

ENVIRONMENTAL FORESIGHT AND MODELS | A MANIFESTO



EDITED BY
M.B.Beck



Preface

Everyone - or so it seems at times - has an opinion on modelling. This belittles the subject, I fear. For it suggests the principles of constructing a mathematical model, evaluating it against whatever experience one has of the behaviour of the prototype, and subsequently applying it for the purposes of exploring the future, are trivially straightforward - easily grasped by the non-expert. There is, of course, no need for us to make the subject full of spurious jargon and complication, just to give ourselves a sense of what Simon Schaffer has called our "own private world where ignorant outsiders cannot penetrate". My point is rather this. I acknowledge I know little in detail of the subjects of, say, meteorology, forest ecology, or aluminium speciation in soils; I do not presume therefore to tell those who do, how best they should go about their business; I am not the one to judge whether good science has been done in these subject areas; I have respect for their subtleties and complexities, which I know I am unable to fathom. So it should be with modelling. This is a free-standing academic discipline and one in which profound questions of the appropriateness of our premises and principles should be being asked, not least because of the times in which we live and the momentous issues with which we must struggle in order to cope with environmental change. Some of these questions we shall try to articulate in this monograph.

But first I must confess the book has a somewhat unusual origin. In 1992 a small group of twenty or so scientists and engineers was assembled to form the *International Task Force on Forecasting Environmental Change*. With financial support from the National Water Research Institute of Environment Canada, the National Institute of Public Health and Environmental Protection (RIVM) of the Netherlands, and the International Institute for Applied Systems Analysis (IIASA), Laxenburg, Austria, the purpose of the Task Force was to deliberate on the methodological, and to some extent theoretical and philosophical, problems of forecasting the behaviour of the environment. This concern, to mount a sustained attack on the question of whether models may be trusted in predicting a change in the climate or some part of the environment more generally, was born of a less formally gathered collection of papers appearing under the same title in a special issue of the *Journal of Forecasting*.²

1 Schaffer, S.. 1993. Comets and the world's end, in: *Predicting the Future* (L. Howe and A. Wain, eds.). Cambridge University Press, Cambridge, pp. 52-76.

2 Beck, M.B. (ed.), 1991. Forecasting environmental change. *J. Forecasting*, 10 (1&2).

The Task Force was designed from the outset to generate a single product: the monograph you are now reading. This was to be achieved essentially as a networked activity, focused and catalysed, however, through three Workshops to be held at IIASA (in February, 1993, July, 1994, and July, 1996). The deliberations of the Task Force have thus far received no public exposure, as intended; and sincerely, I hope I have not buried the freshness of everyone's ideas in the time it has taken me to wrestle with making a coherent whole of the parts. I must further confess to an abiding anxiety to escape from appearing naive in my expression of the problems and solutions before us. Substantially new thinking is presented for the first time in the monograph. It is, in short, the integral of almost a decade of research across the network of the Task Force.

A manifesto is a public declaration of intentions, and that is how I feel about this book, especially Chapter 5. When I had finished drafting that chapter I could not get rid of the idea that we were "all dressed up with nowhere to go". We had thought hard and long about how we might use computational analyses for detecting, exploring, and coping with a future in which there might well be "structural change"; yet, within the span of the Task Force, we had no all-embracing case study on which to demonstrate the worth of our entire argument. In some ways, in the time it has taken me to go from Chapter 5 to the rest of the book, I am pleased to say I have been overtaken by events. Many of the intentions expressed herein have begun to be put into practice in a current research project, on the watershed of Lake Lanier, Georgia, in the south-eastern United States. But that might be the subject of another book - and I can already hear the patter of feet, of any potential co-authors running away from the prospect of a decade-long moratorium on their publishing plans. Chapter 11 will have to suffice for the time being: as an inkling of where I (rather than my much loved "royal we") might next proceed from this book, dressed up and all.

I have in mind an imagined reader of this book, who would begin at the beginning and end at the end. If such a reader exists, s/he would find the text cycles through its subject more than once. The first six chapters (Part I) are a miniature of the remaining thirteen. Thus, Chapter 2 has its larger counterpart in the Case Histories of Part II; Chapter 5 has its counterpart in The Approach of Chapters 10 through 17 (Part III); and the epilogue of Chapter 6 is echoed in Chapters 18 and 19, which form Part IV (the Epilogue). More specifically, there is one turn of the cycle in Chapter 5, another in Chapter 6, and yet another in Part III. Chapter 2 reflects my personal view on some of the major studies of the past in modelling the behaviour of the environment. Naturally, my views may be read as diverging from those expressed by other authors in the case histories of Chapters 7, 8, and 9. There is a less obvious cycle rotating through the sequence of chapters in Part III (The Approach). It has to do with the enduring tension between low-order and high-order models, or between the "small" and the "large" in the vernacular. We begin with the relatively large in Chapter 11 and continue likewise through Chapter 12 until Chapter 13, which is pivotal in dealing with both the large and the small, thereby launching the reader into the smallness of the models in Chapters 14 and 15, and even 16, which nevertheless points us back to the very large indeed, once more, in Chapter 17. And then there is

my idiosyncratic use of the metaphor of branch-node network diagrams, to explain to myself, and to others, how we might conceive of structural change, its component problems, and the potential avenues of approach to their possible solution. Tracking through Chapters 4, 5, 11, and 15, will tell something of this pictorial story.

I owe many people, places, and institutions my gratitude for now having the pleasure of writing this Preface. If the length and style of what follows seems to suggest this monograph has been exhausting, you are correct. It has. And for that reason alone, I wish to grab this opportunity while I have it. It may not come along again.

Let me start by thanking some of the people. First, there are my fellow authors, who truly have had to have a good measure of patience to wait so long for their labours to see the light of day. Some have had to put up with my interfering with their writing. I wanted so very much to give the reader the smoothest possible ride from start to finish. My co-authors still associate with me, this notwithstanding. Then there are those who took part in the Task Force and influenced its direction, though they do not appear as authors. I am indebted to Jerry Ravetz, in particular; and to Tom Barnwell, Lin Brown, Peter Janssen, Olivier Klepper, Todd Rasmussen, Wout Slob, John Taylor, and Howard Wheeler. Jenny Yearwood had everything to do with producing the figures and diagrams for the book; few may come to know those idiosyncratic diagrams - as I have called them - as intimately as she has.

Then there are the places and institutions to which this book owes its existence. I was with the Department of Civil Engineering at Imperial College when the Task Force began. Since 1993, however, I have been with the University of Georgia. The workshops of the Task Force were held at IIASA, while Chapter 15, which in many ways betrays the origins of this monograph (going back to my first time in Cambridge), was completed - appropriately enough - during a visit to the Isaac Newton Institute for Mathematical Sciences (in 1998). I recall I hatched the plan for the Task Force while a Visiting Scientist with the US Environmental Protection Agency (EPA) in Athens and, if one is looking for a certain symmetry, it is fitting that the EPA is currently supporting the case study material of Chapter 11 (with a hint of what is to come) through a grant from its Water and Watersheds Program. To all of these institutions I am deeply indebted for the freedom they have given me to work on the subjects of this monograph.

Most of all, however, this book is about IIASA and the privilege it was for me to spend my defining years there.

A friend of mine, who shall remain nameless, put this in the Preface to his book:

"My wife has asked me not to write one of those embarrassing acknowledgements, saying how impossible this research would have been without her constant encouragement and support; consequently I shall leave this to the reader's imagination."

No such request has been put to me. And in any case, why should I presume to dedicate an edited book in a personal manner, when so many others have invested so much of their effort in its production? But since I doubt I shall edit, let alone write,

many *real* books (the ones without multiple contributing authors), I feel compelled nevertheless to say something now - rather than never - of a strictly personal nature.

Thank you - so very much. It was fine for me; how about you? I think I know the answer.

On a lighter note, for those who know only of my work as though it dealt narrowly with the subject of "sludge" alone - of the sewage-derived sort, that is - welcome to my spare-time hobby!

M.B. Beck
Athens, Georgia
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