Photo: David Dahmén

Dealing with Flood Risk

Droughts and floods claim more lives than all other natural catastrophes. An analysis of the hundred most deadly and the hundred most expensive natural catastrophes since 1950 reveals that droughts caused more than half of all fatalities (Fig. 1). In the remainder of the catastrophes – i.e. not including droughts – more than half of the fatalities were due to flooding. Almost half of the overall losses were generated by floods. Natural catastrophes have increased alarmingly in recent decades. Looking at the losses from great natural catastrophes in the last fifty years, we find that the overall losses in the ten years from 1996 to 2005 were almost seven times as high as in the 1960s (Fig. 2). This applies in like manner to great flood catastrophes.

Reasons for the increase in flood losses

There is at first a direct correlation between the increase in losses and the number of people that live in areas at risk. Whilst the population pressure often leaves the people in poor countries with no other choice than to settle in exposed areas, the motivation in industrial countries is provided by other factors.

Flood valleys are usually cheap as building land, attractive and easy to develop. They offer good conditions for establishing the necessary infrastructure. River proximity is advantageous for commercial and industrial facilities that need large amounts of space and sometimes process or cooling water. Larger rivers and the sea also enable transportation of freight by ship.

Towns and cities have an interest in their own growth and prosperity. They have to make land available for housing or for commercial and industrial facilities. Many owners are either not aware that there is a danger of flooding because they do not come from the region and assume that if land is released for development it will be safe, or they ignore the danger. Others consciously accept the danger emanating from a nearby river, but often forget it if nothing untoward happens. It is only when a dangerous situation arises or a loss occurs that those affected are shaken awake again.

Moreover, many people still believe that technology can control flood events. The positive effect of flood control is that frequent losses and discomfort are prevented. This effect is counterbalanced, however, by the fact that the feeling of security it creates leads people to expose more and more objects of increasing value to the risk of flood. This feeling of security is transmitted not only by dykes and embankments, early-warning systems, and the availability of disaster relief organisations but, also by the intentional or unintentional transmission of false information and by local authorities or groups with a vested interest (e.g. the tourist industry) playing down the risk.

Never before have people had so many valuable but at the same time vulnerable possessions. Homes are full of expensive objects and indispensable electronic devices, whilst commercial buildings often accommodate underground car parks, storage rooms and sometimes even computer centres. This modern-day sophistication breeds susceptibility to flood waters and increased loss.

Prevention strategies against floods

Not every flood necessarily leads to flooding. And even if flooding does occur, losses do not always have to be major. This presupposes a suitable prevention strategy which embraces all aspects of floods, from their genesis to the avoidance of loss potentials.

Floods are a part of the natural water cycle; but humankind has ways of intervening in this cycle. They include influencing the climate (resulting in more frequent and more intense precipitation), changing the infiltration capacity of the soil (due to paving and to soil being compacted by agricultural activities), discharging water into rivers and lakes (drainage ditches, sewers), and directing it towards the sea (e.g. river regulation, removal of flood retention areas). Retaining

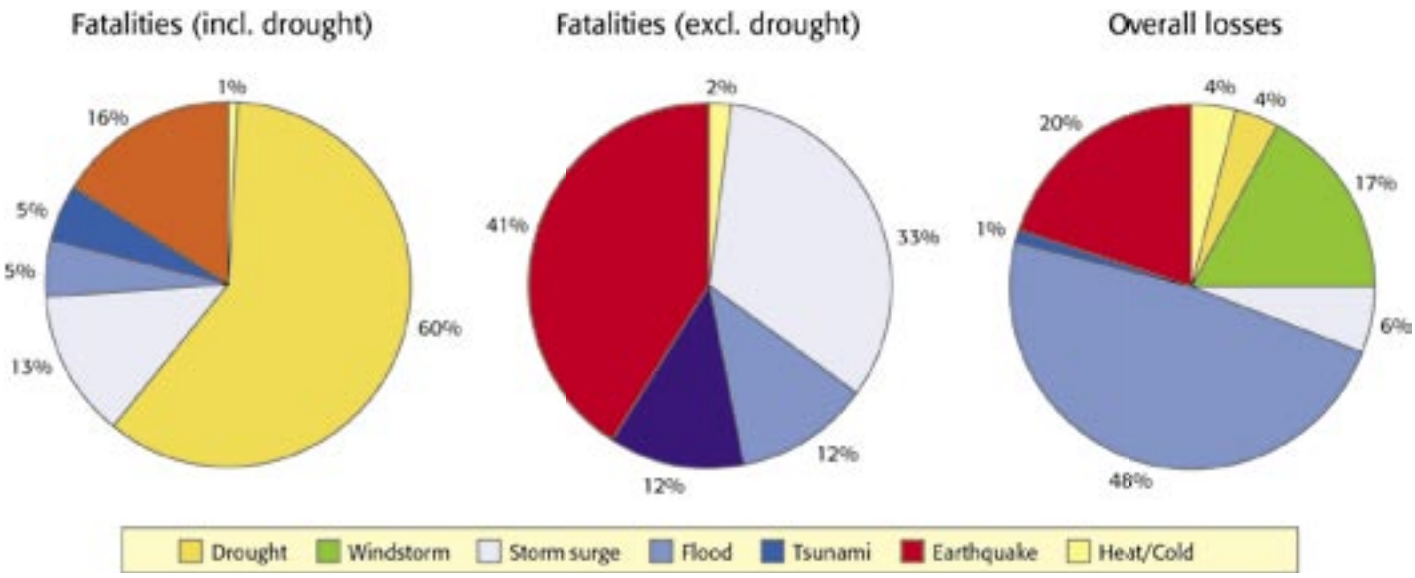

Fig. 1: Fatalities and overall losses due to various natural hazards (basis: the 100 deadliest events and the 100 most expensive events since 1950).

water must have top priority whenever possible. One thing must be noted, however: extreme floods in large catchments are only marginally attributable to surfaces that have been made impervious by human activity. Likewise, the masses of water flowing down large rivers during floods are so huge that decentralised flood retention, river restoration and dyke relocation can only reduce the extreme flood peaks to a limited degree."

Flooding occurs when the soil, a lake or a river is unable to take up any more water. The water then stands or flows in areas that are usually dry. Flooding can be influenced by technological measures such as retaining the water at specially designated places (flood detention areas, polders, reservoirs), or directing the flood waters by means of dykes within a predetermined area, possibly by means of flood channels. All these measures are based on what is called a design flood, i.e. a relatively high flood value used as the basis for designing protection measures. If an event exceeds the design value, flood control may be rendered ineffective.

The most effective way of preventing damage is, therefore, to keep people and their belongings away from flood-prone areas, i.e. to institute an appropriate land-use policy that does not permit building development near bodies of water. Where this has not been done, much can still be achieved by taking permanent and temporary structural measures, adjusting the management of values and responding to danger in the correct manner (e.g. evacuating threatened parts of buildings). But even if these measures reduce the risk of loss, a residual risk will still remain. And that is where insurance comes in. Insurance makes the uncertainty of future financial strains calculable. In return for a premium, the policyholder can either buy complete freedom from that uncertainty or (by paying a lower premium) limit the loss to a certain deductible.

Only if the risk of flood is shared among several carriers is effective disaster reduction possible. Three partners – the state, the people affected and the insurance industry – must cooperate with each other in a fine-tuned relationship in the spirit of a risk partnership. Reducing the underlying risk for society as a whole is primarily the job of the state. It sets up observation and early-warning systems, controls flood discharge, and, by enacting statutory provisions, determines the framework for the use of exposed areas. Those affected are obliged to make their own contribution to loss prevention by building in an appropriate manner, being prepared for emergencies (e.g. writing a checklist of what to do when there is a flood), and being ready to take action as soon as disaster strikes.

Finally, insurance companies should be on hand, their main task being to compensate financial losses that would have a substantial impact on insureds or even constitute their ruin. This means that although insurers are not social institutions (in the sense of charities), they are indispensable institutions within the social system. They distribute the burden borne by individuals among the entire community of insureds, which is ideally composed in such a way that they all have a chance of being affected – albeit with different degrees of probability.

What about climate change?

Although there still seem to be a few sceptics, human-induced climate change is now accepted as fact by the overwhelming majority of scientists. A warmer climate means that precipitation will increase in many areas, whereas other areas will experience longer dry periods. Above all, however, extreme weather conditions will increase, and that is

Great Natural Disasters 1950-2005
Decade comparison

	Decade 1950-59	Decade 1960-69	Decade 1970-79	Decade 1980-89	Decade 1990-99	Decade 1996-05	Factor last 10:1960s
Number	21	27	47	63	91	57	2.1
Economic losses	48.1	87.5	151.7	247.0	728.3	579.2	6.6
Insured losses	1.6	7.1	14.6	29.9	137.7	176.6	25

The comparison of the last ten years with the 1960s shows a dramatic increase

Fig. 2: Comparison of mean decade losses from great natural catastrophes since 1950 (losses in USD billion, 2005 values, as at 1 January 2006)

Photo: EC/ECHO South Asia Office

Table 1: The deadliest flood catastrophes since 1970

Rank	Year	Area(s) mainly affected	Fatalities
1	1970	Bangladesh (storm surge)	300,000
2	2004	Indian Ocean, esp. Indonesia (tsunami)	210,000
3	1991	Bangladesh (storm surge)	139,000
4	1999	Venezuela (mudslides)	30,000
5	1985	Colombia (mudslide following eruption of Nevado del Ruiz)	25,000
6	1977	India (storm surge)	14,200
7	1985	Bangladesh (storm surge)	11,000
8	1998	India (storm surge)	10,000
9	1998	Central America, esp. Honduras (Hurricane Mitch)	10,000
10	1999	India (storm surge)	10,000

Table 2: The most expensive flood catastrophes worldwide since 1990 (original values, not adjusted for inflation)

Rank	Year	Area(s) mainly affected	Losses (US$ m)	
			Overall	Insured
1	2005	USA (Gulf Coast, Hurricane Katrina)	125,000*	60,000*
2	1998	China (Yangtze, Songhua)	30,700	1,000
3	1996	China (Yangtze, Yellow, Huai)	24,000	445
4	2002	Southern, central, eastern Europe (Elbe, Danube)	21,200	3,400
5	1993	USA (Mississippi)	21,000	1,270
6	1995	Korea	15,000	≈ 0
7	1991	China (Huai, Taihu Lake)	13,600	410
8	1993	China	11,000	≈ 0
9	2004	Twelve countries on the Indian Ocean (tsunami)	10,000	1,000
10	1994	Italy (southern Alps)	9,300	65
11	1993	India, Bangladesh, Nepal	8,500	≈ 0
	2000	Italy, Switzerland (southern Alps)	8,500	470
13	2002	China	8,200	≈ 0
14	1999	China	8,000	≈ 0

*These figures contain both wind and water losses; an exact breakdown is not possible, but a division into two equal shares would appear realistic.

the decisive factor. Isolated extreme events are nothing new, but in the future we will have to reckon with more frequent and more catastrophic events with generally greater losses and more serious consequences.

The evidence is that this development has already begun. Whole regions may then become practically uninhabitable. Hitherto, the response to recurrent natural disasters has been to upgrade engineering works and to rebuild. Future change will eventually force people to leave their homelands and migrate to other areas. (See page 9).

Hazard and risk

Water-related events are more frequent and much more deadly in some regions than in others. This difference is expressed in the term hazard. But even if the hazard is the same, the effects of an extreme event are quite different. Take the Netherlands and Bangladesh, for example. Although the storm surge hazard is comparable in these two countries, there is a vast difference in the way it is reflected in the casualty statistics. Why? Because the hazard is tackled in different ways. Which takes us to the aspect of risk.

For all practical purposes, risk is the product of the size of a hazard and the probability of that hazard occurring at a specific location and the potential effects of such an occurrence. A natural catastrophe can only occur at a certain location if two conditions are met: firstly, an extreme natural hazard event must occur and, secondly, vulnerable values (human beings and/or assets) must be present. In an uninhabited valley, a flood is simply a natural event, however large, whereas in an inadequately protected city, even a moderate event can trigger a natural catastrophe. In other words, the risk is small when the hazard or the value at risk or the vulnerability is small. The first is determined by nature, the second by human activity, and the third can be influenced by prevention measures.

However, even if our own human activity is partly responsible for many catastrophes, we must appreciate that the errors we make are not all to blame. We will simply have to get accustomed to living with extreme – and even catastrophic – natural events. It is important that we come to terms with the fact and refrain from placing our hopes on – or our trust in – these kinds of events being controllable by technological or other means. There will always be a residual risk. The crucial factor is to make an appropriate response to this residual risk. We must strive to avoid the unmanageable and to manage the unavoidable. Therefore, if we take the correct action, we can make an existing risk bearable even if we cannot make it controllable. Catastrophes are not only products of chance but also the outcome of interaction between political, financial, social, technical and natural circumstances. Effective safeguards are both achievable and indispensable, but they will never provide complete protection. The decisive point is the awareness that nature can always come up with events against which no human means can prevail. As Aristotle (384–322 B.C.) said, "It is probable that the improbable will happen."

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