ZURICH

Risk Nexus

Flash Floods:
The underestimated natural hazard

Contents:

Introduction:

In late May and early June 2016, storms 'Elvira' and 'Friederike' resulted in extreme rainfall exceeding 180 mm in some regions of southern Germany. Some towns were especially hard hit. The center of Braunsbach in Baden-Württemberg was destroyed when a small tributary to the Kocher river overflowed. In the town of Simbach/Inn in Bavaria, five people died when a local creek rose to over five meters from a normal depth of just half a meter. Over 150 people had to be rescued. Fifty schoolchildren were forced to take shelter in their school in Triftern until flood waters subsided. Floods damaged over 5,000 homes. In Simbach alone, floods left about 1,000 people homeless.

Germany has much experience with intense river floods, like those that affected parts of the country in 2002 and 2013. In such floods, people generally receive adequate warnings, as it can take days for water levels to rise. In the 2016 floods, however, people in villages were often taken by surprise as rivers rose and flash floods developed, sometimes in a matter of minutes. Evacuation plans designed for slower river flooding failed to work.

Why were the areas affected by the latest floods caught unprepared? Could the extent of the events that left 18 people dead across Europe, including France and Austria, and caused billions of euros in property damage have been better anticipated? Did weather warnings (the German weather service DWD issued over 3,000 of them) lack clarity, or did such warnings come too late?

What is PERC, and how does the study work?

The Post Event Review Capability (PERC[1]) is an independent assessment of large disaster events. PERCs are performed at watershed or event level, and assess the interactions between the extreme event, the built environment, and the people and institutions involved. It is a semi-structured process aimed at learning what has worked well (best practices for sharing) and where potential for improvements lies. Our studies support the UNISDR's Sendai Framework for Disaster Risk Reduction (SFDRR)[2] and its requirement to learn from current events to better inform risk reduction in the future. This Risk Nexus highlights the differences, but also the parallels, between small-scale and fast reacting flash floods and the large floods in major European river systems.

Key questions

This study looks at the main reasons why flash floods in Germany in 2016 had such a devastating impact, and how risks associated with such events can be mitigated. It provides an overview of the events and produces findings based on extensive field work and interviews, including with public authorities and aid organizations, and intervention and rescue teams. We know that flood prevention is cost-effective: well-designed programs on average save five dollars in future losses for every dollar invested[3]. Our findings here confirm the value flood prevention has. **Implementing a strategy of integrated land use planning and zoning, physical protection at regional and local level, and the right behaviors can go a long way in achieving sustainable flood risk reduction strategies.**

Picture 1: Destroyed road due to a creek flooding in Triftern, Bavaria.

Source: Bayerisches Rotes Kreuz (BRK)

1 https://www.zurich.com/en/corporate-responsibility/flood-resilience/learning-from-post-flood-events
2 http://www.unisdr.org/we/coordinate/sendai-framework
3 Zurich Risk Nexus, 2015. https://www.zurich.com/en/knowledge/articles/2015/09/turning-flood-resilience-theory-into-action

What we can learn about flood protection in southern Germany

Flash flood hazards in Germany

Understanding the process of flash floods and where they occur can reduce the human toll and cost to property, and reduce risks for first responders. Although incidents of intense precipitation tend to be more common in southern and eastern Germany in regions with hills and mountains, flash floods can occur anywhere. Extreme rainfall can lead to local floods and fatal flash floods in small and steep valleys. The characteristics of such flash floods are quite different from river floods. The speed of flood waters and the speed in which such a flood develops is much greater. Such floods can also often occur in small or even dry water courses, taking people by surprise. They can also carry debris.

Flash flood intensity depends on a number of factors, including not only rainfall, but also soil saturation, the type and size of the watershed, and the energy that floodwaters derive from the topography. Less-well understood processes include erosion of agricultural or forested land, and how flood-born debris and objects are carried downstream, obstructing flow at bridges, underpasses or culverts. These factors played a significant role during the flooding in Europe in 2016. **We believe planning and decision-making needs to keep these determining factors in mind to ensure people and communities are prepared to face future floods and mitigate the impact of these events.**

The EU floods directive represents progress – but more is needed

The current approach taken by the European Union (EU) to flood risk management is captured in its Directive 2007/60/EC. Germany put the Directive into practice in 2010 through their revised Federal Water Act, led by German states working with communities, districts and water and levee authorities. The focus was on four key elements: people, the environment, cultural heritage and economic activity. Actions are coordinated among state, national and international bodies includes cross-border commissions for the Danube, Elbe and Rhine rivers. But not all potential flood scenarios, especially flash floods, were considered in these discussions. **Our study identifies potential ways to improve the flood risk management that could help to mitigate flash flood risks associated with small creeks and watersheds in topographies where hazards are especially high.**

Significant gaps in natural hazards coverage remain

Severe weather events in May and June in Germany led to estimated losses of USD 2.6 billion, of which approximately USD 1.2 billion were insured. Across Europe, total losses amounted to USD 5.4 billion with only about half insured. Although citizens and communities received immediate relief payments from national and state governments after the floods, a significant amount of damage was not covered. Beyond physical damage, the trauma that affected people's lives will take a long time to overcome, and complete recovery could take up to 10 years. We believe more financial protection is needed, but we are not in favor of using risk transfer alone (for example, insuring every potential risk without an attempt to improve its risk quality) to completely close the coverage gap. Risk aggregation would put too much pressure on local capacity. Floods put lives at stake, and many losses, such as keepsakes or damaged paper or electronic documents, cannot be restored through financial insurance. Clearly, more work is needed to reduce risks before floods occur, and better use must be made of prevention measures to protect lives and property.

What does this mean for the future?

Studies indicate that climate change is increasing risks of more intense and frequent extreme rainfall in Europe. Weather station readings in Germany indicate that short-duration, high-intensity precipitation has increased in recent years. These events are particularly pronounced in the summer months. **There is an urgent need to act now to invest in land use planning, risk reduction, emergency management and financial risk protection to prevent higher losses in the future.**

Our key findings

Our PERC findings on the flash floods in Germany 2016 are organized around the '5 Capitals' approach we use to measure flood resilience. This approach evaluates existing 'capitals' (resources) and how people access, use, and manage them, to determine where resilience can be built.[4]

Physical Capital

Flash floods are not random – flash flood 'hot spots' can be identified. Although descriptions of the 2016 floods in Germany dwell on their unimaginable scope, and play up the freak nature of these floods, we know that some areas are more likely to be flooded than others. Potential flash flood hotspots can be identified by: looking where weather events produce torrential rainfalls and mapping those; figuring out where topography is more prone to flash floods; taking into account population density and concentration of high-value assets potentially in the path of flash floods. We already know that:

a) According to the German Weather Service's climatology publication, called KOSTRA, extreme rainfall events grow more intense as one moves south and east. In other words, for a 1 percent annual probability and a rainfall duration of 24 hours, Hamburg can expect rainfall totals of 70-80 mm, Berlin 100-120mm, and the southern alpine foothills 140-190 mm.

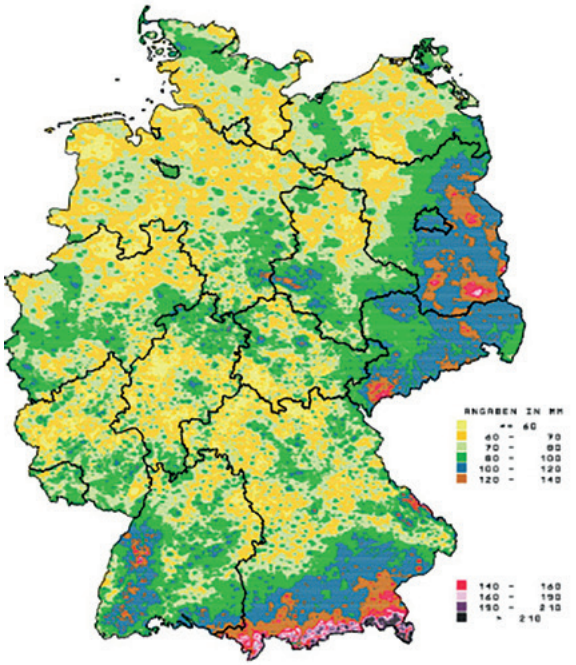
b) What happens with the rainfall when it reaches the ground depends on the watershed, whether rainfall is absorbed or runs off, and where the water then goes. The size of the watershed and the energy the water gets from a steep topography is decisive. Steep channels in hills and mountains intensify flows, causing erosion and leading to floodwaters carrying debris and trees. Taken together, a) and b) create the natural flash flood hazard.

c) A community with highly interconnected and dependent infrastructure is at higher risk if a flash flood occurs: not only is valuable infrastructure directly damaged, but it creates secondary damages where supply and value chains are interrupted.

To understand the flash flood risk, extreme rainfall probabilities, topography and the distribution and density of infrastructure and values all need to be taken into account. No flash flood risk map yet exists in Germany, but there are processes to create such maps already in place. The DWD plans to map flash flood hazard zones in the coming years.

Flash floods are insufficiently understood or ignored in decision-making. It is not just the water that causes the damage. In flash floods, the water picks up significant debris which then is caught on obstructions like bridges, underpasses and other critical structures, damming the water, intensifying flooding, and risking infrastructure damage or failure. Some of these man-made obstructions might be avoided, but flash flood flows are not always well understood. The risks posed by debris and damming are rarely included when emergency plans are drawn up, or taken into account when deciding how and where to build or how to protect infrastructure.

People build too close to the water. Some areas have no 'buffer zone' requirements. In many places, including Bavaria, there are no legal or regulatory requirements enforcing a minimum distance between structures and river banks, creeks or dry channels that can carry flash flood waters. Buffer zones considerably lower risks, making this approach more cost-effective in the long run than having to make repairs every time it floods.



Picture 2: Rainfall totals in Germany for 100 year return period and rainfall duration 24 hours based on KOSTRA 2000.

4 The five capitals go back to the well-established Sustainable Livelihoods Framework (SLF). They comprise physical, human, social, natural and financial capital and are an integrated, comprehensive way of displaying what is needed to be or become resilient. To learn more about our flood resilience framework, see https://www.zurich.com/en/corporate-responsibility/flood-resilience/measuring-flood-resilience

Financial Capital

Germany's penetration of natural hazard insurance, in particular flood insurance, is still lower than what it could be. A more structured and comprehensive approach for prevention incentives, and to eliminate undesirable incentives, could help reduce flood risks and costs in Germany. Only USD 1.2 billion out of 2.6 total losses from the 2016 event in Germany were insured. In the state of Bavaria, only 26 percent of buildings are insured against damage from natural hazards. By contrast, in the state of Baden-Württemberg, 94 percent of buildings are insured, a legacy of regulations requiring compulsory cover (regulations that are now no longer in place).

Clearly, insurance in and of itself does not prevent damage, but it does provide financial security and transparency about what losses will be covered in which situations – thereby providing the financial stability needed for planning and recovery. Property insurance, including cover against various natural hazards, is universally available in Germany. Buying such cover is absolutely recommended. In Baden-Württemberg, an estimated 80 percent of the damage from the 2016 floods was insured. When combined with the additional EUR 10 million of immediate aid from the state, Baden-Württemberg was in a much stronger position than Bavaria, where flood insurance is less common. But in both states, there is lower penetration of contents cover, and more work needs to be done to raise awareness with consumers. German businesses that report a loss of over EUR 10,000 can apply for government support, but such aid is limited if it can be established that the business didn't make genuine efforts to buy coverage, or it could have bought it but chose not to.

The severity of the event determines the size of ex-post indemnification. The percentage amount the German government pays is determined by the severity of the event. The more extreme the event, the higher the indemnification. But it can be difficult to apply this – considering an event to have been 'rare' and 'exceptional' creates an incentive to classify events as less likely to occur than is actually the case. Classifying events as extremely rare can lead people to underestimate the risks of such events occurring again, and could weaken the case for having insurance.

Human Capital

People lack awareness of the risks posed by locally occurring, intense flash floods. We note that people in southern Germany are often unaware that they are at risk of flash floods, and don't know how destructive flash floods can be. Such floods are likely to be more common in future as the effects of climate change intensify. Event probability and flood consequences are also not well understood. Newspaper with headlines like 'Not again' or 'Why did these floods happen so soon after the last one?' can lead the general public to assume that flash floods are rare, singular events.

Rapid and unpredictable onset following intense precipitation makes forecasting flash floods difficult. River gauge readings are fine for producing warnings for some floods, but far less effective when a flash flood occurs. Using weather radar and real-time rainfall measurements on the ground can produce better warnings. The complexity of large-scale weather conditions can make it difficult to forecast flash floods related to local storm cells. Early warning systems depend on being able to make good and accurate forecasts, which are important for people who might be affected, and for responders. Lacking accurate forecasts, agencies often issue multiple general warnings. To be effective, such warnings need to be carefully communicated, as they may become counterproductive.

Picture 3: Dispatch meeting of intervention forces in Simbach, Bavaria.

Source: Bayerisches Rotes Kreuz (BRK)

Early warning systems and behavior to heed the warnings are not always effective. Even if an early warning is provided, people often don't know what to do. Germany has no consistent national public alert system (an earlier system was dismantled after German reunification). Starting in 2013, a modular warning system (MoWaS) that states and communities could tap into triggers certain so-called 'warning multipliers' via mass media, internet portals, and the federal emergency information App (Notfall-Informations- und Nachrichten-App des Bundes, NINA). It also disseminates German Weather Service (Deutscher Wetterdienst, DWD) warnings. DWD issued about 3,000 alerts in the period that included the floods (May to June 2016). To improve local warnings, starting in July 2016, DWD began issuing these at a lower community level (10,000 communities) instead of simply at a more general district level (400 districts).

Losses, including total building losses, can be lowered. Many risks can be easily eliminated using appropriate measures, for example, by anchoring household oil tanks. Around Simbach, fire brigades had to capture and filter 250,000 liters of heating oil that leaked from ruptured tanks. A large proportion of total household losses were caused by oil contamination, sometimes from the same house, but often from neighboring houses.

Social Capital

Organizations responding to the floods had a high degree of cooperation. In several places, a state of emergency was declared early enough to allow organizations to mobilize and respond quickly. Experts interviewed for this study consistently said that teams mobilized, communicated and cooperated quite effectively. Although flooding streams and rivers left certain places accessible only by high-clearance vehicles, help was available when needed. Water and air rescue provided critical support. These services are expected to play an even more important role in the future.

Volunteers and monetary support were positive, but coordination difficult. Donations in terms of volunteers and money were positive, with solidarity for affected areas coming from neighboring districts and even Austria. Businesses provided support, particularly construction companies that sent heavy equipment. But professional emergency organizations struggled to coordinate assistance from the many people who volunteered, who, though helpful, sometimes made mistakes, such as throwing away documents and other important material when clearing out flooded houses. Officials are willing to integrate what was learned in future training programs.

Picture 4: Emergency operations use boats on a flooded street in Simbach.

Source: Bayerisches Rotes Kreuz (BRK)

After the crisis, solidarity rapidly declined in favor of individual interests. Despite impressive solidarity in the emergency phase, we found also weak aspects of social capital, such as out-migration and financial gaps. People were leaving affected areas to be closer to relatives or their workplace. We learned that rents increased, which is legal even during periods of high and urgent demand after floods. Having an exodus of residents from an area that has suffered floods is hardly ideal, as the state only provides assistance to current owners who rebuild. Assistance is not paid out if residents move, or if ownership changes. People who do not rebuild lose the right to claim state assistance. There is a risk that houses will stay empty and eventually be ruined. Roundtable meetings included discussions on how to ease housing pressure by building more densely in urban centers, but lack of solidarity has become an issue; for example, some property owners view denser urban areas as unacceptable eyesores which impact the value of their property.

Resilience is visible already but can be enhanced. A positive outlook, as demonstrated by the media statement of the mayor of Simbach: "The old Simbach does not exist anymore, but we will create a new, much prettier Simbach." The state of emergency lasted for three weeks, yet people coped quite well, finding creative solutions to solve issues such as closed roads, long detours or running daily errands in different places. This clearly demonstrates the community's resilience in the face of disaster.

Natural Capital

Natural topography plays a role in flash floods. People we interviewed emphasized the important role that natural flow and the percolation of water play in creating flash flood risk. Factors increasing flood risk include steep, rocky terrain, built infrastructure and paved surfaces, all of which increase runoff and intensify flash flooding. Factors that are not well understood or addressed include the impact of agriculture and forestry. Factors which can reduce flooding and flash floods include retention areas, natural, undeveloped floodplains and other such spaces which ensure water has somewhere to go.

Some key actors in the agricultural sector are not easily reached. The type of crop can affect the amount of soil erosion and surface runoff. Thin plant cover, loamy soil and intense use that compacts soil can increase the speed of surface runoff. These conditions are created when cultivating corn in its early growth stage, which coincides with the period of highest occurrence of flash floods in central Europe (May and June). People we interviewed mentioned the undesirable incentives provided to farmers and forestry. This dilemma is thus not just one of the actors mentioned, but also of those deciding on the subsidies for these sectors.

Picture 5: Damage due to a blocked culvert in Bavaria.

Source: Bayerisches Rotes Kreuz (BRK)

Summary of recommendations

Risk reduction

Prioritize risk reduction based on risk assessment. Don't focus only on large waterways or arbitrary 'return' periods. Germany's current policies and decisions on flood protection focus mainly on large river systems. Investments are made with a goal of protecting assets up to a level with a set period of return (typically a one-in-100-year event). But investments are also needed to reduce risk, including flash floods, in smaller watercourses, as the floods in 2016 so rightly show. A more comprehensive approach based on risk assessments is needed; it is imperative to include all risks and channel investments to the highest-risk areas. Here too, it is important to keep in mind that land use and climate change affect all types of flooding. Ultimately, whatever solutions are found, they reflect a process of what society decides are acceptable risks.

Invest more in understanding and mapping small-scale processes. Water is not the only reason for flood damage. Particularly when it comes to small watercourses, better understanding is needed of how additional processes contribute to the flood. Obstructions that can form at underpasses and bridges, as well as the potential for high flow velocities should be included in flood maps and incorporated in decision-making. Flood debris, including soil, trees and cars, machinery, etc., needs to be included. This should also lead people to think about where to store materials that can be swept away and encourage them to develop realistic and feasible plans when a flood warning is issued; that might include temporarily relocating materials and dispatching equipment needed to clean at-risk areas.

Mapping small watercourses, and including these considerations, is of course data intensive and hence a costly and challenging task. In addition, the density of the river gauge equipment is directly dependent on investments in personnel resources. In reality, many water management offices are working under resource constraints. It is a question of priorities by society to invest in a risk-based approach and allocate corresponding resources to these important offices.

Risk reduction requires a multifaceted approach; physical protection and land use planning. Weirs and levees do not provide absolute safety and often leave significant residual risk. They can also lull people into a false sense of security and inadvertently increase risk in the long term. Residual risk that such structures might be overcome in floods needs to be weighed and publicly discussed. Given the increase of flash flood hazards, raising and reinforcing physical defenses by itself is neither desirable nor cost-effective. Physical protection should be complemented with land use planning so that risk areas are kept permanently clear where flood risks are high. Establishing effective regulations and zoning requires cooperation. Multifunctional areas such as parks can double as retention areas. Watershed assessments should take into account upstream land use, and be combined with careful urban planning. Project URBAS (http://www.urbanesturzfluten.de) highlights cost-effective strategies that consider the overload case.

New technology should be used to generate flash flood hazard maps. Intense precipitation and flash floods depend on certain spatial factors. New technology can be used to generate flash flood and (urban) surface flood maps. There are already successful examples of this approach used to map larger river systems. If this approach is applied to flash flood risks, fatalities could be significantly reduced.

Provide better incentives to reduce risk. We found very few incentives that would induce individuals or businesses to invest to reduce flood risk. Our research suggests that insurers could play an influential role in incentivizing risk reduction. There are several potential way this could be achieved, including coverage limits, deductibles and basing insurance premiums on risk. Incentives to increase cover could also be cost-effective for the German government. Policy needs to be explicit about how much government assistance should be expected (and feasible) if those receiving state funds after a flood have no private insurance. Banks and lenders also can play a role here, by providing incentives to buy private natural hazards cover.

Tax incentives and construction regulations could be enhanced to encourage risk reduction. We also identified certain contradictions in regulations that should be addressed. For example, building laws regulating the height of structures limit the extent to which the ground floor of a structure can be raised to protect against flooding.

Flood insurance penetration needs to be increased. Germany's insurance industry relies on the ZUERS flood zone system to assess flood hazard. Locations in Germany are classified at address level from zone 1 (lowest) to zone 4 (highest) hazard. The German Insurance Association confirms that not only can zone 4 locations be typically insured, it is key that property owners actively seek cover. The public was already informed that in the future, it will be increasingly hard to get ex-post government reimbursement for flood losses if people cannot prove they tried to buy insurance cover and got several quotes from different companies.

Insurers can go beyond providing financial cover for flood losses. They have important knowledge and expertise with regard to risk awareness, risk communication and risk management. This can be used to improve protection.

Flood losses may become a liability risk. With the new flood maps, people can no longer claim that they did not know their property was located in a flood zone. Many communities already inform people in high hazard areas and actively communicate the information. The existing maps produced to satisfy the European Union's Flood Directive have already led to some behavioral changes. The publication and use of surface flood maps will result in further improvements.

Significant losses from contamination can be easily and should be avoided. The lack of willingness to anchor and protect household oil tanks leads to significant losses to owners and their neighbors' properties. Information about simple and cost-effective measures to avoid this contamination need to be widely publicized. If this proves insufficient, more compulsory means and controls should be considered.

Flood risk management requires cooperation and coordination. A common misconception is that all flood risk management lies with the central government. In fact, it requires active commitment of many public entities, individuals, businesses and others. Even best-practice integrated flood risk management can be undermined by individual interests. Coordination is essential in order to achieve cost-effective protection. In the past, many flood protection schemes were delayed or blocked by special interest groups. Ways need to be found to include all stakeholders in finding solutions.

Preparedness

Flash flood awareness is critical in at-risk areas. The general population lacks awareness of basic flood safety behavior, such as avoiding basements and garages during flash floods. There is a similar lack of awareness of the potential severity of flash floods among organizations responsible for emergency response. As one responder told us: "It is also human nature to not want to understand that something you can typically cross with street shoes without getting wet can grow to a water wall five meters high."

Improve understanding of return periods and flood probabilities. A "100- year flood" is often mistakenly interpreted as a flood of a magnitude that will not occur again for another century. People need to understand that, in fact, it means that there is a 1 percent chance of a flood that size occurring every year. A risk-based approach to decision-making should be forward looking and include the lifespan of infrastructure and buildings.

Similarly, flood events should not be characterized as "completely unexpected" or "never seen before". Usually, flooded areas were often clearly identifiable hazard zones where such events had happened in the past. The frequency and severity of such floods will continue and likely increase in the future. Illustrative language is needed to highlight the consequences, including the frustrations and the irreplaceable losses when living through a flood.

Local, indigenous knowledge should be incorporated into future decisions. A lot of indigenous knowledge, especially in rural areas, has been lost. This historic knowledge is very important. In low-lying areas in pre-alpine hills in southern Baden-Württemberg, historic buildings have strongly fortified basement and ground floor levels – a construction-based adaptation to the flood hazard. In the past, there was an awareness that the stream could burst its bank in certain seasons and people were willing to endure certain sacrifices to comfort, such as temporarily closing openings in lower floors. This culture of adaptation has unfortunately been lost. Historic traditions cannot be revived exactly as in the past, but they illustrate how creative solutions could reduce risks today.

To effectively communicate, the social context must be understood. If flood awareness campaigns are to be successful then they must communicate with their target audience effectively. For example, some states have identified the need to provide flood warnings in specific languages: In Baden-Württemberg, for example, communicating in Turkish and Russian, as well as German, has allowed the state to communicate better with all those people living in an area at risk of floods.

Response operations

Forecasting of local intense events should be improved. Warnings, to be effective, require an end-to-end system integrated with forecasts. The current lead times for warnings of summer thunderstorms are too short to allow people to take effective action. In the next five to 10 years, improvements should provide higher precision and reliability. To reach people, modern technology including warning apps and 'push' notifications should be better utilized.

High-resolution maps are needed for aid and rescue organizations. Local knowledge is critically important for first responders and emergency teams. In the 2016 floods, especially in Bavaria, responders from out of town had difficulty with existing maps that lacked certain information where roads might develop into streams and where obstacles were submerged, making response difficult and dangerous.

Multiple events could overwhelm resources, which needs to be better planned for. Multiple storms could hopelessly overwhelm available resources. This risk has also been identified in other events, such as the storm 'Desmond' in the UK in 2015. This is relevant during months in which catastrophic events could occur in different locations in quick succession. These scenarios need to be incorporated into future planning.

Awareness is needed that rescue operations during flash floods are much different from river flooding ones. While rescue operations in the 2016 floods typically went well, in Bavaria rescuers pointed out to us that a river flood typically requires evacuations rather than rescues. Flash floods, however, require rescuing people in dangerous situations, and in challenging conditions to operate boats. Those involved in rescues in the 2016 floods now have developed such knowledge, but other organizations could strongly benefit from this knowledge prior to having to cope with a flash flood.

Recovery and reconstruction

People need to be better prepared to cope with the consequences after flash floods. In 2016, after the immediate crisis was over, there were lots of questions about essential next steps, overwhelming many citizens. Knowledge and awareness regarding appropriate and effective recovery actions needs to be improved. We found that households currently perceive that they lack information what to do next, where to get help, etc. In regards to improving resilience, there is a need for discussions at the community level how insights from this event will help to become more flood resilient in the future.

Simplify and streamline payments. Providing a fast, simple way to handle government compensation could reduce potential for abuse. It would also help to minimize frustration as people try to obtain financial support. A unified approach was put into place in Saxony after the floods 2002, which appears to have worked well in the 2013 floods, and we recommend that other states implement a similar practice.

Improve knowledge about how insurance helps in recovering quickly and effectively. Many people we spoke to for this study told us that insurance companies provided sound advice and helped them to get repairs and recovery underway, while providing financial security and clarity. Getting support from the state typically takes longer. Insurance offers benefits that should be more proactively communicated and households should be encouraged to take out private cover.

Encourage people to take measures to reduce risk before an event occurs. If someone expects to receive funds to cover damage after an event like a flood, they may be less willing to invest in prevention. Governments could encourage people to take preventative measures by making pay-outs only when they took prior steps toward prevention and obtaining insurance coverage. Support for marginalized and vulnerable groups needs to be considered separately, but a situation in which a large part of the population fails to take steps to reduce risks and get cover, especially given the increasing frequency and severity of weather-related events, is unsustainable.

The Zurich flood resilience alliance

An increase in severe flooding around the world has focused greater attention on finding practical ways to address flood risk management. In response, Zurich Insurance Group launched a global flood resilience program in 2013. The program aims to advance knowledge, develop robust expertise and design strategies that can be implemented to help communities in developed and developing countries strengthen their resilience to flood risk.

To achieve these objectives, Zurich has entered into a multi-year alliance with the International Federation of Red Cross and Red Crescent Societies, the International Institute for Applied Systems Analysis (IIASA) in Austria, the Wharton Business School's Risk Management and Decision Processes Center (Wharton) in the U.S. and the international development non-governmental organization Practical Action. The alliance builds on the complementary strengths of these institutions. It brings an interdisciplinary approach to flood research, community-based program and risk expertise with the aim of creating a comprehensive framework that will help to promote community flood resilience. It seeks to improve the public dialogue around flood resilience, while measuring the success of our efforts and demonstrating the benefits of pre-event risk reduction, as opposed to post-event disaster relief.

About PERC

As part of Zurich's flood resilience alliance, the Post Event Review Capability (PERC) provides research and independent reviews of large flood events. It seeks to answer questions related to aspects of flood resilience, flood risk management and catastrophe intervention. It looks at what has worked well (identifying best practice) and opportunities for further improvements. Since 2013, PERC has analyzed various flood events. It has engaged in dialogue with relevant authorities, and is consolidating the knowledge it has gained to make this available to all those interested in progress on flood risk management.

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