California program got off to a slower start than was expected, prompting Governor Edmund G. Brown, Jr., to ask for federal assistance with the project. Meanwhile Medfly larvae have turned up outside the area where the infestation was originally thought to be confined. In one case they were found only 30 miles from the San Joaquin Valley, a major agricultural region. Ames, for one, thinks the start of the spraying program may have been delayed too long in the first place. He says of the Medfly, "It is like a case of gangrene; the longer the delay, the worse it is. It just spreads and spreads."

If the spraying program does not control the infestation, California agricultural officials may have to turn to other methods of combating the Medfly to protect their agricultural industry. The next most likely step is fumigation of California crops with ethylene dibromide, which Ames has found to be a carcinogen in test animals at a dose of 2 milligrams per kilogram of body weight per day. Hooper says, "This is a potent carcinogen in both species, mice and rats. It is spermatoxic and a mutagen in many tests." In other words, he thinks it makes a lot more sense to spray with malathion than to take the chance that ethylene dibromide will have to be used. Nevertheless, the whole situation has Hooper rather bemused. "I often have to tell people that a chemical is more hazardous than we thought," he says. "It is weird for me to be in this position [of defending malathion]."—JEAN L. MARX

Earthquake Prediction Retracted

Brian Brady of the U.S. Bureau of Mines in Golden, Colorado, has formally withdrawn his prediction of two mammoth earthquakes off the coast of Peru. Because the prerequisite seismic activity has not occurred, "The probability of the last two [large] events occurring is extremely small," he says. Brady informed his Peruvian colleagues of his decision in a letter prepared on 20 July. His withdrawal came 5 weeks after William Spence of the U.S. Geological Survey (USGS) in Golden, the scientist most closely associated with Brady's prediction, rejected it as being no longer supportable. More than 5 months earlier, the U.S. National Earthquake Prediction Evaluation Council flatly condemned the prediction as unsubstantiated and scientifically unconvincing (*Science*, 20 February, p. 808).

In the opinion of most seismologists, nothing predicted for Peru by Brady has occurred. Brady disagrees, but he concedes that not enough has happened to justify any longer his prediction of a magnitude 8.8 earthquake on 10 August and one of magnitude 9.8 on 15 September. Brady expected a dozen forerunners of the big quakes to strike a small region southwest of Lima last fall. Those moderate events did not show up in the USGS's worldwide records as they should have, but Brady says that a local seismic network detected two earthquakes of magnitude 3.2 and 4.5 that could have been all that was detected of those foreshocks. The next test came in mid-May when at least five earthquakes of magnitude 4.5 were due. Waverly Person of the USGS in Golden reports that, in the region that Brady considered crucial, nothing of that magnitude has happened. Along the Peruvian coast as a whole, he says, seismic activity has been "just about what you would expect." Brady says that local seismic networks did find two events of magnitude 3.8 and 4.2, which meant to him that the prediction could not be dropped.

The magnitudes of warning shocks, it seems, are not crucial in Brady's prediction scheme. The size of a foreshock of a large event cannot be reliably predicted, he says, unless its own foreshocks have been reliably detected. Thus, more common, smaller earthquakes can just as readily fit the requirements of his foreshock predictions. Spence, who had for several years provided evidence supporting the possibility of huge Peruvian earthquakes, bowed out at this point. The seismic record, he said, had clearly failed to support Brady's prediction.

Finally, after the largest predicted foreshock (magnitude 7.5 to 8.0) failed to appear on 28 June, everyone agreed that a necessary precursor had indeed failed to appear. Brady had seen this event as the final signal that the rock along 1900 kilometers of the sea floor off Peru had begun to fail on a microscopic scale. On the basis of his rock failure experiments in the laboratory, relativity theory, and his study of the San Fernando earthquake of 1971, Brady felt that the huge earthquakes predicted for August and September required such a foreshock. Without it, the big ones are extremely unlikely, he says. Perhaps his theory is wrong, but he may have simply misinterpreted the complex pattern of seismic activity in the area, he says.

Although the U.S. National Earthquake Prediction Evaluation Council had been convinced much earlier that Brady could not reliably predict great earthquakes with his theory, many Peruvians took seriously the prediction of a credentialed U.S. government scientist. "The impact on the city of Lima was greater than I had expected," says John Filson, the head of earthquake studies at the USGS in Reston. He visited there on the day of the predicted earthquake to lend credence to the council's boast that none of its members would mind being there then. In spite of his reassurances to the Peruvian press, the prediction was "taken very seriously," he says. Alberto Giesecke, former head of the Peruvian Geophysical Institute, agrees. The city seemed exceptionally quiet that day, he says, and many of those with the money to do so arranged to be elsewhere. Although taken seriously before 28 June, the prediction does not haunt Peruvians any longer. As one headline after 28 June put it, "Peru–Sí, Brady–No."

A lesson learned from the experience, some scientists say, is that the federal government's handling of earthquake predictions can still be improved. In particular, scientists have censured the Agency for International Development's Office of Foreign Disaster Assistance (OFDA). Filson notes that for 2 years the USGS had emphasized to OFDA that Brady's predictions totally lacked support in the scientific community, outside of Spence's feasibility arguments. These "early informal reviews by the Survey were not taken as seriously as we would have liked," he says. Clarence Allen of Caltech, chairman of the council, says, "Many of us are upset with OFDA's handling of this." In spite of the lack of scientific support, OFDA continued to place credence in Brady's prediction and even promoted the idea, he says.—RICHARD A. KERR

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