

A Seismic Crime

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NEW YORK – Few people outside Italy are aware that six seismologists and a government official are on trial in the small city of L'Aquila. But the story has implications for scientists, engineers, administrators, and legal systems far beyond Italy's borders.

L'Aquila was largely destroyed by earthquakes in 1461 and 1703. The city was rebuilt, eventually grew to more than 73,000 inhabitants, and remained stable for more than 300 years – until October 2008, when tremors began again. From January 1 through April 5, 2009, 304 additional tremors were reported.

Italy's National Commission for Prediction and Prevention of Major Risks, which comprised the seven men now on trial, met in L'Aquila for one hour on March 31, 2009, to assess the earthquake swarms. According to the minutes, Enzo Boschi, President of the National Institute of Geophysics and Volcanology, was asked if they were precursors to an earthquake resembling the one in 1703. He replied: "It is unlikely that an earthquake like the one in 1703 could occur in the short term, but the possibility cannot be totally excluded."

On April 6, 2009, a 6.3 magnitude earthquake struck L'Aquila and nearby towns, killing more than 300 people and injuring more than 1,500. The quake also destroyed roughly 20,000 buildings, temporarily displacing another 65,000 people.

More than a year later, in July 2010, prosecutor Fabio Picuti charged the Commission members with manslaughter and negligence for failing to warn the public of the impending risk. The trial began last September, and is expected to last for months, if not years.

After Picuti made the charges public in June 2010, Alan Leshner, Executive Publisher of *Science*, sent an open letter of protest to Italian President Giorgio Napolitano on behalf of the American Association for the Advancement of Science. He wrote that the "charges against these scientists are both unfair and naive....[T]here is no accepted scientific method for earthquake prediction that can be reliably used to warn citizens of an impending disaster." The American Geophysical Union and thousands of other scientists also objected.

Picuti reportedly responded: "I'm not crazy. I know they can't predict earthquakes. The basis of the charges is not that they didn't predict the earthquake. As functionaries of the state, they had certain duties imposed by law: to evaluate and characterize the risks that were present in L'Aquila."

In 1989, a United States National Research Council report, *Improving Risk Communication*, recommended that one-way communication from experts to non-experts be replaced with an "interactive process of exchange of information and opinion." The report suggested that risk communication is successful only if those involved are satisfied that they are adequately informed about the relevant issues, given the limits of available knowledge. Yet such information exchange remains a problem – and not only in Italy – more than 20 years later.

The interactions between science, technology, and law are growing increasingly complex. As science and technologies evolve, risk assessments and the dialogue between scientists and governments must adapt. Both sides must continually determine, before disaster strikes, whether existing laws provide scientists and administrators with clear, realistic standards for their analyses and public communications. If they do not, the best qualified scientists and administrators might be frightened away.

In 2011, the National Research Council and the US Federal Judicial Center issued the 1,016-page third edition of the *Reference Manual on Scientific Evidence*. Although its purpose is to help judges and attorneys to understand the science from which legal evidence is derived, its index contains no entry for earthquakes. Furthermore, the manual mentions risk communication only briefly, in the context of medical testimony.

Given such shortcomings, courses on science and engineering and their social applications should become part of the core training and continuing education of those in law, public administration, and official policymaking positions. Legislators, prosecutors, and judges, in particular, need to understand what natural sciences, social sciences, and engineering can and cannot offer.

At the same time, natural scientists must become better educated to work effectively with engineers, public administrators, and social scientists (for example, economists, demographers, and psychologists) to communicate the consequences of scientific findings, especially when high risks are involved.

Those risks will not go away. In February 2011, almost 200 people died when a 6.3-magnitude earthquake struck Christchurch, New Zealand. The following month, Japan's Tōhoku earthquake killed almost 16,000 people. As the anniversary of that earthquake approaches on March 11, Japanese researchers predicted in January 2012 that another major earthquake will strike the southern Kanto region, including Tokyo, by 2016 with 70% probability. The Big One will one day strike California. Will we be ready?

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