Learning to live with floods

Here Comes the Flood

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Can disastrous floods be avoided? The answer to that question of course has to be "no": we are simply unable to fully protect against these natural phenomena. Nonetheless, research on the course and consequences of floods is helping us to mitigate their negative social, economic, and ecological impact, and above all to avoid human fatalities

A flood is an excess level or flow of water that spills out of the river channel resulting in economic and social damages and sometimes even taking a toll of human life. As a natural element of the hydrological cycle, floods have always been with us and will surely continue to be part of our lives. Still, recent years have witnessed an increased frequency of extreme hydrological-meteorological phenomena, such as hurricanes, high/low temperatures, storm surges, tsunamis, severe rains or droughts, and above all floods.

The final decade of last century and the beginning of the new millennium brought many water-related natural cataclysms. Here we can mention the flood on the Rhine River in 1993, on the Rhine and Moselle in 1995, on the Oder and upper Vistula in 1997, on the Yangtze in 1998, on the upper Vistula and in the city of Gdańsk in 2001, on the Elbe in 2003, the extraordinary flooding of New Orleans in 2005, and the flood along the Danube in the spring of 2006.

Maciej Skawiński/FOTORZEPA

The 1997 flood on the Oder and Vistula Rivers caused losses on the order of 14 billion PLN and took a toll of 54 lives

An excellent indication of the importance of this problem is the fact that 2004 World Water Day - a yearly event designated by the UN in 1992 - took the theme "water and disasters." Ninety percent of the natural cataclysms occurring in 1992-2001 resulted from hydro-meteorological phenomena. More than a billion and a half individuals worldwide have been affected by floods. Yet as the number of floods and the scope of the economic damage has increased, the number of fatalities has simultaneously decreased. That success can be put down to more accurate flood forecasts and better flood control measures.

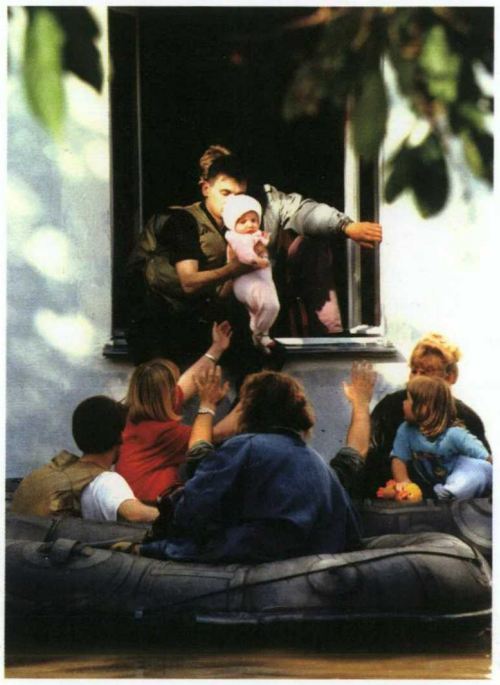
Floods result from extreme hydrological-meteorological phenomena, such as severe rainfalls, the melting of snow and ice, storm surges, and ice jams on rivers. However, they are caused by design mistakes or human error in the operation of hydroengineering facilities.

The greatest devastation is caused by floods occurring in densely populated river valleys. Note that many of our cities came to be situated on rivers, thus gaining the advantage of easy water access, navigation and fishing potential, and even such factors as sport and recreation. Since such regions generate the highest share of economic output, the upshot is that they are therefore most under threat, yet most favorable in economic terms. The people inhabiting such areas have to be aware of this tradeoff. Property and accident insurance, with rates depending on the degree of the threat, are increasingly used to offset the threat.

Floods in Poland and their aftermath

The current degree of flood danger is signaled in Poland in terms of two specific water levels, reported by the media: a warning level, after which a state of flood preparation is announced, and an alarm level entailing a real flood threat, after which a state of flood alarm is announced.

Poland is a country that has to face a very high and at the same time very diverse flood threat. Floods are most commonly caused by severe and concentrated rains - the 2001 flood in Gdańsk being the result of such rainfall. Floods may also be caused by ice related phenomena, such as frazil-ice jams, which occur in the autumn-winter period,



Maciej Skawiński/FOTORZEPA

The 1997 flood inundated 680,000 homes in Poland

and ice jams, which occur in the springtime when the ice cover on rivers breaks up. An ice jam at the mouth of Vistula River in 1829 resulted in flooding of the city of Gdańsk up to the first-story level. In 1844, an ice jam on the "Gdańska Wisła" section of the river led to the creation of a new mouth to the sea (the "Śmiała Wisła"). To reduce the threat of flooding in the Gdańsk region and the Vistula Delta, an artificial channel and mouth of the Vistula called the Przekop was constructed in 1895, a solution that proved very effective.

In 1934 a catastrophic flood in the Dunajec River's catchment basin caused vast material losses and took a toll of many lives. To alleviate similar floods in the future, the Rożnów and Czorsztyn dams and reservoirs were built. The Rożnów dam was finished in 1942, while the Czorsztyn dam, after being under construction for more than 20 years, was completed and commissioned for use in 1997, just before another high flood wave struck.

On the upper and middle Oder and lower Vistula, the 1997 flood caused damages of 14 billion PLN and the deaths of 54 individuals. Indirect losses came to nearly 3 billion PLN.

In 2001, a sudden flood caused by severe rainfall in Gdańsk within the course of 4 hours caused 200 million PLN of damage to city infrastructure alone. Three hundred

families lost their homes and property, although fortunately no lives were lost.

Evolution of flood protection

Flood control has always been an important field of hydroengineering. One of the earliest approaches involved the notion of "keeping water away from people," i.e. constructing of flood dykes, retention reservoirs, relief canals, dry reservoirs, and polders.

Flood dykes are earthen constructions running alongside rivers, meant to protect against any excessive overflow of flood waters. Retention reservoirs, in turn, are meant to catch part or all of a flood wave, thus limiting the degree of flooding downstream from the reservoir. Relief canals are channels to protect urban areas or other places of specific economic or cultural value, and come into operation whenever a flood wave approaches. Dry reservoirs are designed in the upper sections of rivers, which are automatically filled whenever high discharge approaches, at other times being utilized as meadows or grazing land. Polders are artificial basins situated alongside riverbanks which become filled automatically upon the arrival of a flood wave, thereby reducing its height, and are then drained after the water level recedes. At other times polders often serve as recreational areas.

All of these methods are expensive to construct and to keep in use - maintaining many kilometers of flood dykes being a very costly endeavor. In the past it was often thought, albeit mistakenly, that such elements provide complete protection. Yet once economic analyses began to be performed about the feasibility and efficiency of raising the level of existing flood dykes or increasing in the capacity of retention reservoirs, the conclusion often reached was that doing so simply did not pay. It had also been frequently neglected that increasing flood control in one place might worsen it in others: constructing flood dykes along an upper river section often simply turned out to accelerate the flow and to cause higher water levels downstream.

Once these shortcomings were realized, other solutions began to be developed, following the notion of "keeping people away from water," i.e. removing human settlements and industrial facilities from flood-prone areas. While often economically justified, such efforts have also been very costly.

Finally, consideration began to be given to the possibility of temporary flooding of defined areas, together with existing infrastructure, paying greater attention to protection of buildings against flooding and damage. Efforts of this sort can be described as "learning to live with floods." A necessary condition here is that the timing and height of floodwaters need to be forecast accurately, to give people time to

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Ice fragments piled up on the left dam of the Włocławek reservoir during a flood in 1982

Krzysztof Rak/Agencja Gazeta

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prepare adequately. For private homes, for instance, this method involves protecting basement windows and entry doors with overlapping closures that prevent any water from penetrating inside – a solution that is widely employed in many European countries. Then, after a flood subsides, work must be efficiently planned to quickly eliminate the damages caused, bringing life back to normal as soon as possible.

Integrated flood management

The new approach to flood control is known as "integrated flood management." Previously, all flood control efforts concentrated on the river channel itself, or its immediate vicinity. This new approach encompasses efforts undertaken throughout the entire catchment area. On the one hand, this means such aspects as spatial planning, forestation, land cultivation, and urbanization – efforts which may be described as "technical," since they deal with buildings, constructions, and land management. Yet on the other hand, research has shown that a significant reduction in flood impact can be achieved through "non-technical" means, i.e. investing in forecasting and warning systems or making organizational preparations (accumulating the necessary equipment and drafting evacuation plans). It is likewise extraordinarily important to educate society about what flooding can mean for them, about how floods may occur and proceed, and about what every citizen should know to protect themselves and their property. Such non-technical efforts take significantly less funding than technical means, but often yield more tangible results.

In the wake of the devastating 1997 flood, Poland began reinforcing its means of hydrological-meteorological protection. This consists of automatic water level and meteorological monitoring stations, plus a system of meteorological radar devices providing early warning of oncoming clouds, fronts, and precipitation. These are maintained by the State Hydrological-Meteorological Service, under the Institute of Meteorology and Water Management. Local flood warning systems and crisis reaction centers are being established in numerous areas threatened by floods, with all these elements being coordinated by the National Rescue and Protection Center.

Following a number of catastrophic floods in Europe, the European Commission has initiated joint action aimed at improving flood control measures Europe-wide, and a special EU flood directive is now in the works. The current approach envisions a system of safeguards which can ensure that losses are minimized and that life can proceed relatively normally, regardless of the degree of flooding intensity. That will above all require good meteorological and hydrological forecasts, as well as power and communication systems that operate reliably under flood conditions. ■

Further reading:

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