

## Risky prediction

Geoscientists are increasingly being asked for predictions and projections. Climate researchers are under pressure to produce scenarios for the coming decades, and volcanologists risk their reputations when they recommend the evacuation of communities around a volcano. At least seismologists should be in far less of a bind. After all, according to the state of the science, earthquakes cannot be predicted.

An Italian court, however, takes a different view. It has charged seven geoscientists with manslaughter, because they allegedly failed to issue a warning ahead of the disastrous earthquake in L'Aquila in April 2009. The trial is scheduled to begin on 20 September 2011, despite protests from thousands of scientists from all over the world. If they are convicted, the defendants could be sentenced to long prison terms. The scientists are accused of providing "imprecise, incomplete and

contradictory information" about the risk of an earthquake in L'Aquila. The prosecution argues that the information given prevented residents from taking measures to protect themselves.

As a result of the  $M$  6.3 earthquake, 309 people were killed and thousands of others injured. Today, 20,000 people are still living in temporary accommodation such as hotels or army barracks. In the weeks ahead of the quake there had been slight tremors, so a civil defence committee — including the seven scientists facing charges — met on 31 March 2009. After the meeting, the scientists said that there was no danger.

The committee said that tremors were normal in the region — an undisputable fact. Yet after the earthquake, these particular tremors were interpreted as foreshocks. According to media reports, residents of L'Aquila had wanted to leave the town because of the tremors but stayed at home after the scientists gave the 'all clear'.

From a scientific point of view, the case is obvious. Foreshocks are not a reliable warning signal — as thousands of scientists wrote in a letter to the Italian president and have emphasized in other joint statements (*Eos* **91**, 248; 2010). It is possible that a large earthquake may follow a series of minor tremors, but most of the time nothing happens. It would be impossible to evacuate cities every time tremors occur. For decades, foreshocks have been tested as predictors of impending quakes, but time and again, the results have been unsatisfactory (see, for example *Nature* **437**, 969; 2005).

There is one counterexample, when foreshocks did provide a life-saving clue. In 1975, the Chinese authorities evacuated the region around the city of Haicheng, following tremors of increasing strength over a period of weeks (*Bull. Seismol. Soc. Am.* **96**, 757; 2006). When, on 4 February, a large quake of  $M$  7.3 actually struck, most of the residents were in safety. This case has remained the only successful instance of earthquake prediction — a fluke that was favoured by unusually strong foreshocks, much more powerful than those in L'Aquila.

Nevertheless, the L'Aquila case has sparked a storm of debate about communicating risks. The Italian volcanologist Flavio Dobran of Hofstra University in New York criticised his colleagues for meddling in judicial affairs. "I see serious flaws in involving a scientific organisation in judicial business", he wrote (*Eos* **91**, 384; 2010). Scientists are



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too often portrayed as having an almost god-like prestige, said Dobran, and suggested that the defendants "may be guilty of failing to properly exercise their social responsibility".

Indeed, seismologists have drawn up detailed geological maps of regions where the threat of earthquakes is high. On one such map, the region of Abruzzo around the town of L'Aquila, is bright red, indicating that large earthquakes were expected. Every schoolchild in the region learns that.

Yet after the devastating earthquake and tsunami in Japan on 11 March 2011, seismologist Robert Geller of Tokyo University pointed out that these maps are often wrong (*Nature* **472**, 407; 2011). Geller wrote that researchers must more clearly emphasize their inability to predict quakes.

Seismologists have always urged governments to ensure that buildings in quake-prone areas are earthquake-resistant, notes the American Geophysical Union in its statement on the L'Aquila disaster. And indeed, the statement "earthquakes don't kill people, buildings do" has been a seismologists' mantra for decades. In L'Aquila, that warning had not been taken seriously enough. □

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### The journalist's take

The necessity for professional distance admonishes journalists not to take up a cause, even if it is a good one. But I admit that the L'Aquila case makes me angry. Are scientists to be held responsible for failing to do something they are incapable of? That is absurd! I wanted to inform the public about the scientific background of the case. In my experience, many people believe earthquakes can be predicted. They will understand how outrageous it is to bring the case to trial only if the context is explained in some detail.

But apart from my personal drive for justice, the case has a number of ingredients for a top story:

- **Oddity:** like "Man bites dog", "Scientists charged" turns an apparent certainty on its head. To have scientists accused — essentially on scientific grounds — by the judicial system and not fellow scientists is surprising.
- **Conflict:** a court case with high-status defendants raises questions and creates tension. The reader wants to know how it all turns out.
- **Drama:** people are facing trial for serious allegations even though the charges seem completely absurd — that is material for a crime novel. And the status of the people in the dock merely heightens the drama.