

# Balkan floods of May 2014: challenges facing flood resilience in a former war zone

A Zurich flood resilience  
program case study



“  
Severe flooding worsened  
a situation in a region that  
was still recovering from the  
aftermath of war.”

## At a glance

- In mid-May 2014, Bosnia and Herzegovina, Serbia and Croatia faced severe flooding, in some places the worst in 120 years. The floods killed approximately 80 people and affected the lives of nearly three million others. The International Red Cross and Red Crescent National Societies, a member of our flood resilience alliance, provided food, water, clothes, infant supplies, and other necessary items as well as emergency and reconstruction assistance to those in need. The IFRC worked along with many other organizations.
  - The disaster followed torrential rainfall that triggered flash floods and led to large-scale flooding in major rivers of the Danube watershed. Precipitation over a 48-hour period exceeded the amount that in some places would normally occur over three months. Raging floodwaters and thousands of landslides destroyed houses, public infrastructure and farmland. The three nations of Bosnia and Herzegovina, Serbia and Croatia all declared a state of emergency.
  - The floods caused an economic loss to the region estimated at EUR 3.3 billion.
- The gross domestic product (GDP) of the countries affected was reduced by some one percent, and tens of thousands of people were put at risk of losing their job temporarily or even permanently. The long-term impact of the floods include poverty and food security in rural areas where crops were destroyed. The impact was particularly grave given that up to two-thirds of the people living in these rural areas depend on small-scale agriculture for food and income.
- Armed conflicts in this region during the 1990s also left a tragic legacy that has further reduced these countries' capacity to cope with, and recover from flooding. The floods dislodged land mines, rendering previous information about the location of these mines inaccurate. Recovery efforts have been slow, difficult and dangerous. Post-conflict investments in flood early-warning systems and in physical flood protection, such as levees, fell short of what would have been required to mitigate losses: there is a pressing need to upgrade these structures, and for better coordination at a regional level before the next damaging flood occurs in this region.

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# Balkan floods of May 2014 continued

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## 1. The flood event in the Balkan region

Heavy precipitation arrived in the region on May 13, 2014. The rain that fell in three days was generally equal to, or exceeded volumes typical for the entire month of May. At a measurement station near Tuzla in eastern Bosnia and Herzegovina, 180 mm of rain was recorded in 48 hours, equal to the normal average rainfall for three months. In Serbia, Belgrade's rainfall was even higher, with 225 mm in the same period, equivalent to the maximum rainfall normally recorded over three months. Heavy rains led to very powerful, high-velocity flash floods in the smaller tributaries of the Sava and Great Morava rivers between May 13 and 16. As the tributaries emptied into larger rivers, more-widespread flooding occurred for a further four days, lasting until May 20. In some municipalities, flood waters did not recede until early June.

The floods followed high winds and heavy rain brought to the Balkan region by a slow-moving low-pressure system, Yvette (called locally 'Tamara'). Extreme precipitation and flooding in areas of central or eastern Europe are not unusual in this season. For example, floods in 2013 that occurred in late May and early June affected large areas of central Europe. What was unusual in 2014 was the slow movement of the weather pattern: a 'V-b,' or 'five-b,' according to the numerical meteorological classification formulated by van Bebber, denoting a slow-moving, sometimes almost stationary, low-pressure field. It brought lots of moisture from the Adriatic over the continent and then unloaded most of it across Bosnia and Herzegovina, Serbia and Croatia. In May 2014, the weather pattern took a particularly long time to dissipate, giving it ample opportunity to dump large amounts of rain.

Analysis of the flood event shows that it surpassed many historic readings. The highest flood stages were seen mainly in

tributary rivers including the Sava (which at one gauge station reached 6.3 meters, a record), the Vrbas, the Bosna, Great Morava and the Drina rivers. The cities of Brčko and Maglaj Olovo in Bosnia and Herzegovina and Mitrovica, Sid, Paracin, Obrenovac (where 90 percent of the city was flooded, with flood waters in some areas more than 2 meters deep), and Šabac in Serbia were significantly affected. Around Šabac, destruction was particularly severe due to flash floods in the smaller tributaries of the Sava river, which totally destroyed houses and public infrastructure like roads and bridges. The floods also caused secondary damage in the form of widespread landslides triggered by oversaturated soil in hilly areas: some of these landslides, due to their size and speed, caused fatalities. In the municipality of Paracin, the Crnica tributary of the Great Morava river flooded the city center and its surroundings, affecting 1,100 households. In the municipality of Svilajnac the Resava, another tributary river of the Great Morava flooded over 2,500 households. Overall in Serbia, more than 19,000 households suffered moderate to severe damages to houses and residential buildings as a result of the floods, and many more from the indirect consequences.

The floods and related damage resulted in losses in the billions of euros. Aon Benfield estimated the economic loss of the floods to be approximately EUR 3.3 billion. Property damage in Serbia alone was estimated at between EUR 1.4 billion and EUR 1.8 billion, according to the Serbia Rapid Disaster Needs Assessment Report 2014 (SRDNAR). Overall, nearly 3 million people in the region were estimated to have been – and continue to be – affected by the floods. In Serbia alone, SRDNAR estimated that 51,800 jobs would be temporarily lost and the entire Serbian economy could suffer, affecting GDP by one percent.

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## Balkan floods of May 2014 continued

“Lack of effective early warnings meant that those affected by floods suffered severely.”

### 2. Putting the consequences in context

The impact of the floods was in part, at least, similar to that of other recent flood events, including the central European floods in June 2013. These are described in detail in Zurich's report, 'Central European floods 2013: a retrospective'<sup>1</sup>. In the countries on the Balkan peninsula, as is often the case elsewhere, consequences are the result of inadequate flood risk management and the problems associated with it, which we discuss in section 2.1, together with recommendations for future improvements. However, alongside more commonplace issues, the countries in the Balkan region also faced some special problems. These issues are discussed in section 2.2.

#### 2.1 Addressing flood risk management problems

##### 2.1.1 Early warnings can help save lives and limit damage

Early warning systems and flood hazard awareness offer invaluable ways to prevent loss of life and livelihoods in flood-prone areas. Providing timely notice of impending floods makes it possible for people to prepare and evacuate in a coordinated manner, taking with them their most important documents and possessions. In commercial locations, advance warnings help limit property damage, in particular inventory losses, and can significantly reduce business interruption.

At the time of the flooding in the Balkan region, some early warning systems were working at only a limited capacity, mostly because they were old, out of date, and, in many cases, were not even functioning. In Serbia, although the Republic Hydrometeorological Service of Serbia (RHMSS) has a widespread network of weather and river discharge measurement stations providing data and forecast capabilities for the country, early warnings were not received in time and/or the warnings were not well-enough targeted to the people who

should have received and understood them. This made warnings ineffective. In addition, while some of the meteorological and hydrological services provided information about the rain that had been forecast, these messages relayed the facts but offered no advice on any potential consequences of the precipitation, or precautions that should be taken. Thus, the intensity of the event caught the general population completely off guard. A big problem in fighting the floods was the inability to monitor the rainfall and the water levels of all rivers in real time. The data displayed online were delayed by several hours, which prevented local emergency teams from responding efficiently, especially in flash flood situations.

Without effective early warnings, those affected by floods suffered severely, and their homes were significantly damaged. People lost property, sometimes all their possessions, and were cut off from the outside world. Many had to be rescued and evacuated. Insurance penetration to cover the financial impact of property and content losses in the areas affected is very low. Many inhabitants lost most, or all of their assets. Insurance mechanisms designed to compensate for property damage and income loss appear to have failed, partly due to absence of a functioning insurance market – this stems from cultural changes that have taken place since the 1990s and also from lack of buying power in places where people once bought insurance but no longer do. People received little or no compensation for the losses they incurred in the 2014 floods.

Fatalities were higher than might otherwise have been the case if timely evacuation procedures had been in place. Evacuation, where it was possible, sometimes came too late and when much had already been lost – some people had already drowned in their homes before help could arrive.

<sup>1</sup> Available for download in English and German (tab 'Flood resilience') [www.zurich.com/en/corporate-responsibility/news-and-reporting/reports-publications](http://www.zurich.com/en/corporate-responsibility/news-and-reporting/reports-publications)

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## Balkan floods of May 2014 continued

Unaware of the impending risks, many people had to evacuate at the last minute. A significant number of fatalities, in particular around Obrenovac, were blamed on lack of time to get out of the path of the flood. In that city alone, some 25,000 people had to be evacuated.

Preventive measures might have significantly reduced damage and loss of people's livelihoods. Early warning systems must be upgraded and roles and responsibilities clarified. A change in how early warnings are transmitted is needed, too, to ensure messages are targeted to the right groups. These problems are similar to those we have uncovered in our other flood reviews.

### 2.1.2 The need to assess critical infrastructure

Industrial losses were acute and included loss of machinery and installations, business interruptions and supply chain issues. Critical infrastructure needs to be assessed not only to determine the risks posed to an individual structure; attention must also be paid to the potential chain of secondary effects if that critical structure fails. In Serbia, the public sector sustained severe production losses especially in the energy and mining industries. The important coal-fired power plant 'Nikola Tesla' (TENT A) to the west of Obrenovac, located directly on the banks of the Sava river, was flooded, interrupting power production. This left hundreds of thousands of households without electricity. A coal mine north of Lazarevac near the Kolubara tributary of the Sava was also flooded and had an estimated volume of 75 million cubic meters of water inside. The two affected locations directly depend on each other: the TENT A complex's production capacity relies heavily on supplies from the Kolubara coal mine. Serbia faced a power shortage of some 20 percent and was forced to import 'emergency' power supplies from neighboring countries.

### 2.1.3 Failures of levees and other flood protection infrastructure

In line with the EU Floods Directive of 2007, the '2007/60/EC,' some flood protection measures had been put in place throughout the region along the major rivers, the Danube and the Sava. However, the planning process failed to take into account some of the smaller rivers and infrastructure systems (drainage in cities and towns) and the runoff from the heavy rains proved too much for these.

In Serbia, the levees that failed included those on the banks along the Kolubara river in the city of Obrenovac. The Kolubara contributed to most of the flooding in the region. The levee failures, besides causing heavy damage to the city of Obrenovac, increased the damage to the energy sector, which included the flooding at the Kolubara coal mine that affected the TENT A power plant.

Two challenges must now be faced. Assessing the chain of events that led to the levee failures is one issue; many levees seemed to have been breached before they were overtopped. More pressing, however, is to prioritize repairs and work to strengthen long sections of damaged levees, based on need and critical infrastructure. Completely repairing all levee sections appears impossible at the present time. This leaves, generally speaking, the current status of flood protection in a worse state than before the 2014 flood event. The situation was further exacerbated by trends related to climate change. Changes in river behavior and the potential for future – possibly even more destructive – events must be incorporated in risk assessment strategies and when planning future protection approaches in the region.

In Croatia, large levee failures led to flooding in towns and villages such as Gunja, Rajevo Selo, Racinovci, Posavski Podgajci, Drenovci, Strošinci and Durici. Large areas of farmland were also

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## Balkan floods of May 2014 continued

“  
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affected by flood waters that stood for weeks on end. These Croatian levees were new or had been only recently renovated. The government is now investigating why they failed.

### **2.2 Special problems posed by the floods in the Balkan region**

The 2014 floods in the Balkan region in particular highlight the difficulties of carrying out cross-border flood protection. This is obviously more challenging when it involves coordinating flood protection and reducing flood risk in regions that were only recently at war. One key aspect to consider is that some of the countries in the Balkan region share borders along rivers. The legacy of conflict coupled with the transition from a centrally-planned economy in former Yugoslavia significantly add to the difficulties these countries face in coordinating their approach, according to the United Nations International Strategy for Disaster Risk Reduction (UNISDR) (2008). In particular, rapid and often unplanned changes in land use have increased vulnerability to flood hazards in the region.

Approximately 800 square kilometers of previously mapped land mine fields were affected by the flood. An unusual problem the countries of the Balkan region face has been made worse by this most recent disaster: Before the flood, the land mine problem was at least somewhat under control. Hazardous locations were identified and clearly marked – an operation which took over 10 years to complete. But in just a few days the floods destroyed all these efforts. The flood exposed land mines, eroded areas where they were originally positioned and carried the mines away, often to places that were not mined during the war. The flood not only shifted mines, but also displaced warning signs. Information on mine hazards collected before the flood is now useless. After the floods, there were 300 reports of incidents relating to flooded mine fields and dislodged mines. Clearly these

contamination problems pose an extremely urgent risk. In some ways, it is similar to problems experienced with flooded waste disposal sites that we have highlighted in earlier flood reports.

Problems also arose in the coordination of, and request for, humanitarian aid in Bosnia and Herzegovina, which in practice works as a decentralized country. In Serbia, a more centralized country, according to humanitarian experts, coordination worked better. This arrangement of structures dates back to the Dayton agreement, which had as its goal ending the war, but did not offer a clear vision for the future. The consequence has been ongoing internal division in Bosnia and Herzegovina. This has led to more effort and some duplication that was identified by humanitarian organizations responding to the crisis in this country: for example, paying duplicate visits to people who were affected by the floods, having to answer the same questions several times, etc.

People still have vivid memories of the war and in their minds the flood has associations with the war. Sadly, many people had already lost everything they owned in the war. The floods forced people, often the same ones who had already had to seek refuge after the war, to suffer another displacement. However, according to reports by various organizations, those affected by floods in Bosnia and Herzegovina were quicker to react and better able to do so; they had already suffered a great deal during the war, and thus were ‘experienced,’ having learned to better cope with a crisis.

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## Balkan floods of May 2014 continued

### 3. Lessons learned and recommendations

The event in southeastern Europe demonstrated once again that floods are a cross-border problem, and that the direct damage they cause, as well as their indirect consequences, can continue to affect entire regions long after flood waters have receded. It is therefore imperative to learn from past flood events, share these learnings and work together to reduce flood risks at watershed level. The flood hazard is a regional one, with many rivers running through several countries. In particular, the Sava and Danube rivers are transnational rivers, which makes it difficult to respond to flood hazards and/or flood events only at the national level.

It is encouraging to see that the first 'lessons learned' reports on the floods have already been published and that a conference was held in late 2014 in Sarajevo, 'Floods in South Eastern Europe – lessons learned and next steps.' The purpose was to analyze the consequences of the May 2014 floods and draw up recommendations for decision-makers and water authorities across all the countries affected by the floods.

It is now time to put what has been learned into practice and ensure risk is effectively reduced in coming years – hopefully before the next major flood. Such improvements might be part of a new generation of disaster risk-management programs at country and regional levels that some of the countries in the Balkan region have already started work on. We know that pre-event flood risk reduction is effective and cost-efficient in the long run, especially when compared with post-event recovery and relief, but unfortunately, investments in prevention are still insufficient, even at global level.

Flood protection measures based on the EU Floods Directive will need to be upgraded in future; the appropriate

funding, which has been limited, is also needed. According to SRDNAR, the Serbia Rapid Disaster Needs Assessment Report, now is a good time to upgrade flood forecasting capabilities and invest in disaster risk reduction. These needs offer an opportunity for more regional cooperation among countries affected by floods; working together they can achieve economies of scale. Otherwise, the level of flood protection may remain lower than what it used to be before the 2014 floods.

Better implementation of integrated flood risk management is also necessary. This means engaging the right stakeholders in an iterative dialogue at the right time and getting them to agree funding for pre-event risk reduction. Again, this pre-event prevention is far less costly than post-event relief. But it requires a commitment to act before an event occurs. Improving the early warning system is also key. Help for this might come from the European Floods Awareness System (EFAS), an early floodwarning system complementary to national and regional authorities. It provides national institutes and the European Commission with information on potential river flooding that could occur within three or more days. Messages then need to be targeted to the respective audience to allow them to respond with the necessary actions.

In particular, war's impact on flood risk management has been poorly understood. As officials begin to examine the causes and the consequences of the floods in the Balkan region, gaining greater insight, the questions they raise deserve priority. The answers found may offer interesting lessons that can be applied in other regions, ideally before the next catastrophic flood strikes.

It is also important to educate people about flood risk. At Zurich, we see it as our part of our role to help raise risk awareness which, hopefully, encourages the introduction of a functioning

## Balkan floods of May 2014 continued

insurance market where flood risks can be insured adequately, properly reflecting risk and thus helping to reduce overall economic risk. We hope this report is a small contribution to that effort.

### 4. Map and references

Country	Serbia	Bosnia and Herzegovina	Croatia
Fatalities	51	13-23	2-3
Households affected	120,000	100,000	~3,000
People displaced	32,000	90,000	~9,000
People without water or electricity	300,000	50,000	
Economic loss estimates	EUR 1.37bn property damage	EUR 2bn total losses	EUR 300m, of which EUR 30m agricultural losses

### Balkan Flood Extent 2014



### Legend

- Cities/Towns
- Capital cities
- Power plant
- Waterways
- Major rivers
- Flood extent
- - - State borders
- - - Country borders

The flood extent was produced by our Zurich flood resilience alliance member IIASA. Data was derived from the Esri Disaster Response Program and is the approximate flood zone generated from available reports (esri.com). The basemap was provided by openstreetmap.org and fao.org.

## 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 programs 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.



We want to acknowledge the many people who have made this report possible. Thanks go to the Croatian Red Cross, the Red Cross of Serbia, the Federation of Red Cross looking after the Balkan region, the Swiss Agency for Development and Cooperation and its Rapid Response Team, and our Zurich colleagues from the Zurich Hub.

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