

Concern Disaster Risk Reduction - Riverine Contexts



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Acknowledgements

This publication draws on ten years of experience from Concern Worldwide's disaster risk reduction programming experience in riverine contexts. The publication is part of a series documenting Concern's approach to disaster risk reduction. The series consists of five context papers focusing on DRR approaches in mountainous, dryland, coastal, urban, and riverine contexts. A sixth paper synthesises conclusions from these context papers and identifies how Concern uses DRR to contribute to building community resilience.

The success of our programmes is largely due to the invaluable insights and commitment of thousands of programme participants, community leaders, local government officials and other community members. It is our great honour and privilege to partner with local organisations, communities and ministries. We would also like to acknowledge Concern's dedicated field staff, who have devoted countless hours ensuring that our programmes are constantly striving to reach the most vulnerable with the highest quality of programming possible. Special thanks are due to devoted teams leaders, programme managers, advisers and country directors that have championed Concern's work on disaster risk reduction.

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Settlement on a riverine island in northern Bangladesh 2013. Photo by Aaron Clark-Ginsberg, 2013

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Acronyms and Abbreviations

BRE	Barotse Royal Establishment
CA	Conservation Agriculture
CAG	Contextual Analysis Guidelines
CBO	Community Based Organisation
CFW	Cash for Work
CPA	Administrative Council Post
CTD	<i>Conseil Technical de District</i> (District Technical Council)
DMC	Disaster Management Committee
DRR	Disaster Risk Reduction
DRM	Disaster Risk Management
ERT	Emergency Response Team
EWS	Early Warning Systems
HCUEP	How Concern Understands Extreme Poverty
HDI	Human Development Index
HFA	Hyogo Framework for Action
IBIS	Indus Basin Irrigation System
IWRM	Integrated Water Resources Management
LDC	Local Disaster Council
NARRI	National Alliance for Risk Reduction and Response Initiatives
NGO	Non-Governmental Organisation
NRM	Natural Resource Management
OFDA	Office of U.S. Foreign Disaster Assistance
PIPs	Policies, Institutions, and Processes
PEER	Preparedness in Emergency Response
RAG	Risk Analysis Guidelines
UC	Union Council
UNISDR	United Nations International Strategy for Disaster Reduction
WASH	Water, Sanitation, and Hygiene



Executive Summary

This report describes Concern Worldwide's approach to disaster risk reduction (DRR) in riverine contexts. Riverine contexts showcase Concern's approaches to addressing hazards typically found in riverine areas – **seasonal floods, water erosion and water pollution**, as well as secondary hazards such as **water borne disease**.

Concern Worldwide is a non-governmental, international, humanitarian organisation dedicated to the reduction of suffering and working towards the ultimate elimination of extreme poverty in the world's poorest and most vulnerable countries.

Concern works closely with and for the poorest and most vulnerable people in these countries, directly enabling them to improve their lives. Concern understands that disasters are a central factor causing and maintaining poverty, and has, for more than a decade and across more than 25 countries, been using DRR to address risks associated with disasters and contribute to building community resilience.

To innovate, improve, and capture good practices and lessons to be learned, Concern has documented its experiences in DRR and has produced a series of papers, based on its DRR programming in ten countries. Practitioners, policy makers and academics can use these papers to understand how Concern reduces risk in different geographic contexts and with different hazards.

The series consists of five context papers focusing on DRR approaches in mountainous, dryland, coastal, urban, and riverine contexts. A sixth paper synthesises conclusions from these context papers and identifies how Concern uses DRR to contribute to building community resilience.

Large rivers are for livelihoods, transportation, and drinking water. The dynamic characteristics of rivers are both a blessing and a curse. Seasonal floods provide needed fertility and water to agriculture alongside rivers, but can turn into disasters when they are exceptionally intense or when vulnerability is high. To live successfully alongside a river is to adapt to it and develop livelihoods that harness the benefits of the river while reducing the associated risks.

The report is based on Concern's DRR in four riverine contexts: the Barotse floodplain in the Western Province in **Zambia**; the Indus floodplain of **Pakistan**; the *char* riverine areas of **Bangladesh**; and the Zambezi floodplain in the Chinde District of **Mozambique**. People's lives and livelihoods in these areas are fundamentally shaped by being on the floodplain of a large river, which makes floods inevitable where they live. They must take into account and adapt to the hazards inherent to these floodplains.

DRR in riverine areas can be gathered into three broad types of intervention: **preparedness, natural resource management, and structural measures**. Adapting to seasonal floods can be the most effective approach to DRR in riverine areas, complemented with NRM and structural measures implemented together in high risk areas.

Preparedness includes strengthening response capacity, reducing response time and improving access to information. Establishing and strengthening community disaster management committees (DMCs); household, community and organisational preparedness planning; and linking vulnerable people to early warning systems (EWS) are key mechanisms for achieving preparedness.

DMCs should be a mix of elected representative positions and technical positions, including both administrative and traditional leadership. Training and capacity building of these committees is best done through district DMCs who can act like partner organisations, which further strengthens government commitment to DRR.



Community and government capacity to cope with and recover from disasters can sometimes be overwhelmed. Concern, as a humanitarian organisation, needs to be prepared to respond to emergencies. Concern can considerably expand its response coverage by responding through partners. In Pakistan and in Bangladesh Concern has a country-wide network of emergency partnerships with local and national NGOs that can serve as a model for Concern in other countries. These partners can mobilise and start assessments quicker than Concern could as they are already in the affected areas. Partners need to be prepared, so in these countries Concern assists partners by facilitating a 'preparedness for effective emergency response' (PEER) process for building preparedness.

Linking riverine communities to flood early warning systems (EWS) is important but the language of the EWS is of fundamental importance. Technical jargon must be avoided or the warning will be misunderstood. Messages need to be adapted to suit the end audience or they will be ignored.

Natural resource management includes improving the adaptability of livelihoods, erosion control and the clearing of drainage canals. Traditional livelihoods are often well adapted to seasonal flooding, and should be supported wherever possible through enhancements to productivity. However, population pressure and social changes can undermine these traditional systems, so in some cases, adaptation is required. Deliberate planting of vegetation to slow water erosion has limited impacts, and shows most promise when integrated into livelihoods activities.

Structural measures include constructing household plinths and embankments. Great care must be taken not to exacerbate risk elsewhere, or through time. Embankments, for example, can increase downstream flooding risk while removing the fertility improvements brought about by siltation. These measures are often necessary in high risk areas (such as in built up areas), but should always be accompanied by natural resource management.

Structural measures such as flood walls can be expensive but designing structures to resist medium intensity floods can be a balance between hazard tolerance and expense. Perhaps more cost effective is reducing the exposure to floods by constructing housing plinths or relocating people away from the flood plain. The former approach is used in Pakistan and Bangladesh. It is cost effective and largely successful, and Bangladesh's approach of integrating plinth construction, livelihoods improvements, and WASH interventions can be considered best practise for riverine risks. Relocation is highly contentious and comes with its own risks. This should only be considered as a last resort.

Rivers need to be considered from a systems perspective, with upstream-downstream linkages clearly considered. Riverine DRR needs to be considered within the basin management strategy, working closely with the river basin management authorities, who may span several countries. Although highly important, Concern has little experience in this area.

This report outlines some general good practices across cases, but ultimately, each intervention must be understood and adapted to the specific context. Furthermore, riverine risks are a product of vulnerability, inequality, and hazards, meaning that general DRR practices hold true and should be adapted to DRR in riverine contexts.



1. Introduction

Disaster risk reduction (DRR) is a key part of sustainable development in riverine areas. The floodplains around rivers are subject to seasonal inundations that can be hugely damaging if they are unusually intense or if vulnerability is high. Any development that occurs within the confines of riverine habitats must take floods into account.

Floods can be extremely damaging: floods in the river areas of Pakistan in 2010 caused an estimated \$43 billion in damages and affected over 20 million people (WFP, 2010; Kirsch *et al.*, 2012). While riverine disasters can be extreme, they are not, however, inevitable. They are created by human interactions with their environments, and are characteristic of the societies within which they occur (Berton *et al.*, 1978; Cannon, 1994; Hewitt, 1983). As such, it is possible to reduce risks in riverine areas with the appropriate approaches.

This report documents how Concern Worldwide uses disaster risk reduction¹ (DRR) to reduce risk and build resilience of the poorest and most vulnerable people living in riverine areas.

Concern Worldwide is non-governmental, international, humanitarian organisation dedicated to the reduction of suffering and working towards the ultimate elimination of extreme poverty in the world's poorest and most vulnerable countries. It operates in over 25 countries around the world and takes a multidimensional approach to addressing extreme poverty, and responds to humanitarian emergencies when a community's capacities to cope and recover from crisis are overwhelmed. The organisation uses its knowledge and experience to influence decisions made at a local, national and international level that can significantly reduce extreme poverty.

This report is based on the past decade of Concern's DRR programming experience in riverine contexts.

The lack of, or low returns from assets defines poverty and is caused and maintained by inequality and risk and vulnerability. These three dimensions of poverty are conceptualised in figure 1 (below).

Concern's understanding of DRR, first articulated in 2005, identifies four components common to risk reduction; risk analysis², preparedness, mitigation, and advocacy, which together build community resilience.

This report is based on the past decade of Concern's DRR programming experience in riverine contexts.

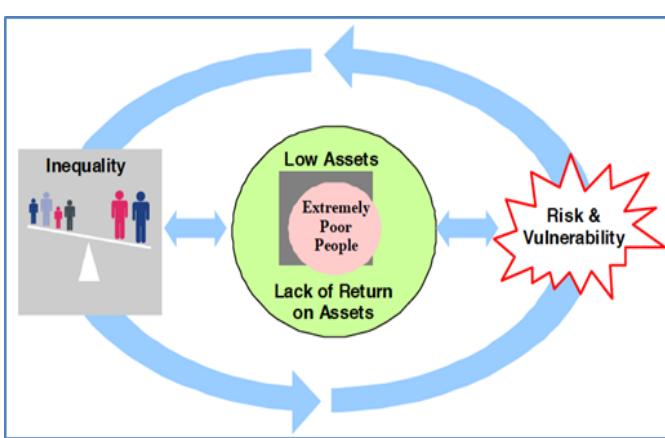


Figure 1: How Concern understands extreme poverty (from Concern, 2010)

Methods of comparison and structure of the report

To develop an understanding of how Concern reduces risk in riverine areas, this report compares Concern's DRR work in four riverine areas: the Barotse floodplain in Western Province, Zambia; the Indus floodplain of Pakistan; the *char* riverine areas of Bangladesh; and the Zambezi floodplain in Mozambique's Chinde district. The four areas, while all riverine, display a high degree of variance in terms of the risk context. Therefore, comparing them provides a means of developing an understanding of good practices for DRR in river areas. To facilitate such comparison, the report has been divided into four sections:

- The first section introduces the concept of riverine risk and DRR.
- The second presents and compares each case to identify DRR activities common across these four areas.
- The third compares each activity in detail and develops lessons learned.
- The last concludes with overall lessons for DRR in riverine contexts.

This structure builds an understanding of Concern's approach to DRR in coastal areas from the bottom up, developing conclusions from the context and activities of the organisation itself. It is based on a series of 2-4 week country visits for each case (Pakistan in May, 2014; Bangladesh in August, 2014; and Mozambique in September, 2014), consisting of focus group discussions and key informant interviews of Concern staff, partners, and beneficiaries and collection and review of secondary data.



2. Riverine areas and disaster risk reduction

A riverine area is a body of land that is, in some way, connected to a river. Since a river forms part of a watershed and all landmasses not permanently frozen fall within a watershed's catchment area, such a definition is too broad for an understanding of what makes riverine areas unique from a DRR perspective. Defining a riverine area on the basis of its risk profile — its hazards, vulnerabilities, and capacities — can be a way to understand what constitutes a riverine area is and how to reduce risk in such contexts:

Element of risk	Riverine attribute
Hazard	Exposure to common riverine hazards including floods, water erosion, and water pollution
Vulnerability	Common riverine vulnerabilities such as population density, pockets of extreme poverty and the impact of human activities along rivers
Capacity	Access to common riverine resources including rivers for fish, water, and transport, alluvial soils for agriculture, and flat land for settlement

Table 1: elements of disaster risk and their riverine attributes

Approaching riverine areas on the basis of each of the elements of risk helps provide a nuanced understanding of riverine risks. For example, people living on floodplains are often exposed to hazards like floods, water erosion, and water pollution, but might not always have access to riverine resources; fishing can be restricted and rivers might not be appropriate for transport. In this instance the area might be considered riverine from a hazard perspective, but not a capacity one. Such a view allows for distinctions to be made between riverine and non-riverine areas from a risk perspective and therefore provides the basis of this report.

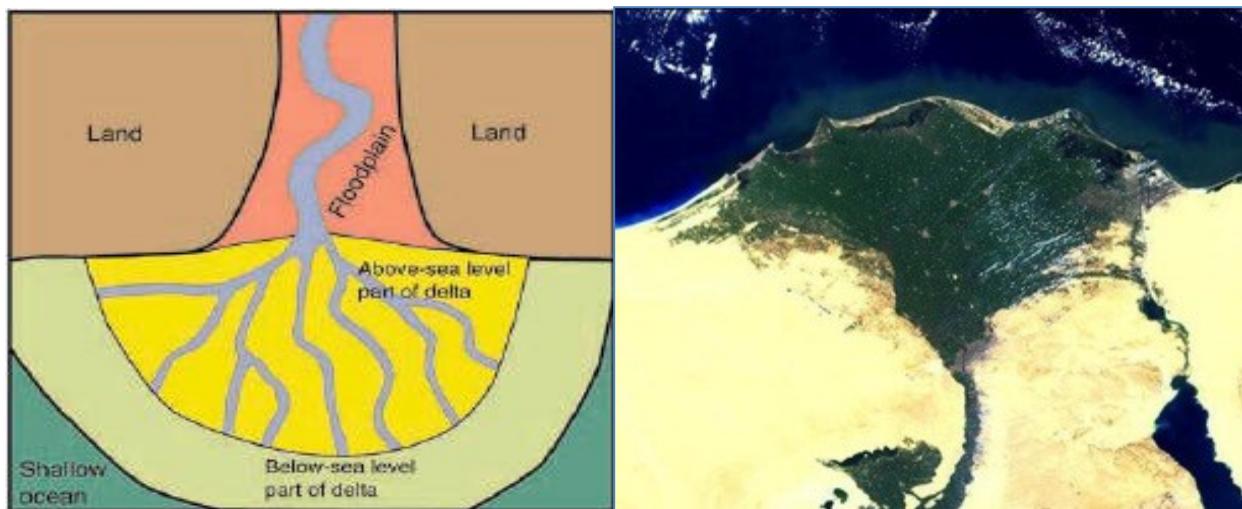
Riverine hazards, vulnerabilities, capacities, and risk reduction

Living in riverine areas has certain advantages. Rivers and streams hold only 0.006 percent of the world's freshwater, yet are the main source of society's water, including for agriculture, livestock, industry, and human consumption (Solomon, 2010). Upper riverine areas are often located in mountainous areas with steep valley walls, and can be dammed as a source of power. Lower areas tend to flatten out and have rich deposits of alluvial soils, rendering them ideal for agriculture and settlement. River ecosystems can provide a source of food and offer protection from hazards. Wetlands, for example, can absorb excess waters and reduce the chances of flooding. Rivers themselves can be used as part of a transportation network, connecting disparate places together and facilitating trade and governance. Risk management in riverine areas is therefore about maximising these social, economic, human, political, and environmental benefits and minimising river risks.

Rivers are dynamic moving bodies of water and it is this dynamism that characterises the hazards encountered in riverine areas. Some of the main hazards include **floods** (where water overflows and submerges land that is usually dry); **water erosion** (removal of soil and rock from an area); and **water pollution** (the contamination of water bodies by pollutants). These risks can also create secondary hazards, a main one being **water borne disease**.



Floods occur regularly on floodplains and deltas. Floodplains are the areas adjacent to rivers that absorb floodwaters and allow rivers to be dynamic (Gilvear *et al.*, 1995). They are created by river erosion and the subsequent deposition of sediment. Floodplains can be broken into two sections based on their propensity to flood: flood ways (areas that flood regularly) and flood fringes (areas that flood less frequently). A delta is a fan-shaped area that is produced by the deposition of sediment where the river enters a body of water or a desert. Delta flooding can be similar to flooding in floodplains in that it is produced by the river itself, but can also be produced when seawater backs up into the river, such as during storm surges.



Deltas often have a distinct fan shape, caused by the spread of sediment. Figure 2, on the left, is a model of a floodplain. The photo on the right is of the River Nile in Egypt.

There are three categories of floods: slow onset flooding, quick onset flooding, and flash flooding (EMA, *n.d.*). Slow onset flooding, otherwise known as regional flooding, occurs when a large area gradually becomes inundated with water over a prolonged period of time. Such flooding can happen over a period of weeks and take weeks to subside. Regional flooding is common to deltas and floodplains . Quick onset flooding, also called upstream flooding, occurs when water moves downstream at fast rates, flooding the downstream areas in the process. This type of flooding typically occurs over a few days in places where waters flow quickly, mainly in mountainous river areas with steep elevation changes. Flash flooding is the product of short and intense bursts of rain. It is rare for large rivers to be subject to flash flooding, mainly because their size allows them to absorb the sudden increase in water volume.

Natural and manmade forces influence the scale and frequency of floods. Heavy rainfall and sudden or heavy snowmelt can exacerbate flooding. Infiltration rates - how readily water can seep into the soil - also affect flooding. Areas with high infiltration rates (like wetlands) can hold water and reduce flooding, while areas where infiltration is low (e.g. roads), can create runoff and increase chances of flooding. Vegetation cover, extent of water saturation in the soil, soil type, frozen ground, and human construction all influence infiltration (Tulane 2012, Renaud, 2012). Floods are also influenced by the water flow of the rivers themselves. Blockages in rivers (whether temporary, like debris in the water, or more permanent, like roads or buildings that constrict flow) can hinder water flow downstream and cause upstream flooding, and rivers with fast flow rates upstream can create downstream flooding.



Water erosion occurs when water forces overwhelm and wash away soils. Water flow rates, soil type, and flora can all influence erosion, with erosion increasing as water flows more quickly; flows over more coarse-grained soil; and with decreased density of plant root systems. Erosion can occur when raindrops hit exposed soil (raindrop erosion) as water moves downhill (sheet erosion and gully erosion) or as it flows through river areas (stream and channel erosion) (see Figure 4). Erosion can destroy land and deplete nutrients. However, nutrients can be transferred downstream, creating a fertile bed for agriculture.



Sudden onset flooding is common in the mountains of Afghanistan. The left photo shows villagers attempting to salvage a micro-hydropower plant during a sudden onset flood. Regional flooding is a major challenge in the UK, as seen by the floods in the winter of 2014 (right, New York Times, 2014).

Water pollution occurs when pollutants are discharged into water bodies. It can be classified in a number of ways, including by the body of water that is contaminated (surface or groundwater pollution), causes of pollution (chemicals, pathogens, or thermal pollution), and by impact (human, environmental, or agricultural). Water pollution is a major contributor to diarrhoeal diseases; 88% of the 1.5 million deaths per year from diarrhoea are attributed to unsafe water, inadequate sanitation, or insufficient hygiene (Prüss-Üstün *et al.*, 2008). It can also affect agricultural productivity and ecosystem stability.

Floods, erosion, and pollution can create a number of other risks. Floods can spread pollutants and contaminate water sources, increasing the risk of water borne diseases. Stagnant floodwaters can become breeding grounds for malaria. Floods and erosion can destroy critical infrastructure and lead to technological disasters. The 2010 floods in Pakistan, for example, were in part a technological disaster as engineering of the Indus has exacerbated extreme flooding (Mustafa and Wrathall, 2011). At a smaller scale, hospitals, schools, and other structures might be destroyed during flooding.

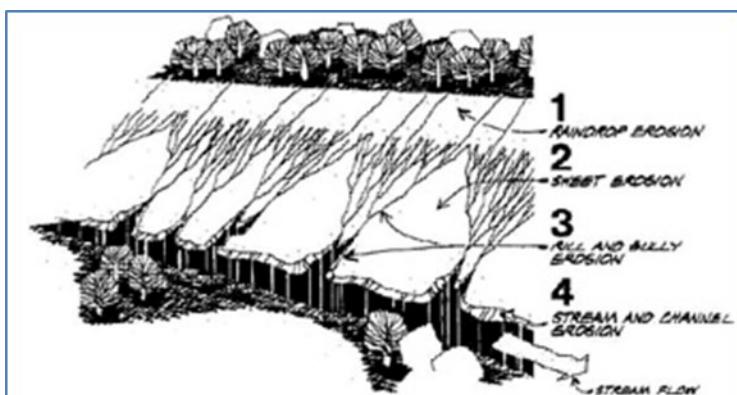


Figure 4: Types of water erosion (USDA NRCS, 2002 in IIHR, n.d.)

Given the scale of these risks coupled with the rewards that come with living in riverine areas, risk management is a crucial component of riverine development. Approaches to risk management in riverine areas fall between two categories: those treating disaster risk as a negative externality attributed to nature to be controlled via technocratic measures, commonly known as the *hazard paradigm*, and those understanding disaster risk as an internal product of both society and nature, which are both inseparable from each other, known as the *vulnerability paradigm*. These two categories should be thought of as two positions on a spectrum within which all interventions can be positioned.

The focus on controlling and separating hazards from humanity often involves large scale investment in the scientific monitoring and prediction of hazards; planning and managerial activities to contain hazards via structural interventions or manage human activity; and respond to disasters through the provision of emergency relief (Hewitt, 1997). In riverine areas, this work tends to focus on controlling rivers to reduce their dynamism through the construction of floodwalls, embankments, canals, dams, and other structures. These methods can create a sense of structured predictability and allow for settlement on otherwise high-risk areas, but they can also exacerbate risks by changing water patterns and increasing pressure on environmental systems. They can also create a false sense of security and encourage settlements in marginal and risk prone areas, and can add new technological disaster risks via dam or floodwall failure. The UK floods of 2013, for example, were partially attributed to widespread building in floodplains over the past 30 years (Temperley, 2014).

While the hazard paradigm treats disaster risk as a negative externality to be controlled through experts using top-down interventions, the vulnerability paradigm understands disaster risk as internally created as a product of human inequality and actions. As such, it seeks to address the underlying inequalities that create such risks, and acknowledges that everyone in society is responsible for risk and its reduction.

While these hazards have mostly negative impacts, they can also have some benefits. Slow onset floods frequently leave behind rich deposits of alluvial silt, which improves soils and agricultural productivity. These deposits and erosion also flatten floodplains, which makes the areas better for settlement (Solomon, 2010).



The picture above shows a river flowing through the city of Freetown, Sierra Leone. The river serves as an open-air sewer, exacerbating vector borne disease risk including cholera, and causing river blockages that increase flood risk.



Ecosystem DRR, the management of ecosystems as a mechanism for reducing disaster risk, is related to the vulnerability paradigm, but has a more explicit focus on human-environment interactions (Gupta and Nair, 2012; Renaud *et al.*, 2012). Ecosystem approaches revolve around letting rivers remain dynamic and adapting social life to river systems themselves. This might include changing patterns of living (e.g. seasonal migration during flooding), developing in ways that are not affected by risks (e.g. building houses on stilts) and do not increase risks (e.g. building structures with permeable ground or reducing activities that contribute to pollution), and supporting natural risk reduction processes (such as wetlands, which filter pollutants and act as a storage mechanism for flood waters). These approaches treat disasters as a product of broad human interactions with natural environments and focus on how social patterns influence risk.

Riverine DRR is increasingly being approached through vulnerability perspectives. Integrated Water Resources Management, a process promoting the coordinated development and management of water and related resources for sustainable development is an example of such thinking as it focuses on the interconnected nature of riverine risk, sustainable development, and risk management (Rahaman and Varis, 2005; see figure 5 for an example). This approach, while new for policymakers, is a long-standing and common amongst communities in riverine areas. In China, for example, local communities have used an ecosystem approach to managing rivers for over 2,000 years (Weng, 2007). As such, it is more of a rediscovery of existing knowledge rather than a new form of knowledge and management in itself.

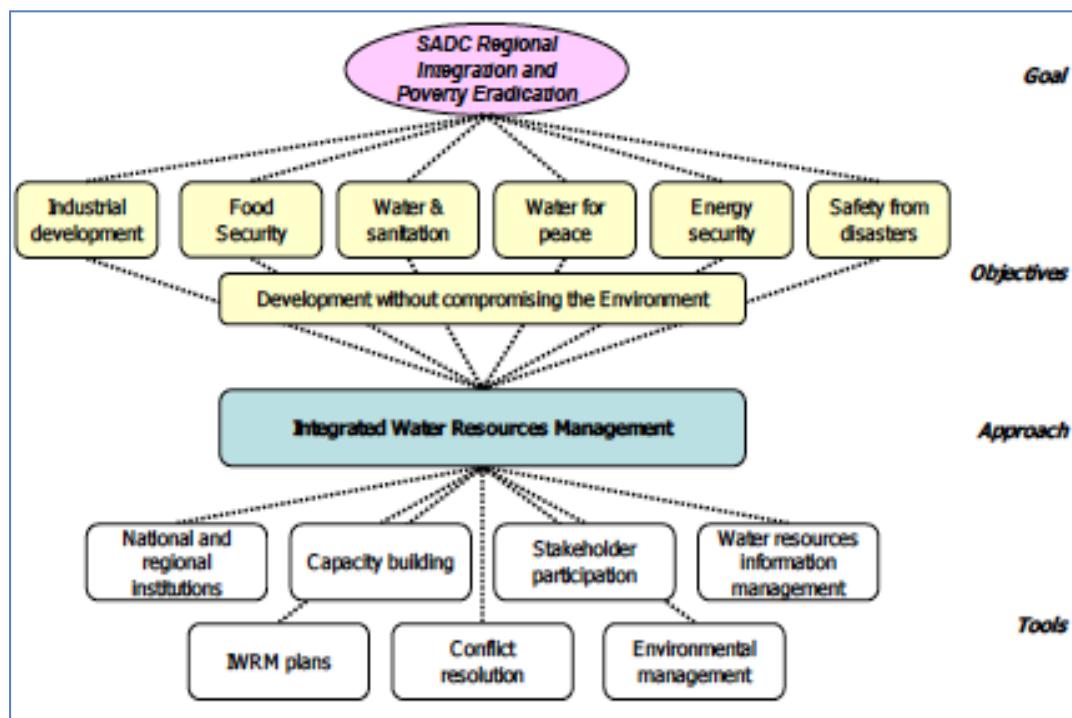


Figure 5: Conceptual framework for SADC regional water strategy (SADC, 2006). This figure is an example of integrated water resource management, showing how the approach has a number of objectives and utilises a variety of different tools.



3. Overview of the riverine case studies and Concern

Concern works to eliminate extreme poverty in a number of riverine areas including the Barotse floodplain of the Western province, Zambia, the Indus riverine areas of Pakistan, *char* parts of Bangladesh, and the Zambezi river basin of the Chinde District of Mozambique.

The Barotse floodplain of Western Province, Zambia

The Barotse floodplain is a 550 km² floodplain of the Zambezi River, the fourth longest river in Africa. Located in Western province of Zambia, the floodplain offers a mixture of habitats, but is mostly made up of grasslands and savannahs on the floodplains and wetlands in the areas close to the rivers, with trees on higher areas. The Zambezi is rain-fed and swells yearly during the wet season from around January to May, inundating the floodplain and often causing slow onset regional flooding. Along with flooding, the 250,000 beneficiaries of the floodplain experience other risks related to water pollution, water scarcity, malaria, diarrhoea, fires, HIV/AIDS, livestock disease, drought, and separatist tensions.

Poverty in Western Province is chronic and multidimensional, and is largely concentrated in the rural areas (Molony *et al.*, 2012). The area has a low population density, and in the upper flood plains and hinterland agriculture is difficult due to the mainly sandy soils and lack of basic irrigation technology. The poor and vulnerable are heavily dependent on rain-fed subsistence agriculture and have little access to key services like health centres, water points, schools, and markets. Gender discrimination is rife, and women are often marginalised from decision-making processes. While the area is generally poor, Concern has found the poorest and most vulnerable to be female-headed households with few assets and a dependency on agriculture, the elderly dependent on others in the community, orphans, and households with large families (Molony *et al.*, 2012).



The Barotse floodplain of the Zambezia province. Waterlogging (left) is common in areas close to the river where drainage is poor. Small villages dot the province; pictured right is an example.



The local population has developed a number of systems to manage risk. Agricultural and livelihood activities revolve around seasonal flooding; crops are planted and harvested to take advantage of rains and floods. Most settlements are built on raised areas — flood fringes, not flood plains. In the past, people used to migrate to higher areas during rains and return to lower areas in the dry season; this practice has, however, mostly stopped following the advent of more industrialised modes of production and consumption. The area has one of the most extensive canal networks in the world, developed under British colonial rule in the 1800s, and many of the canals are still functional and maintained with the support of the Barotse Royal Establishment (BRE), the customary governance authority. Canalising water helps it drain more quickly and can reduce regional flooding. Canals are also used as sources of irrigation water in the dry season and as a transportation network. Historically, communities cleared canals on their own under the guidance of the BRE. However, over the past decades NGOs have used canal clearing as a cash for work activity, which has undermined this voluntary system. The BRE also engages in other DRR activities related to fire management and disease control. These activities help manage risks in ways that generally limit hazards from becoming disasters.

Concern has been working in Zambia since 2002, mainly in the country's Western and Central provinces. In the Western province, Concern works in the areas of agricultural production, nutrition, market linkages, women's empowerment, and advocacy, with DRR and HIV/AIDS mainstreamed across all sectors. Specific DRR interventions are focused on strengthening community disaster management committees (DMCs), community level government structures responsible for managing disaster risk, and on supporting higher-level risk management structures. Concern uses these committees to support a variety of activities such as canal clearing and constructing firebreaks. It also works in emergency response, supporting centralised governmental emergency response systems and responding to emergencies itself when needed. Concern's last large scale emergency response in the province was in 2007 to widespread flooding.

The Indus valley riverine areas of Pakistan

The 3,100 kilometre long Indus River, which runs across most of Pakistan, has created a 518,000 km² floodplain that spans the fertile areas of the Punjab province in the north of the country and the more arid Sindh province in the south. The Indus is fed by melting glaciers and snow and the Asian monsoon rains, and can cause sudden and slow onset flooding from around mid-July to August. These floods can be extreme: slow onset regional floods in 2010 left a fifth of the country under water, affected 20 million people, and created \$43 billion of damage. Floods occurred again in 2011 and 2012, although their extent and financial impact were less than those in 2010. In addition to floods, the area is exposed to water shortages, water pollution (including salinisation in coastal areas and bacterial disease throughout), erosion, drought, earthquakes, conflict, and malaria.

The poor and vulnerable in these areas tend to live in rural areas, work in agriculture, and come from marginalised groups. In South Sindh, for example, Concern found the poor and vulnerable to be comprised of landless sharecroppers, agricultural wage earners, and women.



Floods in Pakistan can be huge. The photograph above shows an area affected by the floods of 2010, which affected over 20 million people in total (photo: BBC, 2014).

The Indus also has had a large impact on the people living in the area. The Indus valley civilisation was, with Mesopotamia and Egypt, one of the first three civilisations of the world, and is a fertile agricultural area that is easy to settle. The river today provides the country with most of its drinking and irrigation water and is a main source of power. Population growth and an increase in utilisation per person has created severe water shortages, particularly in downstream areas: the Indus has shrunk to 10% of its original size, an extreme example of physical water scarcity (IUCN, 2004 in Concern, 2013). Because of this the floods of 2010 actually had a (partly) positive effect on the eco- and agricultural systems as they brought much needed fresh water to the areas.

Communities use a number of strategies to reduce risk. Agricultural activities revolve around seasonal flooding to capitalise on deposits of rain and soil. The Indus River is also very heavily engineered. It is home to the Indus Basin Irrigation System (IBIS), which, at 180,000 km², is the largest continuous irrigation system on earth. The system can be traced back to the Indus valley civilisation, but was dramatically expanded while the area was under British colonial rule. Today it is comprised of three large dams, 85 smaller dams, 19 barrages, 12 inter-river link canals, and hundreds of thousands of smaller systems. IBIS manages large infrastructure at national level and, at the local level, communities manage flood risks using their own devices including constructing canals and bunds, much of the labour provided as part of a feudal sharecropping land management system. The system provides flood protection but has exacerbated risks, and has been identified as a contributing factor to the increase in the magnitude of recent floods in the country. Indeed, the system has mainly been developed for mechanising river resources for industry; few projects have taken environmental sustainability or risk reduction into account, and most efforts to manage river risk focus on short term response, not longer-term mitigation (Murtaza *et al.*, 2012).



Concern works across the emergency/development spectrum in Pakistan, with core programmes in livelihoods; health (mainly environmental health); and emergency response, rehabilitation, and early recovery. Concern addresses disaster risk directly by establishing, training, and supporting disaster management committees (DMCs) and emergency response teams (DMCs), the local government bodies responsible for disaster risk management. It supports DRR activities including risk assessment, disseminating early warnings, and constructing bunds, canal clearing, repairing transportation networks, school based contingency planning, and DRR education. It also networks and connects these bodies together for collective advocacy and support. Concern also works to reduce disaster risk indirectly by building back better following disasters, flood proofing physical and structural mitigation structures, and by ensuring the environment is protected during the construction of physical mitigation structures. As a humanitarian organisation Concern responds to disasters when necessary, and has built a large emergency response network across the country comprised of over 60 national NGO partners, which gives the organisation country-wide emergency response capacity.

The char riverine areas of Bangladesh

Every year, more than two billion metric tons of sand and silt from Nepal and India are washed downstream to be deposited in Bangladesh. Some of these deposits form into riverine sandbars and islands, which are known as *chars* in Bengali. The *chars* are in a constant state of flux, forming and collapsing with changing water movements, some lasting a few years and others decades. Compared to their mainland counterparts, governmental and non-governmental services in the *chars* are few; they have little recognition within government policy; and are among the ‘poverty pockets’ of the country (Concern, 2013).

Around 600,000 people live in the *chars*. They mainly rely on rain-fed subsistence agriculture, fishing, household gardens, and small-scale business for their livelihoods. In the dry season, some *chars* are accessible by vehicle, but in the rainy season a boat is required to access them.

Regional flooding and riverine erosion are the two main risks found in *chars* (both can be severe), but water insecurity and drought are also pressing issues due to the reliance on rain-fed agriculture and high levels of water pollution, including pathogens in the water. Animal and human disease, earthquakes, fires, tropical storms, cold waves, reproductive health issues, and early marriage are other prevalent risks.



This picture shows a char, a low lying temporary riverine island. Chars are formed by depositions of silt and are very exposed to floods and erosion.



In Bangladesh, the government and local communities both work to reduce risk. Community risk management practices include engaging in seasonally appropriate agriculture in line with flooding and drought periods; planting certain crops that help reduce erosion and flooding; and constructing houses on raised plinths and embankments on the leading edge of chars. When floods occur, migration to communal or family land is common; sometimes people can be away from their homes for months until waters subside. People use other familial and community practices for social support, for example buying and selling livestock and receiving small loans following disasters. The government of Bangladesh has a disaster management system in place focused on disaster risk reduction and emergency assistance. Over the past few years it has been shifting away from response toward more preventative forms of disaster management.

Concern has been working in Bangladesh since 1973, and currently works in the northern and western *chars*. In the northern *chars*, it has an integrated *char* programme, which has a broad focus that includes improving assets and the returns derived from them, reducing disaster risk, and reducing inequalities. In the western Concern runs a community based disaster preparedness project, focused on preparedness, DRM institutional capacity building, and small-scale mitigation. It also responds to disasters as necessary, and as in Pakistan, has built up a network of national NGO partners for response.

The Zambezi River Basin area of Chinde district, Mozambique

The Zambezi River basin comprises 20.2 percent of Mozambique's landmass, with the river flowing across four of the country's ten provinces, including Zambezia province, a province situated roughly halfway down the country's coast, where the Chinde district is located. As with the upstream areas of the Barotse floodplain in Zambia, the Zambezi Basin tends to flood from December to April, with a peak around February, often leading to slow onset regional floods. Along with floods, erosion, HIV/AIDS, malaria, bacterial contamination of water, drought, and agricultural disease are prevalent. The area is also coastal, so is exposed to tsunami, tropical storms, and coastal erosion³. The province itself is the poorest in the country, with 70 per cent of households living in poverty. Most people in the province live in rural areas isolated from services, markets, and sources of political power, and rely on subsistence agriculture for their livelihoods. Female-headed households, households with dependent elderly, households with members unable to work (whether from chronic illness or disability), and orphan-headed households are considered to be the poorest.

Communities have developed a number of mechanisms to cope with risk. They plant seasonally appropriate crops, taking advantage of alternating rainy and dry seasons as a form of risk mitigation. They use the river resources for livelihoods, as a source of drinking and agricultural water, transportation, for fishing, and the soil deposits from floods for growing crops. Some can read plant growth and weather patterns to help predict droughts and floods—a form of indigenous early warning. People will commonly provide support to each other in times of need, regardless of kinship connections (Concern, 2012). The government of Mozambique has also developed a disaster management structure focused on risk reduction and emergency response designed to be operational at all levels, from local to national, and across all departments. While developed in policy, implementation local levels is particularly limited due to funding constraints and poor institutional capacity.

Concern has been working in Mozambique since 1987, and in the Chinde district since 2005. Concern targets the poorest and most vulnerable households and communities in the district. Its programmes revolve around livelihoods and emergency response. DRR is incorporated across programmes as a crosscutting issue and is integrated within the livelihoods programme. Most of its direct DRR work is focused on improving the government's disaster management system, including creating and supporting disaster management committees, small-scale mitigation, strengthening flood and cyclone early warning systems, and relocating households from high to low risk areas.

Discussion

The riverine areas of Bangladesh, Mozambique, Pakistan, and Zambia where Concern works share certain characteristics in terms of their poverty and risk profiles. However, there are also some key differences.

They tend to have similar types of hazards: all experience seasonal slow onset flooding, water erosion, water pollution, malaria, and water borne diseases. Hazard impacts tend also to be similar, with floods contributing to great damage and erosion posing more specific localised damage. These underlying similarities, however, mask key differences; raindrop erosion is contributing to soil degradation in Zambia, but it only causes minimal danger to houses and livelihoods, while in the Bangladesh stream and channel erosion is severe, threatening entire settlements. All areas are also exposed to hazards not directly related to rivers. These vary. For example, in Mozambique and Zambia rates of HIV/AIDS are high, and in Pakistan earthquakes and conflict are both major risks. Such differences and similarities demonstrate the value of assessing riverine areas on the basis of a broad approach that considers all hazards and not only river related ones.

The areas are also similar in their vulnerabilities and capacities. While all are marked by extreme poverty and inequality, the local population has social, environmental, and economic structures in place to manage risk themselves. Residents of all areas use river areas for livelihoods, as a form of transport, and as a source of water.

Government river risk management systems vary. In all cases, the government risk management systems are written in policy, but have significant local level implementation gaps, some of which Concern is addressing. Flood and erosion control methods show major variations. In Pakistan, the Indus is highly engineered, maintained using a combination of local level inputs as part of a customary land tenure system and national level support from the government. Zambia is similar, however, customary canal clearing structures have been undermined by NGO involvement and are not as effective as they are in Pakistan. In Bangladesh, there are few government water control structures to protect *chars* from erosion and flooding, with the state instead focusing resources on the mainland areas. Mozambique, likewise, has few flood and erosion control mechanisms in the rural areas in which Concern works. In all cases risk systems mainly focus on the localised level of hazard realisation, with little consideration of upstream or downstream impacts. In Pakistan, for example, the highly controlled flood management systems exacerbate downstream flood impacts, and high upstream water consumption reduces water availability downstream. Rivers in all cases are trans-boundary, and there are few active multi-country coordination mechanisms in place for reducing risk.

The following lessons can be learned by comparing Concern's work in these riverine areas:

- Non-riverine risks can be found in riverine areas.
- Risk reduction in riverine areas involves direct and indirect actions.
- Riverine risks are not confined to or by political boundaries, and government regulations on risk reduction do not correlate to the scale of risks, as riverine risks in many river basins are trans-boundary.
- Generally, poor and vulnerable people can be found in rural and isolated riverine areas; poverty can be further concentrated into pockets of extreme poverty.
- Structural and non-structural measures can be used to address risk in riverine areas, but some large structural measures, like flood control mechanisms in Pakistan, can increase risk.



4. Concern's approach to disaster risk reduction in riverine contexts

Concern has documented its approach to DRR in a series of policy and guidance papers. These include *Approaches to DRR* (2005) and *Risk Analysis Guidelines* (2012). Concern uses risk analysis as a first step to better understand the hazards and vulnerability that communities face, and inform where Concern can reduce the scale, intensity and frequency of events whilst addressing both general and specific vulnerabilities within the community.

Concern has adopted a broad understanding of hazards that includes human derived hazards (e.g. conflict) and natural hazards (e.g. floods) and their often complex interactions. Concern places equal emphasis on intensive risk (large events happening in areas of dense population or economic activity) and extensive risk (small, localised but very frequent events that, are highly erosive to livelihoods and keep people poor). Concern understands that risk can affect all sectors and interventions, and so mainstreams DRR into all sectors and programmes⁴ by ensuring that risk analysis is central to their design, in addition to running selected stand-alone programmes. Concern takes an explicit **community focus** centred on individuals, households, and communities.

Whatever the context, Concern's practice takes an integrated and holistic approach to DRR that capitalises on and strengthens the asset base of communities. Risk is reduced through various activities including structural measures, supporting early warning systems, building up livelihoods assets and recognising that risk reduction requires a strong social base, strengthening governmental or community DRR institutions.

Lastly, to ensure interventions actually achieve what they are designed for and to learn how to improve and build upon its work, Concern **measures interventions** with baseline and endline surveys, evaluations, and other studies.

These components are common to all DRR activities, including those in riverine contexts. For the riverine areas of Pakistan, Bangladesh, Mozambique, and Zambia, Concern's specific DRR activities include:

Common DRR activities

- Contextual analysis
- Participatory risk assessments
- Supporting early systems
- Building organisational preparedness
- Local capacity of community disaster management committees
- Supporting livelihoods
- Supporting sustainable agriculture
- Conducting one-off DRR studies

Unique DRR activities

- Improving transportation (Bangladesh, Zambia, Mozambique)
- Building community protection bunds (Pakistan, Bangladesh, Mozambique)
- Raising structures on plinths (Pakistan, Bangladesh, Mozambique)
- Improving drinking water points (Pakistan, Bangladesh, Mozambique)
- Canal clearing (Zambia, Pakistan)
- Relocation and resettlement (Mozambique)
- Controlling erosion with natural resource management (Bangladesh and

The interventions can be sorted under a broad typology. Some, like prepositioning stocks, developing early warning systems, and building the capacity of disaster management committees are **planning and preparedness activities**, designed to improve disaster response. Sustainable agriculture, forestry and fisheries management, and climate change actions are interventions broadly focused on the environment, and fall under the category **of natural resource management**. The shelters, roads, embankments, and houses are all **structural measures** to reduce risk. All of these interventions rely on built infrastructure. Figure 6 conceptualizes this:

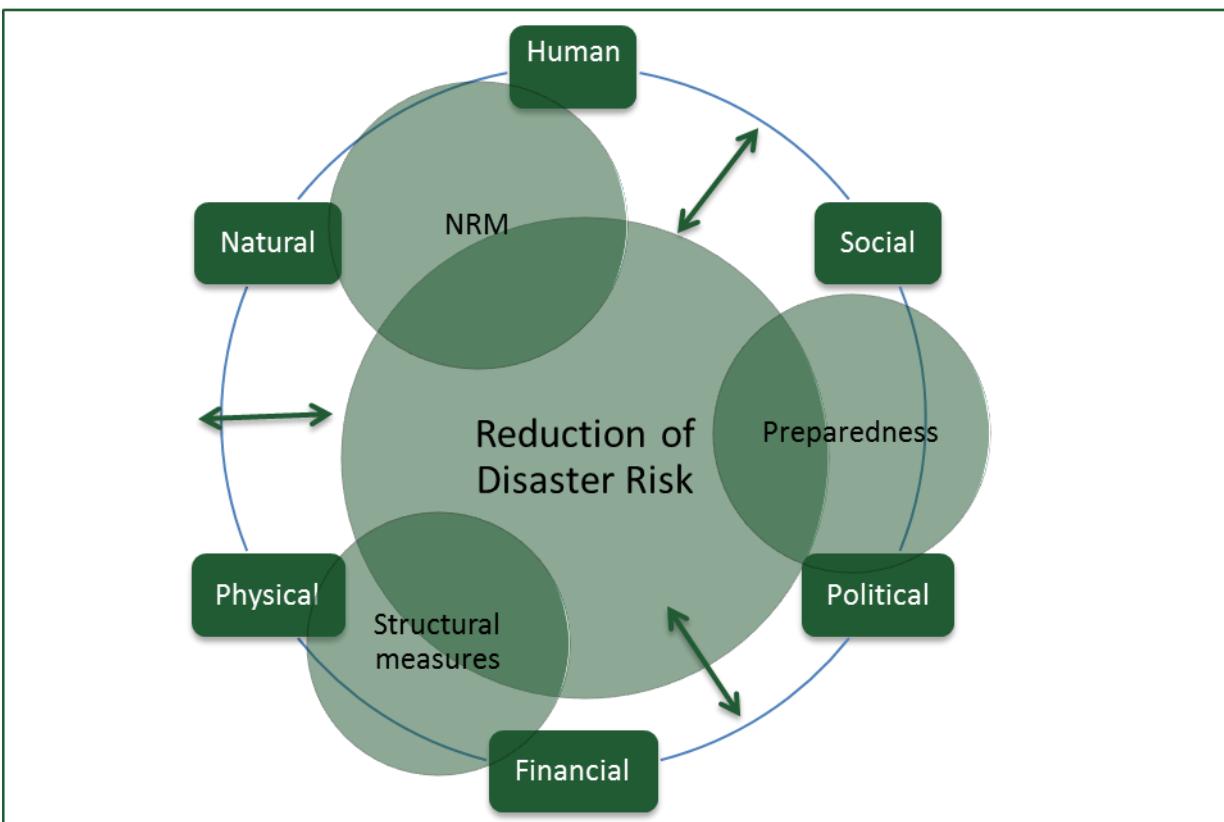


Figure 6: the interplay of interventions, assets and DRR in riverine areas



The figure shows that, in riverine contexts, preparedness, natural resource management, and structural measures are the three main overarching yet related categories for reducing disaster risk within which all of the above-mentioned interventions can be placed. It also shows that the interventions utilise, protect, and build upon existing assets.

The following definitions can be given for preparedness, NRM, and structural measures:

Preparedness

The UNISDR (2009) defines preparedness as “the knowledge and capacities developed by governments, professional response and recovery organizations, communities and individuals to effectively anticipate, respond to, and recover from, the impacts of likely, imminent or current hazard events or conditions”. Any of Concern’s interventions that support response - like prepositioning stocks, improving transportation, and supporting early warning systems -can be considered preparedness.

Natural resource management

NRM describes “the sustainable utilisation of major natural resources, such as land, water, air, minerals, forests, fisheries, and wild flora and fauna” (World Bank, 2000). In riverine contexts Concern uses NRM for vulnerability and hazard mitigation, with activities ranging from livelihoods improvements, developing forest committees, and afforestation of trees.

Structural measures

Structural measures are “any physical construction to reduce or avoid possible impacts of hazards, or application of engineering techniques to achieve hazard resistance and resilience in structures or systems” (UNISDR, 2009). Like NRM, Concern implements structural measures as a form of risk mitigation.



Preparedness

There is always a chance of disasters occurring, meaning that planning and preparing to respond to disasters is a necessary component of DRR in every context, including riverine ones. Concern prepares for disasters in all of the countries in which it operates by focusing on improving the ability of all stakeholders to respond to disasters (strengthening response capacity), improving the flow of information before and during emergencies (improving information), and improving the speed in which life-saving goods can be supplied (reducing response time). In this way, Concern helps to ensure that the right goods quickly reach those in need in an efficient manner. Figure 7 shows the activities within these categories:

Strengthening response capacity

Everyone plays a role in emergency response, so Concern works to improve disaster response for all stakeholders it works with, including the organisation itself (all countries); community and government (all countries); households (Bangladesh); and implementing partners (Bangladesh and Pakistan).

Communities are often the first to respond to disasters, and strengthening the preparedness of the communities to respond to disasters is one of the main activities Concern undertakes in all cases. In all of the cases, community disaster management committees (DMCs) were not operational even if they had been established prior to Concern's involvement; so Concern first starts by establishing DMCs.

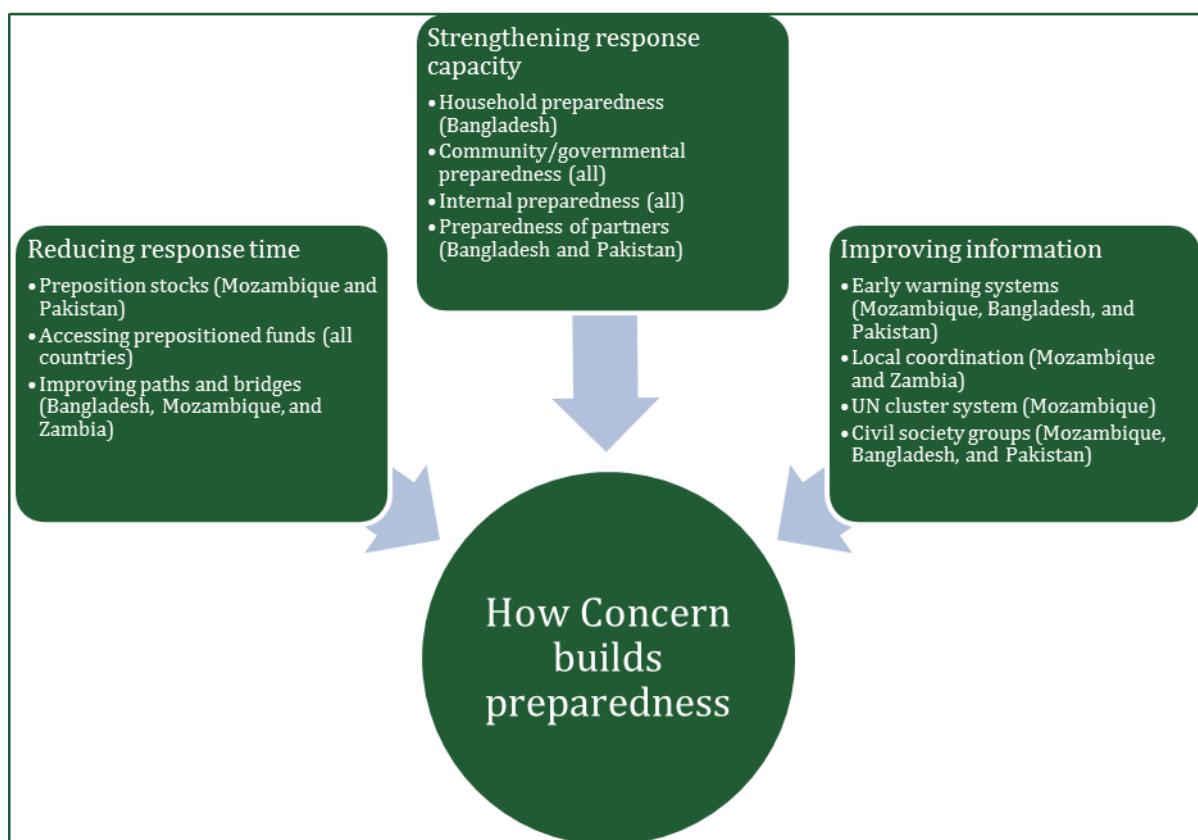


Figure 7: How Concern builds preparedness



In Zambia, Concern works at local and district level to strengthen government disaster management structures. Around half of the local level community DMCs (satellite DMCs) are not functional, so Concern organises and trains committees in the basics of DRR - analysis, early warning, mitigation, response, reporting, and governance - over the course of three days. In many cases, DMCs might be functional but might not be organised in accordance with the structure laid out in disaster management policy, so Concern focuses on reorganising committees in accordance with the policy. The committees typically cover one village each, with around 15 members per DMC. They are comprised of democratically elected representatives, who are usually key community leaders (including those from the Barotse Royal Establishment, which respondents describe as important stakeholders for reducing risk), technical experts (including local ministry representatives like teachers), with equitable representation between women and men. Concern also works to strengthen the higher-level disaster management structures. At the district level, it provides DMCs with financial support to engage in DRR activities including establishing and training lower-level committees; equipment for the committees to do their job (laptops, printers, etc.); and transportation for committee members to ensure that they can access project locations.

Pakistan has a host of disaster management structures, so Concern invests heavily in strengthening local preparedness by providing training, financial, and material support to community, *tehsil* (county), district, and province level government disaster management actors - including village, union council, district, and province DMCs, emergency response teams (ERTs) at district level, NGOs at local and national level, specific DRM organisations like Rescue 1122, a Punjab based rescue organisation, and by building preparedness in schools. At the local level, it works to establish village DMCs, including the creation, training, and financing of DMCs for emergency preparedness and response. Some of the technical training Concern supports includes first aid and CPR, first response, search and rescue, and fire fighting.



Preparedness training is key to improving emergency response. On the left, community members from flood-affected areas of Pakistan participating in a mock water rescue drill. On the right depicts a first aid training session in the same location (photos: Muhammad Bux, HELP Foundation, 2014)



At the next higher level, the Union Council (UC), Concern has established, trained, and equipped emergency response teams (ERTs) - 15 member governmental emergency response teams comprised of village representatives and government extension workers. Training includes first aid, search and rescue, and damage and needs assessment. Rescue 1122 conducts each training over a two-day period. Training sessions are tailored to the specific needs: first aid, for example, includes standard topics like how to manage airway, breathing, and circulation, but also includes locally relevant topics such as how to treat snakebites. ERTs also receive other specialised trainings, like emergency flood rescue and rescue boat operation. Rescue 1122 also facilitates disaster simulations, which are designed to offer a chance to practice emergency response skills in a lifelike but controlled setting.

Concern implements school based DRR activities in every UC where it supports DMCs. The activities focus on building preparedness of teachers and schoolchildren, and include teacher training (50 teachers per UC), simulation exercises, and developing school preparedness plans, all of which occur over a few days. A knowledge, attitude, and practice (KAP) study conducted after the training revealed these activities created widespread changes in preparedness. Concern is working with the government to integrate DRR into the curriculum.

Concern also works to improve preparedness at higher levels, from tehsil and district to province. It has helped develop higher-level committees comprised of representatives from the lower level committees to support responses. These committees provide an information sharing and coordination platform and can be used to advocate for emergency response. One committee was able to secure a visit by an Assistant Commissioner to recent flood areas that affected 3-400 individuals. The visit drew media attention and resulted in support for emergency response and reconstruction from the Commissioner.

Concern's work in Mozambique is similar to its work in Pakistan in that it supports government structures at community and higher levels. At community level, Concern focuses on forming local disaster councils (LDCs), the name for the local level DMC structures outlined in the government of Mozambique's disaster management policy. First, Concern conducts a community meeting explaining the objectives of the LDC and the requirements for participation. Next, community members vote for those they want to represent them. Once members are selected, Concern, over the course of a few days, provides training in analysis, prevention, preparedness, and mitigation. The process is democratic and helps to ensure that representation is based on community interests; that said, it means that technical experts are not represented. This was not the case in the past: in one village where LDCs were formed before Concern's arrival, a local chief gathered together 40 members of the community that he believed to be good local leaders, explained the objectives of the LDC, and then selected the volunteers himself.

Concern also works at a higher level, establishing, training, and providing financing to administrative council posts (CPAs) and district technical councils (CTDs). The CPA is the body directly above LDCs, and is responsible for collecting and validating LDC maps and plans and providing support to implement activities. Each CPA has around 20 members, including a coordinator, LDC representatives (1 per LDC), locality chiefs (1 per locality), and several other influential people, for example ministry representatives. After supporting their establishment, Concern provides technical training to CPAs including training on how to reduce specific risks (e.g. flood, cyclone, and drought), simulation exercises for disaster response involving all district level stakeholders, and shelter training for how to build hazard resistant shelters and emergency shelters.



The CTD is responsible for coordinating and mainstreaming DRR across all district-level ministries. It is comprised of one representative per ministry department (e.g. health, education, and agriculture). They work to implement DRR activities within their departments, including coming up with contingency plans for before, during, and after disaster and incorporating activities into budgets and plans. Members noted that they were able to implement these activities: the Ministry of Education representative, for example, stated their ministry had plans on how to continue providing education services during floods (including securing supplies, teachers, and temporary facilities). The Ministry of Agriculture representative described contingency plans that included delivering quick yield seeds to flood and drought victims to facilitate early livelihood recovery and animal vaccination campaigns for times when livestock disease risk was high. The Ministry of Health representative also described their contingency plans that included securing medication for communities following disasters.



LDC members in front of a LDC warehouse/office. LDCs are the front line workers supporting DRR at local levels.

Concern's work in building community preparedness in Bangladesh also focuses on supporting community disaster management structures. While governmental disaster management policy is generally well developed, the structure of local (ward) level DMCs is not outlined in policy. Concern is working to pilot ward DMCs and developing lessons to be learned from the work, hoping eventually to contribute to the development of government policy to include ward DMCs. The ward DMCs that Concern has developed are democratically elected with leaders in key positions, but also includes representation from marginal groups (including women and the poor) and those with special needs (such as those with disabilities and the elderly). Concern trains members in analysis, preparedness, and mitigation, with some work on response (limited compared to the work in Pakistan) focusing on how the work can be specific to the context (e.g. how to engage with governmental structures and how to address specific risks).

In Bangladesh, *char* households are often displaced for months following floods. Concern helps households develop flood preparedness plans to improve household flood preparedness before, during, and after floods. Households develop the plans themselves in accordance with their own vulnerabilities and capacities, for example, including specific instructions for each household member, where the elderly and people with disabilities might be assisted by younger and stronger members of the family. While specifics vary between households, there are some general common activities, including: reinforcing walls and raising houses on plinths to reduce flood exposure, collecting vital goods that can be used during emergencies, and outlining steps for recovery including household repairs and re-establishing livelihoods. Each household writes their plan in a small book that doubles as their financial ledger, an important document that will be saved.



Along with developing the capacity of various structures to prepare for disasters, Concern provides funding and technical expertise for supporting actors in engaging in preparedness activities. In Mozambique, this includes sensitising communities on EWS and what to do in the case of an emergency, contingency planning, and response. At a minimum, community DMCs meet twice a month, but come together more frequently when the occasion warrants, such as when responding to emergencies. They also implement community preparedness activities such as community seed storage. DMCs engage in similar activities in Pakistan and Bangladesh, including EWS sensitisation, contingency planning, and response. In Zambia the work focuses more on reporting disasters to district DMCs and disseminating early warning information and other information to communities, not on preparedness.

In Zambia and Bangladesh Concern has developed manuals to guide its work strengthening DMCs. In Zambia, Concern developed the *Training Manual Facilitator's Guide* in 2012 in conjunction with the National Disaster Management Authority and Mulungushi University, a national university with a department specialised in DRR. The manual provides step-by-step instructions on how to develop DMCs, which helps ensure consistency in approaches across contexts. Some of these are general good practice, but others have been developed specifically for the Zambian risk reduction context, so cover hazards, vulnerabilities, capacities, and governance structures unique to the country. Concern provides government members with copies. The guide, while useful, has not been adopted by all DRR stakeholders and other NGOs might have their own approaches to training DMCs.

The Bangladesh guidelines are similar in that they cover the development of DMC structures and are made specific to the context. Its development, however, is different: the guide was developed by National Alliance for Risk Reduction and Response Initiatives (NARRI), a NGO DRR consortium of which Concern is a member. The guidelines were developed with the government, and are embedded within government DRM programmes. Their focus is comprehensive, including guidelines on how to institutionalise DRR within higher-level government structures, not just community structures, as is the case in Zambia. Models showing this process have been developed for urban and rural contexts. Figure 8 on the next page shows a rural model:



In Bangladesh, household flood preparedness includes preparing a stock of food, medicine, money, fuel, a portable stove, seeds, and other goods to use during emergency. Pictured is some of the food and medicine within this household preparedness basket. Contents are wrapped in plastic to protect them from water.



In Mozambique, Concern has helped establish community grain silos, used to store seeds for planting following emergencies. The silos are raised on plinths to prevent inundation by floods, and have metal barriers to prevent mice, rats, and other pests from accessing the seeds. These community preparedness measures diminish the loss of assets and help residents to re-establish their livelihoods quickly following disasters. Improving recovery helps mitigate risk and can reduce negative coping post-disaster.

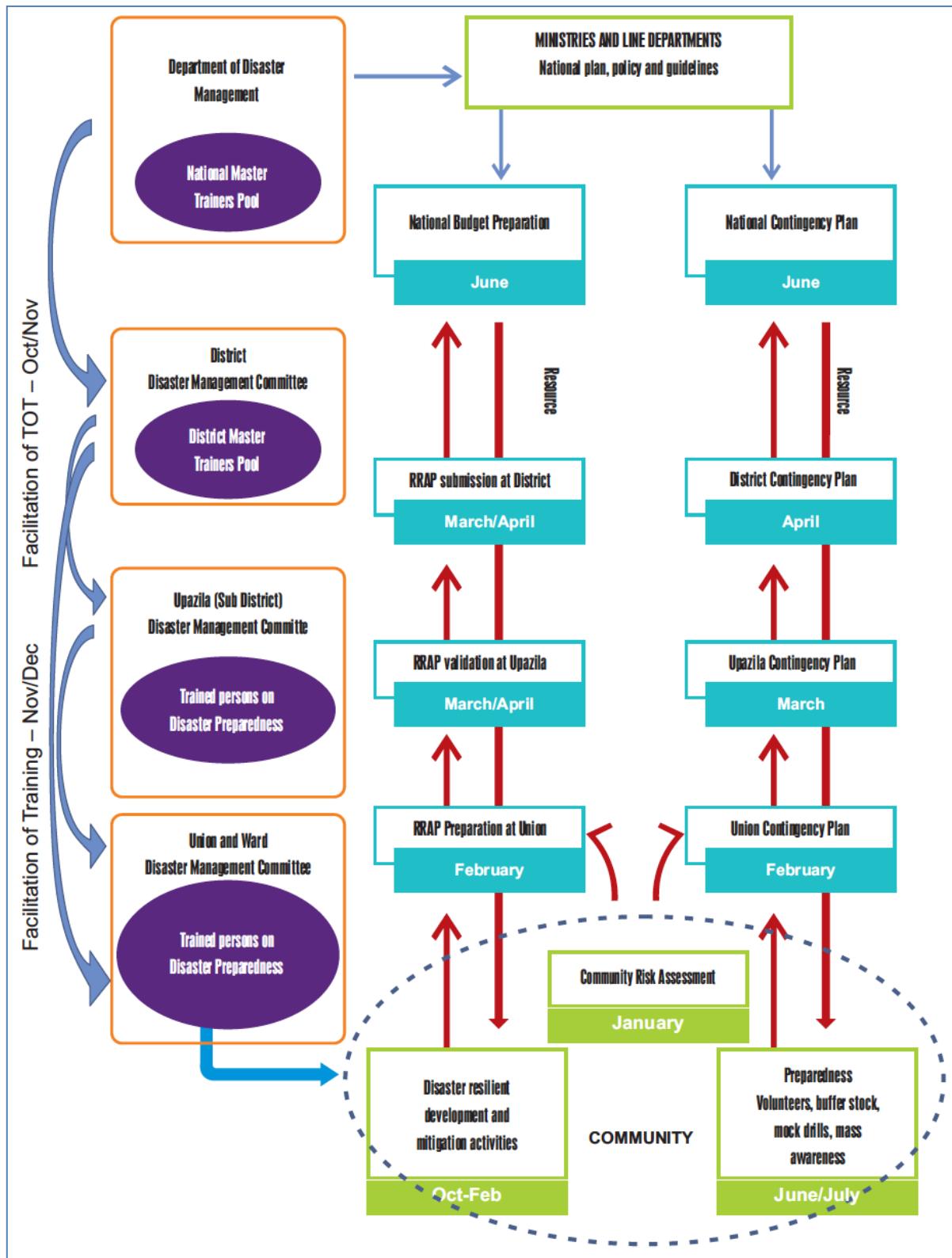


Figure 8: the rural community based disaster preparedness institutionalisation model (DDM, 2014). The model shows how to work at all levels - from ward to national - to strengthen DRM. Components of the work include: model development and endorsement by the Department of Disaster Management; developing harmonised training and master trainers; community risk analysis; mass awareness; and inclusion. Strengthening involves the formation or reformation of DRM committees in areas where structures are non-operational, training committee members in preparedness, and providing assistance in the implementation of DRR activities. The work is designed to improve technical ability for preparedness, increase support from government, and ultimately leave communities better prepared to respond to disasters.



Improving internal preparedness

As a humanitarian organisation Concern will respond to disasters if the community capacity to cope and recover is overwhelmed. Concern prepares for emergency responses through the *Preparedness for Effective Emergency Response* (PEER) process across all of its country programmes. PEER is an obligatory annual planning process reflecting the dynamic and changing nature of disaster events and response. PEER has three goals:

- to reiterate and reinforce the humanitarian nature of the organisation and the obligation to respond,
- to ensure that hazards and the humanitarian context are continuously monitored and engaged with, and
- to ensure that there is sufficient capacity at all times to mount an effective and timely emergency response

The level of Concern's preparedness work varies in accordance to its level of disaster response. In Zambia, Concern responds to disasters infrequently due to their low incidence, with its last major response in 2007; in Mozambique, it responds to disasters every few years; whereas in Bangladesh and Pakistan, it responds regularly due to the much higher incidence of disasters in the country. The level of response in some ways reflects the level of vulnerability in the different areas, as disasters do not regularly occur in the floodplain areas of Zambia, but occur more frequently in the other contexts.

In Pakistan, Concern has developed a number of documents to guide its emergency response including the *Emergency Preparedness and Response Strategy* (2007), the *Concern Worldwide in Pakistan Emergency Response Manual* (2009), and the *Checklist for Mainstreaming DRR in Flood Recovery Programme in Pakistan* (2012). Staff try to design as many elements of interventions as possible in advance; they have, for example, designed shelters to be used for emergency reconstruction. Technical focal points develop these documents, but do so with the input of country and head office staff and external partners. Concern provides national NGO partners with a copy of the emergency response manual and guidelines.



Lessons learned activities often include field visits (left) followed by lessons learned workshop (right). Concern and partners carry out activities together for mutual learning.

In Bangladesh, Concern uses lessons learned workshops as part of its approach to improving its response. They involve field visits to observe interventions and talk with key stakeholders (beneficiaries and government), followed by discussions between Concern and partners on the project, focusing on what worked well, what could be improved, and what lessons might be learned from the intervention. Before conducting the workshop Concern staff draft and develop initial assessment ideas; these serve as discussion points to guide the workshop. Outcomes are written in a report and are used to develop standard operating procedures to guide future programming.



Building preparedness of partners

In Bangladesh and Pakistan, since Concern implements all its emergency activities through its national partners Concern invests heavily in improving the ability of its partners to respond to disasters. In Bangladesh, Concern provides PEER training to all partners and has helped them develop their own PEER plans, which cover similar topics as Concern's PEER plan. Trainings are conducted once or twice yearly. Concern also assists in developing partner emergency response contingency plans. The plans cover all of the elements of emergency response (who, what, where, when, why, how) so offer an easily accessible framework to follow for any emergency. Concern has found that plans need to be short and easy to follow and has supported partners in reducing plans - one revised its contingency plan from over 150 pages to around 20.

Concern also conducts trainings in Pakistan. Concern has 61 partnership agreements with national partners, which allow the organisation to respond to disasters quickly and give it a wide geographic coverage across the entire country. Concern trains these partners in emergency response, in issues of organisational governance and management, and in how to work within Concern systems (for example, its procurement policies). Concern is in the process of developing a systematic capacity building toolkit, action plan, and database to track its national NGO capacity building activities that will include a rating systems and level of development for each partner.

Improving information

Information is key to preparedness. With the right information stakeholders can respond to hazards quickly before they cause too much damage, sometimes to the extent that hazards do not become disasters. If, for example, people know in advance that floods are coming, they can relocate themselves and their valuables to higher ground. Similarly, a coordinated response can help stakeholders work in a complementary manner, ensuring appropriate coverage geographically and of services. Rather than leave these information flows up to chance, Concern works to improve information, supporting the development of early warning systems (EWS), and coordinating responses with governmental and non-governmental stakeholders when disasters occur.

Most of Concern's preparedness efforts in Zambia focus on transmitting information from local to national levels. Although meteorology department officials monitor river levels, information is not used as any part of a functioning flood EWS. The government does, however, have a national level disaster response system in place that can be used for large-scale disasters (i.e. regional and higher). If DMCs provide indications of a disaster, the Zambian Vulnerability Assessment Committee sends out a team to assess the situation, using a wide range of qualitative and quantitative tools, and allocates resources based on the information collected. If they declare a disaster they coordinate the response at national levels. At local levels, Concern trains DMCs in how to conduct post-disaster assessments and sends the results of these assessments to higher levels of government. At district levels Concern is an active member of district disaster management coordination structures, which it uses to share information.

In Mozambique, Concern supports the government's multi-hazard and multi-level EWS. Forecasting information is compiled by national meteorological departments and other departments and transmitted downward to province, district, and local levels, whereupon LDCs distribute the message to their communities. The system is designed so that EWS messages can be transmitted within 72 hours. Concern supports this system by providing LDCs with equipment and resources for receiving and transmitting EWS information (including radios and megaphones), and helps them conduct community sensitisation campaigns for EWS response, using local leaders to help convince community members to attend the sessions. Each DMC has a focal person who is responsible for EWS.



These pictures are of an EWS in Mozambique. Messages are communicated via solar powered radio, and then relayed via LDCs to the broader community using megaphones, drums, and horns. An attendant mans the station from 9am-3pm, 7 days a week. This system is designed so that messages are communicated between local and national levels within a maximum of 72 hours. LDCs conduct community sensitisation activities to help ensure communities are receptive to and know how to respond

There are still challenges to overcome in Mozambique's EWS. Firstly, the system mainly relays flood and cyclone information, and has little information on other hazards. Second, funds for repairing and replacing equipment are not always available, and many of the megaphones provided by Concern have become damaged. Furthermore, megaphone batteries are not always available in local markets. Some DMCs use local equipment (drums, horns, etc.) instead of megaphones, but it is not as loud and is more difficult to communicate specific messages. Third, there are gaps in the system: in one instance only one person was available to man the radio, which meant that messages were not received when he was unavailable. Lastly, some community members still do not respond to messages despite the fact that they had gone through sensitisation training. LDC members believed they will often choose to stay to protect their livelihoods and valuable assets.

Bangladesh and Pakistan EWS are similar to those in Mozambique. In Bangladesh, the meteorological department collects weather information for floods and communicates it to various ministries and line departments including DRM structures, which then communicate it to the communities themselves through union and ward DMCs. The information is also transmitted through radio, television, mobile phones, and local announcement tools like mosques and rickshaw megaphones. At the community level there is one focal point in each committee responsible for monitoring information and mobilising DMCs, who then go out and distribute messages to communities, paying careful attention to ensure that poor and vulnerable groups receive the messages. DMCs also distribute posters and other material explaining EWS flag messages and provide training for understanding and responding to EWS.



The government of Pakistan has a centralised multi-hazard EWS. Concern accesses this information through the cluster system and also receives updates directly from EWS service providers, including the meteorological department and Federal Flood Commission. It uses EWS information for its own interventions, modifying programmes and strategies to take into account forecasts, and disseminates warnings to its partners and to the communities in which it operates. At the local level, Concern supports the UC DMCs and ERTs in disseminating EWS by providing them with dissemination trainings and materials, including megaphones, mobile phones, and radios. It works to ensure that the local system is regularised: each ERT has an EWS focal person responsible for liaising with stakeholders, disseminating EWS information, and engaging with respective focal persons at higher levels. It also supports local extension officers and health workers to access and transmit EWS messages related to agriculture and health risks. The organisation's work sharing EWS information is useful for ensuring risk messages are communicated but is a hindrance for sustainability, since Concern occupies a critical link in the communication chain.

For all three cases Concern works to coordinate its emergency responses with other stakeholders at a national level. In Pakistan, Bangladesh, and Mozambique Concern participates in civil society forums focused on DRR and preparedness; in Mozambique and Bangladesh, the forum is part of the organisation's DRR funding structure, while in Pakistan it is a separate entity. Pakistan and Mozambique also have active cluster systems, and Concern participates in cluster activities in these countries to gather and share information.

Reducing response time

Concern has explicit measures to get goods to places of need faster, including improving roads and paths (all countries), prepositioning stocks (Mozambique and Pakistan), and accessing prepositioned funds (all countries).

In Pakistan and Mozambique, Concern stockpiles key goods in strategic locations to use for emergency response. In Pakistan it has enough prepositioned stocks to provide immediate life-saving response to 2000 households, split across depots in each province, and has provided UC DMCs with stocks for their own responses. Concern modifies its own stocks depending on hazard projections - increasing them if disasters are predicted, decreasing them if they are not, and moving them from one province to another when needed. In Mozambique, many of the areas in which Concern works are difficult to reach, which can delay its response to new disasters. Concern has prepositioned stocks in key locations to facilitate faster response. It has stocks in Chinde district that contain key non-food items for cyclones, floods, and other disasters that displace populations. Goods include generators for power, wooden beams and posts for houses, tarpaulins, and other construction materials for shelter. The stocks are financed by general donations and are replenished regularly.

Concern has access to a number of funds for emergency response. Irish Aid has the Emergency Response Fund Scheme where €400,000 is allocated annually for initial funding to rapid onset emergencies. Concern can also apply for funding for emergency responses from two contingency funds held by the UK's Department for International Development (the Rapid Response Facility and the START fund).

Concern also has an internal funding mechanism, the Chief Executive Officer Fund, designed to provide immediate funding to allow large-scale rapid-onset emergency responses to be initiated while additional donor funding is being sought, or to fund responses to small-scale localised crises for which donor funding would be very difficult to access. Up to €250,000 can be accessed with the approval of the CEO.



Concern's warehouse in Chinde, which contains key lifesaving goods. Getting goods to the district can be a slow process, so prepositioning stocks helps Concern respond to disasters more quickly.

In Pakistan, most of Concern's emergency response is financed through the RAPID programme, an emergency response programme funded by the US government's Office of U.S. Foreign Disaster Assistance (OFDA). The programme is designed to provide funding for response, rehabilitation, and reconstruction in eight different sectors. Since 2009, Concern has secured and allocated over \$40 million to implementing partners through the fund, representing approximately a quarter of Concern's expenditures in Pakistan. All emergency response supported by RAPID is delivered through partners, with Concern working as an intermediary donor and capacity builder. Grants have ranged from US \$5,000 to US \$300,000, and must be approved by OFDA before implementation. Accessing RAPID funds follows a normal programming cycle, requiring the NGO partner to undertake rapid needs assessments, project design and targeting, as well as the identification of capacity gaps which, when necessary, must be addressed before approval is granted. Interventions have been completed within two and four months. Since accessing RAPID funding can take time, Concern will often use its own funds as money for initial response and recuperate costs when RAPID funds become available.

Beneficiaries use bridges and paths to escape from floods, and constructing bridges and paths is a key preparedness measure. In Bangladesh, Concern supports the construction of bamboo bridges and raising paths. Bamboo bridges are used throughout the *char* areas to get over bodies of water since they are inexpensive and easy to construct, maintain, and replace. They are also flexible, so provide some 'give' rather than breaking when placed under stress, such as the stress of a fast-moving current. In some cases, Concern will help DMCs construct these bridges, and in others it supports self-help groups in construction. Concern also helps raise paths and roads. This gives local communities a way to escape floods, provides them a temporary place to stay (they often build shelters on the sides of roads when displaced), and, when constructed parallel to a body of water, can serve as an embankment for protecting against flooding. Acknowledging that floods and cyclones are likely to become more intense as a result of climate change, Concern raises paths a few feet higher than previously recorded high flood levels to ensure that they do not become submerged. In Mozambique, Concern supports DMCs to construct bamboo bridges, which provide a similar means of escape from floods as they do in Bangladesh.

Conclusion and lessons to be learned

Slow onset regional floods are common in riverine areas, and often occur yearly as water levels reach the floodplain. Preparing for floods can make the difference between whether a flood turns into a disaster or remains a hazard.



In all countries, Concern works to improve preparedness for flooding by strengthening information systems and improving response times, building its own preparedness mechanisms as well as supporting the preparedness of others, namely community groups, local governmental organisations and national partner NGOs.

Despite Concern's work, there are gaps in preparedness. In all three cases, preparedness systems focus disproportionately on floods. Although poor flood preparedness can mean that floods overwhelm communities, those living in each of the three areas are also exposed to other risks that warrant investing preparedness. Drought, for example, affects all areas to varying degrees, as does disease. Capacity building exercises are often generic and can be applied to multiple hazards, but early warning systems and some responses need to be specific to the hazard - epidemics preparedness and response differs from that of floods, for example.



These pictures show a few of the bridges constructed with Concern's support. On the left is a picture of a bridge constructed by one of the LDCs in Mozambique. It connects a community living in a flood zone to higher land so offers an escape route from floods. Crocodiles are common in this area, and the bridge reduces exposure to attacks. The other two pictures are of bridges Concern helped construct in Bangladesh. The bridge on the upper right was constructed with the support of the DMCs, and the one on the lower right was constructed by a self help group, using money that they had saved. The bridge on the lower right is being repaired after being damaged in heavy rains, appropriate because it was constructed using local material and labour. These two bridges serve emergency purposes - providing a means of escaping from low to high ground during floods - and non-emergency purposes - connecting residents to schools, markets, and other resources.

Community level Disaster Management Committees are crucial for improving community preparedness. They need to be established and strengthened in every context. The ideal DMC membership includes elected positions that are representative of vulnerable groups (such as the elderly or disabled), livelihoods groups (such as farmers and fishers) and geographical areas. These should be gender balanced. Non-elected 'technical' positions including both traditional and governmental leadership and expertise from health centres or schools are also critical.



DMCs need to be trained in a number of areas including in search and rescue, analysis and planning, leadership, and DRR. This training does not need to be given by Concern or partners - it is often better outsourced to technical experts such as fire-fighting forces or search and rescue experts. In some countries (such as Pakistan), cadres of voluntary emergency response personnel who would do the actual rescuing are under the DMCs, and DMCs mainly play a coordination role.

DMCs then **implement preparedness activities** which include establishing contingency stocks (household level food stocks in Bangladesh, or community level grain banks in Mozambique), sensitising people on early warning systems, and determining and improving evacuation routes.

District level DMCs also need capacity building and support – although this tends to be more slanted towards providing equipment, logistics support and expecting them to assist in the establishment and support of community DMCs. In many ways Concern treats district DMCs more like partners than beneficiaries. This is done so as to **encourage governmental support for community based DRR**; encouraging visits by high level politicians and media can also raise the profile of the work being done, or collaborating in high profile DRR consortia can further contribute to building governmental support. Further work in this area includes contributing to the drafting of government manuals on aspects of DRR.

To backstop community and governmental structures, Concern also needs to prepare to respond to emergencies when the community capacity is overwhelmed. Pakistan and Bangladesh show that Concern can significantly increase its **response coverage by responding through partners**. Partners must have capacity, and this is supported by providing them with preparedness planning based on Concern's internal mechanism (PEER). In Pakistan Concern now has countrywide response coverage. Concern is also moving in this direction in Bangladesh. These countries can serve as models that Concern could aspire toward in other countries with strong civil society.



This picture shows a path that Concern helped to raise. Before Concern's involvement the path was submerged during floods, meaning that residents had to escape floods by boats. Concern raised the path about a metre, providing a means of escaping floods and accessing key services.



Early warning systems are integral to preparedness, but warnings need to be transmitted to the vulnerable people, not just response agencies. NGOs being involved in the communication chain is inherently unsustainable and should be avoided – it is better to build the capacity of permanent institutions to be part of the communication chain. **Language is incredibly important** – not only the language used, but also avoiding technical jargon, which can be misunderstood by local people. If people don't understand a warning they simply ignore it – to their cost.

Overall, a number of general lessons can learned from analysing this work:

- Preparedness needs to focus on all stakeholders involved in responses, from household to national level, although activities for each group may differ.
- With proper preparedness, flood impact can be minimised to the extent that floods do not turn into disasters.
- Due to their geographic location, riverine areas experience slow onset regional flooding regularly, and in some cases annually; meaning that preparedness systems can be implemented to regularise response.
- Bridges and paths can help in response, but boats are also necessary for response in riverine areas.
- Common preparedness structures and systems – including training, DMC composition, and roles and responsibilities – can help regularise response.
- Preparedness plans should include post-disaster recovery.
- Large scale regional flooding can be managed through national systems and structures, however those structures are often not oriented for responding to smaller scale events.
- In areas in which there is a frequent need for emergency response, and government services are well developed, investing in partnerships can be a good strategy for scaling up preparedness and response.
- Technical skills - including search and rescue and first aid - are necessary for responding to floods.
- Preparedness activities in riverine contexts place a disproportionate emphasis on flooding – to the detriment of other hazards that may be present (such as drought or disease, and in coastal areas, cyclones and storm surges).



Natural resource management

Natural resources can be managed to reduce the probability and impact of river-based hazards, making improving natural resources a key component of mitigating disaster risk. Unlike preparedness, which falls solely in the domain of human action, natural resources are by definition non-human so can only be influenced by humans, demonstrating the interconnected nature of humans, their environment, and disaster risk.

Concern uses natural resource management (NRM) across all of its riverine contexts. Its efforts can be divided into those where natural resource management functions as a direct tool to manage hazards or their impacts, and where NRM based DRR is mainstreamed as a secondary outcome within other interventions. Figure 9 illustrates the activities within these categories:

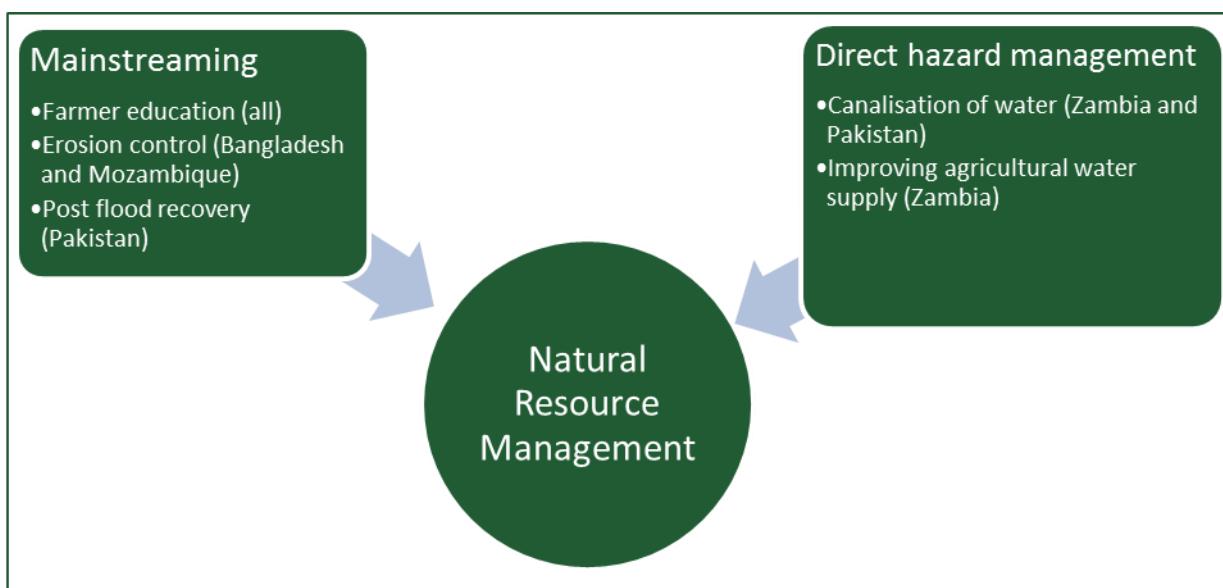


Figure 9: How Concern uses NRM to reduce risk in riverine areas

Mainstreaming

Concern's interventions in riverine areas can affect the environment in ways that reduce or increase risk. Concern's mainstreaming work focuses on making sure that its interventions, at a minimum, do not increase risk, and that, ideally, they reduce it. These include farmer education (all countries) reducing erosion (Bangladesh) and controlling flooding (Pakistan).

In Pakistan Concern works to ensure that its post-flood recovery interventions do not further flood risk. Concern was the lead organisation for mainstreaming DRR in the Consortium of British Humanitarian Agencies flood recovery programme. Concern developed a checklist for mainstreaming DRR in flood recovery across sectors as part of this work. It begins with four points common to all sectors:

- *Environmental and natural resource management approaches and other natural hazard-related issues are considered in the design of all activities in hazard-prone areas.*
- *The “build back better” principle is applied to all infrastructure reconstruction, both in terms of its resilience to hazards and its environmental sustainability.*



- *The use of hazard risk information is promoted in land-use planning. Vulnerable elements are taken into account in the construction of physical infrastructural facilities and services. Areas by rivers and other water bodies (flood plains) are not used for new developments.*
- *The programmes facilitate improvement in both people's understanding of floods and other hazards, and of their awareness of disaster risks and basic preparedness measures. Access to existing flood forecasting and early warning systems is supported.*

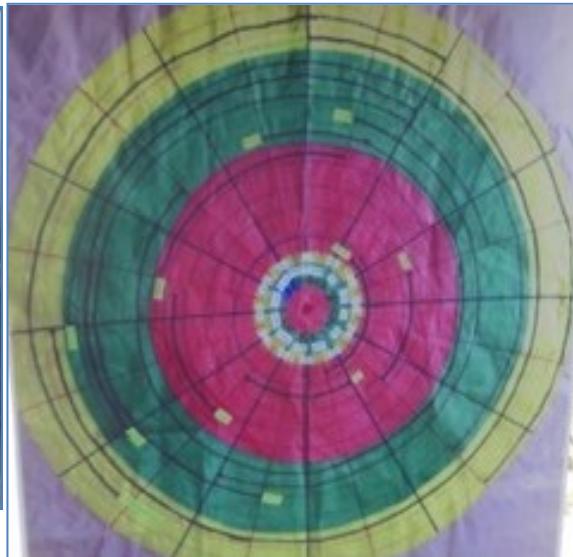
Concern includes environmental issues as a key component of post flood recovery that should be taken into account when developing any intervention. Concern also provides checklists and best practices for agriculture, livestock, cash for work and off farm activities, shelter, and WASH sectors - the main areas for recovery. The checklist provides programme staff (both Concern and partner staff), many of whom are not DRR specialists, with clear guidelines for ensuring risk mitigation is included in recovery programmes.

In Bangladesh, Concern mainstreams NRM and DRR by using livelihood programmes to help control erosion. Concern supports the planting of *kashibon* on marginal lands to reduce the risk of erosion and flooding and improve livelihoods. *Kashibon* is a grass that traps silt and can help *chars* to form. This can raise the land and reduce flooding risk. The roots also reduce erosion risks by binding the soil. The grass has numerous uses⁵ and is harvested and sold by the bundle; an acre provides an income of between \$150 and \$200 annually. Certain *char*-appropriate plants (onions, garlic, corn, and pumpkins) can be planted alongside the *kashibon* for an additional income source. Concern identifies areas for planting (government land and private plots, both donated) and gives the land and inputs to programme participants, most of whom are poor and vulnerable beneficiaries without land, who use the land for their livelihoods.

Kashibon is effective at controlling erosion, but only to a certain level. Beneficiaries report that erosion is difficult to control using NRM techniques in areas where water flows quickly. Structural measures like reinforced concrete embankments can help prevent erosion, but there is little support for constructing embankments on *char* areas.



Mature kashibon in Bangladesh ready for harvest. Kashibon can help to reclaim land and reduce erosion.



A poster of a disaster resilient livelihood assessment in Bangladesh.



In all three countries, Concern works with farmers to protect the environment and reduce risk. Agriculture is a crucial source of income in these rural areas, so by improving agricultural production or reducing loss builds economic assets, which can in turn be used for other resilience building activities. Agricultural practices can also shape the broader risk context: certain practices might contribute to or degrade soils, for example.

In Bangladesh, Concern works with farmers to make livelihoods more resistant to hazards through its community level disaster resilient livelihood assessments. The photograph shows a seasonal disaster resilient livelihood calendar created during the assessment. The calendar shows the hazards (red), current livelihood activities (green), and disaster resilient livelihood activities (yellow), broken into months (slices of the circle) with the range of livelihood activities as lines running across the circle. Assessments are conducted with the support of DMCs and self help groups using participatory techniques and provide benefits of raising community awareness on how hazards affect livelihoods. Action to implement activities, however, is limited as funding is not available for supporting livelihoods.

In Zambia and Mozambique Concern uses farmer field schools to improve agricultural activities and make activities more resilient to hazards. In Mozambique, Concern has supplied communities with drought resistant, fast germination, high yield rice varieties. Faster cultivation can reduce exposure to hazards: traditional rice takes six months to cultivate, whereas the varieties introduced by Concern only take three. Slower maturing varieties approach maturity when floods are more likely, so faster maturation reduces the chances of crop failure by decreasing hazard exposure. The seeds were provided to beneficiaries one time only, but they have been saved and shared following harvests. In Mozambique, through the DMCs, Concern is also promoting the '3 farm' system, whereby households grow their crops on three farms in separate locations.

Diversifying locations helps reduce the chance of a single disaster wiping out all crops. One committee member noted that this drastically reduced the livelihood impact of floods and drought and that most community members had adapted this approach. This technique is only possible because land is not scarce and can be devoted to these methods.

In Zambia, Concern focuses on conservation agriculture and community gardens. Conservation agriculture (CA) is "a concept for resource-saving agricultural crop production that strives to achieve acceptable profits together with high and sustained production levels while concurrently conserving the environment" (FAO, 2007). Indeed Concern uses CA for building economic productivity and reducing environmental degradation. CA centres around no-till methods, preserving the soil structure and increasing organic fertility in the soil with mulching, and companion planting and crop rotations. Concern supports CA with training and material support consisting of tools and seeds. CA was a new practice in all of the villages visited and no households were practicing CA before Concern's support. Interest in CA is strong: one village reported that 150 households were currently practicing CA, a major growth from the initial 50 volunteer households at the start of the programme. Households described CA as important for preserving soil and for reducing the reliance on external inputs like fertiliser.



DMCs in Mozambique visit a farmer field school to learn about high production, drought and flood resistant, fast yield rice.



Community gardens are designed to improve food security and nutrition of poor households. Concern targets poor and vulnerable women, and organises them in groups of twenty, and gives support in the form of training, equipment (including treadle pumps) and seeds. Many gardens have expanded in size because of Concern's support.

Direct hazard management

Along with considering the environment when implementing other activities, Concern uses NRM as a tool to improve the environment directly to reduce risk. These direct hazard management activities include: the canalisation of water, the use of water for irrigation (Zambia and Pakistan), and planting trees to slow riverbank erosion.

In Zambia and Pakistan Concern engages in canalisation. Canalisation is the act of diverting water into canals. Canals channel water to a specific location, improving flow and reducing the risk of water-related hazards, including floods, droughts, waterlogging, diarrhoeal diseases, and malaria. Concern's general targeting guidelines and approaches to canalisation are similar for both contexts. In both cases, Concern works to support the repair and maintenance of existing canals through supporting canal clearing, rather than building new canals; it focuses on the smaller scale canals that communities are required to maintain rather than larger scale canals that the government has responsibility for; and it works within existing canal governance structures, in Zambia this is the Barotse Royal Establishment and the state, and in Pakistan local farmers and the state.

In Pakistan, farmers clear canals yearly. Many work as sharecroppers and clearing canals is included in the sharecropping contract. Concern provides cash for work to support the clearing of minor canals. To reduce the possibility of dependency, Concern only provides cash for work to cover half the clearing work, and requires the rest to be performed by communities voluntarily.

Canal clearing is one of the main activates DMCs undertake in Zambia. Community DMCs facilitate canal clearing by motivating communities to clear canals and providing them with an array of hand tools. They also report canal-clearing activities to higher level DMCs.

As much of the Barotse floodplain is marshland, canalising water reduces flood risk by improving the rate of flow of floodwater, and increasing the speed at which waters recede from the flood plain, freeing it up for agriculture. Canalisation, however, has large impacts on the ecosystem. Draining lands destroys marshlands. This leads to species loss and encourages settlement in more flood-prone areas, which in turn exacerbates flood risk. In Zambia, however, the canal systems have been in place for hundreds of years, so social and ecological systems have adapted to them.



Community gardens in Zambia improve food security by increasing the volume of food produced and helping to ensure that food is not destroyed in disasters.



A treadle pump in action in Zambia. The pump helps reduce the reliance on rain-fed agriculture.



In Zambia, one of the reasons for canal clearing is to provide water to agricultural activities. Concern supplies community gardens with treadle pumps so that they can more easily access water. The treadle pumps reduce reliance on rain-fed agricultural practices, extending the growing period well into the dry season. This intervention is possible because community gardens are situated near a perennial source of water. This reduces drought risk and improves food security.



These pictures show the canal clearing process in Zambia. From upper left clockwise: distributing tools for canal clearing; women clearing the canals; clearing draining lands; and using cleared lands for agriculture.

Canal clearing follows a specific pattern. Downstream canals are cleared before upstream canals and main canals before secondary and tertiary canals. This gives water a place to flow. Clearing needs to take place before the main rains and before farmers have to shift toward farming, so it tends to occur in June and July.

Canals require regular maintenance, which in turn requires community participation. Canals must be cleared yearly and, except in a few cases where the state clears large canals by machine, it is a manual job that requires high amounts of physical labour (upwards of 10 hours per week per household during the canal clearing season). Cooperation between communities is also needed since some canals can be hundreds of kilometres long and straddle multiple communities.



A review of canal clearing in Zambia by Concern (Concern, 2008) found that 98% of respondents were motivated to participate in canal clearing because it benefited their livelihoods. The benefits included opening up land to plant early (90%), increasing arable land for production (75%), delaying floods (60%), and providing a better source of water (45%).

In Zambia, previous and on-going compensation for clearing canals by the government and NGOs in the form of cash or food for work shifted the perception of responsibility for clearing canals from communities to external actors. This is a problem because such external support is inconsistent, meaning that canals are not always cleared. Concern does not provide cash for work because of this; instead, DMCs reference historical self-help and customary maintenance approaches (such as the concept of *lubile*, eating and working together) to appeal to canal clearing. This approach is somewhat successful, however there are still cases where communities do not clear canals. Gender norms also influence how canals are cleared. Despite Concern's efforts to introduce more equitable relations in labour, women do most of the canal maintenance.

Concern has tried to control erosion in Mozambique by planting fast growing trees with strong roots on the banks of rivers. As in Bangladesh with the *kashibon* initiative, this work is only partly successful as, in some cases, currents are too strong for the trees to prevent erosion. Since it is possible to control erosion with vegetation, failures in erosion control indicate the need to consult with experts with technical knowledge on the subject. It may be that there are insufficient opportunities for the vegetation to mature before being assessed; similarly the vegetation may not be able to mature in high flow areas without some kind of temporary structure that reduces the flow in the short term, allowing vegetation to grow enough to become effective. It may also be that planting vegetation to control erosion will only ever be partially successful and should be complimented with engineered solutions.

Conclusion and lessons to be learned

NRM is a central tool for reducing risk in riverine areas, and Concern uses NRM to address all riverine hazards - from flooding to erosion to water access. Differences in geography and in vulnerability between cases, however, mean that the NRM interventions are not uniform in their implementation and effects. All country programmes practice farmer education, for example, but in Bangladesh, Concern only uses participatory approaches focused on educating local populations, while in the other countries it includes asset transfers. Canalisation is widely implemented in Zambia and is an effective activity for controlling floods and improving livelihoods, but it is not practiced as frequently in the other contexts. Because canalisation can negatively impact the ecosystem, it is not necessarily appropriate to construct new canals as a mechanism for controlling floods. In Zambia the canal system was put in place over a hundred years ago, and the ecosystem has adapted to this highly managed form of landscape.



Each case study area faces challenges in implementing NRM activities. In Zambia, aligning incentive structures to clear canals is problematic, as there is a tension between actors using voluntary approaches and those using cash for work. **Upstream/downstream issues** are also challenging: in Zambia, Concern must convince downstream users to clear canals to reduce the chances of flooding upstream; in Pakistan, Concern needs to ensure that its upstream structural measures do not change water flow patterns and contribute to risk downstream. There are also many cases where risks are created due to land degradation outside the organisation's control: increasing canalisation upstream can exacerbate floods downstream, increasing water use upstream limits downstream availability, and land degradation upstream increases both floods and erosion, leading to more siltation and clogging of rivers downstream. This shows the **importance of regional and national authorities – and in some cases international authorities** (such as the Zambezi River Authority) being involved in coordinating riverine DRR. Concern has not engaged – even in an advocacy strategy – with these issues; and until it does, it must be careful not to exacerbate risk elsewhere.

NRM approaches work best when they are integrated into livelihoods, as the planting of an economically useful grass species in Bangladesh (*kashibon*), the introduction of conservation agriculture into Zambia, or the 3-farm system in Mozambique show. However, planted protection of banks against erosion is only partially successful and does not work in high flow rate areas. In these areas it needs to be complimented with engineered approaches if deemed important enough. Even better is to conserve already matured natural vegetation and to **ensure that any activity that is implemented in riverine areas does not contribute to environmental degradation**.

Traditional livelihood patterns in areas subject to seasonal flooding may already be adapted to these seasonal fluctuations. Instead of trying to change their livelihoods, **it is better to strengthen already adaptable livelihoods systems**. This may include seasonal migration away from flooded areas – as was the case in Bangladesh and still is in Zambia, or having more than one farm area, as in Mozambique. In some areas these traditional systems are breaking down and require assistance – such as canal clearing and introducing conservation agriculture (Zambia), the introduction of fast maturing crop varieties (Mozambique) or developing alternative income streams (Bangladesh). **In all cases improving the seasonal planning of agricultural livelihoods helps**.

The NRM work also shows how risk and its reduction are development issues to be integrated within other programming activities. Livelihoods and structural patterns shape the environment and risk, meaning that a DRR approach needs to be considered in all development interventions.

Overall, a number of general lessons can learned from analysing this work:

- Upstream and downstream resource and livelihood patterns affect each other.
- Traditional mechanisms of managing natural resources should not be undermined.
- Canalisation can be employed to reduce riverine flood risks and is particularly effective in marshy areas. It can also provide livelihood support, but must be treated with caution as it can exacerbate downstream risks.
- Controlling erosion can be difficult and NRM interventions alone are unlikely to be sufficient. This warrants further research into rates of erosion and appropriate mechanisms to deal with it.

- Whole of watershed approaches cannot always be employed in large basin riverine areas due to their large scales and international boundaries. Engaging with river-basin wide institutions for DRR might be necessary to reduce risk but has not yet been attempted by Concern.
- Improving water points for agriculture and human consumption can reduce economic water scarcity.
- In implementing NRM activities it is necessary to be aware of prevailing gender and social norms, as interventions can further exacerbate existing inequalities.

Structural measures to reduce disaster risk

Structural measures, like NRM, are used to transform and control the environment and make it more conducive for life and livelihoods, including reducing the impact of negative events like disasters. Houses, for example, can provide protection from the weather and store valuable goods. Concern builds a number of structures - including schools, houses, toilets, seed storage silos, roads, paths, and water points - as part of its approach to reducing extreme poverty in riverine areas, often used as part of another intervention designed to reduce risk (like NRM or preparedness). To effectively reduce risk, structures themselves need to be able to withstand the impact of hazards. Other structures are built solely for the purpose of reducing risk: check dams slow water to prevent erosion, and embankments protect against flooding. Relocating structures from high to low risk areas can be another structural measure for risk reduction in riverine contexts. Figure 10 shows the activities within these categories:

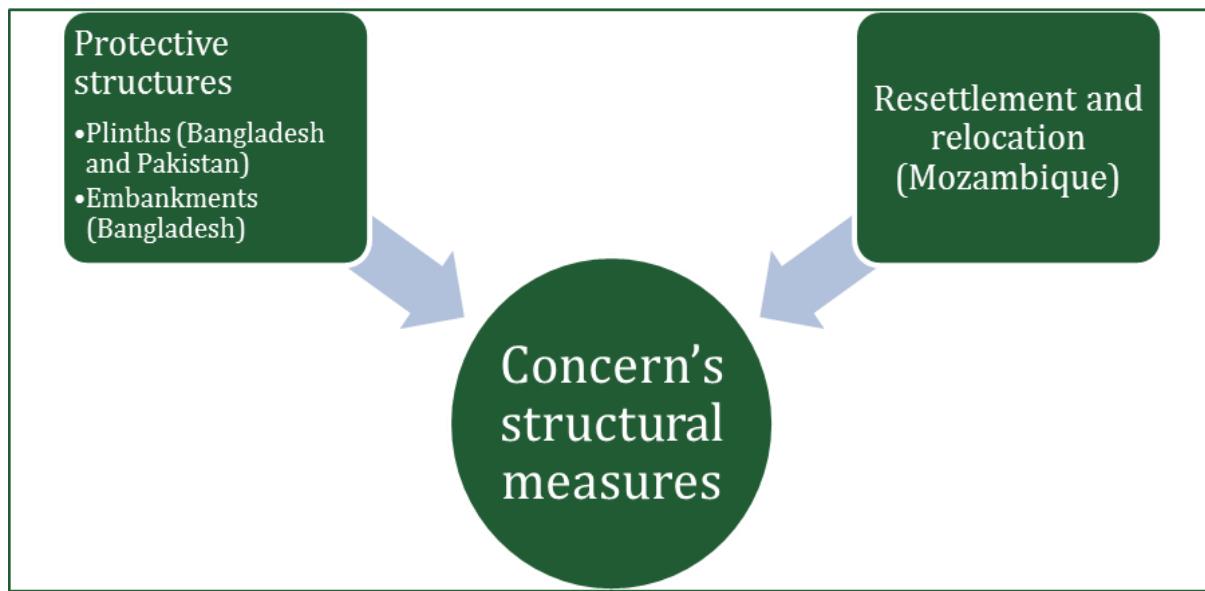


Figure 10: how Concern uses structural measures to reduce disaster risk in riverine contexts

Concern uses a different combination of approaches per country to reduce risk: it focuses on resettlement and relocation in Mozambique; building embankments in Bangladesh; and canalisation and embankment construction in Pakistan.



Protective structures

Plinths and embankments are two of the main protective structures Concern constructs in riverine areas. An embankment, known also as a levee, dike, or flood bank, is a ridge by a river that keeps floodwater in the main channel, preventing it from overflowing. Embankments form naturally as soil is deposited next to riverbanks, but can also be constructed. In Bangladesh, embankments often double as roads so Concern constructs new embankments and raises the height of existing embankments as part of its work constructing roads. Concern constructs these embankments a metre or two higher than previous high-level floods in the hope that this will be enough to withstand floods that are predicted to become more intense. Communities will use raised roads as temporary settlement areas when floods and storms inundate their lands, so constructing embankments is also a form of preparedness.

Plinths are raised structures upon which buildings can be constructed. In Pakistan and Bangladesh, Concern constructs plinths for communities that serve a variety of purposes. Concern has only constructed a few plinths in Bangladesh, mainly as smaller pilot projects, part of its longer-term DRR work supporting and strengthening DMCs. Like its approach to constructing embankments, it builds plinths at a higher level than highest-level floods. The projects are selected by DMCs, with financial support coming jointly from Concern and the government. The land on which the plinths are constructed is either provided by the government or donated by private landowners. The plinths are constructed from soil or sand, tampered down every metre. Following construction, the sides are planted with fast growing grasses and trees to stabilise the soil and reduce erosion. Concern has assisted in constructing plinths for settlements, markets, and facilities like schools and health centres. For settlements, Concern also assists communities to rebuild their houses on plinths, and then installs water points and latrines and encourages community members to establish kitchen gardens and fruit trees to increase food security.

Concern uses plinths as a main structural mitigation tool in Pakistan. Plinths are traditionally used as flood protection devices in some parts of the country, but in the areas where Concern works only around 5% of households at risk of flooding use plinths. As with its work in Bangladesh, Concern works with DMCs to support the construction of plinths. The organisation supports plinth design, provides technical supervision during construction, and subsidises construction with cash for work, providing it only partially to avoid dependency. Concern constructs plinths to protect houses from small to medium intensity floods. Plinths are accompanied by reconstructing houses to be partially waterproof: the foundations and lower third of the superstructure are constructed with kiln-fired bricks and cement mortar, above which is the traditional mud-brick and mud-mortar construction.



Vegetable gardens, wells and latrines are all constructed on top of the plinth (Photo: Dom Hunt, 2010).



DMCs, supported by Concern, constructed this plinth to protect households from flooding and erosion. Twenty poor and vulnerable families will soon live here. A wealthier resident from the area donated the land.

Protection from larger scale floods is too costly, and the government does not allow for building protective structures in high-risk areas because it wants to discourage settlement (although Concern has, in the past, constructed embankments around villages in flood plains). In low and medium flood risk areas DMCs use participatory methods to understand the flood hazard history and then build plinths about a metre higher than previous low intensity flood levels - if the flood is 1 metre, plinths will be built around 2 metres; if it is 2 metres, plinths will be built 3 metres, etc. Concern considers downstream risk by building plinths in a way that does not exacerbate downstream flooding. Construction typically takes a little over two weeks but varies depending on plinth size and labour availability. Following construction, plinths are planted with grasses and trees supplied by beneficiaries, to reduce flood erosion and provide additional livelihood support. To ensure that the plinths are maintained, Concern establishes committees comprised of plinth beneficiaries to manage the plinths, including securing volunteer maintenance labour.



A reconstructed house in Pakistan: constructed on a plinth, the bottom third is waterproof, the top two thirds are mud brick. (Photo Dom Hunt 2012)

For both Bangladesh and Pakistan, plinths have a number of benefits. They take only a few weeks to construct, but can save houses, which take upwards of four years to construct, from being destroyed in floods. They can also be used to protect livestock and other productive assets from floods. In Pakistan, furthermore, by saving houses, plinths support a life with dignity, since in many rural parts of the country it is unseemly for women to be seen outside of the house.



This photograph shows that plinths can be very effective in protecting against floods in Pakistan. In the picture, floods are helping to save lives, livestock, houses, and other key assets of poor and vulnerable families. (photo: Salman, HELP Foundation, 2014)

Relocation

In Mozambique, rather than reducing risk by building structures, Concern focuses on relocating local population from high risk areas (mainly lowland areas close to rivers exposed to floods) to lower risk ones. Once high-risk areas are identified, DRM committees conduct bimonthly advocacy discussions to persuade beneficiaries living in high-risk areas to relocate to lower risk areas. They then support those in relocating by providing them with building material and support and helping them to construct key service centres like schools and water points. Committee members have found that targeting community leaders is an effective mechanism for encouraging relocation: they state that once a community leader relocates, the rest of the community tends to follow within a few months. Concern has been able to convince many living in high risk areas to move to lower risk ones using this approach. The process can be time consuming, and it can sometimes take as much as two years to convince beneficiaries to relocate.

Although Concern's programme participants describe the impact of relocation positively, studies of relocation in Mozambique show that the costs of relocation often outweigh the benefits and that supposedly voluntary relocation is, in actuality, often forced (Arnall 2014; Arnall *et al.*, 2013). Since these studies contradict Concern's experiences, it suggests a need to better understand the impact of Concern's work, particularly the question of whether relocation is actually voluntary. If relocation is voluntary it is important to document the conditions necessary for encouraging beneficiaries to relocate and advocate for them to be implemented across all areas of Mozambique.



Similarly, if relocation is not voluntary Concern should cease its relocation work and advocate to the government to stop relocation.

Conclusion and lessons to be learned

Structural measures are important components of DRR in riverine areas. Concern's work shows that while buildings must always be constructed in ways that are resistant to hazards, making the buildings themselves hazard resistant is not always the only or the best strategy for reducing risk in riverine areas: reducing exposure, whether from constructing plinths, by relocating and resettling people, or by following government policy and only building plinths in lower risk areas (as is the case in Pakistan), can mean that buildings do not need to be constructed to withstand hazards but can instead be removed from the hazard.

Another factor to take into account is whether an engineered structure increases or decreases risk. Pakistan has abandoned the construction of embankments around farm land as it realised that preventing flood water from entering into agricultural land is counter-productive, and that instead it is better to adapt farming to seasonal floods.

In some cases, for example on the Barotse floodplain, communities traditionally used to move every year in flood times. In a similar way, in the Bangladeshi *char* areas, beneficiaries state that in the past, before land became scarce, they used to use the *char* solely for agriculture, retreating to higher ground in the flood season. This demonstrates that the threats facing communities living in riverine areas exposed to floods on a regular basis can be addressed by temporary seasonal migration, when society is structured in a way that allows it. However, the **relocation programme in Mozambique is highly contentious**, and as yet it is unknown whether it is actually the best way to reduce the risk to which people living in the Zambezi floodplain are exposed.

The review of Concern's structural measures also shows the **close relationship between structural measures and NRM**. In many cases, Concern uses NRM to protect structures. For example, it plants fast growing plants to reduce erosion and build up land. Structural measures influence the environment: embankments reduce erosion; water points improve drinking water; and plinths can be built in ways that exacerbate or reduce downstream flooding risks. **In essence, structural measures and NRM should be looked at as complementary elements of DRR in riverine areas.**

Building structures in ways that reduces risk sometimes requires additional inputs. Raising an embankment to address higher-level floods is more expensive than leaving it at the same height, and relocation requires time to convince members to leave, and material support to help construct a new settlement. The benefits of hazard-proofing a structure at some point become marginal relative to the cost of implementing these measures, and should be weighed against each other. Consideration must also be given to whether there are alternatives to structural measures, namely relocation, and the associated social, economic, and political costs therein. Concern's work, however, has not reached the point of being overly expensive, and is still relatively low cost compared to the gains; its plinths in Pakistan are inexpensive compared to the cost of reconstruction following low-level floods, as are the plinths in Bangladesh. They also provide protection and can save lives. In areas where floods occur regularly, such measures are well justified.



Pakistan's engagement in actual rebuilding of houses destroyed by floods – whilst improving the design specifications to withstand medium intensity floods – is perhaps a way of balancing cost against long term durability, a risk that may pay off if there are no high intensity floods in the coming years. In Bangladesh there are no structural improvements made to houses themselves, but houses are rebuilt on plinths alongside vegetables, water supply and latrines. **This integrated approach of reducing risk alongside livelihoods and WASH improvements is an example of good practise.**

Overall, a number of general lessons can learned from analysing this work:

- Reducing flood exposure structural mitigation measure in riverine areas.
- Erosion and flood control often requires a mix of structural and NRM interventions.
- Reducing exposure, either by relocation or by the construction of plinths, should be considered in areas where floods occur regularly.
- Structural measures can provide some protection against riverine hazards in areas where people are forced to live in marginal places; and can be more durable than natural methods (especially in high flow areas).
- Structural measures can exacerbate risks in other areas, either downstream (increased flooding or erosion downstream) or over time (reduced fertility through siltation in farmland), and these risks need to be properly analysed during the design phase.
- Relocation can create other risks so should be approached carefully, including providing beneficiaries with post-relocation support.

5. Conclusion: overall lessons to be learned and good practices for DRR in mountain regions

Concern works to reduce risk in every context in which it works as part of its approach to eliminating extreme poverty. This review developed general lessons learned about Concern's approach to DRR in riverine areas. Comparing the organisation's work in four different contexts - the riverine areas of Pakistan; the Barotse floodplain in Western province, Zambia; the *char* areas of Bangladesh; and the Chinde district of Mozambique - reveals the similarities and differences in both disaster risks and Concern's approach to DRR. This, in turn, allows for generalisations to be made over what might constitute DRR in riverine areas, both in terms of activities performed and how to perform them.

Understanding riverine areas by their risk characteristics is a key first step for DRR in riverine contexts. As the cases demonstrate, riverine areas are home to number hazards that can cause widespread devastation and destruction including regional floods and erosion. Whether they actually cause damage, however, is dependent upon how they are managed. Erosion is an example of this: in some cases it can seriously impede livelihoods and lead to long-term poverty, while in others it can deposit valuable soils that improve agriculture.

Considering a river from a systems perspective is key to building this understanding of DRR in riverine areas. Rivers are dynamic, moving bodies of water, where upstream changes can affect downstream users and downstream changes upstream users. High water consumption upstream can reduce availability downstream, downstream river blockages can exacerbate upstream flooding, and flood EWS requires the monitoring upper reaches of a catchment and transmitting information downstream. Concern addresses these issues at a localised level. For example it assesses upstream and downstream impact when it clears canals in Zambia and when it builds structures in Pakistan. At the higher levels, however, the organisation does little work engaging across jurisdictions to reduce risk.

Concern's work in riverine areas shows how simple interventions can go far in reducing riverine risk. Concern largely operates at the community level and seeks to improve asset bases and change knowledge, attitudes, and practices. Its work in preparedness, NRM, and structural measures shows that a mixture of approaches can be used to reduce risk. Some approaches are highly technical and precise in nature, utilising scientific expertise and practice, but adapting it to local contexts. All, however, involve addressing risks communities deem important and supporting communities in risk reduction.

Given the limited resources of many of the areas in which Concern works, some of its work requires an engineering approach rather than an ecosystem approach by which humans adapt to the hazard. While not ideal, Concern works to make sure that this approach does not contribute to future risk, either in the immediate areas (by, for example, working to build embankments to withstand high standards of hazards which will not fail catastrophically), or in surrounding areas (e.g. by mainstreaming downstream risks into upstream areas). Concern has had some limited success in addressing some of those upstream risks - it has been able, in certain cases, to ensure that canals are cleared - but cannot always reduce upstream causes - for example, the building of large scale embankment control mechanisms in Pakistan, or the widespread degradation in upstream areas of the Zambezi.



The case studies used for this report show a loose set of guidelines for riverine risk:

- Adapting livelihoods to seasonal flooding cycles and harnessing natural resources to reduce risk, is an environmentally benign and cost effective approach to risk reduction that also helps avoid unforeseen negative consequences of structural measures. These approaches work best in low population density areas.
- In high risk zones, areas with high population densities or in built environments, natural resource management and livelihoods adaptations on their own will not be sufficient to reduce risk, so structural measures will also have to be considered.
- Permanent relocation away from flood plains is likely to be contentious and create other risks. It should be viewed as a strategy of last resort.

While this report offers a series of lessons on general good practices in riverine areas, such lessons should not be taken as panacea, but must be assessed based on the specific contexts. Riverine areas are not just 'riverine', but also have other characteristics that shape their risk profiles: parts of Concern's riverine programme areas in Pakistan and Mozambique are located by the coast, so are also exposed to coastal hazards, and all areas can experience drought. Likewise, the specific hazard, vulnerability, and capacity profiles of the area differ, and beneficiaries have different levels of access to DRR resources. Generally, however, although riverine areas have certain issues and challenges, neither riverine risk nor its reduction is unique. In all cases, inequality, lack of services, extreme poverty, and environmental degradation contribute to risk, showing that risk is ultimately a human expression of deep-seated social patterns, not a natural product. Risk reduction requires changing those social patterns and relations at local, national, and international levels and across all sectors, through a multitude of interventions and actors. Indeed, this suggests the importance of applying general tools and approaches to riverine regions.

The following lessons can be learned for DRR in riverine regions:

- Preparedness, NRM, and structural activities are key complementary measures for reducing risks in riverine areas.
- Upstream practices can affect risks downstream, both positively and negatively. DRR practices should be carefully planned and undertaken so as to avoid negative consequences.
- Changes in settlement patterns that occur out of necessity can expose people to more riverine risks.
- Flooding is common in riverine areas, but levels of erosion and water pollution often vary.
- DRR in riverine areas is mainly a development activity conducted over a long time periods, not an emergency one.
- Reducing or removing exposure to flood hazards is often possible in riverine areas, sometimes by relocation, but often by raising structures. However, adapting livelihoods to seasonal fluctuations of water levels is also a powerful tool for reducing risks associated with these hazards.



It is not always desirable to stop flooding on flood plains, as this would also stop positive deposits of fertile silt onto valuable farming land. Engineered solutions to floods, furthermore, can exacerbate risk downstream. Floodplains provide an interesting illustration in which hazard prevention, by working to reduce or stop the hazard itself, may be counter-productive as a form of DRR. Instead, adaptation to the hazard and mitigation of its negative impacts, is the better approach. Humans have been living along the three rivers featured in this report - the Indus, the Jamuna and the Zambezi - since time immemorial, and have learned to adapt to the seasonal fluctuations inherent with close proximity to such a dynamic system.

Taking an engineering approach, as Pakistan has done with the Indus, does not guarantee a reduction of risk – indeed, it appears that certain risks have also increased. Relocating people out of flood zones, as in Mozambique, is highly contentious and probably not the best solution. Significantly interfering with floodplain dynamics and ecosystem, as with the canals in Zambia, is likely to have huge downstream impacts and is only continued because the canal system is old enough for the natural systems to have adapted to their presence.

Perhaps the best approach for addressing riverine risks involves the integration of livelihoods adaptation to seasonal fluctuations, natural resource management, structural measures in high risk zones, and a systems approach to determine the best strategy for each place, keeping in mind upstream-downstream linkages. For a system or large river basin-wide approach like this, DRR approaches like Concern's must complement the work being undertaken by the authorities that are responsible for managing the entire river basin, should they exist.

Notes

1. Concern defines DRR as "the process of protecting lives, livelihoods and assets of communities and individuals from the impact of hazards (Concern 2005)".
2. Comprising the analysis of hazards, vulnerabilities and capacities, which leads to action planning period.
3. These hazards, and Concern's approach to addressing them, are documented in the accompanying report on coastal areas.
4. Including those aimed at strengthening livelihoods, reducing inequalities, and building human, social, political, natural, financial, and physical capitals.
5. This includes as feed livestock, as fuel, as broom for dust cleaner, to produce herbal medicines, as a pulp for paper, as a thatching material, and as a source of molasses.

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