# We must build resilience into our communities

*Innovative approaches can better equip society to deal with natural disasters and other shocks, says* **Erwann Michel-Kerjan**.

As part of a series of initiatives marking the tenth anniversary of Hurricane Katrina, this week I will join the mayor of New Orleans and other business and civic leaders in Louisiana to discuss publicly how science can help to prevent such devastation from happening again.

Katrina remains the most destructive natural disaster in recent US history — with more than 1,800 deaths, US$125 billion in economic losses and enduring social and political impacts. When the levee system failed, water from the Mississippi River, pushed by the strong winds and storm surge from Katrina, flooded a large portion of the city. Because many dwellings behind the barrier were built below sea level, it took days for the water to recede, causing permanent destruction. A then-ill-prepared government was slow to react, adding to the tragedy. A year later, New Orleans had lost half of its population, who moved to other cities — and it has yet to be totally restored.

Three questions are central. What have we learnt from Katrina? What new scientific knowledge can help us to be better prepared? And how do we encourage investment to make our communities more resilient?

One lesson was taken on board very quickly — that it is not enough for researchers to predict extreme weather events. They must also better communicate about risks, and plans must be in place to act on these risks. Although comparisons are hard to make, the contrast with Hurricane Sandy, which struck New York in 2012, is clear. Just 117 people in the United States died in Sandy, after the state and federal government (and the media) took the warnings from forecasters seriously and pre-positioned emergency response.

The difference in crisis management between 2005 and 2012 largely came down to improved governance and political leadership — lessons learnt in the seven years between the two events, as well as from other natural disasters, pandemics, oil spills and nuclear meltdowns around the world. No head of state wants to be remembered for another Katrina.

Predicting catastrophes is not an easy task, but we are getting better at it. This is good news, because in today's world, waiting to know for sure is a luxury that decision makers cannot afford. Some uncertainty surrounding the nature, likelihood and impact of adverse events will always remain, but it cannot be taken as an excuse for inaction.

New storm models better predict wind speed at points in space; storm-surge models are also improving. Climate predictions increasingly focus on regional impacts, which are much more relevant to local conditions than are global models. Social science, too, has made huge progress in understanding individual and collective behaviours when faced with disaster risks. Yet we must strive to connect these dots.

There are also major knowledge gaps that science can address. Take flooding, which has affected more people than any other natural hazard. Modernizing our flood maps is one massive but essential undertaking currently under way; an exposure analysis of all buildings, critical infrastructure and other assets in flood-prone areas is also key. It requires granular (hence costly) elevation data for each asset, of the kind typically gathered by a surveyor on site. Clearly, this is not economically practical on a large scale. But new remote-sensing techniques, such as laser and radar-based measurements collected by aircraft, drones or satellites, makes it feasible. And as this technology continues to develop, it will become cheaper.

My third point is on encouraging good investment. Perhaps the greatest contribution that research can make is to improve a region's resilience — and here, an apt mantra holds: what gets measured gets managed. Resilience must be captured holistically to spur financial interest and innovation.

A 'five capital' — 5 C — metric is essential. Physical capital includes the indirect products of economic activity, such as infrastructure; financial capital assesses financial protection and diversity of income sources; human capital pertains to the education, skills and health of people; social capital accounts for social relationships, leadership and governance structure; and natural capital includes land productivity, water and biological resources and actions to sustain them.

Research across many disciplines can gather data on the 5 Cs, to provide a baseline, measure progress and test policies. An agreed-upon set of metrics will enable a specific community to be given a resilience score that can be compared with those of others and tracked.

Our team at Wharton is piloting this approach as part of a global flood-resilience programme in Mexico, Peru, Indonesia and Nepal supported by the insurer Zurich, working with the Red Cross, the International Institute for Applied Systems Analysis and the non-governmental organization Practical Action. The US National Academy of Sciences is helping us to extend the idea to the United States through its Resilient America Roundtable.

In collaboration with the Rockefeller Foundation in New York, a growing number of cities, including New Orleans, are appointing chief resilience officers — who have similar roles to chief risk officers in companies — and the 5 C measurement tool should help them.

New Orleans native and jazz legend Louis Armstrong once said: "The memory of things gone is important to a jazz musician."

This week in Louisiana, it is important to all of us. ■

**NO HEAD OF STATE WANTS TO BE REMEMBERED FOR ANOTHER KATRINA.**

**➲ NATURE.COM**
Discuss this article online at:
go.nature.com/rjqspc

**Erwann Michel-Kerjan** *is executive director of the Center for Risk Management and Decision Processes at the Wharton School of the University of Pennsylvania in Philadelphia, USA, and co-author (with H. Kunreuther) of* At War with the Weather *(MIT Press).*
*e-mail: erwannmk@wharton.upenn.edu*