Due to climate change, in the future sudden floods produced by heavy rainfall could occur more frequently in Germany. For example, the town of Grimma, Saxony was hit by flooding twice in the span of eleven years. In response, flood protection-measures are now being massively expanded in Saxony - with the support of risk analyses and social scientific studies prepared by experts from the REKLIM network.

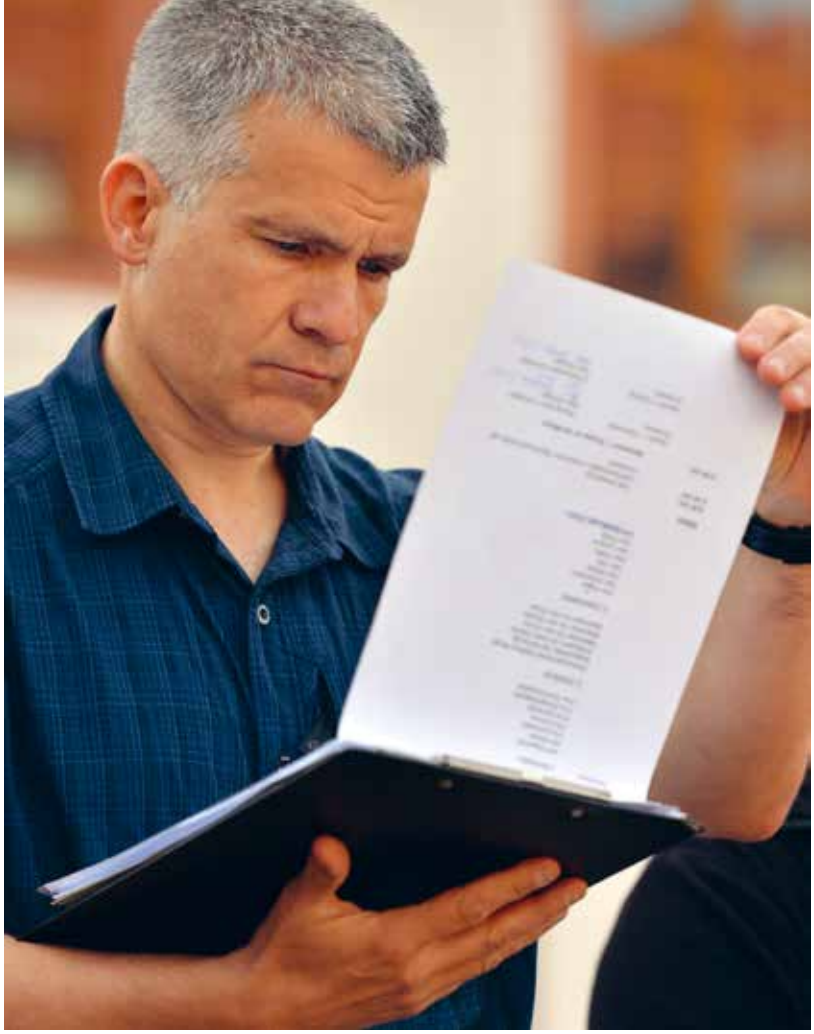
TEXT: TIM SCHRÖDER

Be prepared!

Two hundred-year-floods in rapid succession: just eleven years after the 2002 flood, in June 2013 Grimma's historical quarter was once again underwater.

Grimma wasn't hit just once, but twice: in August 2002 and again in June 2013. In both years, the summer was characterised by heavy rains, causing the normally mild-mannered Mulde to spill over its banks. The Mulde, a small river in northern Saxony, flooded Grimma's historical quarter, rising to fill the basements and ground floors of many buildings. The first flood alone produced damage amounting to 250 million euros; no one could have guessed that history would repeat itself just eleven years later. After all, both events were what are known as hundred-year-floods, which, statistically speaking, should only occur once every 100 years. But in this case, one followed the other in rapid succession.

When disaster strikes twice, it is especially harsh. Prof Reimund Schwarze from the Helmholtz Centre for Environmental Research (UFZ) in Leipzig asked himself what this does to people, how it affects the cohesion and solidarity of communities. In addition, he wanted to find out something else: how can towns like Grimma best protect themselves from future floods? For many regions in Germany and Europe, this is a fateful question; many experts are now warning that heavy rains will likely become more frequent in the future. And this in turn will increase the risk of severe flooding.



Since April 2015 the town's mayor, Matthias Berger, has participated in flood preparedness exercises, which involve ca. 100 members of the local fire brigade.

An ideal research subject

Reimund Schwarze ultimately chose to investigate Grimma in terms of two major aspects – the people affected, on the one hand; and flood protection, on the other. He and his colleagues at the UFZ interviewed town residents, and asked them e.g. whether (and if so, how) they had taken any further precautions against flooding after 2002. They also analysed statistical data – for example, the number of new residents and the number of residents who moved out of the historical quarter after the flooding. "It goes without saying that being hit by serious flooding twice makes the city an unprecedented site. We've tried to use that quality to arrive at important conclusions for the future," says Reimund Schwarze.

One of their findings: after the second flooding event, people tend to sink into a state of resignation. The burden of a second catastrophe is enormous, both psychologically and financially, the researchers determined. In addition, less financial relief was provided by the state after the 2013 floods. Nevertheless, they found that such experiences could also strengthen communities. Solidarity works best, it would appear, when the members of a community know one another, and it is not weakened by too many new faces, or residents leaving. In Grimma, most residents chose to stay – even after 2013. Most of those who left the historical quarter had only lived there for a relatively short time; the 'veterans' stood their ground. But how do you create solidarity? How can people be moved to think of the community first, despite their own hardships and losses? Today, and especially in the future, when floods will likely be more common. Schwarze's answer is strikingly simple: "Solidarity is something that can be learned; not so much during or after catastrophes, but through catastrophe readiness. When people work together to prepare for a potential catastrophe, they begin thinking in terms of solidarity." When asked whether people could also adapt to more frequent weather extremes, Schwarze also answers with a clear yes. "At the end of the day, living with increasing hazards consists in being prepared, rehearsing for the worst-case scenario time and time again as part of a team and, in the process, minimising the damage when and if

During this training exercise, Grimma's fire brigade also closed one of the new floodgates, designed to protect the town from severe flooding in the future.

catastrophe strikes," says Schwarze, who is also a member of the board at the German Committee for Disaster Reduction. Another sensible solution, he claims, is that some communities still turn on their disaster sirens briefly at noon every Saturday, providing citizens with a constant reminder that such natural hazards are a possibility. Doing away with these sirens to cut costs, as most of the cities in Germany have done since 1993, is a policy he finds misguided.

Flood protection that everyone stands behind

Matthias Berger, the mayor of Grimma, has also experienced solidarity first-hand. In 2002, Federal Chancellor Gerhard Schröder visited the flooded town. The media response was correspondingly huge, and was followed by a huge wave of donations. In addition, once all the hype had died down, the community continued to stick together. When it came to planning future flood protection measures, the decision was made to involve the town's citizens; to invite them to share their input on how the bulwark of floodgates should be designed, helping to ensure everyone would ultimately accept it. The result, achieved with the support of the State Reservoir Administration of Saxony (Landestalsperrenverwaltung): a flood protection system that fits perfectly into the old townscape and its lovely rubblework walls. "We tastefully trimmed 79 floodgate elements, each of which is one-of-a-kind, to fit the ensemble of our castle and nearby buildings." As Matthias Berger relates, his hat goes off to the local citizenry: "When the second flood hit in 2013, we had a fairly clear idea of just how bad it was likely to be. And in some parts of town, the damage from 2002 still hadn't been fully repaired. The fact that they nevertheless refused to give up is tremendous."

In the meanwhile, the floodwall has become a real marketing hit for Grimma: groups of experts from throughout Germany and abroad frequently visit the town to learn from its example. Yet Matthias Berger never grows tired of stressing that comprehensive and climate-change-adapted flood protection takes more than floodgates: in many surrounding areas, the ground has been covered with a sealed surface, and the courses of rivers and streams have been straightened. In the past, a raindrop that fell in the Erzgebirge would have needed three days to reach Grimma; today the rainwater rushes into the valley in a matter of hours. "In terms of river restoration and creating flood reservoirs, there's still plenty of work to do," says Berger.

Accurately gauging risks

That being said, Saxony has made considerable strides in flood protection since 2002, and the researchers at the UFZ have contributed to them. Since the early 2000s, authorities in the European Union have been required to prepare hazard maps, allowing at-risk areas to be identified. The maps take into account whether there are any buildings in these areas, what commercial assets there are, and whether important infrastructure elements like the power supply or drinking-water supply could be affected.

As an environmental economist, Reimund Schwarze was involved in creating hazard maps for the Lockwitzbach near Dresden, which are still used as the basis for flood prevention today. "These hazard maps have definitely helped us move forward," says Dr Uwe Müller, a flood protection expert at Saxony's State Office for Environment, Agriculture and Geology. They allowed the offices to determine, for the first time, where valuable assets were accumulated, and

which areas were especially vulnerable. An analysis after the flood of 2002 revealed that, if severe flooding had struck all of Saxony, it would have done an estimated 7.2 billion euros in damage. Thanks to the risk analysis, over the following years the authorities were able to take targeted measures to protect those areas where particularly high damage was likely. And their efforts paid off, as Uwe Müller relates: "When, in 2013, the entire state of Saxony actually was struck by floods, the total damage was roughly 2 billion euros, and not 7.2 billion."

Much more than a water-level report

Uwe Müller and his colleagues simultaneously expanded flood protection in Saxony at several levels, partly in the form of construction measures like those in Grimma, but also and especially in terms of flood warning systems. "In 2002, throughout the various regions of Saxony, four different offices were officially responsible for issuing warnings", says Uwe Müller, "and the warnings and water-level reports put out by the media were correspondingly confusing and, in some cases, simply wrong." Since 2004 there has been a single office, the Saxon Flood Centre (Landeshochwasserzentrum), that issues warnings. And it, too, profits from the findings of researchers like Reimund Schwarze. "We don't just provide simple water-level forecasts when it rains; we provide detailed early warnings for each region before the first drop of rain ever falls," says Müller with a certain measure of pride. This is possible thanks to computational models that draw on data from the German Meteorological Service, but also include further important parameters – e.g. on soil moisture, which dictates how much rainwater the soil can absorb. Citizens can simply visit the website of the flood centre for their home region, where the current flood risk is displayed in a traffic-light system (red/yellow/green), along with the projected water levels.

Three strategies: avoid, withstand or adapt

Needless to say, early warnings can only truly help when citizens also know what to do next. "In this regard, researchers like Reimund Schwarze have made valuable inroads by helping instil a degree of risk awareness among the local citizens," Uwe Müller says. "Today we're building on that basis in several different projects. People are open for the topic and do their part when it comes to protecting valuable assets." As he explains, there are essentially three possible strategies: firstly, to avoid flooding, e.g. by not erecting new buildings in at-risk areas; secondly, to construct and install protective measures like those in Grimma; and thirdly, to adapt. With regard to the third option, Saxony's State Office for Environment, Agriculture and Geology is currently working closely together with engineers who are developing new water-resistant construction materials. According to Uwe Müller, one pragmatic solution is to cover the walls of businesses with tiles; following a flood, the mud left behind can then be simply hosed off.

Uwe Müller and Reimund Schwarze both agree that the growing risk of floods due to climate change can only be effectively combated when everyone works together: citizens, government offices, and rescue services. Several years ago, Austrian researchers and their peers at the University of Innsbruck developed a process in which risk analyses were used to show communities what natural hazards could strike them and how to protect themselves. Today these risk analyses are combined with workshops conducted by the company alpS, a private spinoff of the University of Innsbruck. As a result, more than 300 communities in North and South Tyrol have now taken steps to prepare for climate change – and not only in the form of flooding, but also rockslides, rising temperatures and prolonged dry spells. In Schwarze's view, it's an excellent approach and "perhaps the best way currently available in Europe for communities to prepare for future climate-related risks."

LOOKING AHEAD

I hope that, ten years from now, hazard maps will be consistently used throughout Germany and the economically weaker regions of the EU. Plans for protecting cities and communities in at-risk areas have to be prepared together with the local populace in order to mitigate the effects of climate change.

REIMUND SCHWARZE
Environmental economist, Helmholtz Centre for Environmental Research (UFZ)

IN BRIEF

- **Flood damage can be reduced when flood protection measures are based on a previous, comprehensive risk analysis. The analysis determines how great the risk is for critical infrastructures or assets with historical value. The outcomes can be used to develop targeted measures.**
- **To help communities survive a flood, solidarity is a vital aspect. Moreover, solidarity is something that can be learned – e.g. with emergency drills at regular intervals.**
- **Various measures can help reduce the damage done by floods. These include computer-assisted early warning systems, adapting buildings, and informing the local populace about flood risks and how to protect themselves.**

READY FOR TOMORROW

Extreme events like heavy rain and flooding don't necessarily have to end in natural catastrophes; with the aid of detailed risk analyses and targeted preventive measures, they can often be avoided. The Austrian planning company alpS is a good example of how this process can be optimally handled.