Early Warning and the Human Factor
People-centered warning systems and awareness are key

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INTRODUCTION

Recent decades have seen a significant increase in the number of natural catastrophes with devastating consequences. Tsunamis and earthquakes have resulted in major losses and high death tolls in the past few years. Weather-related events are becoming more frequent and more severe also due to climate change. Warning systems have always played a key role in reducing casualty figures and preventing or minimising losses. Since the massive Tsunami of December 2004, which caused over 220,000 deaths in Asia and Africa, effective early warning has become an increasingly important factor in disaster prevention.
The USA has excellent early-warning systems, however, in 2005 when Hurricane Katrina claimed the lives of more than 1,300 people in one of the richest countries in the world, it became clear that there is a strong human component involved in warning and response. Also the complexity of catastrophes is on the rise. The earthquake in Japan in February 2011 not only caused a severe tsunami but also led to a nuclear disaster in Fukushima despite the fact that the Japanese disaster risk management is said to be one of the best in the world.

THE TONGA TSUNAMI OF 2009

The Pacific's most severe 2009 earthquake, measuring 8.3 on the Richter Scale, triggered a tsunami on 29 September which caused major damage and claimed over 190 lives in Samoa and American Samoa. Many of Tonga's islands escaped more or less unscathed. This was not, however, the case for the more than a thousand inhabitants of Niuatoputapu in the north of the Kingdom. In the early hours of 29 September, the island bore the full brunt of a metre-high wall of water. Houses were swept away, cars washed into the sea and infrastructure destroyed. Nine people were killed. A hospital, a school and a number of low-lying areas were flooded on another Ha'apai-group island, where one of the RANET systems had been installed. Fortunately, there were no casualties. Did the early-warning system work?
Although the warning system set up with the aid of the Munich Re Foundation was fully operational, it was not able to prevent losses in the regions affected. So far, the system has only been installed on the southern islands, around the capital, and thus Niuatoputapu did not benefit from the enhanced early-warning facility.

Human factor in early warning

One general difficulty encountered with effective early warning is that time is of the essence. The devastating tsunami quake occurred only 200 kilometres off the coast of the affected region. Within minutes of the tremor, the first tsunami wave had reached the Samoan Islands and the coast of Niuatoputapu. With so little time available, successful early warning became a difficult if not impossible task, a fact brought home by the many recent events in the Pacific and Indian Oceans.

Apart from the technical issues that Tonga faced, such as slow data transmission, the human element also remains a key factor in early warning. The Samoa quake occurred at 6.48 a.m., before staff had arrived at the radio and television stations and other public facilities that normally issue alerts. Even the presence of a large number of RANET stations would have been of little use on 29 September, since it was the human link in the warning chain that broke down. Nevertheless, the tsunamis of 2009 again underscored the importance of having a well organised, comprehensive warning system. It is to be hoped that the RANET system will be extended to cover the entire Kingdom of Tonga as soon as possible, and will then be more reliable in preventing losses when future events strike.

Tsunami 2009: Loss figures

	Fatalities	Overall losses in US$ m
American Samoa	34	10
Samoa	149	150
Tonga	9	10

Table 1: Tsunami 2009: Loss figures

PEOPLE-CENTRED SYSTEMS - EXPERIENCES FROM MOZAMBIQUE

Mozambique is one of the world's poorest countries. Some 70% of its people manage on the equivalent of less than 40 US cents a day. With only about a quarter of the population (23%) living in towns, Mozambique has one of the lowest urbanisation rates in the world. All together, 17 years of civil war, which ended in 1992, and conflicts with South Africa have cost at least one million lives and laid waste to vast tracts of land and much of the infrastructure. In addition, the region is frequently hit by natural catastrophes. The country has suffered severe droughts in recent years, as well as having to contend with the cyclones that strike the southeastern part of the African continent each year. Several hundred people lost their lives during heavy flooding in 2000 and 2001, which also affected the Búzi in Central Mozambique; many more lost their livelihoods.

The Mozambique flood-warning system

In 2005 a simple but effective early-warning system was built up along the River Búzi. Only two years later a similar system was installed along the Save river. The components of the warning system are simple: village officials take daily precipitation readings at strategic points along the Búzi basin. At the same time, they monitor clearly marked gauges on the river. If precipitation is particularly heavy or the river reaches critical levels, this information is passed on by radio. If reports reaching the control centre indicate widespread heavy rainfall, the alarm is raised. The gauges along the river are vital monitoring devices. Special training ensures that people are fully aware of the risk. Blue, yellow or red flags are raised, depending on the flood-alert level, and an army of helpers spreads the warning by megaphone. Critical areas are evacuated.

VIPPs – Very important project processes

- *Learning:* Awareness of the risks has to start at an early stage.
- *Measuring:* Precipitation levels are measured daily, and critical readings reported. The officials take their work very seriously. Red markings indicate the danger levels along the river.
- *Warning:* Critical levels are reported to the central analysis points. If the river reaches a hazardous level or there is widespread heavy rain, the alert is sounded. Coloured flags are hoisted and specially trained helpers set off on bicycles, armed with megaphones, to warn people along the river.
- *Rescuing:* The Búzi and Save projects also involve evacuation and flood-rescue drills on the river. In an emergency, people and possessions must be taken to safety as quickly as possible. During the major floods of 2000, people often sought refuge on bridges. In next to no time, all available space was taken. This shows how important it is to have an orderly evacuation plan that uses predefined escape routes which, as described below, is what happened in February 2007.

Key success factors

Many local projects in the field of development cooperation and disaster prevention fail in the long term because too little attention is devoted to aspects such as helping people to help themselves and other important sustainability criteria. The factors behind the success of the Búzi project are as follows:

- *Experienced project partners*
  Experts with years of experience in the area of development cooperation manage the project in the field. The project leader is key.
- *Propagation*
  Adoption of a successful scheme from Honduras. Experts who had set up similar flood-warning systems in Central America went to Mozambique to train people there.
- *Testing and practice drills*
  Regular testing of the system as a whole and practice drills for everyone concerned at least once, every autumn, before the start of the rainy season.
- *Ownership*
  The people along the river and the local government understand the system and are responsible for it. Officials are selected and formally appointed. This enhances their status, which helps to ensure that they take their duties very seriously.

Actual use is the best test – the flood-warning system works!

On 25 February 2007, Tropical Cyclone Favio caused severe flooding along the River Búzi in Central Mozambique. Flood alerts had been issued already four days earlier using a variety of techniques involving radio transmitters, megaphones, whistles, bicycles and warning flags. People gradually began to leave the danger zone, so that by 24 February some 2,300 had been brought to safety.

Only one year later torrential rain triggered two flood waves on the Save in January 2008. Rescue teams in Govuro sounded the alarm on 1 January, a major holiday in Mozambique. It was a case of "action stations" for the disaster emergency committees, which were able to make full use of skills acquired just weeks before. The situation on the Save in Central Mozambique is not the same as on the Búzi. Fortunately, some 20 well-trained helpers were quickly on the scene, who were soon able to evacuate the areas threatened by floods. They even were able to help neighbouring districts.

Flooding also occurred in the spring of 2010 and 2011. People were rescued using a boat, one of the components of the warning system. Due to the efforts of emergency teams the claims remained relatively small (15 houses destroyed, 100 families affected, 13 km² of farmland affected).

CONCLUSIONS

The scale of catastrophes will inevitably continue to increase throughout the world. The reasons are obvious: population growth, an increasing concentration of people and values due to human settlement and urbanisation, the development and industrialisation of exposed areas such as coasts and river basins, the greater susceptibility of modern societies and technologies further exacerbated by environmental and climate change.

Technical early-warning systems are no doubt important, but it is even more vital that disaster prevention should be directly based on the people at risk.

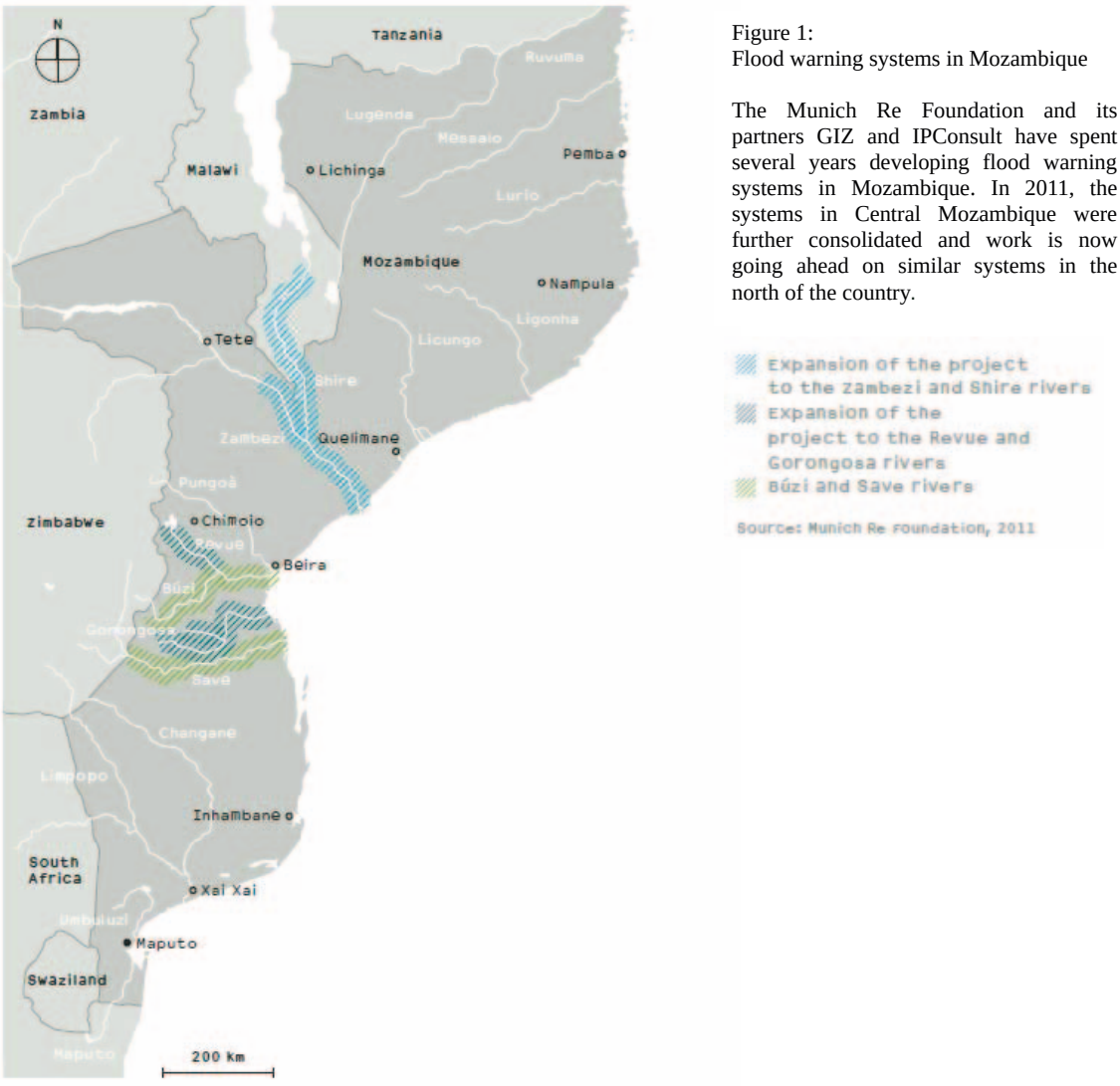

Figure 1:
Flood warning systems in Mozambique

The Munich Re Foundation and its partners GIZ and IPConsult have spent several years developing flood warning systems in Mozambique. In 2011, the systems in Central Mozambique were further consolidated and work is now going ahead on similar systems in the north of the country.

AUTHOR DETAILS

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