WEATHER DISASTERS

Weather disasters can occur anywhere a major storm, flood, or wildfire has hit in living memory. Extreme heat, wind, rain, and flooding are cutting new paths of impact.[231] But not everyone is at risk – far from it. Exposure to major floods, storms, and fires tends to be localized and specific. The worst disasters can cost nearly a decade's worth of global loss of life and damage and can wipe out close to half of an economy.[232] Measures taken in advance to help minimize these impacts are not always cheap. Emergency response measures carried out after the fact are usually far more expensive and will never restore the lives lost that could have been prevented with advance action.[233]

HIGH
Overall Effectiveness Rating

11 #Actions Assessed

FINDINGS

Countries vulnerable to more intense weather and fires are an eclectic group. Island paradises such as Belize join ranks with failed states such as Somalia. Coastal nations such as Cuba, Micronesia, Yemen and the Philippines experience similar scales of impacts as landlocked Mongolia or mountainous Bhutan and Boliva.[234]

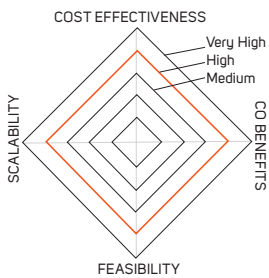
In many cases, even for the most exposed countries, disasters are far from common. For the majority of countries, major disasters occur more on the order of once a decade.

While a disaster, by definition, takes the affected community by surprise, few floods, fires, or cyclones occur in places that have been hitherto untouched by natural disasters, despite the fact that extreme weather is spreading beyond its traditional paths. Unusually strong and unexpected floods or storms can run against prior experience, such as Cyclone Nargis, which devastated Myanmar in May 2008.

Some communities accept risks more or less consciously. The United States' 1938 New England hurricane wiped out tens of thousands of homes and maimed hundreds with its powerful storm surge on Long Island in New York.[235] Today, the affluent West and South Hampton beaches of the area are lined with new homes and buildings, seemingly oblivious to the power of nature.[236]

What overwhelms communities is the breaching of a new threshold. The New Orleans levees breached by Hurricane Katrina,

REVIEW FINDINGS



THE INTERNATIONAL DONOR COMMUNITY IS MORE INCLINED TO PROVIDE FINANCIAL SUPPORT TO A COMMUNITY IN THE WAKE OF A DISASTER RATHER THAN TO PREVENT AS DISASTER FROM OCCURRING IN THE FIRST PLACE

for example, would have been made more robust if they had been expected to withstand more extreme weather than the region had experienced in the past. Since the parameters for climate-caused disasters are shifting, we must regularly challenge the false security of proven, or previously sound, adaptation.[237]

While some communities accept such risks, others simply lack the means to take measures to improve safety. An unfunded USD 2 million emergency flood warning system in Laos, for example, that would be capable of protecting many families from mass inundations, ranks number 7 in the nation's list of climate-change adaptation priorities. Floods of that sort could occur tomorrow or in 10 or 30 years time. In the case of Laos, floods leave nearly half a million people in need of emergency assistance every few years.[238]

The worst natural disasters in modern history occurred when the giant rivers of China, without warning, swamped the plains along the Yangtze or Yellow River, one of the most densely populated areas in the world.[239] But no disaster of that scale – killing millions and destroying the wealth of large populations – has been witnessed since. Communities have learned to protect themselves against the worst natural disasters.

Today, disaster risk reduction – steps to reduce the impacts of possible environmental catastrophes – is a well-developed field. So while the risks of extreme weather are expected to increase, we know where the most acute vulnerabilities lie, and measures exist to reduce risks and exposure to populations and their economies.[240]

Measures must be taken to avoid the worst tragedies. Disaster prevention still fails to mobilize adequate resources among the international donor community, which is more inclined to provide financial support to a community in the wake of a disaster rather than to prevent a disaster from occurring in the first place.[241] No measure of assistance after a disaster will restore lives lost in a large-scale disaster. The catalogue of possible actions provided in this chapter highlights how much more retroactive measures cost compared to proactive ones.

WHAT OVERWHELMS COMMUNITIES IS THE BREACHING OF A NEW THRESHOLD

Flooding in Pakistan. Source: UN Photo/WFP/Amjad Jamal.

THE REVIEW

Options for reducing the severity of weather-related disasters vary significantly in feasibility, cost-effectiveness, and expense. Most actions not only reduce our vulnerability to key climate risks but also help to reduce disaster risk overall.

Some of the most expensive alternatives, such as flood buffers and levees, can require millions of dollars of investment. Other alternatives, such as mangrove-planting and education campaigns, are relatively affordable although still clearly more expensive than most interventions we've looked at (in the health category, for example).[242]

The majority of possible measures provide no guarantee of reduced impacts, since sea or river walls are only ever as powerful as their weakest link.[243] Early warning systems may function perfectly, but a void in awareness of risks could result in millions in need of humanitarian assistance if precautionary guidelines are not adhered to.[244]

Nearly every available option has clear benefits beyond lessening the impacts of climate change. Enhanced weather forecasting to better anticipate storms and floods, for example, will also improve information to key industries, such as agriculture, energy, and transport.[245] Such measures will also help a community rebound from a catastrophe. For example, raised roads built with proper drainage and raised high enough to preserve their composition will allow for emergency assistance to be delivered where needed and will also enable the local economy to get its key trade nodes operational quickly after a crisis.[246]

Mangroves not only slow the wind speed of tropical cyclones. They also sequester carbon from the atmosphere, preserve biodiversity in wetland areas, and reduce the impact of sea-level rise on coastal environments. Mangroves also serve as natural flood barriers, since their roots reclaim sediment that might otherwise flow into rivers and cause flooding.[247]

Coastal barriers can play a major role in preventing the worst effects of sea-level rise and holding back storm surges. The more than USD 60 million sea wall enclosing the Maldivian capital of Male' proved crucial to its survival of the 2004 Indian Ocean tsunami.[248] In the long-term, however, sea walls can also be detrimental to the local environment by trapping saltwater inland and gradually reducing the fertility of adjacent soils through salination.[249]

The most expensive way to reduce the impacts of weather-related disasters, almost invariably, is providing emergency assistance to populations following a disaster. Here, costs may rise into the tens or hundreds of millions of dollars depending on the number of people in need of help. So investing before disasters occur should be the focus of any adaptation strategy focused on extreme weather.[250]

Lives are easier to save than infrastructure, and buildings can be reconstructed, where lives can never replaced. It is critical that any adaptation strategy ensure first and foremost the protection of highly vulnerable civilian populations.

Proactive measures for countering weather-related disasters are generally well documented, although no cost-effective measures relating to wildfires are included in the assessment. Most measures can be applied universally and can benefit all income groups.

TIMEFRAME CONCERNS

Reducing the impacts of extreme weather is going to require major strategic decisions. Some actions, like storm shelters or ensuring emergency evacuation procedures, are easily taught and followed and can offer protection in the relatively near term.[251] Other much more expensive multimillion-dollar disaster monitoring systems may be harder and costlier to implement and maintain but could save hundreds of thousands of lives.

Sea walls or riparian river buffers vary from simple, often weak mud flood levees to giant, kilometre-long concrete barrier systems. Such measures can take anywhere from a few days to several years to construct, and budgets range correspondingly from a few dollars to tens of millions.[252]

There is a need, therefore, to balance the choice of policies so that new measures can be implemented quickly in the most vulnerable communities, while more intensive, high-investment but high-return actions are implemented in parallel.

WEATHER DISASTERS **ADAPTATION ACTIONS**

	ACTION SET	VULNERABILITIES	MOST VULNERABLE POPULATIONS	EFFECTIVENESS RATING	EVIDENCE RATING
1	COMMUNITY-BASED LOCAL EARLY WARNING SYSTEMS	• Injuries • Loss of shelter and livelihoods		High	High
2	FORECASTING SYSTEMS	• Injuries • Loss of shelter and livelihoods		High	High
3	DISASTER-MANAGEMENT TRAINING PROGRAMMES (PREPAREDNESS)	• Immediate impact of extreme weather events		Very High	High
4	DISASTER RELIEF (LIMITED CARE)	• Injuries • Loss of shelter and livelihoods		High	High
5	FLOOD PROOFING OF HOUSES	• Physical damage due to floods		High	Low
6	FLOOD PROOFING OF ROADS	• Storms, floods		High	Medium
7	RIPARIAN BUFFERS	• Floods		High	Medium
8	MANGROVE PLANTING	• Floods		Medium	Medium
9	HURRICANE-RESISTANT HOUSING/SHELTERS	• Injuries, death • Physical damage due to hurricanes		Medium	High
10	FLOOD CONTROL	• Floods		High	High
11	PRE-POSITIONING OF ESSENTIAL ASSETS (COMMUNITY-BASED PREPAREDNESS)	• Human health		Very High	High

Children · General population · Elderly · Low-income populations · Urban populations · Livelihoods derived from fisheries and cash crops · Populations close to rivers · Populations close to coasts

COMMUNITY-BASED LOCAL EARLY WARNING SYSTEMS

1

Creating a system for communities to get knowledge of potential disasters before they happen and to disseminate warnings via local warning communication chains.

ASSESSMENT High

		EFFECT		IMPLEMENTATION TIMEFRAME	
COST-EFFECTIVENESS	Very High	Immediate	✓	Quick Start	✓
CO-BENEFITS	High				
FEASIBILITY	High	Short-Term	✓	Implementation Lapse	Typically after 6 months
SCALABILITY	High				
EVIDENCE BASE	High	Long-Term	✓	Programme Cycle	Typically 1 Year

Expense: $1 million+ per system

Impacts Addressed: **Injuries, loss of shelter and livelihoods, damage to property**

Early warning system programmes rate highly on co-benefits. The system would benefit all groups in the focus area. The early warning system is cost-beneficial within one year if the local community is trained to react to early warnings and if monitoring infrastructure is properly maintained. Implementations will vary depending on weather patterns, location, and risk addressed, and must be complemented by appropriate capacity building in communities at risk, training of professional emergency services, and adequate resources to support preparedness and effective response.

The warning system is highly dependent on the local community's willingness to cooperate and act, and there must be adequate technical expertise on hand to maintain local weather stations and report data. The UN has developed guiding principles for such systems, and many training programmes are available.

The programme has high relevance for low-income countries, since more than 90 percent of natural disaster-related deaths occur in these countries. The interest for establishing local and low-cost early warning systems is growing, according to the German Technical Cooperation.

MDG BOOST ↑1

Sources: IFRC (2009), IFRC (2004), GTZ (2009), UN (2006), Plummer et al. (2003), WMO

FORECASTING SYSTEMS

2

Involves technical monitoring of larger-scale weather systems, climate modelling and warning services, and communication of warnings.

ASSESSMENT High

		EFFECT		IMPLEMENTATION TIMEFRAME	
COST-EFFECTIVENESS	High	Immediate	✓	Quick Start	✓
CO-BENEFITS	Very High				
FEASIBILITY	High	Short-Term	✓	Implementation Lapse	Typically after 6 months
SCALABILITY	High				
EVIDENCE BASE	Very High	Long-Term	✓	Programme Cycle	Typically 1 year

Expense: $1 million+ per system

Impacts Addressed: **Injuries, loss of shelter and livelihoods, damage to property**

Forecast systems rate highly on co-benefits and can be considered cost effective. They inform local communities about potential weather disasters and are also beneficial to agricultural production and other sectors of the economy, resulting in improved quality of life. The systems benefit all groups in the focus area. However, due to differences in weather patterns and available technological services and funding, some communities will experience easier implementation and higher success rates than others.

The forecast systems can be considered cost-beneficial after approximately 8.5 years. However, as they become more efficient and less expensive, their overall cost-effectiveness should improve over time. The World Meteorological Organization coordinates more than 150 national, 35 regional, and 3 global meteorological centres that analyze data in near real-time to make forecasts and issue hazard warnings.

Forecast systems must be complemented by capacity building and a trained local community force (cf. Community-Based Early Warning). The programme will continue to be effective for as long as the systems are maintained.

MDG BOOST ↑1

Sources: IFRC (2009), UNISDR (2007), UNISDR (2005-2015), GTZ (2009)

DISASTER MANAGEMENT TRAINING PROGRAMMES (PREPAREDNESS) 3

Disaster preparedness is primarily a matter of building adequate shelter and human resources (not necessarily investing heavily in advanced technology and equipment).

ASSESSMENT Very High

		EFFECT		IMPLEMENTATION TIMEFRAME	
COST-EFFECTIVENESS	Very High	Immediate	✓	Quick Start	✗
CO-BENEFITS	Very High				
FEASIBILITY	High	Short-Term	✓	Implementation Lapse	✗
SCALABILITY	Very High				
EVIDENCE BASE	High	Long-Term	✓	Programme Cycle	Typically 1 year

Expense: $25,000-$100,000/programme

Impacts Addressed: **Immediate impact of extreme weather events**

Disaster preparedness programmes benefit all groups in the focus area, in addition to protecting and informing agriculture and other productive sectors important to a community's economy and well-being. Preparing populations for natural disasters is often under-prioritized in low-income countries due to a lack of funding.

Building adequate local shelter is one of the most cost-effective ways to improve the quality of national response and external aid in extreme weather events. The programme is quick to implement where educational facilities exist. And it is more cost-efficient to have trained personnel on the ground instead of relying on international aid.

The programme has wide implications for those affected by natural hazards and on how resources are allocated in emergency situations. Regarding the programme's feasibility, international training should be adapted to local conditions. If training and emergency preparedness is coordinated with relevant UN agencies and NGOs, programme results will be consistent. Thorough guidelines exist, and several NGOs and universities have developed training programmes. For example, Columbia University's School of Public Health has an online training centre that offers a variety of courses, tools, and other resources.

MDG BOOST ↑1

Sources: Columbia University (2010), DCP2 (2006), UNISDR (2007)

DISASTER RELIEF (LIMITED CARE)

4

Limited medical care in case of disaster. Includes treatment for infection and minor trauma. Also includes diagnosis, advice, pain relief, and treatment (as resources permit) for more complicated conditions.

ASSESSMENT High

		EFFECT		IMPLEMENTATION TIMEFRAME	
COST-EFFECTIVENESS	High	Immediate	✓	Quick Start	✓
CO-BENEFITS	High				
FEASIBILITY	Medium	Short-Term	✓	Implementation Lapse	✗
SCALABILITY	High				
EVIDENCE BASE	High	Long-Term	✗	Programme Cycle	Typically 1 year

Expense: $25,000-$1,000,000 or more; per DALY: $253-$380 (low-income countries), $507-$760 (middle-income countries)

Impacts Addressed: **Personal injuries and disability**

Limited-care disaster relief programmes rate highly on cost-effectiveness because of their short- to medium-term duration. However, there is a risk of low cost-effectiveness in the cases where inappropriate in-kind donations are made. And bringing in outside health professionals can be less cost-effective than using local services.

Since the programme focuses on personal, limited care, co-benefits are low. However, in the case of natural disasters, medical care is relevant to all groups.

Emergency response efforts usually take place in a politically and emotionally charged climate. Often, the international community launches its own relief operations in the belief that local health services are incapable of handling the disaster. However, local health services are actually best situated to respond to health consequences of disasters in their communities.

WHO guidelines exist on a variety of disasters, and NGO training programmes are common. The programme is highly relevant, since low-income countries are more likely to experience a drop in GDP due to disasters. The World Bank, Red Cross, and WHO have published various peer-reviewed studies on the subject. And risk-management programmes are common in the Ministries of Health in low-income countries.

MDG BOOST ↑1, ↑6

Sources: DCP2, UNFCCC, NAPA Cambodia (2007)

FLOOD PROOFING OF HOUSES

5

Flood proofing of individual houses against the maximum flood level recorded in the past 20 years.

ASSESSMENT High

		EFFECT		IMPLEMENTATION TIMEFRAME	
COST-EFFECTIVENESS	High	Immediate	✗	Quick Start	✗
CO-BENEFITS	Very High				
FEASIBILITY	High	Short-Term	✓	Implementation Lapse	Typically after 2-3 years
SCALABILITY	Very High				
EVIDENCE BASE	Medium	Long-Term	✓	Programme Cycle	Typically 25 years

Expense: $144-244 per house

Impacts Addressed: **Physical damage due to floods, human health**

Programmes to promote the flood proofing of houses rate highly on co-benefits and scalability. Livelihoods and houses are improved and protected as a result of the programme. It is highly relevant to vulnerable groups in low-income countries and promotes consistent benefits for all households. Many UNFCCC and other case examples are available on the subject.

A flood-proofing programme is funded and rolled out over several years and can take 25 years to fully implement. However, it is relatively cost-effective over time, and after four years, the benefits exceed the costs. Also, results are consistent as long as the implementation is designed to fit local needs. If the programme is established correctly, results are consistent.

Policymakers currently show little interest in the programme, and peer-reviewed studies on the subject are limited. However, such programmes have been common in Bangladesh, where flood proofing by way of raising houses and other infrastructure is part of traditional practice. A house raising option programme in Bangladesh's main river char lands will provide raised households to some 2.5 million people.

MDG BOOST ↑1, ↑7

Sources: UNISDR (2007), Islam & Mechler (2007), Caspari & Pokhrel (2008)

FLOOD PROOFING OF ROADS

6

Flood proofing of roads and highways by raising road height to the highest recorded flood and providing adequate cross-drainage facilities.

ASSESSMENT High

		EFFECT		IMPLEMENTATION TIMEFRAME	
COST-EFFECTIVENESS	High	Immediate	✗	Quick Start	✗
CO-BENEFITS	Very High				
FEASIBILITY	High	Short-Term	✗	Implementation Lapse	Typically after 2-3 years
SCALABILITY	Medium				
EVIDENCE BASE	Medium	Long-Term	✓	Programme Cycle	Varies

Expense: $100,000-$200,000 per km of road

Impacts Addressed: **Flooding**

Programmes to flood proof roads rate highly on co-benefits. Benefits of the programme include preventing human and livestock deaths, using of the raised roads as refuges during floods, and providing a corridor for transporting relief goods during floods. Once a raised roads programme is implemented, resources can then be allocated to other flood-prone areas, and transportation will not be obstructed due to collapsed roads. The programme benefits all groups. Results are consistent as long as road standards are high.

Raising roads is a long-term programme implemented over stages and is only cost-effective in high-risk areas, where flooding is frequent. However, compared to the cost of full rehabilitation of roads ($70,000 per km), the programme (approximately $140,000 per km) is cost-effective over time.

Implementation requires funding and occurs over several years. However, it entails low risk, and results are consistent if the programme is established correctly. It is important to note that raised roads without proper drainage and careful planning could submerge poor households that do not have the capability or incentive to build up their own land.

In Bangladesh, approximately 170 km of national and regional roads and 518 km of local roads in high-risk areas will be raised. Since it is a long-term programme with very high costs, portions of roads will be raised when they are due for major maintenance, with priority given to high-risk areas.

There is a lack of well-documented training sources and case examples for this programme. However, comprehensive technical specifications and guidelines are available, and technical capacity often exists at the local level. The programme is highly relevant in low-income countries where roads already exist.

MDG BOOST ↑1, ↑7

Sources: UNISDR (2007), Islam & Mechler (2007), UNESCO (2009), IDS (2007), Caspari & Pokhrel (2008)

RIPARIAN BUFFERS

7

By impeding and absorbing flood waters, riparian forest buffers reduce flood damage. Riparian buffers also lower flood frequency because they reduce the amount of sediment flowing into rivers and streams that can make them prone to overflowing.

ASSESSMENT High

		EFFECT		IMPLEMENTATION TIMEFRAME	
COST-EFFECTIVENESS	High	Immediate	✗	Quick Start	✗
CO-BENEFITS	High				
FEASIBILITY	High	Short-Term	✗	Implementation Lapse	Typically after 2-3 years
SCALABILITY	High				
EVIDENCE BASE	Medium	Long-Term	✓	Programme Cycle	Varies, depending on technique used

Expense: $1,000,000+

Impacts Addressed: **Flooding, water quality**

Riparian buffer programmes rate highly on co-benefits, since they also protect water supplies and prevent widespread source pollution, benefiting all groups.

The programme received a lower rating for cost-effectiveness because some barriers (tree plantation vs. grass, for example) can take a long time to develop and can involve high tending costs. However, in the Feitsui reservoir watershed, there is a 1.245 benefit-cost ratio after a period of three years.

MDG BOOST ↑1, ↑4, ↑6, ↑7

Sources: UNISDR (2007), Chang et al. (2010), Caspari & Pokhrel (2008)

MANGROVE PLANTING

8

Mangroves can serve as buffer zones in front of sea dike systems, reducing water velocity, wave strength, and wind energy.

ASSESSMENT Medium

		EFFECT		IMPLEMENTATION TIMEFRAME	
COST-EFFECTIVENESS	Medium	Immediate	✗	Quick Start	✗
CO-BENEFITS	High				
FEASIBILITY	Medium	Short-Term	✗	Implementation Lapse	Typically after 3 years
SCALABILITY	High				
EVIDENCE BASE	Medium	Long-Term	✓	Programme Cycle	Typically 10 years

Expense: starts at $225 per hectare

Impacts Addressed: **Floods, storms, tsunami**

Mangrove-planting programmes rate highest on co-benefits and scalability. Planting mangroves in their native habitat restores coastal biodiversity (including fish and shellfish production), enhances water quality, and can protect homes, agriculture, and livestock from flooding.

The FAO and various NGOs have developed guiding principles for this kind of programme. The programme is highly relevant for coastal communities in low-income countries, which are most vulnerable to natural disasters. Various NGOs have developed training programmes and materials, but they are not always accessible.

The programme received a low rating for cost-effectiveness because, although restoration pricing varies, it can be high in some regions. Also, the full effects of restoration are felt only in the medium- or long-term. In Vietnam, $1 million was spent to replant 110 kilometres of mangrove forest. As a result, dyke maintenance costs have been reduced by $7 million per year.

In a number of cases, mangrove-planting programmes have reported low survival rates of plants. Once fully restored, however, mangroves are consistently effective against storm surges. Various peer-reviewed studies on the subject are available; however, they lack quantitative data and evidence of cost-effectiveness. There is also a lack of data directly quantifying the role of vegetation in mitigating hazards.

MDG BOOST ↑1, ↑7

Sources: PreventionWeb, Khazai et al. (2007), Lewis III (2001), Chan & Baba (2009), UNISDR

HURRICANE RESISTANT HOUSING

9

Prevention of damage to life and property, particularly by reducing how vulnerable a population's housing and community buildings are to floods and typhoons.

ASSESSMENT	Medium

		EFFECT		IMPLEMENTATION TIMEFRAME	
COST-EFFECTIVENESS	Medium	Immediate	✗	Quick Start	✗
CO-BENEFITS	Medium				
FEASIBILITY	Very High	Short-Term	✓	Implementation Lapse	Typically after 2-3 years
SCALABILITY	Medium				
EVIDENCE BASE	High	Long-Term	✓	Programme Cycle	Varies, depending on extent of retrofitting/ construction

Expense: approximately $2,000,000

Impacts Addressed: **Floods, storms, tsunami**

Hurricane-resistant housing programmes rate highly for feasibility. They are successful if they are targeted at areas prone to seasonal storms, and should specifically target areas that have been assessed as vulnerable.

Co-benefits of hurricane-resistant housing or shelters include fewer personal injuries and material losses in seasonal hurricanes. In Vietnam, the houses of 1,300 low-income households were strengthened directly as a result of the programme. Recently, new construction has accounted for 60 percent of the houses completed through the programme, reflecting the weak state of housing. Families no longer bear the cost of hurricane recovery, enabling them to channel their budget to other activities.

There is high variability in the cost-effectiveness of this programme due to the uncertainty of storm impacts. However, retrofitting can still be cost-effective if it results in a 60% reduction in vulnerability for a cost not exceeding 5% of the initial building cost.

The programme received a low rating in scalability due to the lack of well-documented programme examples and available training.

There is an adequate evidence base for this programme. Many case studies address economic impact; however, few studies look at the cost-effectiveness of the programme.

MDG BOOST	↑7

Sources: UNISDR (2007), Stewart et al. (2003), World Bank (2009), UNDP (2007)

FLOOD CONTROL

10

Predicting floods in highly flood-prone areas and effectively intervening. Such a programme includes mapping of vulnerable areas, developing adequate drainage, and taking steps to prevent floods.

ASSESSMENT High

		EFFECT		IMPLEMENTATION TIMEFRAME	
COST-EFFECTIVENESS	High	Immediate	✗	Quick Start	✗
CO-BENEFITS	High				
FEASIBILITY	High	Short-Term	✓	Implementation Lapse	Typically after 0.5-1 years
SCALABILITY	Very High				
EVIDENCE BASE	High	Long-Term	✓	Programme Cycle	Typically 5 years

Expense: from $13,000 - $900,000

Impacts Addressed: **Flooding, excess rainfall**

Flood-control programmes rate highly for scalability, cost-effectiveness, and co-benefits. There are many case examples available, and various NGOs and universities offer training programmes. The programme is cost-effective. In Bihar, India, a flood-control project that included physical interventions and capacity building had a cost-benefit ratio of 3.76.

The programme can be implemented in the short to medium term but will not reach a positive cost-benefit ratio until the long term.

In contrast to programmes that rely on structural measures for flood control, those that are "people-centred" appear to be highly resilient under a wide variety of conditions and are economically efficient.

Co-benefits are consistent in areas with seasonal flooding. Not all communities will have the local capacity to carry out an implementation. Programmes should be sensitive to social and cultural issues that can play a large role within the community.

MDG BOOST ↑1, ↑7

Sources: Oxfam/Tearfund (2004), Caspari & Pokhrel (2008), NAPA Bhutan (2006)

PRE-POSITIONING OF ASSETS

11

Build up food storage capacity and stockpile essential food and non-food items; set up and maintain community network awareness; and develop strategies for preparedness.

ASSESSMENT High

		EFFECT		IMPLEMENTATION TIMEFRAME	
COST-EFFECTIVENESS	Very High	Immediate	✗	Quick Start	✗
CO-BENEFITS	High				
FEASIBILITY	Medium	Short-Term	✓	Implementation Lapse	Typically after 0.5 years
SCALABILITY	Very High				
EVIDENCE BASE	High	Long-Term	✗	Programme Cycle	Typically 1 year

Expense: $388,000

Impacts Addressed: **Human health**

Programmes that pre-position assets rate highly on scalability, cost-effectiveness, and co-benefits. The Red Cross and other NGOs provide technical specifications and guidelines as well as training programmes. Many well-documented case examples also exist.

Compared to conventional procurement and disbursement of emergency supplies, the programme is highly cost-effective in the event of a natural disaster. Timing is of the essence when pre-positioning assets. Depending on the area in question, the programme is generally short-term.

All groups in a post-disaster environment benefit from such a programme, especially the poorest and most vulnerable. Factors such as facility location, inventory management, and network flows determine the impact and co-benefits.

The programme is logistically complex and assumes that disaster threats have been thoroughly assessed. Also, local infrastructure conditions (pre- and post-disaster) can limit the relief operation.

MDG BOOST ↑1

Sources: DCPP, Duran, Gutierrez, and Keskinocak (2010), NAPA, Tuvalu (2007), ReliefWeb (2009)

Workers construct a flood wall to protect buildings in the United States. Source: FEMA/Liz Roll.