

A photograph showing a large stack of white sandbags used for flood defense. The sandbags are piled high and are partially submerged in muddy, brown floodwater. The water reflects the light, creating a shimmering effect. The sandbags appear worn and are tied with ropes.

RESPONDING TO FLOOD DISASTERS: Learning from previous relief and recovery operations

John Cosgrave

LESSONSPAPER

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Scope of the paper

This paper presents lessons learned from previous flood responses in developing countries, based on a structured review of the literature. It is intended for people working in relief and recovery operations who have to decide if, when and how to intervene after a flood.

The nature of floods

The *Oxford Dictionary of English* defines a flood as ‘an overflow of a large amount of water beyond its normal limits, especially over what is normally dry land’. The number of flood disasters is growing (Parker et al., 2007: 3), driven by:

- changes to catchments (such as deforestation or urbanisation) that lead to increased run-off
- population growth in areas at risk of flooding
- climate change, which increases the variability and severity of weather, such as record-breaking rainfall and possibly more severe tropical cyclones.

All of these factors mean that the number of flood disasters is likely to continue to increase.

Growing wealth also can also make livelihoods more vulnerable to floods. For example, farm implements such as hoes can survive flooding without damage, but the same is not true of farm machinery.

There are many different types of floods.

- *Riverine or drainage-line floods* can be caused by upstream rainfall or snowmelt, or very occasionally by the failure of dams upstream (usually because of upstream rainfall). These typically give advanced warning, and in some places are an annual or multi-annual event – for example, the almost annual floods in Bangladesh. Such floods can affect large areas and tens of millions of people. Floods after dam failures, like the 1993 floods in Nepal (Pradhan et al., 2007), behave more like a storm surge than a typical riverine flood.
- *Flash floods* occur suddenly across a limited area, associated with very heavy rainfall. They occur without warning but are limited in scale.
- *Storm surge floods* occur when the sea level rises to exceptional levels because of storms, typically tropical cyclones. They typically affect

coastal areas. Storm surge can be significant, with water heights in excess of 8 meters (NOAA, 2012; 2013). In deltas, the effects of the storm surge can be felt for significant distances inland.

- *Tsunamis* are usually associated with undersea earthquakes, but can also be caused by exceptional meteorological conditions (meteo-tsunamis) (Woodworth, 2014).

The latter two types of floods can cause very high levels of damage and loss of life. Their duration is normally short, but when sea water floods the land, salt can cause temporary or permanent damage to the soil and its ability to grow crops (Szczeniński et al., 2006; Raja et al., 2009).

In some cases, flooding of different types can occur at the same time. This is often the case with tropical cyclones, during which heavy rainfall can cause drainage-line flooding at the same time as the wind causes a storm surge. This happened in Mozambique in 2000 with Cyclone Eline.

For any type of flood, the two key considerations are its speed and duration. Storm surges and tsunamis arise almost instantaneously but generally have a short duration. Flash floods rise quickly but also fall quickly. Drainage-line floods can rise slowly but last for a long time. All types of floods can cause sustained damage to livelihoods, either through the immediate damage and loss of life or through the damage caused by prolonged inundation.

Lessons

Of the lessons identified during this review, the following were identified as the most important, relevant to flooding, and broadly applicable. Some more general lessons (regarding cash transfers, for example) have been included to reflect their importance in current humanitarian debates. Many lessons that apply to other types of humanitarian response, whether it is the need for coordination or consultation with the affected population, also apply to floods. What makes floods different is that their impact may be long term, either through sustained waterlogging or through the impact that they have on livelihoods.

Lesson 1.

Needs assessments should incorporate existing knowledge and be flexible.

A recent World Bank review of lessons learned noted that ‘the most immediate needs following a flood are for a safe water supply, food, shelter, and medical care’ (IEG, 2010: 3). Even though the basic pattern of needs

is clear, a great deal of effort often goes into overly detailed and poorly coordinated needs assessment (ACAPS, 2012: 4; Darcy et al., 2013: 22) that yields little new information.

Needs assessment is often given a great deal of prominence in the early stages of a disaster response, even though 'the results of formal assessments are often marginal to the decisions taken' (Darcy and Hofmann, 2003: 6). Poole and Primrose (2010: 14) found that 'the most powerful influence on donor ability to fund in accordance with needs is not necessarily ultimately the availability of evidence.'

A recent ALNAP study on the quality and use of evidence in humanitarian action found that 'the evidence from needs assessments is often only one of the several factors that influence decisions' (Knox Clarke and Darcy, 2014: 50). An evaluation of the role of needs assessment in the 2004 Indian Ocean tsunami response (de Ville de Goyet and Morinière, 2006: 24) found that initial needs assessments were effectively based on international satellite coverage and that 'humanitarian assessments intending to influence decisions widely were largely too late to do so' (ibid.: 25).

If an agency is already familiar with the capacities of a flood-affected community, and with the likely impacts of flooding, a needs assessment can be limited to identifying (1) the affected areas and the extent to which they are affected and (2) the scale of the response by other actors (Cosgrave, 2009: 82–85). This is what happened in Sri Lanka after the 2004 Indian Ocean tsunami, when organisations familiar with the context launched response activities rather than making formal assessments (de Ville de Goyet and Morinière, 2006: 37–38).

The issue of what other actors are doing raises the question of single-agency versus multi-agency assessments. Single-agency assessments are more likely to miss out on information about the planned interventions of other actors. Polastro et al. (2011: 30) found that single-agency assessments in the 2010 Pakistan floods led to too many different assessments and over-assessment of and lack of communication with the affected community. Incompatible formats also made effective collation impossible. The lack of a common basis makes joint prioritisation impossible (Polastro et al., 2011: 31).

In flooding in particular, needs assessments may be constrained by access difficulties. This was the case in Mozambique in the floods of 2013, where needs assessment and implementation were both constrained by the difficulties of accessing the flooded areas (Simpson et al., 2013: 4). Access may also be constrained by security, as was the case in the Pakistan floods of 2010 (International Development Committee, 2011: 50; Polastro et al., 2011: 31). Joint assessments can mobilise more resources and address access constraints.

While initial overall needs may be obvious, the needs of individual families often vary more and more with time, due to the different mix of livelihoods in each family and to the results of their own efforts to restore old livelihoods or establish new ones. After the Mozambique floods of 2000, an evaluation noted that ‘beneficiary needs and capacities grew in their range and complexity with time, making the typical “one size fits all” solution of standard kits or packs less appropriate’ (Cosgrave et al., 2001: 3). An evaluation of the 1998 Bangladesh floods response noted the dynamic nature of disasters and said that ‘specific needs on the ground also change over time, as do relative priorities’ (Roger Young and Associates, 2000: 35).

Any needs assessment is rooted in the time in which it is conducted and may quickly become irrelevant. One NGO evaluation of the 2010 flood response in Pakistan found that by the time the consolidated assessment report on the needs of internally displaced people was available, significant numbers had already returned to their homes (Sandison and Khan, 2011: 21). Another NGO evaluation of the same response noted that it was not yet meeting the changing needs brought about by the onset of winter (Hagens and Ishida, 2010: 7). Needs change over time.

An evaluation of the International Federation of Red Cross and Red Crescent Societies (IFRC) hurricane response in the Caribbean in 2004 noted that some elements, such as the health campaign, ‘became less needed as time went on’ (Gamarra et al., 2005: 37) and that while the timely delivery of non-food items was appropriate, the late delivery of such items could be seen as dumping (ibid.: 73). The issue is not late delivery itself, which can happen in any programme – as in the case of edible oil after the 2000 Bangladesh floods (Meyer, 2001b: 18) or fishing gear after the 2004 Indian Ocean tsunami (FAO, 2007: 38) – but delivery so late that the underlying needs have changed. An evaluation of the southeast China flood response in 2002 found that when emergency relief goods arrived in the field five weeks after the appeal, ‘they were no longer relevant to the needs prevailing at that time’ (Wilding et al., 2003: 27). An evaluation of the 2013 Zambia floods found that by the time personal protective equipment had been procured, ‘it was no longer needed, as flood water had subsided’ (Ogle et al., 2013: 20).

Thus, needs assessments need to be continually updated. Even where good secondary information is available, it can soon become outdated (Clarke and Darcy, 2014: 19). This is true even outside of emergency contexts, as happened with nutrition data in the 2010 Pakistan floods (Nutrition Cluster, 2011: 27).

One alternative is to delegate detailed needs assessment to the affected households. This is one of the advantages of cash transfers – which, in the aftermath of Cyclone Sidr in Bangladesh in 2007, ‘allowed households to focus on their own needs’ (Cash et al., 2013: 2099). Cash grants for housing in Sri Lanka after the 2004 Indian Ocean tsunami were seen as enabling families to ‘rebuild their houses according to their own needs’ (Aysan et al.

2007: II). In Myanmar, a social impact monitoring report found that cash enabled households to determine and meet the range of their own needs and priorities' (Tripartite Core Group, 2009: 40).

In sum:

- While needs assessments are necessary, they should be flexible to adapt to what agencies already know as well as local context and constraints. Agencies familiar with a particular context may only need information about the extent and severity of the problem. This lesson is of particular relevance to agencies dealing with repeated floods.
- Needs assessments reflect a particular moment in time and need to be kept up to date. Planners should also consider what the likely pattern of need will be by the time their assistance is delivered as needs will change even if floodwaters have not receded.
- When needs become more complex, as happens in the long impact period following flooding, the use of cash grants allows affected families to assess their own needs and act accordingly.
- Assessments by multiple agencies should ideally be conducted jointly or use a common format to permit collation of data and joint prioritisation. Joint approaches may overcome access restrictions.

Lesson 2.

Floods are not short-term events.

When deciding whether to intervene, agencies should consider how long their engagement is likely to last. The impact of a flood can last for a considerable time. Even when a flood is of short duration, such as a storm surge or tsunami, its impact – the consequences of the loss of assets, shelter and livelihoods and the deaths of economically active household members can endure for many years. This makes floods a significant disruption to the development narrative of any group.

In some types of natural disasters, such as drought, floods affect urban as well as rural livelihoods. Floods (in all their forms) are growing more frequent (Parker et al., 2007: 3) and in some cases reaching unprecedented size and impact, such as the Thai floods of 2011 (Komori et al., 2012).

Floods may lead to impacts on the natural environment such as erosion and landslides. In Bangladesh, some 2,000 to 3,000 km of river banks are severely eroded each year. Those whose lands are eroded lose out, and the new land the floods leave falls to the larger landowners (Hutton and Haque, 2004: 42–43).

Flood-related mortality may lead to demographic changes. In developed countries, men and boys make up the majority of flood fatalities (Jonkman and Kelman, 2005b; Jonkman et al., 2009). The opposite is the case in developing countries, where women are more likely to die. Floods in developing countries, like natural disasters in general, kill more women than men, and at an earlier age than men (Neumayer and Plümper, 2007). In both developing and developed countries, children and the elderly are disproportionately at risk in floods (Sommer and Mosley, 1972; Bern et al., 1993; Chowdhury et al., 1993; Jonkman and Kelman, 2005b; Telford et al., 2006; Pradhan et al., 2007; Jonkman et al., 2009).

Impacts on livelihoods may last for some time. Floods may leave lands waterlogged for several months. After the 2008 Kosi floods in India, land was waterlogged for an average of three months, and in the worst cases for four months (UNDP India, 2009: 12). Land was waterlogged for many months after the 2000 Mozambique floods (Cosgrave et al., 2001: 25).

Tsunamis and storm surges can lead to ecological damage – from inundation or from the deposit of sand and silt (Szczuciński et al., 2006). Some of this ecosystem damage may directly affect livelihoods (Ramachandran et al., 2005: 195). During the 2004 Indian Ocean tsunami, soils were inundated in the Andaman Islands, leading to salinity problems. However, very high rainfall (6,846 mm) in the following two years leached the salts from the soil, returning them almost to their pre-tsunami condition (Raja et al., 2009).

Waterlogging may not only temporarily prevent use of a field but also destroy assets. After the Bangladesh floods of 2000, in one surveyed village, 'all the jackfruit trees and papaya plants were killed as a result of being waterlogged for more than two months. Besides that, 50% of other homestead tree species like mango, pomegranate, hog plum, guava etc. are also dead for the same reason' (Meyer, 2001a: 93).

Floods may also cause enormous livestock losses with a devastating impact on livelihoods. In Cyclone Sidr in Bangladesh in 2007, 80% of livestock and poultry were killed in four districts (Cash et al., 2013: 2098). In the 1998 Bangladesh floods, over 172,000 livestock were lost (ibid.: 2099). Restocking issues can be complex and are discussed further below. Health issues, another potential long-term consequence of flooding, are also discussed in more detail below.

Decisions made during the response and the initial recovery can also have profound long-term consequences. In particular, decisions about relocation may have a critical impact on livelihoods, as is discussed in the final lesson.

In sum:

Floods have long-term consequences, and response plans and budgets should take the long term into account.

Lesson 3.

Disasters create opportunities for disaster risk reduction.

Disasters draw attention not only to themselves but also to the hazards involved and the possibility of reducing risks from future disasters (CARE Brazil, 2010: 8). Thus, they may make it easier to promote disaster risk reduction (DRR), which can be very effective when disasters are frequent, as with repeated flooding. Recurring floods provide ongoing reinforcement of the DRR message.

Responses to one hazard may place people at risk from the same or a different hazard. This was seen after the 2004 Indian Ocean tsunami, where some relocation sites in Sri Lanka were subject to persistent flooding (Khazai et al., 2006: 843; Skat, 2009: 33). A Cordaid review of DRR in four countries noted that 'it is only when interventions pay attention to the disaster risk that they achieve gains that can be sustained in the face of frequent disasters' (Cosgrave et al., 2010: 49). Sometimes the construction of housing or roads can alter the terrain enough to change the vulnerability to flooding (Jha, Bloch et al., 2012: 82).

A problem for flood-related DRR is that many flood mitigation measures may involve significant investment or take many years to implement. For example, the World Bank-funded China Loess Plateau Project – which built check-dams, planted trees, shrubs, and grasses on slopes, controlled gullies, built terraces using contour ditches and stone barriers, and changed land management practices – took eight years to complete (IEG, 2010: 11). This project involved no major infrastructure, which can take even longer to complete.

If disasters do not recur frequently, it is difficult to keep attention focussed on DRR. Funding limits often rule out effective action to reduce vulnerability to future disasters. The Disasters Emergency Committee (DEC) report on the 2004 Indian Ocean tsunami noted that 'the current three-year timescale for DEC funding is too short for vulnerability reduction' (Vaux et al., 2005).

The most effective risk reduction measures may not be in the affected area but upstream (run-off control or dam management) or downstream (dredging or dam management) (Jha, Bloch et al., 2012: 197).

Critical DRR activities may include the protection of assets. Such measures can include raising house plinths above flood level (Alam et al., 2008: 4; Jha, Miner et al., 2012: 113) and making them from more durable materials (Murtaza et al., 2012: 31; Jha, Miner et al., 2012: 113). Measures can include things as simple as installing shelves about the expected flood level to

protect valuables (Alam et al., 2008: 11; Miner et al., 2012: 113) or storing food, fuel, and utensils above the likely flood level. Hand pump platforms can be raised so that they can continue to supply safe water even when the ground is flooded (CRS, 2014: 14).

Without DRR, repeated floods will continue to cause the same avoidable problems.

In sum:

- After a flood, use can be made of the heightened awareness of flooding to reduce the risk from future floods. Risk reduction work should be built into the response.
- Care must be taken to ensure that actions taken during the response do not make the affected population more vulnerable to flooding or other hazards.

Lesson 4.

Economically vulnerable people are most at risk of death during flooding.

In the 1993 floods in Nepal, poor people were more than six times as likely to die as wealthy people (Pradhan et al., 2007: 66). In Bangladesh, Save the Children found that ‘poverty is intrinsically linked with the impact that floods have on any given segment of the population, and its influence can be seen as crosscutting all . . . areas’ (Save the Children, 2006: 6).

An evaluation of the interagency response to the 2007 floods in Mozambique made the point that poverty and vulnerability to disasters are intertwined and mutually reinforcing: ‘Poverty, rather than disasters, is the real issue in the lower Zambezi Valley and in rural Inhambane. Many of the real needs of the affected population reflected structural poverty rather than the impact of the disaster. However, disasters and their related coping mechanisms contribute to this poverty, and this poverty in turn makes people more vulnerable to disaster’ (Cosgrave et al., 2007: 4–5).

The mechanism that makes the poorest the most vulnerable to flood mortality is not completely clear. It is explained in part by factors such as shelter type or proximity to the water, but even when these factors are allowed for, the poorest are still more vulnerable. In the 1999 Taiwan earthquake, those in the lowest of three income categories had double the risk of death of those in the highest category, even after correction for other risk factors (Chou et al., 2004).

The same relationship between economic powerlessness and vulnerability

to disaster can be seen in regard to gender. Neumayer and Plümper (2007) noted that the weaker the socioeconomic status of women in a society, the bigger the difference between male and female mortality rates, and that the biological and physical differences between the sexes are unlikely to explain the differences in mortality rates.

The greater vulnerability of the poor is only partly explained by factors such as housing type or location. Being poor is in itself a risk factor. Thus, effective responses need to consider not only early recovery but also poverty reduction and reducing the risk of future disasters. However, a follow-up study of the response to the 2004 Indian Ocean tsunami, looking at the links between relief, rehabilitation and development, found that 'unifying frames of reference, such as early recovery, disaster risk reduction, or poverty reduction, are still conceived and implemented separately' (Brusset et al., 2009: 10).

In sum:

- To address vulnerability sustainably, it is necessary to deal not only with specific issues such as housing type but also with poverty and the risk of future disasters. Interventions that address poverty as well as physical issues are more likely to be sustainable.
- Targeting assistance by poverty status may be appropriate in the absence of more detailed targeting data. This approach is particularly appropriate in urban flooding contexts.

Lesson 5.

Engagement with local authorities is critical.

While the engagement of the community and of local authorities is often identified as a critical factor in humanitarian action, it is of particular relevance in flood relief operations. That is because of the long-term nature of many flood impacts and because many of the measures required for effective risk reduction require intervention by the local authorities. In Sri Lanka, for example, a Red Cross community-based health project was very thorough its approach to working with the local authority and was regarded by local officials as being more sustainable as a result (Bang et al., 2008: 29).

One challenge for local engagement is the turnover of aid personnel. An evaluation by MedAir considered that staff turnover 'may have affected working relations with' local authorities among others (Lee, 2005: 17–18), and noted the tension between the NGO's desire for independence and the local authority's desire for control of the project (ibid.: 19).

Engagement with the local authorities may take many forms, including advocacy. In Sri Lanka, the Swiss Consortium successfully advocated for 200 formerly landless people to be given land titles to enable them to benefit from the government rehousing programme (Aysan et al., 2007: 4). In Vietnam, the Red Cross found that the size and scale of their relief operation gave them more scope for advocacy with local authorities (Hai et al., 2008: 17–18). The Belgian Red Cross successfully advocated for an effective waiving of the requirement for a the minimum house site size for their tsunami reconstruction programme (Vaes and Goddeeris, 2012: 77).

Engagement with local authorities is also important in order to know what the authorities' longer-term plans are (Loquercio and Mubayiwa, 2007: 18). Local authorities have their own agendas and may face pressure from the local community or central government. They may also lack capacity and experience in disaster management (de Ville de Goyet and Morinière, 2006: 24–25). An overestimation of their own capacity may lead to restrictions on access by international aid actors, as happened in the early stages of the 2011 Pakistan floods (Chughtai and Heinrich, 2011: 7). A recent Department for International Development review of the World Food Programme operation in Bangladesh found that local authorities felt compelled to provide assistance to all households (Meyer, 2001b: 13). It can take months for instructions from the central level to reach the local level, and this can lead to differing policies by different local authorities (Gunatilleke, 2006: 54).

In sum:

- Given the long-term nature of flood impacts, agencies need to engage closely with local authorities to be able to advocate for the most vulnerable and for sustainable policies.
- Agencies need to be aware that local authorities have their own agendas and may be pulled in different directions by different stakeholders.

Lesson 6.

Engagement with the affected population is critical.

There is a natural tension between speed and sustainability in humanitarian response. This is particularly relevant in flooding, due to the sustained nature of the flooding itself, when waterlogging lasts several months, or of the impact of the flooding. Responses need to avoid two traps: delaying action while seeking a perfect solution (Bhattacharjee et al., 2005: 44) and committing to action that is later revealed to be unsustainable.

This tension between speed and sustainability applies not only to humanitarian response, but also to the broader aspects of planning in urban environments, where there is a need to balance day-to-day demands against long-term strategy (Jha, Bloch et al., 2012: 50).

For example, in the Maldives, an evaluation of the reverse-osmosis water plants provided by the IFRC found that the sustainability of the plants was reduced when the relevant ministry stepped in too quickly to guarantee support and spare parts without demanding anything in return from recipients (Fox, 2008: 7). An earlier evaluation had noted that the pressure to spend money quickly limited the possibility of achieving a more sustainable system (Alexander, 2007: 8). The degree to which communities are involved appears to differ from one situation to another, however. While an evaluation of the Norwegian Refugee Council's response to the 2010 Pakistan floods and other crises found that community leaders were involved in all aspects of shelter needs assessment and monitoring (Ternström et al., 2013: 40), Davidson et al. (2007: 100) noted that high levels of engagement with the affected population are rare.

An evaluation of the impact of the 2004 Indian Ocean tsunami response on local and national capacities found that 'when international agencies are able to resist the pressure to spend quickly and facilitate local efforts for meaningful recovery, achievements of the assistance becomes sustainable' (Scheper et al., 2006: 118). A review of recovery operations by the IFRC found that in Honduras, Red Cross societies 'that planned and consulted more thoroughly delivered more appropriate and sustainable housing than their counterparts that moved to implementation too quickly' (IFRC, 2006: 9).

The lesson here is that responses should engage in effective consultation to ensure that their actions are as sustainable as possible. As a Red Cross review of recovery operations noted, 'taking adequate time at the beginning to consult with the affected population and other stakeholders can make things go faster later and can improve the quality of the outcomes' (IFRC, 2006: 9).

Lesson 7.

The risk of disease outbreak is real but lower than commonly thought.

Flooding can have both short- and long-term health impacts. The primary cause of death in flooding is drowning. In developed countries, approximately two-thirds of flood deaths occur from this cause (Jonkman and Kelman, 2005b). A report from the Tyndall Centre noted that 'few deaths from drowning occur during slow rising floods' (Few et al., 2004: vi). In the 1953 North Sea storm surge, rapidly rising waters were accounted to have caused 1,030 fatalities in the Netherlands, 60% of the total (Jonkman and Kelman,

2005a).

Those most at risk of death in flood disasters in developing countries are the young, the elderly and women (Sommer and Mosley, 1972: 1032; Bern et al., 1993: 75; Telford et al., 2006: 34–35). This differs from developed countries, where men and boys are most at risk, largely due to risk-taking behaviours (Jonkman and Kelman, 2005b: 75).

Secondary causes of death vary. In developed countries, because of their older populations, the stress associated with floods can lead to deaths from pre-existing conditions, heart attacks and strokes. In Hurricane Katrina, 19% of the known deaths judged to have occurred as a consequence of the flooding occurred outside the flooded area (Jonkman et al., 2009: 687).

Communicable diseases are usually the second most important cause of death in developing countries, but this depends on the context. Snakebite was the second largest cause of mortality in the 2007 floods in Bangladesh (Alirol et al., 2010: 2).

The health impacts of floods have been the subject of a number of systematic reviews (Few et al., 2004; Ahern et al., 2005; Alderman et al., 2012; Doocy et al., 2013). However, 'there is a surprisingly limited evidence base about the health effects of floods, particularly in relation to morbidity' (Ahern et al., 2005: 43). Similarly, the Tyndall Centre review concluded that 'there is presently a weak evidence-base to assess the health impacts of flooding' (Few et al., 2004: vi).

Evidence suggests that the danger of epidemic after flood may have been overstated. Watson et al. (2006) noted that natural disasters that do not result in displacement are rarely associated with an increased risk of epidemics. WHO (2006: 6) warned that while 'the overall risk of communicable disease outbreaks is lower than often perceived, the risk of transmission of certain endemic and epidemic-prone diseases can increase following natural disasters.'

In their review of epidemics after natural disasters, Watson et al. (2007) identified displacement as the primary risk factor for outbreaks of epidemic disease. This is in line with previous work on both natural disasters and complex emergencies (CDC et al., 1992; Toole, 1997; Toole and Waldman, 1997). Watson et al. (2006) noted that 'postdisaster communicable disease incidence is related more closely to the characteristics of the displaced population (size, health status, living conditions) than to the precipitating event.'

However, floods do appear to pose risks to health in addition to those caused by displacement, in particular with relation to water supply. Floods can contaminate existing water supplies, provide breeding areas for disease vectors, and force changes in behaviour that lead to increased exposure to

vectors (WHO, 2006: 8).

Flooding has been associated with outbreaks of diarrhoeal disease in a wide variety of environments in developing countries, and even in the United States following Hurricane Katrina (WHO, 2006: 6). However, the diarrhoeal disease outbreak among evacuees after Katrina (Yee et al., 2007) was the only serious outbreak after that disaster (CDC, 2005). Alderman et al. (2012) found that, after floods, 'there is an increased risk of disease outbreaks such as Hepatitis E, gastrointestinal disease and leptospirosis, particularly in areas with poor hygiene and displaced populations'. Even when it does not constitute an epidemic, the incidence of communicable diseases may increase after floods, requiring close attention to disease surveillance.

The mental health consequences of flooding have received a lot of attention in developed countries (Murray et al., 2011), and there is increasing attention to the topic in developing countries as well (Durkin et al., 1993; Danvers et al., 2005; Haqqi, 2006; Rodrigo et al., 2009). However, the picture is still not clear, and it has been suggested that there has been too much attention to PTSD rather than to other manifestations of mental ill-health (Weiss et al., 2003).

While a 1998 study found an increased risk of suicide after natural disasters (Krug et al., 1998), this was retracted the following year with the statement that once a calculation error was corrected the data showed no increase in suicide after natural disasters (Krug et al., 1999). Unfortunately, the original article is cited far more often than the retraction and is still used to support the idea that flooding can lead to a rise in suicide (Khan, 2010). A 1998 paper on China linked the higher rate of suicide in parts of the Yangtze Basin to repeated flooding there but offered no compelling evidence for this argument (He, 1998).

Studies of suicide rates after different types of disaster have been inconclusive, with some studies finding an increase (Yang et al., 2005) and another a decrease (Nishio et al., 2009). More research is needed in the area of mental health generally and on other mental health outcomes in addition to PTSD and suicide. The United Kingdom Health Protection Agency's review of flooding and mental health 'identified the vital requirement for more longitudinal studies to understand the true impacts and trajectories of impact of disasters on people's mental health' (Murray et al., 2011: 6).

Evidence of the impact on birth outcomes for pregnant women exposed to flooding is also weak (Xiong et al., 2008; Currie and Rossin-Slater, 2012), but we do know that exposure even to economic crisis can have an effect on birth weight (Eiríksdóttir et al., 2013).

In sum:

- Disease surveillance is critical after floods to detect changing disease patterns and potential outbreaks.
- Floods may lead to outbreaks of epidemic disease, but such outbreaks are rare. The probability of an outbreak increases when populations are displaced, and when there are interruptions to water supply, sanitation, and health-care systems. Despite their rarity, agencies should be prepared for such outbreaks because of their potential severity.
- There is only very weak evidence on the long-term physical and mental health effects of flooding.
- Floods may lead to increases in other threats to health (such as snakebite), and these may, to a degree, be context dependent. Agencies should be aware of previous morbidity patterns following floods.

Lesson 8.

Avoiding interruptions to water and sanitation services is key to preventing disease.

Floods may damage water and sanitation systems or may prevent access to safe water sources. Interruptions to water and sanitation systems are a risk factor for increased levels of communicable disease (Watson et al., 2007), even where no disaster is involved (Huang et al., 2011). Floods may themselves distribute sewage (Few et al. 2004: 8). Overflowing sewage is a particular hazard in urban settings (Sanderson et al., 2012: 13).

The nature of flooding, with water covering the landscape, dictates some of the response activities needed after flooding, which can include protecting water sources from contamination or ensuring post-disaster access to water supplies. This can be done by raising tube wells and boreholes about the flood level (ACF, 2007: 12). Agencies built raised platforms after the 2012 Pakistan floods to ensure the pumps were above flood levels (Dost and Jivan, 2012: 8). This was identified as the second most important DRR activity by communities consulted by CRS in India and Bangladesh (CRS, 2014: 14), after reinforcing housing to reduce flood damage.

While raising pumps works well in rural areas subject to annual floods, a different scale of intervention will be needed in urban settings. There, protective measures can include installing flood walls in pumping stations or protecting the electricity supply (Jha, Bloch et al., 2012: 413).

The provision of excreta disposal facilities for flooded areas is a particular problem, particularly in urban areas. This has been identified as the most significant current gap in emergency WASH response (Bastable and Russell, 2013: 14). Agencies should have facilities ready for desludging of latrines and wells, which is a high priority in flood response (Smith, 2009).

Urban settings present particular challenges during flood emergencies (Smith, 2009: 5–6). Here the urban context increased the need for good communication between the responding agencies and with the affected urban population. Communication can be best effected through small meetings and practical demonstrations (*ibid.*).

In sum:

- DRR activities should include WASH interventions.
- Agencies should strive to prevent the interruption of access to safe water and sanitation, and should be prepared to restore existing wells and latrines to working order as soon as possible.
- The provision of excreta disposal facilities can be a significant challenge in a flood response setting.
- WASH responses should integrate technical and social/communication elements.

Lesson 9.

Simply replacing assets may perpetuate or even increase existing inequities.

As with all natural disasters, the primary impact of flooding, after loss of life, is on livelihoods. Even in floods where there is relatively low mortality, as with slow-rising riverine floods, there can be large impacts on livelihoods.

The destruction of housing can also affect livelihoods, as housing provides a base for livelihood activities (Sheppard et al., 2005). After the 2004 Indian Ocean tsunami, over 97% of surveyed respondents rated the transitional shelter programme as being very important for rebuilding livelihoods (TANGO, 2007: 22). Livelihoods can also be affected by the loss of assets in a flood.

Other factors can impact livelihoods including 'environmental changes, changed opportunities, or changes in the market demand for their products' (Cosgrave et al., 2009: 26). Market demand for fish changed after the 2004 Indian Ocean tsunami when there was a concern that the fish might have eaten bodies that had been washed out to sea.

Increasing relative wealth, even in the poorest counties, is changing the impact of flooding. Flooding can be an important part of the annual cycle, depositing nutrients on the land and maintaining fertility, and thus can have a positive impact. When a community has little more than agricultural implements, clothing, and utensils, floods may do little damage other than to the houses. But when people acquire more assets such as bicycles, motorcycles, tractors, or other goods that support their livelihoods, the potential impact of floods on their livelihoods increases.

Wealthier households also do not always face the same level of risk as poorer households. Typically they are located in safer places with lower levels of flooding (Brouwer et al., 2007: 320–321). Even where richer households are flooded, their level of vulnerability is generally lower. Wealthier households often have more robustly built houses (Pradhan et al., 2007: 62) and better access to credit, on more favourable terms (Meyer, 2001b: 15), and are more likely to have insurance (Werg et al., 2013: 1616).

Within a household, effective ownership of any asset will vary with the asset within any cultural context. After the 2000 Mozambique floods, ActionAid ensured that house plots were registered in both the man's and woman's names (ActionAid Mozambique, 2000: 16). Cash may have a different ownership pattern than other assets. This was why families after the 2013 Zambia floods preferred to get food and NFIs rather than cash (Ogle et al., 2013: 38). However, the same beneficiaries worried about how they were going to pay their children's school fees (ibid.: 21).

Agencies should also pay attention to the way in which flooding affects the livelihoods of those whose houses are outside the flooded areas. After the 2000 Mozambique flood a lesson-learning workshop noted that many households lived on higher ground but farmed in the valley bottoms, suggesting that people in need of agricultural support should be targeted as beneficiaries (UN, 2001).

Many livelihood recovery programmes focus on replacing assets. For example, after the 2004 Indian Ocean tsunami, replacement boats were distributed to fishers. But the focus on replacing assets favoured those who were better off while marginalising women and the poorest (Telford et al., 2006).

The problem with asset replacement is that the rich have more assets and may lose more of them in absolute terms, but not in relative terms. A study of flood damage in Bangladesh found that 'the poor suffer more in relative terms, but not in absolute terms. Average damage costs in absolute terms are significantly higher for wealthier households' (Brouwer et al., 2007: 325). However, the losses, which can amount to one-third of a year's income for the poorest, are relatively insignificant for the better off. Thus responses that concentrate on replacing assets end up reinforcing or even increasing

inequalities.

Agencies should, at the outset, determine whether recovery is intended to restore the pre-flood situation, even if it was 'characterized by extreme poverty, injustice, exposure, and vulnerability to hazards as in the case of Rawalpindi prior to the 2001 floods' (Mustafa, 2003: 71). In the 2004 Indian Ocean tsunami response, there was an emphasis on building back better, but this focussed on making housing and infrastructure more disaster resistant rather than on increasing equity.

The same problems can often be seen in shelter programmes, where only those with land titles are assisted, excluding the poorest (Aysan, 2008: 6). Even certain types of relief distribution can exclude the poorest. Seeds and tools may be distributed only to those with land, with the landless receiving no assistance.

The poorest may also suffer further asset erosion following a disaster. 'A common inequity occurs when the immediate needs of the poor are ignored in the immediate post-disaster period and they have to sell their productive assets, including especially their land to the better-off, as happened following the tsunami in Indonesia, for example' (IEG, 2010: 4). Selling livestock at low prices also effectively transfers assets from the poor to the wealthy.

This sale of assets may also occur with replacement assets provided by agencies (IEG, 2010: 5). After drought and a flood in North-Eastern Kenya in 1996–1998; Buchanan-Smith and Barton (1999: 29–30) found that 15% of the distributed goats and sheep had been sold on in emergency sales. Agencies may seek to protect or assist the recovery of sold assets with cash grants as in the case of response to the 2004 Indian Ocean tsunami in Sri Lanka (Bhattacharjee et al., 2007: 20).

In sum:

- Recovery programmes that do not explicitly focus on the poorest are likely to increase inequalities.
- Agencies need to make a conscious decision on whether they are willing to reinforce existing inequalities or want to try to reduce them.
- Agencies should not become engaged in livelihood support unless they have a good understanding of existing livelihood patterns.
- Patterns of asset ownership and control mean that post-flood assistance needs to consider not only which households should benefit, but who within the household is likely to benefit.

Lesson 10.

Decisions about restocking must be made with careful attention to the context.

Livestock are often lost in floods. After the 2000 Mozambique floods, 80% of the surveyed households had lost their poultry and livestock, while the remaining 20% had fewer than they had before the floods (Cosgrave et al., 2001: 28). The 1991 storm surge in Bangladesh led to the loss of about one million animals and birds (Alam, 2003: 431). Even smaller-scale floods can have significant impacts on livestock numbers. Over 80% of households surveyed in high-flood-risk areas of western Kenya had lost livestock and poultry (Mwango, 2010: 68).

Restocking is a common response to the loss of livestock, and 'providing families with livestock lost after a disaster proved to be effective in most emergency response projects' (IEG, 2010: 5). Restocking after a flood is very different from restocking after drought. The loss of animals during drought raises questions about sustainability, stocking rates and other issues (Heffernan and Rushton, 2000). Such questions are fewer after floods, but basic issues of sustainability should be considered.

Livestock are measures of wealth in many societies, and restocking involves significant wealth transfers that can challenge or reinforce existing inequalities. Sometimes it can be difficult to establish how many livestock have been lost. In the response to Hurricane Dean in the Caribbean in 2007, one country's ministry of agriculture did not see restocking as a priority as officials considered the estimates of livestock lost to be inflated (Walden, 2008: 17).

A recent World Bank lessons paper noted that 'livestock are among the more valuable assets that poor farmers own, and they can be seen as a coping strategy, providing insurance against future crises and crop losses. After a flood when families are desperate for cash, care needs to be taken to prevent elite capture when animals are first distributed' (IEG, 2010: 5). The critical importance of animals in some societies is reflected by the fatalities in floods when people did not want to leave their animals unattended, or when they brought animals to already crowded shelters (Save the Children, 2006: iv).

The types of livestock restocked may also be an issue. After the response to the Mozambique floods in 2000, the DEC evaluation report praised agencies for not rushing in to restock expensive cattle immediately after the floods, 'as restocking projects could result in significant and complex changes in economic power within a community' (Cosgrave et al., 2001: 28). However, the same report found that restocking chickens was appropriate, as they represented a much smaller (and therefore less risky) wealth transfer (ibid.:

28).

Restocking may also be affected by disease. In the Mozambique floods of 2000, ActionAid abandoned plans to restock cattle with purchases from neighbouring South Africa as an outbreak of foot-and-mouth disease there led to a ban on livestock imports (ActionAid Mozambique, 2000: 9). Similarly in the Caribbean, fears of avian flu prevented Oxfam from restocking chickens, even though there had never been a case in the region (Walden, 2008: 17).

Clearly, restocking is more critical where livestock have an important role in cultivation or land preparation. However, each community is on its own development trajectory, and it might be instructive to learn, before rushing to replace draft animals, if there is a trend already underway to replace them with hand or two-wheeled tractors.

As with other assets, ownership patterns within a household may vary with the livestock. The ownership, care, use, benefits and sale proceeds from different kinds of livestock may be highly gendered (Ernerot, 2013). In some cases men and women may be responsible for different aspects of animal care. Feeding may be a female responsibility, but selling (and retaining the proceeds) a male one.

In sum:

- Restocking represents a significant wealth transfer. It is often a major element of flood recovery in rural areas. Agencies need a deep understanding of the nature and forms of livestock ownership so that they understand what the impact of the wealth transfer will be, both inside and outside the household.
- Restocking faces issues with animal diseases. Agencies should also have competence in veterinary medicine to avoid errors.

Lesson 11.

Shelter reconstruction works best when it is owner controlled.

Floods typically destroy a large number of houses. The 2012 Bangladesh floods destroyed over 250,000 houses (Munich Re, 2013: 63), and this was not a record. Rebuilding housing is a frequent task after floods.

It is generally accepted that owner involvement in shelter reconstruction helps to promote positive outcomes. In a review of four case studies, Davidson et al. (2007) found that this was true when the users were involved

at the planning and design stage and not just as providers of free labour. A Belgian Red Cross lessons-learned paper about the response to the 2004 Indian Ocean tsunami compared two broad categories of shelter reconstruction – donor driven, where the work is carried out by a contractor hired by the donor, and owner driven, where the work is done by the owner, directly or using a private contractor – and argued that donor-driven construction should be considered a last resort (Vaes and Goddeeris, 2012: 49). The World Bank’s handbook for reconstruction after natural disasters noted that ‘empowering people to manage their own recovery and reconstruction, both individually and as a community, will be faster and more efficient, and will encourage people to use their creativity and to mobilize their own resources’ (Jha et al., 2010: 94).

Even where shelter kits are provided as a way to repair their own homes, householders often have to purchase additional items. An evaluation of the use of shelter kits after the 2012 Nigeria floods found that 80% of recipients had to purchase additional materials (Bravo et al., 2014: 16–17). This suggests that where shelter kits are distributed, supplemental cash may be appropriate to allow families to adapt or supplement the materials to match their situation.

Satisfaction with owner-driven and donor-driven approaches varied in Sri Lanka with the particular circumstances, including the quality of the donor-built houses, whether owner-builders had faced any problems and the amount of technical support provided (Aysan, 2008: 15).

There can be substantial differences between owner-built and contractor-built costs. In Bangladesh, moving from an owner-built to a contractor-built model increased the unit cost for a core house four-fold (Siddiqui et al., 2010: 17). However, it is not clear if the owner-built cost budget was realistic.

In sum:

- Owner-driven construction is usually preferable when replacing housing lost to floods, but this works best when the house owners are given good support.
- Where housing kits or vouchers are distributed, it is also useful to distribute cash grants so that families can adapt the kit to their particular circumstances.

Lesson 12.

Relocation should be treated as a last resort.

A review of tropical cyclone response in the Philippines from 2009 to 2011 found that 'relocation of affected people outside of their areas of origins should be the last option' (Grünewald and Boyer, 2013: 6). The World Bank advised: 'Avoid relocation if at all possible. Especially avoid relocation to distant sites' (Jha et al., 2010: 83).

A review five years after the 2004 Indian Ocean tsunami found that 'most relocated communities are much further away from important facilities than before the Tsunami and suffer from higher costs for transport and less job opportunities' (Skat, 2009). Such relocation can delay communities' development. Relocation may move people away not only from their livelihoods but also from their kinship networks and social support systems, as happened in India after the 2004 Indian Ocean tsunami (Rawal et al., 2008: 8).

Too often agencies regard relocation as simply a matter of building houses. The World Bank's handbook for reconstruction after natural disasters made the point that 'relocation is not only about rehousing people, but also about reviving livelihoods and rebuilding the community, the environment, and social capital' (Jha et al., 2010: 77).

In sum:

- Relocation after floods is a last resort, as it normally moves people away for their livelihoods.
- Relocation is not just about shelter, or even shelter and services, but all of the elements that make it possible for a community to live and function at a particular location, including such intangibles as social capital.

About this review

This structured review of humanitarian responses is distinguished from a systematic review, which is a 'way of impartially mapping the relevant evidence, assessing the quality of the evidence and synthesizing it' (Hansen and Trifcovic, 2013: 4).

In health, systematic reviews, such as the Cochran reviews, are common. Cochran reviews typically only include the results of multiple randomised or quasi-randomised control trials. For example, the Cochran review on improving water quality to prevent diarrhoea (Clasen et al., 2006) abstracted data from 30 studies. This is only one of more than three dozen systematic reviews of studies dealing with flooding and poor water sanitation (Cochrane Library, n.d.).

These studies generally have a rather narrow focus, usually on medical issues, and do not answer the broader questions facing agencies dealing with a humanitarian flood emergency. Also, there are relatively few randomised controlled trials in acute humanitarian settings, for reasons varying from the unpredictable nature of disasters to the ethics of randomly applying treatments. What studies there are, such as the excellent study of community-driven reconstruction in Lofa County, Liberia (Fearon et al., 2008), normally take place in the later recovery phase rather than in the acute or early recovery phase.

Systematic reviews may use other methods, but relatively few use primary studies based on qualitative research, which form the bulk of the available evaluations and lessons -learned studies for humanitarian interventions (Hansen and Trifcovic, 2013: 20).

The paucity of randomised controlled trials on the broader effectiveness of flood intervention meant that this review had to apply a different approach to identifying primary studies. A wider-ranging literature search using a range of evaluation report databases and academic databases identified 184 evaluation reports and peer-reviewed academic papers. Documents were drawn from the following sources:

- The ALNAP Humanitarian Evaluation and Learning Portal (HELP) for 1,384 evaluative reports of which 46 had the word flood in the title or subtitle. Eventually some 69 documents were sourced from the ALNAP database. (The HELP, formerly known as Evaluative Reports Database (ERD), has been restructured since this research began.)
- The author's own database of evaluations, which provided 52 documents (17 of these overlapped with the ALNAP HELP).

- The IFRC evaluation database, which provided 46 documents.
- Various academic databases such as ScienceDirect (search string: "TITLE- ABSTR-KEY(Flood) and TITLE-ABSTR-KEY(humanitarian)"); JSTOR (Search string ("ab:(Flood) AND ab:(humanitarian)")
- Google Scholar, for papers citing or cited by key references such as Ahern et al. 2005.
- The general Google search engine.

The criterion for inclusion of a document in the review was that it should be an evaluation or a peer-reviewed paper that considered flooding or some aspect of flood response in a developing country. Secondary categories were established for papers or reports on background or side issues (40 in all).

A total of 155 lessons for flood response were identified from this literature set. These lessons were then ranked based on the following criteria:

- broad applicability to flood disasters (lessons specific to one particular context were given a low score)
- specificity to flood contexts (generic lessons that applied to all types of humanitarian response were given a low score, unless they were most frequently found in flood responses)
- expected utility for humanitarian actors responding to floods.

Lessons were chosen for inclusion in this review based on this ranking. The collected primary documents were then searched for evidence supporting the lessons. In all some 275 references were consulted in the writing of this report, of which less than half are cited in the reference list.

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The following publications can also be accessed via ALNAP's Humanitarian Evaluation and Learning Portal.

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