



The benefits of being prepared

Impact, benefits, costs and outlook of disaster risk reduction in Nepal



Abbreviations

AAL	Annual avoided losses	DUDBC	Department of Urban Development and Building Construction
ACT	Assessment and Coordination Team	ECHO	European Union Humanitarian Office
AHL	Avoided hazard losses	EPR	Emergency Preparedness and Response (<i>programme</i>)
APR	Annual probability rate	EWS	Early warning system
BCR	Benefit-cost ratio	FCHV	Female Community Health Volunteer
CBA	Cost-benefit analysis	GoN	Government of Nepal
CBERT	Community-based Emergency Response Team	GIS	Geographic information system
CDMC	Community Disaster Management Committee	IFRC	International Federation of Red Cross and Red Crescent Societies
CDO	Chief Development Officer	IRA	Initial rapid assessment
CORE	Community Resilience (<i>programme</i>)	LDMC	Local Disaster Management Committee
CS	Case study	LDRMP	Local Disaster Risk Management Plan
DAO	District Administration Office	MoHA	Ministry of Home Affairs
DDMC	District Disaster Management Committee	NGO	Non-government organisation
DDRT	District Disaster Response Team	NRCS	Nepal Red Cross Society
DEOC	District Emergency Operations Centre	PHAST	Participatory Hygiene and Sanitation Transformation
DfID	Department for International Development	RJKS	Radha Krishna Tharu Sewa Kendra (Nepali NGO)
DLSA	District Lead Support Agency	SMS	Short message service
DipECHO	Disaster Preparedness ECHO programme	UNDP	United Nations Development Program
DP	Disaster preparedness	VDC	Village Development Committee
DPDRR	Disaster preparedness and disaster risk reduction (<i>programme, DipECHO-funded</i>)	WASH	Water, sanitation and hygiene
DRC	Danish Red Cross		
DRM	Disaster risk management		
DRR	Disaster risk reduction		

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Community review meeting in Lamjung (Danish Red Cross)

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We hope this has been a constructive and helpful process for all concerned and that this report is an accurate reflection of the programme. Any errors rest with the review consultants.

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Executive summary

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For many years, disaster risk reduction (DRR) has been a central feature of the partnership between Nepal Red Cross Society (NRCS) and Danish Red Cross (DRC). This study looks at the impact and cost-effectiveness of these efforts, analyses what worked well and why, and recommends priority actions for future programming.

It finds that target communities are at lower risk than they had been, thanks to a mix of improved early warning, mitigation, community action and adoption of household preparedness measures. Quantifiable benefits exceed costs between 2.6 and 16.6 times.

While these results compare well with other cost-benefit studies, concerns over sustainability are identified that require attention - particularly in the context of Nepal's administrative re-structuring.

Based on field research in eight communities in the Terai districts of Bardiya and Banke as well as the Hills district of Lamjung, the study triangulates the results of a household survey, focus group discussions with NRCS volunteers and 'regular' villagers, key informant interviews, as well as a review of earlier studies and project documents. To assess impact, it elicits counterfactuals by combining historical evidence with community estimates. While common in similar studies, the significant uncertainties mean that results must be read as approximations.

Meanwhile, the study approach traces the logic of DRR: did **inputs** (e.g training) lead to **outputs** (e.g. awareness) and on to **outcomes** (e.g. adoption of actions) and **impact** (e.g. a reduction in hazard damages and losses)? The investigation thus not only reveals what worked, but - perhaps more importantly - also why (or why not).

The context for combatting risk

Two distinct settings were selected for the study:

Lamjung is a hilly district close to Nepal's geographic centre. Between 2012 and 2017, the small and scattered communities visited for the study had been supported through the Community Resilience (CORE) programme, an effort that combined DRR with water and sanitation interventions. While CORE focussed on floods as the main hazard, the impact of the 2015 earthquake highlighted the need for multi-hazard preparedness.

The Terai districts of **Bardiya** and **Banke** in the country's southwest meanwhile suffered little from the earthquake, but are exposed to a far greater risk of flooding. The significantly larger communities here were supported by several projects with a narrower focus on DRR (in particular on early warning regimes) - notably by the Dipecho 8 project of 2015-16.

Benefits and costs

Despite these contextual differences, there is a common finding across all five communities analysed in case studies: the identified benefits of the programmes exceed the costs several times.

In **Bardiya** and **Banke**, the *materialised* benefits are already more than two times greater than programme costs. Here, the benefits of **early warning** became evident: especially where it allows for the timely evacuation of livestock, as in Dhadhwar, there are substantial benefits in terms of avoiding both direct and indirect hazard losses.

In **Lamjung**, the **mitigation** measures supported by the CORE programme were seen as highly effective, and avoided losses attributed to mitigation account for the majority of all quantifiable benefits. Here, the study identifies significant direct economic benefits of CORE activities related to water and sanitation.

Beyond the benefits of early warning and mitigation, this study demonstrates the strong role of **household and community preparedness**: in Bardiya and Banke, high adoption rates of basic household preparedness measures are in fact seen as the primary factor in loss reduction.

In **summary**, the study is in line with other cost-benefit analysis in showing that funds invested in DRR yield much higher returns (albeit benefit-cost ratios (BCR) vary substantially).

In fact, the greater frequency of severe weather events and increased variability of precipitation that come as key manifestations of climate change (not accounted for in BCR calculations) as well as the several non-quantifiable benefits mean that the 'true' ratio between benefits and costs is even greater than the identified benefit-cost ratios of 2.6 to 16.6.

What works well, and why

The strong adoption of **household preparedness** measures is seen as a result of three factors - *first*, effective awareness-raising by Red Cross volunteers, *second*, critical mass as a proportion of the overall village population, and, *third*, recent personal experiences of major hazards (93.8% of survey respondents said they recognised the value of being prepared more in the aftermath of disasters). Somewhat overlapping with the third factor is a high frequency of natural hazards.

In sum, the promotion of household preparedness tends to be most effective in the initial years after a disaster, and where critical mass of early adopters can be quickly attained (favouring smaller communities). With only a quarter (25.1%) of respondents ever having participated in a drill, efforts towards broader inclusion of whole communities are worth strengthening.

The analysis of **early warning systems** in Banke and Bardiya shows that on their own, both the traditional early warning system ('*chowkedar*') and the government SMS alert system have their gaps - less than half the population (41.8%) were reached by either system in 2014. Complementing these systems with NRCS volunteers spreading messages via megaphones, as supported by the project, meant that almost three quarters (74.1%) were reached. Ensuring that equipment works and that volunteers can be quickly mobilised is therefore seen as a factor of success.

Almost two thirds (65.8%) of those who were reached in 2017 took at least one action - and almost all survey respondents who did perceived losses to be lower than they would have been otherwise.

In terms of **mitigation measures**, the study shows that while the assessed interventions in Lamjung were effective in reducing hazard exposure to very low levels (72.1% of respondents see their assets protected by some measure, almost all of whom recognise protective benefits), two aspects will require further attention in future: this includes a more thorough assessment of all environmental and man-made risks as well as more robust and durable engineering solutions. Where requirements exceed the capacities of NRCS and projects, collaboration with authorities towards more durable solutions shall be sought.

Underpinning efforts in early warning, awareness-raising and risk mitigation, the availability of well-trained **volunteer teams** is also critical in terms of preparedness for response. In the smaller communities of Lamjung, these were more visible and better known than in the Terai. Linked to the Community Disaster Management Committees (CDMC), trained volunteers (First Aid, Search & Rescue) were deployed during recent disasters; the technical skills and quality of their assistance was reported as improved. Meanwhile, the quest to sustain these skills beyond external support is recognised as a challenge.

Coordination has improved in many ways, partly as a result of the projects. This includes better collaboration with other district-level agencies and the adoption of a culture of coordination and more pro-active planning (particularly in Banke and Bardiya). Strengthened District Emergency Operations Centres (DEOC) played a critical role in this context.

A rocky road ahead

The achievements of past DRR interventions are commendable and worth maintaining - yet, multiple challenges lie ahead.

First, the ongoing administrative changes mean that many structures and their capacities will need to be transferred to newly established (or yet to be created) entities at the local and municipal levels. Nepal Red Cross Society and Partner National Societies should aim to facilitate this process.

Second, while longer-term commitments of NRCS district chapters are limited, it appears critical that support continues to be provided to lower-level units - in particular to maintain volunteer skill levels and to sustain sub-chapter capacities more generally.

Third, the study identifies a concern that in areas of lower hazard frequency, as in Lamjung, it is more difficult to engage actors in pro-active planning.

Yet, as the study demonstrates, engaging in disaster preparedness and risk reduction bears merit. In light of the strong benefits of DRR, it is worth addressing the challenges to ensure that the risk of local communities is kept at lower levels and reduced further.

Introduction

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Disasters damage, destroy, kill. To the people in Nepal, the 27th of April 2015 brought a devastating reminder of disasters' potential: the magnitude 7.8 earthquake on that day claimed 9,000 lives, injured 22,000, and caused millions of Dollars in economic damages.

The threat disasters pose to lives and livelihoods is nothing new. The INFORM index places Nepal in the 'high' category of countries at risk of humanitarian crises and disasters.¹ In the face of growing urbanisation and population, climate change and extensive poverty, there are little signs of change.

But while nothing can be done to reduce the severity and frequency of natural hazards - such as earthquakes, floods and storms - there are ways to mitigate risk, promote preparedness, and facilitate broader resilience of communities - helping them to be less affected in the first place, and to better cope and recover more quickly in the second.

For many years, Nepal Red Cross Society (NRCS) has been involved in the implementation of such disaster risk reduction (DRR) programmes, several of which have been supported by Danish Red Cross (DRC). With its extensive network of chapters and sub-chapters, NRCS is one of the few organisations in the country able to engage in disaster preparedness and DRR - from the national level to its cadres of trained volunteers in communities.

This study seeks to assess the difference that DRR made: were project-supported communities in fact better prepared, and to what extent? If so, what was the impact in terms of avoided damages and losses? Finally, to what extent did the benefits justify the project costs?

While seeking to learn from past experience (what worked well and why, what did not?) to inform future programming, the study aims to add evidence to the growing literature of impact and cost-benefit analysis (CBA) of disaster risk reduction.

Using a mixed-method research design, the study looks at project-supported communities in two areas - one that was affected by the 2015 earthquake (Lamjung) and another affected by severe floods in 2017 (Bardiya and Banke). The study also builds on previous reviews conducted by DRC, aiming to consolidate and enhance learning. Ultimately, it is hoped that this study will assist humanitarian agencies and donors in the planning and prioritisation of future pre-disaster interventions in Nepal and elsewhere.

The report is structured in three sections.

Section A provides the background. It starts with a review of existing literature and the study purpose (*chapter 1*), describes the local context by introducing the two disasters and the several DRR programmes (*chapter 2*), and provides the overview of the research design (*chapter 3*). **Section B** contains the findings, looking first at the flood-affected districts of Bardiya and Banke (*chapter 4*), then at the earthquake-affected district of Lamjung (*chapter 5*), and finally at the national level (*chapter 6*). The final **section C** summarises success factors and challenges (*chapter 7*), provides recommendations (*chapter 8*) and ends with concluding remarks (*chapter 9*).

While the report is kept in a concise format, further information is provided in the **appendix**. This includes the results of the household survey (*appendix A*), the underpinning calculations and methods of the cost-benefit analysis (*appendix B*), and a case study that is particularly rich in learning (*appendix C*).

1. See <http://www.inform-index.org/Results/Global>



Section A | Background

1. Adding evidence: the purpose of this study

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Over recent years, several studies have analysed the impact as well as the costs and benefits of disaster risk reduction (DRR). Focussing on efforts by Nepal Red Cross Society and Danish Red Cross in Nepal, this study aims to complement this body of literature - adding evidence and insights that are to benefit future programming as well as advocacy to donors and practitioners.

The terms of reference describe the purpose as follows: “Assess and document the impact of investments in disaster preparedness (DP) and disaster risk reduction (DRR) capacity building in Nepal, with a focus on how Nepal Red Cross pre-disaster planning and preparedness made a difference in reducing the impacts during recent disasters, including the 2015 earthquakes and floods and landslides in 2016 and 2017.”

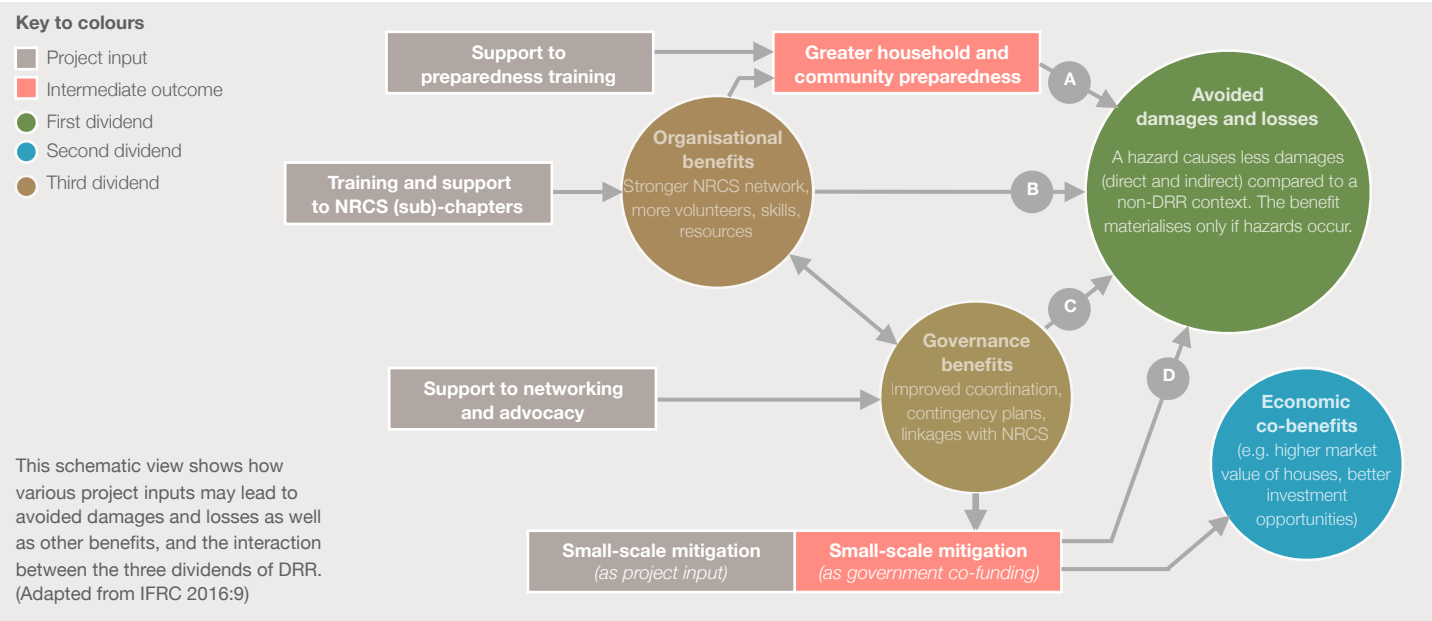
In this chapter, let us briefly reflect on the mechanisms as to how DRR *can* make a difference (*part* 1.1), then review some of the key studies on DRR impact and cost-benefit analysis (1.2), and conclude with particular issues that this study seeks to address (1.3).

1.1 Potential impact of DRR: underlying mechanisms

The primary objective (and thus, the intended impact) of DRR is the reduction of hazard-related damages and losses. Preventing deaths and injuries, reducing direct economic losses², and keeping indirect losses³ at a minimum to enable a swift recovery of affected communities are included in this category. A 2015 paper by the Overseas Development Institute (see ODI 2015) that coined the term of the ‘triple dividend’ of DRR subsumes such avoided damages and losses as the **‘first dividend’** - benefits that materialise only if and when a community is struck by a hazard.

2. **Direct losses** refer to those immediately encountered in the aftermath of a hazard: this may include damages to or losses of houses, assets (e.g. livestock, machinery, vehicles) and agricultural harvest, as well as physical harm (deaths, injuries).
3. **Indirect losses** meanwhile refer to losses encountered over the long term as the result of direct losses. This may include for instance income losses due to lost machinery, milk cows, perennial plants, or injuries and related disability.

Fig 1 | Underlying mechanisms to avoided losses and co-benefits of DRR



4. Cost-benefit analysis (CBA) is a well-established tool amongst economists to help make decisions as to whether a proposed investment shall be pursued or not (*ex ante*). In the development context, CBAs are also used to assess efficiency of past and present programmes (*ex post*).

The basic idea is simple: Identify and quantify all expected and witnessed benefits (B) as well as all related costs (C) and then divide B/C to calculate the benefit-cost ratio (BCR). Generally, where the benefits exceed the costs (B > C and thus BCR > 1.0), there is a positive benefit-cost ratio and thus a case for the suggested or implemented intervention. (Mechler 2009:1).

What sounds simple in theory is more difficult in practice - and the CBA approach has several limitations: **First**, it generally looks at costs and benefits rather than at their distribution. To identify the distribution of benefits (e.g. who were the winners and the losers?), other qualitative methods need to be added. **Second**, CBAs face difficulties in assessing non-market impacts such as those on health and the environment. **Third**, since a CBA involves estimates, the usefulness and robustness generally decreases as time and scale increases (Mechler 2008:7). Generally, cost-benefit analysis must be understood as an approximation rather than an expression of the exact economic value of a given investment.

As the ODI paper points out, there are however other potential benefits of DRR that may materialise irrespective of hazard events: this includes economic co-benefits such as higher values of houses protected by mitigation measures (**second dividend**) as well as organisational or governance benefits such as generally improved coordination and public affairs (**third dividend**).

When analysing the overall impact of DRR, it is prudent to review the underlying mechanisms. While this may not be relevant if we were to exclusively look at impact and benefit-cost ratios (BCR), it renders the analysis more insightful in terms of what worked, and what did not. We should therefore keep four key questions in mind:

- What were the initial **inputs** by a project (costs and activities), and to what extent were they relevant and aligned coherently?
- To what extent did they lead to expected **outputs** - for instance, to what extent did household preparedness training increase knowledge of DP measures?
- To what extent did outputs lead to **outcomes** (to stay with our example, did knowledge translate to the actual adoption of DP measures)?
- Finally, to what extent did outcomes make a difference in terms of **impact**? In other words, did adoption of preparedness measures lead to avoided damages and losses and/or other impact?

1.2 Existing literature

While the body of evidence on the impact of DRR is extremely rich and cannot be summarised here, there are far fewer studies that also include cost-benefit analysis (CBA) - thus addressing the question on the ratio between investments (costs) and their return (benefits).⁴

Most of cost-benefit analyses of DRR focus on avoided losses that can be attributed to mitigation measures - such as dams and canals. Entitled “does mitigation save?”, a review of 25 such studies showed generally positive benefit-cost ratios while also dismantling the regularly cited myth of a generally applicable BCR (Shreve and Kelman: 2014). In fact, the overview shows a wide range of benefit-cost ratios (from 1.3 to 1,800). These are not only dependent on the respective mitigation measures, but also on the methods each study applied (e.g. various time horizons, discount rates, assumptions, and methods of calculation).

Most of these studies have at least two conceptual shortcomings: **first**, they do not analyse the benefits of improved disaster preparedness as such (at household and community level). However, many DRR projects are built around the assumption that a household who is well-prepared will encounter less losses in the event of a hazard.

Second, studies overlook the second and third dividends that may materialise irrespective of hazard events.

Amongst the recent CBA studies published by IFRC (see fig. 2), only the most recent one on DRR in Georgia went beyond assessing the ‘first dividend’ of mitigation - incorporating the ‘first dividend’ of household preparedness as well as organisational benefits into the BCR calculation. The analysis of three case studies in the Georgia report suggest that identified organisational benefits are valued at 5-10% of avoided losses - and thus comparatively minor. Meanwhile, it can be reasonably deducted that preparedness as such accounts for 20-40% of avoided losses - a rather high share considering that the local context in Georgia did not include early warning systems.

The overview of five studies⁵ by the IFRC furthermore confirms the wide range of benefit-cost ratios (in line with the paper by Shreve and Kelman). The cross-study comparison indicates that benefit-cost ratios are highest where DRR efforts are designed to protect **both** lives and livelihoods - in particular in contexts where significant indirect losses are usually experienced (and hence, avoided with DRR) in the aftermath of a disaster.⁶

1.3 Adding evidence

The present study seeks to complement existing evidence in three ways. **First**, it represents the only the second CBA of Red Cross/Red Crescent DRR programming in Nepal. As such, it is an opportunity to assess what worked how and why - and thus support the design of future programming.

Second, the 2015 earthquake (Lamjung) and recent floods in 2017 (in Bardiya and Banke) as well as somewhat comparable floods in 2014 allow the assessment of *materialised* (rather than just *expected*) benefits: to what extent did communities already benefit from DRR, and are likely to do so in the future? **Third**, the study seeks to follow the expanded focus of the Georgia study by adding evidence not just on the benefits of mitigation, but also of general preparedness amongst communities and households, as well as of the early warning systems (EWS) that were improved with the support of NRCS programmes and others.

Fig. 2 | Overview of IFRC cost-benefit analyses on DRR

<p>Nepal 2008 “Cost benefit analysis”</p> <p>The study included benefits from mitigation, small income-generating loans, First Aid, and the protection of water sources. The benefits attributed to mitigation were by far the greatest amongst those identified (96%).</p>	<p>Context: DRR in Ilam district, Nepal, 2001 - 2008 Hazards: River floods, landslides Included benefits: Avoided damages/losses, economic and environmental benefits Time horizon: 15 years Discount rate: 10.0% Range of benefit cost-ratios: A uniform BCR of 18.9 was identified across the area of analysis</p>
<p>Vietnam 2011 “Breaking the waves”</p> <p>Looking at afforestation (mangroves and casuarina trees along the coast, bamboo along river banks) as a mitigation measure, the study found high protective benefits that on their own exceeded respective costs and also identified strong direct economic and ecological benefits (mainly for mangroves).</p>	<p>Context: A coastal afforestation programme in northern Vietnam, 1994 - 2010 Hazards: Typhoons/storms, coastal floods, river floods Included benefits: Avoided damages/losses, economic and environmental benefits Time horizon: 15 years Discount rate: 7.0% Range of benefit cost-ratios: Between 3.1 and 68.9 (avoided losses and economic benefits only), and up to 105.0 with environmental benefits included</p>
<p>Bangladesh 2012 “The long road to resilience”</p> <p>The study identified positive but low BCRs for all four case studies and noted that when discounting the economic benefits of hybrid seeds, BCRs would be below 1.0 for two of the four cases.</p>	<p>Context: A DRR and livelihood programme in Bangladesh, 2005 - 2011 Hazards: River floods, erosion, storms Included benefits: Avoided damages/losses (of mitigation), economic benefits (of hybrid seed distribution) Time horizon: 15 years Discount rate: 7% Range of benefit cost-ratios: Between 3.0 and 4.9 (avoided losses and economic benefits).</p>
<p>Tajikistan 2015 “Managing mudflows”</p> <p>The three case studies analysed the benefits of various measures - a wall to protect a village and adjacent plantations from rock falls (case study (CS) 1), the reinforcement of a mudflow canal (CS2) and of a drainage system to prevent flooding (CS3).</p>	<p>Context: Several DRR projects in rural parts of Tajikistan, 2003-2015 Hazards: Mudflows, floods, rock falls Included benefits: Avoided damages/losses (of mitigation) Time horizon: 25 years (CS1+3), 20 years (CS 2) Discount rate: 5% Range of benefit cost-ratios: 87.4 (CS 1, which included protection of fruit tree plantations), 6.2 (CS 2), 13.3 (CS 3)</p>
<p>Georgia 2016 “How preparedness pays off”</p> <p>This study was the first amongst IFRC CBAs that incorporated the benefits of mere preparedness (household/community-level) in terms of avoided losses. It added the organisational co-benefits into the calculation by monetising the additional volunteer hours at the Red Cross.</p>	<p>Context: Several DRR projects of mountainous rural areas in Georgia, 2010-15 Hazards: River floods Included benefits: Organisational co-benefits Time horizon: 15 years Discount rate: 5% (losses/damages) and 15% (organisational co-benefits) Range of benefit cost-ratios: 22.6 (CS 1), 12.5 (CS 2), 54.5 (CS 3 that included mitigation)</p>

5. As a disclaimer, it should be noted that one of the co-authors of this report also (co)-authored the last four IFRC studies.

6. For instance, shrimp farmers and owners of fish ponds in Vietnam and fruit tree farmers in Tajikistan were found to benefit greatly from DRR, given that it would take them years to recover and re-establish their businesses.

2. Disasters and interventions: the local context

Having discussed the study's conceptual purpose, let us move to Nepal. With its combination of rough topography, steep slopes, active seismic zones and intense impact of monsoon rains, the country is extremely hazard-prone - and affected by earthquakes, floods, landslides, windstorms, hailstorms, fire, glacial lake outburst floods, and avalanches.

There have been close to 15,500 events of large, medium, and small-scale disasters in Nepal between 1971 and 2007 - directly affecting almost five million people, taking more than 27,000 lives, and destroying or damaging almost 350,000 homes. As effects of climate change become more pronounced through increased seasonal variability and extreme weather events, Nepal is among those countries that will be most severely affected by its impacts. Changing frequency and magnitude of flood and drought events is already impacting Nepal's vulnerable people.

2.1 The disasters

This study focuses on two recent disasters: **first**, the 2017 floods, which affected many districts across Nepal, including communities and districts supported through NRCS disaster management capacity building programmes in Banke and Bardiya, and **second**, the 2015 earthquake and how this affected communities supported by the Community Resilience Programme (CORE) in the hill district of Lamjung. The two disasters are described in *fig. 3 below*.

Fig 3 | The two 'reference' disasters

Banke and Bardiya - 2017 floods

Nepal was hit by incessant torrential rains for two days starting from 11 August 2017, which affected 91,396 families (NRCS figures, 2017). A total of 160 people were reported dead, 29 missing and 46 injured (Ministry of Home Affairs, 2017).

Flooding was reported in 35 of the country's 75 districts. Banke and Bardiya districts, where Disaster Emergency Operations Centres (DEOC) were being strengthened by Nepal Red Cross, were reported to be among the most affected districts.

This was the third flood to hit some areas in the space of four years. The 2017 review of NRCS support to DEOCs recorded almost 65,000 destroyed and 460,000 displaced persons. There were substantial impacts on livelihoods, food security and nutrition due to loss of assets, housing, infrastructure, water and sanitation, food stocks and agricultural production.

The flood damaged roads and submerged railways, caused widespread power outages (cutting off access and contact to several communities), and severely damaged crops. Public health facilities (including 39 public hospitals, 109 primary health care centres and 1,554 health posts) were affected, and the flood significantly impacted education, destroying 80 schools across 28 districts, and damaging 710 more.

Lamjung - 2015 earthquake

On 25th April, a 7.8 magnitude earthquake struck Nepal with an epicentre located 80 km northwest of Kathmandu and 68 km east of Pokhara. Thousands of aftershocks and another powerful quake on 12th May (measuring 7.3 in magnitude) hit areas already affected by the earthquake twelve days earlier. The two earthquakes resulted in thousands of casualties, tens of thousands were injured and hundreds of thousands were displaced from their homes.

The earthquake also caused massive destruction and damage to infrastructure, including hospitals, health posts, houses, roads, lifelines, livelihoods and water systems leading to a drastic reduction in living conditions, income, and access to basic services of affected populations.

Of the 75 districts in Nepal, 14 were classified as severely affected (labelled as Category 'A' districts) and 9 were less affected (labelled as Category 'B' districts), despite large local variations across the districts.

Lamjung was originally classified as a Category A district, but was reclassified to Category B, despite the eastern parts close to the epicentre having suffered high levels of damage.

Despite this, the presence of the CORE project team in Lamjung, and Tanahun, was a major factor in DRC extensively supporting recovery programming in these two districts.

Fig. 4 | Timeline and coverage of considered DRR programmes

	2012	2013	2014	2015	2016	2017	2018
Hills area		CORE (07.2012 - 03.2017) Lamjung and Tanahun districts					
Terai area			EPR (01.2014 - 04.2017) 15 districts in Mid-Western Region, incl. Bardiya and Banke				
National level				DipECHO 8 (03.15 - 10.16) 6 VDCs in Bardiya, Banke, and Dang districts		DPDRR (05.17 - 10.18) Focus on Far/Mid-west, incl. Banke and Bardiya	

2.2 The interventions

Four DRR programmes are considered in this study, all of which have been implemented by Nepal Red Cross with Danish Red Cross support. Figure 4 above shows the timeline and coverage of these pro-grammes, each of which is described further below:

- **CORE:** *Community Resilience Programme*
- **EPR:** *Emergency Preparedness and Response Programme*
- **DipECHO 8:** *Delivering improved emergency preparedness and response in Nepal through enhanced partnership between the Red Cross and the Government of Nepal*
- **DPDRR:** *Enhancing preparedness for emergency response through stronger national systems in Nepal with particular focus on Far-western and Mid-western Regions.*⁷

2.2.1 CORE: Nepal Red Cross Community Resilience programme

Nepal Red Cross Society and Danish Red Cross (together with Australian Red Cross as a supporting partner) designed a four-year 'integrated programme' to improve the health and safety of the target population. CORE targeted two geographical areas, the districts of Lamjung and Tanahun - both in the Western Development region of Nepal. In both areas, NRCS oriented its action with an integrated development approach to improve the resilience of 90 wards (communities) across ten selected Village Development Committees (VDCs) – six in Lamjung and four in Tanahun.

The programme set up 90 Community Disaster Management Committees (CDMCs)⁸ to support the formulation and implementation of disaster management plans that led to the construction of 26 flood and landslide mitigation schemes. This was accompanied by the development of 90 PHAST⁹ plans, which included awareness-raising and construction or rehabilitation of 1,282 latrines and 36 drinking water schemes.

Complementing the community-level engagement, there were activities to reinforce the disaster preparedness and volunteer management capacity of the two Nepal Red Cross district chapters. CORE furthermore supported NRCS in piloting community-based early warning systems under a partnership with national agencies.

2.2.2 EPR: Nepal Red Cross Emergency Preparedness and Response programme

At a time when government policies and structures at all levels were being comprehensively revised, the EPR programme covered wider issues within Nepal's disaster management system, harnessing new opportunities for NRCS to engage.

In particular, EPR harmonised training curricula¹⁰ and then rolled out training and capacity-building efforts in addition to basic emergency preparedness support in all 15 districts of the Mid-Western Development Region. EPR pursued an integrated approach to capacity strengthening across the core competency areas of disaster preparedness, response, and health in emergencies.

7. Given the ongoing implementation of the DPDRR programme, this study paid less attention in terms of impact but considered it as an intervening factor.

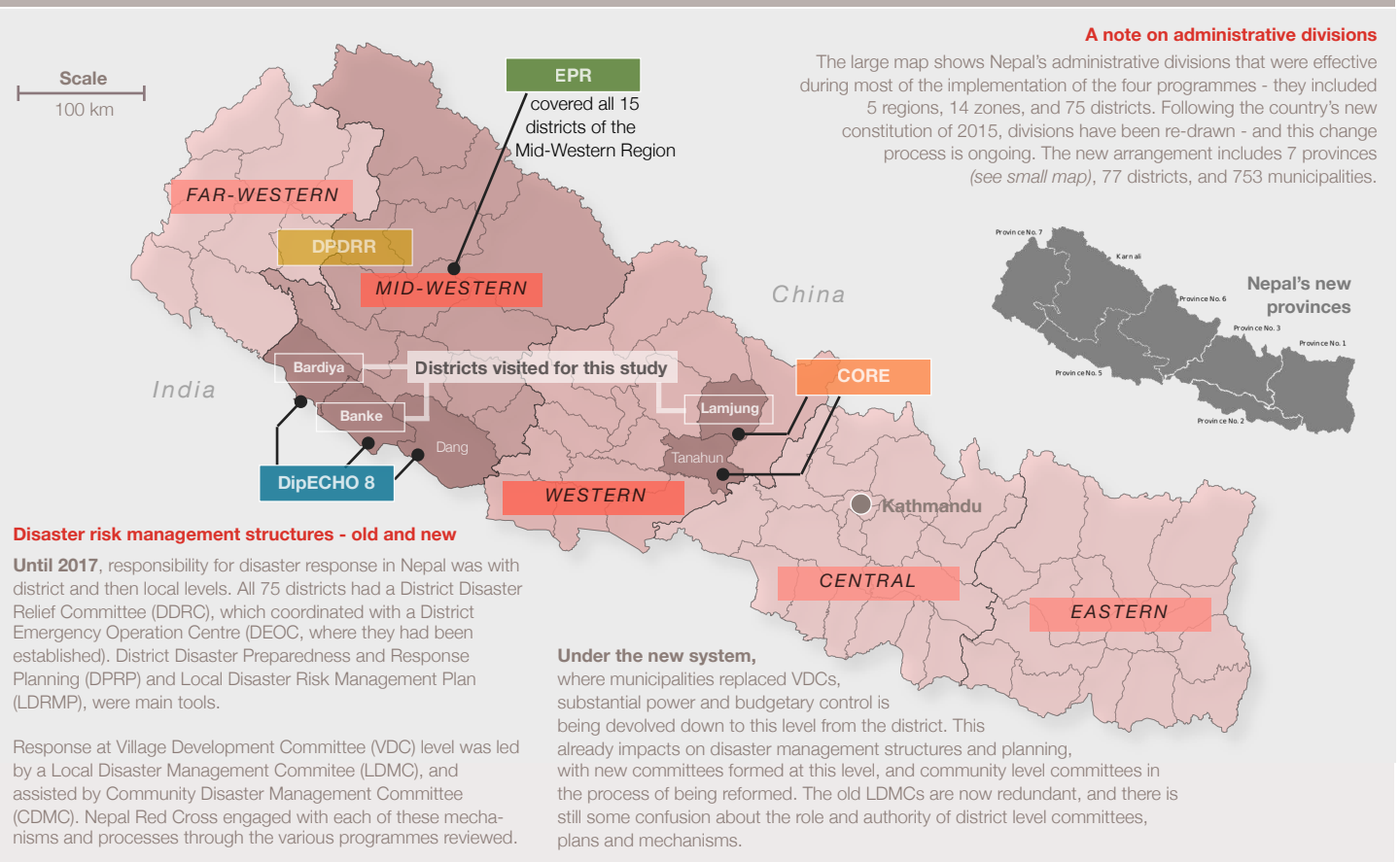
8. The CDMDC is a government structure, but NRCS and other organisations have supported their set-up and capacity building.

9. PHAST stands for 'Participatory Hygiene and Sanitation Transformation' - this is a participatory learning approach that seeks to empower communities to improve hygiene behaviours, reduce diarrhoea and encourage effective community management of water and sanitation services.

10. EPR developed a new standard volunteer training curriculum with three successive levels:

- Level A: Community-Based Emergency Response Teams (CBERT)
- Level B: District Disaster Response Teams (DDRT)
- Level C: Specialised DDRT

Fig. 5 | Map of Nepal with programme locations



11. The DipECHO programme featured three expected results:

Result 1: National-level Assessment and Coordination Team (ACT) roster established and functional (targeting 40 roster members ready for deployment by project end).

Result 2: Target districts and communities have increased capacity to monitor, prepare for, and respond to natural disasters (61,000 individuals and 66 organisations across three districts).

Result 3: Roles and responsibilities of national and district governments in shelter cluster coordination clarified and functional

12. The DPDRR result areas are:

1. The National Assessment and Coordination Team (ACT) Mechanism is further institutionalised through the consolidation of the roster, its coordination structures and deployment systems.

2. DDRC and DEOC increase their readiness for response as per their roles + responsibilities in 5 districts.

3. Cluster mechanism upgrades its shelter partners' capacities (including private sector and civil society) in coordination, information sharing and working in partnership for an effective and appropriate response.

The programme sought to balance community-based disaster risk reduction activities, (such as Search & Rescue training and support to CDMCs) with support to Village Development Committees (the lowest level of government at the time) in the form of planning support and emergency funds. In turn, this activity was linked to district-level health and disaster management interventions, including support to planning and training, and to capacity building of NRCS district chapters.

2.2.3 DipECHO 8: Delivering improved emergency preparedness & response in Nepal through enhanced partnership between the Red Cross and the Government of Nepal

While the four-year EPR programme covered all 15 districts of the Mid-Western Region, key elements from it were further adopted by an add-on DipECHO 8 project in the three Terai districts (Banke, Bardiya and Dang). The objective of this programme was to provide targeted support to the Government of Nepal at all levels - in terms of preparedness and response, and with a strong focus on assessments, data management, and coordination.¹¹

The project complemented other work by donors such as DfID, ECHO and UNDP, who had supported the establishment of District Emergency Operation Centres (DEOCs) in 36 of the 75 districts of Nepal. Whereas their support had focused on training and hardware, DipECHO 8 aimed to better adapt DEOC functionality to the local context, while also strengthening district links to VDCs and communities in the selected target districts, and promoting coordination with the national level.

2.2.4 Enhancing preparedness for emergency response through stronger national systems in Nepal with particular focus on Far-western and Mid-western Regions (DPDRR)

This fourth project only commenced in 2017 with ECHO support - while not fully integrated in this impact study, it is considered as an intervening factor. It builds on DipECHO 8, and widens the district level focus to include Kailali and Darchula districts.¹²

3. The research design

The overall research design was developed on the basis of extensive document review (see appendix D) and in close coordination between consultants, the study supervisor and the Danish Red Cross team in Nepal. It included quantitative and qualitative tools, both of which were simultaneously applied over the course of a two-week field phase in March/April 2018 with the invaluable support of Nepal Red Cross. Let us have a look at survey design (part 3.1), the qualitative components (3.2), and finally go through the essentials to understand our cost-benefit analysis (3.3).¹³

3.1 Household survey

Planned to help quantify trends as well as the benefits of the various DRR programmes across the two areas, the survey **sampling** was stratified by area (strata A: Bardiya and Banke, strata B: Lamjung). Sample sizes reflect a confidence level of 95% and a margin of error of 7%, and communities were selected from a list of suitable programme-supported locations through the Probability-Proportional-to Size (PPS) technique. Overall, five communities were sampled in Lamjung (36 respondents each) and four in Bardiya/Banke (40 each; see fig. 6 below).

The **questionnaire** consisted of four main sections - covering a) recent hazard-induced damages and the link to household preparedness, b) flood damages and the link to early warning (Banke/Bardiya only), c) damages and the link to mitigation (Lamjung only), and d) perceptions of community preparedness. The questionnaire was translated into Nepalese, tested and then applied by trained enumerators, using Kobo Collect, a data collection platform installed on hand-held devices. **Data collection** proceeded without problems, and the overall sample size was reached. The statistical **data analysis** included disaggregations by gender and area, as well as several cross-tabulations to explore correlations (see appendix A for results).

3.2 Qualitative research

Following initial briefings in Kathmandu, the research team spent one week in Lamjung and another in Bardiya/Banke (see the schedule in appendix E). Qualitative work focused on the community-level and made use of numerous tools. In each community, this included two rounds of **focus group discussions** - one with people closely engaged with related projects (e.g. rescue teams) and one with villages that had no direct associations with Nepal Red Cross efforts.

The discussions included the elaboration of a timeline, reflections on disaster risk reduction as well as response. Where time permitted, individual community members were interviewed to gather more depth and identify what was perceived as the most significant changes generated by the project. Community visits also included **transect walks** and site visits in order to better understand risk, interventions, and the impact of disaster events.

Furthermore, **key informant interviews** were conducted with government staff, Nepal Red Cross leaders, and stakeholders at national, district, and community level (see appendix F for the list of interviews). The in-county research phase concluded with meetings at Nepal Red Cross headquarters for debrief and validation.

13. See appendix B for an extended look at the methods, assumptions, calculations and results of the cost-benefit analysis.

Fig. 6 | **Sampled villages**

Strata (sample)	District	Village	Programme	Number of households	Survey sample	Qualitative research
A planned 200 actual 233	Banke	Kanchanapur	EPR	1,703	40	yes
		Udharapur	DipECHO 8	1,456	40	no
	Bardiya	Dhadhawar	EPR	4,369	80	yes
		Mangragadhi	DipECHO 8	3,869	40	yes
B planned 180 actual 179	Lamjung	Satkanya	CORE	58	36	yes
		Pragatisil	CORE	72	36	yes
		Dudhapokhari	CORE	37	36	no
		Siddharta Milan	CORE	90	36	yes
		Sadhikhola	CORE	76	36	no

14. For instance, there are difficult ethical questions as to how a life saved could be monetised - in this study, we generally refrain from including aspects related to physical harm.
15. In terms of costs, two other issues were encountered: *first*, the early warning systems that have been improved over recent years involved many stakeholders at different levels, and it was impossible to attribute overall costs to each community. *Second*, no follow-on costs of mitigation or preparedness measures were identified or quantified. While these community- or government-borne costs may be minor compared to attributed project costs, they should be accounted for (e.g. maintenance, repairs, refreshers).
16. We generally chose to err on the lower side when collating AHL data from survey and focus group discussions and aimed to prevent double-counting - see appendix B.
17. If a main hazard recurs very five years, the APR is 1/5 - there is thus a 20% chance that it will occur in any given year.
18. The timeframe of 15 years may be debatable but generally reflects the expected durability of mitigation structures and most other measures.

3.3 Cost-benefit analysis: what you need to know

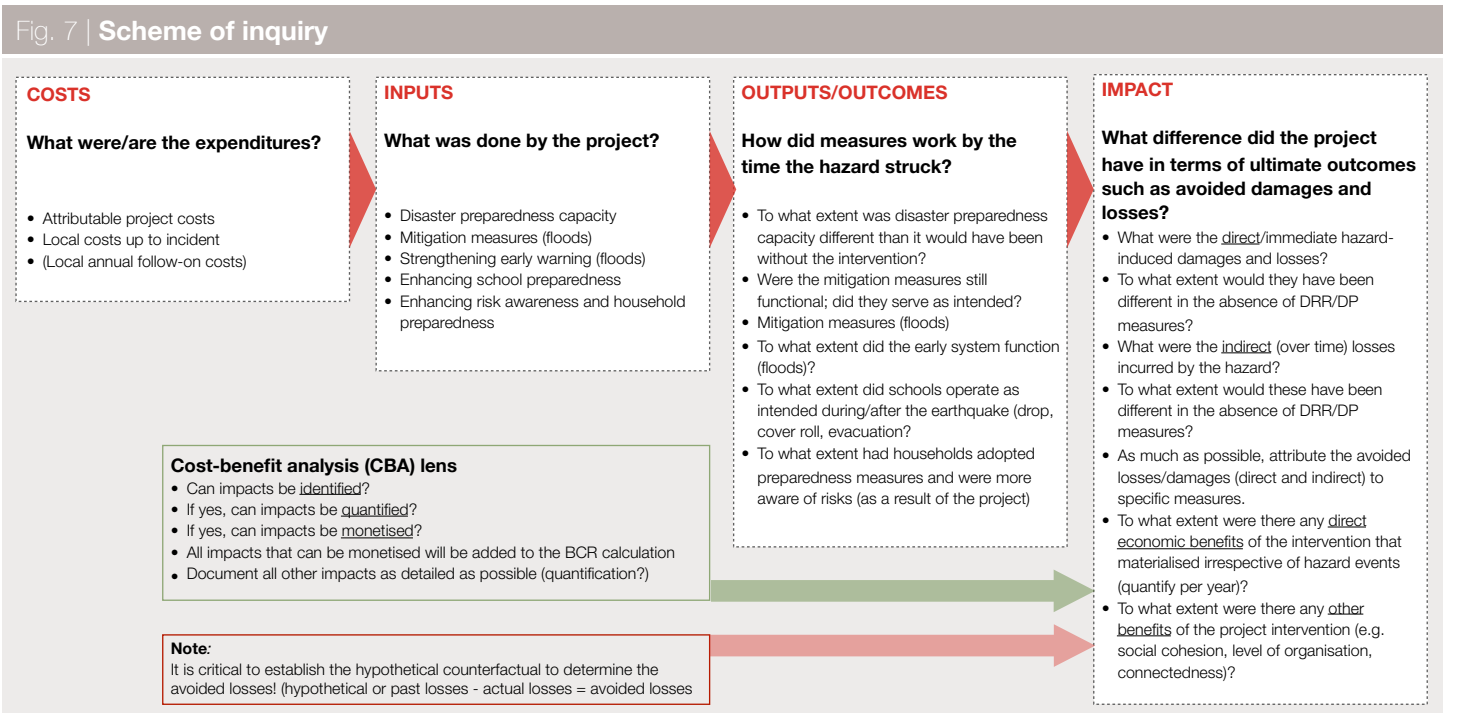
In order to understand the results of the cost-benefit analysis (CBA), it is critical to know the underpinning assumptions as well as the limitations. Most critically, CBAs involve estimates and often have to make do with missing or vague data. Furthermore, it is often impossible (or unethical) to identify, quantify and then monetise all benefits.¹⁴ Whereas CBA results are often quoted as “for every Dollar spent, there have been benefits of X Dollar”, a more appropriate interpretation would be “there have been *around* X Dollar benefits *plus other benefits* that could not be included in the calculation.”

One of the first issues we encountered in our study concerned the **calculation of costs**: since it was not possible to identify the exact costs for each visited community, we took the overall costs of the related programme, subtracted administration costs, and divided the remainder by the number of supported communities.¹⁵

In terms of **calculating benefits**, we collated data from survey and focus group discussions. Where *second-dividend* (direct economic) benefits could be identified, we assumed that these would remain unchanged and sustained over a period of 15 years. In terms of the *first-dividend* (avoided damages and losses), we first calculated the *avoided hazard losses (AHL)*.¹⁶ On the basis of historical timelines (developed during focus group discussions), we then estimated the likelihood of such a hazard returning in a given year - producing the *annual probability rate (APR)* for each case study.¹⁷ Multiplying AHL with APR led to *annual avoided losses (AAL)*, which we then extrapolated over the timeframe of 15 years.¹⁸

Benefit-cost ratios (BCR) were then calculated by dividing all monetised benefits through costs. Aside from the more detailed description of the CBA process in appendix B, the summarised results across chapters 4 and 5 are presented with specific background data.

Meanwhile, *figure 7 below* illustrates the overall scheme of inquiry of this study.





Section B | Findings

4. Bardiya and Banke districts

Exploring the findings of our study, we will start in the two flood-affected districts of Bardiya and Banke, located along the border with India. The communities we visited were supported by either the EPR or the DipECHO 8 programmes - what difference did they make? We first look at the community level and the outcome aspects (*part 4.1*) and then analyse critical aspects at the district level (*4.2*).

4.1 Community level

Awareness of disaster risk improved significantly, and 94.5% of survey respondents and most focus group participants said that this change was influenced by personal experiences of both the 2014 and 2017 floods, and for some, also of the flood in 2015. At the same time, 86.7% of all people surveyed ‘fully’ or ‘partially agreed’ that their community had been better prepared in 2017 as a result of the work of their local Community Disaster Management Committee, or Nepal Red Cross. These findings were consistent across male and female participants and indicated a positive view of the impact of the Emergency Preparedness and Response (EPR) programme and its successors.

Several factors make the comparison of people’s experience of the 2014 and 2017 floods challenging. In Dhadhawar, the 2017 flood was twice the height of the one in 2014. Meanwhile in Mangraghadi, 400 households had been affected in 2014 but only 25 in 2017. Behind the figures are some revealing details – raised construction of new houses has become the norm in Mangraghadi, based on communal experiences¹⁹, while infrastructure developments in Nepal and India continue to change the landscape, creating benefits and potentially new risks.²⁰

Key findings

- The benefits of investing in early warning, skills training and other preparedness measures were demonstrated in 2017, and these were generally applied more effectively than in 2014.
 - There has been positive change in the attitude and behaviour towards risk.
 - NRCS was most prominent amongst actors promoting household-level disaster preparedness. This translated to good or moderate adoption of DP measures ahead of the 2017 flood.
-
19. There was no direct attribution of this change to awareness-raising by NRCS and others, but it is likely that activities like VCAs contributed to a community level culture that encouraged change and improvement in construction.
 20. For example, this included the construction of canals and flood mitigation measures in southern Nepal, and neighbouring Indian districts.

"In 2014, we lost a lot of food and did not have anything to eat during the floods.

In 2017, we were informed about the potential flood and we started moving items to the highest parts of the house. We even prepared some dried foods, we roasted the maize and we used it when the community got flooded. Initially we received only some help, but as time passed, the support increased."

Woman from Mangraghadi

Key findings: early warning

- Improvements in the flood early warning system mean messaging is now more likely to reach the most vulnerable.
- Where the community level early warning system worked, the benefits were significant.
- Improvement is not universal, and there was no consistent link between improved early warning and capacity-building of CDMCs.

"We got information five hours earlier and then the siren was blown, and they mobilised the Chowkedar to share information through his microphone. Based on this, we started to move our valuables and goods and animals. As we were moving, the flood came. We were able to save much but a few people got caught by the floods. The community mobilised teams to rescue people with ropes and life jackets given by the Red Cross."

Man from Dhadhwar

21. The work of Save the Children and others at schools is seen as an additional factor for household-level preparedness, noting the role of children as 'agents of change'.
22. Rather moderate losses of moveable assets (like motorbikes and livestock) demonstrates a benefit of early warning in Dhadhwar and Mangraghadi.

4.1.1 Household and community preparedness

Nearly two-thirds of survey respondents (65.3%) were aware of some disaster preparedness and awareness-raising work by Nepal Red Cross (NRCS) prior to the 2017 floods. NRCS was the primary influence on those who adopted preparedness measures in the home, with 59.4% citing NRCS activities as the main reason for taking these actions. This attribution was stronger amongst communities in proximity to an active NRCS sub-chapter, such as the one in Mangraghadi. Awareness-raising by a range of different agencies appeared well-coordinated, and messaging was consistent.²¹

Improved awareness does not always translate to changed practice. Adoption of household preparedness measures just before these floods was little changed in 2017 from the findings of an earlier EPR programme review in 2016. Main measures taken in 2017 included securing valuables in plastic bags (60.8%), and to lesser degrees, the stocking of emergency supplies (38.3%) and the preparation of 'Go Bags' (20.4%). This first of these three figures should be seen as a success, but the more limited adoption of other measures is largely consistent with the previous review's finding that more than half of people in project areas at risk from flooding do not demonstrate sufficient risk awareness during an emergency situation.

Challenging factors included night-time evacuation and the negative impact on the survey of the Kanchanapur flood (see appendix C). Nonetheless, there is room for improvement in the promotion of household preparedness, as the limited involvement of households in simulation exercises and drills (22.6%) and exposure to training (28.5%) indicates. Some key informants also questioned the move away from community-level activities within the last NRCS project across the two districts.

4.1.2 Early warning

The share of surveyed households indicating that they received early warning of likely flooding increased from 41.8% in 2014 to 74.1% in 2017 (see fig. 8). This improvement was built on foundations that pre-date the Nepal Red Cross programme and was supported by the innovation and strengthened organisation provided by NRCS and others.

In 2014, in the absence of a well-functioning Community Disaster Management Committee (CDMC), there had been no effective way to complement the government's SMS early warning messages - and no active way to disseminate alerts to all households. The chowkedar (watchman) system - where a designated member of the community is responsible for passing around the message - was present in 2014, as were local sirens. Experience in 2014 showed this system could not always cover the whole area of the Village Development Committee (VDC), and in heavy rain, messages and the siren were not always heard.

Megaphones provided by the programme improved this 'last mile messaging' considerably, but this was also supported by improved organisation, which had been developed through external support. In 2017 in Dhadhwar, after a CDMC member got the SMS, the committee and trained volunteers were called together and communicated by phone with volunteers to plan the evacuation of the most vulnerable. A CDMC/LDMC (Local Disaster Management Committee) task force was also appointed to support the community, and to ensure that help and people came from across the VDC.

The benefits of this improved organisation are evident. Over 95% of survey respondents felt that their losses would have been significantly higher had it not been for the combination of early warning, evacuation and other preparedness measures. Community members in Dhadhwar were able to save their valuables and emergency food in the six-hour window provided by reliable early warning, and there were no human or animal casualties.²²

Several cases of pre-existing good practice in evacuation were reported, and these have been further enhanced. Dhadhwar residents indicated that since the time of their grandparents, livestock had been evacuated to higher ground as river levels rose. Now there is a realisation that the elderly, pregnant women, children and others must also be evacuated as a priority.

The link between improved early warning organisation on the one hand and direct NRCS support to CDMCs on the other is not entirely clear. Mangraghadi and Udharapur recorded the highest level of households receiving early warning of the 2017 floods, despite not benefiting from CDMC capacity-building by Nepal Red Cross. By contrast, the early warning organisation in Kanchanapur, whose CDMC had been directly supported, was noticeably weak.

Here, in the chaos of the sudden embankment breach in 2017, it was found the megaphone (and the torches) did not work, and that the batteries had not been regularly checked by the CDMC. While this man-made event rendered early warning impossible, the loss of preparedness materials and damage to the only life jacket (before it was even used) highlighted concerns about the preparedness of this CDMC - and its safe equipment pre-positioning.

Other weaknesses in early warning were identified. In Kanchanapur, there was no back-up system for relaying messages to the 15 of 18 people in the community focus group who are illiterate. As a safety precaution, the authorities tend to cut the electricity supply in advance of potential floods, and if phones are not well charged, there is a risk that some owners will not get the evacuation alerts. This reinforces the need for well-organised local message sharing.

Furthermore, the role of the Disaster Emergency Operations Centre (DEOC) as the first point of contact was not clearly understood in two of the three visited communities, whose CDMC members still contacted the gauge station directly for information.

4.1.3 Community-level response

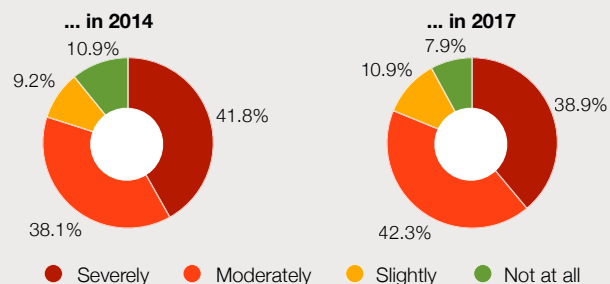
The benefits of NRCS' Community-Based Emergency Response Training (CBERT) approach can be seen in Banke and Bardiya. NRCS volunteers had been active in local relief distributions in 2014, but lacked Search & Rescue training.

While the numbers of people assisted by community volunteers in both emergencies were similar, the technical quality of assistance, particularly in terms of rescue, was noticeably higher in 2017. First Aid-trained volunteers were engaged in the 2017 floods but less so than volunteers trained in Search and Rescue.

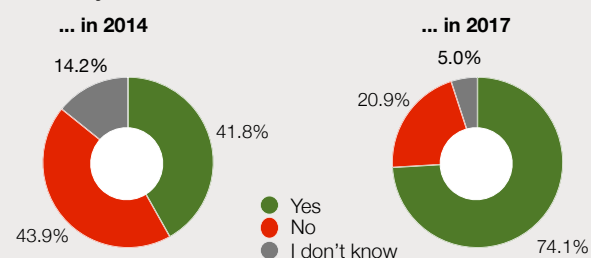
Even in the devastating situation in Kanchanapur²³, training provided by the project was put to good use. Teams assisted three people with First Aid (one after nearly drowning, two from bleeding wounds). Six people were rescued from collapsed houses; five of whom had been trapped inside one house. As the army did not have rescue equipment, volunteers dug through the debris. Whereas three people had died in 2014, everyone survived in 2017.

Fig. 8 | Bardiya/Banke: early warning

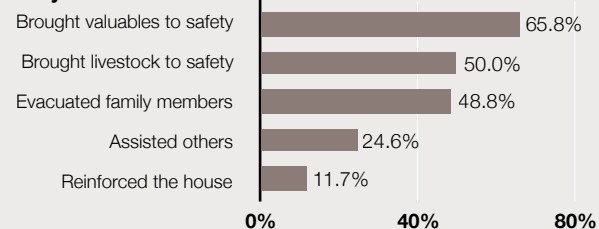
B.1 To what extent was your household affected by the floods ?



B.2 Was your household warned ahead of the floods...?



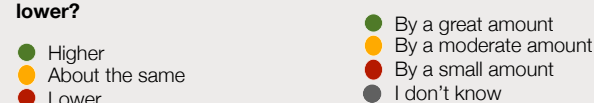
B.3 [...] Following the warning [in 2017], what actions did you take?



B.4 Without taking these actions, would you say that the overall damages and losses would have been higher (more severe), the same, or lower?



B.5 Roughly by how much would damages and losses have been higher if you had not taken these actions?



What these charts show: While the share of respondents warned ahead of floods has almost doubled from 2014 to 2017 (B.2), there is no significant variation in the extent to which they were affected (B.1). Amongst those warned in 2017 (74.1%) however, around two-thirds took at least one action in response - and almost all of them see significant benefits in terms of avoided losses (B.4/B.5).

23. In Kanchanapur (see appendix C), man-made factors led to sudden inundation of the community - with devastating results. The benefits of pre-identified evacuation sites were also lost because the water rose so high, so quickly, that many people could not reach them in time.

Key findings

- The benefits of NRCS' training of community-level Search & Rescue volunteers were evident in the 2017 floods, and widely recognised.
- The impact of CDMCs in the 2017 flood was mixed. Performance was not clearly linked to whether CDMCs had been supported by NRCS.

24. Here, 75% of respondents said they secured valuables in plastic bags in 2017, half stocking emergency supplies, and 17% reinforcing their house. Some 81% said they did this because of factors fully related to the NRCS project, indicating that other interventions - particularly the training of local volunteers - contributed to this improvement.

25. In Kanchanapur, residents still live in poor temporary shelter with negligible access to clean water and adequate sanitation. They feel that their CDMC failed to represent their needs effectively to district and municipal authorities. They also feel that having a CDMC, supported through projects, may influence decision makers to think the needs are not so great compared to villages without support of projects, partners or committees.

26. In fact, independent community members like teachers and Female Community Health Volunteers (FCHV) - who would be well-placed to advise communities of its existence - had only limited awareness of it themselves.

4.1.4 Strengthening local level disaster management structures

The performance of some CDMCs has improved: in Dhadhwar, early warning information had been sent to the committee in 2014, at a time when this had just been formed and still lacked an effective system to alert its community. In 2017, the CDMC was a key actor of the early warning and evacuation process: in using its skills to deploy ropes and life jackets and conduct water rescue, it provided reassurance and assistance.

General awareness of the role and work of CDMCs remains mixed. No clear correlation was identified between awareness of CDMCs and NRCS project support. While not always known by name, over three quarters of survey respondents (78.7%) did know of a volunteer group in their community prior to the 2017 floods.

Groups, or volunteers, were often known to be active in early warning, evacuation and search and rescue, but these might have been recognised as NRCS volunteers or the traditional voluntary practice of communities in times of emergency, rather than the activities of a CDMC. The training of local NRCS/CDMC volunteers for search and rescue did however make a significant difference in 2017 - and while these volunteers were not always clearly identified as either CDMC or NRCS, in reality they often represent both.

It is not clear that a greater emphasis on CDMC formation and organisation resulted in higher levels of community preparedness. In Udharapur, one of the two surveyed communities without direct NRCS support to the CDMC, the highest level of household preparedness was noted across all main categories.²⁴

The review highlights the challenges in creating effective and accountable DM committees at the community level across the two districts.²⁵ Communities, and VDCs or the new political wards that replace them, are often densely populated - and it is no surprise that building a connection between local populations and their CDMC or LDMC is challenging, especially with many political changes taking place. But with only 12.1% of survey respondents feeling that they had been fully involved in any assessment and only 28.5% feeling strongly that the CDMC and NRCS had helped their community to be better prepared, it is evident that more work needs to be done to strengthen these linkages.

The longer-term impact of work at LDMC and CDMC level is uncertain - given the political changes that have taken place - and the dissolution of both structures. New structures at the community level, to be called Local Disaster and Climate Resilience Committees, will take on the work of CDMCs. There is hope that membership and skills will transition between old and new, but a number of stakeholders are concerned that significant capacity will be lost in the process. Even people who were generally aware of the LDMCs appeared unclear about their exact role.

Awareness of the LDMC emergency fund, supported by NRCS, was generally weak.²⁶ The Mangrghadi sub-chapter knew of this fund - and it had even raised and contributed NPR 100,000 (USD 970) of its own money to the fund.

But apart from knowing that some money had been spent on instant meals in the 2017 response, it was not clear how much money was left, or who was now responsible for it within the new structure - thus indicating the need for more work around accountability.



Construction of gabion boxes (big stones in wire cages) for protection against river erosion in Lamjung – an example of CORE mitigation measures.

Photo: Nepal Red Cross

4.1.5 Mitigation

There were no evident 'missed opportunities' for the Red Cross to undertake small scale mitigation²⁷ that would have made a significant difference in any of the communities visited. This validates the decision to not include a mitigation component to the community level work of these projects.

In the longer term, the scale of flood-related problems faced by communities suggests that NRCS would have greater impact if it was to work with others to advocate for improved quality control in infrastructure projects, and a more coordinated approach to water system management - bringing communities and government agencies together to improve decision-making.

4.1.6 Livelihoods

The destruction or damage of agricultural land, fruit trees and gardens, recorded by 80.7% of survey respondents, is a reminder that early warning still provides only limited protection to livelihoods for communities that are highly dependent on agriculture. Focus group participants in Mangraghadi and Dhadhawar reported modest improvement in livelihoods in a basic poll covering the project period, but the opposite conclusion was reached by Kanchanapur participants, many of whom had yet to recover from the 2017 flood.

4.1.7 Emergency health and WASH

Targeted communities appear to have increased their ability to address emergency health issues. Disease incidence in the aftermath of the 2017 emergency was anecdotally reported to be lower than in 2014 - when the standard approach had been the hand out of water purification tablets, without accompanying raising of awareness.

Improvement was linked to several factors. This included health 'camps' organised by the government, the availability of free medicine, female community health volunteers (FCHV) in Dhadhawar receiving training in emergency health ahead of the 2017 floods, NRCS supporting FCHVs in raising awareness of safe water treatment, and the distribution of mosquito nets and water purification tablets. About one quarter (26.7%) of survey respondents identified NRCS' role in promoting safe WASH practice in times of preparedness and response. However, this work was only infrequently referenced by communities during focus group discussions.

4.1.8 District-level response and support to communities

Communities regarded the support received from NRCS in 2014 as good and of uniform quality - although there were issues about timeliness and the concern that assessments took too long, and that some relief (non-food) items from NRCS were distributed up to three months late.

Timeliness has improved for most communities. Focus groups in Dhadhawar noted faster response times in 2017, while relief distribution in Banke was seen as faster by most communities (although not in Kanchanapur). This general improvement in 2017 must be balanced by other concerns voiced by focus groups. They noted that agencies did not always work in a coordinated way, especially those with limited or no previous engagement with working in the district. Some food distributed in 2017 was also criticised as expired or of poor quality. The main criticism, powerfully voiced by communities, was the influence of the new municipality authorities on the assessment process in 2017. The initial rapid assessment conducted by Red Cross volunteers, police and others was not seen as a problem by communities, but subsequent beneficiary targeting was universally highlighted as a concern.

Key finding: health & WASH

- Some improvement was informally recorded in 2017 compared to 2014; this is partially attributed to project activities.

Key finding: response

- Changes in the approach to disaster management at district level did not always result in improved quality or timeliness of response at the community level.

27. These are small-scale, low cost engineering responses to reduce the impact of disaster threats. Usually these are implemented with communities providing free labour and the Red Cross contributing materials and engineering support. Measures are normally conducted in line with government standards.

Fig. 9 | Cost-benefit analysis case studies: Bardiya and Banke

See further explanations in appendix B

Case study 1: Dhadhawar

Benefit-cost ratio (BCR)	12.1	Timeframe	15 years (2016 - 2030; discount rate of 5% applied to future benefits)
Attributed costs	49,312	Parameters and assumptions	<ul style="list-style-type: none"> Costs: EPR programme costs, less administrative costs, divided by 30 target communities Direct economic benefits were not identified For avoided hazard losses (AHL), we distinguished between materialised protective benefits (avoided losses, 2017 flood) and those that can be expected in future events, assuming an annual probability rate (APR) of 40%. Materialised protective benefits amount to USD 120,925; these are the result of early warning (58,049) and household preparedness (62,876). Additional protective benefits are expected to be USD 477,085, consisting of those related to early warning (229,024) and household preparedness (248,061).
Total quantifiable benefits	598,010		
a. Avoided hazard losses (early warning)	287,073 (48.0%)		
b. Avoided hazard losses (preparedness)	310,937 (52.0%)		
c. Direct economic benefits	0 (0.0%)		

In populous Dhadhawar (4,369 households), it was found that the protective benefits of early warning and greater household preparedness, as identified for the 2017 flood, already exceeded the initial programme costs by a factor of 2.45.

Improved **early warning** enabled the timely evacuation of livestock. Not only were cows, buffalos, goats and pigs saved (whereas many had drowned in preceding floods), indirect losses were also avoided - thereby substantially enhancing the process of post-flood recovery.

The greater adoption of **household preparedness** measures further contributed to protective benefits. Taking survey results as a basis and

projecting them for flood-affected households in Dhadhawar, we see that the materialised benefits of preparedness already exceed programme costs. Despite the use of conservative assumptions to interpret survey results on expected loss reduction as well as factoring in the attributed role of the project in the adoption of preparedness measures, we calculate that household preparedness accounts for half of all identified benefits.

No direct **economic benefits** were identified. **Organisational and governance benefits** were identified (see main text) but could not be quantified. Thus, it must be understood that the 'true' benefit-cost ratio is higher than the one calculated.

Case study 2: Mangragadhi

Benefit-cost ratio (BCR)	16.6	Timeframe	15 years (2016 - 2030; discount rate of 5% applied to future benefits)
Attributed costs	49,312	Parameters and assumptions	<ul style="list-style-type: none"> Costs: EPR programme costs, less administrative costs, divided by 30 target communities Direct economic benefits were not identified For avoided hazard losses (AHL), we distinguished between materialised protective benefits (avoided losses, 2017 flood) and those that can be expected in future events, assuming an annual probability rate (APR) of 60%. Materialised protective benefits amount to USD 118,033; these are the result of early warning (6,829) and household preparedness (111,204). Additional protective benefits are expected to be USD 698,506, consisting of those related to early warning (40,410) and household preparedness (658,096).
Total quantifiable benefits	816,539		
a. Avoided hazard losses (early warning)	47,239 (5.8%)		
b. Avoided hazard losses (preparedness)	769,300 (94.2%)		
c. Direct economic benefits	0 (0.0%)		

As in Dhadhawar, the materialised protective benefits of early warning and greater household preparedness in nearby Mangragadhi (3,869 households) already exceed costs by a similar factor (2.39). However, the attribution of these benefits to different programme aspects is different.

Improved **early warning** also enabled the timely evacuation of livestock, but the avoided losses were much lower than in Dhadhawar.

Meanwhile, the greater adoption of **household preparedness** measures plays a much stronger role, accounting for 94.2% of all quantified benefits. Not only are these benefits of preparedness high as a proportion, they also constitute the single largest benefit of all identified amongst the five case studies.

Two factors explain the difference to Dhadhawar - the higher annual probability rate (60% in Mangragadhi versus 40% in Dhadhawar), and a much higher number of flood-affected households in Mangragadhi (665 versus 376 in Dhadhawar).

It should be noted that due to the selected sampling approach, which concentrated on flood-affected wards only, survey results have been extrapolated on these wards rather than entire communities (this applies to both case studies from Bardiya/Banke).

As in Dhadhawar, no direct **economic benefits** were identified. **Organisational and governance benefits** were identified (see main text) but could not be quantified. Thus, it must be understood that the 'true' benefit-cost ratio is higher than the one calculated.

4.2 District level

Bardiya and Banke are not only highly hazard-prone, but have also witnessed increases in disaster frequency and severity over the past ten years. Compared to 2014, both districts were better prepared in 2017, and the loss of life was lower. Many stakeholders recognised that up until 2014, disaster management had not been taken seriously enough. The floods that year represented a wake-up call. Greater government and NGO engagement in disaster management at national and district levels has created a framework and resources to test new approaches and operationalise existing policies and structures more effectively.

Recent political changes and restructuring cast a shadow over the potential medium to long term impact of the Nepal Red Cross programmes in Banke and Bardiya. As technical capacity and decision-making moves from district to municipality levels, there is a concern that technical capacities will be lost if action is not taken to retain and expand this capacity across the new structures.

The scale of this challenge causes concern - there are eleven new municipalities in Banke alone - each with health, education, disaster management and other responsibilities. The wider national challenge, with 753 new municipalities, also requires actors like Nepal Red Cross to consider how and where it can best engage.

4.2.1 Coordination and information-sharing

Through the well-resourced operations centres in the two districts, Nepal Red Cross has been able to improve planning and coordination. Prior to the DipECHO 8 project, the two DEOCs had been basic structures with limited functional capability.²⁸ Through the project, and particularly the two staff on loan from NRCS, the operations centres started collecting plans and bringing stakeholders together, and became information hubs for the districts.

Accountability to the District Disaster Management Committee (DDMC) and the Chief District Officer (CDO) is clear and well-understood, and the operations centres have played a crucial role in promoting government frameworks and guidelines, such as the Initial Rapid Assessment (IRA). The DEOCs provide sound links to provincial and national levels.

Success has not solely been down to NRCS support - UNDP and Radha Krishna Tharu Jana Sewa Kendra (RKJS) also contributed equipment. However, the quality of Red Cross-seconded staff to the two operations centres was frequently highlighted as a strong point. While DDMC and CDO had initially held reservations towards the concept of an enhanced operation centre or Red Cross staff on loan, NRCS deserves credit for the way it has secured local level buy-in. Support and encouragement from Dipecho has also been of great value.

The longer-term future of these operations centres within the devolved disaster management structures is less clear. Creating similar mechanisms at municipality level will be resource-intensive. There may be institutional funding under the provisions of the Disaster Management Act (the Government of Nepal has earmarked positions for the DEOCs), but the overall sustainability approach is in urgent need of greater clarity.

The close collaboration between the District Lead Support Agencies (DLSA), Action Aid in Bardiya²⁹ and Save the Children in Banke, the two NRCS district chapters, and the NRCS project teams was also commonly highlighted as a major factor in the improvement of coordination.

One of many good examples was the pooling of available project funding to support enumerators and data entry during the 2017 assessment in Banke. This type of cooperation was reinforced by the presence of a strong NRCS project team on the ground.

Key findings

- Coordination and planning has improved significantly across both districts as a result of the engagement and cooperation of multiple stakeholders, including Nepal Red Cross.
- This improvement has been significantly influenced by programmatic inputs from Nepal Red Cross, and the benefits cannot be sustained without the longer term involvement of the National Society at district and municipal levels.
- Nepal Red Cross support to the two District Emergency Operations Centres have encouraged significant improvement in district-level coordination and information sharing. Sustainability and scale up of the initiative will be challenging however without strong national direction and leadership.

²⁸. There was one security person in Bardiya (who merely collected information to put in to a register) and in Banke, the equipment was locked up, and the office operated at a very basic level.

²⁹. This role had initially been taken up by Practical Action in Bardiya.

Key findings

- Nepal Red Cross interventions have contributed to improvements in planning, but progress has not been consistent and is not guaranteed to continue at the same level within the new disaster management structure.
- Changes in the way assessments were conducted did not result in the expected improvements in 2017 - mainly due to the effects of recent political changes at the municipal level.

30. Clusters are inter-agency coordination platforms that operate on a sectoral basis. Nepal Red Cross and IFRC co-lead the shelter cluster with the Department of Urban Development and Building Construction (DUDBC).
31. These new Municipality DM plans are not clearly connected to local development plans. Addressing this integration will need to be a future priority.
32. Some progress in improving shelter preparedness has been achieved: whereas there had been no emergency shelter provision in 2014, one local temporary shelter is now in place in Bardiya, and there are plans for ten more across both districts.
33. NRCS had done some sensitisation of new municipality mayors in the short period between elections and monsoon season.

4.2.2 District and VDC/municipality-level planning

NRCS and other partners have encouraged the different clusters³⁰ to deliver more robust sectoral planning, particularly through proactive support from DEOC staff. A better understanding of available capacities and gaps has been encouraged, as has the use of lessons from past emergencies and trend data to guide decisions. Other activities like NRCS support for hazard maps as well as training in cash and GIS mapping, simulation exercises and the promotion of SPHERE standards have also been cited as contributing factors to this overall improvement.

The system is not perfect. The absence of secure funds for emergency response means priority issues cannot all be effectively addressed in advance. Cluster accountability is still seen as weak, and these district level plans are not strongly connected to the new Local Disaster Risk Management Plans (LDRMP) at municipality level, which have not benefitted from same level of rigour and technical validation applied at district level.³¹

Furthermore, concerns over the consistency of cluster engagement across different districts remain. The Department of Urban Development and Building Construction (DUDBC, which co-chairs the shelter cluster) has its regional office in Banke, but its technical officer in Bardiya is not strongly engaged with the shelter cluster in that district, and this lack of engagement is reflected in the district cluster planning.³²

4.2.3 Post-disaster assessments

A key benefit of the programme saw the DEOC facilitate the introduction of a 'one door' system in both districts for data compilation, and the roll-out of the Initial Rapid Assessment (IRA) as the standard tool for use by all actors (with training provided by NRCS). The speed of the IRA in 2017 was seen as equal or faster (depending on location and coverage) than in 2014.

At the same time, NRCS' role changed and it became part of the assessment process rather than the sole responsible agency. This led to a reduced role for the National Society in 2017, to which it adapted to reasonably successfully in these two districts during the flood response. Observers feel this change helped to clarify its role and reduce the pressure to deliver everything. Ironically, external observers now recognise the importance of NRCS' continued engagement with emergency assessment because of their technical strength, and the limited comparable technical capacity available elsewhere.

In 2014, it was only NRCS that carried out the assessment, and it was criticised at the time for the time taken and for not accurately capturing vulnerability within its data. In 2017, the disaster needs were identified to a reasonable degree, but the process fell under considerable influence of new municipal authorities.

Unlike their peers at district level, these new, elected (and accountable) decision-makers had received limited sensitisation³³ and had not fully absorbed their responsibilities.

The new authorities were perceived as either trying to support everyone, or influencing beneficiary selection, resulting in targeting errors that have caused concern at all levels. Confusion over interpretation of "partially" and "fully destroyed" in relation to houses, did not help (in Kanchanapur, the report said 26



The Mangragadhi sub-chapter of Nepal Red Cross.
Photo: Robert Roots

houses were destroyed, when the real figure was 7).³⁴ Sensitisation is on-going post 2017, and there are hopes that mobile phone based assessments in the future will also reduce these problems.

4.2.4 District-level early warning

In Banke and Bardiya, Nepal Red Cross managed to link the activities of its different programmes at several levels. This promoted a more systematic way of ensuring messages reached communities, and messages were disseminated through organised volunteers with megaphones, sirens and other measures. This was supported by active use of media by DEOC, and information-sharing through the Red Cross sub-chapter network. DEOC engagement allowed this work to be delivered in harmony with the Department of Hydrology and Meteorology's early warning SMS system, using the established links to the river gauge systems.

4.2.5 Nepal Red Cross role, capacity and performance

NRCS' capacity has clearly increased since 2014. Some of these gains however are based on the work of capable project teams and staff seconded to DEOCs in both districts, rather than on the organisational strengthening of the district chapters. The two chapters have been supported by a succession of DRR projects by Danish Red Cross and Swiss Red Cross in Banke, and Practical Action in Bardiya - which means that the long-term changes taking place in the chapters can be missed.

The district planning process has helped to mainstream the Red Cross role and means that its technical capacity can now serve all agencies. One of many examples of this is in Bardiya, where NRCS initiated and supported earthquake and flood contingency planning.

External stakeholders have seen an improvement in the two chapters' technical and data collection capacities. In 2017 for example, the Bardiya DDRT was active and visible in assessments, setting up health camps alongside the authorities, mobilising volunteers, and undertaking search and rescue. Emergency funds have been used for volunteer mobilisation and the pre-positioning of non-food items.

The Red Cross sub-chapters and their trained volunteers have grown stronger. These not only deliver relief after an emergency but also support preparedness, risk reduction and search and rescue activities. In 2017, Dhadhwar sub-chapter had built up a roster of 240 search and rescue and first aid volunteers trained to CBERT level A as well as DDRT members trained to levels B and C.³⁵ Having a stronger volunteer base at sub-chapter level reduces the time taken to undertake assessments.

The challenge is to replicate this achievement across the whole sub-chapter network and sustain it beyond the end of a programme. Concerns were raised as to how training of so many volunteers will be sustained. Rosters of trained volunteers should be handed over, but there is currently no mechanism between sub-chapters and municipalities to do so. There are expectations that there will be provision within the Disaster Management Act, but this is still not demonstrated.

At an organisational level, neither district chapter identified any change in their overall capacity to deliver on core responsibilities or other services. The main improvement attributed to the project was the benefit of greater monsoon preparedness. Whether chapters are stronger or weaker cannot be assessed as there is no baseline to measure their organisational change against. Likewise, no clear capacity building plan within the various programmes exists to address identified organisational weaknesses.³⁶

Key findings

- Nepal Red Cross effectively linked its community level work to its district level engagement and support to DEOCs to contribute effectively to the systemic improvement of early warning in Banke and Bardiya.
- The disaster management capacity of both district chapters has increased substantially as a result of programme support, and benefits were clearly demonstrated in the 2017 floods response.
- At the sub-chapter level, the stronger volunteer base enables more rapid assessments.
- The sustainability of these capacity gains and their potential for replication across other districts without the support of similar donor programmes is uncertain.

34. Similarly, across Bardiya, there was a discrepancy in the number of affected households between Ministry of Home Affairs' figures of 6,000, and a much higher, IRA assessment (no figure available).

35. Out of these, 60 were deployed in the floods, rescuing 10 people using ropes and 25 using a boat that had been provided by the Dipecho 8 project.

36. Banke district chapter suggested the use of a 'Well Prepared Branch'-type checklist to guide future projects.

5. Lamjung district

Key findings

- The level of disaster awareness among the population has increased from very low levels, with the Community Resilience (CORE) Programme making a significant contribution to this change.
- The benefits of training and of locating disaster response kits within communities have been limited to date.
- The emergency fund has been of value in a few instances, but awareness levels need to be enhanced.

From Bardiya and Banke, let us travel to the district of Lamjung in Nepal's geographic centre. Supported by the Community Resilience (CORE) programme between 2012 and 2018, the district was one of those heavily affected by the 2015 earthquake. Let us first analyse the programme impact at the community level (part 5.1) and then look at gains at the district level (5.2).

5.1 Community level

5.1.1 Household and community preparedness

The experience of living through the earthquake and coping with its aftermath clearly influenced the recognition of the need to be better prepared. Most respondents in Lamjung (92.7%) said that the 2015 disaster made them realise the importance of being prepared.

Despite the CORE programme's emphasis on flood and landslide preparedness, and the low disaster frequency in most of the project communities, many households had adopted general measures that had some benefit in the aftermath of the 2015 earthquake. The survey found over half of those interviewed had learned to secure valuables in plastic bags (50.8%) in times of emergency to protect them, while nearly half also adopting the practice of food stockpiling (46.9%). All focus groups reported an improvement in their preparedness for disasters.

Support from the Community Disaster Management Committee and Nepal Red Cross was highlighted by 90.5% of survey respondents as a major or contributing factor in improved community preparedness. Despite not being trained to respond specifically to earthquakes, these committees did provide some organised response in 2015, and the visibility (in a small community) of enthusiastic CDMC members trained in new skill areas, like search and rescue, heightened the profile and importance of preparedness to the wider community. Other influences were also identified, including government campaigns and the work of Junior Red Cross Circles in schools.

Nearly all survey respondents (96.8%) felt their losses in the 2015 earthquake would have been significantly higher if they had not taken the preparedness measures promoted by the CORE project. Agricultural and livestock losses were reported by less than 5% of surveyed

people and not mentioned at all in focus groups. The main damage was done to houses - with 70.3% reporting some form of damage.

However, as in Banke and Bardiya, there is no guarantee that increased knowledge and personal experience translates to changed risk behaviour. With the low frequency of disaster events in Lamjung and the high cost of earthquake protection measures, it is not surprising that a smaller share of people recognised the importance of reinforcing their home (12.3%). This reflects both the challenge and cost of addressing construction improvements in poor rural communities, as well as the CORE project's earlier emphasis on floods and landslides rather than earthquakes.



Community stakeholders and trained NRCS volunteers. Photo: Danish Red Cross

Early warning systems were only mentioned in Pragatasil (focusing on landslides). Here, a CDMC sub-committee was appointed to monitor cracks and movement on the terraces above this vulnerable hill-side community. This work revives traditional practice (called *katawei*) and is augmented by the programme-procured megaphones to communicate warnings of any sudden changes.

5.1.2 Community-level response

Only two examples of First Aid skills being used were identified, and these were in response to everyday accidents in Siddharta Milan – one person fell from a tree, and on another occasion, a boy broke his leg playing football.³⁷ Only one person was rescued by trained search and rescue volunteers in Pragatasil, although volunteers did assist the NRCS project team in Siddharta Millan in the evacuation of people to a safe location.

The emergency fund³⁸ has made a difference in a small number of household-level emergencies, but was used sparingly in response to the 2015 earthquake.³⁹ Two thirds (68.2%) of survey respondents across Lamjung were aware of the emergency fund, making this the best-known programme activity. However, one could argue that this awareness should be higher, given its potential value to any household in time of crisis, and the higher visibility of CDMCs in these small communities.

Current balances are healthy, and good flows of contributions were reported from across the communities. Two of the communities had a longer history of having their own emergency fund, but the programme's provision of a barrel for collection and storage of rice (for eventual sale to replenish the fund) was a valuable innovation. The benefit of the initial project input of NPR 5,000 was not mentioned in any of the visited communities.

With the reformation of CDMCs, there is concern that oversight of the funds might weaken (nearly NPR 100,000 in total is currently held in three of these funds). People in Siddharta Milan were already confused over guidelines and how to access the fund. In Pragatasil, there was a discrepancy on the fund balance between community members and the volunteers group.

5.1.3 Community capacity and connectedness

The Community Disaster Management Committees are generally more visible, more active and better connected than those in Banke and Bardiya. Almost half (46.9%) of survey respondents strongly agreed that the CDMC and NRCS had actively involved them in the assessment of risks, capacities and needs. This compares well to the densely populated districts of Banke/Bardiya, where the respective figure was a mere 12.1%.

In Pragatasil, the committee participated in the 2015 assessment with NRCS and visibly helped the elderly and vulnerable after the earthquake - this was seen as a positive enabler for community action. In Siddharta Milan it was seen as apolitical, unlike Ward Citizen's forums. However, awareness of the committee's work in disaster preparedness pre-dates the earthquake (over three quarters had already been aware of this at this earlier time).

The committees in Satkanya and Pragatasil demonstrated the confidence to access external, non-Red Cross support – a key indication of potential sustainability. Links to a school-based child education project were established in Satkanya, and support from a regional Parliamentarian and the district authorities was secured to construct the committee's office/emergency shelter in Pragatasil.

This positivity was reflected in the survey, where 82.7% of Lamjung informants strongly or rather agreed that the CDMC (or the Red Cross) had improved community connectivity to major government departments. Three quarters (74.9%) felt strongly that the committee's work would be sustained in the future.

Key finding

- The level of engagement of Community Disaster Management Committees with local level risk reduction and response was positive, but there are potential concerns over the visibility, functionality and sustainability of these groups.

"We have been taught how to control fire, how to rescue people, how to lift and stabilise. When the earthquake happened the Community Disaster Respon-se team (in the Community Disaster Management Committee) made sure everyone was out in the open."

Female volunteer from Pragatasil

³⁷. In both cases, the person was stabilised by a trained volunteer and then taken to hospital.

³⁸. In some places, community emergency funds had existed prior to CORE support. These have been strengthened by modest injections of cash as well as storage bins for rice. Community members are encouraged to regularly contribute cash or rice. Rice is periodically sold to raise additional funds.

³⁹. The fund was used to support three of the most badly affected families after the 2015 earthquake in Satkanya and was also used twice for non-earthquake emergencies (once in Pragatasil and once in Siddharta Milan).

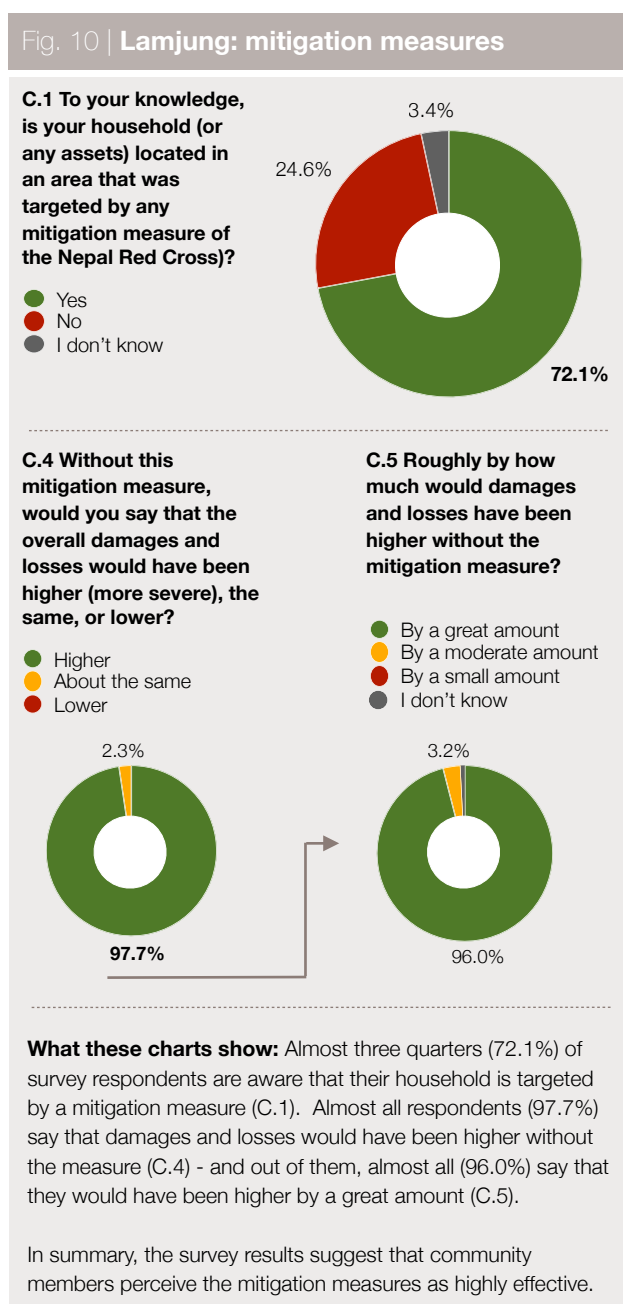
Key findings

- Programme mitigation interventions have positively contributed to improved protection of communities in Lamjung.
- More consideration of how local livelihoods and environmental management practices impact on levels of risk would have resulted in more comprehensive protection for some communities.

However, there were also criticisms and concerns. In one village, the CDMC was seen as just meeting and doing nothing in the absence of an emergency. In Siddharta Milan, the committee had existed in the shadow of the programme team and had not developed a clear identity. There had been an earlier disaster committee in Pragatasil which then faded away. National changes mean all visited CDMCs will need to be reformed. It is possible that many of the same people will reappear in new roles given size of communities, but questions remain over how new people will be trained to take on roles.

5.1.4 Mitigation and natural resource management

All three visited villages now benefit from improved protection to floods (see fig. 10), but a level of threat persists in two of them. Overall, community perceptions from the survey show 72.4% of respondents were aware of the Red Cross role in this mitigation work, and 97.7% felt strongly that disaster losses in the event of flood would be significantly higher without this intervention. To better understand the reality, each case needs to be considered independently.



In **Satkanya**, the gabion box mitigation has successfully redirected a brook away from the school and village, but the frequency of risk was already modest (the last flash flood had occurred 21 years ago), and as the village has grown significantly since then, so the potential impact was hard to gauge. The level of risk is now negligible and no maintenance is required.

Siddharta Milan is similarly fast-growing, and three different gabion schemes now protect the community at three key points. Two schemes protect upstream farmland and a small cluster of households near the main river. The threat here is very real, and mitigation proves effective. The third scheme provides dual protection against rare flash flood from a nearby brook, and protects the base of a bridge, the only connection between the village and its upstream neighbours with the rest of the district during the monsoon season.

The protection of the bridge's base is problematic - it requires regular maintenance and already shows signs of fatigue. Considering that this has deteriorated over a few years, a more substantial engineering solution may be required (government-led). Constant growth of these communities will continue to place pressure on marginalised land and fragile infrastructure.

In **Pragatasil**, perched on the steep side of a hill, well-placed gabion walls protect the village and schools from flash flood at three key points. A previous landslide on the east side of the village (three years before the project start) took away ten houses, and the need is evident. A concern was that attention focused on the river distracted from how the community manages the terraced farmland. Increased farming matched to the effects of deforestation mean there is still a landslide threat, which may not be fully understood by the community and was not well covered in the original assessment.

5.1.4 Livelihoods

Mason training, associated with the project's WASH activities, has brought wider skills benefits which may contribute to improved

Fig. 11 | Lamjung cost-benefit analysis

See further explanations in appendix B

Case study 3: Satkanya

Benefit-cost ratio (BCR)	2.6	Timeframe	15 years (2016 - 2030; discount rate of 5% applied to future benefits)
Attributed costs	141,295	Parameters and assumptions	<ul style="list-style-type: none"> Costs: CORE programme costs, less administrative costs, divided by 15 communities Direct economic benefits relate to the WASH component and include less time lost to water-borne disease and used for medicine/treatment as well as time savings for water collection. These are substantial and amount to almost half of identified benefits (44.8%). For avoided hazard losses (AHL), we distinguished between materialised protective benefits (avoided losses, 2015 earthquake) and those that can be expected in future events (all hazard types), assuming an annual probability rate (APR) of 5%. In terms of protective benefits of household preparedness, some have already materialised in the context of the 2015 earthquake (USD 11,981), while further benefits are expected over the timeframe (5,908).
Total quantifiable benefits	373,332		
a. Avoided hazard losses (mitigation)	188,184 (50.4%)		
b. Avoided hazard losses (preparedness)	17,889 (4.8%)		
c. Direct economic benefits	167,259 (44.8%)		

With greater programme costs than in Banke/Bardiya, smaller village sizes, and lower risk, benefits-cost ratios are generally lower in Lamjung. This is despite the identified **economic benefits** related to the WASH interventions, which are particularly pronounced in Satkanya (58 households).

While some benefits of **household preparedness** were identified (e.g. families preparing 'Go bags'), the main benefit stems from **mitigation**: in Satkanya, this included the protection of 37 houses and two schools from floods. Avoided losses include house damage and rent needed during the period of re-building and repairs.

Case study 4: Pragatisil

Benefit-cost ratio (BCR)	8.3	Timeframe	15 years (2016 - 2030; discount rate of 5% applied to future benefits)
Attributed costs	141,295	Parameters and assumptions	<ul style="list-style-type: none"> Costs: CORE programme costs, less administrative costs, divided by 15 communities Direct economic benefits relate to the WASH component and include less time lost to water-borne disease and used for medicine/treatment as well as time savings for water collection. For avoided hazard losses (AHL), we distinguished between materialised protective benefits (avoided losses, 2015 earthquake) and those that can be expected in future events (all hazard types), assuming an annual probability rate (APR) of 20%. In terms of protective benefits of household preparedness, some have already materialised in the context of the 2015 earthquake (USD 14,873), while further benefits are expected over the timeframe (29,339).
Total quantifiable benefits	1,170,768		
a. Avoided hazard losses (mitigation)	1,015,960 (86.8%)		
b. Avoided hazard losses (preparedness)	44,212 (3.8%)		
c. Direct economic benefits	110,596 (9.4%)		

In nearby Pragatisil (72 households), which is at greater hazard risk (mainly from flooding), the protective benefits of **mitigation** are very high, considering that almost all houses, two schools, and terraced maize fields are now protected from gabion boxes along river banks. The avoided indirect losses from agriculture contribute to the overall figure. Meanwhile, the direct **economic benefits** from WASH activities

were found to be significant. As in Satkanya, the protective benefits of **household preparedness** played a proportionally minor role.

Case study 5: Siddharta Milan

Benefit-cost ratio (BCR)	5.7	Timeframe	15 years (2016 - 2030; discount rate of 5% applied to future benefits)
Attributed costs	141,295	Parameters and assumptions	<ul style="list-style-type: none"> Costs: CORE programme costs, less administrative costs, divided by 15 communities Direct economic benefits relate to the WASH component and include less time lost to water-borne disease and used for medicine/treatment as well as time savings for water collection. For avoided hazard losses (AHL), we distinguished between materialised protective benefits (avoided losses, 2015 earthquake) and those that can be expected in future events (all hazard types), assuming an annual probability rate (APR) of 10%. In terms of protective benefits of household preparedness, some have already materialised in the context of the 2015 earthquake (USD 18,591), while further benefits are expected over the timeframe (18,337).
Total quantifiable benefits	807,199		
a. Avoided hazard losses (mitigation)	731,005 (90.5%)		
b. Avoided hazard losses (preparedness)	47,930 (5.9%)		
c. Direct economic benefits	28,264 (3.5%)		

The biggest of the three communities in Lamjung, Siddharta Milan (90 households) identified rather high benefits of **mitigation**: a large number of houses and fields are now protected. However, the durability of some river bank protection is questionable and may need retro-fitting to retain their value to the community. Avoided losses due to **household**

preparedness were rather minor (as in other Lamjung communities) - so far, materialised avoided losses amount to USD 18,591. Direct **economic benefits** related to improved water availability and sanitation were found to be smaller than in the two other communities, despite the consistent application of underlying assumptions.



A hygiene promotion session as part of the PHAST process that was supported by CORE. Photo: Nepal Red Cross

construction practices in the villages. Improved access to water in Pragatasil supports irrigation but there were no programme measures of its potential impact on livelihoods.

At the household level, time has been saved (reduced need to care for sick family members, less times to fetch water). In Pragatasil, this has translated in to more time spent on livelihood activities such as kitchen gardens.

A basic poll of all focus group participants indicated strong improvement in their livelihoods over the project period, but this change can only be partially attributed to the work of the Red Cross.

Key findings

- The health status of the communities visited has been improved - a result of improved sanitation, hygiene practice and access to clean water.
- CORE programme activities made a significant contribution to these changes even if Nepal Red Cross's involvement was not always recognised.

5.1.5 Health and WASH

"Before the project, only 4-5 households had a toilet - now all have toilets and water facilities. People used to go to the side of the river and the environment was very poor. Now the environment is good and there are still waste campaigns on a weekly basis. Previously, 100-150 people were going to the health centre every month with problems like skin disease, diarrhoea and conjunctivitis. The numbers were higher in the rainy season. Due to that, children were absent from school for an average of 15-20 days every year." Man from Siddharta Milan

Four out of five focus group participants, and all key informants, identified improved health, access to water and improved sanitation as the main changes in their community over the past five years. The survey found only 40% of all respondents identified health and WASH as Nepal Red Cross supported activities, but this was still higher than the numbers identifying community disaster preparedness and planning as project activities. In Siddharta Milan, there have been several other NGO initiatives around hygiene and water safety messaging, which have contributed to this improvement.

The transformative change in WASH practice was underpinned by the comprehensive approach adopted, combining hardware (incentivised support to households to build latrines, and locating new water points within the village, all quality assured by local authorities) with software built around a strong awareness raising component (PHAST). Near eradication of open defecation was reported by focus groups and by health post workers and local officials.

The incidence of severe cases of diarrhoea were anecdotally reported to have fallen in all three locations, with the change largely attributed to project interventions. Health centre numbers of recorded cases showed a dramatic decrease in Pragatasil and a significant fall in Siddharta Milan.⁴⁰ Outbreaks among school children in Satkanya no longer happened, and with continuing promotion of good hygiene practice, cases no longer spread within the family. Teachers also reported that school attendance had improved by between 30 and 75% since the start of the programme.

Nepal Red Cross support to the Female Community Health Volunteers (FCHV)⁴¹ and mothers groups in the communities has also been cited as a factor in improving awareness and response. We heard that recovery times were shorter and that families did not have to spend time going to the nearest health centre, or spend much income on medicines.⁴²

Over 95% of survey respondents think that these project achievements will endure. Some caution is still required based on the findings of an earlier CORE programme review⁴³, which noted that water user committees - trained and registered to manage each new drinking water scheme - still lacked required knowledge and skills.⁴⁴ Without a more detailed health/WASH review, it is difficult to fully assess this impact of the work.

40. The 2017 figure of 26 in Satkanya, however, shows an increase on the 14 cases in 2014 which may be partly due to improved reporting but still represents a fall from a high of 31 cases in 2016.
41. FCHVs are part of a government programme; they are volunteers embedded in their communities who have expertise in maternal and child health, family planning and awareness raising.
42. In Siddharta Milan, households quoted a figure of NPR 5,000 (USD 48) saved when not having to go to Beshisahar for treatment.
43. CORE Programme review 2012-2017.
44. There were also concerns as to whether mothers groups had received sufficient awareness raising to fulfil the health activities required of them.

5.2 District level

5.2.1 Coordination, planning and assessments

Nepal Red Cross has been a key partner in supporting the update of the DPRP, but the change is still in the process of being embedded, and there is still a high reliance on NRCS capacities in times of disaster. District planning is annually updated, but there is no evidence of proactive engagement of clusters, DDMC, and local partners. Improvements were mainly anecdotal, and there was no evidence that the system has been effectively tested since the earthquake.

While DDMC representatives were included within CORE training, linkages between DDMC and LDMC/VDC remain weak (unchanged from the 2015 assessment). Support from CORE and the 'reality check' of the 2015 earthquake were reported, by the District Chapter at least, to have improved overall district level planning and to have led to better definition of roles and responsibilities.

The District Emergency Operations Centre was identified as playing a vital role in emergencies and able to mobilise partners. When visited, it compared poorly to the impressively resourced DEOC in Bardiya, but the Lamjung lower risk profile would struggle to justify similar levels of investment. Whereas it had relied on the police for information before the 2015 earthquake, an (untested) multi-agency information sharing structure and process is now in place.

5.2.2 Nepal Red Cross capacity and performance

The value of programmes like CORE was noted by external stakeholders as a key factor in improvements in the Red Cross capacity both at sub-chapter level and through the growth of its roster of trained staff and volunteers. The benefits from the WASH components of CORE were consistently prioritised by all relevant stakeholders, including the district chapter.

The CORE programme and learning from the earthquake highlighted the need to strengthen volunteer numbers and capacities. Under CORE's umbrella, volunteer numbers have increased three-fold and those trained in First Aid increased from 20% to 80% of all volunteers. Questions exist over how to sustain this level of activity and capacity, but the growth of the District Chapter Emergency Fund indicates the potential for revenue generation that could legitimately be directed to such activities.

No CORE funds were channelled to this District Chapter Emergency Fund during the earthquake response, although from 2017 onwards it complemented chapter funds to build up a balance of NPR 1.2 million (USD 11,600). Warehousing capacity and stock have been improved, in part through CORE support, and these are much used by district authorities. However, there were similar problems with assessments as those raised in Banke and Bardiya, with concerns expressed over political influence in the 2015 earthquake assessment.

As with Banke and Bardiya, no substantial changes in the core business of the district chapter were identified during the programme period. First Aid training directly provided by the chapter declined as more training was provided through the programmes instead.

It is unclear if the programme has improved the district chapter's capability of delivering community level resilience type activities and services. There was no indication that the chapter was ready to provide continued remote support and motivation to the CDMCs that CORE had supported.

Key findings

- In terms of coordination, Nepal Red Cross has contributed to several improvements at the district level, but changes are not yet fully embedded or tested.
- The Lamjung district chapter is better prepared compared to 2012, but the level of change is not as significant as in Banke and Bardiya.
- Improvements can be clearly linked to the contribution of the CORE project.

6. The national level

Key findings

- It is too early to fully judge the effectiveness of the Assessment Coordination Team (ACT), not least because the local environment in to which it might be deployed is in a state of transition.
- Red Cross engagement with national level shelter coordination has delivered only limited benefits to date.
- Nepal Red Cross's role in assessments and coordination is now clearer and this clarity has highlighted a number of opportunities, weaknesses and challenges which the national society will need to address in the future.

45. ACTs were officially deployed in Dang and Banke and informally in Jhapa.

46. Nepal Flood 2017- Real Time Review of ACT Deployment and Assessments.

47. Further weaknesses identified by the 2017 review included the need for ACT roster members to be available for deployment and for training to better focus on activities that will actually be used during deployment.

48. Led by NRCS, IFRC and the Department of Urban Development and Building Construction (DUDBC), the Nepal Shelter Cluster is guided by a working group of 15-20 government agencies and NGOs. The cluster works with these partners to ensure coordination, technical support, and high-level information management between all bodies. It is one of eleven sectoral clusters at the national level.

49. The national shelter contingency plan 2014 has been updated in May 2018; it is still to be endorsed by the Government.

Assessment coordination team (ACT): Under the overall authority of the Ministry of Home Affairs (MoHA) but under the coordination of Nepal Red Cross, the ACT was developed as a national roster of trained multi-agency personnel for deployment in emergencies. This mechanism became functional too late in 2015 to have any effect in the earthquake response. However, ACTs were deployed in several Terai districts during the 2017 flood operation.⁴⁵ The Red Cross is seen as successful in securing MoHA engagement with this type of approach, and is one of the few domestic organisations that has the influence and capacity to take such an initiative forward. As indicated in an earlier review⁴⁶ and mentioned by several stakeholders, this type of activity, as well as the support to District Emergency Operations Centres, is fully consistent with the auxiliary role of the Red Cross to the government.

The benefits are already visible and include additional expert capacity to sensitise DDMCs, clusters and others on good practice and government requirements, as well as the ability to address data weaknesses and manipulation. However, sustainability concerns exist with both deployments thus far funded by Danish Red Cross, and there is currently no firm agreement from MoHA to take on long-term funding.⁴⁷

Banke district chapter identified the value of ACT members deployed in 2017 floods, noting that they played a support role to ensure improved coordination while undertaking municipality level orientation. The two-week deployment was felt to be too short; the chapter thinks they should have stayed at least to the end of the first round of reports.

Nepal shelter cluster engagement:⁴⁸ More money is now available for shelter in emergencies, but there is still limited interest in preparedness or coordination outside of emergencies. IFRC co-leads with DUDBC at a national level, and the technical working group of 15-20 members is more active now, but information sharing can be improved.

The gaps of shelter contingency planning⁴⁹ at districts levels is seen as a weakness. Many representatives of district-level Department of Urban Development and Building Construction (DUDBC) and NRCS chapters (which co-lead clusters in some districts) remain unclear on their roles and responsibilities within the cluster.

Nepal Red Cross coordination & capacity: From a national perspective, there were problems with the 2017 flood assessments across 27 districts, but IRA did provide the initial data required more quickly. In 2014, it took two months to publish the IRA data for a smaller area, by which time some donors were no longer willing to support appeals. However, the 2017 data was not compared adequately with secondary data, and the information systems were not robust enough.

Several stakeholders identified the continued need for wider use of mobile phone technology (linked to GIS mapping across the Red Cross network), thereby supporting improvement and efficiency of data collection. These priorities, together with ensuring the planned update of IRA is in line with wider good practice, are key areas for the Red Cross to improve its own performance while also influencing improvement across the sector.

Nine district emergency operations centres now function at an enhanced level, including those in Banke and Bardiya. They are supported by a national district information management system, which has strong potential but remains work in progress. The DEOC process has clearly built trust between NRCS and MoHA. The next step is however unclear in terms of consolidating progress and establishing the basis for scale up to other districts.



Section C | Implications

7. Success factors and challenges

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Reflecting on the analysis from the two investigated areas, let us distill the main success factors and challenges associated with DRR programming. The two parts of this chapter (success factors, *part 7.1* and challenges, *part 7.2*) each start with the community level, proceed with the district and national levels, and conclude with aspects related to Nepal Red Cross structures and processes.

7.1 Success factors

7.1.1 Community level

For all the Nepal Red Cross (and other) interventions, the **impact of living through flood or earthquake** was a major factor in encouraging behaviour change among affected populations.

Success of flood-based early warning at community level was built on a **combination of traditional knowledge** and practice in the communities, complemented by **technology**, improved organisation and a stronger awareness of vulnerability.

The value of basic **household disaster preparedness** measures, promoted by Nepal Red Cross and others, was recognised by the many households across all project districts, who adopted them as significant factors in improving their resilience during and after disasters. The results of the cost-benefit analysis underscore this aspect, particularly amongst the communities in Banke and Bardiya.

Effective utilisation of Nepal Red Cross’s ground-level capacities, through sub-chapters and community volunteers, has made a substantial contribution towards household and community preparedness. Though difficult to measure, it was noticed that having trained and motivated people in communities had a follow-on benefit to their neighbours, something particularly evident in isolated hill communities.

In Lamjung, the more evident success of CDMCs - compared to those in Banke and Bardiya - lay partly in their greater **visibility** to the whole community, which helps to improve accountability and awareness of their activities.⁵⁰ They were also able to build credibility by **attracting external support** for community projects and activities, like shelter construction and training. The programmes often gave **pre-existing** CDMCs greater **capacity**, and enabled them to be associated with the success of the WASH interventions.

Mitigation projects in Lamjung have contributed to creating safer communities, and protected livelihoods and assets. The cost-benefit analysis confirmed this aspect, showing that mitigation accounts for more than half (Satkanya) or almost all of the identified benefits. In some cases, mitigation measures successfully reduced the disaster risk level to near zero.

The adoption of well-delivered hardware and software WASH approach, fully linked to local government capacities and guidelines has brought potentially transformative health benefits to a number of communities in Lamjung.

Linkage of WASH activities to mason skills training was a valuable step in Lamjung that helped to improve the quality of latrine and water point construction and potentially built a stronger local skill base to encourage safer house construction. The opportunity to link integrated WASH, health and DRR approaches to a more coherent livelihoods approach was, however, missed.

7.1.2 District and national level

Improvement has been made possible through well-managed **cooperation** - for example through the work of a range of state and non-state actors working together to enhance planning, coordination and information sharing in Banke and Bardiya.

50. Another point is that CDMCs had been supported over four years, while those in Banke in Bardiya were supported for just one to two years.

In both Hills and Terai contexts, Nepal Red Cross demonstrated the benefits of active cooperation with public health and other actors to improve emergency health planning and response in flood risk areas, and to work together to improve the health status of hill communities through coordinated WASH interventions.



Volunteers of the 'Specialised DDRT' (Level C) training during the EPR programme in emergency health, WASH, assessment, and emergency shelter, respectively. Photo: Danish Red Cross

A **culture of coordination and more proactive planning** has been carefully developed in Banke and Bardiya. Through its project activities, Nepal Red Cross played a key role in promoting and supporting this way of working. The challenge now is to sustain this culture beyond the programmes and in the new administrative setting.

A particular driver for change in Banke and Bardiya was the close collaboration between Nepal Red Cross and the District Lead Support Agency. The link to Save the Children and Action Aid, based on close personal relationships, shows the potential for strong future institutional partnership.

The **whole system approach** to early warning, adopted by multiple stakeholders but supported in key areas by Nepal Red Cross, has been crucial to the success of this aspect of disaster management in Banke and Bardiya. The success of this system was also built on inputs that pre-date the programmes under review.

The role played by **effective DEOCs** has provided an invaluable, local level capacity that enables the smooth integration of vertical and horizontal coordination at district levels. It also helps to promote a higher level of professionalism across the district level DM system, built upon promotion of good practice, policies and tools.

7.1.3 Nepal Red Cross

Nepal Red Cross **capacities in raising awareness** have contributed to changed practice and behaviour – this was very noticeable in Lamjung through the impact of WASH activities, but also seen in Banke and Bardiya through households adopting good preparedness practice as a result of Red Cross awareness raising activity.

Nepal Red Cross is now clearly part of the disaster assessment and response process (as seen in Banke and Bardiya), rather than being the primary agency undertaking assessment and relief distribution. This is a substantial change that results in a more realistic role emerging for the National Society, as well as in greater accountability as part of a broader disaster management system. While these will present challenges in the future, they are not solely confined to NRCS, and the value of its technical and volunteer capacity is more clearly recognised by its peers - particularly in the programme locations.

7.2 Challenges

7.2.1 Community level

The challenge of **building strong, identifiable CDMC structures** was seen particularly in the Terai areas. They were at their most effective where the community was small and isolated, as in Lamjung, but in the Terai, their performance was inconsistent. It was not always clear whether any success was due to them, or to the involvement of Nepal Red Cross trained volunteers.

The challenge with mitigation projects is to **find solutions that are durable** and that fully address the causal factors of that community's vulnerability to disaster risk. If this is not done properly, the community can find itself facing new risks. In Lamjung, one intervention was notably unsustainable and requires a solution beyond the scope of NRCS or the community to provide.⁵¹ In another case, the environmental and livelihood dimensions of risk vulnerability were not fully considered, creating a new level of risk in the future.

Emergency funds, mainly in the small isolated hill communities in Lamjung, show the potential to provide reassurance and modest support in times of crisis, but **awareness** of the funds was not consistent. Throughout programme implementation, they are visible and easily monitored - however, independent oversight beyond the end of programmes remains a challenging aspect.

7.2.2 District and national level

Substantial investments in infrastructure in many parts of Nepal bear the potential of significant development benefits for local populations, but there are **risks created by poorly implemented construction projects, and a lack of coordination** between the different agencies involved. This can result in the increased risk of man-made disasters, which can invalidate existing early warning systems.

51. This concerned the foundation of a bridge in Siddharta Milan.



CORE programme community in Lamjung - preparing for annual flash flood risks but also affected by the 2015 earthquake. Photo: Danish Red Cross

The uncertainty, and downward reallocation of political responsibility created by **recent administrative changes** is leading to a transition to new structures at community and municipality levels that are not fully prepared to respond to emergencies.

The changes may result in increased political accountability, but may also see many of the capacity investments made by the Red Cross and others diminished unless this transition is quickly and effectively managed.

The new municipality structures have **limited awareness of their role in disasters**. There is a need to sensitise them on their role, and on the need to ensure that future assessment processes are completed without interference.

Given the scale and number of new structures created at municipality level, this is - and will remain - a considerable challenge for years to come.

District-level cluster engagement has proven challenging in the time available in Banke and Bardiya (albeit with some specific successes), and NRCS engagement with the national shelter cluster is still not fully effective due to weak information-sharing and continuing lack of clarity over roles and responsibilities, among other factors.

The difficulty of introducing improvement to planning and coordination, as pursued in Banke and Bardiya, to **districts of lower disaster risk** was seen in Lamjung. While the basic infrastructure is in place and has been pro-actively supported by Nepal Red Cross, the **engagement in clusters and planning is limited**. System testing was not evident in the absence of emergencies, and emergency operations centres and early warning systems functioned only at a basic level.

7.2.3 Nepal Red Cross

Trained Red Cross community volunteers performed admirably during the different disasters but the challenge remains in **maintaining volunteer skill levels** without guaranteed government funding. Even if this is provided, the need remains for Nepal Red Cross and its partners to better identify an optimum capacity at community, sub-chapter and district chapter levels. These must be appropriate to local needs, capacities and resources.

The National Society is some way from reaching this point, and there are serious concerns as to how programme-generated capacities can be sustained. More generally, it remains unclear how Nepal Red Cross (headquarters and district chapter level) will ensure **continued support** to and management of sub-chapter and community level volunteers.

Ownership of longer term commitments was not identified by any district chapter as part of their core business, and there was no indication that any of the projects had strengthened their organisational capacities to take on such a role, although disaster management capacities had improved significantly.

8. Recommendations

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Based on the findings of this study, we suggest twelve key recommendations to further advance DRR programming in general – only a few of the recommendations have special bearing on the Nepal context – organised at three levels: community level (*part A*), the district and national levels (*part B*), the Red Cross/Red Crescent Movement and likeminded agencies supporting DRR interventions (*part C*).

A. Community level

A.1 Monitor and consolidate the capacity of disaster management groups.

Ensure that capacity-building support to community and municipality-level disaster management groups is provided over a time period realistic enough to consolidate such groups - a short project intervention is rarely enough to facilitate sustainability. Outcomes of this work should be monitored against consistent performance, accountability and sustainability indicators.

A.2 Ensure adequate planning and quality of mitigation measures.

Physical mitigation activities should only be undertaken if the engineering solution is durable (with appropriate technical assistance available for design) and the problem analysis has fully considered all causal factors underpinning risk - including livelihood practices, environmental risk management and the risk of new extreme events.

A.3 Include adequate risk analysis in all projects.

At a minimum, all DRR projects should include a generic disaster risk analysis that factors in all risks, e.g. considers earthquake, climate and other changing and prevalent risks. All projects with a DRR component should furthermore include the promotion of relevant safe behaviour and construction measures, such as raised structures in flood-prone areas and earthquake-proofing measures in areas of earthquake risk areas.

B. District and national levels

B.1 Develop capacity requirements of new groups by reflecting on past experience.

Ensure DRR projects support formation of local groups that adequately function within the formal DM structures. Learning from recent emergencies should be used to encourage government and other stakeholders to critically reflect on, and then test, the minimum capacity requirements and functions needed. In the Nepal example, restructuring of the entire national administrative setup calls for adjusting DM to the new community and municipality level DM committees, and bring greater clarity to the role that Red Cross trained volunteers should play in relation to these structures.

B.2 Further enhance and expand early warning systems.

Establish minimum components and capacities at each level needed to sustain an effective, 'last mile' system, and identify steps needed to ensure it can be rolled out to all identified hazard-prone communities across an area with similar risks and early warning needs. This may require further testing to develop appropriate, costed models.

B.3 Consider man-made incidents and climate change in contingency planning.

District/municipal level contingency planning should consider risks from (failure of) manmade structures, e.g. dams and embankments, identify potential infrastructure 'hotspots', and involve relevant agencies in planning, training and early warning systems. It should also build in good practice around climate-smart disaster management, particularly planning for new weather extremes.

C. Red Cross/Red Crescent Movement

C.1 Advocate for infrastructure quality.

Red Cross/Red Crescent Societies should establish stronger humanitarian diplomacy positions on the potential disaster impacts of poorly managed and maintained infrastructure activities and projects on local populations.

C.2 Build on effective structures and tools.

Red Cross/Red Crescent Societies should further develop and document the most successful disaster management elements in their programmes. In the case of NRCS, this includes the capacity-building of DEOCs and community-level Search and Rescue volunteers, to build up low-cost and sustainable models that can be scaled up to cover all hazard-prone and vulnerable communities in targeted districts.

C.3 Adjust training of volunteers to the level of actual need.

Red Cross/Red Crescent Societies should train volunteers in Search & Rescue as well as First Aid as needed - considering the likely level of demand for these skills during disasters and normal times, as well as their ability to sustain these volunteer pools.

C.4 Develop and provide long-term community support.

Long-term consolidation packages should be developed that include future engagement, mentoring and support to communities that have been previously supported through projects. This should be done to maximise the chances that investments in local capacities, emergency funds and structures will be sustained. Potentially, this can be funded through emergency funds. In Nepal, this applies to district chapters covered by DipECHO 8 and CORE programming.

C.5 Share and use good practices.

Learning and good practice from district chapter disaster management capacities strengthened through these projects, and sustained post-project by the chapters themselves, should be documented and inform future policy and minimum requirements for branch capacity.

C.6 Engage with and sensitise new municipal DRM agencies.

Engagement with the disaster management sensitisation of new municipalities should be a prioritised action for Nepal Red Cross in all areas of high disaster risk.

9. Conclusion

Investing in disaster risk reduction (DRR) pays off. While this observation is now broadly accepted in the humanitarian and development world, the findings of this study serve as a reminder that the enhancement, maintenance and consolidation of preparedness are sound and worthwhile endeavours.

Two considerations make this a timely reminder. On the one hand, the potential of DRR in avoiding hazard damages and losses is likely to grow in the context of the greater frequency of severe weather events and increased variability of precipitation that come as key manifestations of climate change.⁵² On the other hand, Nepal's ongoing process of administrative reform and re-structuring puts some of the achievements of stronger groups and institutions at risk: unless newly-formed municipal bodies are sufficiently enabled to take on the tasks (and build the capacities) of their predecessors (those whose capacity had been strengthened through the various Nepal Red Cross programmes), much of what was gained may be lost in the process.

52. Notably, the benefit-cost ratios identified in this study assume a linear progression in terms of hazard frequency and severity. However, it is reasonable to assume higher benefits (in terms of avoided losses) if either hazard frequency or severity (or both) increase with the progression of climate change.

The two areas analysed in this study feature very different contexts: the small villages in the hills of Lamjung were supported by a rather multi-dimensional programme (CORE), while the much larger and more hazard-prone communities in Banke and Bardiya saw a programme approach more strictly limited to DRR. Despite these differences, there is a common finding across all five case studies: the identified benefits of the programmes exceeded the costs several times in spite of these differences.

In Bardiya and Banke, the materialised benefits are already more than two times greater than attributed costs. Here, the benefits of early warning became evident: especially if it allows for the timely evacuation of livestock, as in Dhadhwar, there are substantial benefits in terms of avoiding both direct and indirect hazard losses. Yet, the qualitative analysis also points to the need for - and some gaps in - the effective management of early warning systems.

In Lamjung, the mitigation measures supported by the CORE programme were seen as highly effective, and avoided losses attributed to mitigation accounted for the majority of all benefits. While encouraging, the study points out that these measures need to be well-planned and maintained to be - and remain - effective. The use of cost-benefit analysis in the planning of these measures (what will be the most effective solution?) and robust quality assurance are advisable in future implementation of such measures.

The study identified significant direct economic benefits of the CORE activities related to water and sanitation in Lamjung communities. This integration of two sectors is commendable and could yield additional benefits through even more comprehensive programming - in particular the greater promotion of climate-resilient livelihoods.⁵³

Whereas most cost-benefit studies focus on the protective benefits of mitigation, this study demonstrated the strong role of household and community preparedness in generating such benefits: high adoption rates of basic household preparedness measures in Bardiya and Banke are in fact seen as the primary factor in loss reduction.

Even in Lamjung, where a much lower hazard frequency tends to make DRR awareness-raising more difficult, household preparedness accounted for around five percent of identified benefits. Here, the 2015 earthquake re-invigorated interest - yet, beyond the post-earthquake window of opportunity, programmes that do not bring direct tangible benefits will struggle in the face of a common dilemma of DRR.⁵⁴

The study found many advances in the capacity of Nepal Red Cross and the level of coordination with government partners. With more and better trained volunteers, advances in assessment and planning, several improvements were seen in emergency response and recovery operations. Yet, these organisational and governance benefits could neither be quantified nor monetised and must thus be seen as benefits beyond the benefit-cost ratios.

Notably, the Red Cross has become more embedded in the disaster management system of several districts. Nepal Red Cross support to District Emergency Operations Centres across a number of Terai districts was particularly beneficial. More work is generally required to define and develop a sustainable role and capacity, in order for it to be applied across the Red Cross network.

In order to build on past achievements in terms of raised risk awareness, improved coordination and an overall reduction of risk, the report identifies several recommendations for communities, Nepal Red Cross and the government at the national and district levels, as well as the newly created municipalities. We hope that these recommendations will prove useful and be used - in order to maintain, consolidate and expand the benefits of being prepared.

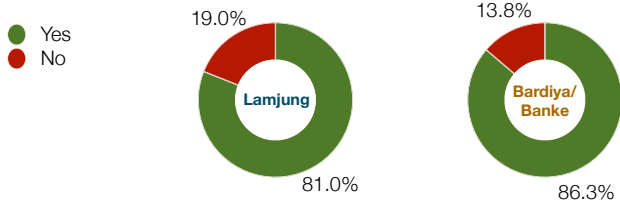
53. Depending on the level of community engagement, the WASH-related work created opportunities to introduce or reinforce basic community preparedness and risk reduction measures. There is scope to widen these in the future to better consider earthquake and climate risks, as well as to look at livelihoods - at least in terms of their relationship to disaster and environmental risk.

54. The dilemma of pure DRR programmes is that investments are in the present while its main benefits are in the future (and only in the case of hazard events). Especially in contexts of lower hazard risk, it is therefore advisable to consider more comprehensive programming that also brings more immediate and tangible benefits to communities - thus enhancing the sustainability of programme outcomes.

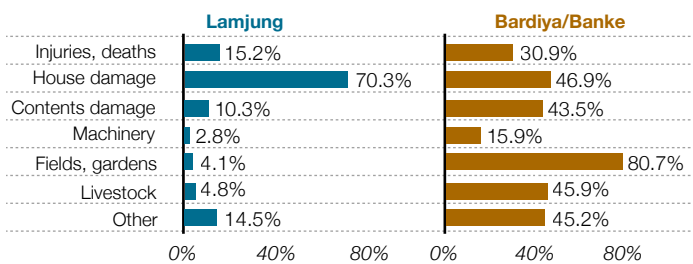
Appendix A: Survey results

A. Damages and household preparedness

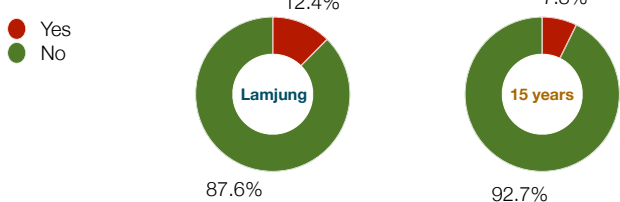
A.1 Has your household been affected by the 2015 earthquake (Lamjung)/2017 flood (Bardiya/Banke)?



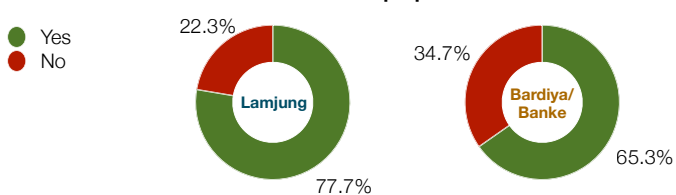
A.2 Referring to this earthquake (Lamjung)/flood (Bardiya/Banke), which of the following statements applies to your household?



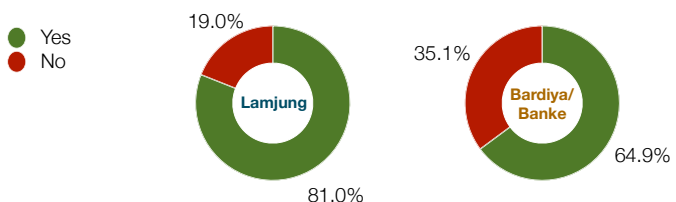
A.6 Did your household encounter any longer-term income losses, for instance due to disaster-induced disability, loss of assets, livestock or fruit trees?



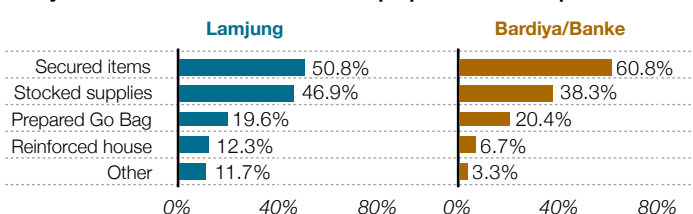
A.10 When the earthquake/flood struck, were you familiar with the Nepal Red Cross activities related to disaster preparedness?



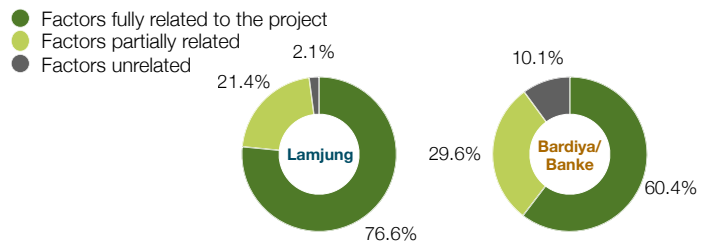
A.11p When the earthquake/hazard struck, had your household taken any measures to be better prepared for earthquakes/flood?



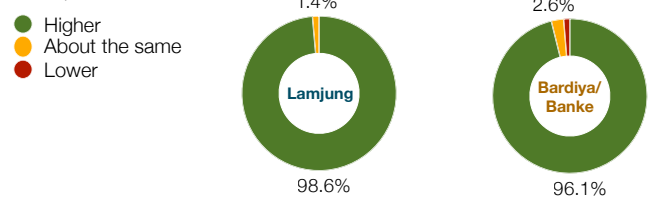
A.11 When the earthquake/hazard struck, which of the following measures had your household taken to be better prepared for earthquakes/flood?



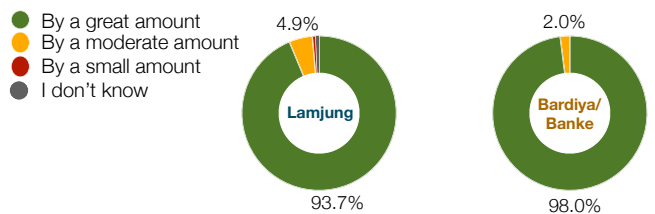
A.12 What made you adopt these measures?



A.13 Without the measures you took, would you say that the overall damages and losses would have been the higher (more severe), the same, or lower?

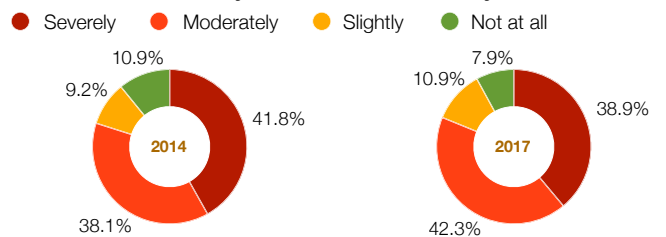


A.14 Roughly by how much would damages and losses have been higher if you had not adopted the preparedness measures?

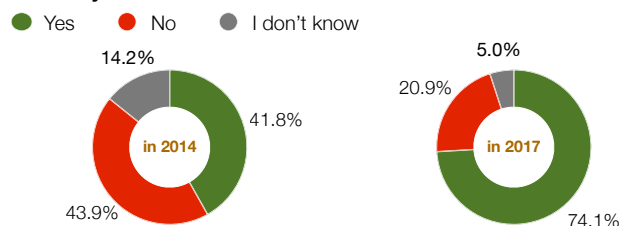


B. Damages and Early Warning (Bardiya/Banke)

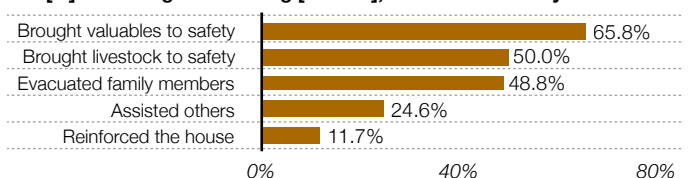
B.1 To what extent was your household affected by the floods?



B.2 Was your household warned ahead of the floods...?

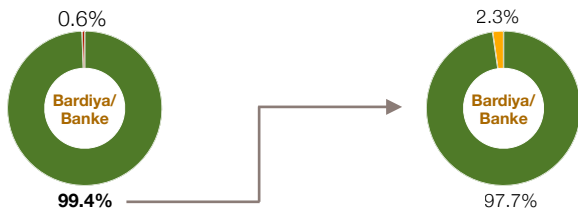


B.3 [...] Following the warning [in 2017], what actions did you take?



B.4 Without taking these actions, would you say that the overall damages and losses would have been higher (more severe), the same, or lower?

- Higher
- About the same
- Lower

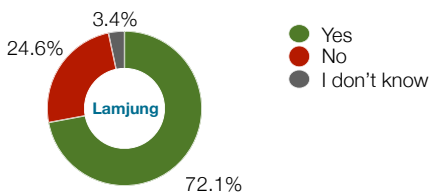


B.5 Roughly by how much would damages and losses have been higher if you had not taken these actions?

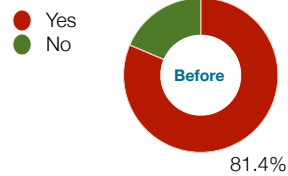
- By a great amount
- By a moderate amount
- By a small amount
- I don't know

C. Damages and Mitigation (Lamjung)

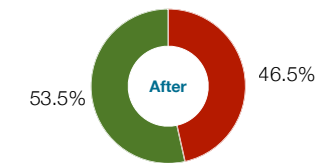
C.1 To your knowledge, is your household (or any assets) located in an area that was targeted by any mitigation measure of the Nepal Red Cross?



C.2 Prior to the construction of this measure, had your household been affected by hazards?

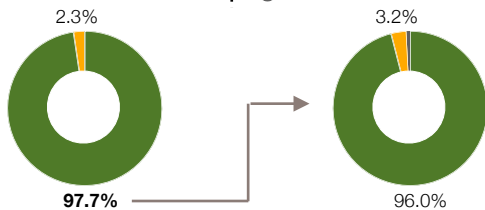


C.3 Since the construction of this measure, has your household been affected by hazards?



C.4 Without this mitigation measure, would you say that the overall damages and losses would have been higher (more severe), the same, or lower?

- Higher
- About the same
- Lower



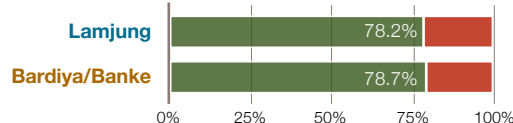
C.5 Roughly by how much would damages and losses have been higher without the mitigation measure?

- By a great amount
- By a moderate amount
- By a small amount
- I don't know

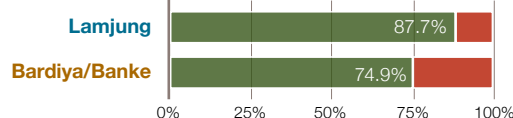
D. Community preparedness

D.0 Prior to the earthquake/flood, were you aware of any volunteer group in your community that was/is engaged in disaster preparedness?

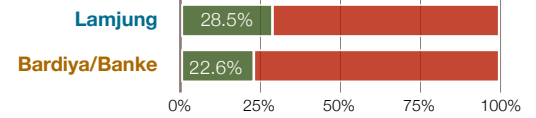
- Yes
- No



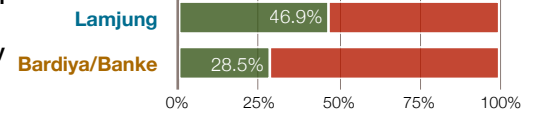
D.1 [...] were you aware of any Nepal Red Cross activities in your community?



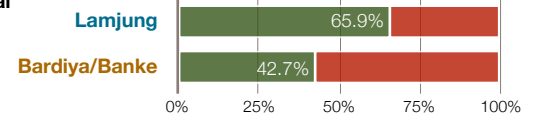
D.3 Prior to the earthquake/flood, had you or anybody in your household taken part in an emergency simulation/drill?



D.4 Prior to the earthquake/flood, had you or anybody in your household taken part in any training activities provided by the Nepal Red Cross?



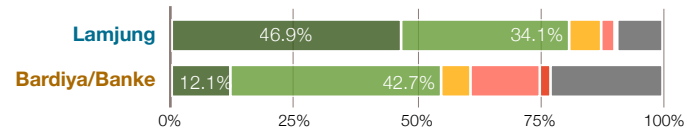
D.5 Prior to the earthquake/flood, had your household been engaged in any other Nepal Red Cross activities?



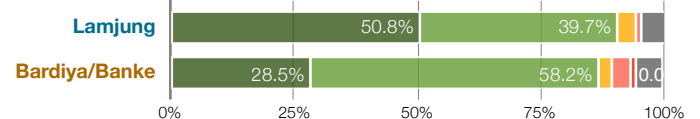
D.6-D.11 To what extent do you agree or disagree with the following statements?

- Strongly agree
- Rather agree
- Neither agree no disagree
- Rather disagree
- Strongly disagree
- I don't know

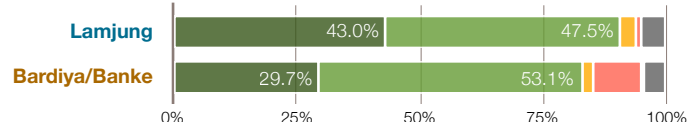
D.6 The CDMC/Nepal Red Cross team engaged me in the assessment of risks, capacities and needs.



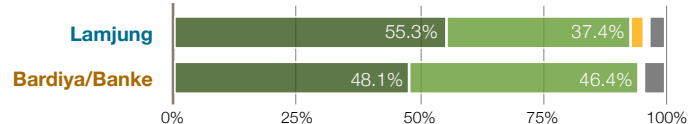
D.7 The community was better prepared for disasters - in part due to the work of CDMC/Nepal Red Cross.



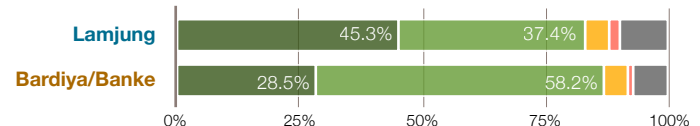
D.8 The activities of the CDMC/Nepal Red Cross led to lower damages and losses from the 2015 earthquake/2016 flood.



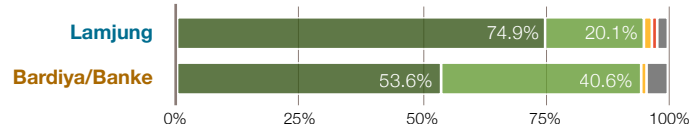
D.9 Following the earthquake/flood, I became more aware of the importance of being prepared.



D.10 Due to the CDMC/Nepal Red Cross activities, our community is better connected to key government departments.



D.11 The key achievements of the CDMC/Nepal Red Cross work are likely to endure into the future.



Annex B | Cost-benefit analysis

This table provides the full list of benefits and the assumptions that underpin the calculation of benefit-cost ratios (BCR).

All figures are in **US Dollars** except in the naarive description, where they are designated with NPR (Nepalese Rupee). The exchange rate of May 2018 was used - NPR 1 equals USD 0.00967.

Costs are provided for the entire duration of the associated programme. All **direct economic benefits** are presented on an annual basis, and added in the overall calculation on the assumption, that these benefits will endure 15 years (a discount rate of 5% is applied). **Protective benefits** are first provided per disaster event (direct/indirect), and then calculated for

the 15-year timeframe - taking annual probability rates and the 5% discount rate into account (2016-2030). In Banke, the materialised benefits have been added to the expected benefits over the 2018-2030 period. The benefits of household preparedness are based on household survey results; see specific assumptions in the text below the table.

District Community	Banke		Lamjung		Siddharta Milan	
	Dhadhawaar EPR programme	Mangragadhi EPR programme	Satkanya CORE programme	Pragatisil CORE programme	141,295	141,295

B. Benefits

B.1 Direct economic benefits (DEB)

None identified	None identified	13,924 - WASH: Economic benefit of clean water source located closer to multiple households. 40 households (approximately) report daily saving of 3 hours of time taken to collect water (water also cleaner and safer). Calculation based on 12 hour working day/25 day working month/average HH monthly income of 12,000 NPR, and benefit calculated over 1 year	1,595 - WASH: Amount spent on medicine for water-borne diseases saved, comparing 2014 and 2017. Based on 32 recorded cases in 2014 and 2 in 2017 and average treatment cost of 2,000 NPR per case. Lost productivity/travel costs to nearest health post of 3,500 NPR per instance, factored in to benefit	1,508 - WASH: Amount spent on medicine for water-borne diseases saved comparing 2014 and 2017. Based on 53 recorded cases in 2014 and 27 in 2017 and average treatment cost of 2,000 NPR per case. Lost productivity/travel costs to nearby town of 4,000 NPR per instance, factored in to benefit		
annual basis		6,962 - WASH: Economic benefit of clean water source located closer to multiple households. 36 households (half total) with estimated daily saving of 2.5 hours on time taken to collect water (water also cleaner and safer). Calculation based on 12 hour working day/25 day working month/average HH monthly income of 8,000 NPR, and benefit calculated over 1 year. Many people reported saved time put in to kitchen gardens and other livelihood/nutritional activities	650 - WASH: Economic/income benefit of reduced water borne disease incidence on health and increase income through reduction in work days lost. Focus group agreed each serious case of diarrhoea approximate to 14 days of lost productivity. Calculation based on half of cases in 2014/2017 affecting productive adults, and daily income of 320 NPR (25 days at 8,000 NPR income per month)	845 - WASH: Economic/income benefit of reduced water-borne disease incidence on health and increase income through reduction in work days lost. Based on Pragatasil, and FGD discussion each serious case of diarrhoea given approximate to 14 days of lost productivity. Calculation based on half of cases in 2014/2017 affecting productive adults, and daily income of 480 NPR (25 days at 12,000 NPR income per month)		
Annually	0	13,924	9,207	2,353		
15 years	0	167,259	110,596	28,264		

District Community		Banke		Lamjung		Siddharta Milan	
Dhadhwar		Mangragachi		Pragatisil		Satkanya	
B.2 Protective benefits		40%		5%		20%	
Annual probability rate		60%		10%			
B.2.1 Protective benefits Mitigation/EWS							
16,245, EWS - livestock assets protected through evacuation - Buffalo.		2,321, EWS - livestock assets protected through evacuation - Buffalo. 3 buffalo with a unit value of 80,000 NPR were saved due to EWS		178,895, Mitigation: gabion box protection to 37 houses. 37 households vulnerable to flash flood from brook at top of village, protected by gabion wall. Each house valued at 500,000 NPR		160,522, Mitigation: Gabion box riverbank protection in 3 locations to a total of 83 houses (75 protected by 1 measure, 5 by 2nd, and 3 by 3rd. Riverbank protection on slope above village protects 75 houses. Community highly vulnerable to flash flood that would likely sweep away much of the current village (previous flash flood destroyed 10 houses). 2 other measures protect 5 and 3 houses. Benefit calculated on house value of 200,000 NPR. Land cost of 50,000 not included	
5,077, EWS - livestock assets protected through evacuation - Cow. 15 cows with a unit value of 35,000 NPR were saved due to EWS		870, EWS - livestock assets protected through evacuation - Cow. 3 cow with a unit value of 30,000 NPR were saved due to EWS		116,040, Mitigation: gabion box protection to 1 school (2 buildings). Same mitigation provides protection to 2 school buildings, each valued at 6,000,000 NPR. DRC contributed to retrofitting of school as part of recovery programme		507,675, Mitigation: Gabion box riverbank protection in 1 location protecting bridge and up to 105 houses (valued at NPR 500,000 each). Difficult to give value to mitigation. Bridge serves community and is only link to Behishahar during monsoon season for whole valley beyond Siddharta Milan.	
2,901, EWS - livestock assets protected through evacuation - Goat. 25 goats with a unit value of 12,000 NPR were saved due to EWS		541, EWS - livestock assets protected through evacuation - Goat. 8 goats with a unit value of 7,000 NPR were saved due to EWS		34,812, Mitigation: Gabion box riverbank protection to 24 ropina of terraced farmland. Terraced land now protected by same riverbank mitigation above. Value calculated on community estimate of 150,000 NPR per Ropina (20 Ropina = 1 hectare)		Economic value significant and hard to quantify. Quality of gabion protection questionable and already being eroded. Level of past threat to houses in village also unclear but protection from flash flood now given by additional gabion boxes	
580, EWS - livestock assets protected through evacuation - Pig. 4 pigs with a unit value of 15,000 NPR were saved due to EWS		116,040, Mitigation: Gabion box riverbank protection to 2 schools. Same mitigation provides protection to 2 school buildings, each valued at 6,000,000 NPR.		116,040, Mitigation: Gabion box riverbank protection to 15 ropina of farmland in location no.2. 15 Ropinas of farmland, with unit value of 350,000 NPR protected through gabion box in upstream location on main river		50,767, Mitigation: Gabion box riverbank protection to 7 houses in location no.3. 7 houses protected with unit value of 500,000 NPR protected from flooding by gabion box protection located on river, near to main community	
116, EWS - 3 quantiles of rice saved. 3 quantiles with a unit value of 4,000 NPR per quantile saved from flooding. All other food stocks held by FGD participants were lost		1,450, EWS - livestock assets protected through evacuation - Buffalo. Based on lost income of 50,000 NPR per buffalo (lost milk production) x 3 buffaloes		18,378, Mitigation protection to 37 houses (rent while houses reconstructed).		10,878, Mitigation: Gabion box riverbank protection to 15 ropina of farmland in location no.2. Loss of land productivity estimated at 4 years. Economic loss calculated based on maize yield of 2,500kg per year/hectare x 150 NPR per kg x 0.75 Hectare (15 Ropina)	
19,495, EWS - livestock assets protected through evacuation - Buffalo. Based on lost income of 72,000 NPR per buffalo (lost milk production) x 28 buffaloes		870, EWS - livestock assets protected through evacuation - Cow. Based on lost income of 30,000 NPR per cow (lost milk production) x 3 cows		17,406, Mitigation: Gabion box riverbank protection to 24 ropina of terraced farmland - productive loss of land. Loss of land productivity estimated at 4 years. Economic loss calculated based on maize yield of 2,500kg per year/hectare x 150 NPR per kg x 1.2 Hectare (24 Ropina)		5,686, Mitigation: Gabion box riverbank protection to 7 houses in location no. 3. Additional recovery costs added of 1,750 NPR rent over 48 months in addition to household reconstruction costs outline above	
5,222, EWS - livestock assets protected through evacuation - Cow. Based on lost income of 36,000 NPR per cow (lost milk production) x 15 cows		777, EWS - livestock assets protected through evacuation - Goat. Based on lost income of 22,000 NPR per goat (lost adult and kid) x 25 goats		40,410		731,005	
5,319, EWS - livestock assets protected through evacuation - Pig. Based on lost income of 80,000 NPR per pig (lost 2 litters) x 4 pigs		3,094, EWS - livestock assets protected through evacuation - Pig. Based on lost income of 80,000 NPR per pig (lost 2 litters) x 4 pigs		188,184		1,015,960	
B.2.1 Total		229,024		40,410		731,005	
		2018 - 2030		2016 - 2030		2016 - 2030	

District Community	Banke		Mangragadhi	Lamjung	
	Dhadhwar	Satkanya		Pragatisil	Siddharta Milan
B.2.2 Protective benefits EWS, materialised					
Materialised	58,049	6,829	included in B.2.1	included in B.2.1	included in B.2.1
B.2.3 Protective benefits Household preparedness					
Materialised	62,876	111,204	11,981	14,873	18,591
Expected	248,061	658,096	5,908	29,339	18,337
B.2.3 Total	310,937	769,300	17,889	44,212	36,928
Summary	Dhadhwar	Mangragadhi	Satkanya	Pragatisil	Siddharta Milan
A. Costs	49,312	49,312	141,295	141,295	141,295
B.1 Economic benefits	0	0	167,259	110,596	28,264
B.2.1 Protective benefits Mitigation/EWS	229,024	40,410	188,184	1,015,960	731,005
B.2.2 Protective benefits EWS, materialised	58,049	6,829	n.a.	n.a.	n.a.
B.2.3 Protective benefits Household preparedness	310,937	769,300	17,889	44,212	36,928
B.2 Protective benefits	598,010	816,539	206,073	1,060,172	767,933
B. Total benefits	598,010	816,539	373,332	1,170,768	796,197
C. Benefit-cost ratio	12.13	16.56	2.64	8.29	5.63

List of additional assumptions

- **Costs:** The overall costs of the overarching programmes were used. We then subtracted the administrative/overhead costs and split the remainder by the number of supported communities. No ongoing costs to maintain outcomes were quantified - the values are therefore static - irrespective of any given timeframe.

- **Direct economic benefits (B.1)** as well as protective benefits related to **mitigation and improved early warning (B.2.1 and B.2.2)** are based on qualitative research (mainly focus group discussions). In Banke, the materialised benefits related to the 2017 flood are listed separately.

- Protective benefits related to **household preparedness** are based on the household survey.

For each analysed community, we quantified the benefits of household preparedness as follows:

- a) we took the share of households who were affected by recent hazards and multiplied it with the number of households in each community and the median amount of hazard damages and losses, resulting in **value A** (amount of damages/losses per community).
- b) we took the share of households who adopted household preparedness measures and said that losses would have been higher if they had not adopted these measures, resulting in **value B** (share of benefiting adopters).
- c) we considered the role of the project that led to the adoption of measures by adding scriptors (full attribution = 1; partial attribution = 0.5; no attribution = 0.0) to the percentages of attribution to the project - resulting in **value C** (project role factor).

- d) we quantified the loss reduction by cautiously interpreting 'great reduction' as 30% reduced losses, 'moderate reduction' as 20%, and 'small reduction' as 10% - and thus calculated **value D** (loss reduction factor).
- e) We multiplied **values A, B, C, and D** with each other. The resulting figure represents the protective benefits of household preparedness in each community.

- **Other benefits:** although 'third dividend' aspects such as social and governance benefits were identified (see main text), it was not feasible to quantify and/or monetise them.

Appendix C: Case study Kanchanapur

Background

What happens when the flood early warning system you rely on is not activated because the flood is caused by man-made actions that were never predicted? The Nepal Red Cross impact study visited the community of Kanchanapur in Banke district to hear their story.

To understand what happened, we have to step back and look at one of many major infrastructure projects that are transforming Nepal. The Sikta Irrigation Project in Banke District is an ambitious Government of Nepal initiative to improve the living standards of the local population through improved irrigation, as well as better access to agricultural support services. More than 42,000 hectares of cultivable area will be irrigated upon its completion.

Like other major infrastructure projects in Nepal, progress has been slow. Started in 2005, it should have been completed by 2015, but costs have nearly doubled - and completion is not expected before 2020. Poor quality of construction and the failure to meet required standards have been publicly criticised. But with forty percent of households in Banke falling below the poverty line and the need for improved irrigation, this remains an important project for the long-term economic development of Nepal.

What happened?

Numerous informants indicate that after a day of heavy rain during the 2017 monsoon, a water control gate on the canal was opened to ease local water levels and prevent the flooding of a nearby community. The canal in to which water was channelled was still under construction, and its walls had not been reinforced with concrete along the full length. As the suddenly released water reached the end of the concrete wall, its pressure breached the mud walls. This breach happened during the night near the village of Kanchanapur in Banke district.

The sudden influx of water caught low-lying parts of the community by surprise - with some people forced on to the roofs of their homes, others trapped inside, and one girl swept away along with most of her house. Fortunately she was spotted and was able to grab a tree under the guidance of Red Cross trained community Search & Rescue volunteers on the nearby embankment. She was later rescued from the tree.

The Community Disaster Management Group did not receive any messages from outside. Even after the flood, they contacted the gauge monitoring office on the Rapti River to be told that the water level was not yet at high risk levels.

It was fortunate that an Armed Police Force (APF) post was nearby, which mobilised boat rescue teams the following morning. But in the early hours of the response, it was members of the CDMC and Red Cross volunteers (often the same people) who were most active. Five people were rescued from collapsed buildings by the Search & Rescue volunteers, while First Aid trained volunteers were able to help three people, one who had nearly drowned, and two who were bleeding from injuries.

What could be done differently?

The absence of joined up risk planning was a factor that reflects the challenge of bringing different government departments and other partners together to collectively plan for river basin risk management. Several stakeholders have identified the need to sensitise construction companies and local government officials responsible for water system management, and to involve them in annual flood planning.

"In 2017, although we had heard of warning systems, we still did not have messages. It was the first day of rain and we didn't think what rain would do one day, but all of a sudden, the community got flooded because of the embankment breach."

Kanchanapur resident

Once the canal is complete, there may not be another flood for the residents of Kanchanapur, but over 83% of households surveyed reported destruction or damage to their homes, and 69% said they had lost livestock or other animals as a result of the flood.

During the review, we heard of one other location that had a similar experience. Even when the canal is finished, there will be a need for regular monitoring and budgeting for infrastructure maintenance, as well as for voices and experiences of vulnerable communities to be considered in the future.

Appendix D: Literature

Chadburn, O., Anderson, C, Venton, C.C. and Selby, S. (2013): *Applying cost benefit analysis at a community level. A review of its use for community based climate and disaster risk management.* Oxfam Research Report, June 2013.

IFRC (2011): *Breaking the waves. Impact analysis of coastal afforestation for disaster risk reduction in Viet Nam.*
http://www.preventionweb.net/files/globalplatform/entry_bg_paper~mangroveimpactreportfinalowapril2011.pdf

IFRC (2011a): *The value of volunteers. Imagine how many needs would go unanswered without volunteers.* <http://www.ifrc.org/Global/Publications/volunteers/IFRC-Value%20of%20Volunteers%20Report-EN-LR.pdf>

IFRC (2012): *The long road to resilience. Impact and cost-benefit analysis of community-based disaster risk reduction in Bangladesh.*
http://www.ifrc.org/Global/Publications/disasters/reducing_risks/Long-road-to-resilience.pdf

IFRC (2015): *Managing mudflows. Evolution, costs, benefits and prospects of disaster risk management in Tajikistan.*

IFRC (2016): *How preparedness pays off. Evolution, costs, benefits and prospects of disaster risk management in Georgia.*
https://www.preparecenter.org/sites/default/files/cba_georgia_report_final_lr.pdf

Mechler, R. and The Risk to Resilience Study Team, (2008): *The Cost-Benefit Analysis Methodology, From Risk to Resilience Working Paper No. 1*, eds. Moench, M., Caspari, E. & A. Pokhrel, ISET, ISET-Nepal and ProVention, Kathmandu, Nepal.
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Mechler, R., Czajkowski, J., Kunreuther, H., Michel-Kerjan, E., Botzen, W., Keating, A., McQuistan, C., Cooper, C., O'Donnell, I. (2014): *Making communities more flood resilient: The role of cost benefit analysis and other decision-making tools in disaster risk reduction.* Zurich Flood Resilience Alliance. <http://opim.wharton.upenn.edu/risk/library/ZAlliance-decisiontools-WP.pdf>

ODI (2015): *Unlocking the 'triple dividend' of resilience. Why investing in disaster risk management pays off. Interim policy note.* London: ODI, GFDRR, World Bank.
https://www.gfdrr.org/sites/default/files/publication/unlocking_triple_dividend_resilience.pdf

Shreve, C.M. and Kelman, I. (2014): *Does mitigation save? Reviewing cost-benefit analyses of disaster risk reduction; International Journal of Disaster Risk Reduction, Vol.10, p. 213-235.* <http://www.sciencedirect.com/science/article/pii/S2212420914000661>

White, B.A. and Rorick, M.(2010): *Cost-benefit analysis for community-based disaster risk reduction in Kailali, Nepal*. Lalitpur: Mercy Corps Nepal.

https://www.mercycorps.org/sites/default/files/mc-cba_report-final-2010-2.pdf

Programme-related documents reviewed

- Nepal Flood 2017 - Real Time Review of ACT Deployment and Assessments
- IFRC DRM capacity building project - briefing note
- CORE Programme review 2012-2017
- DEOC Flood simulation exercise, Bardiya December 2016 (Mountfield and Kaffley) – linked to DIPECHO 8
- DIPECHO 8 review (Knud Falk), December 2016
- NRCS EPR programme review (Knud Falk), November 2016 or June 2017
- NRCS-DRC Earthquake response Evaluation report 2016 (Caroline Holt)
- Nepal Flood 2017- Real Time Review of ACT Deployment and Assessments (no author given)
- Flood review 2017 - DEOC functioning (Gautum and Gautum)

Appendix E: Field research schedule

In-country phase			Activity	Survey work	Qualitative Work (FGD/KII)
14-15	March	Thu	Robert Roots Travel London-Kathmandu		
16	March	Fri	Meeting NRC and DRC, Kathmandu	Preparation	Preparation
17	March	Sat	Drive to Lamjung	Preparation	Preparation
18	March	Sun	Day 1 Lamjung (CORE programme)	Enumerator training	Facilitator briefing
19	March	Mon	Day 2 Lamjung	Satkanya	Satkanya
20	March	Tue	Day 3 Lamjung	Pragatasil & Dudhapokhari	Pragatasil
21	March	Wed	Day 4 Lamjung	Siddharta Millan & Sadhikhola	Siddharta Millan
22	March	Thu	Day 5 Lamjung		District Chapter workshop District level Key informants
23	March	Fri	Debrief and drive to Kathmandu		Data consolidation
24	March	Sat	Kathmandu		Data consolidation
25	March	Sun	Travel to Nepalganj, Banke	Preparation	Preparation
26	March	Mon	Day 1 Bardiya/Banke (DIPECHO 8 & EPR)	Enumerator training	Facilitator briefing
27	March	Tue	Day 2 Banke (locations TBF)	Dhadhawar & Bardiya	Dhadhawar
28	March	Wed	Day 3 Bardiya (locations TBF)	Mangragadhi, Bardiya & Udharapur, Banke	Mangragadhi
29	March	Thu	Day 4 Bardiya (locations TBF)	Kanchanapur, Banke	Kanchanapur
30	March	Fri	Day 5 Bardiya/Banke		Banke and Bardiya District stakeholders
31	March	Sat	Day 6 Bardiya/Banke		District Chapter workshop, Bardiya District Chapter workshop, Banke Team debrief
1	April	Sun	Return to Kathmandu		
2	April	Mon	Meetings, Kathmandu		Key informants – NRC, DRC and national
3	April	Tue	Meetings, Kathmandu Robert Roots departs Kathmandu		KII – NRC and DRC

Appendix F: List of interviews

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Bardiya district

Bhagi Rani Chaudhory, Sri Nepal Pragik Secondary school, Dhadhawar
Ramdhaniya Tharu, FCSV (former ward no 5), Dhadhawar
Harikala Chalise, FCSV, Mangraghadi
Lekhnath Bhusal, Chair NRCS Sub chapter, Mangraghadi/Dhadhawar
Prem Chaudhary, programme officer Action Aid (DDMC member, Bardiya)
Dilli Ram Acharya, DM Focal Point, Bardiya
Rupan Gyawali, Information Management Officer, Bardiya (staff on loan from NRCS)
Lekhnath Bhusal, Chair NRCS sub-chapter (Dhadhawar)

Banke district

Buddhi Raj Bhandari, LDMC convenor/Ward secretary), Kanchanapur
Dev Bahadur Thapa, School Principal, Kanchanapur
Dhan Singh Oli, Vice President NRCS Sub-chapter, Kanchanapur
Homnath Bhusal, Shelter Cluster Lead Engineer, Department for Urban Development and Building Construction
Khagendra Paudel, DM Focal person (In absence of Assistant CDO)
Ratna Raj Ojha, Programme Manager Livelihoods, and Co-Lead DLSA, Save the Children
Dhan Singh Oli, Vice President NRCS Sub-chapter Kanchanapur
Khim Bahadur Khadka, Chief Public Health Officer (Plus health cluster lead)
Gauri Lalbudhathoki, DEOC Information Management Officer, Banke (staff on loan from NRCS)

Lamjung district

Laxman Guram, CDMC coordinator, Pragatasil
School Principal, Satkanya
CDMC conveyor & vice chair rural municipality, Satkanya
Ward Secretary, Siddharta Milan
School Principal, Siddharta Milan
Assistant CDO, Lamjung District

National level stakeholders

Silvia Crespo, Head of Delegation, Danish Red Cross, Nepal
Mr Pandey, Head of DM, Nepal Red Cross
Sanjeev Hada, IFRC shelter adviser, Nepal delegation
Piush Kayastha, ECHO Office, Kathmandu, Nepal
Mr Shankar, Head of National Emergency Operations Centre, MoHA



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For many years, disaster risk reduction (DRR) has been a strong feature of the partnership between Nepal Red Cross Society (NRCS) and Danish Red Cross (DRC). This study looks at the impact and cost-effectiveness of these efforts, analyses what worked well and why, and recommends priority actions for future programming.

It finds that target communities are at lower risk than they had been, thanks to a mix of improved early warning, mitigation, community action and adoption of household preparedness measures. Quantifiable benefits exceed costs between 2.6 and 16.6 times. While these results compare well with other cost-benefit studies, concerns over sustainability are identified that require attention - particularly in the context of Nepal's administrative re-structuring.

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