, 2013; Brida *et al.*, 2013; Kusters and Wangdi, 2013; Traore and Owiyo, 2013).

To capture changes in risk-management strategies, the questionnaire distinguishes between measures that were always part of livelihood systems (e.g., preventive strategies such

as risk spreading in agriculture) and measures that were adopted in response to changing conditions (i.e., adaptation). While some of the measures that people in the study area adopted – such as construction of physical barriers to keep floodwater out of farms – are very clearly a response to climate-related stressors, other measures may be partly in response to non-climatic changes. Such adaptation measures, in the words of Moser and Ekstrom (2010: 22026), “aim to meet more than climate change goals alone.”

Aware of the need to look for the multivalent aspects of coping with and adapting to flooding, we complemented our quantitative sampling with qualitative techniques, especially focus groups and key informant interviews (see Appendix 3 and 4). After spending several days completing questionnaires in each village of our study site, we understood a bit about the local history of flooding and could also identify key informants. We interviewed them at length to gather stories about flooding; these open-ended interviews helped us understand the subtle and often non-monetary effects of flooding.

### *Focus groups and open interviews were conducted to complement the questionnaire data*

In addition to interviews, we conducted a series of focus group discussions to gather information on the complex dynamics between climate variability and vulnerability. These focus group discussions enriched the quantitative data we had collected

through surveys. In particular, talking with groups helped us understand flooding impacts and responses at the community level. The focus group discussions also allowed us to explore *differences* in the experiences of men and women, young and old, castes and different occupational groups (e.g. crop cultivators, labourers, traders) as well as between wealth groups.

Our research team was assembled under the auspices of Integrated Development Society Nepal (IDS-Nepal), a Nepali NGO. Prior to field mobilisation, two days of training were held for enumerators during which the household questionnaire was translated, wording was clarified, and question prompts were tweaked. Two of the five enumerators were women, a significant factor in our ability to gain access to households and to interview women in the field. Fieldwork was conducted in Jogidaha and Hadiya Village Development Committees (VDC) during December 2012 and January 2013. The research team completed 300 household surveys as well as 8 focus group discussions, 9 key informant interviews (see Appendix 3 and 4), and extensive participant observation. Three-quarters of our respondents were male heads of household.

Each day, our team set out by jeep from the headquarters of Udayapur District, Gaighat, to one of the two VDCs in our study site. In order to randomize our sampling once we arrived in a village or hamlet, we counted every fifth house and then looked for that household's head to interview. If no one was available or willing to

complete an interview in a randomly selected household, we sought out the immediate neighbour to this house. The sample population were not chosen on the basis of whether or not they had experienced floods. Likewise, we selected households randomly regardless of their caste/ethnicity, gender, apparent economic status, or the proximity of their farmlands or residence to flood-prone areas.

*300 households were selected randomly, regardless of caste, gender, economic status or proximity to flood-prone areas*

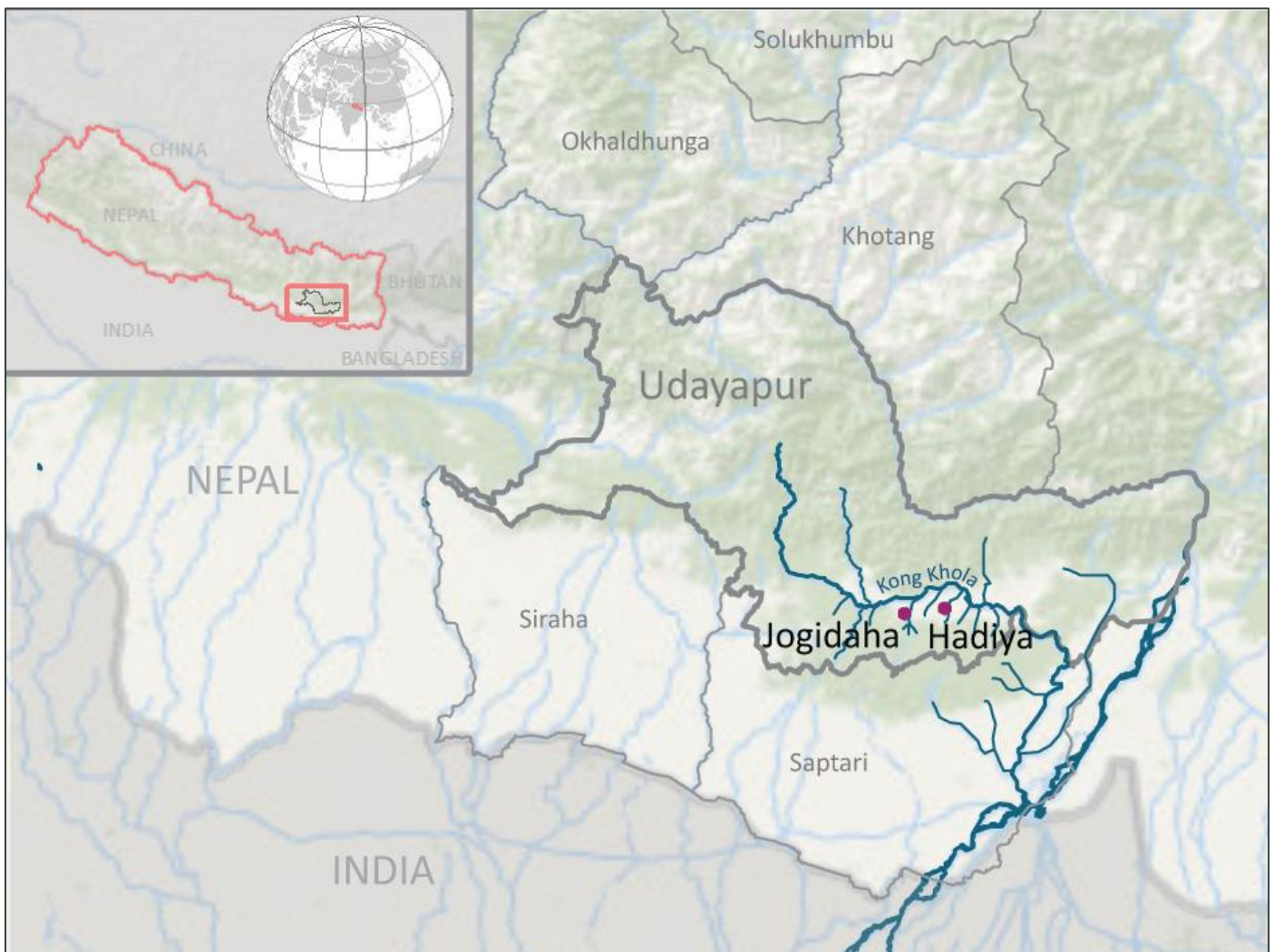
By contrast, in-depth interviews were not randomly selected and were solicited based on snowball sampling and the targeting of key stakeholders involved at the community- and government-level in disaster management, namely village representatives, extension workers, sub-district representatives, and government officials. At times we re-visited respondents who had been interviewed as part of the household survey, for complementary in-depth interviews. We also organised two focus group discussions with only women, focusing explicitly on gender roles in the household economy and the differences between men and women in vulnerability to climate-induced changes. In addition to collecting household-level data, we gathered village- and district-level information from government offices.

## 2. The study site: Udayapur District

The study site, Udayapur District [Figure 2-1], was chosen in consultation with the UNDP and other stakeholders in Nepal, who pinpointed this region as being less developed than other parts of the country and potentially more vulnerable to the adverse effects of climate change. The Government of Nepal has targeted the Inner Terai, the region where Udayapur District lies, in its disaster relief and emergency preparedness planning due to recent and sustained damages from catastrophic floods.

Udayapur was selected as a study site based on a number of criteria. The season during which research was conducted (December-January) precluded fieldwork in Nepal's high mountain and mid-hills regions due to the practical limitations of organizing the logistics for a large research team operating in a rural area. IDS-Nepal had also worked in the study area before, which facilitated access to the community, NGO representatives, and government officers.

**Figure 2.1 Map of study site**



Map by Dara Mendeloff, The Earth Institute, Columbia University.

## 2.1 Watersheds in udayapur

The main rivers in the study site, Kong Khola and Hadiya Khola, originate from the southern Siwalik range, also known as the Churia Hills, which lie 300-1500 meters above sea level and are composed of steeply sloped and weak, consolidated bedrock. The rivers of Hadiya and Jogidaha VDCs flow into Triyuga River basin, which eventually crosses out of Nepal and feeds into the Ganges on the plains of nearby India. These rivers are characterised by high rates of sedimentation during the monsoon and little or no discharge during dry periods. Nevertheless, they are an extremely important water source where snow-fed rivers are not available. Highly localized, prolonged rainfall can generate water volumes in excess of local drainage capacity. Between June and September, flash floods cause extensive damage even in years when overall precipitation is relatively low.

Anthropogenic factors exacerbate seasonal flooding. Man-made obstructions such as roads, bridge piers, floating debris, weirs, barrages, and embankments restrict the flow of water, make rivers shallower, and accelerate sedimentation. We were told repeatedly by older interviewees in Udayapur that local rivers used to run in narrow channels clear and deep; today, these erstwhile rivers are shallow, trickling through sand-filled wastelands with banks that are hundreds of meters wide in places. In addition to the hydrological changes triggered by downstream development (i.e., Chandra Nahar irrigation scheme), upstream land conversion and deforestation have increased sediment loads

flowing into these watersheds. These erosive flows undermine the integrity of riverbanks and increase the likelihood of flash floods during monsoon. Moreover, illegal mining for sand and stone is exacerbating flooding by altering river channels and undermining stream banks.

Seasonal flooding in Udayapur District can damage crops, destroy paddy walls, and sometimes sweep away fields altogether. In some cases these impacts are immediate, such as inflation in food prices and grain shortages in the aftermath of a flood. For instance, according to local officials, a severe flood in 1989 destroyed 25 houses and almost 70,000 m<sup>2</sup> of fields just in our study site (Hariya and Jogidaha VDC). Floods also wreak havoc in the longer term through sand inundation, which reduces soil fertility and organic matter content, exacerbating food insecurity. Cultivating land with declining returns makes households more susceptible and less able to accumulate food reserves for the coming year.

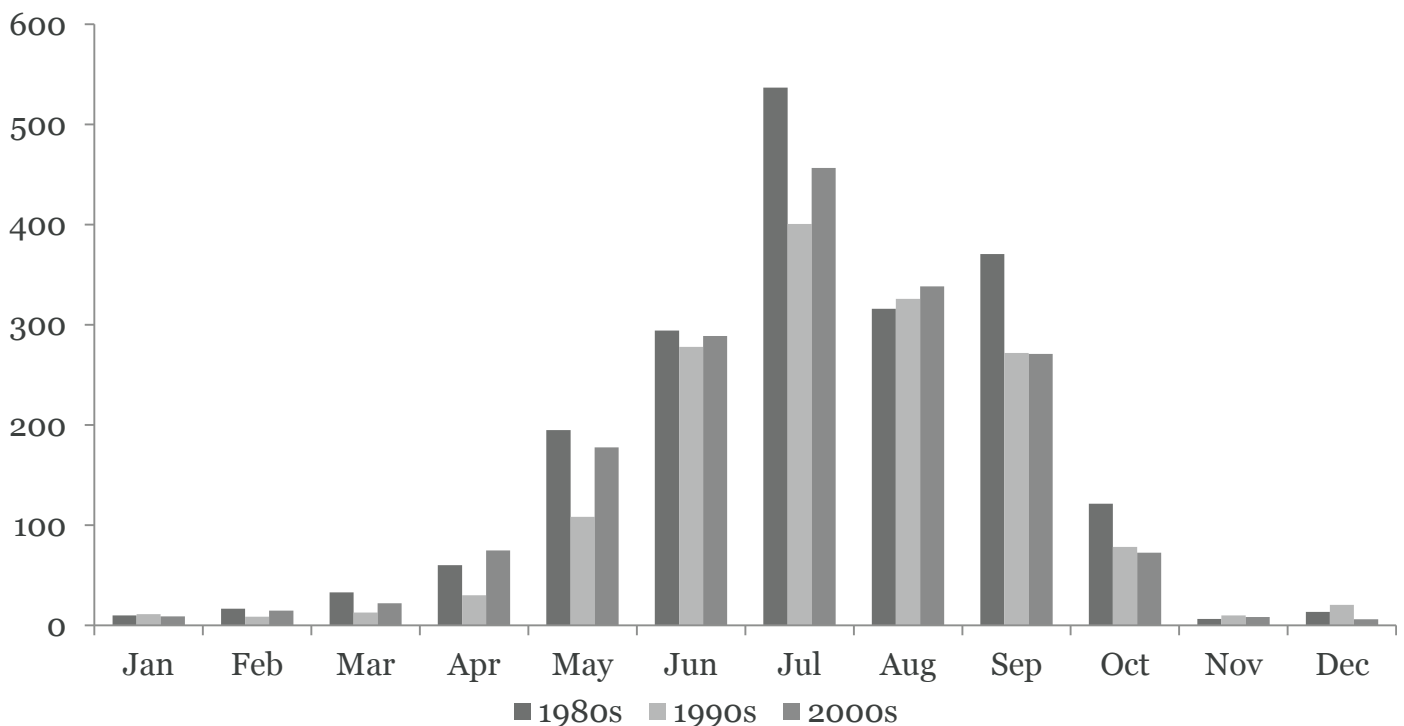
Nevertheless, extremity of flooding was not one of the criteria in our selection of Udayapur as a study site. Of Nepal's 75 districts, Udayapur is *not* the most vulnerable to flooding, according to government reports and planning documents. Overall, the vulnerability of Udayapur district to natural disasters was ranked by Nepal's Ministry of Environment (2010) as, "very high" (0.78-1.0), particularly with respect to landslides. However, the district scored "very low" on the NAPA Flood Vulnerability Index. Even so, local informants unequivocally indicated that floods occur

frequently and have adverse impacts on their lives and livelihoods, despite the preventive and coping measures they have adopted. There is an inherent fallacy to categorizing geographic regions – in this case, all of Udayapur District, which again borders seven other districts – according to one type of hazard label. In reality, localities have diverse physiography and ecologies that create multiple and linked hazards, which in turn are shaped by historical and contemporary land use regimes. A local convergence of conditions that make an area prone to flooding cannot be reflected in a national-level database.

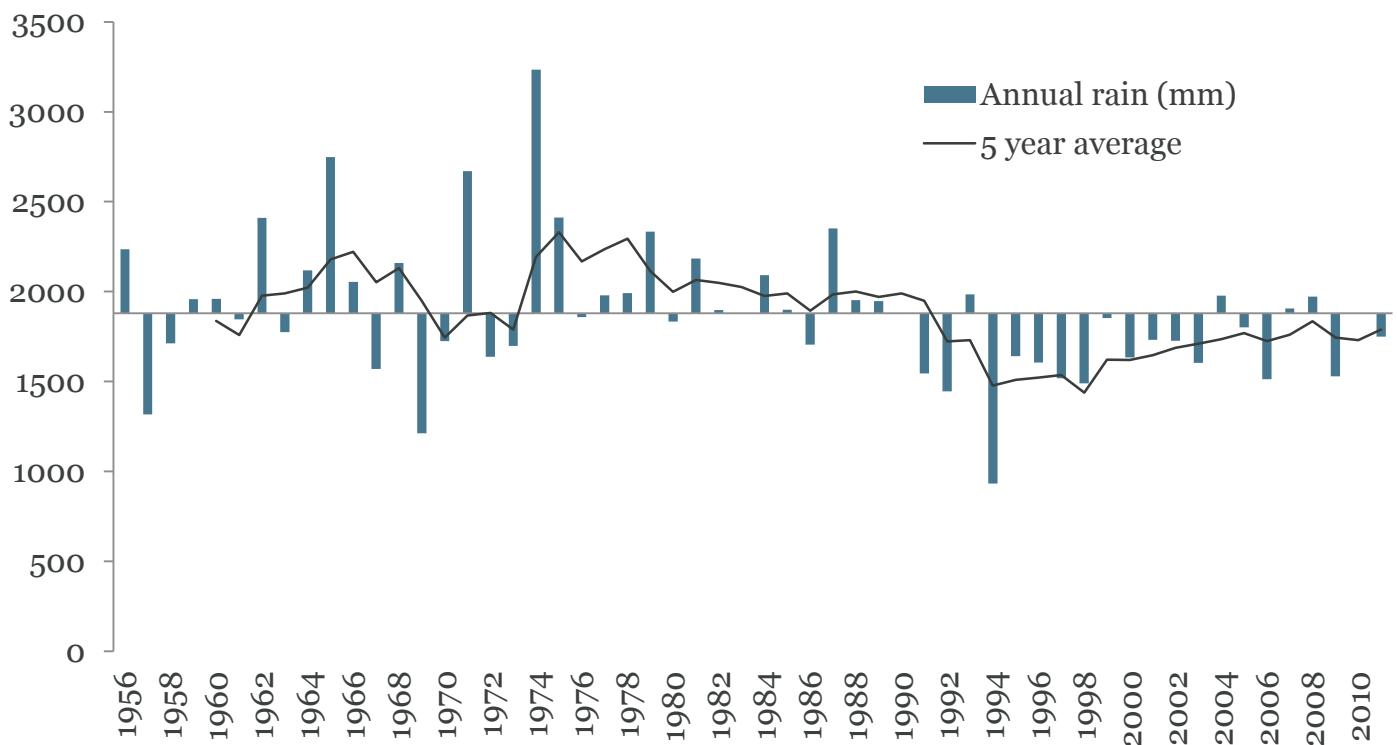
## 2.2 Climate patterns in Udayapur District

Since flooding is the focus of this study, the immediately relevant climate indicator for which we have data is rainfall. Data availability is limited for Udayapur District, like much of Nepal: there is only one meteorological station in the whole district. From this single source, we compiled data on inter-annual and intra-annual variability (Figure 2-2 and 2-3). Average annual rainfall is 1900 mm in Nepal. However, these statistics vary by region and altitude. Rainfall in Nepal is driven by the monsoons, which migrate through a majority of the country between June and September; winters are largely dry.

**Figure 2.2 Trends in precipitation, 1980s-2000s**



Source: Analysis of rainfall data by Kees van der Geest (UNU-EHS).  
Based on data from the Meteorology Division, Government of Nepal

**Figure 2.3 Annual rain, udayapur district (1956-2010)**

Source: Analysis of rainfall data by Kees van der Geest (UNU-EHS). Based on data from the meteorological station at Gaighat, Udayapur District, Meteorology Division, Government of Nepal

The period covered by our survey appears to have had *below average* totals in terms of annual precipitation according to the District's meteorological records, as seen in Figure 2-3.

In accordance with these records, a majority (61%) of households reported that the frequency of floods has decreased in the past 20 years. On the other hand, nearly everyone (96%) reported having experienced flood events and two-thirds asserted that floods have become more severe. These findings underscore the importance of the differences between *frequency* and *severity* in considering the kinds of impacts that climate risks can have.

## 2.3 Demographics and livelihoods

According to the Nepal National Census of 2011, Udayapur District has a population of almost 320,000 inhabitants, while the VDCs encompassing our study sites number nearly 17,000 residents [Table 2-1].

**Table 2.1 Population of Study Communities**

	1981	1991	2001	2011
<b>Udayapur District</b>	159,805	221,256	287,689	317,532
<b>Hadiya VDC</b>	n/a	8,564	9,120	10,546
<b>Jogidaha VDC</b>	n/a	4,698	5,164	5,876

Source: GoN, 2012b

Our household questionnaire elicited the self-identified ethnicity of respondents by asking questions about mother tongue, religion, and ethnic group<sup>6</sup> (as per labels used in Nepal's 2010 National Census). The communities in which we worked are quite diverse in terms of their ethnic composition as seen in Table 2-2.

**Table 2-2 Ethnicity of respondents**

Ethnic groups	N	%
<b>Chaudhari (Tharu)</b>	111	37
<b>Chhetri</b>	80	26.7
<b>Rai, Tamang, Magar</b>	46	15.3
<b>Dalit (Pariyar, Biswakarma, Sada)</b>	34	11.3
<b>Brahmin</b>	21	7
<b>Muslim</b>	4	1.3
<b>Thakur</b>	2	0.7
<b>Malla</b>	1	0.3
<b>Rajput</b>	1	0.3
<b>Total</b>	300	100.0

The demographics of the Inner Terai has been profoundly influenced by the large-scale migrations of hill groups (e.g., Rai, Tamang, Magar) that began after 1960, when DDT was

<sup>6</sup> As it is, 'ethnicity' in Nepal is a complex and very much still evolving concept that encompasses Sanskritic norms of caste, diverse religious modalities from animism to Buddhism and Hinduism (along with syncretic blends of these belief systems), place- and clan-based identities, and laws which have differentiated and defined the peoples of this diverse nation. The *Muluki Ain*, promulgated in 1854, officially ranked the peoples of Nepal along caste and ethnic lines.

broadly applied to eliminate mosquitoes carrying malaria. In the span of a few generations, hundreds of thousands of migrants settled in lowland districts like Udayapur (Kansakar 1974, 1985; Subedi 1991). Across the southern girth of Nepal, what were once impenetrable malaria-infested forests, to which only the indigenous Tharu groups had adapted, were cleared for agriculture and new settlements. One elder Tharu man put it like this, "Before, when we were the only ones who lived here because we could resist malaria. But when they cleared the mosquitoes, we could not resist the migrants swarming in from all over the country!"

The expansion of road networks opened the fertile riverine floodplains and Sal forests of Udayapur to conversion by immigrants. A few giant Sal trees still stand as reminders of the once towering forest that stood there. Not surprisingly, there are tensions among ethnic groups as a consequence of these 20<sup>th</sup> century migrations, particularly in relation to land use change and the distribution of natural resources. There is palpable sense of competition for resources between the new settlers and the old. Traditional common property regimes were overrun by the rapid fragmentation of land and deforestation, resulting in open access grazing and unregulated conversion of land, particularly in floodplains and streambank areas.

Coping with climate-related risks sometimes requires collective action to effectively mobilise communal labour and to leverage support from outside organisations. Organizing collective efforts

to respond to flooding may be challenging in communities that are as ethnically diverse and socially stratified as our study site. If there is a lack of solidarity within the community – and the diversity of ethnicities in our study site suggests this might be the case – the potential for communal and reciprocal labour arrangements is highly attenuated. As a baseline, then, this research recognizes that the adaptation measures that households adopt in response to the actual and expected impacts of climate variability are situated within the context of broader social changes and demographic shifts, which themselves have complex interactions with, and implications for, land use and livelihoods.

#### **2.4 Household characteristics: Education, livelihoods, and assets**

Most of the households in our study sites comprised extended nuclear families, typically with three generations living under one roof; only 12 of the 298 families we interviewed did not own a house. The mean age of respondents of our mostly male (75%) respondents was 50.6 years; nearly everyone was married (87%) or widowed (9%).

The heads of household whom we interviewed in Jogidaha and Hadiya Village Development Committees self-reported a low level of educational attainment, with more than two-thirds (69%) having never gone to school or having only basic literacy; only one out five (21%) had a secondary education. The Nepal Census of 2010 reported that overall literacy (among the district population 5 years and older) was 70%; male

literacy rate was 75% compared to female literacy rate of 58% (GoN, 2012a: 4). Literacy levels for women in this population can be presumed to be even lower since our figures report only the levels of literacy and education attained by the household heads, which in three-quarters of our sample were men. In Nepal, girls have less access to formal education: only 29.3% of women have at least secondary education compared to 53.5% of men (UNDP, 2009). Nationally, literacy rates show marked gender differences: 81% for men and 54.5% for women (*ibid*).

Most of Nepal's citizens live in rural areas and small-scale, subsistence agriculture is the mainstay of the economy, employing 78% of the country's workforce (World Bank 2010). Yet, Seddon et al. (2002) note that agriculture-based livelihoods are changing in Nepal. Planting and harvesting seasons are shifting in Nepal, and these shifts are likely to become more erratic under a changing climate. As a result, crop yields of major cereals in Nepal are projected to fluctuate significantly. Since agriculture provides sustenance to Nepal's predominantly rural population and 62% of the agricultural land is rain fed, climate change is projected to have significant impacts on farming households. Reduced water availability during dry periods will further increase irrigation needs.

Relatively low per capita income and low levels of infrastructure development characterise Udayapur District's rural population. The agriculture sector constitutes the centre of economic activity in Hadiya and Jogidaha VDCs: nearly 9 in 10 households (0.86) described their primary

occupation as “farming.” The 2011 National Census showed that more than a quarter (0.27) of households in Udayapur District have at least one absentee member, indicating widespread outmigration even in farming families.

Almost everyone (0.91) in these VDCs owns some agricultural land. Still, almost ten percent of the population we sampled does *not* own land. These landless families (Nepali, *sukumbasi*) typically live in the most marginal, flood-prone communal lands, upon which they squat and over which they have no rights; these families may equally be displaced overnight by a natural disaster, a change in policy, or an infrastructural development project. Land typically has mixed uses and may be divided into different lots or sections depending on the configuration of fields, house sites, fruit trees, animal shelters, wood and hay storage, etc. Four-fifths (0.83) of the households we interviewed cultivate all or some of their crops on their own land. Those without adequate land holdings access additional fields either through farming on community land (0.16), sharecropping (0.12), or renting land (0.03). Overall, very little private land (0.01) is left fallow or used for purposes other than farming (0.07).

There is a relatively low intensification in agricultural production based on levels of irrigation and mechanization. Less than half (0.42) of households in the study irrigate their land and only a third (0.35) of land is irrigated overall. Means of cultivation are still mostly rudimentary: three-quarters of households (0.75) use animal for ploughing, with just 12% owning tractors and the

remainder forced to rent others’ plough animals or mechanised traction. The data we collected indicate a generalised lack of capital assets in the communities we studied. Limited assets curtail the range of livelihood options available to a household preparing for, or dealing with, the effects of climate-related risks as well as the resources available for reconstruction following disasters.

In our study site, basic utilities such as electricity are widely in use, if only to light bulbs and to power basic appliances; only 6% of the sampled households had no electricity. For the vast majority of households (0.88), the source of household drinking water is a simple hand pump, with ten percent of families using wells. Among other assets, the most common possessions in households were a mobile phone (0.88), bicycle (0.61), and television (0.57); fewer households had a motorcycle (.06), car (.01), refrigerator (.02), or computer (.02), suggesting a relatively low level of disposable income to intensify production or increase consumption.

Fewer than half of the households surveyed (0.44) had built a toilet. The notable absence of sanitation infrastructure is, in part, explained by a cultural preference especially among the Tharu to keep polluting influences separate and distant from the home; some respondents also claimed that with frequent flooding, latrines were often destroyed, negating their usefulness.

Almost every family (0.92) owns some kind of productive domestic animal. Livestock are

important to households as liquid capital and insurance in times of crises, brides' wealth, and as powerful symbols of wealth and property (Nellemann *et al.*, 2011). Table 2-3 summarizes animal holding patterns in the study site, based on animal type and frequency of household ownership.

**Table 2-3 Animal Ownership in Study Communities**

Animal Type	% Households
Goats & sheep	71
Cattle	64
Fowl	64
Oxen	58
Pigs	20

For households in this part of Nepal, goats are an essential source of protein along with domesticated pigeons, the most common fowl kept. Such animals also serve critical ritual functions in these farming communities, particularly around important festivals like Dasain, when animals are ritually sacrificed in honour of the goddess Kali. Three-quarters of the families (0.76) we interviewed own an animal shed, which indicates the value of animals in the domestic production cycle. As it is, these sheds also commonly double as hay and wood stockpiling areas as well as equipment storage areas.

With respect to flooding, domestic animals seem to have good survival rates as only a small number of households reported "moderate" (4%) or "severe" (2%) effects on livestock from flood events; most reported "no negative" effects on

their livestock. As climate conditions continue to change, we may anticipate shifts in local herd structures. Smaller animals such as goats and sheep – "the poor man's cattle" – may be more adaptive to climate change: they reproduce more quickly, are easily sold, and tolerate a different range of environmental conditions. Livestock overgrazing and out-of-season grazing, especially in streambeds, has interactions with watershed management and, by extension, flooding. Local grazing rules differ in the study site: Hadiya VDC does not allow community members to graze animals along riverbeds while this is permitted in Jogidaha VDC.

## 2.5 Food security and flooding

Weather directly affects food security via crop production and indirectly through associated landscape-level processes like soil formation and erosion, plant succession, etc. It is worth considering whether changes in precipitation regimes and flood cycles are prompting farmers in Udayapur to shift planting choices and other agricultural practices. When asked whether they had, "made any changes in agricultural production to prevent impacts of flood in the future," the overwhelming majority of households (0.93) answered 'No.' Specifically, neither the data nor our conversations with householders indicate any shift away from rice as the major crop grown. The most important crop according to locals remains paddy, with maize, mustard, and vegetables mentioned among other crops grown in addition to all-important rice. In contrast to reportage from the Kathmandu Valley (Shaikh and Tunio, 2013), there is no indication that cropping

practices in Udayapur are changing in any discernible or significant way, for example, a switch to cultivation of vegetables or other marketable crops.

The local agricultural regime is clearly not producing surpluses, as indicated by the minimal amount of crop production sold by households in our study sites [Table 2.4].

**Table 2.4 Amount of crop production sold by local families**

Amount Sold	%	# Households
Everything	0.7	2
Almost everything	0.4	1
More than half	1.8	5
Approximately half	1.5	4
Less than half	5.5	15
Hardly anything	8.1	22
Nothing	82.0	222
<b>Total</b>	<b>100</b>	<b>271</b>

Cross tabulation of our data showed that, of those who identified as having “less income”, almost all of them (0.96) sell none of their crop production. By contrast, almost a quarter (0.24) of those who report having “more income” sell half or more of their crop production. Still, more than half of all families (0.59) sell “nothing” from their crop production. According to locals, a lack of viable markets is made even more difficult by unreliable access to those markets, in part due to seasonal flooding.

Householders and key informants alike consistently cited the progressive siltation from

the Chandra Nahar irrigation scheme (downstream in neighbouring Saptari District) as the most important factor contributing to breaches of riverbanks and subsequent inundation of fields and homes. When rivers to breach their banks and inundate fields during the monsoon season, endemic issues of food security facing these farmers are further aggravated. Floods cause long-term damage through topsoil erosion, which reduces soil fertility and organic matter content. In turn, declining returns from land makes households less able to accumulate food reserves for the lean times when families are vulnerable to climate-related risks.<sup>7</sup> Agricultural productivity is perceived by most locals to be in decline. Four in five households reported that crop production has decreased, either by “a lot” (0.48) or “a little” (0.33). Eventually, adaptation to climate change may eventually entail switching to crop varieties better suited to projected conditions; for the present, farmers are retaining their traditional practices.

Agricultural fields in the study site are situated along the alluvial plain of Udayapur’s seasonal rivers. When they occur, floods inundate fields, deposit sand, damage paddy walls, and sometimes sweep fields away entirely. Sometimes the costs are temporary, such as inflation in food prices and grain shortages. Other times, the impacts are more lasting. In 1989, for example, a severe flood in Udayapur destroyed 25 houses

<sup>7</sup> Some estimates suggest a loss of 1.7 mm of productive soil annually in Nepal, reducing already scarce productive agricultural land (Practical Action Nepal 2009).

and almost 70,000 m<sup>2</sup> of fields. Almost half (0.47) of the interviewees reported that the effects of flooding in the past ten years on their crops have been severe with fifteen percent also reporting “moderate” effects. In turn, almost half (0.45) of respondents noted moderate and severe effects on food prices as a result of floods and more than half (0.55) reported experiencing food shortages in the past ten years as a result of flooding-related disasters. These results indicate that few households in these VDCs are able to produce surpluses, leaving families vulnerable to consequential, if not catastrophic, risks in the event of flooding.

As we have seen, there are clearly shortfalls in this agriculture regime. Crop production is supplemented by fruit trees, the harvesting of NTFPs, and fishing. Fruit trees, especially papayas and mangos, are an important nutritional supplement. Almost three-quarters (0.74) of households own fruit trees, though only 11 families reported that they had stands with enough trees (>50) to market fruit for sale. Flooding appears not have substantial impacts on fruit trees, with more four out of five households (0.82) reporting “no effects.” Another crop about which we did not ask directly is *Cannabis sativa*, the cultivation of which is common in our study sites, especially among Tharu and low caste families, who typically have one to several plants growing within their compounds. While it is illegal to cultivate cannabis for sale in Nepal, several informants discreetly told us that cannabis sells for NRs. 3000 per kilogram to middlemen who distribute the product in the District headquarters,

Gaighat, and urban centres like Kathmandu. In the interest of protecting our interlocutors, we did not collect systematic data on this source of income, but given its ubiquity, this crop is surely an important part of the local economic strategies.

With respect to fishing, the overwhelming sense we got during interviews was that this livelihood has been on the decline in recent generations. Few (0.11) households choose to fish as part of their livelihood strategy, which suggests that the opportunity costs do not justify allocating time and labour to this mode of production. Where fishing is a viable source of food or for sale, one would expect to see equipment – nets, traps, rope – in active use. Instead, during our house visits in Jogidaha and Hadiya, we noted how seldom such tools of such trade were in evidence. There are two immediately plausible explanations for this set of observations.

Across the Terai, Tharu have declined as a proportion of the population since the post-1950s migrations, which saw a wide swathe of Nepal’s ethnic groups – most of whom did not practice fishing – move *en masse* to newly opened lands, which they converted to agriculture. Still, Tharu comprise more than a third (0.37) of the population in our study site and live adjacent to the Kong Khola and its tributaries, so fishing would seem to be possible. Another explanation to consider is that of environmental change in the Kong Khola watershed – particularly the siltation that has accumulated upstream of the Chandra Nahar irrigation scheme for the past seventy years. Shifting riverbanks, changing channel

depths, obstructions, and other habitat changes resulting from siltation have plausibly led to declines in fish populations in this watershed.



Picture 1: Focus Group Discussion in Jogidaha VDC. Photo: Kenneth Bauer

### 3. Prevention and coping measures for flooding

In the questionnaire, we asked respondents to focus on a particular flood event – typically the most severe or the most recent – and to answer a series of questions on impacts, adaptations, and residual loss and damage for that event. The flood years people chose to focus on were diverse, with 1995-1996 and 2008-2011 mentioned most frequently.

#### 3.1 Prevention measures

Respondents were asked whether they had adopted any preventive measures to reduce impacts *before* the specific flood to which their answers referred [Table 3-1]. Without probing for specific preventive measures, about a third (35%) of our respondents indicated that their households had undertaken some kind of action to prevent the recurrent impacts of floods. Most commonly, they had constructed embankment structures or had planted bamboo fences and trees along stream banks. Many also mentioned contributing labour or other resources to community-scale flood-control measures.

In addition to the group of respondents who indicated that they had adopted preventive measures before the flood year they focused on, another 35% adopted such measures afterwards in anticipation of new flood events.

It is worth considering whether changes in precipitation regimes and flood cycles are

prompting farmers in Udayapur to shift their planting choices or other agricultural practices. There is little indication of a shift away from rice as the major crop grown here in contrast to reportage from the Kathmandu Valley (Shaikh and Tunio, 2013). When asked whether they had, “Made any changes in agricultural production to prevent impacts of flood in the future,” the overwhelming majority of households (93%) answered ‘No.’ Eventually, adaptation to climate change may entail switching to crop varieties better suited to projected conditions; for the present, it seems, farmers in Udayapur are retaining their traditional practices.

**Table 3-1: Measures adopted by households to prevent flood impacts**

Measure	Number of HHs	% of all HHs (n=293*)
<b>Physical barriers</b>	165	56.3
<b>None</b>	84	28.7
<b>Changes to house</b>	74	25.3
<b>Shift to non-farm income</b>	59	20.1
<b>Migration</b>	45	15.4
<b>Agricultural change</b>	20	6.8

\* 7 respondents did not answer the questions about preventive measures

In our study sites, households adopt a variety of preventive measures to adapt to flooding. Farming families invest substantial time and

resources into maintaining community flood control works including planting trees, construction of gabion walls and bamboo weirs, and embankment maintenance as well as volunteer labour (e.g., hauling rocks and materials) for larger-scale engineering projects funded by the government and INGOs. Communities use traditional bioengineering methods and materials (e.g., bamboo fences and sand dykes) to diminish the worst effects of flooding. District- and village-level government offices have funded the construction of stone and cement retainer walls to stabilize soils in flood-prone areas. However, these infrastructural and engineering works are very limited and government efforts remain inconsistent and underfunded.

We inquired about specific preventive measures, including changes to houses, construction of physical barriers, agricultural changes, livelihood diversification and migration. These measures largely involve adaptations that aim to reduce vulnerability to flooding. More than two thirds (71.3%) of study households indicated that they had adopted at least one such measure. One in four (25.3%) of those who took preventive measures had made changes to their houses like relocating to safer locations and using alternative building materials. Likewise, more than half (56.3%) had built physical barriers around their homes and fields in order to reduce damage.

Out of 293 households that experienced flood events, only 49 families (16.7%) have not adopted any preventive measures – no direct, proactive

actions – to reduce their vulnerability to floods. For some, flood prevention works are not a priority because of their poverty. These desperately poor families simply have other, more immediate contingencies to address like working for wage labour and finding a meal. Another subset takes little action because their properties are outside of flooding zones or they are not dependent on agricultural production for their subsistence or income. Yet another factor associated with those not taking preventive actions is lack of available household labour. Outmigration has produced shortages of young men, who would traditionally contribute labour to community projects. Communal initiatives to control floods have been neglected because of other demands on households' productive labour.

### 3.2 Coping measures

Households employ a number of strategies to cope with flooding impacts. Among other strategies, they may: look for alternative sources of food; sell livestock or other household assets to buy food; earn non-farm income; call upon social networks, rely on external assistance; or some combination of these. About two thirds (67%) of households interviewed had adopted at least one such coping strategy.

A common way to cope with climate-related risks (or the spectre of catastrophic risk) is to migrate outside for labour in search of wages to compensate for actual or potential shortfalls (e.g., loss of agricultural fields or declines in productivity) in household income (Banerjee *et al.*, 2011). Nearly one in five households (17%) said

they had responded to floods by sending household members outside to earn extra income engaging in crafts like carpentry and construction, basket making, tailoring, and petty trade.

These employment-seeking patterns can be seen both as a form of *adaptation* and a *coping* mechanism. There is adaptation in the search for outside sources of income to spread the long-term risks associated with increasingly intense or frequent floods. But wage labour is also a coping mechanism, triggered in aftermath of a given flood, when family members must seek off-farm income to offset immediate losses and earn cash to rebuild their lives. Migration is an important economic strategy for households in our sample. But the links between labouring off-farm and coping with and adapting to flooding risks are not always clear. Some families use labour migration specifically to prevent risks from future floods. But flooding is typically one of a suite of reasons for migrating. Among other factors, land fragmentation, growing population, declining returns from agricultural land, and diminishing per capita land holdings precipitate outside migration for labour from this part of Nepal.

More than half of the households (0.58) we interviewed had members who earn non-farm income, primarily through blue-collar labour and secondarily through petty trade and white-collar occupations like teaching or government administration. Those who tried to earn extra income to deal with floods (0.31) did so either by intensifying existing (0.33) activities or engaging in new one (0.70). Wage labour activities included

carpentry and construction, craft making (e.g., bamboo baskets), tailoring, petty trade provided local off-farm income. In addition to long-distance migration to destinations like Malaysia and Saudi Arabia, one-third (31%) of our study population looks for extra income locally in order to cope with shortfalls in food and household income; this is attributable, in part, to the loss of agricultural land and sunk labour costs required to cope with the impacts of floods [Table 3-2].

**Table 3-2 Coping measures adopted by households**

Coping measure	Adopting HHs	% of all HHs (300)	% of adopting HHs (201)
Help from organizations	124	41.3	61.7
Help from others	91	30.3	45.3
Extra income	91	30.3	45.3
Sale of properties	66	22.0	32.8
Migration	50	16.7	24.9

Based on our data, there is an active local market for farm labour, likely attributable to the large numbers of productive labourers who have migrated for income opportunities regionally and abroad. More than half (0.55) of the households in our study sites employ individuals outside of their families to work in their fields. Conversely, half of households (0.50) we interviewed reported that at least one member works on others' farms. Our data indicate that families invest considerable time labouring in the fields of others: the average and median number of days worked by individuals in these households (n=136) was 92 and 30, respectively. Those households (n=121)

that reported wages from members employed as farm labourers earned a median annual income of NRs. 9000; by contrast, many of our interviewees reported that monthly incomes from household members working abroad are typically NRs. 9-12,000. However, accessing foreign employment relies on enough start-up capital in order to secure through middlemen the requisite visas, work permits, and job opportunities – an increasingly expensive proposal for families across Nepal. In fact, our data indirectly point to wealth disparities as a key predictor of participation in the local labour market. Only a quarter (0.28) of those reporting “more income” do work on other people’s farms while two-thirds (0.66) with “less income” labour in others’ fields.

These suggest several ‘push’ and ‘pull’ factors that may explain the prominent patterns of labour out-migration seen in the study sites. The supply of available agricultural labour can plausibly be explained by declining agricultural yields, population growth (and concomitant declines in per capita land), and insufficient land holdings for a substantial portion of this population. The gaps in agricultural production show up clearly in our data on food security. Almost half (0.47) of the study population stated that they experience months in which they “eat less” while more than half (0.58) of households in our study site purchase at least half or more of the food they consume; regardless of income or amount of land owned, four out of five households (0.80) in this population buy at least some of the food they consume. Nepal is now a net importer of food, so it is imperative that a productive and sustainable

agricultural system is maintained to provide food security for a growing population.

Remittance is central to Nepal’s contemporary economy (Seddon *et al.*, 2002). While Nepalese have long migrated outside of the nation’s borders to earn money, the Maoist civil war (1996-2006) accelerated and intensified out-migration – by 2010, an estimated 4 million Nepalese were working in foreign countries according to Nepal’s national census. Communities in our study site are no exception to these trends. The agrarian landscapes of Udayapur District might at first seem less affected by broader flows of labour and money. In fact, these farming villages are deeply imbricated in these regional and global economic networks.

More than a third of respondents (0.35) reported receiving remittances from household members working domestically or abroad. Most remittance funds come from individuals labouring abroad (0.83) – three times as many go abroad as go for work either within the district or other regions of Nepal (Kathmandu, Butwal, etc.); and five times as many migrate to urban centres compared to rural areas. In our study communities, Malaysia is the most popular destination (0.40) for those working abroad, followed by Qatar (0.22), India (0.12), Saudi Arabia (0.12) and a variety of other Middle Eastern states. Migration for environmental reasons is not a new phenomenon, globally or in Nepal. What is new is our growing and more specific understanding of the linkages between climate change and migration. Migration should not be envisaged as a last resort or a universal

response strategy to environmental risks such as flooding. In our study sites, the effects of climate-related hazards on household assets and prospects is but one of the factors that influences a family's decision of whether to invest in migration.

It is important to note that climate stressors may also restrict migration by reducing the ability of households or household members to undertake migration, for example, if there is a shortage of cash or fungible assets (e.g., livestock) to pay off the middlemen who arrange visas and tickets for work abroad. Migration requires certain resources such as financial means to purchase permits and tickets, social networks to find employment, access to information, etc. While labour abroad has clearly afforded local residents to access economic opportunities, the consequences of these migrations are gendered and, in many cases, result in more labour at home for women (c.f. Mehta 1996). Out-migration increases the workload of those who stay behind, especially women who must assume both agricultural and domestic workloads, the benefits of remittances notwithstanding. While migration is clearly an important economic strategy for households in the study sites, the links between labouring off-farm and strategies to adapt to flooding risks is less clear. Only one in eight of those we interviewed (0.16) confirmed that their household used labour migration as a way to prevent risks from future floods. Of a suite of possible causes for migration, flooding seems to be but one factor among others such as declining returns from agricultural land, diminishing per capita land

holdings, and other factors. Still, one in five (0.20) households reported engaging in non-farm activities, including labour migration, to reduce risks from future floods.

To cope with the impacts of floods, a possible recourse for local households in the aftermath of climate-induced disasters is to seek assistance such as food, money, or shelter from other people such as relatives or neighbours. Yet, only one-third (0.35) asked others for help as a coping strategy, while the majority (0.65) of households had not. Almost half (42.3%) of households in our study site had received government or NGO support to cope with the impacts of floods. In the absence of government relief, social entrepreneurs have sometimes played a critical role in helping communities cope with flood impacts. For instance, one local community leader, whose own father had drowned, donated his family's land for a disaster shelter that was constructed for Jogidaha VDC residents with government and NGO funds, as described in Box 3-1.

In some cases, community members take matters into their own hands. For example, local residents of Hadiya Village Development Committee (VDC) are making concerted efforts to cope with, and adapt to, flooding. After a particularly bad flood in 1995, the German Cooperation Organization (GTZ) funded some initial rehabilitation efforts and distributed tree saplings to control erosion along the river. "We started to plant *kansh* (a type of grass) along the river banks and we controlled open grazing," recalled Tej Bahadur Thapa. "We formed a group, *Janashakti Misrit* (United People's

Power Group), that is now managing and overseeing the *kansh* plantation." The head of the Janashakti Mishrit group, Dal Bahadur Khatri, asserted, "We learnt about *kansh* and it proved our saviour and protector. If we had not had

taken up these efforts, we would have migrated elsewhere. We had a lot of land where the river now flows. We lost our fields but now we can protect our village from floods," he said with some pride.

### Box 3-1 A Victim of Flood, A Community's Loss

It was Wednesday, the 9th day of Bhadra (August-September), 2010. It was 8 o'clock in the morning. Vikari Das had set off with two companions for Deoghar, the home of his clan's deity, and was planning to visit a fair there. The company of three was attempting to cross the Trijuga River at a place known locally as Bishnujagar (Hadiya VDC, Ward no. 1). As he was checking the depth of the muddy, flooding river with his walking stick, Vikari fell into the strong current. His companions had to leave his side to save their own lives. He was never seen standing again. The villagers gathered and wept and whispered in each other's ears what a good man he was. Not only was one man dead. A whole community had lost a leader and social entrepreneur. Vikar Das is remembered as a kind-hearted gentleman with a loving nature. He contributed greatly to society using his personal wealth, skill, and knowledge for the benefit of others. He was a social worker among the local Tharu (Chaudhary), from the Panchayat era (1960-1992) until his death. He chaired the Janajyoti Primary School Management Committee as well as the Kang Khola Dam Construction Committee. He also served his community as a *dhami* (shaman), who helped villagers stricken by ghosts and evil spirits. He was self taught and educated his own children, instilling in them a love of learning: the brothers have built a free library and community centre that carries on their father's legacy. Posthumously, Vikar Das's four sons donated a plot of land (1800 ft<sup>2</sup>) for the construction of a flood shelter at Budhnagar to provide relief for the flood stricken victims.

During our visit to this village, we observed the plantation areas and grazing exclusion zones and we were shown minutes from meetings of the watershed management committee as well as receipts and the group's constitution and by-laws. Within the plantation area, the riverbank is covered in thick *kansh* and bamboo clusters as well as other shrubs and trees. When floods come, locals related that the *kansh* slows the current and preserves soil from scouring by water. "Now our land is not eroded by flood because of

the *kansh* plantation. Our efforts have been successful," noted Dambar Bahadur Thapa, a member of the group. Local families are not permitted to use these wetland resources without permission from the Janashakti Mishrit group. "We plant *kansh* for the community not just individuals," explained Mohan Lal Chaudhary, a member of the group. Strict rules apply to the plantation areas. For instance, all types of cattle grazing are prohibited and grass can only be harvested for fodder with formal permission from

the group. If the rules are broken by anybody, they have to pay a fee. Critically, "No external inputs are needed for this, we manage it ourselves," according to Krishna Bahadur Thapa, another group member, who stated that, "Our hope is that these ideas spread to more places." Individuals are also providing models of adaptation to flooding, as seen in Box 3-2.

### Box 3-2 Rajendra is Investing in Hope

Rajendra Prasad Chaudhary (33 years old) was born and raised in Jogidaha Bazaar, where he owns a cycle repair and maintenance shop. Rajendra is literate but only studied up to class eight. He tried being a security guard in Kathmandu only to return to his village. Recently, he moved to the banks of Kong Khola, at a place where many families had been displaced by floods. Rajendra saw the possibilities for rehabilitating this land. So he purchased 2 *kattha* (7200 ft<sup>2</sup>). Few think this is a suitable place to live and he was the first to move to this degraded land, which he bought for just Rs. 15,000 from a local Chaudhary family. Rajendra really had no choice but to build his new house on the margins of the village. Like many rural poor, he had taken a loan from a group of moneylenders. But he couldn't return his loan of NRs. 100,000 for many years. With compound interest, the amount increased to NRs. 350,000. His father also got sick and became paralysed. Making a harsh decision, he sold his family's property to the moneylenders: he had no other options for repaying the loan and paying for his father's treatments. The balance left was minimal and not sufficient to build even a small house in the bazaar, pay for his children's education, and buy medicines of his father. Rajendra said, "I could only buy land along the riverbank." Rajendra and his family have built a small house with walls of cement block and sheet roofing. He has raised the building plinth more than half a meter above the ground. He thinks that if a flood comes, it won't be able to enter his house. "My home is water proof and strong," he says, "The roof is also heat resistant. Rajendra and his family spent more than NRs. 20,000 to build a sand embankment along the river that will protect their land and home. They also planted bamboo roots and other fodder trees to preserve the embankment. Rajendra has not received training about soil conservation and bioengineering techniques but is well aware of which plants grow in these conditions and which will help protect soils. Rajendra cheerfully explained his reclamation strategy. This year, he has planted potato and radish on the land he is rehabilitating. He has planned to farm paddy on another plot next year; he has also started goat and pig keeping in another corner of land. He states with confidence, "The sand ultimately will turn to soil after I irrigate it and apply compost and manure. I am very much hopeful." He thinks this land will definitely help improve his living standards. His three children are going to school now and his wish is for them to be well educated and to enter business or serve the community as doctors. Rajendra has many responsibilities in trying to singlehandedly rehabilitate this land, but he sees hope. He added, "Many of my friends have also purchased land nearby and we are making efforts to raise hope on the banks of the Kong Khola."

Based in local ecologies and social networks, community and household initiatives like these are lower cost than infrastructure intensive interventions. Infrastructural and engineering works such as culverts and gabion walls have been built on very limited basis at various points along tributaries of the Kong Khola watershed. However, these District- and village-level government efforts have been inconsistent and underfunded with respect to the watershed-scale management needed.



Picture 2: Sand embankment protecting paddy fields. Photo: Kenneth Bauer

## 4. Loss and damage from flooding

Impacts from flooding occur despite the kinds of coping and adaptation measures households adopt, as detailed above. In our study site, 73% of the households interviewed reported adverse effects of flooding on their households. The most commonly cited impact of flooding was on crop

production: almost half (46%) of our interviewees reported “severe” effects of flooding on their crops, with others (14%) noting “moderate” effects. Almost half (44%) noted higher food prices in the aftermath of floods [Table 4-1].

**Table 4-1: Flood-affected households by impact type (n=300)**

Impact on	Moderate impact	Severe impact	Total affected	% of households	% of affected households
Crops	43	137	180	60.0	84.9
Food prices	89	43	132	44.0	62.3
House / properties	18	55	73	24.3	34.4
Trees	23	6	29	9.7	13.7
Livestock	11	6	17	5.7	8.0
Fishing	5	3	8	2.7	3.8
Trade	8	0	8	2.7	3.8

A quarter of sampled households noted “severe” (19%) or “moderate” (6%) effects from flooding on family homes. That more homes are not damaged may be a function of house placement (typically not directly adjacent to rivers) and the relatively higher location of buildings in comparison to fields, which are mostly located within the floodplain of local watersheds. More than a quarter (0.26) had made changes to their houses including relocating to safer locations and using alternative building materials.

The Loss and Damage framework emphasizes the impacts of climate change on communities that, despite their best efforts to cope and adapt, are

losing resilience and are increasingly vulnerable to climate-related risks, in this case flooding. In some cases, entire sets of households are forced to relocate, as seen in Box 4-1.

There are a number of heuristic measures of ‘vulnerability’ to climatic risks: socio-economic indicators such as income and income inequality; food security; access to disaster relief; and availability of insurance. In our study population, more than a quarter of household respondents (0.26) identified themselves as “more vulnerable” to floods, with others describing their vulnerability as “average” (0.36) or “less vulnerable” (0.38).

**Box 4-1 On how people struggle to restore their livelihood after floods**

Mishri Lal Chaudhary, a resident of Dhanti Tol, in Hadiya VDC related this story of his community's experience with the effects of flooding. "We have lived in Udayapur from the time of our fathers and forefathers. I am 59 years old and I have two daughters, one son, and a wife. We moved to this place in 2052 B.S. (1995 AD). A big flood had swept our family home away. I had a house and two cattle sheds before this flood. I used to make tiles and put up roofs all around Udayapur. I earned about 9000 Rs. per month. And I used to work my fields. We two brothers jointly owned 2.5 *bigha*. But the flood took all that land. It was *Asar*. The paddy was fully-grown and about to fruit. The rain had been falling continuously for 6 or 7 days. The river started to swell and the flood came at 7 o'clock. Water entered all the houses in the village. The water reached up to waist level in my house. My wife and I captured all the livestock (2 oxen, 3 cows, 6 goats) and then we moved to upstairs with our two children. We also carried our clothes and food upstairs. We spent the next two nights sleeping and eating upstairs. We were then relocated to Hadiya Higher Secondary School with 12 other families. The VDC provided us 2 kg rice, 2 litres of kerosene, and a lantern. The Red Cross distributed tents, blankets, cooking utensils, clothes, cooking oil, snacks, and lentils. We spent 15 days but had to leave after the school reopened. After that, we started to construct huts of bamboo and straw in the Dhanti jungle. Six forest guards arrived and told us to stop building. They arrested us and took us to the District Forest Office. We put all our grief and problems before them. All of our assets and houses had been swept away by the river. We had to settle somewhere. We negotiated for a full day without even eating. The forest officer gave us some oral assurances after talking with our VDC Chairperson. He said, "Go to back to Dhanti jungle. I will visit shortly and make a decision." When he visited, the forest officer warned us that we could live here for only one year and then we had to leave. After six months, the forest office again warned us to leave the place and gave us seven days' notice to leave. But we had no other homes; we were already living in tents provided by the Red Cross. Later, we were permitted to live at Dhanti Tol so long as we don't encroach further on the jungle.

Half of the households we interviewed noted that, despite the measures they had taken to prevent flood damages, they had still experienced, "severe negative effects" (0.50). Almost a quarter (0.23) of the households interviewed had sold property including homes, livestock, and heirloom possessions to compensate for flooding damages. Additionally, close to forty percent of interviewed

households had reduced expenses (e.g., school fees, health care, productive investments, etc.) and food consumption in the aftermath of floods. Arguably, these measures are not just coping behaviours: they are also a sign that existing coping measures are failing. Indeed, more than three-quarters (78%) of households reported that

the coping strategies they had carried out to deal with flood impacts were “not enough”.

Resignation, expressed in the Nepali idiom of *ke garne* (‘what to do’), permeated our interviewees accounts of the loss and damage they had experienced because of flooding. “There was nothing we could do,” to cope with or adapt to flooding was a common (0.29) response to our queries about lack of adaptive measures. Many cited a lack of money (0.35) while others noted an absence of skills or knowledge as the reason they had not taken any steps to respond to floods. Still others noted that the needed measures were not a priority (0.17) or not their responsibility (0.06). After successive natural disasters, poor families with insufficient financial, land, or other assets are likely to lose the minimal buffer they have and face increased indebtedness and economic poverty. “Now I can only cultivate 3 *bigha* even though I own 23 *bigha* according to the documents. Kong Khola is flowing over all my other lands. I can’t even recognise the border of my land these days,” said one farmer of the losses he could not recoup.

There were several registers of resignation: some described efforts to control flooding that had simply been swept away, while others spoke to a sense of helplessness before the forces of nature. Thus, one woman said, “The river is already so wide. How can we control it?” Helplessness, too,

was understandable in local attitudes towards given the ‘assistance’ afforded by the government. Though local government officials claimed that 40-50% of VDC budgets were spent every year on flood control, visible evidence to validate these claims was largely absent.

#### 4.1 Gendered effects of flooding

Gender shapes vulnerability to climate change in terms of access to resources, power relations in community and household level decisions, and mobility, among other factors (c.f. Röhr, 2006; Arora-Jonsson, 2011; Cannon, 2002; Terry, 2009). By a two to one margin, our respondents noted that the effects of flooding were more severe for women and children than for men. Women and children are more at risk of drowning and have difficulty moving about during floods, especially if they are sick. Pregnant women face great obstacles accessing ambulances and other government health services. School is frequently cancelled or is difficult to reach during flood events; women and children may also have to spend more time collecting water, fodder, and fuelwood. Climate-related disasters such as floods may disrupt local security safety nets, leaving women and children unaccompanied, separated or orphaned. These kinds of gendered effects of flooding on women are illustrated by the story of Dukhani Sada, as described in Box 4-2.

**Box 4-2 The Destitution of Dukhani Sada**

Dukhani is 47 years old, the mother of three children. She was born in Ward-5, Jogidaha VDC, in the same village where she now lives. In June 1979, when she was 15 years old, she lost her father to a flood. One afternoon, as he was crossing the Kong Khola with his plough and a couple of oxen enroute to the family's paddy, her father heard voices shouting, "Help, help!" Two women were caught in the middle of the river. Dukhani remembered that the younger woman had been a teacher who every day had to cross Kong Khola to get to school. Her father waded in to help them but the water rose. Within an hour, they were swept away. She continued, "I was at the bank of the river. Oh, if someone could have rescued my father. I saw him get carried away by the flood. I cried but finally I lost him." It was worst day of her life. "His daughter and I was not able to do anything to save my father," she said with tear-filled eyes. The VDC produced a death certificate and the family received 20 kilos of rice from the district authority as well as a set of clothes. "After this disaster, we became very poor so my sister and I had to labour on others' farms," Dukhani recalled. She was obligated to leave her husband's household and return to her natal home since she was the eldest child, with four younger siblings. All the responsibilities were on her shoulders. "When I return to my past, I always remember my father's warm love and care, all his good suggestions to me, my sisters and brothers, and even my husband. My father shared everything – candy, clothes, money. There was something special in his eyes. He was a very good husband and very caring dad." Five years after the disaster, her mother married another village man. There have not been any severe problems with Dukhani's new father; he has a caring nature and he has taken responsibility for her mother's family. Dukhani is finally free to live with her husband but she still helps her mother. These days she has started to raise goats. But it's not easy to take care of them and she worries about the uncertainty of raising livestock. And still she has to work on others' farms to earn her family's daily subsistence. "Though mother is happy with her new husband, I'll always miss my own father. In every happy and sad moment of my life, at every festival I celebrate, I remember my father and all his deeds. The flood swept away my happiness and I remain forever destitute." Thus Dukhani ended her story.

## 5. Discussion

There are no universally accepted or objective means of measuring 'vulnerability'. As such, a comprehensive assessment of the causes and conditions that lead to household vulnerability in relation to flooding is beyond the scope of this research. Since 'vulnerability' remains a contested term (Sietz *et al.*, 2012) in development literature, the emphasis here is on the elements that constrain the ability of households to cope with and mitigate climate related risks. Drawing upon van der Geest and Warner's (2013) framework, we can note that there are a number of pathways by which vulnerable households incur loss and damage from flooding.

*Household vulnerability to flooding in the study area largely depends on land ownership, migration history and access to formal and informal support networks*

Structural characteristics such as gender, income, education, and ethnicity, among others, all affect a household's vulnerability in relation to flooding. During our interactions with villagers in Udayapur, local narratives about flooding converged on a number of variables that forecast a household's capacity to cope with and adapt to flooding: whether or not members had migrated outside for labour, amount of farm land owned, level of assets, and support from government projects and international relief efforts. Households that

succeed in coping with flooding have diversified income sources; are able to maintain strong social networks; and can access government support programmes.

*Vulnerable households are often low-caste, landless and marginalized. Each successive disaster makes them more destitute*

Of more pressing concern, though, are the more numerous households that are vulnerable – they are not adapting successfully and they have few viable opportunities to diversify their livelihoods. Why are such households more or less vulnerable to flooding and its attendant impacts? There are many reasons why a given family may be unable to cope with climate stressors. Among our sample were truly destitute households: landless, low caste, and utterly marginalized families. When they can, they labour for day wages. Mostly, they go hungry and live out their lives ever at the edge of vulnerability if not ruin. After one or successive natural disasters, poor families with insufficient financial, land, or other assets are likely to lose the minimal buffer they have and face spiralling indebtedness and poverty (Gentle and Maraseni, 2013). Such vulnerable populations are systematically disadvantaged in terms of accessing resources, which exposes them to increased risks *during* disasters and *in the wake of* climate-related events. These risks include physical dislocation and psychological trauma, the loss of

household resources (e.g., livestock) and catastrophic harvest failure.

Households have different vulnerabilities to climate change and divergent sets of resources (e.g., livestock, tractors, or economic trees, migration, off-farm labour) to deal with environmental risks like flooding (van der Geest and Dietz 2004). Some local determinants of adaptive capacity that emerged as key variables were: availability of labour and financial capital, level of intensification, per capita land ownership, and level of support from national programs and international projects. In other cases, families go through temporal cycles in which their resilience as a household is less robust. For instance, when illness or death strike a household, the family's savings or subsistence capital can be wiped out; there are also better times when everyone is healthy and productive, when the family has enough members who can labour and earn wages. In other words, both structural conditions (termed 'structural vulnerability' in the climate risk literature) and singular situations (i.e., 'proximate vulnerability') interact in complex ways and shape a household's response to life's contingencies, including flooding (van der Geest and Dietz, 2004).

*Some households are structurally vulnerable while others go through temporal cycles*

Attribution remains a key issue in assessing the relationship between climate change and household vulnerability. Rainfall patterns in Nepal

remain poorly understood, largely because of an inadequate meteorological and hydrological database. Also, fluctuations in precipitation are highly region-specific – making it difficult to identify general patterns and trends. It can also be argued that flooding is not clearly a 'climate stressor' particularly if these events are caused primarily by deforestation, land fragmentation, siltation, etc.

*Attribution of floods to global warming remains a key question; floods are caused to a large extent by erosive land use locally*

The regional complexities and politics of resource use and watershed management must also be acknowledged here. At all levels, people with whom we spoke in our study sites identified the Chandra Nahar irrigation scheme (in neighbouring Saptari District) as a key driver of changes they had observed over generations in the hydrology of local watersheds. The dilemmas associated with this downstream development underscore the challenges associated with coordinating and aligning policies related to managing climate-related risks. The more densely populated districts of Terai, which are supplied with waters from this irrigation scheme, have relatively more political capital than Udayapur. So any proposal to open the irrigation scheme's sluices to flush river channels and clear sediment upstream, for example, would be met by loud opposition from communities downstream that rely on this same water for irrigation. This reinforces the notion that solutions at the local level will be insufficient to

solve the problem of sedimentation originating from waterworks downstream.

Though planning for climate change is today built into government policy, it is unclear how these policies will be implemented. Nepal emerged from a 10-year civil war in 2006 with a government in tatters and the country's political elites deeply divided over proposals to address regional and economic inequalities as well as the deep-seated caste system, which plays a visible role in access to land and other resources in the villages we surveyed. Our research indicates that early action and proactive adaptation are more beneficial than no action or ad-hoc relief efforts after a flood disaster (Barua et al., 2013). Anticipating and managing ongoing land conversion and deforestation in this area could, for instance, be more cost-effective than attempting remediation through engineering works or restoration ecology. Indigenous knowledge, especially in the use of local plants like bamboo, can provide cost-effective methods of engineering flooding solutions (Nelleman *et al.*, 2011).

*Our research indicates that proactive adaptation is more beneficial than ad-hoc relief efforts after a flood disaster*

Efficient implementation of preparedness activities has often been hampered by weak coordination between and within government and non-government organizations. The focus of disaster preparedness has, in general, been on response

and recovery and assistance to communities struck by disasters on an ad hoc basis and, that too in insufficient amount. Lack of coordination has, in many cases, led to duplication of work. This issue was repeatedly mentioned during district-level stakeholder consultations during fieldwork that led to this document. The priority is still mainly on post-disaster activities, i.e., rescue and relief work. Because of this mindset, authorities have not given sufficient priority to preparedness activities in disaster management activities.

*Climate stressors affect food security and livelihood strategies as well as public health and education*

There are climate-related public health concerns in relation to waterborne diseases for places like Udayapur. Recent evidence from Nepal shows increased incidence climate dependent diseases such as cholera and diarrhoea. Diarrheal diseases are already a significant problem in Nepal, and flooding may exacerbate sanitation problems by increasing surface water pollution. Securing local drinking water supplies and proper drainage is an essential step towards curbing diseases of water quality. Poor quality and access to water are compounded by a lack of health facilities and medicine, widespread poverty, and gaps in hygiene awareness. In addition to its human toll, poor water quality also increased the incidence of liver diseases in domestic water. But in addition to the effects of climate variability, the public health sector must address structural issues of poverty,

sanitation, nutrition, and environmental degradation, all of which significantly hamper communities' vulnerability and capacity to adapt risks like floods.

*Development will be compromised if efforts to mediate the impacts of a changing climate are insufficient or not timely.*

As we have seen, climate stressors currently affect and will continue to impact future food security and livelihood strategies as well as public health and education. In this flood-prone region of Nepal, extreme climate events cause severe and sometimes lengthy disruptions to schooling, commerce, and public services. What kind of

coping mechanisms and adaptations will future generations in Udayapur District devise to deal with climate variability and extreme weather events? This research has highlighted a number of indigenous strategies, everyday practices, and creative innovations that communities already use to respond to the anticipated or realised impacts of floods. In this, we are reminded that the solutions to climate change and adaptation processes go far beyond technological innovations and market mechanisms. But development in Udayapur will be compromised if efforts – local, regional, and national – to mediate the impacts of a changing climate are insufficient or not timely.



Picture 3: Land being rehabilitated after flooding. Photo: Kenneth Bauer

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## Suggested Reading

Ten journal articles based on the loss and damage case studies have been published in a special issue of the International Journal of Global Warming (Open Access):

Bauer, K. (2013). Are preventive and coping measures enough to avoid loss and damage from flooding in Udayapur District, Nepal? *Int. J Global Warming*, Vol. 5, No. 4, pp. 433-451.

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Kusters, K. and Wangdi, N. (2013). The costs of adaptation: changes in water availability and farmers' responses in Punakha district, Bhutan. *Int. J Global Warming*, Vol. 5, No. 4, pp. 387-399.

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## Appendix 1: Institutional framework for disaster and climate policy

By Dr. Dinesh Devkota (IDS-Nepal)

A variety of state institutions have a stake in policy formulation and coordination in relation to disaster management and climate change planning (Pradhan, 2007). Prominent among these are:

- National Planning Commission
- Water and Energy Commission
- Ministry of Finance
- Ministry of Home Affairs
- Ministry of Water Resources
- Ministry of Forest and Soil Conservation
- Ministry of Environment
- Ministry of Science, and Technology
- Ministry of Health and Population
- Ministry of Local Development
- Ministry of Women, Children and Social Welfare

A number of government departments (below) are responsible for implementing disaster preparedness planning and relief efforts. The departments also provide feedback on disaster preparedness to their respective ministries.

- Department of Water Induced Disaster Prevention
- Department of Soil Conservation and Watershed Management
- Department of Hydrology and Meteorology
- Department of Mines and Geology
- Department of Irrigation
- Department of Health Services
- Armed Police Force (Disaster Management Cell)

In addition, there are a number of international and domestic NGOs as well as research centres that are also involved in coordinating and implementing disaster risk preparedness and management, including:

- Nepal Red Cross Society
- National Society for Earthquake Technology
- Jalshrot Vikash Sanstha
- National Centre for Disaster Management
- Nepal Landslide Society
- Nepal Geological Society
- Natural Disaster Management Forum
- Friends Service Council Nepal
- Disaster Preparedness Network Nepal
- Institute of Engineering, Tribhuvan University
- Nepal Engineering College
- Department of Geology, Tri-Chandra Campus, Tribhuvan University
- Kathmandu University
- International Centre for Integrated Mountain Development (ICIMOD)
- Lutheran World Federation
- Oxfam
- Practical Action
- United Nations Development Programme (UNDP)
- United Nations Children's Fund (UNICEF)
- Action Aid Nepal
- Danish Christian Aid
- CARE Nepal
- Asian Disaster Preparedness Centre (ADPC)
- Asian Disaster Reduction Centre (ADRC)
- United Nations Office for the Coordination of Humanitarian Affairs (UN/OCHA)
- World Food Programme (WFP)
- Save the Children Fund (SCF)
- World Vision International, Nepal
- World Health Organization (WHO)
- World Wildlife Fund Nepal Program (WWF)
- Handicap International

The Government of Nepal constituted the Climate Change Council chaired by the Prime Minister in July 2009. The Council is a high-level coordinating body that provides guidance and direction for formulating and implementing climate change-related policies and programmes. The government established the Climate Change Management Division

under the Ministry of Environment in March 2010. The Government of Nepal also formed a Multi-stakeholder Climate Change Initiatives Coordination Committee (MCCICC) to facilitate coordination and promote collaborative programmes; this Committee is chaired by the Environment Secretary and has representatives from government ministries, local bodies, academia, I/NGOs, and other development partners.

### **Climate Change Policy: Nepal's National Framework**

At the national level, a series of laws and policies have begun to focus on climate change, with increasing attention being paid to these issues into the present. These include laws related to natural resource management, clean energy development, and pollution control, i.e., laws that address aspects of climate change.

The Sustainable Development Agenda (2003) stresses managing resources, reducing pollution, promoting renewable energies and minimizing the adverse impacts of climate change. The Interim Constitution of Nepal 2007 recognizes the 'right to a clean environment' as a fundamental right (Article 16.1). It also requires conservation of at least 40 percent of the natural forest area of the country (NPC/UNDP, 2011). The most recent Three-Year Plan (2011-2013) calls for climate-resilient planning in the infrastructure sector. The National Planning Commission is also mainstreaming climate resilience perspectives into its planning processes.

### **National Adaptation Programme of Action (NAPA)**

In September 2010, the Government of Nepal endorsed the NAPA to implement urgent and immediate adaptation actions in priority areas. NAPA has the following priorities:

1. Promoting community-based adaptation through integrated management of agriculture, water, forest and biodiversity.
2. Building and enhancing adaptive capacity of vulnerable communities through improved systems and access to service for agricultural development.
3. Community-based disaster management for facilitating climate adaptation.
4. GLOF monitoring and disaster risk reduction.
5. Forest and ecosystem management for supporting climate-led adaptation innovations.
6. Adapting to climate challenges in public health.
7. Ecosystem management for climate adaptation.

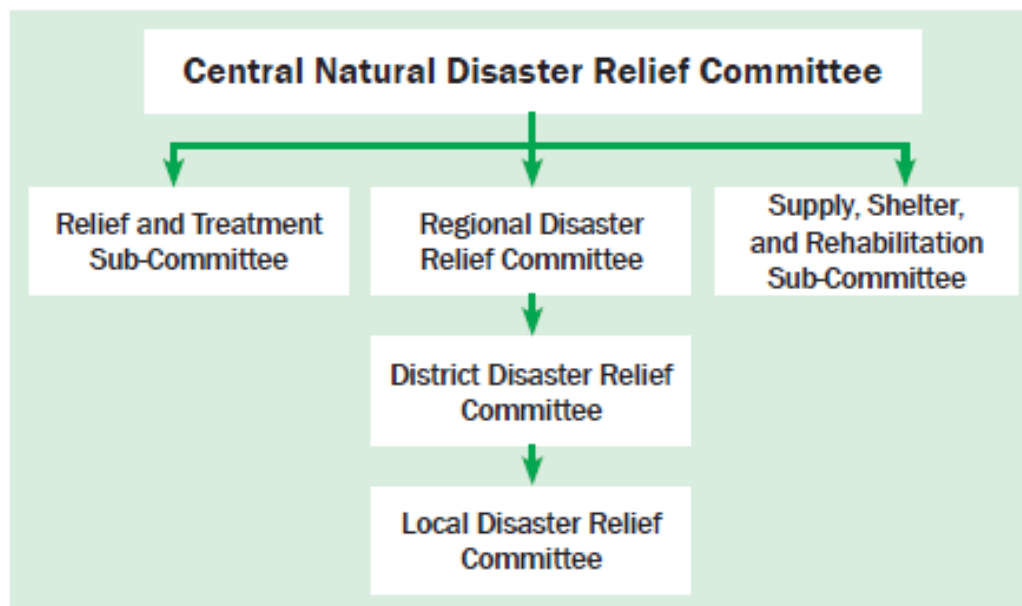
8. Empowering vulnerable communities through sustainable management of water resources and clean energy supply, and Promoting climate-smart urban settlements.

### **Local Adaptation Plan for Action (LAPA)**

In line with Nepal's Climate Change Policy (2011), and as a means of integrating NAPA adaptation initiatives into local development planning processes, GoN approved the Local Adaptation Plan for Action (LAPA) in November 2011. LAPA provides a basis to implement location-specific, people-centric plans.

### **Policy Framework for Disaster Risk Reduction (DRR)**

Prior to 1982, before the formulation of the Natural Disaster Relief Act, there were no plans or activities for disaster mitigation and preparedness in Nepal. The Natural Disaster Relief Act provided for the formation of a 25-member Central Disaster Relief Committee under the chairmanship of the Minister for Home Affairs. It describes the functions of this committee in relation to natural disasters. It also empowers the government to constitute regional, district, and local level natural disaster relief committees (see figure below); the specific functions of these committees are detailed in the Act.



It was only after 1991, following the declaration of the International Decade for Natural Disaster Reduction, that preparation for, and management of, natural disasters was taken into explicit consideration by the Government of Nepal. A National Action Plan for

natural disaster planning and relief was eventually prepared in 1996 (Ministry of Home Affairs 1996). Planning documents have since proposed a number of actions including: capacity building for institutions involved in water-induced disaster management; strengthening the collection, storage, and dissemination of information about water-induced disasters; zoning of hazardous areas through the preparation of risk and vulnerability maps of probable flood, debris flow, and GLOF-prone areas; drafting of flood and river control master plan to identify priorities and implement integrated programmes; and reclamation of unused lands along river flood plains (see also Water Induced Disaster Management Policy, 2006).

The National Strategy for Disaster Risk Management in Nepal (NSDRM) was adopted by the Government of Nepal in 2010. It was initially drafted by the Nepal Society for Earthquake Technology (NSET) through an extensive process of stakeholder consultation, with assistance from the European Commission and UNDP. It contains not only a disaster management strategy but also substantial data detailing risk profile at the district level as well as a detailed analysis of the existing and proposed institutional and legal system related to disaster risk management in Nepal. Issues of social justice, social inclusion and equality including gender, ethnicity, people with disabilities, and marginalized communities including Dalits are mentioned explicitly in this national document. In 2009, the Nepal Risk Reduction Consortium was formed to support the Government of Nepal. The members of the Consortium are the Asian Development Bank (ADB), the International Federation of the Red Cross and Red Crescent Societies (IFRC), United Nations Development Programme (UNDP), UN Office for the Coordination of Humanitarian Affairs (OCHA), UN International Strategy for Disaster Reduction (ISDR) and the World Bank.

Disaster risk management system in Nepal is shifting from a relief-based approach to proactive mitigation and adaptation measures. At the local level, this includes a number of possible initiatives:

- enhancing local level risk assessment methodologies;
- improving the reliability and geographical coverage of community-based early warning systems;
- scaling up of community-based preparedness and mitigation actions;
- investing in local-level risk reduction projects.

## Appendix 2: Questionnaire

Note: The original questionnaire layout has been modified to save space

- |                                     |                                |
|-------------------------------------|--------------------------------|
| 1) Questionnaire number:            | 6) Name of data entry officer: |
| 2) Date of interview: __ / __ / __  | 7) GPS location:               |
| 3) Name of village or town:         | a. Latitude:                   |
| 4) Name of interviewer:             | b. Longitude                   |
| 5) Date of data entry: __ / __ / __ |                                |

### **Section 1: Respondent and household information**

- 8) Name: \_\_\_\_\_
- 9) Relation to household head (HH-H): 1=Household head | 2=Spouse | 3=Other, specify \_\_\_\_\_
- 10) Sex (of HH-H): 1=Male | 2=Female
- 11) Birth year of HH-H (write age if easier): \_\_\_\_\_
- 12) Marital status of HH-H: 1=Single | 2=Married | 3=Widowed | 4=Separated | 5=Other, specify \_\_\_\_\_
- 13) Place of birth (HH-H): 1=This village or town | 2=Elsewhere in Sagarmatha zone | 3=Elsewhere in the country, specify zone/region \_\_\_\_\_ | 4=Abroad, specify country \_\_\_\_\_
- 14) Education level of HH-H: 1=None | 2=Literacy classes | 3=Primary | 4=Secondary | 5=Tertiary | 6=Technical/vocational \_\_\_\_\_ | 7=Other, specify \_\_\_\_\_
- 15) Mother tongue: \_\_\_\_\_
- 16) Religion: 1=Christian | 2=Muslim | 3=Buddhist | 4=Hindu | 5=Other, specify \_\_\_\_\_
- 17) Ethnicity/Caste: \_\_\_\_\_
- 18) Household composition: Adult men (aged 15-59) \_\_\_ | Adult women (aged 15-59) \_\_\_ | Boys (<15) \_\_\_ | Girls (<15) \_\_\_ | Elderly men (>60) \_\_\_ | Elderly women (>60) \_\_\_

### **1.2 Land and farm**

- 19) Do you (or does your household) 'own' land? 1=Yes | 2=No
- a) If yes, for what do you use your land (multiple options)? 1=House | 2=Crop cultivation | 3=Livestock raising | 4=Renting out | 5=Fallowing | 6=Nothing | 7=Other, specify \_\_\_\_\_
- b) If yes, please estimate the total land size? Number \_\_\_\_\_ Unit \_\_\_\_\_
- 20) Do you (or does your household) farm? 1=Yes | 2=No (if no, go to next section)

- 21) What is the size of the land that you cultivate this year? Number \_\_\_\_ Unit \_\_\_\_\_
- 22) Do you own the land you farm? 1=Yes, all | 2=No, none | 3=Partly  
 c. If 2 or 3, how do you get access to this land (multiple options)? 1=Renting |  
 2=Sharecropping | 3=Borrow | 4=Community land | 5=Other, specify \_\_\_\_\_
- 23) Is some of the land you farm irrigated? 1=Yes | 2=No  
 a) If yes, how much? Unit \_\_\_\_\_
- 24) Which crops did you cultivate last year? [in order of importance] (1) \_\_\_\_\_ (2)  
 \_\_\_\_\_ (3) \_\_\_\_\_ (4) \_\_\_\_\_ (5) \_\_\_\_\_ (6)  
 \_\_\_\_\_
- 25) Do you use animal traction or a tractor to cultivate your land (multiple options)?  
 1=Yes, animal traction | 2=Yes, tractor | 3=No  
 a) If yes, do you own, hire or borrow these implements (multiple options)? 1=Own |  
 2=Hire | 3=Borrow | 4=Other, specify \_\_\_\_\_
- 26) Do you employ people to work on your land? 1=Yes | 2=No  
 a) If yes, please estimate the total number of 'person days' per year \_\_\_\_\_
- 27) Do you or household members sometimes work on other people's farms? 1=Yes |  
 2=No  
 a) If yes, how many household members? \_\_\_\_\_  
 b) Please estimate: the total number of 'person days' in the last 12 months \_\_\_\_  
 c) Please estimate the total annual income from farm labour in the last 12 months  
 \_\_\_\_\_
- 28) How much of your crop production do you usually sell? 1=Everything | 2=Almost  
 everything | 3=More than half | 4=Approximately half | 5=Less than half | 6=Hardly  
 anything | 7=Nothing
- 29) How much income did your household derive from crop sales in the last 12 months?  
 \_\_\_\_\_
- 30) In the last 10 years, did your crop production... 1=Decrease a lot | 2=Decrease a little  
 | 3=Remain the same | 4=Increase a little | 5=Increase a lot  
 a) If decreased or increased, please indicate the cause(s):

### ***1.3 Livestock, fishing and economic trees***

- 31) Do you or other household members own livestock? 1=Yes | 2=No  
 a) If yes, please indicate the number of (1) Cows & Buffalo\_\_ | (2) Oxen \_\_ | (3)  
 Goats and sheep \_\_ | (4) Pigs \_\_ | (5) Fowls \_\_ (5) Others, specify \_\_  
 b) Please estimate the income you derived from livestock raising in the last 12  
 months? Specify Product (eggs, milk, meat) and Income \_\_\_\_\_

- 32) Do you or any other household members engage in fishing or fish raising? 1=Yes | 2=No
- If yes, please specify: 1=Fishing | 2=Fish raising | 3=Both
  - Please estimate the income your household derived from fishing / fish raising in the last 12 months? \_\_\_\_\_
- 33) Does your household own economic trees (fruit, timber, etc.)? 1=Yes | 2=No
- If yes, please indicate the number of economic trees: (1) <10 | (2) 10-50 | (3) 50-100 | (4) >100
  - Please estimate the income your household got from economic trees in the last 12 months \_\_\_\_

#### **1.4 Other income generating activities**

- 34) Do you or any household members derive income from non-farm activities? 1=Yes | 2=No
- If yes, how many household members engage in such activities? \_\_\_\_\_
  - In which activities do they engage (multiple options)? 1=Petty trading | 2=Larger business | 3='White collar' salary work, specify \_\_\_\_\_ | 4='Blue collar' salary work, specify \_\_\_\_\_ | 5=Crafts, specify \_\_\_\_\_ 6=Processing natural resources (charcoal, wood collection, firewood, liquor, NTFPs), specify \_\_\_\_\_ 7=Other non-farm income, specify \_\_\_\_\_
  - Please estimate the total income derived from non-farm activities in last 12 months? \_\_\_\_\_
- 35) Does your household receive remittances from migrant family members/relatives? 1=Yes | 2=No
- If yes, what kind of migrant work \_\_\_\_\_
  - If yes, from whom [relation to HH-H] (multiple options)? 1=Daughter | 2=Son | 3=Brother | 4=Sister | 5=Parents | 6=Other, specify \_\_\_\_\_
  - Where do they live (multiple options)? 1=Within Sagarmatha Zone | 2=Other zone, specify \_\_\_\_\_ | 3=Abroad, specify \_\_\_\_\_
  - Please estimate the total amount of money you received in the last 12 months \_\_\_\_\_
- 36) Do you have any other sources of income besides the ones you mentioned? 1=Yes | 2=No
- If yes, please specify source \_\_\_\_\_
  - Please estimate the total income derived from this in the last 12 months \_\_\_\_

- 37) Please estimate the amount of money your household usually has to its disposal:  
Amount \_\_\_\_\_ Currency \_\_\_\_\_ per (underline time unit): week / month / year
- 38) Compared to other households in your village/town, would you say that your income is (1) Less than most others | (2) Average | (3) More than most others

### **1.5 Housing and other assets**

- 39) Do you 'own' the house you live in? 1=Yes | 2=No
- 40) Please indicate the building materials of the house you live in:
- a) Roof (multiple options): 1=Roofing tiles | 2=Iron sheets | 3=Concrete | 4=Natural materials, e.g. thatch or earth | 5=Other, specify \_\_\_\_\_
  - b) Walls (multiple options): 1=Cement blocks/concrete | 2=Baked bricks | 3=Sun-dried bricks | 4=Wood | 5= Iron sheets | 6=Other natural materials | 7=Other, specify \_\_\_\_
  - c) Floor (multiple options): 1=Cement | 2=Earth | 3=Wood | 4=Other, specify \_\_\_\_\_
- 41) Compared to the other houses in your village/town, would you say that the house you live in is (1) Of better quality | (2) Average or | (3) Worse quality?
- 42) Does your house have electricity? 1=Yes | 2=No
- 43) Do you have a storage shed or animal shed?
- 44) What is the source of your drinking water (multiple options)? 1=Surface water | 2=Well | 3=Borehole/Pump | 4=Pipe | 5=Other, specify \_\_\_\_\_
- 45) Does your house have a pit latrine or WC? 1=Yes | 2=No
- 46) Please indicate whether your household owns the following assets [and how many]:  
(a) TV \_\_ (b) (Mobile) phone \_\_ (c) Bicycle \_\_ (d) Motorbike \_\_ (e) Car \_\_ (f) Fridge \_\_  
(g) Computer \_\_ (h) tractor \_\_

### **1.6 Food security**

- 47) How many meals a day do adults in your household eat on a 'regular day'? \_\_\_\_\_
- 48) Do men and women eat differently? If so, describe \_\_\_\_\_
- 49) How many meals a day do children in your household eat on a 'regular day'? \_\_\_\_\_
- 50) In the past year, have there been months that you had to eat less? 1=Yes | 2=No
- a) If yes, in which months did this happen (multiple options)? 1=Jan | 2=Feb | 3=Mar | 4=Apr | 5=May | 6=Jun | 7= Jul | 8=Aug | 9=Sep | 10=Oct | 11=Nov | 12=Dec
  - b) What was/were the cause(s) of this food shortage?
- 51) In the past ten years, has your household experienced any food shortages? 1=Yes | 2=No

- a) If yes, in how many out of ten years?  
 b) What was/were usually the cause(s) of such shortages?
- 52) How much of the food your household consumes is bought (i.e. not produced by household itself)? 1=Everything | 2=More than half | 3=Approximately half | 4=Less than half | 5=Hardly anything | 6=Nothing

## 2. Floods

- 53) In the past twenty years, how many years have you lived in this district? \_\_\_\_
- 54) Has your household ever experienced a flood? 1=Yes | 2=No [If no, interview ends here]
- a) If yes, please estimate how many floods in the past twenty years?  
 b) Has the frequency of floods increased, reduced or stayed the same over the past twenty years? 1=Increased | 2=Reduced | 3=Stayed the same | 4=Don't know  
 c) Have floods become more severe or less severe over the past twenty years?  
 1=More severe | 2=Less severe | 3=Stayed the same | 4=Don't know

*If the household has experienced at least one flood, please choose a particular one (typically the most recent or most severe one) and answer the questions in this section for this flood.*

- 55) In which year did this flood occur?
- 56) How did this flood affect your household? Specify, did anyone die? Women, children? Other effects?
- 57) Did this flood have a negative effect on:
- a) Your crops: 1=None | 2=Moderate | 3=Severe | 4=Not applicable (NA)  
 Please explain: \_\_\_\_\_  
 If 2 or 3, please estimate costs: \_\_\_\_\_
- b) Your livestock: 1=None | 2=Moderate | 3=Severe | 4=NA  
 Please explain: \_\_\_\_\_  
 If 2 or 3, please estimate costs: \_\_\_\_\_
- c) Your fishing activities: 1=None | 2=Moderate | 3=Severe | 4=NA  
 Please explain: \_\_\_\_\_  
 If 2 or 3, please estimate costs: \_\_\_\_\_
- d) Your economic trees: 1=None | 2=Moderate | 3=Severe | 4=NA  
 Please explain: \_\_\_\_\_  
 If 2 or 3, please estimate costs: \_\_\_\_\_

- e) Your trade/business: 1=None | 2=Moderate | 3=Severe | 4=NA  
Please explain: \_\_\_\_\_  
If 2 or 3, please estimate costs: \_\_\_\_\_
- f) Food prices: 1=None | 2=Moderate | 3=Severe | 4=NA  
Please explain: \_\_\_\_\_  
If 2 or 3, please estimate costs: \_\_\_\_\_
- g) Your house and other properties: 1=None | 2=Moderate | 3=Severe | 4=NA  
Please explain: \_\_\_\_\_  
If 2 or 3, please estimate costs: \_\_\_\_\_
- h) Other negative effects, specify \_\_\_\_\_ 1=None | 2=Moderate | 3=Severe | 4=NA  
Please explain: \_\_\_\_\_  
If 2 or 3, please estimate costs: \_\_\_\_\_

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***PREVENTIVE MEASURES*** – things people do to avoid negative effects of floods in the future

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- 58) Before this flood, did your household do anything to prevent impacts of floods?  
1=Yes | 2=No  
a) If yes, what did you do?
- 59) If no, do you anything *now* (after this flood) to prevent impacts of floods in the future? 1=Yes | 2=No  
a) If yes, what?
- 60) Have you made any changes to your house In order to prevent impacts of floods?  
1=Yes | 2=No  
a) If yes, what did you change? 1=Relocate to a safer place | 2=Use other building materials | 3=Changed interior design | 4=Other, specify \_\_\_\_\_
- 61) Have you constructed any physical barriers around your house or farms (e.g. dykes, walls) to prevent impacts of floods in the future? 1=Yes | 2=No  
a) If yes, where? 1=House | 2=Farms |3=Elsewhere, specify \_\_\_\_\_  
b) What materials did you use? \_\_\_\_\_
- 62) Have you made any changes in your agricultural production to prevent impacts of floods in the future? 1=Yes | 2=No  
a) If yes, what did you change? 1=Crop mix | 2=Cultivation techniques | 3= Location of farms | 4=Adopt/change irrigation | 5=Other, specify \_\_\_\_\_

- 63) These days, do you engage in (more) non-farm activities to reduce risks from future floods? 1=Yes | 2=No
- a) If yes, how (multiple options)? 1=Switch to new economic activities, specify \_\_\_\_\_ | 2=More household members engaged in economic activities | 3=Expand existing non-farm activities | 4=Other, specify \_\_\_\_\_
- 64) Does your household use migration as a way to reduce risks from future floods? 1=Yes | 2=No
- a) If yes, who migrated (multiple options)? 1=Household head migrated | 2=Other household member(s) migrated, specify relation to HH-Head, specify male/female + age \_\_\_\_\_ | 3=Yes, whole household migrated
- b) If yes, for what periods? 1=Short-term (<6 months) | 2=Longer-term (>6 months)
- c) If yes, where to? 1=Within region | 2=Other region, specify \_\_\_\_\_ | 3=Abroad, specify \_\_\_\_
- d) Was migration destination rural or urban? 1=Rural | 2=Urban
- 65) Do you know any households that have left? If yes, how many \_\_\_\_\_
- 66) Did you conduct rituals to prevent impacts of floods in the future? 1=Yes | 2=No
- a) If yes, what rituals? \_\_\_\_\_
- 67) Did you do anything else to prevent impacts of floods in the future? 1=Yes | 2=No
- a) If yes, what did you do? \_\_\_\_\_

*If no measures were taken at all to prevent flood impacts, skip next question.*

- 68) If preventive measures were taken, was it enough to avoid negative effects? 1=No, still severe negative effects | 2=No, still moderate negative effects | 3=Yes, it prevented negative effects | 4=Yes, it has even improved our situation
- a) Please explain:
- b) If 1 or 2, why were there still negative effects (multiple options)? 1=Measures were not enough | 2= Measures had costs | 3=Measured had negative effects in the long-term or | 4= other reason specify \_\_\_\_\_
- c) What made it difficult for you to adopt more effective prevention measures (multiple options)? 1=There was nothing we could do | 2=Lack of money (to do what?) | 3=Lack of skills/knowledge (to do what?) | 4=Lack of other resources (to do what?) | 5=No priority | 6=Not my task | 7=Other, specify \_\_\_\_\_

Please explain: (e.g., if "Lack of money", what would they have done with sufficient money?)

- 69) If no measures were taken, why not (multiple options)? 1=There was nothing we could do | 2=Lack of money (to do what?) | 3=Lack of skills/knowledge (to do what?) | 4=Lack of other resources (to do what?) | 5=No priority | 6=Not my task | 7=Other, specify
- a) Please explain:

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***COPING MEASURES*** – things people do to deal with the impacts of a flood that they have not been able to avoid through preventive measures

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- 70) Did your household do anything to deal with the impact of this flood (so *after* it occurred)? 1=Yes | 2=No
- a) If yes, what did you do? (e.g., change livelihood completely)
- 71) Did you ask for food, money, shelter from other people to deal with the impact of this flood? 1=Yes | 2=No
- a) If yes, to whom (multiple options)? 1=Relative | 2=Neighbour | 3=Friend | 4=Other, specify \_\_\_\_\_
- 72) Did you receive support from an organization to deal with flood? 1=Yes | 2=No
- a) If yes, from whom (multiple options)? 1=Government agency, specify \_\_\_\_\_ | 2=NGO, specify \_\_\_\_\_ | 3=Religious organization, specify \_\_\_\_\_ | 4=Other, specify \_\_\_\_\_
- 73) Did you or household members try to earn extra income to deal with the impact of this flood? 1=Yes | 2=No
- a) If yes, what did you do (multiple options)? 1=Intensified existing activities, specify \_\_\_\_\_ | 2=Engaged in new activities, specify \_\_\_\_\_
- 74) Did you or household members migrate (more) to deal with the impact of this flood? 1=Yes|2=No
- a) If yes, who migrated (multiple options)? 1=Household head | 2=Other household member(s) | 3=Whole household
- b) If yes, for what periods? 1=Short-term (<6 months) | 2=Longer-term (>6 months)
- c) If yes, where to? 1=Within district | 2=Other district, specify \_\_\_\_\_ | 3=Abroad, specify \_\_\_\_\_
- d) Was migration destination rural or urban? 1=Rural | 2=Urban
- 75) Did you sell properties to deal with the impact of this flood? 1=Yes | 2=No

- a) If yes, which properties (multiple options)? 1=Land | 2=Livestock | 3=House | 4=Productive assets, specify \_\_\_\_\_ 5=Means of transport, specify \_\_\_\_ | 6=Luxury items, specify \_\_\_\_\_ | 7=Other, specify \_\_\_\_\_
- 76) Did you try to spend less money to deal with the impact of this flood? 1=Yes | 2=No
- a) If yes, how (multiple options)? 1=Spent less on food items | 2=On school fees | 3=On healthcare | 4=On productive investments, specify\_\_\_\_\_ | 5=On house maintenance | 6=Other, specify\_\_\_\_\_
- 77) Did you modify food consumption to deal with the impact of this flood (multiple options)? 1=Yes | 2=No
- a) If yes, how (multiple options)? 1=Bought less expensive foods | 2=Limit portion sizes | 3=Reduce number of meals per day | 4=Adults ate less so children could eat | 5=Less people eating at home | 6=Other, specify\_\_\_\_\_
- 78) Did you do anything else to deal with the impact of this flood? 1=Yes | 2=No
- a) If yes, specify (e.g., loans) \_\_\_\_\_

*If no measures were taken to deal with flood impacts, skip next question*

- 79) If measures were taken to deal with flood impacts, were these enough to avoid negative effects? 1=No, still severe negative effects | 2=No, still moderate negative effects | 3=Yes, it allows us to carry on | 4=Yes, it has even improved our situation
- a) Please explain:
- b) If 1 or 2, why were there still negative effects (multiple options)? 1=Measures were not enough | 2= Measures had costs | 3=Measured had negative effects in the long-term or | 4= other reason specify \_\_\_\_\_
- c) What made it difficult for you to adopt more effective measures (multiple options)? 1=There was nothing we could do | 2=Lack of money (to do what?) | 3=Lack of skills/knowledge (to do what?) | 4=Lack of other resources (to do what?) | 5=No priority | 6=Not my task | 7=Other, specify
- Please explain:
- 80) If no measures were taken, why not (multiple options)? 1=There was nothing we could do | 2=Lack of money (to do what?) | 3=Lack of skills/knowledge (to do what?) | 4=Lack of other resources (to do what?) | 5=No priority | 6=Not my task | 7=Other, specify
- a) Please explain:

**3. Vulnerability, gender and policy**

81) Do you feel that your household is more or less likely to suffer from the impacts of floods than other households in your community? 1=More | 2=Average | 3=Less

a. Why?

82) Do you think that the impacts of floods affect women differently than men? 1=Yes | 2=No

a) Please explain. (e.g., labour time collecting fuelwood, fodder, and water)

83) Do you think men and women play different roles in dealing with floods? 1=Yes | 2=No

a) Please explain.

84) Do you think that the impacts of floods affect children differently than adults? 1=Yes | 2=No

a) Please explain.

85) What do you think the government or other organizations could do to reduce the impacts of this climate threat?

## Appendix 3: Focus group discussions

Group type	Place	Date	Number of participants
Mixed	Jogidaha VDC	14 December 2012	9
Mixed	Hadiya VDC	17 December 2012	7
Women	Jogidaha VDC	18 December 2012	17
Mixed	Jogidaha VDC	21 December 2012	9
Forest users	Jogidaha VDC	23 December 2012	30
Women	Hadiya VDC	27 December 2012	9
Mixed	Hadiya VDC	27 December 2012	11
NGO staff*	Gaighat	29 December 2012	12

\* Participants of the focus group with NGO staff are listed below

### Focus group discussion with Udayapur District NGO staff

Location: Gaighat

Date: December 29, 2012

Participant	Affiliation
<b>Chandeshwor Shrestha</b>	Chairperson, Pancahwati Rural Development Centre (PRDC); District Chairman, FEDWASUN
<b>Ram Basnet</b>	Local Development Forum
<b>Durgananda Chaudhary</b>	Nabha Prabhat
<b>Khim Rag Guragai</b>	Nepal Red Cross Society, Udayapur District
<b>Janak Giri</b>	Executive Director, PRDC
<b>Yub Raj Parajuli</b>	
<b>Ms. Sunita Chaudhary</b>	REFLECT facilitator Community Worker, Sundarpur VDC
<b>Khum Raj Gaire</b>	Sub-Engineer, District Development Office
<b>Belu Sundas</b>	WatSan Programme
<b>Shailesh Basnet</b>	Prayas Nepal NGO
<b>Ms. Gita Phuyal</b>	FACT Nepal / PAF
<b>Narayan Pokhrel</b>	Disaster Risk Reduction Program Manager, Nepal Red Cross Society, Udayapur

## Appendix 4: Expert interviews

Dates: 12.18.12 - 12.30.12

Location: Gaighat, Udayapur District

<b>Interviewee</b>	<b>Affiliation</b>
<b>Gopal Kumar Adhikari</b>	Local Development Officer, District Development Committee (DDC)
<b>K.P. Baral</b>	District Secretary, Unified Communist Party-Maoist (UCMN-Maoist)
<b>Bishwojit Rai</b>	Information Officer, District Development Committee (DDC)
<b>Puskar Pokhrel</b>	Divisional Engineer, District Technical Office
<b>Ram Chandra Bhusal</b>	veterinarian, District Livestock Service Office (DLSO)
<b>Sudip Chhatkuli</b>	Officer, Udayapur District Forest Office
<b>Netra Regmi</b>	Officer, Udayapur District Forest Office
<b>Surya Narayan Chaudhary</b>	District Soil Conservation Office
<b>Bijaya Kumar Yadav</b>	Civil engineer, District Irrigation Office

## **The Loss and Damage in Vulnerable Countries Initiative**

Accepting the reality of unmitigated climate change, the UNFCCC negotiations have raised the profile of the issue of loss & damage to adverse climate impacts. At COP-16, Parties created a Work Programme on Loss and Damage under the Subsidiary Body on Implementation (SBI). The goal of this work programme is to increase awareness among delegates, assess the exposure of countries to loss and damage, explore a range of activities that may be appropriate to address loss and damage in vulnerable countries, and identify in which ways the UNFCCC process might help countries avoid and reduce loss and damage associated with climate change.

The “Loss and Damage in Vulnerable Countries Initiative” supports the Government of Bangladesh and the Least Developed Countries to call for action of the international community.

The Initiative is supplied by a consortium of organisations including: Germanwatch, Munich Climate Insurance Initiative, United Nations University Institute for Environment and Human Security (UNU-EHS), and the International Centre for Climate Change and Development (ICCCAD).

More info: [www.loss-and-damage.net](http://www.loss-and-damage.net)

## **United Nations University Institute for Environment and Human Security**

The UN University (UNU), established by the U.N. General Assembly in 1973, is an international community of scholars engaged in research, advanced training and the dissemination of knowledge related to pressing global problems. The University operates a worldwide network of research and post-graduate training centres, with headquarters in Tokyo. UNU created the Institute for Environment and Human Security (UNU-EHS) to address and manage risks and vulnerabilities that are the consequence of complex - both acute and latent - environmental hazards including climate change - which may affect sustainable development. It aims to improve the in-depth understanding of the cause effect relationships to find possible ways to reduce risks and vulnerabilities. The Institute aims to establish cutting edge research on climate change and foster an internationally renowned cohort of up-and-coming academics. Based on the research-to-policy mandate of the UNU, UNU-EHS supports policy processes such as the UNISDR (disaster risk reduction), UNFCCC (climate change) and others, as well as national governments across the world with authoritative research and information.

More info: [www.ehs.unu.edu](http://www.ehs.unu.edu)

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