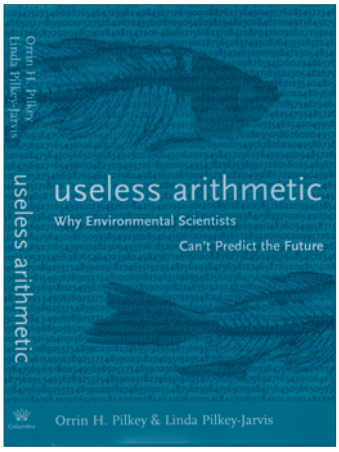
BOOKS/PERIODICALS REVIEWED



Useless Arithmetic. Why Environmental Scientists Can't Predict the Future.

BY ORRIN H. PILKEY & LINDA PILKEY-JARVIS

Published by Columbia University Press, New York, NY. 2007. 248 pages. Illustrated. Hardcover. Price: US$ 29.95

After teaching mathematics for 15 years, it was a bit awkward to receive a request to write a critical note on a book with such a provocative title. Still it was also a challenge not to look at the book too much through the eyes of an engineer.

When I saw the title of the book I had to think of one of the statements in my PhD thesis written in 1987: Modelling is the attempt to describe reality without pretending to be reality. With this in mind the reader can approach the book in the right perspective.
The authors are both scientists. Orrin H. Pilkey is the James B. Duke Professor Emeritus of Geology and Director of the Program for the Study of Developed Shorelines at Duke University's Nicholas School of the Environment. Linda Pilkey-Jarvis is a geologist in the State of Washington's Department of Ecology, where she helps manage the State's oil spills programme.

They use a number of explicit examples to prove that the future cannot be predicted.
The first one is cod fishing near Newfoundland. Based on models the quota for cod fishing were determined, but this did not lead to a stable situation.

The reality was much more complicated than the models assumed. In addition, the models required a good description of the starting situation, which in fact was not available. Even with the perfect model the rule applies: "garbage in, garbage out".

The second example concerns the radioactive distribution of high-level radioactive waste. How does this distribute over the years through the groundwater flow? Also here the modelling has to take into account many unknowns. For example, to know the groundwater flow, one has to know the exact permeability to make a good prediction. It is almost impossible to know this for the whole area concerned.

The third example is the rise of the sea level. There is no doubt that the sea level is subject to change. But whether or not this is caused by human interference is difficult to determine. There are too many parameters involved of which many are almost impossible to ascertain.

As a scientist and an engineer I do believe that it is possible to create models for many physical phenomena. In engineering we already have many models that have proven their usefulness. The fact that we can do strength and stiffness calculations and predictions for many systems and constructions, like bridges, without these constructions to fail, proves that there are many models that are reliable. We can send people to the moon, based on mathematical models.

One of the main reasons for rejecting the use of mathematical models, the authors say, is the lack of knowledge of initial conditions, confirming the statement of "garbage in, garbage out".
After reading the book, my opinion about the use of mathematical models has not changed. The book might put mathematical modelling in another perspective; the use of mathematical models to predict the future in any discipline depends on the modelling itself and on the input. If one of them is not accurate or complete, the results will be doubtful.

This does not, however, mean we should stop creating more and more advanced models. One day we will be able to predict things that we cannot predict now. But we should stand with both our feet on the ground and realize which models are ready for use in the real world and which models should be kept in the scientist's environment for further development.

The book is available from Columbia University Press at http://www.columbia.edu/cu/cup

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