Future flooding and coastal erosion risks

Edited by
Colin R. Thorne, Edward P. Evans
and Edmund C. Penning-Rowsell

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Contents

Dedicated to

Elieen, Pia and Jacky

Preface

I am delighted to provide a preface to this publication on the research that lay behind the important and highly influential Foresight Future Flooding Report, published in two volumes in 2004.

Flooding is an issue that affects us all. Over £200 billion worth of assets are at risk around British rivers and coasts and those risks are likely to increase over the next 100 years due to changes in climate and society. In 2002 I therefore commissioned the Foresight Project on Flood and Coastal Defence to address a number of issues surrounding how the flood risk might change and how government and the private sector might best respond to the future challenges. The report that emerged had several key messages for government – flood risk would continue to rise to unacceptable levels; those risks had to be tackled on a broad front and hard choices would have to be made regarding where to direct investment. This work established a new paradigm for futures work and, with the issues of flooding and flood prevention continuing to be in the headlines worldwide, it rightly continues to command widespread interest.

This book is edited by three of the team who undertook the original Foresight study and elaborates on the work undertaken by approximately 60 leading experts in the field, over 20 months between 2002 to 2004. A great deal of work was necessary to produce the evidence base that underpins the Future Flooding Report. However, the published documents contain only brief summaries of the deep descriptions, quantitative analyses and risk models developed and applied in the study. It is therefore most welcome that Thomas Telford have published this monograph as a detailed record of the science and engineering research performed during the Foresight Project on Flood and Coastal Defence.

The UK government fully appreciates the threats posed by flooding and is already supporting cutting-edge techniques and policies for managing flood risk. It is investing heavily in research to develop new and innovative approaches to flood risk management, based on applying holistic principles and achieving sustainable outcomes. However, the government is not complacent and recognises that more needs to be done. At the conclusion of the Foresight Project in 2004, the Minister with responsibility for flood management acknowledged the important role that the results of that research would play in preparing a government-wide strategy for managing the risks of flooding and coastal erosion. In order to capitalise on the knowledge gained during the study, he therefore established a Flood Action Plan, which is on-going. It involves all the relevant branches of government – a fine example of how scientific evidence can be used to inform better policy decisions.

Of course, the benefits of taking a long-term and far-sighted approach to flood risk management in a changing world are not unique to the UK. There has been a great deal of international interest in the Foresight model – the Foresight team have had some very useful discussions with interested parties from the Netherlands, Japan, the USA and India, and there have also been Foresight Future Flooding missions to China and Russia.

Clearly, the work begun with the Foresight Flooding Project has not ended but will continue in the coming years and decades, both in the UK and overseas. The issues covered by the Foresight study are likely to assume increasing importance as we enter an era of climate change, economic growth and societal evolution. This volume will therefore be a valuable resource to scientists, engineers and a wide range of stakeholders who share a common concern for flood risk management and an interest in evidence-based policy making.

Sir David King
Government Chief Scientific Adviser
June 2006

List of contributors

Nigel W. Arnell	Tyndall Centre for Climate Change Research, School of Geography, University of Southampton, Southampton, Hampshire SO17 1BJ
Richard M. Ashley	Pennine Water Group, Department of Civil and Structural Engineering, University of Sheffield, Sheffield S1 3JD
David Ball	Centre for Decision Analysis and Risk Management, Middlesex University, Enfield, London EN3 4SA
Kevin Burgess	Halcrow, Burderop Park, Swindon, Wiltshire SN4 0QD
John Chatterton	John Chatterton Associates, 32 Windermere Road, Moseley, Birmingham B13 9JP
Nick J. Cooper	ABP Marine Environmental Research Ltd, Suite B, Waterside House, Southampton, Hampshire SO14 2AQ Now, Royal Haskoning, Marlborough Crescent, Newcastle upon Tyne NE1 4EE
Sarah E. Cornell	Tyndall Centre for Climate Change Research, Department of Earth Sciences, University of Bristol, Bristol BS8 1RJ
Rob Deakin	Halcrow, Burderop Park, Swindon, Wiltshire SN4 0QD
Edward P. Evans	'Bevis', Great Somerford, Chippenham, Wiltshire SN15 5JA
Colin H. Green	Flood Hazard Research Centre, Middlesex University, Enfield, London EN3 4SA
Jim W. Hall	School of Civil Engineering and Geosciences, University of Newcastle upon Tyne, Newcastle upon Tyne NE1 7RU
Claire Hinton	ABP Marine Environmental Research Ltd, Suite B, Waterside House, Southampton, Hampshire SO14 2AQ
Helen Jay	Halcrow, Burderop Park, Swindon, Wiltshire SN4 0QD
Andrew Jordan	School of Environmental Sciences, University of East Anglia, Norwich, Norfolk NR4 7TJ
Stuart N. Lane	Department of Geography, University of Durham, Durham DH1 3LE
Peter H. von Lany	Halcrow, Burderop Park, Swindon, Wiltshire SN4 0QD
Laure Ledoux	Environmental Futures, 54 Rue Jean Baptiste Esch L1473, Luxembourg

Joe Morris	Institute of Water and Environment, Cranfield University, Silsoe, Bedfordshire MK45 4DT
Robert J. Nicholls	Tyndall Centre for Climate Change Research, School of Civil Engineering and the Environment, University of Southampton, Southampton, Hampshire SO17 1BJ
P. Enda O'Connell	School of Civil Engineering and Geosciences, University of Newcastle upon Tyne, Newcastle upon Tyne NE1 7RU
John Palmer	Halcrow, Burderop Park, Swindon, Wiltshire SN4 OQD
Mike Panzeri	HR Wallingford, Howbery Park, Wallingford, Oxfordshire OX10 8BA
Edmund C. Penning-Rowsell	Flood Hazard Research Centre, Middlesex University, Enfield, London EN3 4SA
Paul F. Quinn	School of Civil Engineering and Geosciences, University of Newcastle upon Tyne, Newcastle upon Tyne NE1 7RU
Nick S. Reynard	Centre for Ecology and Hydrology, Wallingford, Oxfordshire OX10 8BB
Adrian J. Saul	Pennine Water Group, Department of Civil and Structural Engineering, University of Sheffield, Sheffield S1 3JD
Paul B. Sayers	HR Wallingford, Howbery Park, Wallingford, Oxfordshire OX10 8BA
David A. Sear	School of Geography, University of Southampton, Southampton, Hampshire SO17 1BJ
Jonathan D. Simm	HR Wallingford, Howbery Park, Wallingford, Oxfordshire OX10 8BA
Stuart Suter	Halcrow, Burderop Park, Swindon, Wiltshire SN4 0QD
Sue Tapsell	Flood Hazard Research Centre, Middlesex University, Enfield, London EN3 4SA
Colin R. Thorne	School of Geography, University of Nottingham, University Park, Nottingham NG7 2RD
Robert Tinch	Tyndall Centre for Climate Change Research, Schools of Biological and Environmental Sciences, University of East Anglia, Norwich, Norfolk NR4 7TJ
Ian H. Townend	ABP Marine Environmental Research Ltd, Suite B, Waterside House, Southampton, Hampshire SO14 2AQ Now, Hydraulics Research Wallingford Ltd, Howbery Park, Wallingford, Oxfordshire OX10 8BA
Andrew R. Watkinson	Tyndall Centre for Climate Change Research, Schools of Biological and Environmental Sciences, University of East Anglia, Norwich, Norfolk NR4 7TJ
Alan Werritty	Department of Geography, University of Dundee, Dundee DD1 4HN
Howard Wheater	Imperial College London, South Kensington, London SW7 2AZ

7 Human behaviour

David J. Ball and Colin H. Green

Introduction

From a social science perspective our primary interest is in the nature of, and relationships between, individuals and groups, where those relationships notably include power and the roles of each group. It is through these relationships in particular by which we attempt to understand the world.

Thus, from a social science perspective, the Foresight 'Future Flooding' exercise is itself worthy of study as a social experience, and as an expression of the clash of what Braudel (1995) would describe as 'civilisations'; the Foresight process sought to reconcile the two quite different understandings of the world represented by the physical sciences and the social sciences. As a social process, it expressed quite different understandings of such concepts as risk, uncertainty, vulnerability and the future.

Of these two conflicting worldviews, that of the physical sciences dominated and while the determinism was reassuring we nonetheless experienced a degree of discomfort in seeking to fit our understandings into a strong physical science framework. But the challenge laid down by the physical scientists, namely, how can we predict the future and how, consequently, can we choose the future, is one which social scientists should welcome, not least because it is revealing of one's own preconceptions and assumptions.

The approach taken by the Foresight programme on flood risk management and coastal defence was anchored in an essentially deterministic worldview. This is readily apparent from the way in which the process of risk change is seen to result directly from an array of factors, physical, climatological, and even social, termed 'drivers,' whose effects on the socio-environmental system can be modelled to predict consequences.

The power of this type of approach is that change can be simulated, by computer if necessary, predictions made on the state of the future, and if the predictions are not liked, then the effect of hypothetical interventions of various kinds can be simulated by adjusting the model accordingly. Such systems, if they work, are invaluable to decision makers. Of course, it is now recognised that even those processes which are outwardly deterministic are not entirely certain or predictable, as chaos theory and even experience demonstrate. For example, the Pioneer 10 spacecraft which was launched in the 1970s and is now far beyond the orbit of Pluto, has steadily deviated by some 400 000 km from its predicted course. No one has so far been able to explain this curious behaviour (Anon., 2005). Hence, even in the presence of a seemingly deterministic system, uncertainties are present and estimating these constitutes an important element of any study including the Foresight one.

However, while the above classical worldview, which some call the Rational Action Worldview (or Paradigm, hence *RAP*) (Jaeger *et al.*, 2001), is more or less a taken-for-granted of Western thought and provides the foundation for a wide variety of institutions – markets, governments, international security, industrial management, healthcare – it is not the only conceivable theoretical approach. Indeed, behavioural and social science usually has more modest, or at least different, ambitions, recognising that human behaviour is a rather complex business and subject to influence by a vast array of factors, only some of which are amenable to deterministic-style forecasting (Eiser, 2004).

Thus, the world is taken to exist 'out there' whereas the social science approach both tends to see the world as being constructed and as being constructed through human interaction. From this viewpoint, floods are not simply extreme physical events inflicting themselves upon innocent and unsuspecting people, but highly interactive processes that involve inputs from both nature and society. As such, the very definition of a 'flood' becomes problematic. Within this framing, such complex systems are arguably more readily analysed by recourse to alternative sociological models, some of which are located in Fig. 7.1, but these could not be expected to produce the kinds of outputs demanded by the Foresight methodology. This figure can be contrasted to the models presented elsewhere in this volume.

For this reason, while bearing in mind the inevitable shortcomings of any model, an attempt was made to fashion an approach which would lend itself to Foresight as originally envisaged by its designers. In particular, in each of the four scenarios adopted in the Foresight study, the social scientist is inclined to the view that each then determines how floods will be understood, how decisions will be made, and how the flood risk will be managed. Thus, concepts such as 'vulnerability' and

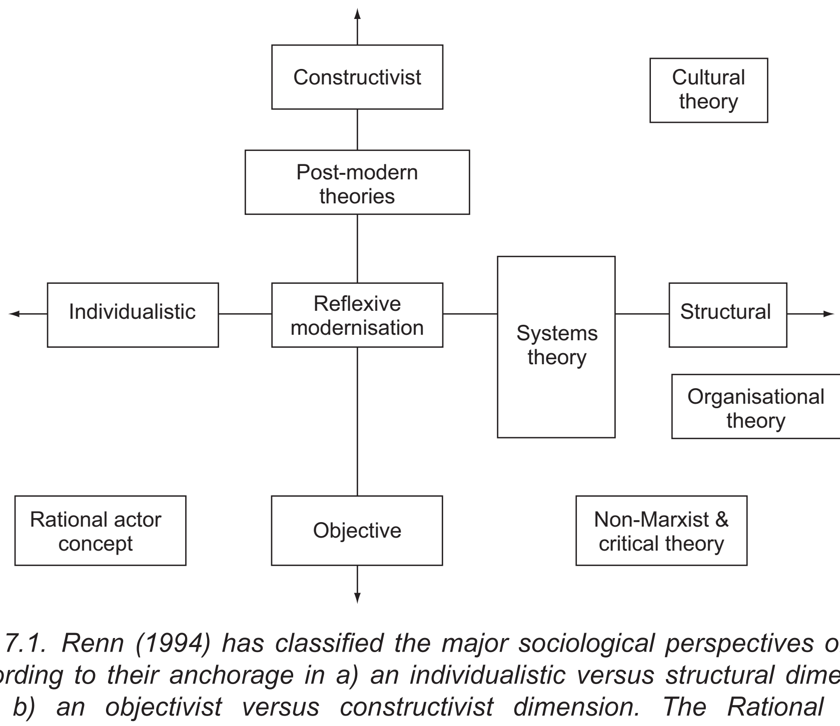

Fig. 7.1. Renn (1994) has classified the major sociological perspectives on risk according to their anchorage in a) an individualistic versus structural dimension and b) an objectivist versus constructivist dimension. The Rational Actor Paradigm of the Foresight programme inhabits the bottom left (individualistic-objective) quadrant of this classification

'risk' will be defined uniquely by each society in different ways. Rather than it being possible to define such terms as vulnerability, risk and uncertainty in ontological terms, they must then be understood epistemologically.

So, for example, a probability is a claim as to what we can know and how or why we can know it, and a claim which can properly be expressed in terms consistent with Kolmogorov's mathematics of probability. In that there are competing theories of probability, there are different claims as to what we can know and the basis upon which we can know it. In short, if we could determine which form of society would exist, then there would be no choices left to make except in that each society would be faced with resolving its own internal contradictions. Similarly, the distinction between society and technology should be regarded a false dichotomy.

The human behaviour drivers

With the above important caveat in mind, human behaviour was deemed for the purposes of this study to comprise two drivers, denoted as 'stakeholder behaviour' and 'public preferences' (attitudes and expectations). These were defined as follows.

Stakeholder behaviour

Stakeholders include any group, cohesive or dispersed, with a direct or indirect interest or influence on flood risk and its management. The public is clearly an important stakeholder but is not seen as having a single opinion. Stakeholder behaviour, expert or lay, is seen as motivated by numerous factors besides risk. These include beliefs, values, ways of working, and perceived fairness of decision processes.

Public attitudes and expectations

In line with cultural theory (Douglas, 1985; Schwarz and Thompson, 1990) the public is not regarded as a single entity with one position on matters related to flood risk. Attitudes and expectations are seen to be determined by multiple factors including actual and perceived risk, equity concerns, issues of process (i.e. the means and manner by which risk management decisions are made) and world view.

It is self-evident that these drivers are closely inter-related. The 'public' has been singled out as one stakeholder group in terms of its preferences, and is clearly one contributor to 'stakeholder behaviour' overall, which will be driven partly by public preferences. Social impacts (see Chapter 8) will clearly influence preferences, especially those of the public, and hence behaviour. Other stakeholder groups – farming, insurance, etc. – will have their own strong preferences too. Because the ways in which the livelihoods of these latter communities are linked with flood risk management are better defined, it may be expected, though is not guaranteed, that their preferences will be less diverse within their own group than those of the public at large.

This framing positions people and groups as though they were physical phenomena to be taken into account in decision making. But people differ from physical phenomena in two key aspects. First, people are the decision makers; it is out of the cognitions and relationships between individuals and groups that decisions will emerge. Second, if research is about learning, when the researcher seeks to learn about the physical world the physical world does not learn anything about the researcher. But when the researcher seeks to learn about the social world, the people studied are changed to a greater or lesser extent by the experience.

Hence, the main impact of these drivers upon flood risk is likely to be by way of their influence upon other actors, such as regulators. Thus there will be strong feedback loops, e.g. between stakeholder behaviour and regulation and other drivers. Regulators will be tuned in to stakeholder behaviour and public expectations in deciding on risk management interventions. But stakeholder behaviour and public expectations will in turn be influenced by the ways in which regulators make choices, as well as actual choices made. In turn, the roles of individuals and groups, and the inter-relations between them, are both defined by and define the society and can be taken to reflect the worldview of that society.

The concept of 'regulators' is itself predicated upon the existence of a particular form of society, being most closely associated with the form of society defined as 'national enterprise'. In the world markets model, with its emphasis upon both the market and individualism, and a desire to minimise the scope of government, the emphasis would be on the use of prices and formal regulation would be minimised. Under the purist form of cultural theory (Adams, 1995), once the nature of the society is determined, there are no choices left to make.

Overall feedback is thus strong, complicated, and perhaps even unfathomable. Furthermore, the stakeholder groups that have the most influence upon regulatory decisions, and who are therefore most likely to feel enfranchised and therefore satisfied, will vary from one Foresight scenario to another, though not in a simple or predictable way. This is because it is as much the 'fine structure' of the scenarios which will be important as their broad brush nature. Self-interest, beliefs, (dis-) satisfaction and ways of working will provide the energy to drive the stakeholder behaviour-regulation cycle, and this energy will in turn be topped up by, among other things, that stakeholder group denoted as 'the public' in the driver listing. 'Public preferences' will in turn be fuelled as much if not more by perception of the regulatory process than the actual risk, and this in its turn will be fed by other drivers such as 'institutions', 'science, engineering and technology' and 'risk compensation and insurance' through their attitudes to the public and the public's then view of their rights to involvement and say in regulatory choice.

In view of the large number of stakeholders, there are inevitably other kinds of stakeholder behaviour which will impinge on other drivers. Agricultural practices, for example, could clearly have a big impact on runoff. Similarly, the insurance industry can be regarded as a separate player or the actions of the insurance industry can be understood in relation to the actions of other players (Green and Penning-Rowsell, 2004). Notably, flooding is seen as uninsurable risk except through some form of public–private partnership (Gaschen *et al*., 1998).

Likewise, the behaviour of the insurance sector – an essentially free market – will have an effect on what is demanded of flood risk managers. Already there is speculation that the insurance sector, faced with rising flood-related claims, might opt for novel risk-transfer or hedging instruments such as catastrophe bonds which transfer the risks to global capital markets (Linnerooth-Bayer and Amendola, 2003).

Mitchell (2003) gives the following salutary example of the complexity of stakeholder behavioural impacts, this in the context of the selection of port locations for industries:

> . . . the burgeoning emphasis on port locations for industries is facilitated by changes in a complex web of factors that includes, among other things, marine transportation, navigation, and dredging technologies; shipboard labor practices; vessel registration and regulation rules; the acquisition of new electronic skills by mariners; the profitability of the shipping industry; and the state of competition between different transportation modes. In turn these components are embedded in a dominant consumer-oriented economy that is made possible by fluid supplies of investment capital and preferences for entrepreneurial risk-taking, coupled with precisely segmented and targeted marketing strategies that rely on vast quantities of timely and comprehensive information about consumer tastes and surplus income.

Index

Page numbers in italics refer to diagrams and illustrations. The abbreviation WM/NE/LS/GS refers to the world markets, national enterprise, local stewardship and global sustainability scenarios of the Foresight Future Flooding Project.