assessment process is too slow and requires too much time from the more than 2,000 scientists from around the world who volunteer for duty. Some have advocated that the IPCC put less energy into monumental assessments and more into shorter reports that focus on major scientific and policy debates. During the last major assessment, the IPCC released special reports on renewable energy and the risks of extreme weather, but even those were major undertakings.

Christopher Field, co-chair of the working group on impacts and adaptation for the most recent assessment, says that there are ways to streamline the process, but maintains that the value of the IPCC comes from the give and take between scientists and governments. "Operationally, it is hard to imagine a way to capture this unique value without key process steps, including multiple rounds of monitored review and line-by-line approval of summaries for policy-makers," he says.

OPEN UP

At the meeting, IPCC members said that the next assessment should have a greater focus on specific regions and include a broader review of non-English scientific literature, with more involvement of science writers and communications experts to help reach a broader range of people.

The panel also wanted to open itself up to researchers who have been seeking access to the closed-door meetings in an effort to study the assessment process and the institution itself; research proposals will be evaluated on a case-by-case basis.

"That is indeed a major step forward toward both increased transparency of the IPCC process and eventually finding ways to improve it," says Michael Oppenheimer, a climate scientist at Princeton University in New Jersey who is part of a team of researchers seeking such access.

Oppenheimer has advocated reforms that would emphasize smaller, faster assessments while decreasing the workload for scientists. He says that the latest decision largely represents "business as usual", but does open the door for improvements. In particular, he credited the IPCC for emphasizing communications and engagement with developing countries. "This is important and needs to be done," he says.

The IPCC will hold its leadership election in October. Candidates include van Ypersele and Thomas Stocker, a climate scientist at the University of Bern who co-led the working group that wrote the physical-science portion of the report during the most recent assessment. Field, who is founding director of the department of global ecology at the Carnegie Institution in Stanford, California, says that he, too, is likely to run. ■

Mount Merapi, the most active volcano in Indonesia, erupts every few years.

OSCAR SIAGIAN/REDUX/EYEVINE

NATURAL HAZARDS

Global volcano risk quantified

UN assessment aims to save lives by aiding planning.

BY ALEXANDRA WITZE

Swept away by mudslides, entombed in lava or suffocated under ash, nearly 280,000 people have died in volcanic eruptions during the past four centuries, but only now has humanity managed to quantify the risk posed by these fiery phenomena. The first detailed assessment of global volcanic risk — part of a larger international hazard assessment released on 4 March by the United Nations Office for Disaster Risk Reduction — aims to save lives by providing better information for risk planners and by showcasing effective response measures.

"For the first time, we really have a shared understanding of volcanic activity at the global scale," says Jean-Christophe Komorowski, a volcanologist at the Institute of Earth Physics in Paris, who contributed to the report. "This is a major turning point."

Eight hundred million people live within 100 kilometres of a volcano that could erupt. But the hazards differ greatly from place to place. High in the snow-capped Andes, an eruption might melt ice and send floodwaters rushing into nearby villages. In southeast Asia, a powerful eruption might blast ash over a wide area, causing roofs to collapse under the weight.

The report aims to put hard numbers on exactly who is at risk. It comes from a UK-led international network of institutions called the Global Volcano Model, working with the International Association of Volcanology and Chemistry of the Earth's Interior.

Team leaders sifted through a database of nearly 9,500 eruptions over the past 10,000 years kept by the Smithsonian Institution in Washington DC. They noted how often a particular volcano had erupted and what kind of physical hazards it posed. Then they tallied the number of people who now live within 10, 30 and 100 kilometres of that volcano and whether they live in places where eruptions have killed people before (see 'Mass destruction'). The result is a complete catalogue of the highest-risk volcanoes and a list of countries ranked by the number of residents in harm's way.

Researchers were surprised to find risk in places not typically thought of as highly volcanic. The Auvergne region of France, for instance, has been quiet in historic times. But it has had eruptions in the past few thousand years, putting it relatively high on the hazard scale because so many people live nearby. In New Zealand, the Auckland volcanic field — the eruptive history of which is not particularly well known — lies directly under the country's biggest city.

"Volcanoes are extremely attractive areas to

live," says Jenni Barclay, a volcanologist at the University of East Anglia in Norwich, UK. Volcanic soil is often fertile and the altitude provides good living conditions in hotter climates.

Worldwide, 62 volcanoes fell into the highest risk category, meaning that they have been recently active and lie close to a lot of people. Indonesia tops the list of most threatened countries, with 77 historically active volcanoes, including Mount Merapi, which erupts frequently near the city of Yogyakarta.

But by a different measure, small volcanic islands — such as Montserrat in the Caribbean — are the most vulnerable. When these island nations start to rumble, all their citizens must flee or risk death. In these places, uncertainty has its cost: a controversial 1976 evacuation of the Caribbean island of Guadeloupe left residents angry when no major eruption happened.

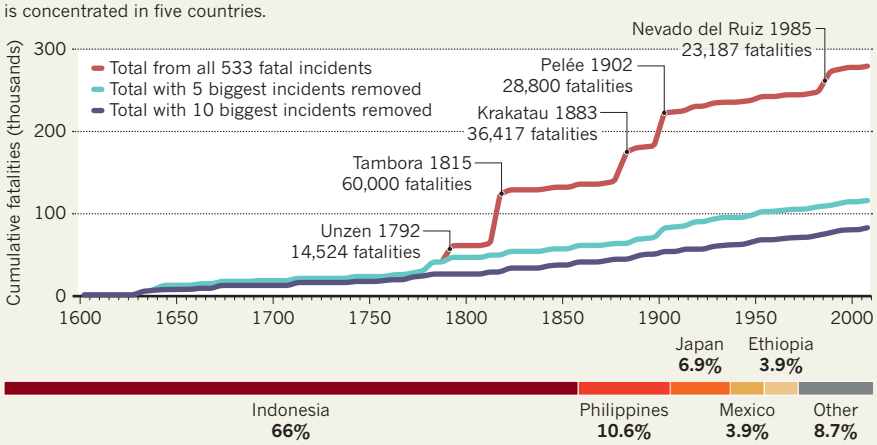
Just because a volcano ranks as hazardous does not mean that people living near it are sitting ducks. If a volcano has enough scientific monitoring equipment on it, and a well-organized local response, then the risk to human life can be reduced, says Stephen Sparks, a volcanologist at the University of Bristol, UK, and a lead author of the report. At Merapi in 2010, the authorities used information about physical changes in the volcano to evacuate hundreds of thousands of people before a large eruption, saving many lives.

"We want to showcase what volcanologists around the world are doing," says Sue Loughlin, a volcanologist at the British Geological Survey in Edinburgh and another leader of the survey.

In Ecuador, around the Tungurahua volcano, local volunteers serve as a network of *vigías* or 'volcano watchers'. They watch for changes in the mountain and radio in to the nearby volcano observatory every evening with their reports (J. Stone *et al. J. Appl. Volcanol.* **3,** 11; 2014). Such initiatives could translate to other volcanically active regions, says Barclay. "We can learn much more by bringing all this knowledge together." ■

MASS DESTRUCTION

More than half of the fatalities caused by volcanic eruptions in the past four centuries occurred in just five major events that killed an estimated 162,928 people. Today, more than 90% of the volcanic risk is concentrated in five countries.



SOURCE: GLOBAL VOLCANIC MODEL/IAVCEI

BIOTECHNOLOGY

Therapeutic cancer vaccine survives biotech bust

Pharmaceutical company rescues landmark prostate-cancer treatment, Provenge.

BY HEIDI LEDFORD

The first therapeutic cancer vaccine to be approved in the United States will stay on the market despite the financial collapse of the trailblazing biotechnology company that developed it. The vaccine, Provenge (sipuleucel-T), was purchased on 23 February by Valeant Pharmaceuticals of Laval, Canada, which paid US$415 million for the prostate-cancer treatment and other assets of the bankrupt Dendreon Corporation.

The now-defunct Dendreon, of Seattle, Washington, made history in 2010 by showing that complex treatments made fresh for each patient could win regulatory approval, and could be expanded beyond the realm of specialized academic hospitals. Industry took note: today, experimental cancer therapies that spur patients' immune cells to attack tumours are among the hottest properties in biotechnology.

"Dendreon had vision and foresight," says Usman Azam, head of cell and gene therapies at Novartis, a Swiss pharmaceutical company that has purchased one of Dendreon's manufacturing plants to fuel its own cell-therapy efforts. "Don't view Dendreon as a failure: it paved the way."

But although Dendreon created the market for such cell therapies, it ultimately could not survive in it.

Provenge is made by harvesting a patient's dendritic cells — a type of immune cell — and then mixing them with a protein that is particularly abundant in prostate tumours. This primes them to recognize and attack the tumour; the cells are then infused back into the patient.

The technique was pioneered in the early 1990s by Edgar Engleman, an immunologist at Stanford University in California, who had seen promising results in animal studies of a different cancer, lymphoma. He teamed up with fellow Stanford immunologist Samuel Strober to work out ways to make the process more efficient.

When the two pitched their idea for a company to investors, they had few clinical data and were too optimistic about how fast the treatment could reach patients, says Strober. The company was an enormous gamble: harnessing the immune system to fight cancer was still a controversial idea, and no other company had marketed a therapy so personalized and labour-intensive. "But at that time it was a little different from now," says Strober. "Companies were getting funded on the basis of promise, rather than actually looking at their capacity for early commercial success."

Engleman and Strober founded Dendreon in 1992; the US Food and Drug Administration approved Provenge in 2010.

The approval was celebrated as an important proof of concept by researchers working on cancer vaccines and other treatments that stimulate immune responses to the disease. But Dendreon, already strained by the long wait for approval, soon ran into financial difficulty. ▶