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BOOK REVIEW

Robert Ayre, *Earthquake and Tsunami Hazards*, 150 pages;

Earl Baker and Joe McPhee, *Land Use Management and Regulation in Hazardous Areas*, 124 pages;

Don G. Freidman, *Computer Simulation in Natural Hazard Assessment*, 192 pages;

Gilbert F. White, *Flood Hazard in the United States*, 141 pages;

Boulder, Colorado: Institute of Behavioral Science, University of Colorado, 1975.

The results of a National Science Foundation sponsored multi-year study of Natural Hazards in the United States conducted at the University of Colorado's Institute of Behavioral Science is in the process of being presented in a series of 20 monographs. The remarks below pertain to the four monographs indicated above. These four are treated here collectively since they are homogeneous and complementary as regards methodologies and the reporting of results.

EARTHQUAKE AND TSUNAMI HAZARDS

In his monograph on seismic hazards, Ayre employs the same analysis procedures and methods of presenting results as did White with regard to floods. A lucid description of the physical aspects of the hazard and its geographical distribution is presented, the adjustments to reduce losses are discussed together with changes in emphasis needed to optimize the benefits. White ends with recommendations for additional research costing nearly \$50 million over a 5 to 10 year period and requiring the professional services of more than 100 researchers.

While the central message regarding research emphasis is the same, it is clear that a hierarchy of different problems is involved: the dimensions in both space and timing are dissimilar; public responses to earthquake programs, especially in the area of prediction and warning, will be vastly different from those to floods; the data base for analysis is frailer than that for the flood plains. Ayre expresses no small concern

with regard to the prospect of earthquake prediction and warnings. His discussion, while fairly presented, poses serious questions about the desirability of issuing predictions or warnings. The reader is told that “Scientifically successful prediction and warning . . . *cannot* be expected to lead of itself to *desirable* social response” and “for inaccurate (forecasts) which . . . will inevitably occur, the social response may . . . lead to greater economic loss and social disruption than an earthquake per se.”

Many conceptual hiatuses in research emphasis are identified, for example, in the field of earthquake resistant construction design, shaking resistance in tall structures has received much more attention than the design of lower structures; and considerations of secondary effects such as fire and the security of elevator services in skyscrapers which might be used as refuges. It is noted that 80% of the losses in the San Francisco earthquake of 1906 were due to fire.

This monograph employs a series of excellent diagrams and tabular data which in establishing the dimensions of earthquake hazard demonstrate why the social response factor is so critical in evaluating the benefits of adjustment programs. First, catastrophic earthquakes are very rare, and second most people consider Alaska and California to be the only areas of the U.S. in which earthquakes are a noteworthy hazard whereas at least 5 other regions — including the Mississippi and Ohio Valleys, New England and South Carolina — have risks of equally severe earthquakes, albeit with longer return periods and involving processes more difficult to predict than those of the Andreas fault in California.

The section on tsunamis in this monograph, apparently because of the limited and frail data base, is more of a commentary on the physical nature of the phenomenon, how warnings of its arrival are derived and transmitted, and what actions are appropriate in the short time between receipt of warnings

and the initial onslaught of the tsunami waves. As the author recognizes, this seismic event poses adjustment problems more akin to flash floods than to earthquakes.

The greatest contribution here is the attractive and comprehensive assemblage of factual information about seismic events and their potential impact on the economy and social welfare of the nation. However, because of the range of unresolved questions and uncertainties in the analyses, the reader will find himself less at ease with the recommended changes in research emphasis and the justification of a \$50 million research augmentation than he was with the recommendations for the Flood Plain.

Overall the monograph series by the Institute of Behavioral Sciences on natural hazards should have a significant impact on planning and administering programs to minimize economic and social losses if for no other reason than that it assembles a massive amount of factual information on the physical character of these hazards, and on the interaction to be expected between the various adjustments most of which are presently supported individually and independently by various government agencies.

Whether the recommendations made will effectively impact federal research policies will very likely depend more on the political expediency with which they are viewed by the incumbent and following administrations than upon the urgency with which the National Science Foundation supports the recommendations of the study it has sponsored. Experience has shown that this in turn is likely to depend upon whether one or more natural disasters of sufficient political importance to the nation occur before obsolescence overtakes these important publications.

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