THE CHARTERED
INSURANCE INSTITUTE

RESEARCH REPORT

Climate change and insurance

Contents

BACKGROUND TO THE REPORT

In 1994, the Society of Fellows of the Chartered Insurance Institute published a research report entitled 'The impact of changing weather patterns on property insurance', which was written by a volunteer group of members. The report identified a number of issues and proposed a range of actions to deal with them. It also proposed that the subject should be revisited in five years' time. This report is the response to that recommendation.

As with the previous report, a call for volunteers was made and a group was established under the leadership of the previous chairman, with further members co-opted to ensure the necessary breadth of expertise, particularly in meteorological science. The group met four times between April and November 2000 to plan the research and review progress. A number of experts were interviewed face to face or by telephone. The group also scanned the literature and participated in other climate-related activities.

A questionnaire very similar to one used in the 1994 study was distributed to all members of the CII to establish the current opinions held by insurance practitioners. The replies were valuable in considering whether the industry's perceptions had changed, and also helped to direct the proposals for action in the current study.

To examine all the implications of climate change for the insurance market would be a gigantic exercise, well beyond the available resources. To achieve something meaningful, the group focused primarily on the UK general insurance (ie, property/casualty) market, with only limited consideration of non-UK developments.

The current study is deeper and wider than the previous study as more emphasis has been placed on some key customer sectors (tourism, construction, utilities, property) to explore the implications of climate change on them in more detail. Secondly the scope has also been widened beyond simply property damage, as there are significant issues for insurers to consider in the areas of environmental and investment policy.

To make the report accessible to a wide audience, the minimum of technical language has been used. As far as possible in this little-researched field, useful references to other research have been identified and are listed in the bibliography.

Following the1990 storms the UK had a relatively kind decade, which led to some relaxation of attention, but the extreme weather in autumn 2000 has broken this spell. Many other countries too have experienced record losses recently, often without the support of a modern insurance system. There is still much to be done to address the issues thoroughly, and we hope that this study will assist others faced with that task.

The CII, as the leading professional body for the insurance sector, provides a range of qualifications and examinations as well as training programmes. It also has a 74-strong network of local institutes that support and promote its qualifications, and links with affiliated institutes globally. With over 60,000 members it is ideally placed to facilitate the research that has gone into this report.

The Society of Fellows was set up in 1986 and is an integral part of the CII. It represents the interests of all chartered titleholders—those holding a Chartered Insurer or Chartered Insurance Practitioner title, who will also be Associates (ACII) or Fellows (FCII) of the CII.

TERMS OF REFERENCE

The group is asked to pay particular attention to the management issues that face the insurance industry arising from climate change (rather than to examine detailed procedural issues).

Consideration should include indirect impacts (eg, investment and environmental policy) as well as direct ones (eg, storm damage). The international repercussions for the UK insurance industry should be borne in mind. The study should exclude the marine, life and pensions markets, focusing on general (property/casualty) insurance.

The group should adopt as its starting point the 1994 CII Society of Fellows' study 'The impact of changing weather patterns on property insurance', together with subsequent official publications on climate change by HM Government and the Intergovernmental Panel on Climate Change (IPCC), and concentrate on how managements should respond. This should include views on

- criteria for business acceptability/acceptance
- pricing—measurement of future hazard frequency/severity
- risk differentiation—basis of assessment
- co-operation between insurers
- reinsurance/other means of spreading risk
- market capacity —continued availability
- loss prevention/reduction—the roles of insurers, government (eg, flood defences), insured, planners, designers/architects
- education
- repercussions for other industries, the public and the authorities arising from the insurance industry's response
- corporate environmental policy in the light of climate change
- guidelines for investment practitioners
- institutional arrangements to improve the speed and efficiency of adaptation to climate change.

GROUP MEMBERS

Throughout the report the term 'the group' refers to the opinions of the following research group. The membership of the group comprised:

Andrew Dlugolecki, BSc, MA, PhD, FCII, FRMetS

Dr Andrew Dlugolecki joined General Accident as a statistician in 1973. He soon realised that pricing decisions required consideration of the impact of weather on claims! He has held a variety of senior management positions at General Accident and through subsequent mergers in CGU and CGNU before retiring in December 2000.

Since the late 1980s he has become one of the leading experts on insurance and climate change, and has served on major official UK and UN (IPCC) projects dealing with the issue. He chaired the previous and current CII Society of Fellows research groups on the topic, and is a member of the Board of the Tyndall Centre for Climate Change Impacts Research.

Dr Andrew Dlugolecki
Earlybank
17 Craigie Place
Perth, Scotland PH2 0BB
e-mail: andlug@hotmail.com

Maureen Agnew, PhD

Dr Maureen Agnew has been a senior research associate employed in the School of Environmental Sciences, University of East Anglia, Norwich, since 1996. Her main interests are in the area of climate variability and change with particular reference to climate impacts on natural, social and economic systems. She has developed a broad portfolio of research publications in the impact areas of retailing, tourism, insurance and health.

Dr Maureen Agnew
Climatic Research Unit
University of East Anglia
Norwich, Norfolk NR4 7TJ
Tel: 01509 260799/223012
e-mail: m.agnew@uea.ac.uk

Mike Cooper

Mike Cooper has over 30 years' experience in the insurance industry and during that time has worked in the UK and the USA. He has held a number of senior underwriting and management roles with major international insurers, most recently as group underwriting manager—general insurance development, for CGU. He has considerable experience of global insurance arrangements for multinational companies.

Mike P. Cooper
CGNU
21st Floor, St Helens
1 Undershaft
London EC3P 3DQ

David Crichton, MA, FCII Chartered Insurance Practitioner

Professor David Crichton is an economist with some 28 years' experience in the insurance industry. He is environmental consultant to the Association of British Insurers, and a member of the Natural Environment Research Council's Earth Observation Expert Group. He is an honorary visiting professor at Middlesex University Flood Hazard Research Centre, and an honorary research fellow at the University of Dundee. He is a member of the Research Sub-committee of the Building Standards Advisory Council in Scotland, and represents the ABI on Scottish Flood Appraisal Groups and on the United Nations' UK–ISDR initiative. Professor Crichton was asked to give written and oral evidence on the insurance impacts of climate change to the House of Commons Select Committee on Climate Change in March 1999.

Professor David Crichton
1 Quarryknowe Crescent
Inchture
Perthshire PH14 9RH
Tel/fax 01828 686 493
david@crichton.sol.co.uk

Neil Kelly, FCII, FCILA, FUEDI-ELAE, Chartered Insurance Practitioner

Neil Kelly has been a chartered loss adjuster since 1960, with considerable 'hands on' experience of investigating and mitigating losses attributable to man-made and natural disasters. He has written a variety of articles and other works on weather hazards and catastrophe planning.

Neil is a former CEO of Thomas Howell Group (UK) and a past president of the Chartered Institute of Loss

Adjusters. He chaired a working party examining insurers' considerations for the Arson Prevention Bureau in 1991 and recently assisted the Home Office arson scoping study which led to the formation of the National Arson Control Forum.

Neil Kelly
Highview
22A Tredcroft Road
Hove BN3 6UG
Tel: 01273 553807

Thomas Loster, Dip Geog

Thomas Loster is a geographer and a member of the Geoscience Research Group of the Munich Reinsurance Company. He is in charge of weather perils and climate change issues and is also responsible for the statistical analyses of worldwide natural catastrophes and trend analyses which are published in an annual review on natural catastrophes.

Thomas Loster
Head of Water Perils and Climate Section
Geohazards Department
Research & Development
Munich Re
Koeniginstrasse 107
Munich 80791
Federal Republic of Germany
Tel: +49 89 3891 5287
Fax: +49 89 3891 75287
e-mail: tloster@munichre.com

Richard Radevsky, BSc, CEng, FICE, MCIWEM, FCIArb

Richard Radevsky originally qualified as a civil engineer and spent several years investigating failures and providing technical advice to the insurance industry and legal profession. Twelve years ago he became a founding director of Resolve International Loss Adjusters and Risk Consultants. Since then he has been involved in technical loss adjusting, risk consultancy, management consultancy and risk research.

He is a regular contributor to the insurance press and conferences on a variety of technical risk subjects including subsidence insurance. In 1999 he undertook a research project for ABI which resulted in the publication of 'Subsidence—a global perspective', General Insurance Research Report no.1 He is also a contributing author to the IPCC Third Assessment Report.

Richard Radevsky
Resolve International
The Ivory House
World Trade Centre
London E1W 1BL
Tel: 020 7702 1095
Fax: 020 7702 3987
e-mail: RARadevsky@cs.com
website: www.resolveglobal.com

Julian Salt, PhD

Dr Julian Salt studied chemistry at Imperial College, London. He joined Shell Research in Amsterdam in 1986 and studied catalyst systems for petrochemical applications, returning to Imperial College in 1990 to study an MSc in Environmental Technology. This was followed by two postdoctoral studies on the verification implications of the UN Framework Convention on Climate Change. He has tracked the political discussions at the UN since 1992 from Rio to Kyoto and beyond. He is the official observer for the Loss Prevention Council to the COP discussions. Presently, he is a project manager on natural perils for the LPC Centre for Risk Sciences at the Building Research Establishment, and has lectured widely on the implications of climate change for the insurance industry.

Julian Salt
LPC Centre for Risk Sciences
Building Research Centre
Garston
Watford
WD2 7JR
Tel: 01923 664930
Fax: 01923 664994
e-mail: saltj@bre.co.uk

David Viner, PhD

Dr David Viner is a senior research scientist at the world-renowned Climatic Research Unit, where he has been since 1991. He is the scientist responsible for the UK Department of Environment, Transport and the Regions' Climate Impacts LINK Project and a number of other projects funded from various sources. Dr Viner has considerable expertise in the construction and provision of climate change scenarios and

accompanying technical and scientific supporting advice. He also has experience in studying the effects and impacts of climate change, for example on the tourism industry. Dr Viner has presented numerous papers at international conferences, written and contributed to many scientific reports and papers and given many television, radio and press interviews.

Dr David Viner
Climatic Research Unit
University of East Anglia
Norwich NR4 7TJ
Tel: +44 (0)1603 592089
e-mail: d.viner@uea.ac.uk
websites: www.cru.uea.ac.uk/link/dave.html
www.cru.uea.ac.uk/tourism

John Walden, FCII, FCIArb
Chartered Insurance Practitioner

In 1953, John Walden joined Sedgwick Collins and, after early experience on large industrial and engineering risks, joined the international special risks construction team. In 1972, he left to establish the Lowndes Lambert Group Construction Division, becoming managing director. In 1980, as a founder director, he assumed a similar role with John Plumer & Partners, now part of the Arthur J Gallagher Group. Since 1990, he has worked as an independent consultant. A past CII and CIS prizewinner, he has acquired considerable international experience of major civil engineering, oil, energy and water-related projects. He was a member of Advanced Study Group 208 of the Insurance Institute of London of the CII (construction) which republished its guidance in 1999.

John Walden
'Fallen Oaks'
10 Baymans Wood
Shenfield
Brentwood
Essex CM15 8BT

Tim Walker, MSc

Tim Walker joined CGNU as a risk analyst in the reinsurance department. Previously he obtained degrees in environmental sciences from King's College, London and the University of East Anglia. He specialises in insurance risk quantification, natural catastrophe modelling, and portfolio exposure analysis. His main research interests include environmental risk management, risk perception/communication, and new methods of quantitative risk assessment.

Tim Walker
Group Reinsurance
CGNU
21st Floor, St Helens
1 Undershaft
London EC3P 3DQ
e-mail: tim_walker@cgnu.net

ACKNOWLEDGEMENTS

The group expresses its thanks to

- the CII Society of Fellows for its support during the project and helping us to deliver;
- members of the CII who responded to the survey on changing weather patterns;
- CGNU for help with the survey of the CII members;
- the reviewers who gave an invaluable and very speedy objective appraisal of the work:
  —Business in the Environment
  —Gordon Fox, Swiss Re UK
  —Vanessa Holder, *The Financial Times*
  —Peter Ledger, Steve Harvey, David Reynolds, Risk Solutions, Willis
  —Chris Mounsey, Association of British Insurers
  —Nick Nuttall, *The Times*
  —Professor John Page, Emeritus Professor, University of Manchester Institute of Science & Technology
  —Dr Allen Perry, Department of Geography, University of Swansea
  —Dr Jean Palutikof, Climatic Research Unit, University of East Anglia
  —Tim Radford, *The Guardian*
  —TessaTennant
  —Graham Dodd, Travel Research International

They are not of course responsible for the final content, which is the responsibility of the group alone.

- our own organisations for being tolerant of the time used in tackling this complicated subject;
- all those who kindly gave interviews and assisted in other ways;
- the Hadley Centre for data from its climate experiments provided through the Climate Impacts LINK Project (UK DETR EPG 1/1/68). Many thanks to Mick Kelly for his help and to the other members of the Climatic Research Unit for their help and assistance;
- J. T. Walden for permitting the reproduction and inclusion of Figures 5.1, 5.2, 5.3, 5.5 and Table 5.1;
- special thanks are due to Julie Spendlove at CGNU for her attention to detail in coping, particularly with scripts and figures presented in a variety of tidiness and complexity, and keeping track of the various drafts as the final product evolved.

EXECUTIVE SUMMARY

The consensus of scientific opinion is that man-made climate change is happening. However, for insurers the future behaviour of extreme weather events is critical, and science cannot provide much guidance there yet. Losses from extreme weather have continued to escalate globally, with record insurance events in several countries. In large measure this increase is due to non-meteorological factors, in particular burgeoning property values in hazardous areas. For UK insurers the position was alleviated because the property exposure in the UK was relatively stable, and there were no major windstorm catastrophes in the UK after 1990, or the USA after 1992.

The catastrophes of the early 1990s galvanised the UK and US insurance markets into various measures aimed at improving their management of extreme event exposures, prompted and supported by the international reinsurance and modelling communities, but there are still areas for improvement, and most other markets have not developed the equivalent expertise. Interestingly, the repeat survey of CII members suggests that the profession is now less concerned that climate change will prove to be disastrous for insurers, but more aware that it will affect their market in a variety of ways, and increasingly as time passes.

While windstorms and droughts can cause tremendous damage, the major extreme event hazard for many countries, including the UK, still appears to be flood. The widespread UK floods of November 2000 were a timely reminder of the potential insurance exposure. Overseas the situation is compounded for the victims by the general absence of commercial flood insurance. Data suggests that even in the developed world roughly 50% of economic losses from extreme events are borne by the victims, and that this figure is virtually 100% for less-developed countries. Furthermore, 'normal' weather variability is one of the key influences on corporate profits in many industries, but conventional insurance products do not pick up such 'trade' risks, just mainly the physical damage to property assets.

From an initial review of four market sectors (tourism, construction, utilities and property), it is clear that climate change will alter these industries significantly in terms of demand and supply, and industries further up the supply chain, like insurance, would be well-advised to start considering what that could mean for them.

Pressures will arise for insurers in the areas of environmental policy and asset management also, as governments, investors and other stakeholders begin to react to concerns about fossil fuel consumption. With their control of massive funds, insurers are exposed to such influences, and can also play a part in determining the speed of change. Very few insurers have taken this on board yet.

What remains to be done about climate change? Apart from flood risk, the major areas for action seem likely to be outside the UK property insurance market. As the industry consolidates, individual companies now control more resources, and the gradual withdrawal of governments from many areas of funding means that business will need to partner, or even take the lead in, government initiatives to deal with climate change. At the international level, too, business leaders will need to be more proactive, because much of the political debate is sterile.

In the early 1990s climate change was typically seen as a threat to the insurance industry. While the exposures are real and growing, given proper attention to analysis of the issues, there will be many opportunities to develop new financial and risk-related products and services to assist society to adapt.

Section 1—Introduction
CHAPTER 1: INTRODUCTION

Andrew Dlugolecki

Interaction between insurance and climate change

Climate change will interfere with the insurance industry's operations in three fields—underwriting, investment and environmental policy.

Figure 1.1 shows that climate change will potentially affect the core activities of insurance companies. Risk transfer will be touched through changes in the risk profiles of business underwritten and serviced. Asset management will be impacted though the more insidious effects of climate change. Climate change will also progressively affect the economics of entire industries and regions, through changes in resource availability and even the viability of settlements themselves.

Nor will these effects be restricted to purely general (non-life) insurance. There will be changes in human mortality and morbidity, but probably not in the populations which benefit from life and pensions services; it is rather the investments in that branch of insurance which will be vulnerable, possibly more so than in non-life, given the long-term nature of commitments.

In addition, all businesses and individuals will have to adapt their behaviour, particularly energy-related, as the drive to limit greenhouse gas emissions intensifies.

To examine all the implications of climate change for the insurance market would be a gigantic exercise, well beyond the available resources. To achieve something meaningful, the study group focused primarily on the UK general insurance (ie, property/casualty) market, with only limited consideration of overseas developments and with no consideration of the life/pensions branches. The current study is deeper and wider than the previous study because more emphasis has been placed on some key customer sectors (tourism, construction, utilities, property) to explore the implications in more detail; and secondly because the scope has been widened beyond simply property damage, as there are significant issues for insurers to consider in the areas of environmental and investment policy.

A full-time team might wish to adopt the procedures recommended in Carter et al (1992), integrating climate impact and adaptation assessments (see Figure 1.2). What has been attempted in the current study is a very high-level approach, which at least raises some of the key issues in terms of energy-consumption drivers, customer behaviour, and international interaction in a qualitative way. It is hoped that others will take up the challenge of extending the work into a rigorous analysis.

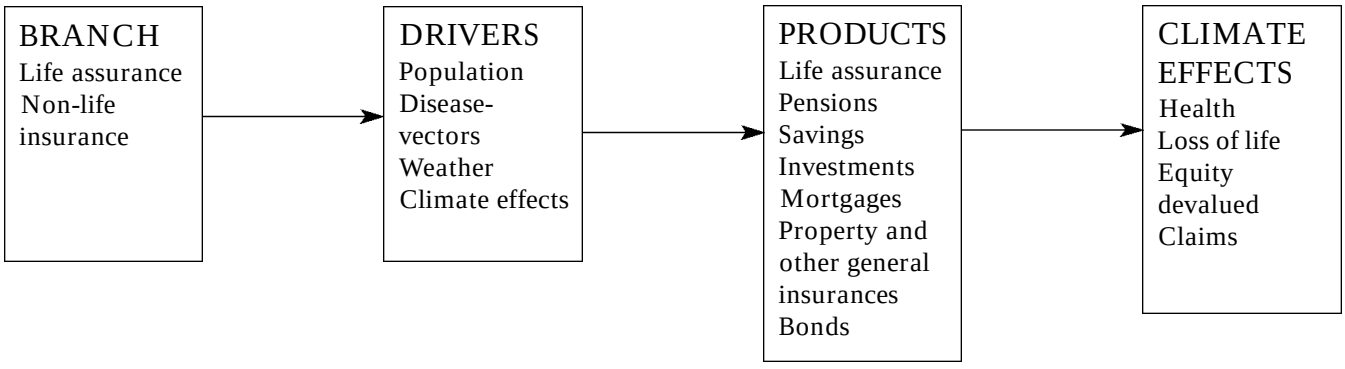


Figure 1.1. Life and non-life activities and climate change

Structure of the report

Chapter 2 creates a bridge to the previous report in 1994. It reviews what progress, if any, has been made on the various issues which were identified, and what major changes have occurred in the business and insurance world since then. A questionnaire very similar to one used in the 1994 study was distributed to all members of the CII to establish the current opinions held by insurance practitioners. The replies were valuable in considering whether the industry's perceptions had changed and also helped to direct the proposals for action in the current study.

Chapter 3 deals with the scientific aspects of climate change and provides an authoritative view of possible climate future in the UK, so that the implications for the insurance industry and its customers can be assessed with the best available information.

The study group decided to focus on four key sectors of interest to insurers, because of their economic importance to the UK, and their sensitivity to climatic factors: tourism, construction, utilities and property. These are dealt with sequentially in chapters 4, 5, 6 and 7. Each of these sectors is very large and so the authors deliberately selected particular aspects to demonstrate the process of integrated impact analysis, rather than conduct a comprehensive study.

For section IV, a second survey was conducted of insurance companies themselves, to find out about their investment and environmental policies, and how they took account of climate change in those areas. Chapter 8 considers investment or asset management, and explores where best practice currently lies. Chapter 9 looks at environmental policy, and combines the current survey with other information, since there is very little formal information in this field.

Chapter 10 then steps back to consider whether the traditional individualistic underwriting approach will be appropriate in future, and suggests some alternative approaches for insurers which might be more fruitful, since change can be seen as an opportunity, as well as a threat. Some actions will need to be undertaken collectively, and here the insurance industry can be a very powerful force for change if it uses its financial muscle.

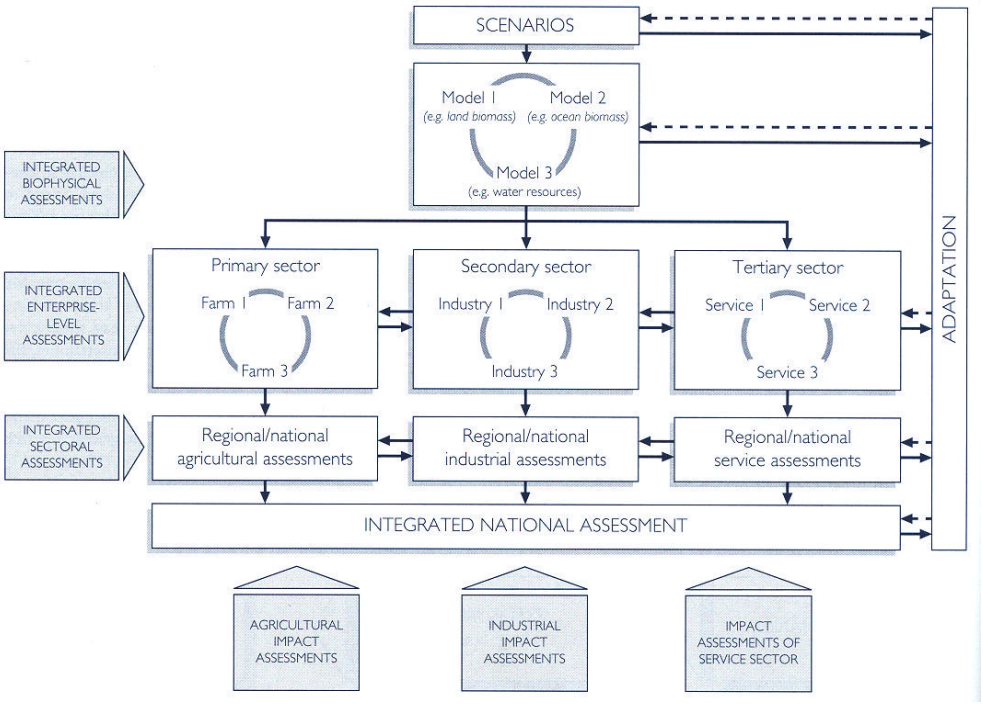


Figure 1.2. An integrated approach to climate impact and adaptation assessment (Carter et al, 1994)

Finally, chapter 11 draws on the findings of previous chapters to assemble an agenda for action by the various stakeholders in the insurance market.

Use of the findings

To make the report accessible to a wide audience, the minimum of technical language has been used. As far as possible in this little-researched field, useful references to other research have been identified and listed in the bibliography.

The previous report was well-received in the insurance industry, and although it perhaps helped to trigger the medium-term strategy adopted by the Association of British Insurers (ABI) on natural hazards, not enough use was made of the platform, partly because the CII itself has limited resources. One of the challenges will be to ensure that more widespread research and implementation occurs this time.

CHAPTER 2: DEVELOPMENTS SINCE 1994

Tim Walker

This chapter sets the scene for the more detailed study in later chapters, and provides background information which might be unfamiliar to newcomers, or which could have been overlooked by insurance professionals. First it reviews progress on the main recommendations of the previous SoF report in 1994. Under 'Recent weather events' it reviews recent experience in weather losses as these help to condition attitudes to climate change, which is considered next. The section is concerned with developments in risk management techniques and related research. Finally, the chapter discusses changes in the broader business environment.

Review of progress on recommendations of the previous SoF working party

The 1994 working party made a number of recommendations for action by various bodies. The most active group has been the ABI, which has prepared and launched a comprehensive strategy to tackle natural hazards based on independent research. A brief summary follows. Details are given in chapter 7.

ABI completed projects

- **Subsidence—experience of other countries**
  Damage to buildings from soil movement has cost the UK insurance industry £3bn in claims during the 1990s. Several other countries have evolved more effective ways of coping with this problem, including better foundations and self-insurance for minor damage.
- **Assessment of flood risk on UK rivers**
  In 1999, the ABI commissioned ENTEC, an environmental consultancy company, to carry out an assessment of the flood risk from British rivers. Its report was published to ABI members in 2000 (Research report 10—Inland flooding risk, 2000), and indicates that there is a considerably higher risk than previously realised, with a maximum insured loss of as much as £2bn from a single event.
- **Insurance and the planning process**
  The ABI assisted the Scottish Office (now the Scottish Executive) in drawing up new guidelines for local authority planners (NPPG 7). These guidelines recommend that planners set up flood appraisal groups involving a representative from the insurance industry. Such groups now cover most of the population of Scotland and several new ones are in the pipeline. English and Welsh local authorities now have Planning policy guideline 25—development and flood risk.
- **UK national flood claims database**
  With ABI assistance, 25 leading insurers agreed to contribute flood claims data to a new national database of flood claims. The results of the first analysis, covering all major floods from 1993 to 1998, were published in 1999. It is hoped to be able to extend this to cover windstorm in the future, but the feasibility of this might depend on a market agreement to capture data in a consistent way.
- **Further assessments of coastal flood risks**
  Halcrow, the consulting engineers which had produced the original assessment of coastal flood risk for the ABI, was commissioned to produce a further range of studies, including the identification of 'weak links' in sea defences and the hazards of flood in the Thames upstream of the Thames Barrier.
- **Windstorm vulnerability and climate change**
  Through the Loss Prevention Council, the ABI was involved in a research project on windstorm claims to assess which types of buildings were most vulnerable to windstorm damage. The results are of significance to those involved with building standards, but a bigger sample and more research is needed.

The Chartered Insurance Institute

- Systematic progress on education on natural hazards is slow, with contemporary updates mainly covered through the various CII periodicals. As consensus on climate change emerges and leads to a better understanding of the effects on insurance, this will feed through to CII texts and exam syllabuses through its regular review processes.
- This study is in fulfilment of the recommendation to review progress after five years.

Authorities

The Environment Agency (EA) was created in 1996 by the Environment Act 1995 to supervise all matters

relating to flood defence. It has taken some steps to communicate flood disaster plans openly, with measures such as leaflet deliveries in vulnerable areas, a flood warning helpline and a strategic document for outlining its flood defence policies ('Policy and practice for the protection of floodplains'). It remains concerned about the political ramifications of possible housing 'blight' caused by actively delineating flood areas. The key issue it must resolve is how to stop more development in vulnerable areas such as floodplains without damaging existing house values.

English and Welsh local authorities have a new Planning policy guidance note (PPG 25) entitled 'Development and flood risk'. This document recommends that the EA should take the leading role in advising on flood risk, that the precautionary principle should be applied to flood risk and that planning policies and decisions should recognise that flood risk management should be applied on a whole catchment basis. Three categories of risk have been identified:

- *Strategic sites*
  Facilities which must continue to function in times of flood (hospitals, emergency services, etc.).
- *Residential development*
  Facilities where the public sector is prepared to provide a high standard of flood defences for existing development.
- *Commercial and industrial*
  Development where the owners would be responsible for their own flood defences or where flood was considered less important than site-specific locations.

The insurance industry will need to follow this development closely to confirm that it is as effective as its Scottish equivalent.

Recent weather events

Global position

The period 1994 to 1998 was very quiet globally for weather-related insurance losses (see Figure 2.1), though there were some surprises, both insured and uninsured—the Canadian ice-storm, Indonesian haze, Auckland power crisis. The year 1999 proved to be very busy, with eleven serious weather events contributing to the second highest insured losses ever. Particular storms in the 1994–99 period include Hurricanes Fran, Luis, Floyd and Georges, Typhoons Vicki and Bart, and

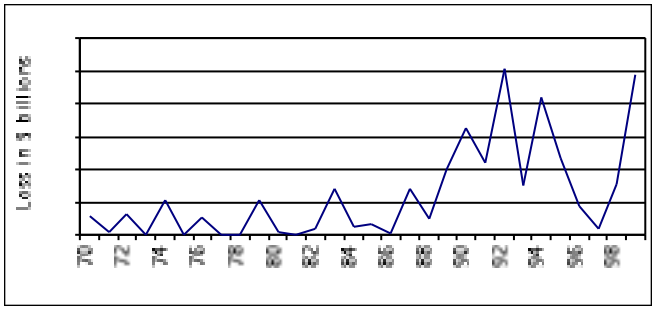


Figure 2.1. Global insured losses 1970–1999

winter storms Anatol, Lothar and Martin. Figure 2.2 indicates that the lull in insured loss between 1994 and 1998 was largely a matter of chance; the number of catastrophes did not fall, but their locations were less costly, and in fact the upward trend resumed in 1999 on both bases.

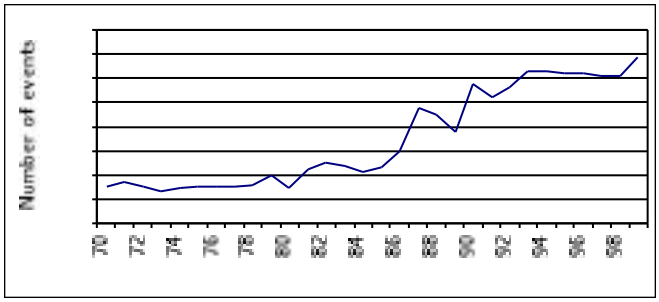


Figure 2.2. Number of natural catastrophes 1970–1999

UK situation

In UK non-life, underwriting losses have been increasing dramatically since the last report.

Net written premiums have been increasing steadily, but not fast enough to match the increased rate of losses (see Table 2.1). This has led to the general unpopularity of non-life companies with investment analysts, and under-performance and poor market capitalisation across the sector.

The lack of recent large weather insurance losses in the UK may well have contributed to the relatively superficial scrutiny in this area. Table 2.2 shows weather claims this decade (excluding subsidence).

The extremely wet and stormy autumn of 2000 has been costly in insured and uninsured losses. Although it should not reach the levels seen in 1987 or 1990, it is a timely reminder of our vulnerability to extreme events.

Table 2.1. UK general insurance profitability 1993–1998 (£m.)

Year	*1993*	*1994*	*1995*	*1996*	*1997*	*1998*
NWP	28,913	29,415	30,211	30,215	30,445	31,713
U/W profit	-1140	423	- 488	-1546	-1709	-3978

Figures are motor and non-motor, UK and overseas business
Source: Association of British Insurers

Table 2.2. Insured losses—UK weather (excluding subsidence)

Years	*1990*	*1991*	*1992*	*1993*	*1994*	*1995*	*1996*	*1997*	*1998*	*1999*
Claims (£m)	2140	707	425	559	387	361	726	607	1002	861

Source: Association of British Insurers

It could serve to help insurers in their efforts to curb the almost reckless development of land which is vulnerable to flooding.

Attitudes to climate change

Coping with climate change is largely a matter of mobilising individuals. Behaviour is dependent on a number of factors including belief, peer pressure, and coincidental priorities. The research carried out here suggests that there is still a long way to go, judging by the priorities and actions which individuals are assigning to the issue.

CII members

A survey of CII members was carried out using a questionnaire which was almost identical to that used in the 1994 report. Appendix 2.1 contains the 2000 questionnaire. The full statistical analysis of the 2000 survey compared with the 1994 survey are shown in appendix 2.2. Of the 896 responses received in 2000, 72% were received from UK-based individuals. There were relatively more intermediaries in the 2000 survey, and relatively fewer general insurers. Almost three-quarters of respondents had a working knowledge or better of climate change.

The results show that a large proportion of respondents believed that man-made climate change was happening and that the rising toll of weather losses was due to altered weather patterns. They felt that the overall effect of climate change would be less than was believed in 1994; 40% felt that there will be 'significant' effects for their market in the next 10 years, and 77% believed that it will be significant or considerable within 20 years, compared with 58% and 81 % respectively in 1994. Coastal flood and severe windstorm were thought to be the most important effects of climate change, in terms of their cost to, and effect on, property insurance.

By 2020, respondents expected that a wide range of consequences of climate change would affect their insurance market, from price increases (89%) and cover changes (82%) to increased losses (82%), more difficult reinsurance terms (75%) and withdrawal from high hazard areas (60%). A number of companies have already responded by adopting strategies to manage this risk, through tighter underwriting, information-gathering and reinsurance. Insurers and reinsurers were found to be the most active, with brokers focusing more on discussion and new product development.

Respondents felt that the most important areas for future action by their insurance industry were: research on (future) weather patterns (73%); studies of vulnerable areas (73%); emphasis on risk management (73%); and closer co-operation with authorities on planning and construction (68%).

The insurance industry

Despite recent high (but not catastrophic) underwriting losses in the UK there continues to be a general air of 'wait and see' among insurers. Nevertheless, the ABI has steadfastly continued its research in this area. There is a small but important core that keeps climate change to the fore, mainly the European reinsurers (Munich Re, Swiss Re). The UK insurance press also follows the issues sporadically (usually in relation to recent losses). The United Nations Environment Programme Insurance Industry Initiative (UNEP-III) has steadily recruited

members, but has recently lacked momentum. The industry also continues to contribute to official studies like IPCC and UK government initiatives, but it is noteworthy that although there were two insurance professionals involved in the current IPCC research, neither of them was a convening lead author.

Business community

A study by the Association of Insurance and Risk Managers (AIRMIC) and Lloyd's in 2000 showed that climatic effects continued to be low down the scale of issues that really worry corporations (Table 2.3). Top of the list were the more immediate effects such as loss of reputation and e-commerce risks. Extreme weather remained a worry, but was rated lower than more immediate and topical issues. Part of this low level of concern is to do with a lack of understanding of the latent potential of climate change (both direct and indirect), but the main problem lies with the issue of timescales and the perception of its non-immediacy. It was notable that climate change was higher up the agenda in 2000 than in 1999 (Fleming, 2000).

Table 2.3. Risks that concern corporations (as a % of weighting of risk facing organisations)

Loss of reputation	80%
e-commerce	74%
Mergers and acquisition	74%
Litigation	71%
Stress	71%
IT malfunction	69%
Extreme weather	66%
Internal fraud	63%
Political decisions	63%
Brands	62%
Financial instruments	61%
Pollution	59%
Intellectual property rights	59%

Source: AIRMIC/Lloyd's

On the international level, global warming has made an appearance. At the February 2000 meeting in Switzerland of the World Economic Forum, hundreds of business leaders and policy makers voted climate change the most significant challenge to mankind. It was suggested that politicians accepted it as a pressing challenge, but the absence of action showed a lack of leadership, and businesses were identified as best positioned to adopt that role.

Developments in techniques

Catastrophe modelling

Natural systems behaviour is being increasingly well understood and is found to be not inexplicably random but deterministically complex. This advance in knowledge has allowed insurers to set rates via the frequency or return period method using extreme event analysis. As human activity increasingly affects the behaviour of deterministic natural systems, the notion of 'natural hazard' is replaced by terms such as 'quasi-natural hazard' and 'environmental hazard' (Hood et al., 1992).

Lack of information about extreme events hampers insurance activity and makes insurers wary of committing their capital. Lengthy base periods and a stable climate system are essential to assess return periods accurately. Reilly (1984) suggests that using 30 years' data could underestimate the catastrophe risk by 50%. Return periods are constantly re-evaluated in the light of new extremes (Anderson and Black, 1993), so are rarely anything more than a probabilistic guide. All models assume that these represent future event frequencies (Michaels et al., 1997), so knowledge of the true long-run probability is therefore necessarily limited. 'Catastrophe insurers can't simply extrapolate past experience. If there is truly "global warming" for example, the odds would shift, since tiny changes in atmospheric conditions can produce momentous changes in weather patterns.' (Warren Buffet in a letter to shareholders of Berkshire Hathaway Inc, 1992.)

By quantifying the event probability, it is repackaged in such a form that insurers can analyse the risks and play the percentages. The potential impact of this ability has been compared to with the Black-Scholes model, which encouraged the rapid expansion of the options market by reducing very complex data to values people could trade by. In view of increasing catastrophic weather costs insurers are now concentrating on quantitative risk assessments (QRAs) to transform uncertainty into 'usable knowledge' (Hood et al., 1992), involving better predictive mechanisms (catastrophe models), new funding sources for irregular disasters, harnessing of the capital markets and mitigation measures for property.

Chapter 2:
Developments since 1994

Since 1994, modelling of natural hazards has made enormous strides, but it is still at a relatively early developmental stage in its evolution. This is characterised by incremental changes towards increasingly complicated generations of models, as new sources of data from recent events are used to revise the model structure and parameters. As a matter of practicality, each model simplifies and parameterises the world in a different way and therefore they vary in their response to changes in assumptions and the way the same data set is processed. They are only 'parametric' models, and we are a long way from a perfect simulator, but they are still useful predictive tools. However, experience of their performance shows that there is a long way to go before there is high confidence in the results. Where they have really been revolutionary is to provide total loss profiles over all return periods for all hazards for the complete portfolio or any portion of it. In essence they have allowed us to move from single point, one-dimensional estimates, to a three-dimensional picture of the risk (Walker, 1997).

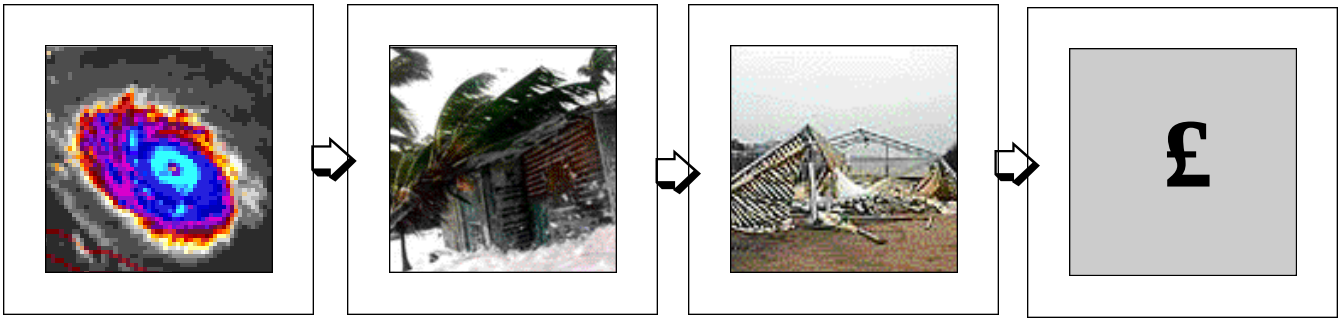
The three main commercial hazard-modelling companies, EQECAT, RMS and AIR, have, until recently, relied on marketing to persuade their customers of the validity of their models, but to most they remain 'black boxes'. Brokers such as Aon, Benfield Greig, Guy Carpenter and Willis use these models under licence to analyse the underwriters' portfolio as an integral part of placing the catastrophe excess of loss reinsurance programme. As the hazard modelling industry has matured, suppliers and brokers are being forced to become more open to customers' demands for greater transparency, so customers can calculate how their portfolios' structure affects the model's analysis. The differences in output are still alarmingly wide, but this is to be expected, given the proprietary differences in structure and massive simplification of the real world that the models have to make. As with Black-Scholes, the key element is to understand the variability and limitations of the model.

The models have also been adapted to act as an underwriting tool to analyse the spatial 'footprint' of the peril and so help to make better decisions in zones of marginal threat. They can support the issue of quotations, new business, mid-term alterations and renewal of business (Hallett, 2000). Bespoke risk analysis software has been developed to assist underwriters with property exposure and to support rating. One of the consequences of a move towards integrated risk management has been the use of underwriting information systems to manage portfolios of risk, in turn maximising economic performance by limiting accumulations and selectively pricing premiums based on individual policy risk. Financial protections (reinsurance) can then be optimised for expected net earnings (including the cost of reinsurance) in terms of the company's own risk appetite (Walker, 1997). The reduced volatility in turn lessens the need for capital. By matching capital requirements to risk involved, insurers can manage their portfolios more efficiently without destroying capital and realise higher share valuation.

Current problems in this field include the following points.

- The implications of changing modelling assumptions (modelling uncertainty). It must be recognised that models are necessarily limited in their ability to

Figure 2.3. Hazard model components



represent natural catastrophes. As the understanding of physical concepts increases, problems will be overcome and new challenges will be accepted. This evolution will continually modify the output of the software. It needs to be remembered, however, that this remains 'exploratory modelling' (Banks, 1993).

- The methods modellers use to generate the model's hazard parameters (parameter uncertainty). Parameterisations are based on limited observation of natural processes, where arbitrary constants and functions are used to fit the data. Although parameterisation appears to be based on physical concepts, when not derived specifically from observed extreme events, these arbitrary constants and coefficients always appear. The limited observations of natural catastrophes are often interpreted through the lens of remarkably simplistic models.
- Damage functions—building materials and designs change, as do vulnerability functions, and new designs may be more or less prone to damage than old ones. The criticality for failure of a building will depend largely on construction technique, and this is only now being modelled actively.

Alternative risk transfer (ART)

Two major developments in the past five years have changed the insurance industry's attitude toward financial risk mitigation—increasing natural hazards losses and ART (Kunreuther, 1997). Insurance companies now recognise that they may need to turn to financial risk transfer tools and mitigation to meet additional capacity needs and to reduce their chances of insolvency from future catastrophic events.

Advances in catastrophe modelling and risk assessment enable risk managers to estimate the chances and potential losses of catastrophic events more accurately than in the past, so quantifying the risks. For the first time, non-linear natural perils risks can be converted into a monetary default rate, creating capital market opportunities for investing in these 'alternative' risk transfer products.

Catastrophe bonds and weather derivatives have been increasingly used as an insurance linked securitisation (ILS) device. The advent of multi-line multi-year policies was seen as another encouraging efficiency measure, and it is thought likely that they will thrive in a hardening reinsurance market.

Hurricane Andrew raised serious questions about the ability of the international insurance industry to respond to the 'Big One', usually defined as a hurricane in the $100bn range. At first glance, the US property insurance industry, with equity capital of more than $300bn, should be able to sustain a loss of this magnitude (Cummins et al., 1999). However, the reality could be different, depending on the distribution of damage and the spread of coverage as well as the correlation between insurer losses and industry losses. Doherty (1997) felt that a $50bn catastrophe event would seriously weaken the insurance industry and leave property owners less well-protected financially. Thus, the prospect of a mega-catastrophe brings the real threat of widespread insurance failures and unpaid insurance claims (Cummins et al., 1999). Recently, catastrophe modelling of potential disasters has shown that the industry and society already face the risk of a hurricane that could cause $75bn, $100bn, or more, in insured property losses (ISO, 1999). The Third Assessment Report of the IPCC (publication mid-2001) considered this issue and judged that there could be significant local or regional insolvencies to insurers, but no worse than that.

Insurers realise that the reinsurance mechanism probably fails for the largest disasters because the pools of capital are too small, so have begun to explore the possibility of transferring some of the risk to the capital markets (Michaels et al., 1997). For example, selling catastrophe 'options' to capital market investors (Hodges, 1997), incorporates the risk into another part of the global economy. The capital markets are being seen as a large financial pool to cover claims at the higher levels where there is a low probability of loss (after reinsurance has been exhausted).

The prospect of future high reinsurance premiums, coupled with the fact that catastrophe losses exhibit little correlation with capital market indices has attracted considerable interest on international financial markets through, eg, catastrophe bonds, enabled by 'parametric' catastrophe models. Investors are attracted to higher interest rates for bonds with comparable risk of default (Doherty, 1997). The advantage to investors is portfolio diversification (Hodges, 1997) and high yield (the bonds can pay 3–4% more than comparable corporate bonds) if the book of business closes 'clean' (Hedge Financial Products, 1998). Catastrophe losses

are unrelated to the usual speculative risks, which are generally economic. While the number of transactions involving the capital markets is still relatively small, some insurance industry observers expect securitisation of catastrophe risk to grow significantly (Munich Re, 1998). Although there are a variety of types, the most successful have been catastrophe bonds and contingent capital structures (Contingent Surplus Notes and Catastrophe Equity Puts). Below is a brief discussion of catastrophe bonds and weather-related derivatives, swaps, and options.

Catastrophe bonds

Catastrophe bonds are high yield corporate bonds. Funds are provided by the capital market (the bondholder) to the issuer (an insurer or reinsurer) who pays annual interest, and at the end of the bond term repays the principal. The bond has a special condition that requires the bondholder to defer some or all payments of interest and/or repayment of principal if actual catastrophe losses surpass a specified amount, or 'trigger'. When that happens, the insurer or reinsurer that issued catastrophe bonds can pay claims with the funds that would otherwise have gone to the bondholders. The 'transformer' mechanism (an SPV or special purpose vehicle) between the capital market investors and the reinsured is now well understood. The coupon/rate on line has been falling with each cat bond issue, demonstrating the capital markets' increased familiarity with the product (Punter, 2000). Trigger mechanisms are evolving, with recent deals using index and parametric triggers. For an index trigger the bond payment is determined by an index of losses rather than actual company losses, reducing insurer moral hazard but introducing basis risk.[1] Parametric triggers determine bond payment solely on the parameters of a catastrophe (such as hurricane strength, or quake intensity), and are considered to be a 'purer' investment (based on the underlying peril rather than the impact on the insured book of business).

Weather derivatives

Weather derivatives appear to be an area likely to be influenced by climate change in the future. Although catastrophic extremes of weather are usually covered by standard insurance and reinsurance policies, there is a market for less extreme weather coverage which conventional insurance products do not cover. Temperature and rainfall particularly can affect business profits and it is estimated that up to 20% of US businesses are 'weather exposed' (Punter, 2000). The vast majority of deals have concentrated on direct swaps, options, and derivatives in the 'over-the-counter' market. They are like other derivatives in that they need a mechanism or index to convert temperature or other weather phenomena into prices. The most commonly used indices are heating degree days (HDDs) and cooling degree days (CDDs). A strike price is then set (the number of hot or cold days for a specific period). The investor can therefore use weather models and geographical data to determine the probability that an actual value for a weather index will surpass the given strike price.

Scientific research initiatives

Climate change research has attractions for insurers. However, researchers have struggled to integrate climate change with understanding and predicting long-term trends in the frequency of costly weather events, within the context of risk assessment and underwriting. Long-term predictions have the potential to allow reinsurers to adjust their covers on time scales that conform to current market constraints (Murnane, 1999). They could use long-term forecasts to adjust the landfall probabilities generated by catastrophe models that most property insurers use to make business decisions. Table 2.4 gives examples of other organisations involved in this area.

Seasonal forecasting and underwriting

In the last five years we have observed an increase in the number of atmospheric phenomena that have been converted into predictive indices. Seasonal variations have been detected for El Niño Southern Oscillation, Southern Oscillation Index, North Atlantic Oscillation, Quasi-Biennial Oscillation, and recently the Pacific Decadal Oscillation and Madden-Julian Oscillation. Despite these advances, it is extremely difficult to forecast weather more than five days ahead. Seasonal forecasts are still of limited use and only then in areas that exhibit high regional fluctuations in atmospheric disturbance (such as El Niño Southern Oscillation).

TSUNAMI, the British co-operative venture between the insurance industry and UK universities, is attempting to improve the competitiveness of the insurance industry by science-linked risk assessment. Although UK research

Table 2.4. Climate research organisations	
TSUNAMI	A number of insurance linked research projects in the UK
Risk Prediction Initiative (RPI) (see 'Seasonal forecasting and underwriting' on page 10)	Privately funded US research projects, mainly on hurricanes
UK Climatic Impacts Programme (UKCIP)	Global warming scenario consequences at a regional level
Tyndall National Climate Change Centre	The Extreme Weather in Northern Europe project
Benfield Greig Hazard Research Centre	6–12-month lead-time hurricane forecasts
Middlesex Flood Hazard Research Centre	Flood warning and forecasting research
Building Research Establishment (BRE)	Published 'Impact of climate change on building and building materials'
ECLAT	Provides an opportunity to monitor all EU research

institutions are considered to be of the highest calibre, there has been only a limited transfer of applied information and expertise to the insurance sector. TSUNAMI identified that many scientific research topics investigated in academia could be of use to an industry that relies heavily on analysis of low frequency, high severity losses on the natural and economic environments. Research topics include long lead forecasts, UK flood risks, extreme weather events in northern Europe, tsunamis and the economic impact of catastrophic losses.

The US-sponsored Risk Prediction Initiative has invested in research on paleoclimatic data to extend the data-series available for analysis. It has done ground-breaking work on analysing proxy records of tempestites (distinctive beach deposits created during severe storms) and increasing the length of the storm record.

For seasonal forecasting, 'statistical parametric' methods first search historical climate data for climatic phenomena and then look for relationships with extreme event activity. Researchers such as William Gray of Colorado State University and Mark Saunders of the Benfield Greig Hazard Research Centre have detected a certain cyclicity which can be extracted from the climatic record, and extrapolated it to yield 6 to 12-month extended forecasts (Gray et al., 1999).

Jim Elsner of Florida State University has produced long lead storm sets which reach back to 1886. He has found that observed fluctuations in hurricane frequency can be explained largely by the interplay of three distinct climate cycles, which act on time scales of 2.5, 5.6 and 7.4 years (Murname, 1999). The longer predictive time scale could allow effective risk mitigation and transfer to take place.

However, the recognised source of future climate change predictions is the general circulation model (GCM). Once again the very limited instrumental record makes extensive analyses of the natural variability of global hurricane activities difficult. GCMs have been used to try to infer changes in hurricane activity by analysing the resolvable-scale vortices that develop (Malmquist, 1997). Recent thermodynamic estimation of the maximum potential intensities of Atlantic hurricanes shows good agreement with actual hurricane observations.

Work is also progressing on predictive flood modelling. A research project at the University of Dundee has studied the effect of climate change on flood return periods, and it is hoped to develop a new methodology for determining the probability of a flood event. The report highlighted such parameters as seasonality, temporal variability and differing synoptic controls, so that the choice of risk estimation technique for the UK will be better advised. (Cargill, 2000.) It is hoped that this can be combined with studies of regional rainfall patterns to increase predictive knowledge and better understand the threat from flood. Other elements of the picture are also being researched, such as rainfall in UK, which has already changed, as predicted by GCMs (Osborn et al., 2000).

Changes in the business world

Overall in the market-place there seems to be an increasing awareness that weather-related claims are possibly on the increase, especially as 1999 was a bad

year in many parts of the globe, particularly in areas where insurers were exposed. As a result of this awareness many insurance companies are having a second look at their overall strategy on non-life (property) insurance in general and some are even making the conscious decision to reduce their exposure to the poorly performing property and casualty business lines. The more lucrative life side of the business has thus begun to dominate corporate strategy. Indeed it could be argued that this could be the driving force behind many of the recent mergers and acquisitions.

Globalisation of insurance

Even in the six years since the last SoF report was published, financial services such as insurance and banking have increasingly been operating in the dematerialised world of cyberspace. They depend for their existence on modern computing power and efficient reliable telecommunications. Insurance products have no material index and exert no inertia; they are essentially 'weightless' (Collins, 2000). In the search for 'intellectual capital', human resources may become the inertia factor. Communications technology and cheap, easily available, computer power are circumventing the links between production, workforce, specialised services and the physical market-place. The exponential increase in ownership of computers and ubiquitous access to telecommunications has coincided with the increasing use of IT to streamline insurance practice. This has provided the critical mass for the rapid takeoff of e-mail and the Internet as new channels for doing business. E-commerce has allowed insurers to restructure their operations to sell goods in the virtual rather than physical market-place. In consequence, insurance has been able to divorce itself from the traditional constraints of location dependence.

Dematerialisation and IT together have provided business with the tools to ignore national boundaries and traditional physical markets, and to locate on the basis of previously peripheral factors such as cheap office rent and a highly trained workforce. Although this is happening in IT- literate workforces such as India, it also exposes companies to political risk from less stable governments and economies.

Information technology

Risk managers are increasingly using IT and the Internet to quantify the overall costs of risk, explore various risk financing mechanisms, and facilitate access to the information required to make qualified decisions. Information and science is expanding rapidly and there is an increasing demand to embed this information into working practices to reduce uncertainty from natural and technological sources. Increasingly the Internet is being used by risk managers to gather market intelligence quickly, to search easily for specific research from the vast selection available, and to communicate efficiently both internally and with external brokers and vendors (Burns et al., 1998). The value of IT in enabling people to be networked within the company regardless of distance is another recent development. Being able to call on the expertise of professionals from within the organisation but in different countries via e-mail, discussion boards or 'team' rooms has reinforced the image of the global village.

The amount of software generated in the push to streamline insurance and harness the potential of IT has snowballed. Claims administration software, medical costs containment systems, asset liability models, portfolio analysis and optimisation programs, underwriting information systems, and catastrophe models have all been developed in recent years to deal with the ever more complex nature of insurance. As we hand more of the calculation over to computers, we become more dependent on their smooth function and compatibility. The credibility of screen/graph/printout still remains tied to the data entered, and quality control becomes more important—GIGO (garbage in garbage out). With the year 2000 bug safely behind us, the main vulnerability seems to be malicious or accidental interference. Insurers are starting to recognise the potential for losses through IT-based catastrophic failure and the associated business interruption claims.

Vulnerability and risk management

As society comes to terms with new trends in business such as just-in-time manufacturing, single source suppliers, reduced stockpiling of finished goods and minimum resources to transfer manufacturing capacity (making each process critical to completion), there is an associated increase in business vulnerability (Holmes et al., 1998). Risk managers can no longer see risk to enterprise in isolation, but as part of a chain of interdependent networked businesses. As a result crisis management has become more important in mitigating the damage from unforeseen or 'upstream' disasters.

The move towards evaluating operations and the potential for financial, operational, legal or client-based impacts is firmly established. Firms are seeing lost business from natural and technological disasters as not only a loss of profits and revenue, but also as damaging to their brand value or reputation. Contingent (indirect) business interruption, such as loss of a supplier or incompatibility of a critical business programme that can cause a loss of revenue, is often the area of highest exposure and greatest uncertainty.

Business continuity and formalised recovery strategies are key to mitigating the physical and operational risks and ensuring that the analysts' view and public perception of the company remains positive. Organisations are more likely to be judged on how they handle a crisis than on the crisis itself.

Mergers and acquisitions

Recent merger and acquisition activity in the insurance sector has been frenetic. Two main issues are important during and after a merge or take-over. Firstly, the culture of the two partners will inevitably be different. It will always take time for such cultural mismatches to be ironed out. Invariably one culture will predominate over the other. The question (for this study) is whether that over-riding culture has a better or worse approach to risk management in the face of natural perils and property related underwriting. It may well be the case that poor results in the property area have brought about a merger situation, and that in the newly formed company this part of the business is jettisoned.

Secondly, the method of underwriting risk may be different in the two companies, leading possibly to a situation whereby the newly created company could have a different view about risk on the books of the two component partners. The result could ultimately be certain business sectors going into run-off and whole classes of insurance being dropped. Usually in a merger, a suitor company will seek a partner that operates in a business sector in which it is weak, and thus the newly created company has a broader base of risks on its books.

There is still no definitive evidence that mergers are good for either the companies involved or their shareholders. It may simply be a fashion that the sector is presently going through. The objectives of cost-cutting and efficiency may be negated by the problems of controlling a larger organisation in a fast-changing business environment. In principle, there should be benefits from increases in scale which could reduce the impact of 'normal' variation in claims, but claims might not behave 'normally' in the future.

New organisations

New organisations that have appeared since the first SoF report include the UNEP–III and a number of research groups. UNEP–III was created in 1995. Its main task and mandate was to create a forum in which insurance companies could discuss matters related to sustainable development. Climate change was one of the main themes taken up by UNEP–III when the first Conference of the Parties (COP–1) met in Berlin in 1995. UNEP–III produced a position paper on climate change along with the guiding principles of its membership. It is a multinational initiative, with signatories from 84 companies in 26 countries, mainly in Europe. It enjoins insurers to incorporate environmental considerations into their internal and external business activities. Internal good practice activities include corporate environmental reporting and employee education. Customer-focused activities include risk management, loss-prevention, product design, claims handling and asset management.

One of the guiding principles of the UNEP-III statement requires a signatory company to

> 'make every realistic effort towards achieving a balance between economic development and the welfare of society, through environmentally sound management practices.'

The statement goes on to call for insurers to incorporate environmental considerations into their internal and external business activities. With this in mind, it is becoming increasingly obvious that it is in the interests of insurers (and their policyholders and shareholders) to take climate change issues seriously—to do anything less would be a failure of society in general.

Insurers can act internally through good environmental practices and management of the day-to-day operations. In addition they can influence externally all their clients and customers.

At a higher level the insurance sector can bring pressure to bear on respective governments to help meet present

Kyoto targets and go further along the road of reducing greenhouse gas emissions to a safe level in the atmosphere. This is an on-going fight, but one that must be won, otherwise there is an outside chance that climate change impacts could undermine the operations of the entire insurance sector.

The well-known and influential International Decade for Natural Disaster Reduction (IDNDR) programme drew to a close in 1999. But by the conclusion of the decade the continual rise in the frequency, severity and cost of disasters had underlined the importance of intensifying commitments to making hazard and risk reduction a public value. In 2000 the United Nations decided to implement the International Strategy for Disaster Reduction (ISDR) as the appropriate platform to continue this work. This decision is motivated by the importance of shifting from a culture of reaction to hazards to one of risk management and prevention. The ABI represents UK insurance interests here.

Note

1. Moral hazard: the hazard from the possible behaviour of the insured or their family or employees which may increase the possibility of loss through carelessness or dishonesty. Basis risk concerns hedging with derivative products and is measured by the difference between the actual cost of an event and the value of the security.

CHAPTER 3: THE CLIMATE SYSTEM AND ITS IMPLICATIONS FOR THE UK

David Viner & Maureen Agnew

This chapter presents the current understanding and the implications of climate change. It provides current estimates of how the climate system is responding at the global and regional scale, with a set of expert-judgment-based scenarios which are designed to provide a probability based assessment of how the climate of the British Isles is evolving. An overview is given of the methodology of impacts assessment and how climate change science is communicated.

The global climate system is responding to increasing concentrations of greenhouse gases that have occurred since the start of the industrial revolution (~1750). Figure 3.1 shows the reconstructed temperature anomalies (the black line shows smoothed values) for the period 1000 to 1999AD; superimposed on this are the observed (instrumental) global-mean temperature anomalies for the period 1860 to 1999. Since 1860 (the beginning of reliable global temperature records), there has been a warming of nearly 1.0 degree Celsius. It is estimated that globally 1998 was the warmest year of the second millennium and that the 1990s were the warmest decade.

A considerable amount of scientific research has been undertaken since the possibility of human-induced climate change was first openly discussed. The focal point for this research has been the United Nations' IPCC. The IPCC is charged with the task of reviewing the scientific literature and presenting its findings to governments that have signed up to the UN Framework Convention on Climate Change (UNFCCC).

Climate change has high public awareness, and within the UK and Europe it is widely accepted (for example see 'Attitudes to climate change', page 6) that there is now an artificial human-induced impact on the global climate system. The media, however, often incorrectly give an impression of scientific debate on the possible causes of the observed climate change being 'balanced'. This is an inaccurate representation of the situation, since the weight of scientific evidence as presented in the peer-reviewed literature supports the statement that there is a 'discernible human influence on the climate system' (Houghton, 1996).

Within the UK there is significant research into the issues that surround climate change. The UK scientific community makes a large contribution to the activities of the IPCC. Through agencies such as the UK Department of the Environment, Transport and the Regions, the UK hosts the Hadley Centre for Climate

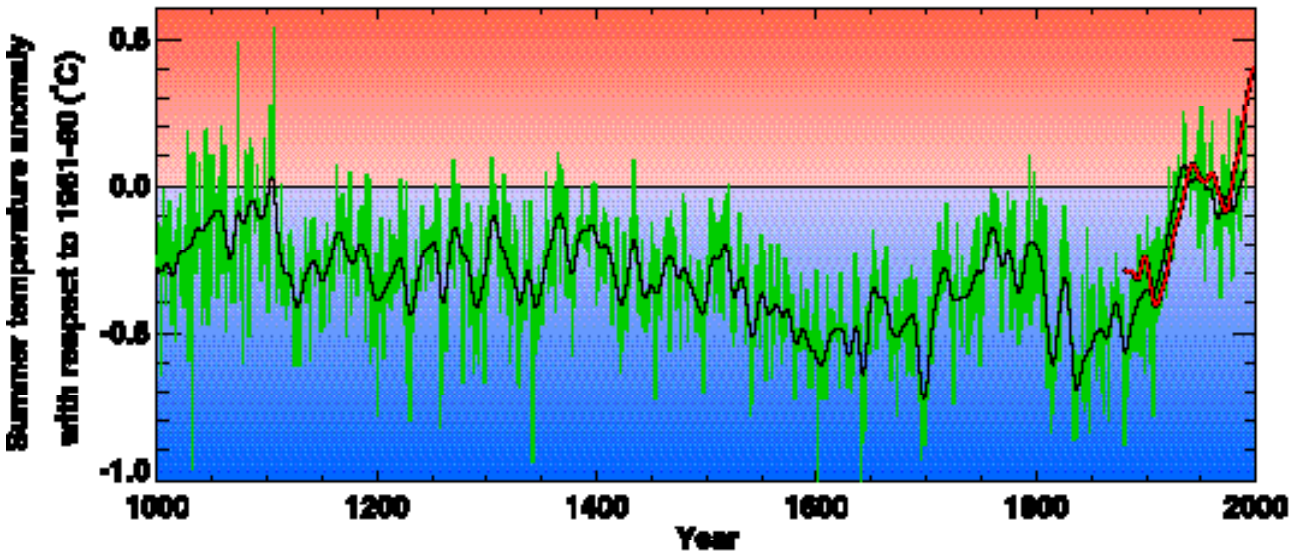


Figure 3.1. Global temperature anomalies 1000–1999 AD

Prediction and Research at the UK Meteorological Office which is recognised as the leading global climate modelling centre. Coupled to this, the Climate Impacts LINK Project (Viner and Hulme, 1997) based at the Climatic Research Unit distributes the results from the Hadley Centre's climate change experiments to many of the world's scientists who study the impacts of climate change. Additionally, the government has just awarded a five-year programme of research into the impacts of climate change to the Tyndall Centre at the University of East Anglia.

The causes of observed climate change

While the balance of scientific evidence supports the view that there is a discernible human influence on the global climate system from increasing concentrations of greenhouse gases, a number of contrasting viewpoints are often aired. To understand the full causes of climate change we must examine those factors which cause the climate to vary over all time scales.

Solar variability

Change in the amount of the Sun's energy arriving at the top of the Earth's atmosphere is considered to be a major cause of climate variability. On the longest time scales of Earth's geological history, variability in solar output is thought to influence the succession of glacial and inter-glacial epochs. On shorter time scales, the 10 to 100 years which are important to human-kind, sunspot cycles of around 11 years influence certain climate parameters. However, the fluctuations are weak and tend to appear and disappear without reason.

The 11-year sunspot cycle itself varies in strength on time scales of 80 years and longer, and these longer-term fluctuations have also been linked to climatic change. In the early 1600s, the sunspot cycle almost disappeared and this phenomenon, the so-called Maunder Minimum, has been associated with the height of a cold period known as the Little Ice Age. It has also been claimed that the warming of the 20th twentieth century was largely due to trends in sunspot activity, for example, in the length of the sunspot cycle. The evidence, however, for these apparent correlations is not strong. Moreover, the fluctuations in solar output that probably accompanied these sunspot trends were insufficient to generate the observed climate changes without some (yet to be identified) amplifying mechanism (Wigley et al, 1998; Haigh, 2000).

Geo-catastrophes

Two known causes of major climatic disturbance are the impact of a large extra-terrestrial body and the eruption of a 'super volcano'. Palaeoenvironmental evidence indicates that both events have occurred on several occasions in the past (eg, the impact crater identified on the Yucatan Peninsula). On the scale of human history (10,000 years), such events are mercifully infrequent, but they will no doubt happen again.

Only certain types of volcanic eruption have an effect on the climate. The eruption has to be of sufficient magnitude to emit very large quantities of material into the stratosphere (20–25km above the Earth's surface) and, for maximum impact, it should occur in lower latitudes. The most well-known eruption in historical times was Tambora, Indonesia (1815). The following summer became known as the 'the year without a summer' in many parts of the northern hemisphere. Mount Pinatubo which blew in 1991 fulfilled these conditions and in fact the ensuing veil of gases cooled the atmosphere by about 0.5°C for almost two years (Kelly et al, 1996).

On a par with volcanic activity, a major extraterrestrial impact could also be cataclysmic. These impacts operate in much the same way, by throwing a cloud of dust and gases into the upper atmosphere, but appear to be even rarer than major volcanic eruptions.

The greenhouse effect

Atmospheric gases like water vapour and carbon dioxide do not interfere to any great extent with incoming solar energy. Once that energy reaches the Earth's surface, it is absorbed, warms the land and ocean surface of the planet and is then re-emitted. The amount of heat re-emitted and eventually lost to space must equal the amount gained from the Sun if the temperature of the planet is to remain constant. But the so-called terrestrial energy stream is different—it is longer in wavelength than the incoming solar energy since the Earth is cooler than the Sun—and the 'greenhouse' gases interact with it strongly before it can escape to space.

The greenhouse gases absorb the outgoing terrestrial energy, trapping it near the Earth's surface, and causing further warming. This is the 'greenhouse effect'.

Without this effect the planet would be too cold to support life as we know it. Unfortunately, humanity, through energy generation, changing land use and other processes, has produced a substantial increase in the concentration of greenhouse gases in the atmosphere, enhancing the natural greenhouse effect, and it is feared that this continued interference will lead to a major shift in global climate.

Climate variability can also be generated by smaller-scale changes in the energy balance—the balance between heat received and heat lost. Many processes can lead to disruption of regional climate. Because of its enormous mass, and inertia, the ocean and its currents have a major effect, even on distant regions, through effects on precipitation and wind patterns. The related Pacific Ocean phenomena of El Niño, La Niña and the Southern Oscillation have the greatest societal impact. Atmospheric perturbations, while of shorter duration, can also modify regional climate. The North Atlantic Oscillation, for example, has a major effect on the winter climate of the Atlantic-European sector.

The current state of climate science

The climate system is complex and inherently chaotic, so to understand and appreciate its behaviour climatologists have constructed mathematical models. The current state-of-the-art models are three-dimensional mathematical representations of the coupled ocean-atmosphere-biosphere system, known as GCMs (General Circulation Models or Global Climate Models). Figure 3.2 shows the conceptual structure of a GCM. These models are detailed and complex and require large super-computing capacity. As a result, there are only a limited number of centres around the world that can construct such models and perform experiments with them. One of these facilities is the Hadley Centre.

GCMs are internally consistent, and as such are deemed the best tool available to estimate the changes in global and regional climate resulting from increasing concentrations of the greenhouse gases. The output from climate change experiments have been widely used in impacts assessments, which have been reviewed most comprehensively in two IPCC reports, 'Climate change' (Houghton et al., 1996) and 'The regional impacts of climate change' (Watson et al., 1997). However, there are a number of difficulties associated with using the GCM results for climate impact studies:

- GCMs are at a relatively coarse spatial resolution. For example, the Hadley Centre's most recent GCM, known as HadCM3, has a surface resolution of 2.5 degrees latitude by 3.75 longitude. This is too coarse a spatial scale to be of use in most impact studies.
- GCMs require enormous computing power (a

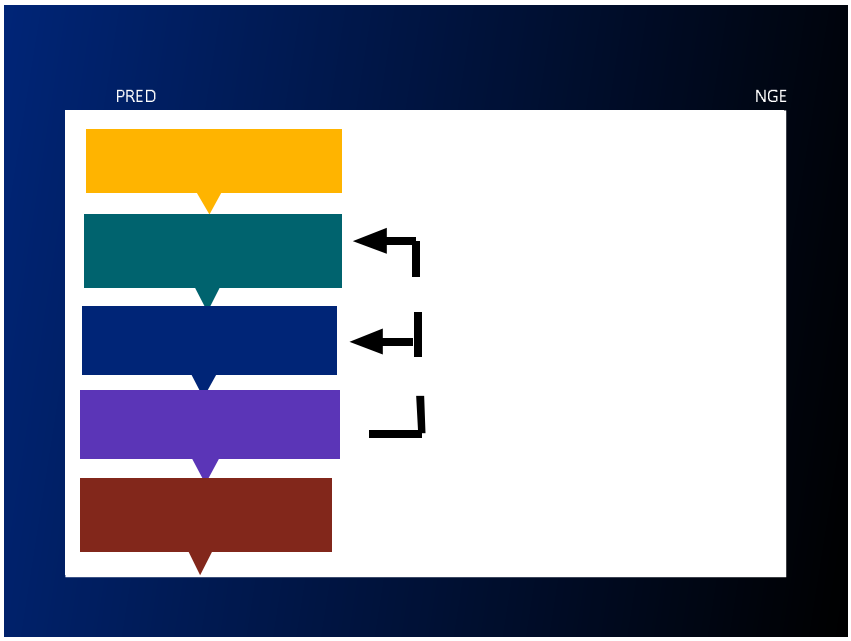


Figure 3.2. GCM structure

typical 240-year simulation will take 2–3 months of supercomputing time, and produce over a terabyte of data). As a result, relatively few GCMs have been developed and the number of climate change integrations, useful for impacts studies, is currently less than 100.

- Due to inherent uncertainties (see 'Uncertainties in the science' below) GCMs cannot be used to produce forecasts or predictions. Instead, the results from climate change experiments should be viewed as scenarios of possible change.

Therefore, to use the results of GCM climate change experiments in a consistent manner, researchers need to understand how GCMs work, what their limitations are and how to adopt a suitable framework in which to adjust results for regional or local conditions. This methodology is known as climate change scenario construction.

Uncertainties in the science

There are a number of uncertainties in the construction of climate change scenarios. The best way to examine the uncertainties that exist in climate science is to view them in the context of a chain of processes from socio-economic forcing factors through to impacts of climate change. Uncertainties are present at each stage, from the use of socio-economic projections to the resultant emissions scenarios and the climate model experiment. Additional uncertainties materialise if adaptation and mitigation strategies are considered. The four key elements that give rise to uncertainties in any future projections of climate are:

- Socio-economic conditions: future socio-economic conditions are largely unquantifiable and cannot be assigned probabilities since population growth, energy demand and technological development cannot be projected with confidence. This uncertainty is one reason why future estimates of climate must be treated as scenarios. To allow for this uncertainty, a range of emissions scenarios, such as the SRES emissions scenarios (SRES, 2000), are generally used. However, the use of multiple emissions scenarios has not always been possible; many GCM experiments have been undertaken which examine the effects of just one emissions pathway.
- Climate system: the climate system is inherently chaotic and, therefore, impossible to predict with any degree of accuracy in the long term. There are also uncertainties in several key parameters, for example the climate sensitivity to increasing concentrations of greenhouse gases and the time lags between atmospheric and oceanic processes. Typically, climate sensitivity is expressed as the temperature which would be produced by a doubling of natural carbon dioxide levels in the atmosphere.
- Impact assessments: the level of uncertainty in climate change impacts depends on the activity sector, the complexity of the methodology used and the region of interest. For example, for water resources the impacts of rising temperature on evapotranspiration may or may not outweigh the impacts (in a given region) that precipitation increases would have on water resources. In other sectors, social changes such as increasing population and/or including standards of living will dwarf any impact from the climate. For a given impacts sector, different 'impacts models' will produce different results even with the same climate input.
- High impact low probability events: certain events because of their low probability of occurrence are by their nature unpredictable. One possible climate disruption that has been hypothesised is that of major changes to the North Atlantic circulation. This hypothesis suggests that if large amounts of fresh water (produced by a rapid melting of Greenland's ice sheets) enter the North Atlantic, there would be a breakdown in the oceanic circulation, leading to a disappearance or severe weakening of the Gulf Stream. In turn, this could cause a more continental climate over north-west Europe (ie, cold winters). While this hypothesis is plausible, and sudden switches in the Gulf Stream have occurred in the geological past, only very extreme scenarios of greenhouse gas emissions have generated such effects in GCMs, and only after many decades.

The implications of climate change

Scenarios

Figure 3.3 shows the estimates of future concentrations of atmospheric carbon dioxide as represented by the IPCC Special Report on Emissions Scenarios 1998 (SRES98; see SRES, 2000). The SRES marker scenarios are created from four different 'storylines' which are based on future projections of population, economic

growth rates, energy technologies, degrees of international co-operation and so on.

- B1 represents a world that has undergone rapid changes in economic structures and technology, is less materialistic, has low population growth and a high level of international co-operation.
- B2 represents somewhat greater population growth, an emphasis on local co-operation and environmental sustainability and less rapid but more diverse technological change.
- The A1 world is one of rapid economic growth, the rapid introduction of new and more efficient energy technology, low population growth and a considerable reduction in regional income disparities.
- Finally, A2 relates to a future world with high population growth and a low level of economic and technological development.

These four marker scenarios are combined with three levels of climate sensitivity, low (1.5°C), mid (2.5°C) and high (4.5°C) to give B1–Low, B2–Mid, A1–Mid, and A2–High.

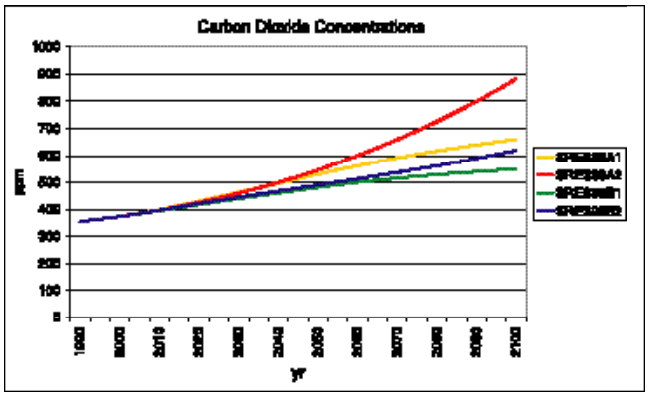


Figure 3.3. Future atmospheric concentrations of carbon dioxide

Sea-level and temperature predictions

The observed global mean surface temperature record for the last two decades of the twentieth century reveals a warming of about 0.14°C per decade. Figure 3.4 shows the global mean temperature response for the four preliminary SRES emissions scenarios; the temperature range described here is from 1.9 to 3.2°C by the end of the next century or a rate of change between 0.2 to 0.3°C per decade. The scenarios,

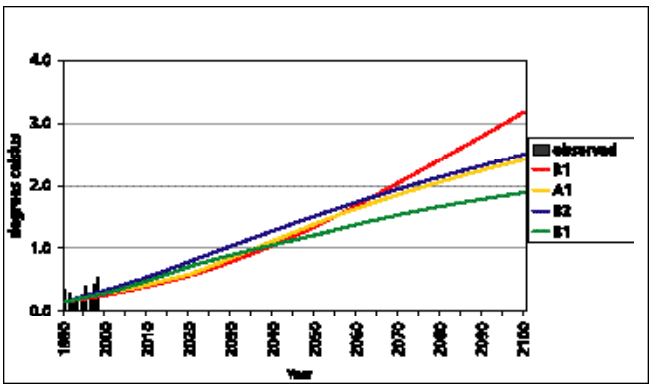


Figure 3.4. Predictions of global temperature rise

however, do not include positive feedbacks which will enhance this warming and rate of change due to, for example, the release of additional methane as the tundra thaws. In 1998 the UK DETR (Department of the Environment, Transport and the Regions, formerly the DoE) established the UKCIP, through which a new set of climate change scenarios were produced for the UK (Hulme and Jenkins, 1998). These scenarios have been widely circulated and used for many impacts assessments and are based on a range of assumptions about future emissions and climate. The UKCIP scenarios form the basis for the four scenarios that are presented for use in this report : Low, Medium–Low, Medium–High, High (see appendix 3.1).

The UKCIP scenarios suggest that by the 2080s the global mean temperature could be 1.1–3.5°C warmer than the 1961–90 mean. Global mean sea-level and temperature increases associated with the four UKCIP98 scenarios are shown in Table 3.1. The rate of sea-level rise varies from about 2cm per decade for the Low scenario, to about 9cm per decade for the High scenario.

UK context

Sea-level changes

By the 2050s, sea-level rise in the UK is projected to be about 10% higher than the global mean, since rates of thermal expansion and water accumulation in the north-east Atlantic are expected to be greater than the global average (Hulme and Jenkins, 1998). There will also be regional differences with sea level in the south-east of England rising at a greater rate than in west Scotland. This is because the land is tilting down in southern and eastern England and rising in northern

Table 3.1. Estimates of global climate change (temperature and sea-level rise) for the four UKCIP98 scenarios

1980s	*1990s*		*2020s*		*2050s*		*2080s*	
°C	*°C*		*°C*	*cm*	*°C*	*cm*	*°C*	cm
0.1	0.3	Low	0.6	7	0.9	21	1.1	18
0.1	0.3	Medium-low	1.0	8	1.5	18	1.9	29
0.1	0.3	Medium-high	1.2	12	2.1	25	3.1	41
0.1	0.3	High	1.4	38	2.4	67	3.5	99

Changes in global temperature and sea level are calculated with respect to the 1961–90 mean. The time slices are 30-year means centred on the given decades. The data for the 1980s and 1990s are observed global -mean temperature changes, with respect to the 1961–90 mean (Source: Hulme and Jenkins, 1998).

Table 3.2. Increase in sea level (cm) around the coast of Great Britain by the 2050s

Scenario	*Low*		*Medium–low*		*Medium–high*		*High*	
	Climate	*Net*	*Climate*	*Net*	*Climate*	*Net*	*Climate*	*Net*
West Scotland	13	2	20	9	28	17	74	63
East Scotland	13	8	20	15	28	23	74	69
Wales	13	18	20	25	28	33	74	79
English Channel	13	19	20	26	28	34	74	80
East Anglia	13	22	20	29	28	37	74	83

The global mean climate-induced sea-level changes shown in Table 3.1 are used, but adjusted by 10% to account for slightly higher rates of increase around the British coastline. The net change incorporates the effect of vertical land movement estimated from data provided by Ian Shennan, University of Durham. Changes are with respect to the mean 1961–90 levels (Source: Hulme and Jenkins, 1998).

Britain due to the retreat of glacier ice about 10,000 years ago (see Table 3.2).

It is not currently possible to estimate the influence of climate on the UK storm-surge regime. Even without an increase in the frequency of storm surges, an increase in the risk of inundation, flooding and erosion is possible as a result of increased sea level. The most vulnerable areas are the Wash, the East Anglian coastline and, to a lesser degree, south-west Lancashire and areas of Teesside. Significant increasing trends in relative sea-level rise have been recorded, eg, 1.55 mm pa (+/- 0.53mm) at Lowestoft, and 1.12 mm pa (+/- 0.39mm) at Newlyn (Sparks and Cannell, 1999).

Climate extremes

1997 was the third hottest year ever recorded in the UK (almost 1.1°C warmer than the mean 1961–90 temperature). Table 3.3 shows, for three time slices, the probabilities that the annual temperature in the UK will exceed the anomaly for 1997. The probability of exceeding the 1997 anomaly increases under all four

Table 3.3. Percentage probability of occurrence of hot years in southern UK

	1961–90	*2020s*	*2050s*	*2080s*
Low	6	13	26	56
Medium–low	6	47	74	88
Medium–high	6	59	85	99
High	6	67	89	100

Proportion exceeding the observed 1997 annual anomaly for Central England under the four UKCIP98 scenarios. Probabilities are all calculated using pooled results from the four HadCM2 ensemble experiments for the two southern UK gridboxes. The 1961–90 values are based on model simulations and not on observations. (Source: Hulme and Jenkins, 1998).

scenarios. By the 2080s, under the high scenario, every year is warmer than 1997.

Climate extremes (relative to current conditions), such as unusually hot and dry summers, are likely to become considerably more frequent in the future (Table 3.4). For example, by the 2050s, one- third of years could have summers as hot as 1997 and 12% of the summers could receive precipitation less than 50% of the 1961–90 average.

Projected changes in the frequencies of gales in the UK are shown in Table 3.5. There is some indication of a decrease in the frequency of winter gales in the future, with the exception of the very severe gales, for which there is a projected increase of 11% by the 2080s. It must be said that modelling future storminess is in its infancy and projections from other models give both increased and decreased frequencies. All categories of summer gales show an increase by the 2080s although the number of summer gales in the UK is currently small.

Selected regions outside the UK

HadCM3 (Gordon et al., 2000) is the first of a new generation of coupled atmospheric GCMs. Figures 3.5 and 3.6 show the seasonal temperature and precipitation changes for the period 2040–2069. Figure 3.6 suggests that the greatest changes in precipitation will be experienced in equatorial regions with strong regional contrasts, due to large systematic increases or decreases.

Arctic

The rate of warming is generally greatest in arctic and sub-arctic regions (Figure 3.5). This could have serious implications for existing infrastructure (eg, roads and pipelines) currently located in permafrost zones.

Table 3.4. Probability of occurrence of various climate extremes across southern Britain

	1961–90	*2020s*	*2050s*
Mean temperature			
A hot 1997-type August (+3.4C)	2	15	32
A warm 1997-type year (+1.06C)	6	59	85
Precipitation			
Summer precipitation < 50% of average	1	7	12
A two-year precipitation total < 90% of average	12	11	14

Probabilities are all calculated for the medium-high scenario using pooled results from the four HadCM2 ensemble experiments for the two southern UK gridboxes. Anomalies are with respect to the average 1961–90 climate. The 1961–90 values are based on model simulations and are not observations (Source: Hulme and Jenkins, 1998).

Table 3.5. Changes in seasonal gale frequencies over the British Isles

	1961–90	*2020s*	*2050s*	*2080s*
	Gales/year	*% change*	*% change*	*% change*
Winter gales	10.9	-1	-9	-5
Winter severe gales	8.5	-1	-10	-5
Winter very severe gales	1.4	+8	-10	+11
Summer gales	1.8	+3	0	+14
Summer severe gales	1.1	0	-2	+15
Summer very severe gales	0.1	+25	-16	+9

Changes for the medium-high scenario shown as percent changes from the 1961–90 mean. 1961–90 frequencies are calculated from climate model outputs and not from observations. Data are pooled from the four HadCM2 ensemble experiments (Source: Hulme and Jenkins, 1998).

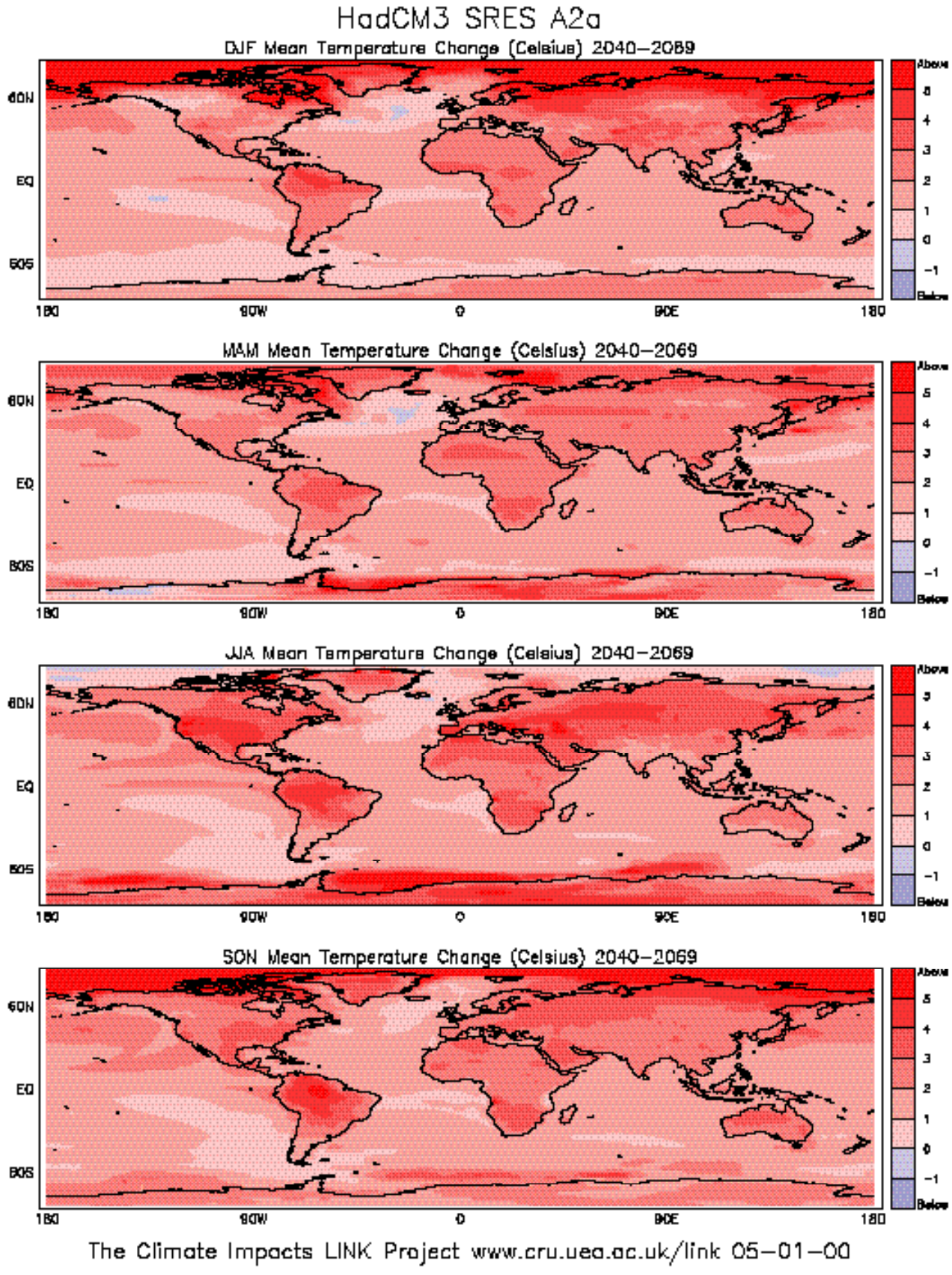


Figure 3.5. Regional temperature changes 2040–69

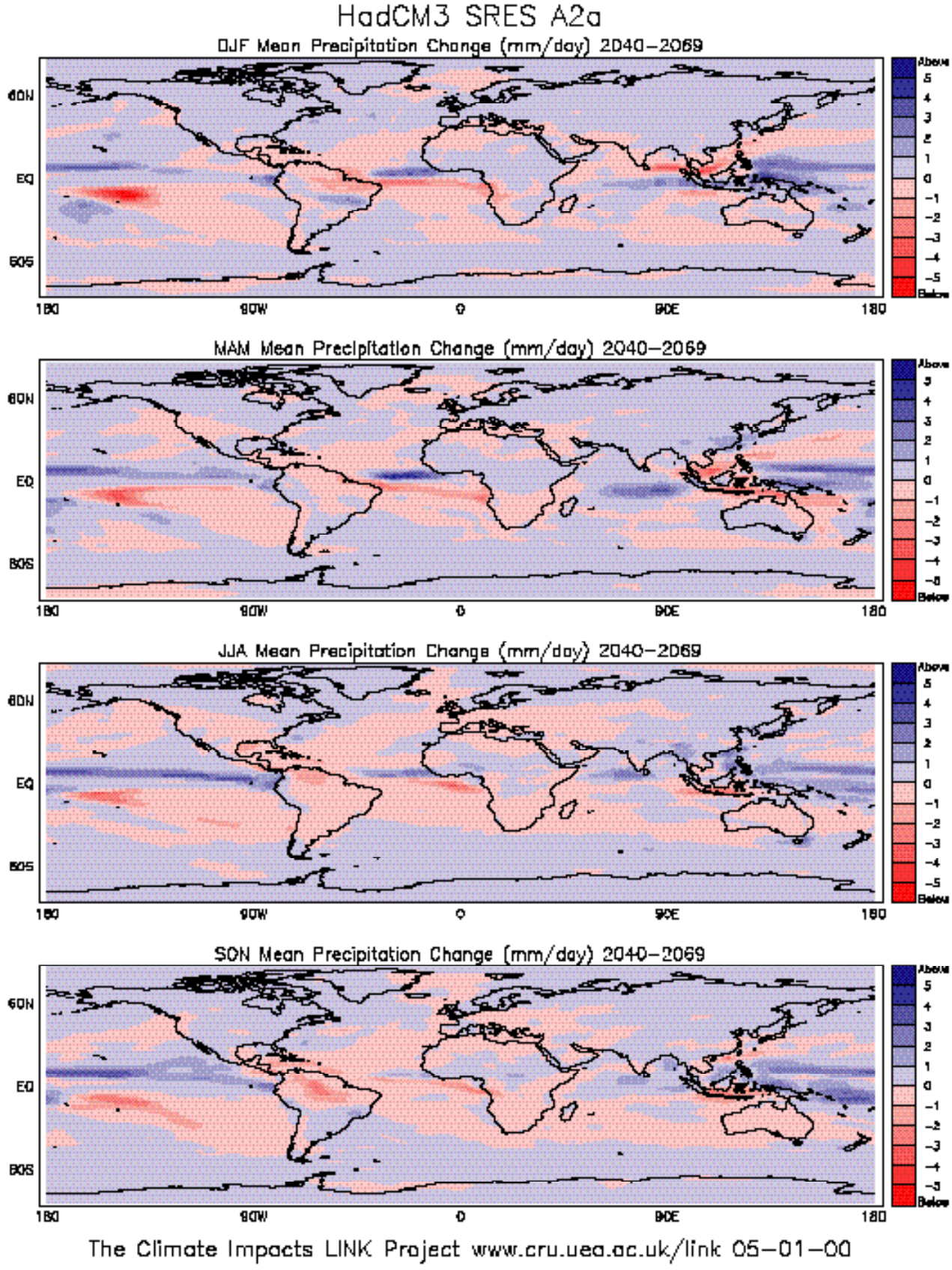


Figure 3.6. Regional precipitation changes 2040–69

Mediterranean

Summer temperature increases could be particularly high around the Mediterranean basin (greater than +3C by the 2050s). There is a concern that incidences of heat-stress could rise dramatically in countries such as Greece and Turkey, where it is already a problem. Figure 3.6 shows that summers in the region will be drier, exacerbating the problem of heatwaves (Parry, 2000).

Climate change issues of relevance to the UK insurance industry

While scientists are very confident about the predicted changes in global and regional temperature, they are less confident on the changes in other variables. For example, while it follows that as a result of an enhanced hydrological cycle the global average precipitation will increase, the changes in regional precipitation are less certain. Furthermore when the effect of increasing temperatures is taken into account, the overall availability of water (as a resource for natural and socio-economic systems) may decrease due to increasing evapotranspiration.

The change in the seasonality of precipitation and potential evapotranspiration will in turn affect secondary and tertiary impacts of climate change. For example Osborn et al. (2000) have shown that there has been an increase in the contribution to the total winter rainfall from heavier rainfall events. Such changes will increase runoff (causing soil erosion and damage to agricultural land through erosion) and the likelihood of fluvial flooding.

One of the major concerns on human-induced climate change is that the nature and frequency of extreme events will alter. Analysis of the results from GCM experiments indicate that the increasing intensity of winter rainfall noted by Osborn et al. (2000) will continue into the future (Lorenzoni et al., 2000). This has been supported by Easterling et al. (2000) who have shown an increase in extreme events (eg, amplification of precipitation at the tails of the weather distributions, decreasing cold periods and increasing numbers of hot days) based on analysis of observations from different locations around the world. In addition to such changes, extreme events are being, and will be, amplified by social changes in vulnerability, for example more people living on the coast, flood plains or along cyclone tracks.

High river flows indicator

Approximately seven million people in the UK are at risk from flooding due to high river flows. This represents one of the most costly and damaging natural hazards in the UK. The frequency of high flow days in north-west Britain has risen sharply since 1980. However, no apparent trend has been identified in the high flow river series for south-east Britain. The frequency of high flow days will increase in the future, if climate change results in higher total rainfall and /or a larger percentage of winter rainfall. A change in the frequency of storm events, however, is likely to have greater significance (Marsh, 1999). The floods of November 2000 in the UK provide a telling example.

Soil moisture indicator

The balance between rainfall and evapotranspiration losses influences soil moisture conditions, although soil type and land use are also important factors. Time series of soil conditions 1969–96 (Wallingford, Oxfordshire) show no apparent trends, but there have been large deviations from average conditions. In recent decades, for example, high soil moisture deficits characterised the periods 1988–91 and 1995–97 (Marsh, 1999).

Cyclonic storms

Severe storms, such as those of 1987 and 1990 in the UK and 1999 in France, have enormous implications for the insurance industry. Accurate forecasts and timely severe weather warnings help to reduce the damage, but inevitably the costs in lives and damage to property are high.

1987J[1]

During the night of 15/16 October 1987 a fast-moving vigorous depression tracked south-west—north-east across England. An exceptionally intense pressure gradient in the system's flank contrasted strongly with the weak flow around and to the north of the centre. Wind strengths were at their maximum between 0400 and 0500 GMT, gusting up to 106 knots at Gorleston, East Anglia, and 90 knots at Langdon Bay, near Dover. Return periods for both the highest mean and maximum gust speed, south-east of a line from Norwich to Southampton, exceed 200 years (Burt and Mansfield, 1988). Gale warnings were issued at 0630 GMT on 15 October, and at 1030 GMT these were upgraded to a warning for severe gales in most areas. However, TV

forecasts for the storm were understated (Houghton, 1988). As many as 15 million trees were blown down, 47 lives were lost, and hundreds of millions of pounds worth of damage were caused by the storm (Burt and Mansfield, 1988).

1990A[1]

During the daylight hours of 25 January 1990 an intense depression tracked across southern Scotland bringing severe gales and storm-force winds to a large part of England and heavy snow to parts of Scotland. The most damaging features were the powerful gusts of wind, which were comparable with October 1987 but experienced over a wider area. The maximum recorded gust was 93 knots at Aberporth and over a wide area of southern England winds gusted to 90 knots. Coastal sites were most severely affected by the gale force winds. Despite severe gale warnings being issued from the Meteorological Office, the number of casualties was greater than in the October 1987 storm because the event occurred during daylight hours and affected a wider area (McCallum, 1990).

The 1993 *Braer* storm

Severe storms can cause enormous environmental damage. A depression crossing the Atlantic between Iceland and Scotland fell below 920 millibars atmospheric pressure, probably reaching an (unrecorded) European record low on 10 January 1993, and was responsible for the final break-up of the oil tanker *Braer*. The break-up caused the tanker to discharge large quantities of oil into the seas surrounding the Shetland Islands. The vessel had been stranded on rocks off the Shetland Islands by a storm almost a week earlier (Burt, 1993; McCallum and Grahame, 1993).

1999 European winter storms

Three storms in December 1999 (Anatol, Lothar, Martin) caused havoc in north-west Europe, but miraculously bypassed the UK. The scale of the events overwhelmed the normal response procedures, necessitating government intervention, and it has taken many months to get close to a realistic estimate of the losses.

Sea water flooding

The Thames Barrier is closed to avoid the risk of flooding when water levels at Southend and riverflow at Teddington Weir, on the Thames, reach critical limits. More than 750,000 homes are at risk from a major storm surge, and over 150 square kilometres of London lie below the high tide level. Storm surges occur when atmospheric pressure and wind speeds are such that they exaggerate the tidal peaks. It is likely that climate change will increase this risk as sea levels rise (due to ice-melt and thermal expansion of the oceans). Over the last 14 years, there has been an increased tendency to close the Thames Barrier (Marsh, 1999).

Qualitative thresholds and scenarios of the future climate for the UK

This section presents the 'expert-judgment' based probabilistic scenarios constructed for and used in this project (appendix 3.1). They are based on available evidence from current climate science and from climate change scenarios presented in recent reports (eg, Hulme and Jenkins, 1998; Agnew and Viner, 2000). These scenarios are descriptive examples of how the climate of the British Isles is likely to evolve in the future. They present different levels of probability, from scenario 1—what is most likely to happen, to scenario 4—a plausible scenario but with low probability of occurrence, based on the high values of climate sensitivity and rapid growth in greenhouse gas emissions. Each scenario describes the associated changes in mean temperature, precipitation, windstorms and sea-level rise.

The expert-judgment-based scenarios presented here should be used as guides for assessing possible future impacts. Comparisons can be made with thresholds that might exist within the insurance sector and, where applicable, other exposed sectors (eg, transport, agriculture, water resources and tourism). A given exposure unit deemed vulnerable to climate change as described by scenario 1 is going to be very sensitive to likely changes in the near future, while one only sensitive to scenario 4 is a robust sector which will show few impacts above those already experienced within current natural variability.

The scenarios have been constructed to capture the ranges of change for a number of variables as described by the IPCC: for example, the 4–10cm rise of sea-level per decade and the temperatures changes prescribed by a climate sensitivity of 1.5 to 4.5°C. The scenarios are

time dependent but where possible show rates of change rather than changes by a given period. One problem that exists in presenting climate change scenarios for given periods in the future (eg, the 2050s) is that many stakeholders see this as a distant time horizon which is beyond their envelope of concern. Thus there can be a tendency to view climate change as a phenomenon which is problematic for the next generation rather than the current one. However, it is the rates of climate change and how we move from the current state to an evolved climate that are problematic; the impacts of human-induced climate change are happening already.

Impacts studies and communication of results

A considerable amount has been published about the results of climate change impacts assessments research in the peer-reviewed literature and research reports. The major forum, however, for presenting this research to the wider community is the IPCC, through the First (1990), Second (1995) and Third (to be published in 2001) Assessment Reports.

The DETR has over the last decade been funding a considerable amount of climate change research. This is directed through the Hadley Centre, which is responsible for climate modelling. Data from the Hadley Centre's climate change experiments are provided to the international climate change research community via the Climate Impacts LINK Project (Viner and Hulme, 1997). Data from the Hadley Centre models, in particular HadCM2, are the most widely used by the international research community. These data have been used by many scientists and have formed the basis for many national climate change impacts assessments (including the US National Assessment, 2000). At a national level the DETR also funds the UK Climate Impacts Programme, which is designed to facilitate stakeholder-led research. A series of global impacts assessments funded by the DETR has used the results from policy-driven GCM experiments to investigate and promote the results of impacts assessments at the global scale.

The results from impacts assessments are used in three key ways:

- To help in our understanding of the interactions between the climate system and natural/socio-economic systems, and the interactions and relationships within a given system.
- To help inform policy and decision makers about future pathways of key climate-sensitive activities or systems.
- To communicate the results of climate change research to the wider (public) community to help them understand the future changes that are likely to impact on them and to inform them of the adaptation and mitigation policies that are required.

The communication of climate science to the informed public is not straightforward. Climate science is complex and the uncertainties can often mask the results. The majority of results are assimilated through an individual's exposure to the media, rather than the peer-reviewed literature. As a result, therefore, scientists rely on the media to ensure that the science is correctly represented. Best practice to avoid misunderstandings is for the scientists to deal directly with the media rather than through an intermediary.

Summary and conclusions

This chapter describes the science behind climate change and presents a selection of the facts that support the growing scientific consensus that there is a discernible human influence on the climate system. The global climate system is now changing at rates unprecedented since the end of the last Ice Age, as is the climate of the British Isles. The estimated rate and magnitude of this change will impact on many commercial sectors, including the UK and global insurance industry.

A series of expert-judgment-based climate change scenarios for the British Isles, based on the most recent literature and science available, offers four levels of probability of how the climate of the British Isles may evolve during the course of this century. Temperature rises of between 0.2 to 0.5°C per decade are estimated along with a sea-level rise of between 25 to 100cm by the 2050s, coupled to changes in the frequency of extreme weather events.

Note

1. The UK insurance industry assigns letter codes to major disasters which affect it.

Section 2—Consumers

CHAPTER 4: RECREATION & TOURISM

Neil Kelly

The impact of climate change on weather-sensitive (ie, outdoor) recreation and tourism is likely to manifest itself in a number of different ways according to local conditions. Much of this impact will develop indirectly through increased stresses placed on environmental systems. The most serious impact will result from the effects of sea level rise, which will increase the vulnerability of some coastal populations to flooding and land loss from erosion.

Since this is a vast subject, this chapter will focus on two case studies demonstrating the need for acceptance of change and early response.

The leisure industry

Tourism is one of the key UK long-term growth sectors, with total spending in 1998 estimated at £61bn; the British Tourist Authority estimates the value of tourism in 1999 at £63bn. Some 1.78m. people are employed in tourism and related activities; of these, around 154,000 are self-employed. About 159,000 businesses, mainly independent small ones—hotels and guest houses, restaurants, holiday homes, caravan and camping parks and the like—are responsible for providing the bulk of tourism services; about 8.5% of small businesses are engaged in tourism ('Britain 2000—The official year book of the UK').

The number of overseas visitors to the UK increased by 1% in 1998 to reach an estimated 25.7m., spending £12.7bn. London's Heathrow and Gatwick airports, the seaport of Dover and the Channel Tunnel are the main points of entry. Some 48% of overseas tourists spend all or most of their visit in London, though others venture further afield to see the many attractions in the English regions as well as Scotland, Wales and Northern Ireland.

Domestic tourism generated about £45bn in 1998. Of British residents opting to take their main holiday in the UK, 47% choose traditional seaside destinations, eg, Blackpool (Lancashire), Bournemouth (Dorset), Great Yarmouth (Norfolk) and resorts in Devon and Cornwall. Short holiday breaks (up to three nights), valued at £3.1bn in 1998, make up an increasingly significant part of the market.

Business travel accounts for a growing share of the tourism market, as organisers seek more exotic or convenient venues, often offering packages to include accommodation and entertainment; this sector includes attendance at conferences, exhibitions, trade fairs and other business sites. Activity holidays—based on walking, canoeing, mountain climbing, or artistic activities, for example—are becoming more popular. The Youth Hostels Association operates a comprehensive network of hostels offering young people and families a range of affordable facilities, including self-catering.

The health and fitness boom in recent years has led to more indoor tourism. Sophisticated weatherproofed facilities such as tropical pools with other sporting refreshment facilities also offer scope for quasi-serviced accommodation and year-round operation. These centres are likely to be complemented with more swimming pools and community sports halls containing squash, indoor bowls and ten-pin bowling. There is also likely to be a need for more modern hotels, providing indoor pools, squash courts and gymnasia which will not only encourage more business use but will also attract short-break holidaymakers.

Health and fitness have high spending profiles. In the circumstances, the provision of such attractive year-round holiday environments, free from the imposed stresses of severe weather, should be of ongoing interest, especially in north Britain where the weather is predicted to be less settled.

Further south, existing theme parks are likely to attract even more than the present 75m. visitors a year, mostly day-trippers. Some parks such as Thorpe Park, Surrey, already concentrate on water slides. Given significant changes in summer weather conditions, aqua parks modelled on facilities in southern Spain or Tenerife

might become popular. In this connection the LINK study referred to in chapter 3 indicates the potential for an increase in tourism in the east Midlands. Consideration might be given to development of similar attractions in that area.

Insurance and leisure

Clearly insurance arrangements are of significant importance to organisations connected with recreation and tourism. Faced with the prospect of financial ruin should disaster strike with no insurance cover available, many businesses, especially those in high-risk areas, would cease to operate. Equally, individuals with holiday homes, often located near the sea and other exposed areas, would be placed in a difficult position, especially if they had mortgages outstanding.

The traditional approach to providing cover has been to insure buildings and contents for their full or reinstatement value, thereby ensuring that an adequate premium is achieved for the risk incurred. However, today an alternative risk transfer market is emerging that is affording large customers greater opportunities to eliminate or reduce their exposure to losses. Additionally, insurance and reinsurance companies as well as some industrialists and governments have been issuing catastrophe (CAT) bonds to protect themselves from natural catastrophe losses. Writers of CAT reinsurance receive a predetermined premium in exchange for protection for a specified event, with a predetermined maximum loss for a specified period of time. On the other side of the equation, investors earn an annual return on the invested capital until maturity of the bond—which can vary from less than a year to ten years—unless the bond is triggered. (See chapter 2 for more detail.)

For many years business interruption insurance, which operates provided material damage has occurred, has satisfied the majority of needs but in recent years it has become more and more obvious that businesses can suffer substantial economic losses, regardless of material damage. A specialised product was pluvius, most notably provided by Eagle Star, providing compensation if an event were interrupted by rain. Today, weather products are emerging which operate regardless of material damage to reduce the negative financial impact of weather events.

Significant demands arise for liability insurance ranging from the staging of hazardous events, such as motor racing, to the everyday conduct of business operations. To give some examples: children can suffer injuries in parks or at fairgrounds; people can be injured moving around hotels or contract food poisoning in restaurants; chemicals legitimately used to maintain golf courses can lead to contamination of water sources or injury to third parties.

Travel insurance is an important product especially for holiday makers visiting places such as the USA, where medical costs are high, and long-haul destinations where they could be exposed to local health hazards, making insurance as essential as the relevant immunisations. Holidaymakers might be tempted to take part in such high-risk sporting activities as scuba diving or bungee jumping.

According to a Mintel report in 2000, UK residents took nearly 54m. overseas trips in 1999, an increase of 59% on 1992. In theory this represents 54m. opportunities to sell travel insurance. Clearly not all trips are likely to be covered but the same source estimates that the travel insurance market, in terms of gross premiums, is likely to be worth £555m. in 2000.

The market for personal travel insurance has always been difficult for insurers and brokers; adverse press comment about selling practices has exacerbated the problem. Such a situation has assisted high street providers and direct sellers to advance their own interests and to create downward pressure on premiums. However, since summer 2000 the selling of some travel insurance has been regulated by the General Insurance Standards Council—travel agents now have to obtain a licence and show that they are competent at selling the product. Their domination of insurance sales could in consequence be eroded; currently Datamonitor believes that about 85% of customers purchase travel insurance from travel agents.

The impact of climate change

The recreation and tourist industry is likely to undergo a significant change in the coming years as service providers and operators seek to meet the challenges of global climate change.

A progressive change in holiday-taking habits could

result in a growth of civil disorder, such as the vandalism and drunkenness witnessed in a number of popular overseas resorts in recent years. Such changes concern insurers and need to be addressed, as do the likely effects of the other numerous advantages and disadvantages if cost-effective progress is to be made with minimum disturbance.

Environmental issues, an already sensitive area, will grow in importance because of congestion, noise/air pollution and development of coastal areas to meet demand.

International tourism

In a recent paper, Agnew and Viner (2000) considered the potential impacts of climate change on ten key holiday destinations. It is evident that these locations are likely to experience serious problems in the coming years which could lead to loss of business and consequentially damaging financial implications, given that many of them rely on tourism for their existence.

Table 4.1 Potential impacts of climate change (overseas examples)

Location	*Problems*
Greece & Turkey	Heat stress/mortality
	Water supply restrictions
	Forest fires, urban smog
	Pollution
Switzerland	Shortening of snow season and reduction in snow
	Reduction of skiing season
Southern Spain	Resurfacing of malaria
	Heat stress
	Flash floods, forest fires
Florida and the SE coastline of USA	Sea level rises affecting recreation and tourist activities concentrated along the state's beaches
	Severe storms discouraging holiday makers
	Erosion, coral bleaching
	Threat to geomorphology and ecology

(Source, Agnew & Viner 2000)

Examples of the problems, some of which are already surfacing, are given in Table 4.1.

Insofar as UK personal accident and medical insurers are concerned, they need to be aware of the risk factors and to monitor the effects of climate change in other areas, including the UK. They also need to be aware that although reductions in the popularity of overseas locations could result in a growth of UK tourism there could be other implications.

For instance, Travel Research International has pointed out that a small change—say of just 2%—in the number of British who, instead of taking a holiday trip abroad, might decide to take one in the UK instead, could result in an extra £350–400m. being spent at home on leisure and holidays. In 1997, the county of Cornwall recorded tourism receipts of £937m., of which £846m. came from UK residents. Suppose that the 2% all went to Cornwall instead of Benidorm; they could add 40–50% to Cornwall's tourism receipts but at the same time create a serious water shortage. Such a switch might also deprive British insurers of £9m. in premium, because generally consumers only purchase travel insurance when they go abroad.

Advantages/disadvantages for the UK

Research reveals that the UK could experience a number of advantages and disadvantages as a result of predicted weather changes. Not all the implications can be addressed but a number are listed in appendix 4.1. In the final analysis, a significant level of change will happen, requiring long term planning at local and national level, and insurers will need to review their exposure.

Coastal sites are constantly prone to flood exposure and considerable care needs to be exercised in their development. Interestingly, during a recent interview with the estate manager of a marina where the majority of structures were six feet below sea level, it was mentioned that although gradual rises in sea level could be absorbed, constant monitoring is essential and there was a proposal to strengthen the defences at the rear side of the marina to prevent the sea circumventing the sea wall. Defences are only effective if they provide a complete defence and do not deflect problems to other locations.

Enquiry reveals that flood cover is essential for many

policyholders. In the case of the marina, the interviewee stated that without it there would be significant devaluation of properties. The need for perils cover, including flood, was endorsed by insurance brokers, some of whom provide advice to clients on site locations and support the need for contingency planning.

Case studies

To develop this analysis on the impact of climate change, it was decided to focus on two case studies, since that would allow a deeper analysis, with a naturally defined framework. Other researchers would then benefit from seeing the methodology in operation, even if the content were not directly relevant. At the same time, some lessons might flow immediately from the selected case studies to insurers. The areas chosen were the sport of golf and the holiday destination of Florida.

Case study one—The sport of golf

Golf has been gaining popularity in recent years as it has become more accessible and more courses have been built to meet demand. Today the number of young people playing golf is increasing and many clubs are actively seeking to expand their junior sections. The game is popular with the silver market (55+ age and early active retired) and the greater numbers of women playing are making it more of a family activity.

As at June 2000, data provided by the National Golf Unions indicated that there are approximately 1,423,200 amateur players in the UK. However, it is interesting to note that the Golf Research Group believes that a further 4,130,000 people play casual golf, ie, not as members of a club, or from time to time. It is clear that golf has a significant following.

Royal & Ancient Golf Club golf conference

At the beginning of February 2000, the Royal and Ancient Golf Club (RAGC) of St Andrews organised a major conference to tackle the challenges facing the game in the first decades of the new millennium. After research and discussion the advisory panel identified six key issues, namely
—climate change
—water
—chemicals
—levels of play
—planning
—the environment.

This is a good example of integrated impact analysis, outlined in Figure 1.2, where climate change is seen in the context of an evolving complex.

The main speakers included people of world renown including Dr Mike Hulme, head of the Climatic Research Unit at the University of East Anglia, who is an adviser on climatic prediction to both the British Government and the United Nations and Professor John Pethick of the Department of Marine Sciences and Coastal Management, Newcastle University. A comprehensive digest of the two days' discussion has been produced in a report called 'On course for change' (RAGC, 2000).

Professor Pethick, when discussing the consequences of sea level rise on links courses, alerted all concerned to the need for forward planning:

> 'Because of these largely inevitable changes to future climate and to future sea level we need to take seriously now our role in planning and adapting our various natural and social assets.'

Despite the need to consider natural restoration and accretion, there are differences of opinion on the way in which coastal protection can best be achieved. Such matters are important, as many tourist attractions, holiday homes and other facilities are located along the coast. Throughout the conference a number of references were made to the increasing impact of EU legislation, eg, EU Habitats Directive, which could affect the manner in which sea defences are managed. In this context a note of warning was raised as to whether planners could become embroiled in a bureaucratic nightmare, given the introduction of international legislation and timid approaches by certain government departments.

The problems associated with the use of pesticides and fertilisers were highlighted in the light of changing legislation in the UK and the EU, which could give rise to new liabilities or duties.

Legislation on water usage will change with the arrival from Brussels of the Water Framework Directive. The Directive, in draft form in late 2000, is designed to protect inland water, transitional waters (tidal or

estuarial waters to all intents and purposes), coastal waters and groundwater. It will introduce a statutory form of catchment management. Golf clubs should give consideration to storage of water against a background of climate change—a matter that might also interest insurers, given the isolated location of some clubs and the increased risk of fires in heath/forested areas.

Changes are afoot in the licensing system for water abstraction and there will be greater consistency in the assessment of licensing applications through national guidelines. The key judgment of reasonable need will be linked to benchmarking of best practice of water use. These will be compared to what resources are available and in future licences will be time limited.

Michael Meacher, Minister for the Environment, stated that

> 'water is possibly the most important issue. Forty or fifty years ago… the availability of water seemed infinite. We are of a very different mind today, after the droughts in the 1990s particularly.'

Links courses

The August 2000 issue of the magazine *Golf World* reported the outcome of investigations on how rising sea levels are putting some of the UK's greatest courses in peril. In producing the report, which included advice from Professor Pethick, a questionnaire was sent to 50 links courses to assess the current threat from coastal erosion and flooding. Given the current predictions of rising sea levels and climatic change, the clubs were asked about the future problems they are likely to face. Seventy-two per cent of the clubs responded and the key findings, which make gloomy reading, include the following:

- 75% of clubs say they have suffered the effects of coastal erosion and/or flooding in the past 20 years;
- 69% say their course is facing serious threat from erosion and/or flooding in the next 50 years.

For further details of the survey see appendix 4.2; a resume of case studies of five selected courses appears in appendix 4.3.

In chapter 3 a number of scenarios are considered relative to the rate of sea level rise. Applying similar principles, it seems reasonable to conclude that although gradual sea level rises, as envisaged in scenarios 1 and 2 (low/medium-low; see appendix 3.1), might be sustainable, serious problems are likely to arise should the conditions in scenarios 3 and 4 (medium-high/high) manifest themselves. Besides the forecasts which reveal an escalating problem in the coming years, storm surges could exacerbate the problem at any time. It follows that the future of many links golf courses seems bleak.

Photo: James Cheadle/*Golf World*

Figure 4.1. Erosion on a golf course

Summary

The sport of golf, outwardly thriving, is beset by a number of interlocking challenges, one of which is climate change. While they have been recognised, solutions still have to be found.

The American experience

Eighty-five per cent of all US tourist revenues are generated by coastal states (Houston, 1996), with Florida being the most popular state internationally. Sea level rise is of particular concern to Florida since many recreational and tourist activities are concentrated along the state's beaches, which are low-gradient and particularly vulnerable to erosion (Leatherman, 1989).

Regrettably Florida's problems are not confined to erosion. Hurricane Andrew (1992) caused US$16bn damages, thereby eliminating much of the local insurers' capital (eleven insurers were eventually bankrupted), and a major incident in Miami could result in claims of over US$50bn. Potential impacts of events of this size are discussed in chapter 2.

A very full article appeared on this subject in the international edition of *The Miami Herald* of 21 August 2000. Headed 'Hurricane insurer passes risk to insured', the article carried a picture of a house with a board outside stating 'Sold—cannot pay insurance premiums'. A number of points warrant comment as lessons can be learned after Hurricane Andrew.

> 'Insurance money flowed freely as homeowners rebuilt homes, bought new furniture and replaced damaged cars. Because of generous payouts the storm became known as St Andrew.'
>
> Source: *The Miami Herald*

Regrettably major catastrophes expose insurers' inability to police the volume of claims they receive, thereby generating their own cost inflation factor. In relation to the latter, one catastrophe specialist estimated that the inflationary factor attributable to demand for services and materials and insurers' inability to police claims for the recent European windstorms, Lothar and Martin, could be as much as 30%.

Given UK insurers' apparent predilection for reducing claims handling costs, they might be well advised to consider how they could realistically control claims after future major events, always assuming that they continue providing storm and flood cover.

After Andrew, US insurance companies woke up to the fact that they had underestimated their exposure in South Florida for years, using homeowners' insurance as bait to sell other products. As a result, the state's insurance industry passed the burden of hurricane risks to the state-created Florida Windstorm Underwriting Association (FWUA). This now insures more than 400,000 coastal property owners against hurricane damage from wind; flood losses are insured separately.

When the FWUA was created in 1970 by state legislature it sold hurricane insurance in areas where private insurance companies refused to cover the risk. Initially its portfolio was relatively modest but, after Andrew, insurers dropped thousands of policies throughout South Florida and the FWUA became the insurer of last resort. Today it is controlled by the insurance industry, which is increasingly criticised for its lack of consumer representation, and as a result of a law passed in 1997 can place the burden for catastrophic losses directly on the state's 5.4m. residential policyholders. The report also indicates that insurers can pass assessments directly to policyholders across the state—whether they are hit by a hurricane or not.

The FWUA has now implemented some of the most dramatic changes in the way Florida homeowners are insured and these are stirring fears about the region's ability to recover from the next major catastrophe. Most homeowners now have deductibles of 2 to 5%, rather than the US$500 to US$1000 before Andrew. In addition, most policies no longer pay homeowners to replace damaged goods, such as furniture or appliances with 'as-new' settlements. Instead, policies now pay the cash value of those goods (ie, the depreciated second-hand value).

With less protection, South Florida legislators fear that some people might default on their mortgages and lose their homes, while others might abandon their property rather than struggle to rebuild.

Not unnaturally many homeowners in Florida are far from happy with current arrangements. Some homeowners have taken the logical step of dramatically redesigning their houses to cope with storm surge problems by mounting them on stilts.

However, it seems likely that controversy will continue for some time to come. Unless a future administration conceives a way of overcoming the dilemma, Florida's recreational and tourist industry could also come under threat.

Lessons learned

Clearly, against a background of significant climate change in the UK and with rising sea levels, insurers will be faced with catastrophes in the coming years. The American experience is therefore worthy of examination as it could have a bearing on UK insurers' future considerations, eg,

- The need for some form of cover, no matter how limited in scope, was recognised by Florida following Andrew. The method adopted is interesting in that the burden of a catastrophe will now be borne by Florida's 5.4m. residential policyholders. This means that following losses running into billions of dollars, as was the case in 1992, each policyholder will receive a significant bill, presumably including those who had suffered

losses and had separately been obliged to meet their policy deductible.
- A significant deductible now applies.
- 'Indemnity' payments are made for contents. Such an arrangement is believed to be long overdue in the UK and the basis of cover in relation to holiday homes and properties generally, in areas that are prone to flooding, should be reviewed. Claims for contents should be related to their value at the date of the loss and the market value of buildings should be taken into account when assessing the viability of repair following a major loss.

The leisure industry and climate change

Regrettably, despite the existence of substantial evidence of climate change, conflicting reports are causing confusion in some quarters resulting in apparent inactivity (the sport of golf is an honourable exception). Although a number of organisations are seeking to raise awareness, there is little evidence to suggest that the leisure industry and/or its providers is formulating a strategy or has turned its attention to the planning or close examination of the issues involved.

This is a view shared by Travel Research International. As an example, it has cited the area around the Solent, Isle of Wight and Chichester Harbour. There is clear understanding in that region of the broad issues involved, and of the importance of tourism to the local economy. Thousands of pleasure boats based in and around the Solent and the boating industry that these boats support will be directly affected by storm surges along the Channel. This danger is already being taken into account in the area of flood defences which are especially vulnerable, such as at the entrance to Chichester Harbour and around the Selsey peninsular, but what might the implications be for the financial profile of the harbour conservancy? What will the insurance implications be for water sports? Will rising costs resulting from climate change alter the demand profile for these activities? If so, what will the knock-on effects be on the local economy?

A further example mentioned concerns the Isle of Wight—a labour surplus area—where tourism is vital. Is there any realistic chance that this destination might be facing a steady upsurge in demand? What would the consequences be for accommodation, transport links or employment? What are the planning implications of possible demand changes?

Apart from being surprising, this lack of action is a cause for concern and suggests the need for implementation of a national strategy, involving the government, given its focal role and that its policies on water conservation, transport, development in the south of England and other issues are likely to influence decisions. The insurance industry should be part of this effort, since the implications are considerable, both for travel insurance per se and for some of the wider implications involved.

Underwriting considerations

Insofar as insurers are concerned, enquiries reveal that demand for weather-related perils and flood cover will continue, if not escalate. Clearly, against a background of substantial losses both at home and abroad in recent years attributable to storms, hurricanes, subsidence and flooding, and with knowledge of the impact of the recent European windstorms, Lothar and Martin, the market may need to reflect on its approach to such risks.

The American experience, referred to earlier, should also ring alarm bells. Questions will inevitably be asked on storm and flood cover in the coming years and confrontational situations could develop unless the industry continues to provide cover or an alternative method is devised, involving the government, to cater for financial losses. For some time now, hotel chains in the Caribbean have been concerned about the availability and affordability of hurricane cover.

It is evident that problems will continue to be experienced overseas as a result of weather changes, inter alia, in relation to health and property. Insurers will need to monitor the situation closely, especially if similar problems manifest themselves in the UK, parts of which are predicted to become significantly hotter.

Travel agents are ideally placed to sell travel insurance when they are arranging clients' holidays and it is suspected that many people overlook the protection of all risk policies which they already hold when paying for this cover. Thought might therefore be given to seeking ways of meeting all travel insurance needs as an extension of domestic contents policies. The Internet and digital TV offer potential for growth in this market,

but so far the industry has been slow in reacting. (Mintel)

Today weather products are emerging which operate, regardless of material damage, to reduce the negative financial impact of weather events. Products of this type can have numerous applications but the reliance of amusement parks on good weather for good attendances can serve as an example. In arranging cover, therefore, the trigger for operation of the policy could be a precipitation level, say 3mm. If the daily precipitation level while covered is below 3mm, no compensation would be payable but if it were equal to or above 3mm the park would receive the agreed daily compensation, subject to the terms of any deductible that might apply for the whole covered period. An important issue here will be for underwriters to obtain some guidance on how future weather patterns might differ from historical experience.

Since the indemnity calculation only depends on precipitation level, actual data from a recognised meteorological institution would be used for verification purposes. Products of this type are ideal for organisations whose operations are susceptible to rainy seasons and in this example the amusement park would succeed in mitigating its rain exposure.

The alternative risk transfer market will continue to develop (see 'Alternative risk transfer' in chapter 2 for more details). Indeed, some people are predicting that within a few years, when this market matures, it will be more important than the current catastrophe insurance market. Clearly consumers are being afforded greater opportunities to eliminate or reduce their exposure to losses and unless the UK insurance industry seeks to broaden its horizons it will continue to lose ground. In many ways, changes in climate could provide a window of opportunity for UK insurers, provided they are prepared to return to their roots and actively engage in risk taking, as against seeking stable results above all else.

CHAPTER 5: THE CONSTRUCTION INDUSTRY

John T. Walden

The construction industry affects us all and we all increasingly depend on it. Not only is the construction industry a major employer of labour worldwide, but all other industries generally depend heavily on it for their own existence, development, progress and success. The industry has been, and will continue to be, fundamental to our progress, well being and achievement, meeting new challenges and demands as they arise. Works will continue to be constructed, reconstructed, repaired, renovated and, when utility diminishes, replaced, updating aged stock to add to expanding newly erected man-made structures. Figure 5.1 gives a glimpse of a very different City of London in about 1830 with the 'new' bridge and its predecessor. Although both have now been replaced by a single main span structure, London's bridges have largely enjoyed long lifespans, though the same may not apply to the same extent in the future. With rapid technological advances many unit lifespans may prove to be of relatively short duration whereas others involving water resources, infrastructure and coastal defence will need continual review and strengthening. However, most buildings will last at least 60 years, so current planning and design must fully account for 2060 climate scenarios.

The construction industry by its very nature must be alert to weather conditions and continually heed change predictions for short term weather and long term climate and their likely consequences. European codes of practice must be continually updated to reflect climate change. Sound planning must contribute significantly to risk reduction. Bad planning not only endangers the project work but its surrounding environment. Weaknesses will be a future problem for investors and risk takers—principal among them being the insurance market.

Figure 5.1. London Bridge c. 1830

The construction industry now

Weather and climate forecasting and change predictions are increasingly becoming major risk considerations for all participants, from the short term site operations to the long term planned lifespan of the investment and beyond. A fine balance exists between the project which is successfully profitable for the participating interests and one with a much less favourable outcome, bearing in mind the economic and cost restraints combined with the legal and contractual responsibilities placed on those involved. Inter-party relationships can in practice prove very complex and often multinational.

The interrelated interests must carefully co-ordinate operations to achieve optimum results in terms of time, cost and successful completion. It is not only the contract site that must be considered but also all support locations and transits from it. Loss or delay of vital equipment in transit will create problems similar to those which would have resulted had it occurred on the work site, resulting in suspension or work rescheduling. Each project will have its own key areas of vulnerability.

Each interest will view weather climate risks differently depending on its own individual risk, time exposure, experience and legal obligations. Basic forms of contract are in common use and set out individual responsibilities and obligations including, invariably, insurance.

Table 5.1 sets out typical risk considerations and their duration for a major contract, such as a coastal power station or airport.

Weather and climate risk exposures are an essential component in any co-ordinated risk management programme because of the limitations and economic cost of available insurance protection. Poor planning will inevitably bring problems, as not only must insured

Table 5.1. Separate risk considerations for a major project

Pre-site	To site	Site	Off-site	Post-site
Feasibility study	Accessibility	Occupation	Non-site facilities, eg, storage workshops	Maintenance
Environmental acceptance	Mobilisation	Mobilisation	Manufacturers	Guarantees/ warranties
Planning approval	Transportation —freight	Labour	Suppliers	Decennial
Conceptual to detailed engineering	Importation and customs	Campsite	Quarry	Latent defects
Budget and costing estimates		Installations		
Financing and guarantees		Workshops		
Pre tender evaluation		Storage		
Risk assessment and protection		Construction plant and equipment		
Tender submissions		Temporary and permanent works		
		Testing and commissioning		
		Training		
		Maintenance		
		Estimated period		
2/5 years	12 months+	5/10 years	+12 months	Up to 15 years
		Those requiring insurance		
Architects	Forwarding agents	Contractors	Manufacturers	Generally all to varying degrees
Consulting engineers	Shippers	Sub-contractors, supporting trades	Suppliers	
Designers	Hauliers	Principals		
Surveyors	Access contractors, eg, roads	Owners		
Study bureaux		Developers		
Insurance brokers		Financiers		
Risk managers				

physical loss or damage aspects of risk be considered, but also the uninsured or uninsurable risks which in the event can prove much greater, eg, delay and loss of use. Self insured events will be dealt with in the contract conditions and bills, leaving those responsible to calculate their own projected exposure cost.

Fundamental considerations for any project are

- a thorough pre-tender investigation of all expected climate and weather factors and change variables within the project time and cost projections;
- the fair allocation of contractual responsibilities and liabilities arising for both time and risk;

- the appointment of competent, experienced contractors to fulfil and co-ordinate the work and stipulated maintenance; the appointment should not necessarily be of the lowest tenderer;
- the successful operation, sale or investment in the completed project for its planned lifespan.

A fundamental error of judgment in the original planning or design might prove to be a disastrous future flaw. Weather and climate and their application to a changing environment must be very carefully analysed. A sufficient buffer period or margin of safety needs to be incorporated into the proposed work schedule. With the pool of knowledge available ever-increasing, the onus of professional duty on those entrusted with the work increases considerably and much more care needs to be taken of climate and weather protection and precautionary measures. Detailed environmental evaluation is necessary for the construction's expected lifespan or period of utility. Private housing in many ways is flexible in that certain parts, eg, windows, doors, temperature control appliances, can be changed to meet a climatic change scenario not originally accounted for. However, subsidence and heave that will directly affect the structure are difficult to accommodate.

Foundation engineering needs fully to evaluate ground conditions and conduct soil analysis, particularly in areas where there is a predominant clay or clay-type sedimentary sub-soil, especially when combined with a locally changing water table. Foundation design must be appropriate as to both form and depth using spread, raft forms, piling or, in some cases, special types such as caissons. Inadequate foundations are a contributing factor in many subsidence claims.

Insurance industry now

Construction insurance presents problems in creating technically sound, tax effective, unexpired risk reserves, due to a limited uneven spread of business with premium usually paid by instalments geared to project financing rather than maximum risk exposure periods. Final results will depend on adjustment where final contract values may not be available until well after completion date.

Profit or loss will vary considerably between insurers, depending on their technical acceptance criteria, reserving philosophy and non-proportional reinsurance 'offsetting' arrangements.

Figure 5.2 illustrates the range of insurance covers

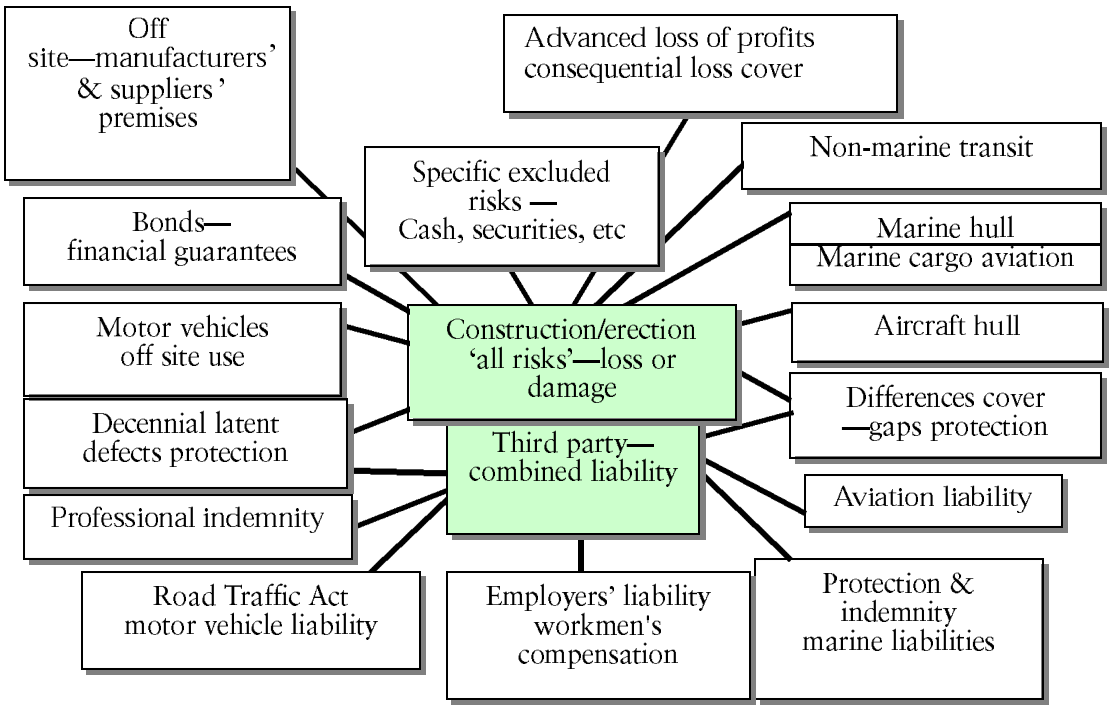


Figure 5.2. The separate insurance covers which may be necessary to supplement the core construction project insurance

necessary to service a major construction project. (NB. The main policy will only cover each insured's insurable interest which generally will be governed by the respective contract terms applicable.)

Insurers, financiers and supporting services increasingly are becoming more actively involved in the project team and make their own assessments and analysis to determine risk exposures.

Project construction risks insurance is a vital ingredient within any risk management programme. Insurers will generally provide 'all risks' coverage combined with third party insurance, protecting each interest within a composite format. Some insurers qualify their cover by adding the words 'sudden and unforeseen'. Terms and costings for the entire project will customarily be agreed at inception to determine a premium based on estimated contract values or price. There are few opportunities to change this once agreed. Insurers must therefore carefully consider not only the weather and climate information presented to them but also make their own independent assessment with forward projections to encompass change statistics within their period of cover (five to ten years not being unusual for a major contract).

Environmental change can make past statistics of very limited practical value if they are not upgraded to include not only known but expected future development. In assessing risk exposures and estimated return periods for major events and likely occurrence it becomes, in many cases, a matter for expert opinion and experience to reach a reliable answer by evaluating all relevant data and applying experience and foresight. The 1 in 100 years' event based on past data alone might easily prove with foresight and predicted change to be more in the region of 1 in 10. There is a price for being more precautionary but insurers know to their cost that previous predictions based solely on past events have proved unreliable and very costly.

The challenge thrown up by climate change is how to link the emerging science of change scenarios with the embedded professional experience of those who have worked a long time on such real risk assessments.

Of the necessary additional insurance covers to the construction policy, particular mention should be made of 'professional indemnity' risks. Usually insured on an annual basis, these relate to the legal liability of architects, consulting engineers and others who in their professional capacity cause loss due to their negligent act, error or omission in design, plan or specification.

Decennial insurance

In Francophone areas where the legal system is based on the Napoleonic Code, building defects liability is usually covered by taking out decennial cover, basically protecting the structure against failure, such as collapse or partial collapse during a 10-year latent defects period. This form of cover with EU influences will no doubt increase within the UK and is similar to cover already in place through the National House Building Council scheme. The essential ingredient when arranging decennial cover is that it is a prerequisite that minimum standards are maintained and independent engineers or study bureaux are appointed to oversee and check compliance by those undertaking the work.

Whether the project is a UK local housing development or major international infrastructure, each must be regarded very differently and climate and weather considered from a variable interest viewpoint. Projects appearing the same or similar at first sight can have quite divergent outcomes. Overall experience is a key underwriting factor (often overlooked) and the depth of knowledge and preparedness of the construction team are all important. Serious investigation and analysis of climate and weather criteria and effects within perhaps a rapidly changing local environment must be clearly addressed, as must the safeguards installed to mitigate risk should predictions prove inadequate. It is interesting that for basically similar phases of a project, different contractors effectively exposed to the same climatic and weather conditions can experience very different results, which are further reflected during the lifespan of the completed work.

The diversity of works within the construction industry and the effect of climate and weather on their successful outcome is unparalleled.

- *Locations* will be widespread depending on geographic, geological, commercial or political factors. During the construction phase not only are site risks to be considered but also access, transportation and off-site activities. Figure 5.3 shows a particularly notable example: Monte Carlo has been developing seawards with newly created

land exposed to the Mediterranean. The works sustained serious storm losses during the construction phase.

- *Types of work* will range from housing, high-rise buildings, dams, bridges, tunnels, roads, railways, power utilities, refineries, factories or offshore development.
- *Lifespan* will vary considerably. For example, for coastal protection works may be
  —permanent: port/harbour facilities;
  —semi-permanent: to withstand say a 1 in 100 year storm, but erosion of a protecting beach or salt marsh are kept under review and in future either strengthened or abandoned as part of a managed coastal retreat programme;
  —temporary (or experimental) having a selectively short useful life expectancy;
  —very temporary: short duration work to facilitate operations, eg, dewatered cofferdam to create permanent foundation works.
- *Materials:* a very wide range of basic materials and components will be employed, wherever possible these being the most economically viable. Added to these will be units, appliances and installation modules manufactured offsite and often imported.

Figure 5.3. Monte Carlo

As mentioned earlier, each interested party in a project will view weather and climate differently. The principals for whom the work is carried out must fully consider with their architects, engineers and designers the useful lifespan and in some cases eventual demolition.

However, while the contractors' concern is generally shorter term, their work such as foundations and piling, which might take only a few months to complete, will be fundamental to a project's success. For the eventual owner, accurate short-term forecasting for the work phases is of less significance than the planned expected lifespan, taking into account expected changes in ground conditions and climate intervention. Basic materials such as sand, cement and aggregate must be carefully analysed for suitability within the ground environment. Potential risks of settlement, subsidence, heave, sulphate attack and, in coastal areas, permanent salt intrusion, are potential problem areas. Possible ground or ground water pollution are areas of concern.

In many coastal locations in the Middle East locally obtainable sand and aggregate will be considered totally unsuitable.

Natural perils

Insurers have long recognised the effect of weather-related risks and their not infrequent occurrence within an 'all risks' policy framework. It is therefore customary for the first part of each insured claim under a construction project policy to be borne by the insured but generally for natural perils the deductible will be assessed separately from other hazards and increased, sometimes substantially. Major civil engineering 'wet' risks will receive particular consideration where exposures can be considerable and where an excess of US$250,000 each loss (unlimited in the aggregate) would not be considered unusual.

The natural perils subject to a deductible are generally expressed as 'storm, tempest, flood, water damage, subsidence, collapse or earthquake'.

- *Storm and tempest*

These cover exceptional wind, rain, hail, sleet, snow or ice and, while these are the terms traditionally used by insurers, clearly geographic terminology and form are included, eg, cyclones or tornadoes. Strength and intensity periods are the key factors. Any adverse variations from those anticipated will add to the risk calculation. Insurers' concern is twofold:
—for the construction phases to withstand temporary vulnerable periods where short-term weather forecasting is essential;
—for the completed works to withstand lifespan stresses, taking fully into account both shorter and longer term climatic forecast and change.

A changed wind effect may be
—a strong steady wind: velocity force factor;
—a short sharp gusting wind: oscillation factor;
—accompanied by driving rain, hail or snow: load factor;
—direction change: funnelling effect factor.

Placing tall structures in close proximity will exaggerate wind effect to produce some highly unexpected results.

A storm or series of connected storm conditions may be far from the project site yet cause very serious flash flooding or water inundation, combined with debris and other offsite material. Cleaning-up costs alone can be substantial. Climate and weather predictions must not be confined to localised expectancy but extend to consider the effects from a major exterior cause. If a heavy windstorm occurs in saturated ground conditions it can wreak havoc, as experienced in 1987.

- *Flood and water damage*

Usually the result of storm or exceptional conditions where the local or natural environment cannot absorb or accommodate water inundation, combined with inadequate or insufficient temporary drainage. Water damage arises in many ways, flood being an extreme case. Examples are rain, snow, ice, humidity, condensation, frost and sea spray. Change to the local natural layout (eg, deforestation, channelling of streams restricting natural drainage) is frequently aggravated by climate change such as wetter winters, drier summers or infrequent heavy rainfall. Many projects contain phases which are particularly vulnerable to water damage, such as the foundation stage.

This is not a new problem. The Kariba Dam suffered major flood damage during the construction phase (see figure 5.4). Because the project was well planned, and the site management was experienced, early warning gave sufficient time to cope with the situation, mitigate loss and deliver the project on time (Oliver, 1960).

The UK 2000 storm floods highlighted current problems involving
—property and environmental drainage inadequate to accommodate changing climatic rainfall patterns;
—effects of saturation, rendering drainage useless in low-lying areas and activation of aquifer type springs elsewhere.

Figure 5.4. Zambesi River in full flood through Kariba worksite. Water flows of over 500,000 cubic feet per second were recorded.

- *Subsidence, heave and collapse*

Included are all aspects of land movement, settlement, heave and unexplained ground collapse. During construction the risk to third parties or adjacent property can be high. Dewatering will in fact create a 'drought season' effect and stand-by facilities are a usual safeguard for work sites. Monitoring of both the works and the surrounding property is a prerequisite to avoid, for the latter, claims for existing subsidence or exaggerated losses where a pre-existing problem was apparent. The Royal Institute of British Architects' contract recognises the potential subsidence risk under clause 21.2.1, allocating a provisional sum for insurance.

Trees are a well-known problem with housing developments, whether they are planted for effect or subject to preservation on sites with buildings around. In the future, with rising sea levels and ground water levels heightened, heave will be a likely major risk. In many low-lying coastal areas it will be combined with salt attack. Ground water rise is not restricted to the coast. Sea rise will increase the height of tidal rivers which, if in flood from heavy upstream rainfall, can create a serious ponding effect.

- *Earthquake*

All forms of seismic/tectonic/volcanic activity are included, as are events created as a direct result. While they are not weather or climate-type risks in themselves, their effect combined with short-term weather can be very marked indeed, eg, mud flows.

Insurers may apply a period, say 72 hours, during which

loss or damage will be deemed to have occurred from one insured event.

The role of the geologist recently assumed greater significance with advances in earth science technology and a need for close examination of climate and weather data and predictions to determine suitable project locations and successful groundworks. During the construction phases, and later throughout their lifespan, structures are dependent on stable ground conditions whether land-based, bordering water or at depth, such as offshore production units. Climatic changes might be considered as very gradually operating phenomena but it should be noted that in certain situations just a small variance can upset a local equilibrium and create a disaster from a latent hazardous ground condition.

Human intervention

Apart from a self-insured involvement by way of a deductible construction, insurers will exclude certain risks entirely or limit cover for these perils. By far the most important are the following.

Faulty design

Basic to all construction is that the structure will perform to planned requirements and withstand the stresses and strains put on it during its expected lifespan. Weather and climate change scenarios must clearly be taken into account and provided for within the design concept model, based on best available information, experience and technology. Large projects can cover long periods so keeping abreast of current development can prove problematic and costly if delays result.

The effect of large-scale town and infrastructure developments on their local environment must be heeded, particularly drainage in low-lying flood plain areas. Adequate local protection might only serve to pass the danger on to elsewhere.

Faulty materials

Materials should be fit for the purpose and function required, within a specified environment and for a planned duration. Safety factors or margins should be incorporated to adapt durability and utility to changing environmental conditions at the design stage. Some items will be regarded as renewable and their lifespan might be much shorter than the structure of which they form a part, eg, windows, doors, modular appliances and some roofing materials. More fundamental items must have a lifespan commensurate with the structure. We need only consider today's principal building block, comprising water, cement and aggregate with or without steel. The suitability of each component together and in relation to the site ground conditions is critical. Ground water levels must not be ignored, particularly in low-lying coastal or clay areas. New innovative elements, while laboratory tested with limited field exposure, can only prove durability in use over time and in their varying environments. The use of cost-effective lightweight materials needs careful consideration against tried and tested traditional construction of brick, stone, slate and tiles.

Climate change will influence temperature and humidity with possible adverse effects on materials that have different expansion characteristics. The Building Research Establishment has begun to address these issues, but only for UK circumstances (Garvin et al, 1998).

Faulty workmanship

This relates directly to the workforce skills and experience combined with procedures within a changing site environment as work progresses. Good working practice needs to be observed throughout, particularly with respect to climate weather risk. It is an unfortunate fact that in boom times in the construction industry the skills shortage can be acute and more speculative work is undertaken with less frequent site inspections and work checks. Shoddy work will fail eventually and adverse future change will only quicken the process.

Proximate cause[1]

In practice it is difficult, if not impossible, to determine in the event of loss or damage whether faulty design, materials or workmanship would be regarded as the proximate cause, especially as other causes, of which weather and climate are important, also contribute to the chain of events. Many losses show a failure to some degree in the planning and operational procedures, methods, supervision, training and foresight on the part of those involved. It is an interesting discussion point if there is a loss whether the natural perils are the proximate cause or merely the last in a series arising from a basic design, workmanship or materials defect.

To prove an exception or limitation as the proximate cause except in the simpler cases can involve very complex argument for insurers, eg, if there is storm flooding whether loss or damage is the result of inadequate design. Expected climate and weather are factors which should be fully evaluated and accounted for within design requirements. With hindsight, many subsidence claims can be directly related to inadequate foundations.

Wear, tear and gradual deterioration

The intention is to exclude loss or damage from normal site exposures and later use. Weathering will be influenced by climatic conditions and environment. A rapid change from that predicted can accelerate the weathering processes. Some elements will be better able to withstand change than others. Inspection of past building structures will provide good examples of the process for given materials such as bricks, tiles or stonework. Even structures that have only been built recently can show signs of future problems, eg, discolouration in reinforced concrete. Climate variance can enhance the process or prolong it. Temperature change with hotter, more humid conditions will encourage condensation, infestation and, in wood, beetle or termite attack.

Projects overseas have shown the limitations of materials used in very different and much harsher climatic scenarios. Materials, methods and procedures well-tried and tested in western Europe have been found totally unsuited to an unresearched foreign environment. Similarly, imported materials, well proven in their country of origin, have failed an 'equable' British climate. These cases illustrate very simply the implications of a sudden climate change encountered merely by transferring to another global location.

Series losses

In many instances, contractors will continually repeat in varying combinations and situations the same standardised procedures and work practices, eg, housing windows, doors, appliances, roof materials or module units. These items, together with fixing procedures, need research to determine their suitability at the selected location and expected weather extremes. Faults or defects may not become manifest until well after the handover to the owners. Those responsible could face a substantial claim for an entire production run or from each location where used. The potential loss can be substantial although individually each unit cost might be small. New systems and materials for roofing clearly show the possible aggregate effect should they not withstand local weather conditions. Not only is the replacement item to be considered but also the cost of access and installation. A good example arose from the post Second World War rebuilding programme where prefabricated system building became widely used, employing factory-made cast components and modular units which were site-erected. This method was cost and time effective and various types were marketed. The failures are now well known and more traditional methods are again the norm. Problems arose from corrosion, dampness and condensation. Poor workmanship, fixing procedures, storage, lack of care in transportation, non-experienced site operations and overall poor design were all contributory factors. A changing weather scenario would have taken its toll had the defects not become manifest so soon.

Delay

Delay is generally not an insured risk and hence each party bears its own cost. The influence of weather and climatic conditions on the financial success or failure of a venture can be very great and weather downtime in its various forms can be a major contributor. Time and cost overruns due to some form of delay are probably the largest risk factor. Civil engineering and exposed 'wet' works are clearly more susceptible. The increased cost of making up for lost time will involve expediting expenses and overtime costs. If resulting from an insured loss, some cover might be given by insurers where necessarily and reasonably incurred. Weather delays are not limited to site but include offsite suppliers, transportation and access.

Offshore projects need accurate short-term forecasting combined with long-term projection scenarios to ensure the structure's planned lifespan. The short-term 'weather window' will be critical and a reliable maximum five-day forecast will need to be carefully supplemented by past data and seasonal storm and surge probabilities. For the longer-term project, some downtime may be inevitable but reliable predictions can mitigate this loss. However, adverse weather can seriously compromise dredging work.

Onshore works might be more flexible and able to cope

with delay through the transfer of operations to unaffected work areas. However, forecasting of wet and dry seasons and hot and cold periods will have a significant bearing on work progress.

Repair, replacement and reinstatement

As well as new construction work, it is important to appreciate that the construction industry is equally involved in renewal and maintenance and this activity is very much an ongoing one. There might also be an increase in 'retro-fitting' to adapt building stock to changing climatic conditions.

Legislation

The impact of climate change will create the need to achieve new standards of design and construction to face the new issues properly. Progress can be promoted through relevant government legislation and improved industrial standards. Government legislation is usually effective but does create problems of achieving efficient management of enforcement procedures to avoid the risks of an expanded bureaucracy delaying construction while ensuring proper compliance. Codes of practice provide a suitable way of forcing improved standards on those who would otherwise continue to provide poor standards. Designers are very exposed to litigation if they do not work to accepted codes of practice and climatic failure subsequently occurs. These codes should protect the building owner and also reduce the risks to be met through insurance.

The difficulties of supervising expanded legislation over the widely scattered pattern of building sites could be made worse if local governments do not give the right priorities to efficient administration. It is clearly a waste of time to have improved legislation without effective enforcement. Disaster analysis of recent earthquake and collapse failures overseas clearly demonstrates the inevitable outcome of this enforcement. Regulation will remain difficult in the construction industry because of its scattered nature compounded by the rather slender and relatively undertrained managerial resources in many of the small firms. Bodies like the House Builders Registration Council should have the capacity to adjust their standards to match the emergent climatic change scenario needs. At the planning stage for new private sector housing, standards might be set to supplement existing consumer protection. This could include introducing an insurance category 'kite' mark clearly making the eventual owner aware of potential natural perils risk exposures, eg, windstorm, flood, subsidence, heave, and using approved materials suitable for the location's potential exposures. Non-standard construction will need special attention. Accepted exposures might be improved by requiring preventive safeguard procedures to improve category rating. The problems of mobile homes, usually encountered on exposed sites, illustrate the issues of location, construction materials and form.

In the UK, local authority planning legislation will need to address potential disaster scenarios and provide sound, resistant, solutions. Problems result from loss or damage in that reinstatement or replacement may invoke changes in law or regulations necessitating not only compliance for the repair works but also for undamaged areas that no longer comply. Cover should be available assuming the proximate cause is an insured peril.

The wider application by local authorities of information technology-based methodologies to speed up the assessment of compliance could confer substantial benefits. Such changes also will imply important new training initiatives in the construction industry to alert staff and workforce to the new legal and industry requirements.

Change scenarios

The World Bank (1999) in a recent publication commented that as much as 30 per cent of its development funding for projects in Mexico has been diverted into disaster recovery on previous projects, showing the need for awareness of climatic factors (Kreimer et al).

Project location and its surrounding environment are the key considerations. Applying climate and weather change scenarios to the site, taking into account existing weather, geology and hydrology, should determine preference and form.

Climate change scenarios require the industry overall, in association with the government and professional bodies involved, to monitor legislation and regulations constantly so as to ensure minimum standards are responsibly maintained and to determine on whom any additional duty should ultimately rest. The UK can no longer be considered in isolation as the industry is very much an international one in terms of both its participants and location.

Natural change alone might be generally regarded as gradual but the human intervention process—the 'wild card' in change prediction—can accelerate events at an alarming rate. Such is the case today. Some examples follow of how change can distort past data and statistical records.

- *Deforestation*

Past recorded river-flows data are of little significance as upstream absorption capacity is drastically altered. Removal of vegetation and trees might take place far from the flood area. Open-plan farming can cause similar problems by removing hedges, ditches and natural drainage. Overgrazing will aggravate the effects of a dry climate.

- *Overdredging*

During severe winter storms, loss of coastal protection occurs. Dredging works offshore can make the coast vulnerable to unexpected heavy weather, wave heights and storm surge conditions. Past statistics on largest possible wave heights and 1 in 100 years' predictions may prove very unreliable, and, in fact, could reduce to less than 1 in 10.

- *Littoral drift*

This can be caused by coastal obstruction or a natural local effect. It manifests itself as a large accumulation of beach material at one end of the beach with corresponding erosion at the other, combined with collapse of the land behind the water line.

- *Temperature*

Storage of raw materials/components can be affected by high desert temperatures. Storage could be prolonged through delays in the works' schedule.

- *Reduced river flow*

If there is upstream storage, brackish water penetrates to a higher upstream limit during very dry periods. Using this water in concrete results in poor quality and so rectification works. The creation of a major dam effectively results in a change in environment and climatic effect upstream and downstream.

These illustrations are just a few of many which can arise through human intervention, although they could be further aggravated by natural change. It is perhaps worth noting that these situations might easily occur naturally but the timespan would be much longer. Parallels examples resulting from climate change are

- tropical-type rainfall against previous temperate precipitation;
- significant sea level rises against those currently applicable;
- loss of beach as land protection with serious land erosion and possible collapse of cliffs;
- much greater temperature variation causing serious deterioration and effect of global change in country of origin;
- drought condition reducing fresh water flow or conversely sea level rise.

Some natural events involving tectonic volcanic activity can however produce very rapid weather climate change, usually temporary but in some cases more permanent. Gradual change is inevitable; the sea level in Southern England has risen by at least three metres since Roman times and the coastline has correspondingly altered. The Thames Barrier (see Figure 5.5) was designed with a margin to handle this factor (Gilbert and Homer, 1992), but man-made climate change was unrecognised at that time, and already the barrier has been raised much more often than had been expected. Coastal erosive change scenarios generally point to a decision between temporary protection and possibly a greater loss elsewhere or overall managed retreat.

During construction, buildings do not fulfil their final design criteria so are more vulnerable to extreme weather events. Once complete, the structure design must be able to accommodate long-term predicted change.

Implications for insurers

A much harder market is likely to develop, increasing ratings, deductibles and differentiating more selectively the better risk from the poor or hazardous exposure. Project values will increase substantially and full value cover as required under contract may no longer be readily available.

Figure 5.5. The Thames Barrier with one gate raised

Probable and possible maximum loss predictions must cater for concentrated exposures if there is a catastrophic occurrence to protect the financial ability of the market to respond. Construction will be included with other property/liability risks but present a large 'all risks' confined concentration of risk in itself, particularly when combined with advanced loss of profits or similar type covers.

The French decennial type covers will become more in demand and insurers' involvement will increase from inception of the building work, by appointing their own nominee with a degree of control as to methods of work and materials used. For new UK private sector housing, an initiative is under way to investigate wider coverage embracing natural perils generally for category-approved exposures, ie, guaranteeing insurance protection for an initial 10 years to support the insurer's supervisory role during the construction phase.

Risk management will take a more active role in an insurer's risk programme. Self-insured deductibles will increase to encourage strong risk management on site. For larger insured clients, alternative risk options will be investigated within an overall risk programme. To be accepted, insurance must be a cost-viable option. The insurance programme will need to address in much clearer terms the subject of professional indemnity to ensure overall protection to those affected by a negligent act, error or omission resulting in an insured loss or damage. Insurers will need access to a much deeper pool of information and technical input and if there is a dispute will be expected to know 'as common knowledge' the latest published material on weather and climatic risks and change phenomena. Overall, the combined knowledge of the insurance industry is considerable and should strongly influence future underwriting strategy.

Policy wordings should clearly explain insurers' intentions on points on which they wish to rely in a dispute. Otherwise the insured may justifiably rely on 'the reasonable man's interpretation' of weather climatic and fault exclusions.

Climatic change, combined with increasing concentrations of people and property values, makes it more urgent for insurers to build up catastrophe reserves so that when the need arises the market can respond effectively. The government should take the initiative by allowing tax effective and ring fenced (eg, on an escrow type account) reserves to be built up. Failing that, the government might find itself compelled to share risk with the conventional insurance market when some currently insured risks become 'uninsurable' in vulnerable areas. The overall insurance premium tax should be applied to improving the industry response.

The initiative in creating Pool Re to cope with the results of terrorism might well set a precedent for coastal flood and surge inundation risks. The subsidence problem is now much better understood and preventative measures are being sought to mitigate the risk. However, the problem of heave in low-lying coastal areas or where ground water levels are now rising is less well appreciated. Banks and building societies will continue to apply pressure to maintain the current wide forms of cover required to protect their loan security.

Rights of recourse against non-insured interests will more readily be addressed, particularly against the 'professionals' and 'manufacturers'. Bad planning should not go unchallenged.

Projects will continue on the fringe of technology with new challenges for all involved. The industry must adapt for the future. The London construction insurance market will continue to play its leading international role in providing insurance and reinsurance protection.

The market, as in the past, will adapt to change and in many areas insurers will take a much more technical approach to classifying risks and will seek to apply scientific analysis to their rating structures. Postcode classification is a useful tool in the UK, for example in flood, subsidence and heave risk areas. Importantly, the industry should seek to anticipate likely problem areas and, with engineering and building industry guidance and support, take action with foresight rather than wait for disasters to happen then be inclined to overreact with hindsight. The competitive and cyclical nature of the business has an important influence on the decision-making process and underwriting approach.

Note

1. Proximate cause is defined as the dominant cause which sets in motion a train of events leading to a loss. There is a direct link between the proximate cause and the resulting loss.

CHAPTER 6: ENERGY AND WATER INDUSTRIES

Mike Cooper

The present

Energy and water are utilised by a wide range of end-users and a disruption in supply can have dramatic and wide-ranging consequences. In February 1998 this happened to the central business district of Auckland, New Zealand when the failure of power supply cables resulted in a major disruption across virtually all aspects of human activity until early April. Fortunately, insurance claims were low, but on the other side of the world Canada experienced major power outages in January 1998 from an icestorm which created record insurance losses for that market. Later, in December 1999, winter storms Lothar and Martin resulted in major interruption to power generation and transmission in France.

These industries are also responding to other forces for change (eg, regulatory and technological innovation) and while these forces will be far more influential than climate change in shaping the future direction of energy supply, it is likely that future weather patterns will have significant implications for them.

Energy

The UK is presently self-sufficient in energy, largely as a result of its access to oil and gas from the North Sea and coal reserves. Some estimates, however, suggest that current known UK energy reserves could be substantially depleted over the next 25 years.

In the UK the raw material for energy is now predominantly natural gas and the use of coal as an energy source continues to decline. UK electricity is supplied from one-third natural gas, one-third coal, 25% nuclear fuel, with renewable sources contributing around 3%.

The energy sector embraces a number of related key activities—extraction of fuel (oil, gas and coal), fuel refining, conversion of fossil fuel, nuclear and renewable energy sources to generate electric power, transport, transmission, distribution and marketing.

All the UK's petroleum refineries and operating nuclear power stations and many of its fossil fuel-fired power stations are located on coasts or estuaries—which provide distinct benefits in terms of access to the necessary fuel and water (for cooling purposes) supplies.

The energy sector is the largest source of man-made carbon dioxide emissions—that most important gas of the basket of greenhouse gases associated with global warming and linked climate changes. Burning fossil fuels contributes to global warming and UK government fiscal policy in recent times has been designed to encourage a more economical use of energy and the development of cleaner and more energy-efficient technology.

Only a small amount—around 3%—of electricity is presently obtained from renewable sources, mainly hydro, but current UK government policy measures are aimed at achieving 10% of electricity generation from renewable sources by 2010.

Energy demand for space heating is a high proportion of total UK demand and natural gas is the dominant fuel source for providing UK space heating.

Although the present climate in the UK does not make air conditioning essential, it is increasingly a feature in new and refurbished/converted buildings designed for office use or general public access in order to create a more comfortable environment. The demand for air conditioning is also linked to an increasing desire by the general public to distance themselves from noise and other pollution through greater use of non-venting windows. UK air conditioning demands are met entirely by electricity, but lighting continues to be the biggest single source of electricity demand.

Market liberalisation of the energy sector in recent years has produced 26 gas suppliers in the UK domestic market—13 of which can also supply electricity—and has led to significant competition in the market-place. Market liberalisation has also produced a kaleidoscope of change in the electricity sector. Privatisation produced 17 large companies which were, in effect, the direct successors of the previously nationalised entities. As the confidence of both the regulator and successive governments has grown, so further change has occurred

leading to generators acquiring customer supply businesses, distribution companies demerging to focus on customers or power supply hardware businesses, and foreign ownership now being widespread. Companies in the sector are seeking diversified business opportunities to generate new unregulated revenues, both to replace revenue being lost from older traditional sources as a result of the increased competition following market liberalisation, and to provide a broader range of add-on products and services to enhance brand attraction (eg, tie-ins with credit cards or provision of home and motor-related services).

Recently the energy sector has been particularly active in trying to establish the relationships between changes in the weather and the demand for energy and, particularly in the USA during the late 1990s, has been at the forefront in trials of new weather-derivative products. The aim is to counter adverse fluctuations in revenue and profit that can arise because of unexpected periods of warmer or cooler weather and resultant changes in consumer demand. These weather derivatives provide the energy company with predetermined monetary payments if the actual weather experienced falls outside margins which would normally be expected for a given time of year. If a winter is warmer than expected, consumer demand for heating energy would reasonably be lower than expected. But by buying a suitable derivative product an energy company can attempt to protect the stability of its profit level and avoid raising its energy rates which would reduce its competitiveness in the market-place.

A number of contracts have been struck with payments linked directly to these temperature movements—called Heating Degree Days (HDD) or Cooling Degree Days (CDD). This type of product has the potential to be developed to derive payments linked to other variable factors, such as rainfall, where the concept might be capable of wider application, for example by the insurance industry to provide some funding to pay associated flooding claims.

Water

The UK is, as a whole, generally well supplied with water but there are regional imbalances in supply and demand and water supply companies have in recent years increasingly sought to link cost more closely to consumption for both domestic and business users.

The UK water supply comes in broadly equal parts from rivers, reservoirs and groundwater sources. The regional imbalances in supply and demand can be exacerbated in times of reduced rainfall and increased evaporation and by the ongoing unacceptably high loss through leakage—approximately 25% of all water entering the public supply system.

Water utility assets tend, by their very nature, to be located close to water sources and are thus prone to the risk of flooding. Additionally the nature of the product coupled with its wide consumption have the potential for an incident to give rise to widespread health impairment. This was demonstrated by the inadvertent introduction of a large quantity of chemical into the Camelford water supply in 1989.

Water is, however, increasingly being used more efficiently and as the industrial economic base in the UK has reduced over recent decades the heavy water demand from this sector has also reduced.

What of the future?

While science cannot be exact about the extent of the climate change that will be experienced in the UK, current research and knowledge points to a continuation of recent global warming trends which a majority of climate experts generally consider will result in an increase in mean temperature, wetter winters, drier summers—akin to a present day Mediterranean climate—and an increase in sea-level rise for the UK.

Energy

There will be major implications for this sector, both demand-side and supply-side. Market and technology developments (eg, market liberalisation, the greater use of 'intelligent' household appliances and increased efficiency of combined cycle gas turbines) will make energy use more efficient. Also, actions taken by the public, either independently or in response to government or business initiatives (eg, introduction of a carbon-based energy tax on businesses, voluntary agreements reached with automobile manufacturers, changes to Vehicle Excise Duty and investment incentives) to contain greenhouse gas emissions and make more efficient use of scarce resources will have an effect.

Climate change clearly has the potential to impact on

the sensitive space heating and air conditioning markets (in a warmer climate demand for space heating is expected to reduce while the demand for air conditioning will likely rise), power generation, energy transmission and petroleum refining. The official report on the Auckland 1998 power crisis played down the role of the coincident heatwave, but the twin impacts on electricity demand (up due to air conditioning) and electricity supply (down due to reduced soil conductivity) certainly cannot have helped.

Projections of UK energy demand depend predominantly on the chosen variables for GDP growth and energy prices over a given period. The expectations, based on the outcome of recent research (EPTAC), are that energy demand will continue to increase more for transport activities and the service sector than for industrial and domestic use and that overall final UK energy demand will grow at around 1% a year to 2010. Service sector demand will be driven by requirements for space heating and cooling, lighting and other buildings services.

These projections could, however, according to some observers, substantially underestimate early twenty-first century energy demands. It has been reported that in the USA, California's Silicon Valley electricity supply companies are already struggling to satisfy the demands of the new 'internet hotels'—data centres housing a large number of computer servers and other essential hardware for web-based businesses. Such centres need energy to power water coolers to prevent servers overheating. A number of similar 'internet hotels' already operate in Europe but it is expected that hundreds more will be built over the next few years as businesses continue to centralise and outsource the maintenance and management of their computer systems and networks. It is said that if current plans to build ten internet hotels in London proceed there will be a 20% increase in London power demand.

Coal is expected to continue to reduce in importance as a source of fuel, thereby making a useful contribution to overall UK efforts to reduce emissions of carbon dioxide.

Nuclear power generation is expected to fall as nuclear plants come to the end of their operating life and are not replaced, but in the short term they are expected to continue to account for a significant portion of generation through to 2010. Known uranium reserves are expected to be exhausted in around 60 years.

Wetter winters may increase the availability of hydroelectricity as a renewable energy source in the more northerly regions of the UK but viability will depend on the net impact of rainfall and evaporation changes.

Any increase in storminess may offer potential for increasing wind and wave as sources of energy. The Netherlands and other countries in Europe have adopted significant use of this environmentally friendly technology which may provide new risks and premium opportunities for insurers.

It is expected that renewable or alternative energy systems will be encouraged—indeed, in the absence of alternative energy the UK could have difficulty in meeting its commitments under the Kyoto Protocol when nuclear power stations are retired. The UK has among the world's largest resources of wind, wave and tidal energy which, in theory at least, have the potential to generate a high proportion of UK electricity requirements. UK electricity supply derived from renewable resources is projected to reach 5% by 2003.

A number of offshore experimental devices, such as the 1995 Osprey project or the 'Clam' system, have in the past been subject to trials to assess the energy potential from wave power. The Osprey project was destroyed by bad weather before installation was completed and resulted in an insurance loss of around £1m. A shore-based power station called Limpet, located on the island of Islay and using similar technology to that incorporated in Osprey, has just commenced generating power from Atlantic waves. Limpet is the only commercial scale wave power scheme operating anywhere in the world and will no doubt be watched with great interest. Land-based facilities such as Limpet or wind turbines are currently considered to hold more promise than offshore systems.

At Eggborough in North Yorkshire, the UK is pioneering the first electricity plant in Europe fuelled by clean and sustainable wood fuel sources (the ARBRE Project).

Solar energy, particularly in southern England, wind, wave or wood/plant (biofuels) all offer prospects for energy generation but only time will tell if these can be a

Figure 6.1. Wind farm

significant source of regular power supply in the medium term given that the energy source can be intermittent. Certain biofuels do also have an additional benefit in that they can absorb some ground pollutants and thus may contribute usefully by preventing these pollutants reaching the water supply.

The UK is also increasingly finding it difficult to dispose of its waste in landfill sites and there are good prospects for much of this to be burnt in small converter units to provide electricity.

Interest in the development of small local power stations, or 'micropower' as it is sometimes referred to, is gathering pace, particularly in areas of the USA where electricity suppliers are encountering some difficulty in maintaining a reliable uninterrupted supply. Small power plants are able to take advantage of the advances in technology to offer substantial benefits over larger and older plant in terms of efficiency, reliability, price and environmental friendliness. Fuels required by these microgenerators tend to be clean and benign—natural gas, hydrogen and sunlight—and are used in fuel cells and cheap-to-operate microturbines. Such micropower generators can be located close to customers with distribution being via more reliable microgrids rather than large regional or national distribution grids which are often exposed to damage from severe weather storms.

Water

Water suppliers and users are likely to be affected to varying degrees by climate change but the general community is likely to continue to adapt progressively to changes in supply and demand and water quality by using more water-efficient strategies (eg, metering), technology and by reducing current high levels of water loss through leakage.

In the mid 1990s some reservoirs in the north of England were emptied or their levels substantially reduced following a long spell of dry weather, leading to water rationing. Additionally the local water company had, at substantial cost, to transport water into the area by road tankers from reservoirs located many miles further north.

More recently, in the autumn 2000 UK storms, too much water from heavy rainfall or flooding resulted in silting-up at pumping stations and boreholes with a consequent warning to customers that they could see a reduction in supply.

Evidence shows that a warmer climate encourages the formation of algal bloom which could result in increased costs to maintain water quality.

Changes in supply and its reliability could lead to changes in operating costs and the need for significant capital investment across the spectrum of suppliers and users as new sources, supply strategies and technologies are developed. Global warming will further increase the expected underlying rate of rise in demand for water with increased demand likely to be driven by personal hygiene and food and drink production. This demand will likely be welcomed in certain areas of the UK—London, Liverpool, Glasgow, Birmingham and Nottingham—which face the problems of subsidence, buckle and heave, water ingress and chemical attack to their infrastructure and buildings as a result of a rapidly rising water table following the reduction in heavy industrial water demand in these areas.

An increasing demand for water coupled with a warmer climate could lead to dams being constructed closer to major conurbations. Such a development could raise water suppliers' and insurers' exposure to liability losses

if there is a dam burst or overflow. Many of the dams currently in use are thought to be reaching the end of their safe working life and were erected to standards which could be inadequate for present and projected climate conditions.

Concern over dam failure—David Crichton

—The Reservoirs Act 1975 applies to all reservoirs holding or capable of holding more than 25,000m. cubic metres of water. There are over 2500 such reservoirs in the UK, of which 530 are large enough to be included in the World Register of Large Dams. Owners of dams covered by the Act are obliged by law to have them inspected regularly by a civil engineer from a special panel, but the law does not specify the details of the inspection nor that the results should be published. In practice, the thoroughness of the inspection depends almost entirely on how much the dam owner is prepared to pay, and the results are never published, not even to local authority emergency planning officers or the emergency services. Dam owners also refuse to issue flood inundation maps or dam condition reports, which could mean (and indeed this has happened) that planning officers for the local authority might grant planning permission for new housing developments within the area which would be flooded if the dam failed, simply because they did not know that the area was within the danger zone.

—Climate change will lead to an increased risk failure of dams, some of which are 200 years old. Failure can be caused by many factors, for example climate change could lead to subsidence of the dam foundations, landslip into the reservoir or overtopping due to heavy rainfall. Around half of the 2500 large dams have earth embankments, most of them constructed before heavy soil compaction equipment was available. Droughts could crack the embankment wall. In 2000, the government introduced a survey programme of such dams, with the work subcontracted to the Transport Research Laboratory because of its expertise in checking earth embankments. The government also commissioned research into the impacts of climate change on dam safety. It is unlikely the results will be published.

—Other possible causes of failure include vandalism of valves, pipe work or controls, terrorism and aircraft crash.

—Many dams are in or near urban areas, for example there is a large reservoir in Brent in London which is very close to housing and aircraft flight paths.

—Most dams are over 100 years old. A detailed record is kept of defects in dams but this is not published. It is believed that the record contains a very large number of entries, including many defects which are serious.

—The secrecy surrounding the condition of the nation's dams must in itself be cause for concern and dam failure is a hazard which should certainly be taken into account as far as possible by insurance companies in their flood strategies. It is likely that a great many people live within the danger zone of large dams in the UK. In the USA where information is more readily available, it is known that there are more than 2000 communities which have been identified as being at risk from dams which are believed to be unsafe.

—It should be emphasised that no lives have been lost in the UK from dam failure since the Dolgarrog disaster in 1925. However, failures do occur around the world. In 1959 when the Malpasset dam in France failed, 421 people died, and in 1963 in Italy, overtopping of the Vaiont dam caused by a landslide resulted in 1189 deaths, even though the dam itself remained intact. In 1972, a dam in West Virginia, USA failed causing 125 deaths.

—Climate change will lead to more droughts in the south east. At the same time, growing population and wealth in this area will lead to greater demand for water. Management controls for demand, such as water meters, can only have a limited effect and groundwater

abstraction is near its limit. It is therefore likely that more dams will need to be built, and these are likely to be near urban areas.

Some possible issues for the insurance industry

Rising sea levels resulting from global warming affecting the UK coastlines and estuaries could require the energy sector to commit to strengthening its existing coastal defences. However, the relatively slow rate of rise might provide scope for the sector to adopt a policy of managed retreat and install and relocate newer, more technologically advanced facilities in less exposed locations. Rising sea levels might lead, in some coastal areas, to an increased level of groundwater salination and thus the loss of some freshwater abstraction operations in these areas. Rising sea levels are, however, not the only threat to power generating stations. The winter storms of 1999 which affected France and other parts of Europe resulted in power units at the Blayais (near Bordeaux) nuclear power station being disconnected from the grid networks for several weeks with a consequent loss of revenue. A severe summer storm in New Jersey, USA, in August 2000 also caused a water dam to burst and destroyed town water mains. As recently as October 2000 a power station supplying the London Underground was unable to operate fully because storm-driven leaves carried down-river blocked the cooling water intake filters, resulting in a loss of around 25% of train services.

Offshore oil and gas operations could be affected both by sea level rise and by an increase in storminess. However, current design standards for offshore facilities are considered more than adequate to cater for the weather predicted to arise from global warming during the operational lifetimes of existing facilities and it should be possible to reflect any discernible climate change trends in updated standards for future new facilities.

Mining operations are likely to be increasingly susceptible to flooding as a result of increased rainfall and rising water tables leading to the need to abandon workings and close operations.

At present some insurers provide some coverage for loss from a rise in UK groundwater levels but unless action is taken to halt the rise it is likely that insurers will withdraw this cover from the market-place.

Modern power generating stations have a lower demand for cooling water than previous generation plant and those located on the coast seem unlikely to be affected much by rising sea levels. Facilities which rely on abstraction of river water for cooling could find difficulty in operating plant during the summer when river flows may be low. However, such facilities are reducing in number and importance in the UK.

The above-mentioned facilities, generally speaking, tend to be of substantial construction and are thus likely to be little affected by flood, subsidence, storm or rising sea levels within the ranges generally expected to be experienced from climate change.

Changes in supply and demand could result in the establishment of new energy and water infrastructures (reservoirs, generating plant and distribution systems) which might provide additional or alternative, and more technologically advanced, insurable assets opportunities for insurers.

Overhead cables and supporting structures are vulnerable to loss or damage from windstorms and icing. Storms Lothar and Martin which wreaked so much havoc in France in December 1999 brought down many overhead high voltage lines, depriving millions of homes of power and telephone connections. It took a month to restore power fully to the community at an estimated cost of around £1.5bn and repairs to the telephone network were around a further £100m. The loss of scores of electricity pylons and several thousand other posts bore testimony to the fact that existing construction standards for these structures and line configurations were inadequate for the strength of winds. The repair costs for the electricity network were borne by Electricité de France (EDF). It is sobering to reflect that had Lothar tracked a few miles further to the north it would have affected large areas of southern England. Some UK insurers are prepared to give some cover to their customers for damage to overhead electricity distribution and transmission lines, but they do this without having the benefit of reinsurance protection as there has been a standard reinsurance exclusion for several years for this form of damage.

Some of the newer technology under experimentation for energy production, eg, wind turbines and solar

Figure 6.2. Powerline infrastructure

power systems, while potentially providing a source of new premium income, rely on lighter high technology construction which may be more susceptible to climate change and other causes of loss and damage. The pylon damage sustained by EDF in the winter storms of 1999 perhaps provides a pointer to the need for some of these new structures to be designed to cope with climate conditions well in excess of those we have encountered to date.

The icestorm in Canada in 1998 showed that ice can be a problem even when temperatures rise. The critical factors are the nature of the precipitation, the concurrent wind speed and how close to freezing point the temperature lies. Ironically, damaging ice forms when the temperature is close to freezing, not at very low temperatures. Thus, locations which were once relatively ice-free could become vulnerable in future, and the tendency could be compounded by the ability of the warmer atmosphere to carry more water.

Since the early 1990s, combined cycle gas turbine (CCGT) generating stations in the UK have provided efficiency and profit advantages over older coal-fired plant. These newer designs employ turbines operating at high temperatures and speeds and have yet to prove themselves over the longer term. Design faults have already become evident at a good many CCGT power stations and insurers need to be alert to the possibility of accepting a significant design risk.

Although climate change is likely to cause only slow changes in demand and supply for the energy and water sectors' traditional products and services, the future shape and direction of these industries will undergo more rapid change as they look to develop new business opportunities outside their historical market-places and products.

These sectors are also now focusing on the need to satisfy shareholders following deregulation. UK power companies such as Scottish Power, Powergen and National Grid have acquired substantial energy and telecoms ventures in North and South America and Thames Water—the world's third largest water company—is acquiring assets in the USA, Near and Far East and South America. This development is also evident among traditional utility businesses elsewhere in the world—in the USA, ENRON is moving from being a heavily asset-based utility and pipelines business to a global trader of commodities.

Insurers will, therefore, find that these traditionally UK-focused clients present a more diversified and internationally distributed portfolio of exposures. These new ventures could in many cases present insurers with more onerous climate change related exposures than they would encounter in the UK.

Insurers will need to design and offer appropriate *global* solutions. At the same time, they need to consider carefully the exposures, as the utility companies are often very heavily capitalised. Insurers will need to use detailed knowledge of the weather risks, professional internal risk management and to extend to the operation significant self-insurance or captive insurance activities. In global situations the utility is likely to retain the more predictable risks for its own account, leaving a more 'catastrophic' mix for the open insurance market.

Running in parallel with this diversification we are likely to see the larger business enterprises taking a more holistic approach to managing the broad spectrum of risks to their business and a greater demand from them for so-called 'balance sheet' protection. These developments could lead to insurers providing some form of weather derivative product as a part of a balance sheet solution. Agricultural sector yields (fruit, vegetables, wheat, etc.) could be reduced due to too much or too little water, thereby possibly opening up further opportunities for insurers to blend weather derivative products with more traditional insurance cover for clients such as farmers and food supermarkets.

Swiss Re announced in mid 2000 that it had plans to launch an online weather derivative facility, aimed primarily at the utility and energy companies, to offer these businesses the opportunity to hedge against the business impact of temperature fluctuations. Applicants are expected to be able to select an index for defined parts of the world and to view the related temperatures recorded over many years. Against this background information the applicant will be able to indicate the payout level desired for a period of time where actual temperatures are different from those expected. Swiss Re will then provide an instantaneous price which the applicant can accept. Other similar weather derivative trading sites already exist.

Liability risks may also occur with climate change, for example due to supply of tainted water (as seen in the Sydney water contamination incident of 1998), or from spreading fire (as happened with the Australian Ash Wednesday bush fires in 1983 where a utility was deemed to be liable for not foreseeing the additional risk during a drought).

This chapter has tried to focus on some of the possible issues for consideration that face UK insurers as a result of possible climate change impacts on the energy and water industries in the UK. However, it should be borne in mind that the same or similar impacts will arise, to a greater or lesser extent, for these industries operating elsewhere in the world and will need to be considered by their insurers—which may include some UK-based insurers underwriting risks located around the world.

CHAPTER 7: PROPERTY INSURANCE

Richard Radevsky, David Crichton & Thomas Loster

In many countries insurance is not widely available, or affordable, and when a natural disaster strikes uninsured losses are borne by the property owner, state aid or charitable aid. For example, in continental Europe cover for flood damage is frequently a matter for the state to provide. There are other derivations of such systems, as in France and Spain where there is state-guaranteed natural perils reinsurance (CCR in France and the Consorcio in Spain).

In contrast, the insurance of property against natural perils is well developed in the UK, with most natural perils being insured under individual policies. The cover provided by commercial policies often differs from that provided in domestic property policies. Commercial policies may have business interruption cover added to property damage coverage. The business interruption coverage is normally contingent on the occurrence of a material damage loss. Frequently business interruption losses considerably exceed the value of material damage. Commercial policies sometimes do not provide cover for as wide a range of perils as domestic property policies. For example, subsidence is not always insured under commercial policies.

This chapter examines the effect of three weather hazards on insurance underwriting, claims, reinsurance, and mortgage lenders: the perils of flood, subsidence and windstorm. There are, of course, other hazards, eg, hail, snow or low temperature, but they are less important. Indeed, since night-time temperatures are rising faster than the daytime, the probability of extreme cold spells is diminishing rapidly. Wild fire exposure in the UK is relatively low, though already a problem overseas in places like the Mediterranean. There are also perils which neither commercial nor domestic policies cover, such as termite damage. (Termites are now over-wintering in the south west as winters become warmer—an early warning of climate change. Already they are a major problem in the USA, and even in France.)

Financial markets and property

The availability of property insurance is linked to the financial markets in a number of ways, as shown in Figure 7.1. Banks and building societies provide mortgages on properties. Mortgage providers have the option of consolidating large numbers of mortgages into products which are of a sufficiently significant size to be attractive to the global capital markets. Such products are, however, vulnerable to significant changes to the value of the assets on which the mortgages are secured, because of the potential for large-scale mortgage defaults. Chapter 8 of this report includes a more detailed analysis of the investment markets. Markets have in the past largely taken property insurance for granted and it has not therefore been an area of particular interest or concern. However, any serious threat to its continued availability would have implications far beyond the individual policyholder.

It is usually assumed that the person who really bears the risk of property damage, for property or repayment default (mortgage indemnity), is the insurer. What is overlooked is that often insurance policies are short term, and therefore cover may in principle terminate rather than be renewed. In that case, it is unclear whose interests would be at risk, since the title to the property is often passed over as security in financial transactions (eg, to 'free up' a lender's balance sheet).

Flood

The current position

Underwriting

Although flood risk accounts for less than 5% on average of a household policy premium, it has attracted considerable attention over the last ten years. The ABI, initially working with Lloyd's, has devoted a great deal of effort and funds to researching the implications of UK flood risk for insurers.

The UK is the only major country in the world where private insurance companies provide flood cover on virtually all homeowners' insurance policies, but insurers may not be able to continue on this basis, for reasons to be mentioned later in this study.

While river floods are a problem, they tend to be localised, but even so insured losses could reach £1bn in

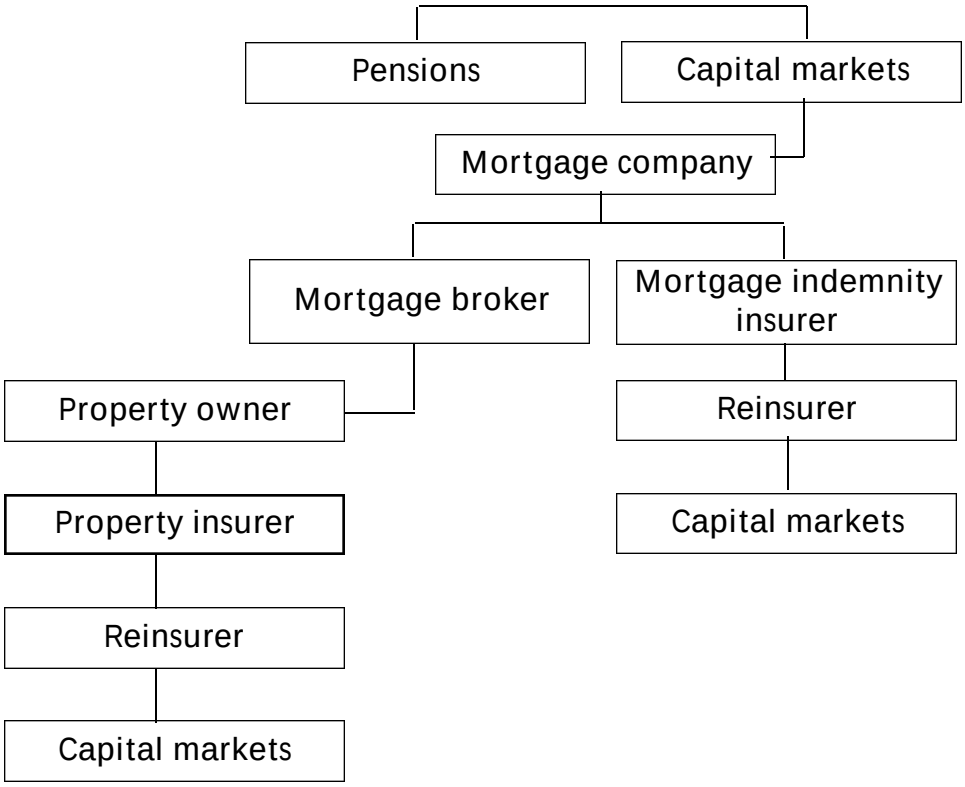


Figure 7.1. Link between property insurance and capital markets

a single event. A major coastal flood, on the other hand, presents the biggest catastrophe loss scenario for UK insurers, with huge potential losses for the industry. Unpublished analyses suggest figures well in excess of £10bn.

The coastal flood hazard is increasing, due to sea level rise and an increasing 'wave climate' which means that mean wave heights are increasing too. Also, in the south east, the land is sinking due to geological conditions (see chapter 3). Of all the potential impacts of climate change, the impact of sea level rise on coastal regions is among the easiest to visualise, and so receives much attention in the popular press. The threat is so serious that insurers have come together, through the ABI, to fund research into various event scenarios, and maps have been produced which show large areas which might be affected by these scenarios, even taking into account sea defences (Halcrow, 1994, 1995).

Many of the coastal flood issues are similar to those of river flood except that there is also a growing concern among insurers and the Environment Agency that the government is not spending enough to maintain sea defences in their current condition, let alone improve them to cater for sea level rise. Poor maintenance was a major factor in the disastrous 1953 floods. Coastal planning authorities are under great pressure to allow new housing developments, but suitable land is hard to find, particularly in south east England, and often developments are permitted in low lying coastal areas.

Claims

Following the extensive flooding in the Midlands at Easter 1998, the insurance industry came in for a great deal of criticism from consumer groups for its handling of claims. Warwickshire Trading Standards produced a report called 'National lessons from the Warwickshire floods' which summarised the criticisms, and the ABI met the organisation to discuss the findings. The main criticisms related to the lack of guidance from insurers as to ways to minimise damage, and a lack of understanding of the role of loss adjusters.

It was also clear that there was a considerable amount of claims fraud and exaggeration: this is quite common in such cases, and indeed was rampant during the Towyn floods in 1990. A new element with the 1998 floods, however, was the widespread looting of abandoned homes, and this may be a sign of things to come.

A big problem for loss adjusters in dealing with disasters

Figure 7.2. Flooding has affected many parts of the UK

such as the Easter 1998 floods is the fact that every insurer has different reporting formats, although there are contingency plans whereby the Chartered Institute of Loss Adjusters (CILA) can streamline the normal procedures.

Reinsurance

Of all the natural perils, flood is one of the main perils which leads insurers to seek reinsurance, the other being windstorm. Windstorm can strike anywhere, so the risk is highly dependent on the vulnerability of properties to storm damage. Flood, however, tends to occur in fairly predictable locations, for example floodplains and low lying coastal areas.

This predictability has led reinsurers and insurers alike to invest in catastrophe modelling systems to try to assess the maximum possible loss from various flood events, and considerable advances have been made (see chapter 2, page 8). For this purpose, modellers now have access to the UK National Flood Insurance Claims Database, which contains an analysis of thousands of flood claims from the 25 leading UK insurers for all major UK floods since 1993 (Black and Evans, 1999).

Mortgage lenders

Mortgage lenders arrange block policies on properties mortgaged by them. The insurer is obliged to accept all risks regardless of hazard or location, even if acceptance results in a heavy accumulation of exposure in a particular area. Worse, the insurer is often not fully aware of the precise location of the properties in the portfolio so cannot manage its exposures adequately.

Increasingly consumers are free to shop around to get insurance quotes and are not obliged to insure through their mortgage lender. Obviously when they do so the lender's portfolio will be increasingly prone to adverse selection, so that the insurer suffers a 'double whammy' of adverse selection and lack of control over its exposure accumulation.

Scenario

The UK flood hazard is increasing for a number of reasons:

- sea level rise (exacerbated by periodically more frequent and severe storms and wave heights)
- more frequent and severe or prolonged rainfall events, allied with
- an increasingly built-up environment which increases surface water run-off
- an old and often deteriorating urban drainage infrastructure.

Sea level rise

Considering sea level rise first, land movements have to be taken into account. The north of the UK (north of a line from Dundee, on the east coast of Scotland, to Abersoch, in North Wales) is rising as the ground recovers from the weight of the ice age glaciers, while the south is sinking.

This means that by the 2050s (as shown in chapter 3) the sea level round the coast at East Anglia could rise by 37cm, nearly 15 inches. Under the worst-case scenario it could rise by as much as 83cm.

Rainfall

In Scotland, precipitation intensities will increase in both winter and summer, with greater risk of flooding (Werritty, 1999). The south east is likely to have much drier summers and much wetter winters, so that even if the annual average does not increase by very much, the winter flood hazard will increase significantly, especially as drier soils from the summer droughts and impermeable surfaces in new urban development will increase rainfall run off.

Compared with pre-industrial times, very wet days (rainfall over 25 mm) are predicted to become some 4 to 5 times more frequent in the winter by 2050 (Bye and Horner, 1998). Already, average rainfall in the west of the UK has risen from 1,700 mm a year in the 1970s to 2,400 mm a year, and protection designed for a 'once in a 100 years' flood will not be adequate for floods with future return periods of every 60 or even 30 years (Werritty,1999).

In 1999, the ABI commissioned ENTEC, a leading consultancy company, to carry out an assessment of the flood risk from British rivers (Northern Ireland was outside the remit). The report, published in October 2000 (ABI General insurance research report no.10), gives a comprehensive overview of the data and other sources available to insurers, plus an assessment of the hazard and exposure to flood risks emphasising particularly areas with the highest exposure. Although inland flood is less costly than coastal flood, a major finding was that the potential maximum loss (PML) to the industry from an inland flood could be in the region of £1–£2bn, a sum much higher than conventional wisdom had assumed.

Surface water run-off and drainage infrastructure

With coastal and river flood it is possible to produce maps of hazardous areas. Floods from inadequate drainage, however, can happen anywhere. For example, the severe flooding in Llandudno in 1993 was entirely due to failure of the drainage system to cope with the heavy rainfall, and none of the areas affected were on any flood hazard map. Drainage systems are just not designed to cope with climate change, or indeed the increasing amount of ground being covered in concrete and asphalt because of urbanisation. This inadequacy is why the Sustainable Urban Drainage Systems (SUDS) initiative is so important, and the ABI has been involved with this project from its inception. The project has culminated in the launch in 2000 of manuals for architects, engineers and developers, and a set of training material to encourage sustainable drainage systems which relieve the pressure on drainage infrastructure and rivers.

Issues arising

Underwriting

For the individual insurer, controlling exposure is the easiest way to control the risk from flood or subsidence. This is most easily done by using the price mechanism to attract or discourage business of different types and different areas, provided the insurer has better knowledge about the risks than its competitors. Where its knowledge is not as good, competitors' actions could result in the accumulation of large volumes of exposure in high hazard areas—exposures which it will be hard to shed without public relations penalties.

The insurer can reduce the risk of flood claims by reducing the number of flood plain properties it insures. It is estimated that in England and Wales there are some 1.3 million homes in flood plains. This figure is not surprising, given the tendency to want to build near river crossings, or along transport corridors, such as river valleys. What should be of great concern to insurers is that this number is still increasing, despite improved knowledge of the hazard. In fact the Environment Agency recently revealed that in 44% of cases where it advised against development because of a flood hazard, the local authority granted permission anyway. (The Department of Environment, Transport and the Regions has prepared a guidance note PPG25 'Building on flood plains' which is at consultation stage, to instil more prudent development.)

Claims

There will be increasing pressure from consumer groups and government for insurers to offer a better standard of claims-handling service to flood victims. While the number of flood claims as a proportion of all incidents is still relatively small, floods do make good television and the press are always prepared to give in-depth coverage to the human interest side of the misery and devastation caused by floods. It must also be said that while some insurers have acquitted themselves well during serious flood events (some insurers were singled out for praise after an investigation by a tabloid newspaper after the 1998 floods), the general standard often leaves much to be desired. The issue for claims managers would seem to be that so far lessons do not seem to have been learned, and if anything the position may be getting worse as companies put the emphasis on reducing claim handling costs, rather than ensuring a high quality service in times of crisis.

Examples of high-quality service could be

- distribution of advice leaflets to the public and the media (explaining the need for a lengthy drying-out period before reconstruction for example);
- availability of immediate cash sums as advance payments on claims;
- pre-booking accommodation for temporary re-housing.

A more fundamental approach would be the concept of 'resilient reinstatement', that is, to reinstate the property to a standard which would make it less vulnerable to

future flood damage. This might mean that the claims cost would be higher for the first flood, but future floods in that area should cost much less. Since this approach would require higher premiums currently, competitive pressures normally prevent this 'sustainable' product appearing. A factor which would assist would be government intervention in the form of new building regulations applying retrospectively to damaged buildings. Interestingly, this is an approach which forms part of the US government scheme.

Reinsurance

A major concern of reinsurers in the future will come not just from climate change but from other factors such as

- improved modelling capability due to better technology;
- improved elevation data from the Environment Agency's LIDAR programme (Light Detection and Ranging: an aerial system for measuring land topography);
- greater use of the UK National Flood Insurance Claims Database;
- statements from the Environment Agency that local authority planners have for many years apparently ignored advice on flood risk in a large number of cases and allowed development in high flood hazard areas;
- lack of adequate exposure accumulation management on the part of insurers who have been prepared to devolve underwriting to mortgage lenders or to subsidiary companies for the sake of growing their book;
- pressure for new construction in brownfield sites without corresponding upgrading or modernising of drainage infrastructure;
- greater flood run-off from increased urbanisation;
- more vulnerable building materials and contents;
- doubts on the level of claims investigation.

These concerns will inevitably be reflected in the cost and availability of reinsurance, and insurers which have the tightest control over exposure accumulations will benefit.

Mortgage lenders

Insurers which write significant block policies for mortgage lenders may come under pressure not only from their reinsurers, but also from the Financial Services Authority (FSA). The FSA was established by the government to regulate banks, building societies, Lloyd's and insurance companies among others. It has adopted a proactive 'risk-based' approach to assess the impact and preparedness of these organisations when faced with various types of risks, including natural hazards. It has stated that it will be closely scrutinising the internal modelling techniques used by these companies, and will also be taking consumer issues into account. The FSA might even demand that an insurance company or mortgage lender submits details of its accumulated flood exposures, for example, and of how it uses computer models to assess likely maximum possible losses. The FSA can then assess whether there are adequate systems in place to manage exposure, quantify costs and arrange sufficient reinsurance protection. By implication, the insurer or building society which does not manage its exposure accumulations to the satisfaction of the FSA, and which does not have adequate modelling capabilities or reinsurance cover, will be a candidate for audit.

Mortgage lenders might in future find that the supply of insurers prepared to hand over their underwriting pen becomes limited as their portfolios become less attractive. Back in 1961, a market agreement (the BIA Flood Statement) provided that every household in the UK would be able to obtain flood insurance at a reasonable cost. The underlying principle has been maintained, with flood cover standard in virtually all policies.

Times are changing though. Spurred on by the continued refusal of many local authority planners to take flood hazard adequately into account when permitting new housing developments, the ABI suggested in July 1997 that the guarantee of flood cover for every household might in future no longer apply in certain situations (Crichton and Mounsey, 1997):

- areas habitually affected by flooding and where no amelioration scheme is planned;
- where planning consent has been given without adequate flood protection/amelioration;
- where a flood alleviation scheme has been declined by residents on amenity grounds.

Since August 2000, the Environment Agency (EA) has been required by government to 'name and shame' local authorities that make planning decisions to allow

building where the EA had advised against the development on the grounds of the flood risk.

It could be argued that in such cases insurers would be failing in their duty to their shareholders if they agreed to provide cover, but where would this leave the mortgage lender if cover were unavailable? Ultimately this could lead to the breakdown of the whole system of cover being available to all. This would give rise to the issue of insurance blight: if a property becomes uninsurable because new mapping work identifies it as being in a flood hazard area, the asset value of mortgage lenders could be affected.

Options

Underwriting

Flood insurance is one area where the best option for the industry is to work together to manage risks. There are a number of actions which could be taken:

- Lobby government for increased spending on flood alleviation schemes.
- Liaise with local authority planners to reduce the number of new developments in areas where there is high flooding hazard.

Some actions have already been taken by the ABI on behalf of its members:

- A dialogue has been started with government to stress the insurance considerations of flood and the need for adequate planning control, amelioration, public awareness and investment in flood alleviation schemes in the light of climate change.
- Flood Appraisal Groups have been set up in Scotland to take advantage of the enlightened planning guidance there which calls on planners to liaise with the insurance industry where there is a flood hazard. (It is hoped that a similar system might be established in England, thanks to ABI lobbying of the DETR.) The ABI is now represented in Flood Appraisal Groups covering the whole of the central belt of Scotland and north east Scotland. It has issued a template to local authority planners which sets out acceptable criteria for permitting development. An extract from this template appears in appendix 7.2. In most cases this has been a very successful initiative, with planners being prepared to adopt the insurance template for future flood planning policy, and already the plans for some major housing development have been altered as a result.

In England and Wales, the draft planning guidelines for flood refer favourably to the insurance template and quote large extracts from it, but English flood appraisal groups are still some way off. Meanwhile, there are some worrying examples of developments at a high risk of flood: one such example appears on page 67.

Claims managers should

- seek to accumulate better quality data on flood damage vulnerability to help their underwriting colleagues;
- seek additional ways to identify and manage fraudulent claims;
- provide better and more sympathetic service to genuine claimants.

The establishment of the UK National Flood Claims Database has been of great value to flood modellers, but it was very labour intensive to establish.

It is useful to insurance to obtain further data on flood and other contingencies and obtained by adjusters as an exercise extra to normal duties. However, the primary objective in claims is to keep reporting to an absolute minimum and settle the claim rapidly. To this end CILA regularly obtains authority from the ABI on behalf of all insurers to use brief report forms and in practice some insurers do not demand reports at all for crises. An example of a form which might be used for additional data appears at appendix 7.1. A small pilot study was conducted in Scotland using this form, but further research would be necessary to establish all the advantages and disadvantages involved (eg, administration, control of fraud, customer service and management information).

Reinsurance

Reinsurers will need to become increasingly selective as the flood hazard and exposure grows. Better mapping data will enable insurers that have invested in geographic information systems increasingly to select the risks they want to write, and painlessly shed legacy exposures in high hazard areas to companies that are not so well equipped.

This means that a gap will grow between selective insurers that manage their accumulations, and those insurers that do not discriminate one risk from another. The latter may find that there will come a time when their reinsurance cover is restricted, and may have to

face some awkward questions from the FSA and other interested parties. We are far from that position at present, but this scenario could develop if the original hazard is not properly managed by the industry as a whole.

Mortgage lenders

One option for mortgage lenders would be to work with insurers and support them in their efforts to lobby government, influence planners and collect data. In some ways they are more vulnerable than insurers. After all, an insurance company is only on risk for a year, and can cancel cover after that time. The mortgage lender could be taking on a 25 or 30-year risk, and no one knows what climatic, social and economic changes might happen in that time.

However, this pressure is weakened by the fact that lenders often 'sell on' their mortgages, in order to take the liability off their balance sheets and permit them to undertake further trading without an increase in capital. Gaining a better understanding of who owns the risk requires further investigation.

Subsidence

The current position

Underwriting

Before the early 1970s subsidence insurance was virtually unheard of. There was a general acceptance that buildings were liable to move seasonally and some damage was likely to occur in dry spells: the necessary repairs were part of normal house maintenance and only if damage became severe was it deemed necessary to take more specific remedial action (Biddle, 1998). Initially, when subsidence insurance was introduced in the early 1970s under pressure from building societies, underwriting the risk was relatively crude. It was based on the surface geology map of the UK showing areas of shrinkable clay—if it was based on anything at all.

Progressively, with increased losses and more data available for soil conditions, more sophisticated underwriting tools were introduced under such names as Ventech, G-HASP and Experian. These tools consisted of models of subsidence risk associated with postcode. They used accurate maps of subsoil condition. Underwriters could enter a postcode and rapidly receive a subsidence risk rating. Such models are in use currently. Anecdotal evidence suggests that there are considerable differences in ratings from model to model. This variation appears to stem from the differing base data and analytical methods used in each model.

A big drawback of these models is that they can only deal with geological causes of subsidence, but a large proportion of subsidence claims are due directly or indirectly to other causes such as proximity of tree roots, leaking drains, flood events, mining works or the construction of house extensions.

The cost of software-based underwriting tools is relatively high and some smaller insurers determine their rates by monitoring the rates of their competitors in different areas.

Proposal form information has progressively developed. Initially, single questions on subsidence experience in the area where the property was located were used. These have been largely replaced with two or three questions asking about trees and cracks, as well as history of subsidence in the area. Supplementary subsidence questionnaires were also introduced if the first three questions produced an unsatisfactory response. Six or seven further questions had to be answered about tree locations and species close to a house.

Set against traditional underwriting based on the proposal form were the increasingly popular policies sold by telephone and the mortgage linked policy. The former, largely pioneered by Direct Line, obtained relatively limited information from telephone interview and relied on postcode derived risk information. The latter was based on pre-purchase survey information requiring the insured to supply no-subsidence-related proposal information. Mortgage-based insurance tended to cover large blocks of properties where occasional bad risks tended to be lost in the volume of properties covered.

Schemes to provide cover for houses with a subsidence history were also introduced in the early 1990s. Houses with a history of underpinning were often difficult to insure under normal schemes.

Insurers generally have undertaken to maintain cover after a subsidence claim, and even to transfer the cover to the purchaser of the property if they wish to take it up. In this way, possible blight of the property is reduced.

Claims

Since the introduction of subsidence insurance in the early 1970s, losses increased progressively until the mid 1990s before levelling off at between £350m. to £450m. annually (ABI, see Figure 7.3). This figure includes both the cost of the physical damage to properties and, in the case of domestic policies, the cost of temporary accommodation while repairs are carried out. Policies currently provide no cover for loss of market value of subsidence-affected houses nor compensation for stress or damage to lifestyle.

Often, under customer pressure, insurers would sanction premature costly underpinning of subsidence-damaged houses. Following heavy losses in the late 1980s and early 1990s, insurers began to look more closely at the management of claims. Significant changes were introduced in claims-handling procedures, reducing the numbers of properties underpinned, and consequently the claim spend was substantially lowered. Recommendations from consulting engineers and surveyors to carry out underpinning were closely scrutinised and often rejected in favour of monitoring and further review. This process allowed decisions about the final extent of remedial works to be delayed until the drought that triggered the claim had passed. Properties on shrinkable clay frequently either recovered from the movement they had suffered or stabilised, often with the aid of tree reduction or removal, and remedial activities were limited in extent to work on cracks and redecorations.

Claims-handling techniques have been progressively refined. The incidence of subsidence in the late 1990s was reduced with the absence of the droughts which had caused heavy losses in the mid 1970s, 1980s and early 1990s. The numbers of claims staff, insurance company technical claims units and adjusters dedicated to subsidence claims have also reduced. Some insurers have made contractual claims handling arrangements with firms of consulting engineers and surveyors. At the high net worth end of the market, some insurers have dispensed with subsidence excesses. But otherwise, a £1000 excess or higher is the norm.

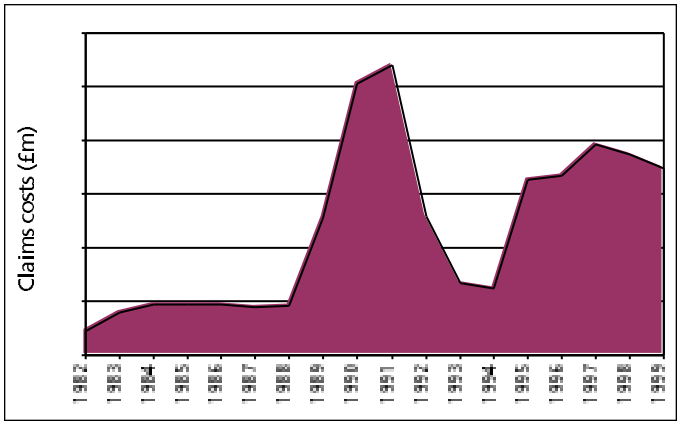


Figure 7.3. UK domestic subsidence incurred claims costs (£m.)

Source: ABI

Claims frequency is also influenced by the volume of house sales, as often it is at the time of sale that a survey report discloses the seriousness of the subsidence, and the mortgage lender may insist on remedial work.

Reinsurance

Subsidence reinsurance began to be most widely used in the early 1970s. Since the early 1990s it has progressively declined. Larger insurers have not felt the need for it as they have been able to predict the level of subsidence losses based on previous experience. Smaller insurers generally continued with the cover for longer but their usage has declined as the cost of the cover has increased. Absence of reinsurance might indicate that insurers generally appear unconvinced of the prospect of an exceptional subsidence event where the annual subsidence loss might rise from £350m. to perhaps £3bn to £4bn as a result of a 'super drought'. In the light of climate scenarios in chapter 3 suggesting drier summers, this belief seems misguided.

Mortgage lenders

In the 1970s mortgage lenders were the original driving force behind the introduction of subsidence as an insured peril. Mortgage lenders have traditionally relied on household insurers to handle the subsidence peril. There has been little concern over the effect of subsidence on mortgage security. Provided a property can be insured for subsidence, mortgage lenders have been happy to lend on it.

During the 1980s and 1990s, there has been an increased trend either of moving large blocks of building society business between insurers or for building societies to start their own insurance companies. There have been few problems for houses with a history of underpinning in changing insurers. This is because the blocks of properties being moved between insurers are so large that insurers have only been offered the business on the basis that they cover all risks, good and bad.

Scenario

The south east of the UK is affected by droughts causing significant subsidence events approximately once in five years. The UK insurance industry has learnt to live with such events. An increase in frequency of these events to two in three years, or more, would lead to a significant change in the attitude of house owners. At present drought is considered an 'abnormal' state of affairs. The more common that droughts become, the more house owners and underwriters will believe that drought represents 'the inevitable norm'. It will also be necessary to consider what an extreme event would consist of set against a background of more frequent droughts.

The UKCIP reports indicate that the south east of England can expect wetter winters and drier summers, with a drought such as the one in 1976 happening every three years by 2020. This will inevitably increase the incidence of subsidence claims in the future. The ABI has an active programme of research in this area.

Issues arising

Underwriting

Insurers are already facing huge claims costs from subsidence brought on by warm weather and drought. In the ten years from 1990 to 1999, the incurred claims cost for UK subsidence was a colossal £3,338m. (Figure 7.3).

There is growing concern that climate change could increase the cost of subsidence claims with implications for insurers' willingness to continue to provide this cover. A number of scientific studies have been undertaken on the incidence and causes of subsidence. A particularly thorough study (Brignall et al, 1996, revised and updated in Downing, Olsthoorn and Tol, 1998) builds on previous studies, along with geological and other data, and attempts to predict areas of subsidence hazard. It then compares the predictions against a large set of subsidence insurance claims data. Studies like these are helping insurers to identify subsidence hazard areas with more certainty.

With the threat of greater subsidence loss, there is increasing sophistication of computer-based underwriting tools related to postcode. If these tools became markedly more predictive (as appears to be inevitable) they could eliminate the uncertainty element vital for insurance to remain the correct vehicle for financing the cost of repairing the damage sustained.

The underwriting of subsidence risk, as with any other insurable risks, has to be based on uncertainty. The more common and predictable the occurrence of subsidence the less the uncertainty and therefore the more difficult it is for insurers to provide cover in a way that is profitable.

A 'super drought', a very severe drought, in which there is effectively no rainfall for six or seven summer months coupled with a dry summer and winter beforehand, could produce claims of £1.5bn to £2bn in one year. Such an event would seriously affect insurers' confidence that they could continue to provide cover.

The UK is in the process of embarking on a major house building programme with particular emphasis being placed by the government on the use of brownfield sites. Generally new houses are regarded by underwriters as being at a lower risk of subsidence than older houses. This is largely the result of the actions of the National House-Building Council in setting foundation standards higher than are required to meet building regulations. Nevertheless, the use of deep unreinforced concrete strip foundations is continuing. There appears to be little interest in considering changes in the form of foundations (to say shallow reinforced concrete rafts) as are used in other countries with unstable subsoils such as Australia and the USA. Pressure may have to come from insurers for changes in foundation design to avoid damage which might only manifest itself some considerable time into the future.

Claims

Insurers currently manage subsidence claims by persuading house owners to accept monitoring until the abnormal drought conditions pass. If droughts become more frequent, the pressure to underpin would increase dramatically and the cost of subsidence losses would rise dramatically perhaps into £ billions/year rather than £ hundreds of millions/year. Some people also mistakenly believe that, having suffered a considerable volume of subsidence in past years, the potential for future subsidence must have been significantly reduced. The potential for further losses remains considerable owing to the increased depth to which soil desiccation could extend in a severe drought. Instances of multiple and progressively deeper underpinning demonstrate this.

Insurers also rely on tree/shrub control involving reduction and sometimes removal. In a more drought-prone climate, lobbying by those with a green agenda is likely to increase making it unacceptable to remove/reduce trees/shrubs. There is likely to be a major public debate on the most appropriate response to subsidence—deeper foundations or fewer trees and shrubs.

Reinsurance

Subsidence reinsurance is already relatively uncommon. An increase in the incidence of subsidence is likely to put further pressure on the existing subsidence reinsurers to withdraw from this market.

Mortgage lenders

So far subsidence has been a peripheral issue to mortgage lenders. They have relied on insurers to deal with the subsidence risk. If, however, properties in some areas of the country became uninsurable against subsidence then such properties would also become unmortgageable. A recent study conducted for the ABI (Radevsky, 1999) has shown that in other countries where there is a subsidence risk but no insurance, the property market can survive. This depends, however, on house owners accepting the regular occurrence of subsidence cracking. For such a situation to develop in the UK would require a major shift in attitudes towards subsidence by numerous groups including insurers, house owners, mortgage lenders, building professionals and pre-purchase surveyors. Such a shift in attitude would also have to be achieved against a background of climate prediction which makes subsidence more, rather than less, likely. (It is interesting to note that UK policyholders take comparable pride in their cars also, with a much higher proportion of damage cover than overseas car-owners.)

Windstorm

Current position

Among the most damaging of natural events both physically and financially are windstorms, partly due to their frequency. Severe convective storms, in particular thunderstorms and hailstorms, cause significant property damage and have been doing so for a number of years. However, the truly expensive storms are cyclonic (see Table 7.1). A number of these disasters have occurred in Europe, most recently in December 1999 when three storms (Anatol, Lothar, Martin) caused on aggregate £7bn insured losses. The high loss potential for insurers was first demonstrated on 15 and 16 October 1987, when the now legendary windstorm '87J' struck, causing insured losses of £2bn in the UK and northern France, and economic losses reaching £2.5bn.

There are a number of obvious reasons for this very significant trend of ever-increasing frequency and severity of natural disasters, for example increasing wealth; concentration of people and values in cities; urbanisation and industrialisation of high risk regions; vulnerability of modern societies and technologies; changing environmental conditions (deforestation for example) and in some regions population growth.

Underwriting

Windstorm is, in principle, covered through the usual market fire policies (those of householders/homeowners as well as of commercial business). Nevertheless, at the time of calculating the fire premium, it is rare to find that a specific portion of the premium is allocated specifically for windstorm. It is therefore supposed to be a small part of the total premium but not easy to identify. Excepted from this statement are risks which pose a special exposure to windstorm damage because of their building style or their condition. In such cases, it is this increased exposure which then influences the overall assessment of the risk as desirable or not.

Following the storms of 1987 the topic of windstorm in the UK received greater attention. The heightened

Table 7.1. Great global windstorm disasters 1950–99. Decade comparison

	1950–59	*1960–69*	*1970–79*	*1980–89*	*1990–99*	*Factor 80s:60s*	*Factor 90s:60s*
Number	7	10	19	21	40	2.1	4.0
Economic losses	10.3	30.5	45.9	48.1	171.7	1.6	5.6
Insured losses	0	6.5	10.4	18.9	76.2	2.9	11.7

Loss in $bn, 1999 values
Source: Munich Re

awareness led to the monitoring and controlling of aggregates, these controls now being universal in the field of insurance. Another important measure introduced at that time was the raising of reinsurance retentions or, in the majority of cases, their introduction.

Reinsurers, brokers and an increasing number of consultants developed in the 1990s a range of windstorm models which have made it possible to determine loss potentials on the basis of incidence rates, otherwise known as return periods. In addition, it is also possible to establish the technical risk premiums for proportional and non-proportional business and to assess the effect of deductibles. Today there is a wide range of windstorm risk programmes, developed and used by individual insurers as well as available commercially. These allow the analysis of individual portfolios and the unreserved handling of all risk-relevant parameters, such as pricing and accumulation.

Evaluation of regional and national occurrences of windstorms is undertaken regularly every year in the UK, although major windstorms and comparable catastrophes only occur once every three to five years. The following constituent factors determine the severity of a windstorm:

a) The extent of the wind fields and wind speeds
b) The loss dimensions relevant to the windstorm. (Loss dimensions are the quantity and vulnerability of property in the path of the storm, with other relevant factors such as policy conditions, policyholder behaviour and the ability of the construction industry to respond to the event.)

Insurers handling windstorm claims have virtually never considered whether wind damaged buildings have complied with UK building regulation requirements for wind loading. The argument is sometimes raised that even if the damaged building had complied with building regulations it might still have been damaged. In addition, many houses in the UK were built before modern building regulations were introduced.

Experience of property insurance in the Caribbean, which is regularly subjected to hurricane force winds, is that insurers (and local building control authorities) are much more conscious of building code requirements and compliance. Should the incidence of windstorm losses increase significantly in the UK, insurers might begin to introduce measures to encourage improvements in the resistance of existing buildings, new buildings and repaired buildings to wind-loading. Again, the ABI has a programme of research in this area.

Claims

One of the most daunting features of windstorm disasters is the sheer volume of claims that have to be handled in a concentrated time and location (one million for 87J, three million for 90 A-G, and three million in Lothar and Martin combined in France). This places claims administrations under incredible stress, since the construction industry also cannot cope. Often the standard procedures are waived to facilitate customer service (for example, the answer might be simply to pay invoices below a defined threshold without checking—of course an incentive to fraud). It is reckoned that through fraud, and price gouging, claims costs in a windstorm disaster

Table 7.2. UK windstorm catastrophes

Date	*Region*	*Insured losses (US$m)*	*Economic losses*
Winter storms			
15/16.10.1987 (87J)	SE	3,100	3,700
25/26.1.1990 (Cat. 90 A)	S, Midlands, N, Cornwall, London, Wales, Constock	3,050	3,400
25/27.2.1990 (Cat 90 G)	S, SW, Midlands, Wales	800	900
Storms/thunderstorms			
13/14.8.1997	Midlands, NW, NE Scotland, Yorkshire E; East Anglia; Norfolk; Lincolnshire	100	150

Source: Munich Re

can rise 30–40% above normal levels. The total volume of transactions in 1990 was enough to be seen in the UK's GDP, the construction mini-boom causing a temporary blip in the midst of recession!

While tele-centres will allow work to be spread among internal staff more efficiently, they do not address the shortage of capacity in field staff, and it is to be expected that the next windstorm disaster will see claims-handling in crisis, due to recent rationalisations in the name of efficiency and cost control.

Also relevant are the findings of Mootoosamy and Baker (1998) that the main cause of wind damage to buildings in the UK is not high wind speed, but

- inappropriate detailing, especially the fixings for tiles and roof panels;
- poor supervision during construction, allowing substandard fixings;
- ageing and deterioration of roofing materials and fixings.

There is nothing new about this—similar findings were reported following the 1962 Sheffield storm (Wolmersley et al., 1962).

Reinsurance

As Figure 10.4 (page 90) shows, reinsurance responds to large events through sharp price increases, followed by steady declines during the troughs between catastrophes like Hurricane Andrew. At the same time reinsurers have raised the retentions of the primary insurers (akin to deductibles on private insurance policies), and tightened up the contract wordings and claims vetting. The reinsurance market was ahead of the primary market in seeking to use geographical information systems to handle rating and exposure control. The experience of the 1999 storms in France and Denmark showed how important it is to use the best techniques. In both cases there was a lack of urgency because there had been no recent events, so the expensive work of gathering data at postcode level and modelling the data had not been carried out. Although reinsurers had an idea of the potential loss before the storms, they were accused of being alarmist, or even self-serving, by trying to generate more business and higher prices for themselves through supposedly exaggerated PMLs, which in fact turned out to be correct.

In fact, European storm is only one exposure which reinsurers deal with, so the reinsurance market is not critically influenced by storms in the UK or Europe, because exposures in the USA from hurricanes or earthquakes are larger. However, reinsurers have been increasingly examining the details; obviously coastal zones are more exposed to storms and sea-flood, and therefore this could be an important factor for individual reinsurance programmes.

The ART market is one possible direction for insurers to pursue if reinsurance capacity/pricing seems unfavourable. However, there has been no real interest in European exposures, because the reinsurance problems really centre on other issues (eg, hurricane/ earthquake).

Scenario

Wind is one of the most difficult dimensions in the realm of weather when it comes to relating its frequency of emergence with climate change. As a consequence, wind has become the subject of great controversy, as the ACACIA study concluded, 'at present… it is not possible to reliably estimate how the frequency of storms may alter in the future'. (Parry, 2000) Seen from a purely theoretical point of view, the frequency of windstorms, and situations where wind disturbances occur, would increase as a result of climate change in the form of increased atmospheric convection and enlarging of the pressure gradients between polar and subtropical areas. As a result, extremes in the atmosphere would intensify, making conditions ideal for localised windstorms to increase in strength and frequency.

However, scientists have not yet been able to prove conclusively that windstorms will necessarily increase in a warmer climate. Nevertheless, we can expect an increasing trend, albeit difficult to quantify even with the best climate models in the world. The spatial resolution is exceptionally high, the grid length measures up to 10 x 10km, ie, the analysed data points are taken each ten kilometres allowing a good model of the real world. Leading UK climatologists, M. Hulme and G. Jenkins (1998), claim that 'Changes in the frequency of extreme events are difficult to predict. There are also uncertainties associated with modelled changes in future wind regimes… Storminess may change little although summer gales and extreme winter gales are likely to become more frequent.' The evidence that does exist, however, points to an increase in either the frequency or severity of storms over northern Europe.

Estimates of these factors vary widely between experts (Downing et al., 1994). Seasonal variations in the incidence of windstorms are predicted, with an expectedly greater variation in force of winds during the winter, but decreasing in the spring. From the spring, wind forces are expected to increase in severity until the autumn, when the strongest winds of the year are predicted, especially in the north (Hulme & Jenkins, 1998). Figure 10.1 (page 88) shows how sensitive property damage is to wind speed.

Issues arising

Although a dramatic worsening of the risk situation for windstorms in the UK may not come about, greater loss burdens for the insurance industry must be contended with. The following is a list of the possible effects of windstorm in the area of property insurance:

- higher wind forces for windstorms;
- values in various regions, with greater loss potential;
- more frequent and greater windstorm catastrophes;
- subsequent premium adjustment;
- vulnerability of buildings due to different codes in different parts of the country;
- increased vulnerability of buildings constructed after 1971 following the new code of practice for roofs.

Other aspects that insurers should consider are

- market co-operation on the collection of data after a windstorm to assist with future windstorm modelling and to input into new building codes;
- lobbying government for stronger building codes and for sustainability scoring on new building designs;
- preparing for the possibility, as suggested in a recent government consultative document, that stronger building codes might not only be introduced for new buildings but made retrospective for future repair work, thus requiring insurers to reinstate to a higher standard;
- resisting pressure from the EU to harmonise building codes across Europe;
- lobbying the scientific community to adopt the CORINE system currently in use throughout Europe with the exception of the UK. This omission leaves the UK at a major disadvantage in modelling windstorm events. (The 'CORINE' system [Co-ORdination of INformation on the Environment] is derived from satellite imagery and helps to model surface roughness and land use.)

Options

Underwriting

With weather patterns changing, if the current insurance arrangements were to continue then properties which are currently regarded as high risk could become uninsurable and those currently with medium risk could become high risk and so on.

Underwriting is an area in which increasing losses and higher loss burdens will have most impact. A list of techniques to adopt are suggested below for use in the future, depending on how serious the ramifications of weather events are:

- adjustment of premiums (technically adequate premiums);
- introduction of substantial deductibles (according to degree of exposure);
- increased accumulation control;
- intensive loss prevention/loss avoidance;
- improved organisation/standardisation of claims settlement;
- introduction of various limits of indemnity;
- increased reinsurance/retrocession;
- changes in reserving policies.

If a significant increase in weather-related losses were to occur, such as windstorms which plagued the UK in the winter of 1990, it might well be expected that a combination of the above measures would come into force. Exclusion of insurance in especially exposed areas is unlikely, but unfortunately cannot be precluded.

If insurance becomes unsustainable under normal commercial practice, either because of systematically localised risk, eg, flood or subsidence, or on a regional scale because of the magnitude of the potential losses (as with windstorm in Florida, discussed in chapter 4), then the government will need to intervene to produce a sustainable solution. There are a range of possible solutions, from the government becoming the reinsurer of last resort (as with terrorism in the UK or disasters in France), to regulated mandatory pools for high-hazard risks (as in the USA). Whatever the case, it is preferable to involve commercial insurers in the administration, so as to minimise operating costs, and provide prompt service to victims (Dlugolecki, 2000). However, it should be emphasised that insurers are more than willing to provide insurance cover, provided other stakeholders play their part. The authorities need to set

and enforce hazard-aware regulations, and policyholders must mitigate their losses by emergency planning and prompt emergency actions. It is ironic that even if UK insurers wished to adopt a uniform rate for natural hazards, as happened for flood in 1961, consumers have now become so demanding that those in lower hazard areas would probably complain that they were subsidising the risks, in perhaps more scenic districts at the tops of hills (where wind exposure is high) or close to rivers or the coast (where the flood risk is high).

Severe repeated damage to houses might make some properties in certain areas uneconomic to repair. These houses might need to be demolished and replaced with housing on less exposed sites, built with different building technology more resistant to natural perils exposure, such as is seen today in the USA and Australia. Houses of this type can pose a far better storm, flood or subsidence risk and would thus most probably be insurable in the conventional way. The cost of replacing large numbers of existing houses with new ones would, however, be considerable. Replacement might also need a change in the building regulations. Care would be required in drafting new regulations because of their potential effect on the existing house stock, which might need to be modified to comply with any updated building code. A consequence could be a considerable increase in the cost of building repairs which are the subject of insurance claims through the application of the local authorities clause in policies.

In the case of subsidence, ground stabilising technology involving moisture control, chemical stabilisation or other techniques is being progressively developed. Such techniques hold the potential to stabilise shrinkable clays at a cost which is economic for widespread use. The insurance business has to be aware, however, of the potential for pollution that could be associated with some of these techniques.

Reduction of property flood risk can be achieved by constructing properties at higher elevations or protecting them with flood walls but again the cost of these measures is normally very high where existing properties are to be protected.

Flood and windstorm insurance are areas where the insurance business needs to co-operate to manage risks. For flood risks, there are a number of actions which could be taken:

- lobby government for increased spending on flood alleviation schemes;
- liaise with local authority planners to reduce the number of new developments in areas where there is a high flooding hazard.

Some actions have already been taken by the ABI on behalf of its members, as set out on page 59.

In England and Wales, the draft planning guidelines for flood refer favourably to the insurance template used in Scotland (see appendix 7.2) and quote large extracts from it, but English flood appraisal groups are still some way off. Meanwhile there are some worrying examples of developments at a high risk of flood: one authority on the south coast has granted planning permission to a developer on condition that it builds new sea defences. Over 2500 homes are planned, and many have been built, but work has yet to start on the sea defences. Mortgage lenders and insurers are presumably accepting the flood risk for these properties at normal terms without knowing the potential for losses.

Claims

In the case of flood, claims managers should

- seek to accumulate better quality data on flood damage vulnerability to help their underwriting colleagues;
- seek additional ways to identify and manage fraudulent claims, eg, by spot checks;
- provide better and more sympathetic service to genuine claimants.

The establishment of the UK National Flood Claims Database has been of great value to flood modellers, but it was very labour intensive to establish.

The FASTER system was devised in 1997 to attempt to standardise the reporting of losses so insurance loss adjusters could respond more quickly to major flood and storm events. After a successful local pilot, improvements were made based on practical experience. It was designed not only to speed up claims handling, but to identify fraudulent claims more easily and to enable the creation of a national database of claims costs for different types of flood and storm events, to assist with computer modelling and underwriting. The ABI and CILA should give this approach further consideration, including the impact on administration

costs and customer service in both emergencies and normal conditions (see appendix 7.1 for details).

In the case of subsidence, insurers are still refining their claims-handling techniques and arrangements with service suppliers based on the current insurance set-up. Such refinements are unlikely to have a significant effect on subsidence claims. A major drought would put such arrangements under strain. Since the large numbers of subsidence claims were recorded in the early 1990s the numbers of staff with subsidence claims experience in both insurers' and loss adjusters' offices has diminished.

Changes in methods of financing or underwriting subsidence risk could have a dramatic effect on the job that claims departments are required to undertake. They could, for example, be used as the mechanism by which local authorities handle underpinning grants if such a system were introduced.

Reinsurance

Naturally, reinsurers will continue to apply information technology to their underwriting of natural perils, and to exploit the latest techniques of data capture, eg, satellite. However, often reinsurers will not share with their customers, the insurers, how they have arrived at their overall premium. This lack of transparency hinders the process of risk adaptation, because the individual original risks should really bear their correct share of the reinsurance premium, and this figure can only be guessed where the hazard has not happened recently.

A particular concern to reinsurers is the fact that whole series of events are becoming more common, generating large losses even if each single event is not a catastrophe. This trend is increasing the demand for 'aggregate' covers, and needs very careful underwriting, as so far modellers have assumed that events are statistically independent. This assumption is clearly wrong scientifically, as the tele-connections around the world show when there is an active EI Niño or La Niña, and more recently this has manifested itself in Europe with the 1990 and 1999 storms.

There has been a move to open up new avenues of risk finance (ART), to provide an alternative to reinsurance. Currently this seems to have become bogged down because of the complexity of the contracts and their very unfamiliarity. Indeed, to date none of the contracts have had a claim! Reinsurers have been exploring ART both as buyers and suppliers, and their position in the property insurance market seems solid.

Mortgage lenders

Mortgage lending is currently based on the premise that certain perils, which could significantly affect the value of properties on which a loan is secured, are insured.

Insurance policies are normally one-year policies protecting properties, which are the subject of mortgages, which are much longer-term commitments. Mortgage companies also tend to securitise their portfolios and if securitised portfolios were under threat from restrictions on natural perils insurance cover, then pension funds could feel the effect on the value of their investments.

Large numbers of houses rendered uninsurable by weather pattern change could produce a threat of a major negative equity problem for borrowers which in turn would adversely affect mortgage indemnity insurers.

Perhaps more significantly, if the link between a mortgage and insurance were under threat or broken there would be a significant impact on the mortgage market. Some form of government intervention would almost certainly result in owing to the fundamental link between the mortgage market and the health of the UK economy. It is outside the scope of this paper to speculate on the impact such developments might have on the UK economy as a whole save to say that insurers would be expected to contribute to the debate.

One option for mortgage lenders would be to work with insurers and support them in their efforts to lobby government, influence planners, and collect data, as outlined earlier. In some ways they are more vulnerable than insurers. After all, an insurance company is only on risk for a year, and can cancel cover after that time. The mortgage lender could be taking on a 25- or 30-year risk, and no one knows what climatic, social and economic changes might happen in that time.

Section 3—Corporate policy
INTRODUCTION

Julian Salt

Climate change has wide-ranging implications for the UK insurance industry. Since the first SoF report in 1994, much has altered on the climate change scene, both politically and scientifically. It is the aim of this section to review how the UK insurance industry is approaching and reacting to the issue of climate change by analysing its policy position on both the investment and environmental front. It was decided that the best way to achieve this end was by analysing insurance company annual reports and any relevant corporate policies.

UK insurers are becoming aware that their activities and the markets in which they operate are ever more prone to the vagaries of environmental issues and in particular the potential impact of climate change. Some insurance companies are taking a proactive stance, leading the debate into unknown and uncharted territory, culminating in a new dialogue with customers and suppliers alike. The remaining firms are tending to lag behind by some considerable distance although, in time, competition for the lead role will become more apparent.

This awareness of the issue of climate change and its impacts is emerging in various forms. Annual reports and associated environmental reports show the first signals that something is changing. Discussions within the company and with supply chains are the next stage of the learning process. The customer will become increasingly aware of the company's position on climate change as policy wording will begin to change to anticipate the effects. Finally, investment activity of the major insurance companies on the markets will have to reflect the internal and external realities of climate change over the coming years.

Environmental and investment policy linkages

Every activity that an individual, company, local authority or nation-state indulges in has an associated environmental consequence. In general these activities have a negative effect on the environment in that they either deplete the natural resource base or emit some form of pollution to the 'global commons'. Many of these activities are performed by companies for customers, whether they be individuals or other companies. As such, these activities have an economic consequence which in some way or another will be linked to a value in the market-place. How that value is calculated is a matter of concern, the issue being whether a true value of the cost of the associated damage is internalised to the 'agent' or whether it is effectively 'dumped' on the global commons.

Once a true value is placed on the environment and its destruction, one can argue that the market-place can begin to correct the wrongs of the consumerist society by making the 'polluter pay' for the damage caused. Eventually, this will be reflected in the share price and value of the company concerned. Various forms of investment selection criteria can be used then by individuals and institutional investors to reflect this concern in the market-place.

Analysis of annual reports

To understand the status of environmental and investment policy of the major UK insurers it was decided that the best approach would be to start by analysing the annual report of each of the companies of interest, together with any relevant corporate policy documents available. A letter explaining the nature of the project was sent to 60 major insurance companies in the UK, requesting a copy of their annual report, environmental policy and investment policy. Twenty-five replies were received—these companies are listed in appendix 8.1.

Most respondents sent only the annual report. Only one company (CGU) sent an actual environmental report, for 1999 and 2000. This lack of response is surprising considering that in the Business in the Environment

annual survey of environmental reports (see chapter 9), nine insurance (life and non-life) companies appeared in the financial sector for 1999, and all these companies were contacted for this project.

Buried within the text of the annual reports are clues to both the environmental and investment policies, but firm evidence has to be teased out of the reports.

CHAPTER 8: INVESTMENT POLICIES OF INSURANCE COMPANIES

Julian Salt

The global insurance industry is responsible for cycling over $2.2 trillion in premiums annually (Swiss Re, 1999). As Figure 8.1 shows, this flows through two main channels (life and non-life). Roughly 10% of the total flows into reinsurance, ($200bn), while the remainder is split between operating costs, claims and profits. The bulk of the financial flow at any one time is invested in assets of various forms on the financial markets (equities, fixed-interest bonds, etc.), as well as in property.

Most of the non-life risks that are underwritten presently have been accepted assuming past claims date and historical return-periods for given hazards. The belief that those same conditions will prevail in the future could be very damaging to the bottom-line of the insurance sector, since the claims cost is sensitive to extreme events. The irony is that, at present, just as climate impacts are beginning to emerge, the markets are 'soft', ie, insurance prices are low relative to costs.

Capital invested on the markets

The UK market has a significant slice of the global insurance throughput of $2.2 trillion as evidenced by the latest figures from the ABI (Table 8.1).

In terms of net written premiums a survey in 2000 by Standard & Poor's[1] showed that the top ten insurance companies (globally) alone have written $96bn of premium and that these same ten companies control shareholders' funds worth $105bn (Table 8.2). The top ten are mainly US based.

Table 8.1: UK insurance underwriting and assets

i) Underwriting

Net written premiums = £ 20,962m.
Reinsurance = £ 1,009m.
Non-motor premiums = £ 12,953m.
Underwriting profit/loss = (£ 723m.)

ii) Assets

UK land/property = £ 46.8bn
Other assets = £ 26.6bn
Unit trusts = £ 65.1bn
Loans/mortgages = £ 10.7bn
Overseas govt securities = £ 17.5bn
Overseas company securities = £ 82.1bn
UK company securities = £ 373.6bn
British govt sterling securities = £ 127.9bn
Short-term assets = £ 46.2bn
Total assets held = £ 796.5bn

Source: ABI *Insurance trends*, July 2000

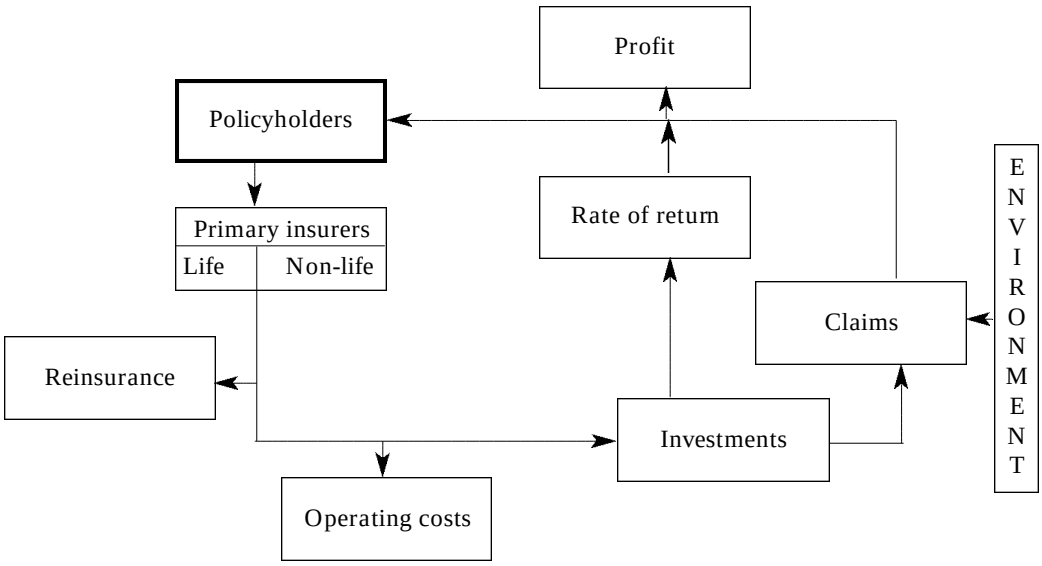


Figure 8.1. Cash cycle

Table 8.2. Top ten insurers (net premium written)—2000

	Global		*UK*
1.	Zurich Group ($13.67bn)	1.	Royal & Sun Alliance (£4.37bn)
2.	Royal & Sun Alliance ($11.45bn)	2.	CGU (£3.44bn)
3.	American International Group ($11.1bn)	3.	AXA (£2.58bn)
4.	Tokio Marine & Fire Insurance ($10.11bn)	4.	Norwich Union (£2.3bn)
5.	Lloyd's ($10.06bn)	5.	Zurich (£2.15bn)
6.	CNA Groupo ($9.88bn)	6.	Cornhill (£1.09bn)
7.	Nationwide Group ($8.49bn)	7.	New Hampshire (£0.73.bn)
8.	Citigroup ($8.29bn)	8.	Direct Line (£0.73bn)
9.	Yasuda Fire & Marine Insurance ($7.1bn)	9.	GAN (£0.54bn)
10.	Liberty Mutual ($6.51bn)	10.	Consolidated Financial (£0.51bn)

Table 8.3. Fund managers league table (assets managed in £billions)—1998 figures

	Premier league (in excess of £30bn)		*First division* (less than £30bn under management)
1.	Morgan Grenfell (£32bn)	1.	Royal & Sun Alliance (£10bn)
2.	Hill Samuel (£37.4bn)	2.	Britannia Investment Management (£7.7bn)
3.	Henderson Investors (£41bn)	3.	Friends Ivory & Sime (£28bn)
4.	CU Morley (£45bn)	4.	Scottish Mutual (£13bn)
5.	Standard Life Pension Funds (£64bn)	5.	Baillie Gifford (£15bn)
6.	Fidelity Investments (£36bn)	6.	Scottish Equitable (£19.5bn)
7.	Hermes Pension Trust[2] (£33bn)	7.	Guardian Asset Management (£22bn)
8.	Barclays Global Investors (£65bn)	8.	Newton Investment Managers (£13bn)
9.	Legal & General (£48bn)	9.	Foreign & Colonial (£25bn)
10.	Norwich Union (£46bn)	10.	HSBC (£18bn)
11.	Threadneedle (£41bn)	11.	Colonial First State (£5.4bn)
12.	AXA Sun Life (£41bn)	12.	Clerical Medical (£21bn)
13.	Prudential (£87bn)	13.	Guinness Flight (£7bn)
14.	Mercury Asset Management (£80bn)	14.	M&G (£18bn)
15.	Schroder Investment Management (£84bn)	15.	Scottish Widows (£13bn)
16.	Gartmore(£50bn)	16.	Edinburgh Fund Managers (£6.5bn)
17.	Phillips & Drew (£50bn)	17.	National Mutual (£4bn)
18.	Fleming Investment Management (£30bn)		

Friends of the Earth report, 'Capital punishment'

In 1999, Friends of the Earth published a report entitled 'Capital punishment'. The essential argument of the report was that financial institutions and insurance companies in general have a major role to play in promoting and implementing sustainable environmental policies. By being major shareholders of 'blue-chip' stocks on the markets (through their portfolio management activities) UK insurers could seriously influence them into acting in an environmentally friendly and sustainable manner. In addition, there is growing evidence that such a move would benefit all concerned (shareholder and company) in terms of share price position because environmental issues do affect operating profit. There is no longer a case for doing nothing; in fact doing so could be seen by investors as

being negligent, given the mounting evidence of the potential threats of climate change impacts. The study looked closely at the investment activities of 15 top UK insurers. These were

Prudential Assurance (including Scottish Amicable)
Standard Life Assurance
Commercial Union Assurance
Norwich Union Life and Pensions
Equitable Life Assurance
AXA Sun Life
Legal and General Group
Royal & Sun Alliance
General Accident Fire & Life Assurance
Scottish Equitable
Scottish Widows Fund & Life Assurance
Barclays Life Assurance
Clerical Medical and General Life Assurance
Allied Dunbar Assurance
Friends' Provident Life

The companies were asked five main questions linked to sustainable development activities.

Questions

1. Does the company have a sustainable development policy?
2. Does it report on policy implementation?
3. Does the company carry out mainstream screening of investments on environmental and social criteria?
4. Has the company signed the UNEP Insurance Industry Initiative Statement of Environmental Commitment ?
5. Does it offer a green or ethical investment fund?

Results

- Total assets under management by top 15 insurers = £550bn.
- The majority of the shares owned by the top 15 insurers were oil-company and related stocks (Chevron, Exxon, Mobil, Elf Aquitaine, RJB Mining, ICI, Great Lakes Chemicals, Zeneca, Glaxo Wellcome, Monsanto, Rio Tinto and Occidental Petroleum).
- 50% of the top 15 had ethical/green investment vehicles.
- Only 2 out of 15 insurance companies had signed the UNEP-III statement.

The report went on to propose the following recommendations:

- All major insurance companies should sign up to the UNEP-III statement;
- The insurance companies signed up to UNEP-III should implement it through appropriate investment activity (ie, non-fossil/sustainable stock selection);
- All investments should be screened for sustainable development activity;
- Environmental reporting by insurance companies should be mandatory;
- All insurance companies should endorse a policy of reduced ghg reductions.

The implications for insurers are clear. If unsustainable investments in fossil and related stocks are perpetuated then one of two things may occur. Firstly, because of increasing climate change impacts (related to greenhouse gas emissions from the very companies insurers have invested in), an increase in climate-related claims will cause ever more damage to their bottom-line and hence their share price. Secondly, as a reaction to the first effect, investors and the public in general will move their investments to other asset managers, where longer-term sustainable growth is more likely.

The power of the market and the public could be harnessed in a positive manner through such a dynamic. If the insurance industry ignores the warning signals encapsulated so neatly in 'Capital punishment', then they will only have themselves to blame in the medium to long term.

Social/ethical and environmental investing

In the UK, 330,000 people have some form of ethical investment vehicle. The sums invested are small (£2.8bn) compared with the situation in the USA ($1 trillion)[3]. Ethical investment will be a burgeoning market in the future. The need for a 'third leg' of social responsibility to complement the traditional objectives of security and rate of return is rapidly becoming acknowledged in asset management. Initially such socially responsible investment (SRI) may operate separate portfolios, but as attitudes change it will enter mainstream practice.

Worries that such funds will underperform compared with the FTSE are unfounded as shown by the latest

results from a survey by Sarasin (a leading investment management company)[4] of the top 65 European securities. The survey showed that 'returns from ethical investments were at least comparable to those from a more traditional equity base'. A full analysis of the SRI investment market is to be found in the latest discussion paper from Sustainability[5].

Strategies for socially responsible investment (SRI)

There are four main strategies which SRI asset managers can adopt: active engagement, niche investment, screening and property management.[6] In active engagement, the investor meets the company's management to discuss how they are incorporating environmental issues into their corporate strategy. Such private sessions are better for free and frank discussions.[7] The second strategy involves selecting particular activities which will be important for sustainable development (eg, renewable energy), and then acquiring expertise in the analysis of that industry in order to develop a specific portfolio of investments. Often this requires skill in venture capital, as the technology may be very novel and still in the R&D stage. Screening involves passing investment prospects through a series of filters, discarding at each stage those companies which do not come up to scratch on the relevant parameter, for example CO_2 emissions, to establish either 'best in class' or 'above the tidemark' companies which qualify for investment on the basis of the three investment principles (security, rate of rate, SRI).

Finally, a much neglected angle is property management. Insurers occupy and own huge amounts of property as investment assets. Thus they have a direct opportunity to practise environmental principles themselves as tenants and landlords, by ensuring that their buildings are located and operated in a sustainable way. There is a further benefit to such an approach: insurers generally have to renovate buildings when they are damaged by extreme events and an SRI strategy would avoid damage.

A more general approach is illustrated by the model which Friends Provident uses. There are three types of company in which an insurer can invest. In terms of their effect on the environment these companies can be described as positive, neutral or negative. In pure economic terms the ability to create a profit and thus return a good rate on the initial investment (by the company) will either be high, medium or low. Thus one can create a matrix for a given company describing all possible combinations of effect on the environment and ability to return on investment (see Table 8.4).

Table 8.4 Environmental categories of investment

		High	Medium	Low
		Effect on the environment		
High	Effect on rate of return on investment	Neutral	Positive	Positive
Medium		Negative	Neutral	Positive
Low		Negative	Negative	Neutral

The worst type of company is one that has a high environmental impact (detrimental effect on the environment) while delivering a low rate of return. Conversely the best type of company is one that delivers a high rate of return while having a minimal effect on the environment.

The positive companies self-select themselves as do the negative types. The neutral type is of interest to Friends Provident (although most investors would not be so interested) in that, with concerted dialogue and the appropriate management training, these neutral companies could be turned into positive companies.

The pension law—the Welfare Reform and Pension Act 1999—that came into force on 3 July 2000 effectively allows individual pension holders to ask their pension fund managers where exactly their pension funds are being invested. Up until now this sort of information has been opaque at best, the pension holder only being able to judge a pension fund's performance once a year. Now,

with the introduction of the new law, there is the potential for individuals to put indirect pressure on fund managers to invest more to their liking, which could mean in a more ethical, social or environmental manner.

More generally, the SRI principles can be extended into normal investment analysis, by educating practitioners about the key issues. For example, this research group investigated the underwriting implications of climate change in four economic sectors (tourism, construction, utilities and property). This type of research would be just as valuable for investment decisions, as climate change will potentially alter the fundamental economics of many businesses.

Analysis of investment policies

This section aims to give an overview of the respective investment policies of the insurance companies that supplied details. All but one (Pearl Assurance) of the companies included an investment policy in their annual report. Some simply aimed to return the greatest profit possible to shareholders while minimising the risk to exposure. Others were more proactive and have gone to considerable lengths to devise strategies to increase investment returns while acting in a socially responsible manner. Brief details are given for these companies, then the strategies and policies adopted by a progressive insurer, Friends Provident are examined in more detail.

CGU

CGU has an investment arm called Morley Fund Management. This has adopted a socially responsible investment (SRI) code, managed in the UK. The fund controls assets in the region of £60bn. The SRI code used to select appropriate investments takes account of five main issues that include the following:

- community involvement
- employment issues
- environmental issues
- corporate governance
- human rights.

All property investments (£300m.) are conducted using the BREEAM[8] assessment methodology for environmental efficiency.

The Dutch subsidiary of CGU (Delta Lloyd Nuts Ohra) operates an Added Value Investment Fund, which effectively finances local community renewable energy projects such as wind farms in the Netherlands. It also invests in fixed-interest bonds and companies that generally make a contribution to improving the environment.

On the issue of climate change CGU is an active player in the insurance sector. It is fully aware of the potentially damaging impacts (financially and environmentally) that climate change could have on the property side of the insurance business. CGU accepts that the insurance industry should be taking the lead on some major investment decisions in order to help contain the potential damages of future climate change impacts.

CGU announced major losses due to the European storms in 1999, amounting to £70m., at its AGM in 2000.

Ecclesiastical

Ecclesiastical operates the Amity Fund which is an ethically based managed fund. Over a five-year period (1992–97) it has shown growth of +85%. The fund invests ethically and environmentally and favours such investments as water sterilisation and waste management companies (in the UK) as well as companies that research into life-threatening diseases. It is the leading insurer for churches. It actively avoids investments related to companies that destroy the environment or social systems such as

- tobacco/alcohol/weapons/drugs,
- videos/magazines/gambling,
- oppressive regimes/cosmetics.

Skandia

Skandia has an investment policy that incorporates a balanced approach. It invests in a mix of fixed-income securities, equities and real estate. The overall objective for the investments is to create a good return over the medium term without allowing fluctuations on property & casualty losses to become excessive in the short-term. Most equity holdings are in Europe as opposed to the USA/Far East. There is also an Ethical Selection Fund, run by Jupiter.

Royal & Sun Alliance

Royal & Sun Alliance operates a risk-weighted capital allocation model for investment portfolio selection with the RSA Group. In 1999, results were generally better than expected despite the 'unusual level of weather-related large losses'. Typically the return on investments was +13%. There was a continual growth in the savings/pensions sector of the business. In terms of asset management, RSA was voted 'best performer in the UK' (Standard & Poor's). Total assets under

management amounted to £26bn. Particularly badly hit areas for weather claims were Ireland, USA, Canada, Caribbean (Hurricane George) and Australia.

Norwich Union

Norwich Union operates an Ethical Investment Fund based primarily on UK equities. The aim is to generate long-term profits under strict ethical investment criteria. Six main exclusions to investments include the following:

Exclusions

- Fossil fuels (ghgs),
- Ozone-depleting chemicals,
- Tropical hardwood (from unsustainable sources),
- Pesticides,
- Water pollution,
- Nuclear power.

Inclusions

- Companies that publish environmental policies,
- Renewable energy,
- Conservation projects,
- Waste management.

Assets under management total £65bn. The UK recently had £10m. property-related claims (lower than usual weather-related claims).

Aegon

Aegon has investments totalling $160bn in the USA and in the UK it has £10bn tied up in assets through the acquisition of the long term arm of Guardian Royal Exchange. Aegon (UK) was responsible for creating the UK Social Investment Fund.

Family Assurance Friendly

Family Assurance Friendly runs a small Family Charities Ethical Trust incorporating £15m. of investments. Through this vehicle Family Assurance has discovered that only 39% of the FTSE is eligible for investment under its selection criteria. EIRIS (Ethical Investments Research Information Service) has been used to screen its portfolio selection, with additional use of company visits to bolster the investment choices. The fund has grown in value by + 148% in the last 5 years and supports 40+ charities. It is a partner of the Ecology Building Society. The fund aims for long-term growth.

The Pavilion Eco Friendly Fund is part of Family Assurance. The investment management company controls assets of £2bn and focuses on green investment products. Companies that it invests in are encouraged to adopt good environmentally sustainable positions and policies. Environmental and ethical screening of UK equities is used by the Fund.

Lloyds TSB

Lloyds TSB has an Environmental Investor Fund which is in the top-20 equity funds in the UK.

Zurich

Zurich operates a sustainable asset-management operation through Scudder. The overall aim is to integrate sustainable development performance criteria into all areas of business in the group through economic, environmental and social factors. Large individual losses were recorded in 1999 because of weather-related events in the USA, Ireland and South Africa. Assets under management total $415bn.

Scottish Widows

Scottish Widows operates an Environmental Trust Fund which is quite small (£37m). It has generated a return of +300% since its inception, 11 years ago. The fund is categorised as a medium-high risk portfolio and its main aim is to achieve long-term growth in a sustainable manner.

Prudential

Prudential as a group commands assets totalling £170bn. Prudential Portfolio Managers (PPM) manage £145bn of this total for the group. Contained within this overall figure, £72bn are placed in the Prudence Bond (operating with-profits) and £33bn placed in fixed interest accounts. Prudential has recently acquired M&G, the unit trust provider, strengthening its operations on this side of the business considerably. 1999 saw a record flow of funds (£18bn) into the group, with an increase in the sale of investment products. Prudential is very focused on developing its e-commerce operations mainly through the Egg vehicle. M&G has £21bn funds under management mainly in the form of unit trusts (growth rate: 39% a year). PPM ventures control some £600m., while property holdings (Bluewater, Milton Keynes and the rebuilt Arndale centre in Manchester) within the group total £9bn. New products being launched include

M&G Global Management Bond Fund
M&G Global Technology Fund

The US arm of Prudential operates through Jackson National Life, mainly dealing with pensions, and controls some $99bn.

Prudential claims in its annual report that as a group it controls some 4% of the UK stock market through equity holdings and implies that through ethical selection of stocks it commands considerable leverage on companies and their environmental positions.

Standard Life

Standard Life commands assets totalling £79bn, this figure having grown by +20% in the last year alone. Most of the money is tied up in pensions. Typical returns for the last year have been of the order of 19% (with-profit funds), 13% (endowments), 16.5% (pensions). Not so strong has been the performance in both the property and health sectors. Future growth is seen in the e-commerce side of the business and in the stakeholder pension market to be introduced by the Government in 2001.

Legal & General

Legal & General controls assets of over £100bn, mainly in the form of pensions, mortgages and savings vehicles. It operates an ethical pensions and unit trust. The majority of the group's activity is in the pensions and savings sector. Growth in the on-line mortgage market will be developed in the near future as well as in the new stakeholder pensions schemes to be introduced in 2001. L&G has 5% of the national savings market and manages investments for 33 of the top-FTSE100 companies.

Sun Life & Provincial Holdings

Sun Life & Provincial Holdings is a UK subsidiary of the French-based AXA Group. It operates mainly in life assurance and related financial services (asset management). Its motto is 'Think global, act local'. As a group, AXA controls assets totalling £486bn, with annual revenues of £42bn. AXA Investment Managers UK itself controls assets of £49bn. It recently acquired Guardian Royal Exchange (GRE), including PPP Healthcare, while UK Life (GRE) was sold to Aegon. AXA is now the second largest healthcare insurer in the UK. Web-based motor and healthcare insurance products are soon to be launched. AXA has taken the stance that to stay in the top league it needs to have strong under-writing skills coupled with a prudent pricing policy. Sun Life controls assets totalling £48.5bn mainly through the Pension Managed Fund, Pooled Pension Fund and the Life Distribution Fund.

MGM Assurance

MGM Assurance is heavily involved with mortgages as well as insurance products. Total net premium income for 1999 was £114m. Unknown amount of assets under its control. Two new products for the housing market are to be launched:

MGM Flexible Homebuilder Plan
MGM Mortgage Payment Protection Plan

The Managed Fund operated by MGM has a neutral position on equities, while its investments in general were weighted towards Japan/Asia (giving good returns) and underweighted on the fixed interest side of the market. Typical returns on investments over the previous year were 12% (investments), 23% (equities), 31% (overseas equities), -1% (fixed interests), 15% (property).

St Paul

St Paul is a major financial service provider in the USA with operations in over 70 countries including the UK. Net income for 1999 was $834m. It majors in medical surety and product liability and has leading positions in global marine, technology, financial institutions and product liability. It aims to be a leader in property liability insurance.

On the whole the group produced good investment performance in 1999 ($1.6bn pre-tax), managing to reduce the losses from catastrophic events such as Hurricanes Mitch and Georges by judicious use of reinsurance to only $257m. (previous year losses were $267m). Other catastrophic events that added to the losses included Hurricane Floyd, earthquakes in Taiwan and Turkey, windstorms in Europe as well as storms and floods in the USA. Losses related to the Paddington rail crash in October 1999 (covered by three Lloyd's syndicates it was linked to) also contributed to the total.

Total assets under management for the group were $70bn, with $59bn being handled by John Nuveen Company. Investments totalled some $21bn with a split along the following lines:

fixed maturities ($15.5bn), equities ($1.5bn), real estate ($1.2bn), venture capital ($0.86bn), securities ($1.2bn), short-term investment ($1.2bn). As a group it aims to improve its underwriting skills, efficiency, claims handling and loss control services.

Hiscox

Hiscox has control of £700m. assets. It operates through Syndicate 33 at Lloyd's. Its target is to be a major specialist insurer, underwriting the large and more complicated risks. It is a world leader in

political risks, the insurance of international trade transactions and international investments. Its logic is to do what it does best and leave the rest alone—operating in the volatile insurance/reinsurance niche sector of the market. Hiscox supplies 53% of the capital that flows through Syndicate 33. Its reinsurance account traded the second worst losses last year, mainly because of the 'storm of the century' that hit Europe in December 1999.

Case study of an active SRI company, Friends Provident

Friends Provident has assets of £38bn under investment, majoring in retail business/asset management as its core function. E-commerce and stakeholder pensions are to be developed in the near future. Its business model is to strive for 'continuous improvement'. This is reflected in its goal to become the leading supplier of business financial services and high-quality products to the commercial world. Currently it has 3.5% of the market share in this sector.

Friends Ivory and Sime

In terms of investments Friends Provident uses the company Friends Ivory and Sime (FIS) to manage the operation of investment. The funds operated all feature in the top three of their sector. Its main objective is to become a leading global fund manager and adopts the 'growth style' approach to managing its investments (based on growth, consistency performance and business momentum. FIS delivers the best performance for pensions over 1, 3 and 5-year time frames. FIS adopts an advanced version of ethical investment practices throughout its selection of stocks and investments. Termed 'responsible engagement overlay' (REO), when choosing stocks, the approach aims for

a) a commitment to seek to use influence as a shareholder to support/encourage companies in their efforts to move towards socially responsible/sustainable business practices ;
b) unlike ethical investment, REO will not exclude companies on ethical grounds, but instead, where practicable, will engage with them to encourage positive change.

The main investment areas chosen by FIS are

- Property asset management
- AIM (alternative investment market)
- Value asset management
- Investment trusts
- Private equity

FIS oversees the whole SRI/REO business for Friends Provident and as such dominates with 50% of the UK SRI market. The introduction of new pension fund rules in July 2000 will promote this approach as individual pension holders will be encouraged to enquire about individual stock selection, in effect applying their own version of the REO approach. This will result in positive pressure for change from the laggards in the market.

'Stewardship' ethical investment—process

Friends Provident takes the issue of SRI very seriously and this is reflected in the dialogue it has with the companies with which it is involved.

A 'Committee of Reference' was created by Friends Provident to oversee the guidelines for SRI-investing within the group. Guidelines were written for investment managers to apply to portfolio selection. The Stewardship Trust offered by Friends Provident is the vehicle in which all ethical activity sits. It uses its voting rights at AGMs to press home key ethical questions to companies it wishes to invest in. New forms of dialogue with prospective companies are being explored by Friends Provident. It is even assessing its own behaviour from a social and ethical standpoint.

The process adopted by Friends Provident in performing stock selection is as follows:

1. Investigation by Ethics Unit adopting EIRIS guidelines and 1000 company databases
2. Determine policy—Committee of Reference (FP)
3. Company selection
4. Encourage positive action (at company of choice)
5. Accountability

This process has been operated by Friends Provident for 14 years. The selection criteria used for companies (both positive and negative) are as follows:

Positive

1. Supply basic necessities of life?
2. Provide high quality products/services of long-term benefit?
3. Conservation of energy/natural resources?
4. Environmental improvements/pollution control?
5. Good relations with customers?

6. Good employment practices?
7. Training & education?
8. Strong community involvement?
9. Equal opportunities?
10. Transparency of data?

Negative

1. Environmental damage and pollution?
2. Exploitation of animals?
3. Trade with oppressive regimes?
4. Weapons?
5. Nuclear power?
6. Exploitation of Third World countries?
7. Tobacco/alcohol?
8. Gambling?
9. Pornography?
10. Misleading advertising?

In practical terms the Committee of Reference and associated investment sub-committee meet eight times a year to discuss appropriate stock selection for the Stewardship portfolio. In reality there are three types of company in which to invest (positive, neutral and negative). Friends Provident invests in both the positive and neutral types, the latter being reinforced by site visits and extensive dialogue with the management to bring about positive change in the companies' management structure and philosophy.

Future investments—silicon or carbon?

Since global warming is caused by the ever-increasing build-up of greenhouse gases (principally CO_2) in the atmosphere, and extreme events seem to be on the rise in both number and severity (and total loss value), one can argue that investing in stocks directly linked to the emission of carbon is a bad thing. In effect, by continuing to invest in 'carbon' companies, insurers are hastening their own demise on two fronts.

Firstly, increased weather-related claims will damage their property and casualty bottom lines and make them less attractive to investors themselves. Secondly, their investment portfolio will generate increasingly poor returns on investments in 'carbon'.

Losses from natural disasters in 1999 reached a global economic total of $100bn, $12bn of which was an associated insured loss (see Figures 2.1 and 2.2, page 5).

Research by Munich Re[9] has shown that over the last 40 years, decade by decade, economic and insured losses have been increasing at an alarming rate (economic x 8, insured x 15). From a societal point of view the rate of increase in economic losses from all types of natural disasters rose at an annual rate of 12% between the 1980s and 1990s, and the rate of increase is itself increasing. If one contrasts this against a conventional GDP growth rate of 3% per year for the global economy, a 'cross-over' occurs whereby the losses from climate-related losses will exceed the world GDP in the year 2065. Obviously, long before that occurs, something will have to give!

Thus, insurers that pursue business-as-usual will face a potential 'double-whammy' effect on their results as climate change impacts bite politically, economically and environmentally with adverse impacts on claims and investments. This is demonstrated in Figure 8.2.

An alternative to this business-as-usual investment scenario could involve a general transition from carbon-based investments into silicon-based investments. In other words, from the old-economy smokestack stocks to the new-economy sustainable stocks. The future of energy generation will be in non-conventional renewables (solar, biomass, geothermal and wind), not fossil-derived (oil, coal and gas) power stations. Equally, e-commerce is setting a new working paradigm. Electronic trading of everything will be the future. Many people will work from home in the future, using the Internet in some form.

In essence society is moving from the oil-age into the solar-age and from the material-age into the information-age. Investment activity should mirror this change. By doing so it will actively promote the transition that is required. The main arguments against such a switch in investments are that there is heavy investment tied up in old-economy stocks and not enough capacity in the form of new silicon-based companies. However, institutional investors have the power and the duty to accelerate the speed of this change. In practice, what will happen is that the most progressive companies will alter their portfolio of activities, so that funds need not even be transferred, simply reinforced. A good example is British Petroleum, which is now marketing itself as Beyond Petroleum, ie, moving from oil to energy.

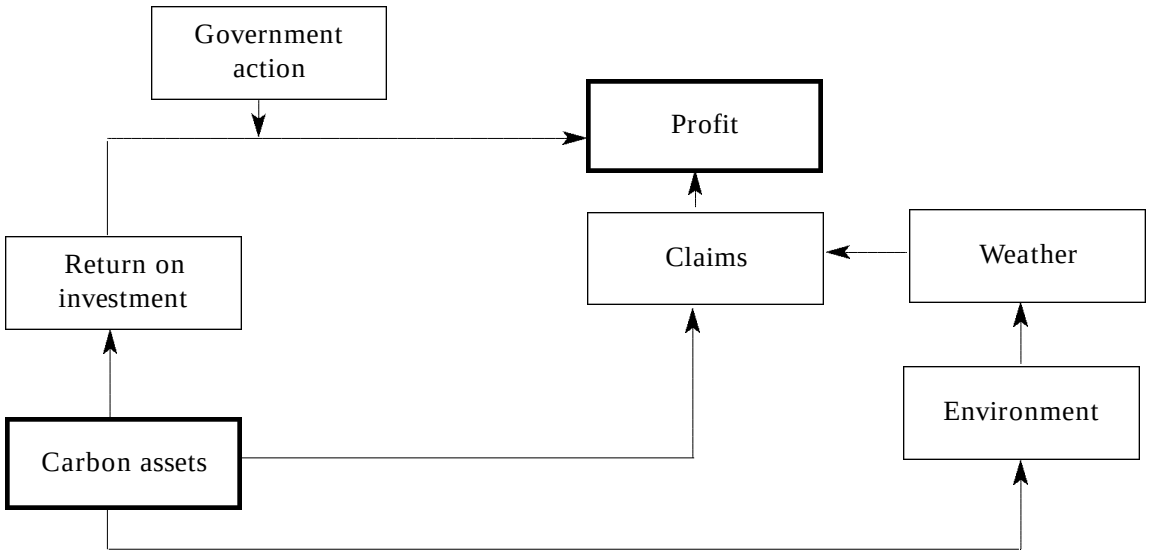


Figure 8.2. Investment cycle and the effects of carbon investments

Analysis of investment policies—summary

An insurance company is effectively an asset management or investment company and thus it has to have an investment policy. However, it is clear that there are various types of investment policy being adopted by the insurers involved in this research. This range of investment options is summarised below.

- The majority of insurance companies analysed have as a central investment policy the target of securing a good return on capital in the medium to long term.
- A few then go on to stipulate that the guiding principle for delivering the former will be through execution of an environmental policy agenda within their investment portfolios.
- Several (seven of those in the research) even espoused the use of either social, environmental or ethical filters on their investments to deliver sustainable returns.

The collective assets of the 25 insurance companies analysed added up to £1.35 trillion in the market-place. Generally, most primary UK insurers invest quite safely in government stocks (bonds, gilts) and securities. In contrast the more specialised insurers tend not to invest in equities, more in property and land assets.

As a whole, insurance companies thus have the ability to command and control the stock markets through sheer force of share ownership. Thus, a signal from insurers that they favour more sustainable companies could have a massive impact on companies further down the supply chain. This power has yet to be wielded by the insurance sector, as evidenced by chapter 9 on environmental policies of insurers. The end result of such a business approach may even help to reduce the damage bill from potential climate change impacts.

Notes

1. Standard & Poor's Top 200 global business insurers, International Risk Management, Feb 2000.
2. Hermes Pension Fund operated for BT and the Post Office.
3. 'Invest your conscience.' *Money Management,* December 2000.
4. *Financial Times*, p8, 8 July 2000.
5. A responsible investment by Sustainability at the Centre for Business Performance, March 2000.
6. Mansley, M. and Bright D., *Socially Responsible Investment: a guide for pension funds and institutional investors,* Monitor Press, 2000. ISBN 187124191X
7. A recent interesting example occurred when Greenpeace brought a case against BPAmoco on drilling in the Arctic. BPAmoco reversed its decision to continue in this region based on a surprising vote by institutional investors against such activity. However, it is far more common for major investors to try to influence corporate strategy in off-line discussion.
8. BREEAM is a management system devised by the Building Research Establishment that can be used to evaluate a building's energy efficiency status.
9. 'Annual review of natural catastrophes', 1998, Topics, Munich Re

CHAPTER 9: ENVIRONMENTAL POLICIES OF INSURANCE COMPANIES

Julian Salt

The environment is not a new issue for business. Industrial companies have been grappling with it for decades, because of problems like pollution and industrial disease. Those problems in turn created problems for many insurers, notably in the USA with Superfund. However, the much broader aspect of sustainable development has superseded that phase, as the realisation spreads that the Earth is only a finite resource. This realisation has heightened the requirement for business to formulate policy in this new area.

The same 25 insurance companies whose investment policies were examined in chapter 8 were analysed in terms of their environmental policies. First, however, we looked at other information—the Business in the Environment survey and some of the principles of corporate environmental policy.

Environmental Management Systems

Environmental Management Systems (EMSs) and their auditing in the financial sector are weak mainly due to there being no EMS standard that meets the needs of this sector. An initiative led by CGNU (FORGE[1]) is therefore trying to address this issue by creating a standard EMS reporting procedure for the financial sector. Recently a document resulting from the FORGE initiative has been released by the British Standards Institute. This summarises a possible set of guidelines for environmental management reporting for the financial services sector. [2]

Communication both internally and externally by the financial sector was seen as an issue that needed improvement, especially as this sector takes up the issue of environmental improvement with increasing vigour in the future. Environmental stewardship was an issue seen by the financial sector that could best be tackled through the vehicle of loans, property purchasing and investment policies.

FORGE members
CGNU, Abbey National, Barclays, Lloyds TSB, Prudential, Royal Bank of Scotland, Royal & Sun Alliance.

Another initiative that is relevant to environmental management systems and their reporting involves the global reporting initiative (GRI). This initiative was set up in 1997 by CERES[3] in the USA in tandem with support from UNEP. The main aim of the project is to create an agreed set of criteria for reporting on the social, environmental and economic issues of any business under an agreed template, allowing a true comparison to be made of companies across the globe. Sustainable development is the key driver to this project and underlies much of the framework of the GRI system. The system is constantly evolving and spreading in its use both geographically and institutionally.

Business in the Environment survey

Business in the Environment (BiE) is the business-led campaign for environmental responsibility organised by Business in the Community. Its aim is to inspire companies to regard environmental responsibility as an essential part of business excellence. BiE's authoritative leadership and advisory teams promote the key role of environmental responsibility as a strategic competitive issue for business. BiE's business-to-business approach helps to argue the case in corporate boardrooms, and demonstrates to companies how working towards environmental responsibility makes business sense.

The 'Business in the Environment' Index of Corporate Environmental Engagement and Performance Measurement has played a critical role over the last four years in changing the attitude and behaviours of the major FTSE listed companies towards environmental management and performance. In 1999, 151 companies took part, including over three-quarters of the FTSE 250 by value, with a combined market capitalisation of £1100bn, and 77 of the FTSE 100.

The objectives of the BiE Index are to

- inspire continuous improvement in environmental management and performance through benchmarking;

- raise awareness of the environment as a strategic competitive issue at boardroom level;
- determine the progress that organisations and sectors have made;
- provide credible, independent, comparative information for stakeholders.

Every year a survey is sent to all member companies of the FTSE, comprising three main sections, these being: environmental management, environmental performance and a verification assurance section.

The sections are further broken down accordingly:

Section I (environmental management):
Leadership, policy, objectives, targets, employee communication, communication with stakeholders, environmental management system, audit, supplier programme, environmental stewardship of products/processes/services.

Section II (environmental performance):
Energy, transport, global warming, waste, water, environmental incidents, biodiversity.

Section III (verification assurance process):
Assurance process, publicly reported information, signature.

Replies were analysed by sector and the respective companies ranked. The financial sector for 1999 comprised 29 respondents, including 10 insurance companies; the remainder were banks and investment companies. The ranking among the financial sector included the insurance companies shown in Table 9.1.

The general willingness among entrants in this sector was encouraging in as much as the insurance and life assurance companies involved had doubled in number from the previous year. A full list of placings in the FTSE –BiE table is shown in appendix 9.1.

Environmental performance

The majority of financial sector respondents (in the BiE survey) set targets for energy, transport, global warming, waste and water usage. Typical scores for each of these sub-sectors were as follows:

% of companies setting targets in sectors	
Energy	70%
Transport	60%
Global warming	70%[4]
Waste	60%
Water	35%

The average sector score from the BiE survey for the financial sector (all participants) was 45% in 1999, compared to 58% in 1998.

It is worth noting some ground-breaking work in the critical area of performance measurement. Tennant and Thomas (1998) developed an indicator to measure corporate performance in terms of carbon dioxide emissions. This work was sponsored by UNEP, and has also been adopted as best practice by the UK DETR.

Table 9.1. Company ranking (insurance industry/financial sector) in BiE survey

Rank for insurance	*Rank in financial sector*	*Company*	*Sub-sector*
1	3	Royal & Sun Alliance Insurance Group	Insurance
2	8	CGU	Insurance
3	10	Britannic	Life assurance
4	13	Legal & General Group	Life assurance
5	17	Prudential Corporation	Life assurance
6	21	Norwich Union	Life assurance
7	23	Independent Insurance Group	Insurance
8	26	Allied Zurich	Insurance
9	27	Sun Life & Provincial Holdings	Life assurance
10	29	LIMIT	Insurance

Analysis of environmental policies

The analysis of environmental policies revealed that they ranged from the very detailed through the very basic to the non-existent.

CGU

CGU produced an environmental report in 1999 and in 2000. Embedded in the later report (2000) there are six targets, which embrace the following issues:

a) Integrate environmental considerations into corporate policy/business decisions/insurance products/purchasing and general management
b) Increase environmental efficiency of offices and the workplace in general
c) Manage group buildings and facilities environmentally
d) Raise awareness of staff and local community to environmental issues
e) Apply environmental best practice for customers
f) Promote external activities and environmental awareness initiatives.

- The 1999 report was similar to the 2000 report, the only difference being that the 1999 report focused solely on UK operations, while the 2000 report was global in its scope.
- All business units within the CGU Group have been tasked with creating and operating Environmental Management Systems (EMSs).
- In the UK CGU took the lead on creating a financial industry consortium (insurers and bankers) to devise new guidance on environmental management systems for the financial sector (FORGE).
- CGU also devised ACORN, a small-business accreditation and environmental review scheme (in conjunction with BSi) run along similar lines to ISO 14001. The system has a five-stage process that allows small business companies in the supply chain to CGU to adopt and operate environment-friendly practices. The logic is that environmentally sustainable practices can flow outwards from CGU to all its customers and suppliers via such a mechanism.
- Within the company, CGU practises good environmental management techniques. For example, it recycles much of its waste and what cannot be recycled is sent to a local CHP (combined heat and power) plant (London). Staff are encouraged to travel in car pools or are given help with mass-transit passes. In the office most paper is reduced by a system known as print-on-demand, while hardware such as printer cartridges is recycled. Greater use of the Internet is becoming increasingly popular both internally and externally. Home-working is encouraged with great use of video-conferencing replacing long-distance travel.
- In business units such as motor, instead of replacing broken glass windows in cars, repair of the window is encouraged. Externally CGU supports such things as the BTCV (British Trust for Conservation Volunteers) conservation holidays for staff, Earthwatch, as well as being main players in the BiE and UNEP initiatives on financial sustainability.

In general CGU is very aware of the inter-connectedness of business and environmental issues. Within the group CGU operates a Joint Policy Committee on the Environment that reports to the main board. Each business unit within a subsidiary has a nominated environmental manager whose task is to oversee all environmental aspects of underwriting/energy use and property management issues. General Accident was one of the founding signatories to the UNEP-III statement.

Ecclesiastical

Ecclesiastical has no environmental policy as such (although it invests in environmental issues). In the 1999 financial year it acknowledges that the market has been increasingly volatile in terms of claims, driven in part by climate change and social inflation issues.

Skandia

Skandia acknowledges that environmentalism and social activism are on the increase and that the public is becoming more aware of ethical issues. Given global deregulation, Skandia is also aware that the greatest insurance risks lie in the emerging markets (eg, China, India, Russia) and property insurance in general.

Skandia underpins its business operations by the banner 'Security for generations'. It has also actively taken part in such things as the WBCSD (World Business Council for Sustainable Development)

Skandia operates an EMS internally comprising three main pillars (management process, environmental performance and financial performance). The underlying premise of operating this system is to deliver sustainable shareholder value.

Royal Bank of Scotland (Direct Line)

Royal Bank of Scotland (Direct Line) has a corporate environmental policy that involves a group-wide Environmental Steering Group. An external consultant has been appointed to oversee the environmental review of group operations. Employees are actively engaged in environmental dialogue and actions. Training for staff is part of corporate policy. Recycling of office waste is promoted and the use of energy and raw materials are minimised. The bank group endeavours where possible to avoid polluting emissions and to minimise environmental infringements. Within the supply chain RBS encourages good sustainable practices and also promotes local sustainable initiatives.

Aegon

Aegon is a major player in the life insurance (savings and pensions) market. Aegon recognises that one has to be a good corporate citizen to retain market share and also has an environmental policy to match. Part of its policy hinges on discussions and an agreement with the Dutch government to reduce energy consumption by 23% by 2006. Recycling of waste is also a big issue for Aegon.

Lloyds TSB

Lloyds TSB has produced an environmental report that lists seven areas of action that it espouses as a company. These are

- minimisation of waste through recycling
- reduction of energy use in offices
- environmental requirements for suppliers
- all products from sustainable sources
- identification of environmental risks prior to lending
- compliance with all environmental, health & safety regulations
- to report on environmental actions within the group.

Lloyds TSB has signed the UNEP Financial Initiative on the Environment.

Zurich

Zurich operates a system within the group that allows it to follow a sustainable development path. Part of this process involves the creation and selling of environmental insurance (liability) products. Deployment of risk engineering services allows the group to understand the risks being underwritten better.

Norwich Union

Norwich Union has an environmental policy that has seven guiding principles. These are summarised as follows:

- Identify adverse environmental impacts (of business) and reduce them
- Take environmental issues into account for investment decisions
- Environmental factors to be factored into lending decisions
- Evaluation of effect of environmental issues on general insurance
- Environmental management training for staff
- Meeting legal obligations with good environmental practices
- Work with other parties to implement environmental policies.

Scottish Widows

Scottish Widows actively engages with the environmental cause by creating an Environmental Trust Fund. This has been available for eleven years and has increased in value (+300%) since its inception. Eleven EIRIS categories have been adopted for stock selection purposes, including the following areas: animal/plant welfare, acid rain, community relations, energy conservation, forestry, healthy eating, ozone layer, pollution control, recycling, sensitive land-use and transport. The fund is categorised as a medium to high risk portfolio due to the nature of the businesses involved. The top ten stocks chosen fall into the four main categories of energy, drugs, communications and financials.

Royal & Sun Alliance

Royal & Sun Alliance operates a group-wide environmental policy (both internally and externally).

Prudential

Prudential operates mainly through offering unit trusts, mortgages and savings and pensions facilities. In 2000, the company created the Environment Policy Group which sets group-wide environmental policy. The main targets are to

- reduce the consumption of materials
- help employees achieve environmental improvement
- encourage suppliers to minimise environmental impacts
- make environmental decisions part of the investment process
- apply best practice to planning/development/ decommissioning of buildings in the group.

As a vehicle for its environmental stance Prudential operates a Light Green Fund, mainly for pension scheme holders.

Standard Life

Standard Life has adopted an environmental policy that creates environmental managers within the group. These managers are responsible for decisions on six principal areas including energy use, purchasing, waste, pollution, transport and design.

Legal & General

Legal & General operates an environmental programme for its staff besides offering two environmental products—Ethical Unit Trust and Ethical Pension Fund.

Sun Life & Provincial Holdings

Sun Life & Provincial Holdings operates an environmental and ethical policy within the company. The main objectives of this policy are to

- minimise effects on the environment
- perform duties in an ethical and environmental manner
- demand the highest ethical standards for business dealt with in supply chain
- create management guidelines
- not tolerate corrupt practices
- monitor performance through six main indicators:
  - —directors: ensure that good governance be applied to business
  - —resource conservation: reduce consumption of paper (increased recycling)
  - —purchasing: terminate/reduce use of environmentally unfriendly products
  - —ethical investments: use ethical screening of investments
  - —energy: reduce energy use
  - —transport: use unleaded petrol/diesel/public transport.

Analysis of environmental policies —summary

On the whole the insurance companies discussed in this chapter have made varying attempts at integrating environmental decision-making into their everyday business practices. Some companies are clearly far more advanced than others, having spent more time and effort thinking through the options and actually implementing them. The following points summarise the section on environmental policies in the insurance sector.

- 25 companies (35%) responded to the initial request for details of annual/environmental reports.
- Of those that did respond, ten had some form of environmental policy in place (corporate statement, EMS or environmental report).
- EMSs were in evidence although only rarely (Legal & General, Skandia Life and CGU).
- Only one (CGU) had all three.

A truly environmentally aware insurance company must practise what it preaches. Currently, the evidence shows that insurers are making fine statements about environmental principles, but these have still to be embodied in practice and procedures. This process should lead to a more efficient operation in terms of the way that business is conducted which, in turn, should lead to an increased profits/earnings (P/E) ratio. If this were the case the above-named companies should be 'best of class' within their sector and this should be reflected somewhat in their share price, though there are of course many other factors which affect commercial performance.

However, the insurance sector is a victim of its own making. There are probably still too many players in the market at present, leading to extremely competitive (possibly unprofitable) pricing of premiums to gain and retain market share. The public judges an insurance company on two main issues—price and reliability. If the price is low and the reliability is high the public will use that insurance company, because that is all they will see when it comes to paying the premium or making a claim. Anything else is additional and unnecessary (in their eyes). The trick as far as an insurance company is concerned is to be able to offer those two key deliverables while being environmentally tuned-in, efficient and profitable.

Overall summary of the analysis of UK insurers

The initial findings on both environmental and investment policies are shown in appendix 9.2. On balance, if one were to consider both the investment and environmental policies of the leading insurance companies analysed, five clear leaders in their field emerge. These are listed as follows.

Top five companies in the survey

1. CGU
2. Friends Provident Life
3. Legal & General
4. Scottish Widows
5. AXA (Sun Life & Provincial)

Only CGU appears to be aware of the linkage between an effective environmental policy and investment policy. One enhances the other and leads to improved performance all round and an improved environment. The other four all have good environmental policies and respectable investment policies underpinned by ethical and socially responsible criteria.

What may be more telling is the number of companies that failed to supply details of their investment and environmental policies. Many of these are likely to be companies that need to concentrate their efforts and improve their systems and awareness of environmental matters and how these impact on the investment side of the business.

Survey of UNEP-III members

An interesting parallel is available from the recently published survey to establish how far members of UNEP-III had implemented the principles of sustainable development to which they had committed themselves.

The responses indicate that most companies are still in the early stages of applying environmental considerations to their operations. For example, 74% were actively embodying environmental principles in the loss prevention function, but this dropped to 49% for asset management. Another indicator is that only 57% had dedicated resources for the environment, and only 37% had a nominated board member for those issues.

Globalisation and environmental policy

For the first time, the two financial industry initiatives (banking and insurance) sponsored by UNEP held a joint annual roundtable, in Frankfurt on 16–17 November, 2000. The theme was globalisation and its implications for sustainable development. While the proceedings are yet to be finalised, it is clear the principal conclusion is that corporate globalisation brings with it new responsibilities and stakeholder expectations.

The revenues controlled by corporations are often larger than those of nation states. At the same time, states are having to limit their involvement in problems because of the growing number of demands on their resources. Thirdly, the scale of the environmental problems themselves is growing—climate change and the ozone hole being just two examples.

Consumers are now well educated and can see this for themselves—the rise in green politics and environmental NGOs (non-governmental organisations) demonstrates this. Therefore, as big business becomes bigger, it will be expected to play an active part in solving environmental problems.

Conclusions

This chapter has revealed that insurers are still only beginning to adopt environmental principles. There are some examples of good practice, but they are still too rare. The insurance companies that have seen climate change as a major threat are attempting to do something about it, but they represent the minority. Ironically, the insurance sector is probably the only sector that has the collective might to do something about climate change (because of its omnipresence and size), but at this moment it chooses to be silent.

Pressure from a more informed public could turn the tide as more householders become victim to the vagaries of extreme weather, coupled with the possibility of utilising recent reforms of the Welfare Reform and Pension Act 1999. Worldwide, big business is being sucked into policy-making on societal issues. The question is how long it will be before the insurance sector is willing to make a stand against climate change on behalf of the customers and society on which it, in turn, depends.

Recommendations

- The insurance sector needs to embrace the environmental changes taking place more proactively than it is doing at present.
- EMSs and environmental reporting should be mandatory within the insurance sector (see: FORGE).
- Environmentally, socially and ethically based investing should become mainstream.
- There is a need for greater urgency internally (within companies) and externally (government) to reduce ghg emissions.
- The UK's Kyoto target for ghg emissions reductions should be the minimum target for all insurance companies.

Notes

1. Financial Organisations Reporting Guidelines on the Environment.
2. 'Guidelines on environmental management and reporting for the financial services sector—a practical toolkit', British Standards Institution, 2000.
3. Coalition for Environmentally Responsible Economies (CERES).
4. Three companies have set the Kyoto target of reducing ghg emissions by 5% by 2008–2012.
5. *Green Futures*, September/October2000, pp40–41.

Section 4—Conclusions
CHAPTER 10: GENERAL STRATEGIES

Andrew Dlugolecki

This chapter pulls together the strands of analysis in previous chapters to draw some general conclusions on the strategies which insurers should adopt in the face of climate change. Because of the serious nature of the issue, 'do nothing' is not an option. First we consider traditional underwriting activities, before looking at the areas of investment and corporate strategy.

Traditional risk management in underwriting

In the last seven years, the USA, Poland, Canada, Australia and France have all suffered record losses from weather events (August 1992 hurricane, July 1997 river floods, January 1998 icestorm, April 1999 hailstorm, December 1999 windstorms). This prospect seems likely to continue because of changes in the return periods of extreme events and the non-linear relationship between property damage and event severity. In some instances, eg, summer temperatures in England, scientists are even prepared to be specific about the shortening of return periods.

The non-linearity of property damage versus event severity is well known—increasing the speed of a 200kph storm by 10% can magnify the damage 150% (UNEP III, 1997). A practical example is given by the losses suffered in the October 1987 'hurricane' which hit England and France (see Figure 10.1). The postcode areas with higher windspeeds suffered disproportionate losses, although the property there was similar in nature to the other areas.

Generally, shifts in the water and wind cycles will alter the location of extreme events. In addition, it can be expected that the increase in atmospheric energy will give rise to an upward shift in storm activity. The net effect of these changes is to exacerbate property losses—the benefit from a reduction in losses in favoured areas will be outstripped by the additional losses in those regions where weather extremes become more common. This is because the newly affected areas will be

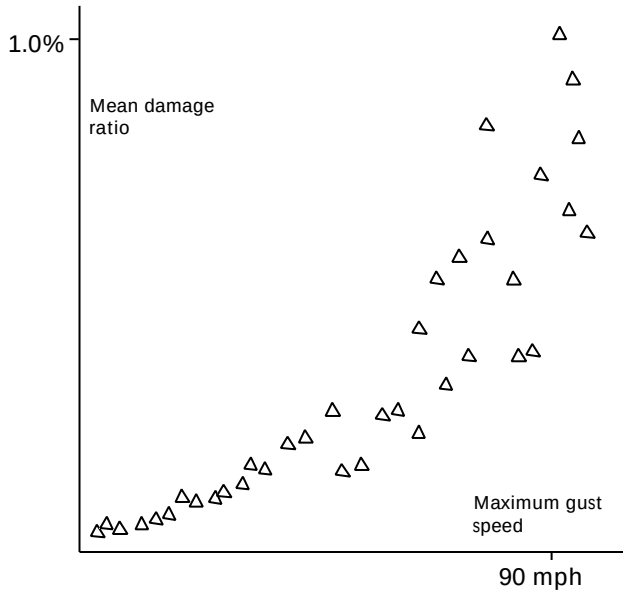


Figure 10.1. Claim cost v. windspeed (October 1987)

unprepared for a disproportional increase in weather losses, and will not be able to adopt the higher design standards which were customary in the other areas for some time. (The only caveat for insured losses is that currently they are dominated by US hurricane losses, so these general trends in economic losses may not be exactly reflected for insurers.)

Figure 10.2 illustrates the general thesis. In (i), there are two settlements, A and B. The hazard in location B is more severe. However, since the hazard is customary, the damage in both locations is similar, because both settlements have adapted to their different, prevailing circumstances.

Now suppose that in future, the hazard severity reverses between A and B. Then as (ii) shows, settlement A will suffer more damage due to the unexpected severity and its nonlinear effect. However, since settlement B was well adapted and suffered minimal damage previously,

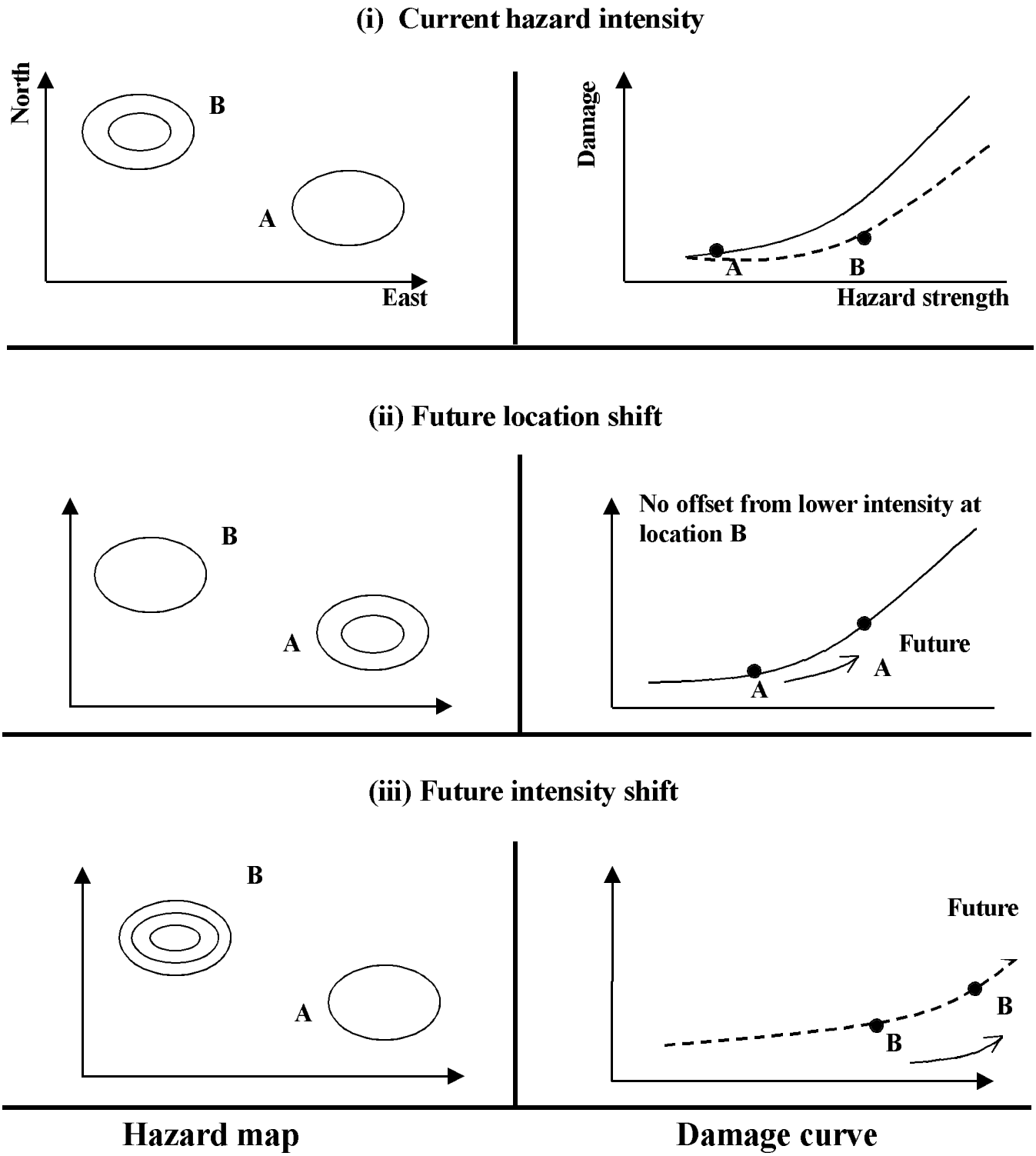
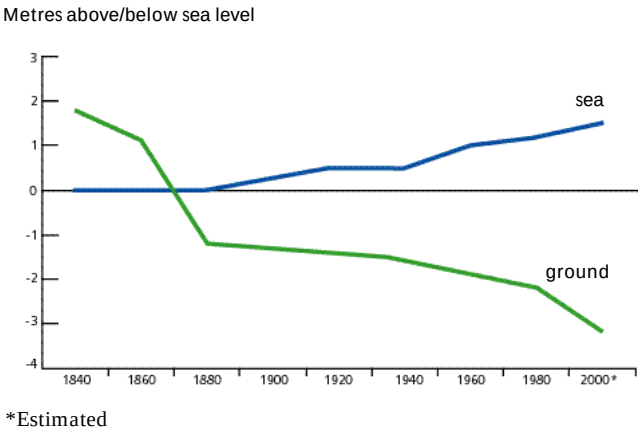


Figure 10.2 Future damage potential from climate shifts

there is little reduction in damage there to offset the worsening at settlement A.

Finally, suppose that the hazard at settlement A remains unaffected, but settlement B undergoes a worsening in the hazard, as shown in (iii). Then, because of the steep shape of the damage curve, settlement B will experience significantly higher costs even though it was adapted to more severe conditions than settlement A.

While there may be uncertainties about many regions, coastal regions will definitely be prone to greater problems, because of the rise in global sea-level. In some areas like East Anglia this is compounded by land subsidence due to drainage projects and post glacial rebound (see Figure 10.3), and coastal storms could exacerbate the problem still further owing to shifts in their location and likely increased strength.



*Estimated

Figure 10.3. Coastal hazard in East Anglia

Source: David Crichton, modified from other sources

Traditionally, insurers have had four strategies to manage their exposure to natural hazards: limit the risk, control the damage, transfer the risk and adjust the product price.

Limiting the risk by not writing it, or restricting the quantum through upper and lower limits of liability, or narrowing the circumstances of loss which are covered are common tactics, but they often give rise to disputes over coverage, and are not welcomed by regulatory bodies, intermediaries or the public. In some cases, they may be essential to safeguard insurers' own interests, but it is helpful to link them with other strategies, eg, pricing incentives. Insurers do often assist their business customers with advice on how to manage specific risks, but it is not generally possible to provide on-site advice for the personal market.

Controlling the damage after it has happened has always been a valuable strategy, and as disasters have become more frequent, and insurance companies have grown in size, so it has become possible to apply a more professional approach. Thus 24-hour telephone helplines are common features of service, linked to the nomination of approved repairers/suppliers with a guarantee of quality delivery. This is immensely helpful in reducing the claim costs and improving customer satisfaction.

It used to be easy to transfer risk through reinsurance. The London Market 'Spiral' of the 1980s showed how little attention reinsurers paid to catastrophic risk, and ultimately proved catastrophic for the reinsurers themselves. Now, reinsurers are the heaviest users of exposure management techniques. The other way in which risk might be transferred would be to demonstrate that human agency had materially caused or worsened a particular catastrophe, and so seek compensation. There have been a few instances of this, most notably the 'Ash Wednesday' Australian bushfire in 1983, but in general it is public policy to dismiss such actions where public agencies are involved.

The final instrument is price. Here the underwriter faces major problems, because of public and sometimes regulatory resistance. This is particularly so with extreme weather, since incidents are relatively localised and infrequent, and prices are therefore unstable (see Figure 10.4). If competitors do not share the same view, the insurer stands to lose a significant proportion of his market share, but the underlying uncertainty and the ease of entry for new competitors make it difficult to reach a consensus.

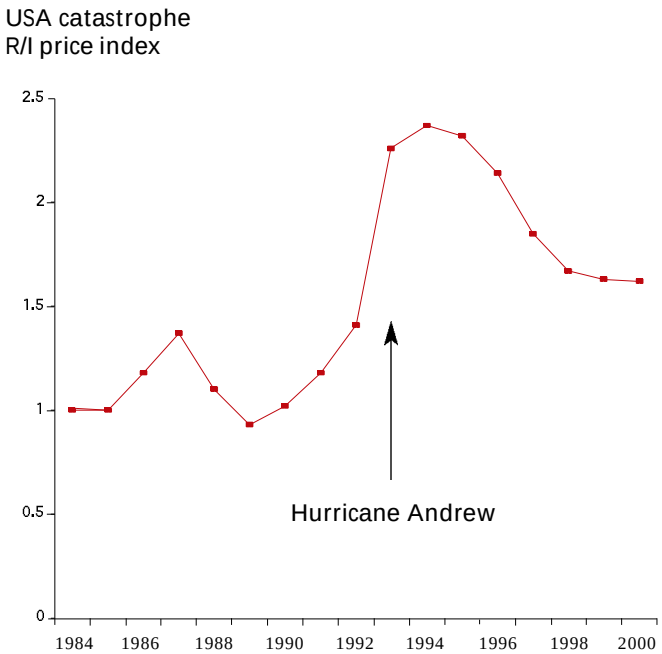


Figure 10.4. The market has a short memory

Source: Paragon

Figure 10.5 gives an example of how sensitive the risk premium for catastrophes is to the return period. Suppose currently extreme events have a 1/100 probability, costing 1 unit and very extreme events are so rare they are ignored. This yields a risk premium of 0.01(1 X 1/100). It is expected that by mid-twenty-first century, the return periods for high temperatures in the UK for example will have shifted so that 'extreme' events may have a 4/100 probability, and 'very extreme' or catastrophic events a 1/100 probability. Because the damage curve is non-linear, the cost of a very extreme event could be in the region of 5 units. This would produce a new risk premium of 0.09 (1X 4/100 + 5 X 1/100), almost a ten-fold increase in the hazard!

	Normal	*Extreme*	*Catastrophe*	*Expected cost*
Event cost	0	1	5	N/a
% of time				
Now	99	1	0	0.01
2050	95	4	1	0.09

Figure 10.5. Loss potential numerical example

The need for a more holistic approach

Statistics on disasters around the world show that much less than half the losses from natural hazards are insured, with the problem being particularly severe in developing countries (Figure 10.6). This pattern was recently confirmed from an unpublished study compiled by the IIASA for the TSUNAMI initiative in the UK, of individual earthquakes, floods and windstorms, including the 1998 floods, in the UK (IIASA, in press, 2000). Thus there is potentially much scope to extend the outreach of insurance.

Stakeholders would be more effective if they shifted to a more co-operative stance between themselves, and it would be in the public interest to avoid a poor response to disasters when they do come. Insurers can contribute greatly to a societal approach, because they have acquired skill and knowledge of use in preparing for, coping with and recovering from disasters through their

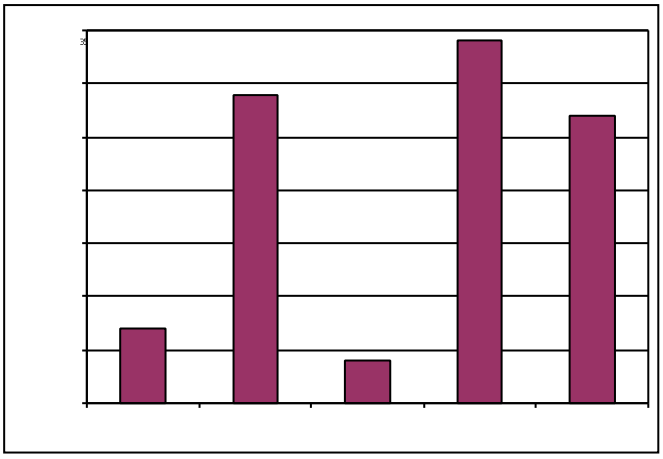


Figure 10.6. 1998 % weather losses covered by insurance

Source: Munich Re

normal activities. Before the event, they have to assess and possibly improve risks, and price them to reflect the degree of hazard, as well as marketing a 'grudge' intangible service, a process which is notoriously difficult. During the incident, they provide emergency advice, and then afterwards they are accustomed to controlling the recovery process because they provide the funds from their reserves. This involves appointing a whole range of specialists, suppliers and contractors, as well as looking after the financial and physical well-being of customers. Their ability to mobilise resources internationally and their possession of an efficient administration release public resources for more vital tasks, and they are instrumental in resisting dishonesty which often abounds after disasters.

Traditionally in the UK, insurers have either been 'in' or 'out': either carrying the risk as well as managing the recovery, or being completely absent. Pool Re, the mechanism for dealing with terrorist acts, set out a new model for the UK—one which already operated in other countries for a variety of hazards, notably flood insurance in the USA. The US model, which combines community physical risk management with government insurance, privately administered by insurance companies, shows that risk-bearing is not an essential private function. Public/private participation can be very effective and can overcome the problem of technical uninsurability.

International considerations

Different countries have their own preferences for the blend of private and public resources, and face a different range of natural hazard problems. Insurers,

through their experience with the economic aspects of disasters, can help to identify key hazards and provide information on how costs arise. Through the economic discipline of pricing, they can also help to educate the various stakeholders in the property market. Currently the insurance industry is in reactive mode as far as the construction industry is concerned, but a shift to a proactive mode would be more effective, because of the longevity of most building stock and infrastructure.

Figure 10.7 illustrates how this might happen. In segment (i), damage is relatively rare, and insurers pay for it passively. In phase (ii), when damage becomes more frequent, insurers begin to share their information on costs with other parties involved in the property market, but this is still reactive. Only in the proactive system seen in (iii), do all the stakeholders realise that, with rising costs, they must assess the potential damage before undertaking physical construction.

Where the economy is underdeveloped, and natural hazards are severe, most of the burden falls locally, as Figure 10.8(i) shows. By mobilising international financial resources, and integrating them with the local insurance and global reinsurance markets, it might prove possible to organise a system which spreads the burden of disasters more equitably, without actually increasing the cost to the international community, because the local economy would be more resilient, as shown in Figure 10.8(ii).

'Contraction and convergence' for the insurance industry

The Intergovernmental Panel on Climate Change (IPCC) has stated that to stabilise the concentrations of greenhouse gases in the atmosphere at current levels, emissions of greenhouse gas would have to be cut by 60% from 1990 levels. The Kyoto Protocol at best will deliver cuts in emissions of 5% by 2012, if enough countries implement the agreement. This is far from guaranteed as shown by the failure to reach agreement

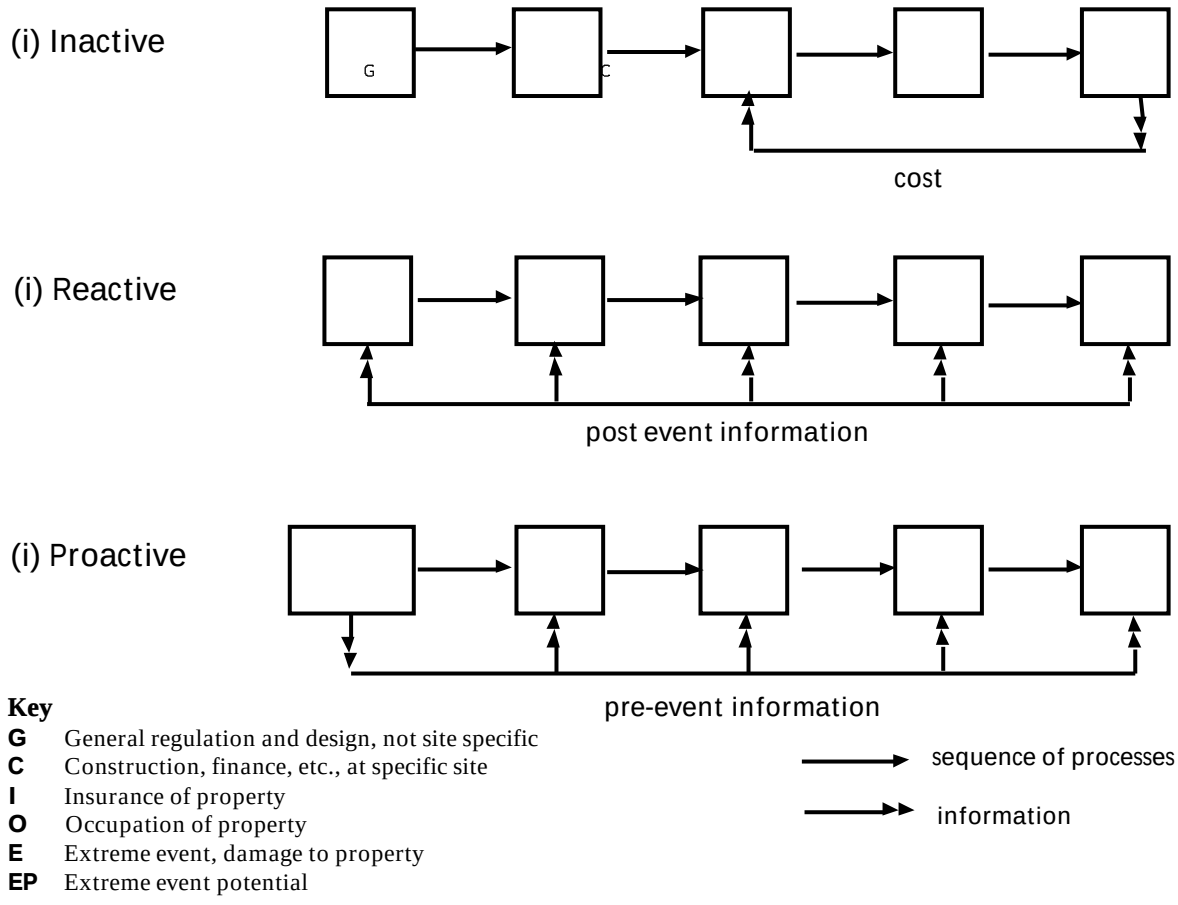
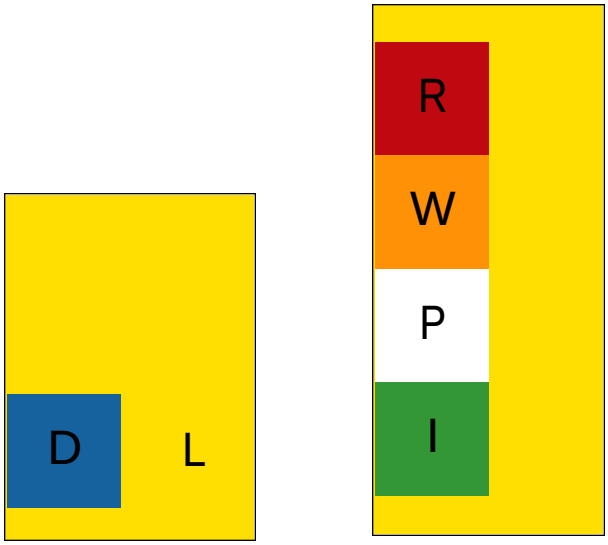


Figure 10.7. An integrated property damage system



i) Now
(impaired)

ii) Future
(resilient)

L = local resources
D = disaster relief

I = local insurance market
P = international hazards pool
W = world financial bodies
R = reinsurance market

Figure 10.8. Substitution for disaster relief

at COP–6, three years on from Kyoto. In simple terms it would need ten Kyoto Protocols back to back in order to achieve the desired IPCC cuts in emissions. This is not feasible, hence the need to look at alternative options.

Depletion of oil reserves

The world is currently dependent on oil and its associated products. The question of how long resources will last is fraught with uncertainty, possibly 40 years according to the environmental organisation, Greenpeace. Even the oil industry itself foresees problems. The World Energy Outlook 1998, produced by the International Energy Agency (IEA), reported on future oil reserves and the potential implications for the world.

> The oil-importing countries' dependence on supplies from the Middle East will increase until liquid fuels from unconventional sources (shale oil, tar sands and conversion from coal, biomass or gas) begin to play an increasingly important role as 2020 approaches. Oil prices could rise during the course of this shift. With increased reliance on Middle East oil and the expected transition to the use of non-conventional liquid fuels, the probability of supply disruptions and price shocks could rise.
>
> The Outlook shows the substantial reductions in CO_2 emissions that will be necessary to meet the commitments made at the Kyoto Conference. The commitments adopted there will affect the future growth and pattern of world energy demand. The challenge now is to identify policies that will ensure that these commitments are in fact met.
>
> New policies will be required if the use of nuclear power and renewable energy sources is to help reduce fossil fuel consumption and greenhouse gas emissions. These policies would encourage the development of new designs for less costly nuclear power plants and find acceptable long-term solutions for radioactive wastes. Unit costs of renewable energy must be reduced and, in some cases, environmental problems posed by the renewables must be solved.
>
> Rapidly growing electricity demand and the need for climate-friendly technologies in non-OECD countries will require foreign investment as well as financing from domestic sources. This, in turn, may require restructuring, privatisation and regulatory changes in the electricity industries in these countries. The Kyoto Protocol and its further developments will encourage sustainable development projects that seek out the lowest cost means of abating CO_2 emissions in developing countries.
>
> Source: 1998 World Energy Outlook

Renewable energy

Although oil will have to be replaced, there are enormous coal reserves, so that a carbon-based economy could continue for most purposes, supplemented with nuclear energy. However, both these energy sources have considerable environmental problems. Therefore it will be necessary to switch from fossil-related energy to non-fossil (renewable energy) in the form of wind, biomass, solar, geothermal and tidal. This transition would take decades under normal circumstances, because of the length of time that capital stock and familiar technology take to be replaced.

The UK is well placed to develop the technology for renewable resources, as it is exposed to strong westerly

winds, surrounded by the sea and has considerable biomass capacity in Scotland. Attempts to speed up the transition to renewables should be accelerated to match progress in Europe, especially Denmark and Germany. However, under normal commercial circumstances, the transition to renewable energy will not be quick enough or wide enough to deliver the required emission cuts.

Contraction & convergence

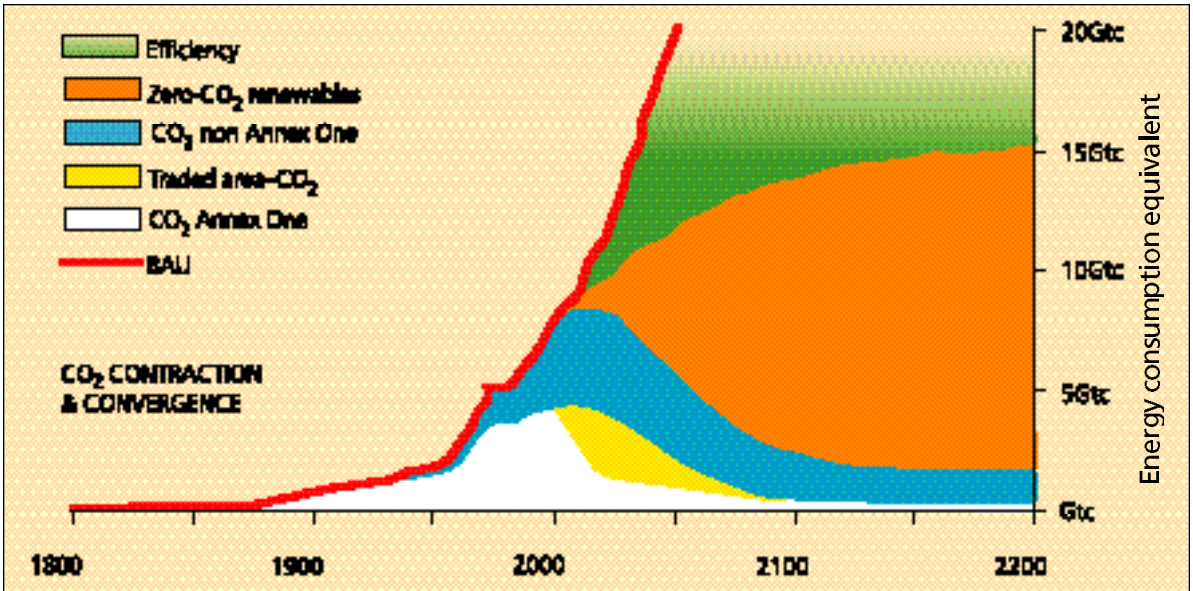
The most realistic way to bring about the required reduction in ghg emissions (which will have the combined effect of reducing the damage imposed on the insurance industry and encouraging the transition to renewable energy) is that proposed in the concept of Contraction and Convergence (C&C). This concept was created by the Global Commons Institute (GCI) and is incredibly simple in its detail. Essentially, everyone has the right to emit an equal amount of pollution (in this case CO_2) to the Global Commons (atmosphere).

At present society emits six billion tonnes of carbon a year (6Gtc) to the atmosphere. Coincidentally there are six billion people alive today—hence everyone should be entitled an equal right to emit 1 tonne/yr. To achieve the required global reduction in ghg emissions an agreed target of say 2Gtc by 2040 could be set and the system allowed to contract to that global budget by converging on an agreed per capita allowance. Those states that need to emit more than their share will have to buy emission entitlements from those that have an excess. This would operate in much the same way as the envisaged emissions trading scheme to be set up within the Kyoto Protocol.

Figure 10.9 illustrates this process, showing that by the year 2100 emissions will have fallen to well below today's levels, and will emanate from what are, today, developing countries. Since economic progress is dependent on energy, the shortfall from 'Business as usual' energy consumption will need to be met from two directions: *efficiency gains, and a rapid growth in renewable energy sources*. It is clear from this that *emissions trading can only be an intermediate stage*, since the total volume of emissions must fall.

The only blockage to this simple system is the absence of political will to 'step outside the box' instead of conducting a tortuous round of negotiations of the Kyoto Protocol. One way to unblock this impasse is to amass a large enough consensus of stakeholders behind the concept of contraction and convergence, persuading governments to supersede the Kyoto Protocol.

The insurance industry is an obvious place to start such a campaign as it has so much to lose and so much to gain. If society continues down the fossil/Kyoto route, future economic losses are likely to become



The red line shows Business as usual CO2 emissions (BAU). The solid segments show 'Contraction, Convergence, Allocation and Trade' to manage emissions down by at least 60% within a given time frame and 'contraction budget'. The renewables opportunity is worth trillions of dollars—the biggest market in history. Annex One is the developed World. Gtc: trillions of tonnes of carbon equivalent.

Figure 10.9. Contraction and convergence

unsustainable: the current rate of increase in damage from natural hazards is 12% pa and the rate is accelerating. Given that the global sum of such losses was $100bn in 1999 (Munich Re, 2000), it would outstrip global GDP (growing at 3% pa) by 2065, if the trends persist. If the insurance industry rallies behind C&C, it not only reduces that risk, but it is well placed to invest in the future renewables market. In fact one could argue that as the insurance companies own the oil companies (through equity ownership), insurers form the only industry that has the collateral and the need to adopt the C&C logic. The desired sequence of events is shown in Figure 10.10.

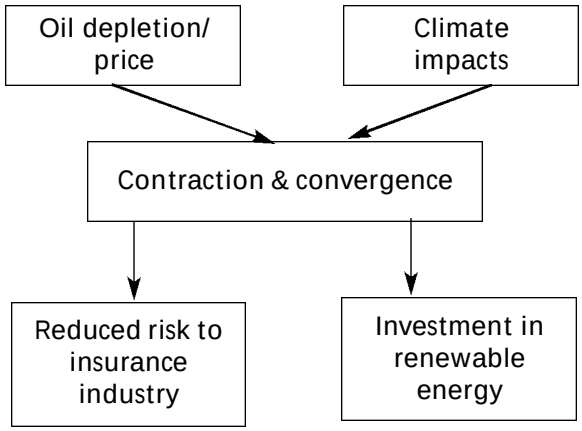


Figure 10.10. Contraction and convergence and risk

Who pays ?

As Figure 8.1 (page 71) shows, risk to property from catastrophic and non-catastrophic events is at present transferred from the individual property owner (via a policy at a given price) to the primary insurer. In 1998 the value of revenues flowing through the non-life part of the global insurance market amounted to $891bn (Swiss Re, 1999). The primary insurer retains most of this risk on an annual basis, but will off-load some of that risk (for a secondary premium) to a reinsurer.

However, when climate change impacts on the insurance industry, it will be the individual who eventually pays the price of the damage, whether it be through the direct mechanism of increased premiums or failed insurance companies or reduced values of equities on the markets linked to individual savings and pension plans.

Other opportunities for insurers

As well as the insurance industry's involvement in managing both catastrophic risk and investment, climate change will present it with a number of other business opportunities, and 'early movers' might be able to gain an advantage.

Superior risk knowledge

Earlier, this study highlighted potential developments in the field of forecasting. It is possible that within five years these may have progressed to the point where they become the basis for commercial decisions, eg, on reinsurance programme design (attachment levels, rating, etc). Such forecasts could be used as input to more detailed simulation models, already commercially available, but limited by the absence of information specific to the period of risk. Because of the cost of developing such complex techniques, most insurance companies will need to buy this information, but they could still gain an advantage over others through (i) better information on exposure, (ii) use of in-house wisdom to supplement the models and (iii) will-power—there will often be strong commercial or political reasons to ignore the advice.

New insurance markets

Chapter 1 identified a wide range of implications for the insurance industry arising from climate change, apart from the most obvious one of changes in property damage risk. For instance, political initiatives to deal with global warming will result in a variety of major infrastructure projects, under the heading of 'adaptation'—accepting and managing the transition to a warmer world—or 'mitigation'—altering the trend in climate. Adaptation could involve flood defence, as well as water supply, agriculture and construction. Examples of mitigation projects could be afforestation or solar energy. Like any enterprise, these new developments will require financial services, including insurance, and they will present new technical risks to be underwritten. One area of risk which UNEP-III considered and rejected was the insurance of liability for default on Kyoto emission targets (UNEP-III, 1998b). This rejection was because of the long exposure period, and the fact that the risk was fundamentally a political one.

On a more positive note, chapters 8 and 9 noted that the environment is becoming an important business issue, and this change is filtering into the asset management world. Already there are a variety of 'green funds' for consumers to invest in, and the number can only grow

as public awareness of global warming improves.

Diversification

Besides providing new markets for supplying traditional services, climate change is likely to bring about an increase in activity in other industries closely related to insurance activities, and therefore might open the door to diversification. Firstly, as exposures escalate, traditional sources of capacity will be exhausted, and thus accelerate the move towards alternative risk transfer.

This transition will be reinforced by the redefinition of 'insurable risk' as regards weather sensitivity. Chapters 4–7 revealed that customers have an unsatisfied need for protection which is not being met by traditional insurance products, with their emphasis on indemnity. We may be on the brink of a renaissance of the product into a holistic risk-coping service, tailored appropriately for the various corporate and mass markets.

Finally, the increasing severity and frequency of natural disasters will create a growth in emergency management/ recovery services, which could become a significant separate business, not one simply dependent on insured damage. The tendency for governments to divest public services could reinforce this. Another interesting avenue might be resource management. As insurers grow in size, the sheer scale of their internal costs will elevate them into an object worthy of serious management attention. When allied to the political and public pressure for environmental efficiency, some insurers might see an opportunity to create an independent profit centre to provide third party services in the field of office and transport management.

Conclusions—a proactive response to climate change

The insurance industry will need to make big changes in its strategies to adapt successfully to climate change. Ignoring the issue will lead to serious problems and even corporate failure, while recognising the challenge could generate entire new profit-streams.

From a societal viewpoint, risk will grow, and this means a greater demand for risk transfer. If the industry does not supply the products, either someone else will, leading to a loss of markets, or there will be a painful process of adjustment often at the behest of other parties with different aims in mind. While there are great opportunities for expansion in the life and pensions markets, it is a moot point whether they will remain more attractive than the property/casualty market, currently so out of favour.

Beyond technical issues, the insurance industry should take an active part in climate change politics to ensure that the threat of natural disasters is attended to urgently. This can be done partly by communicating with national politicians, but since politicians have to reconcile a wide range of opinions in arriving at a negotiating stance, it is still imperative for insurers to be involved in international lobbying through associations like the UNEP Insurance Industry Initiative.

The focus of negotiation is on 'mitigation' —limiting ghg emissions—rather than 'adaptation'—coping with the inevitable impacts of climate change as the weather and the sea respond. Funds are to be made available for adaptation through the Global Environmental Fund, but there has been little work in the area of natural hazard management.

As argued in chapter 9, the trend to giant, global companies brings with it new responsibilities and stakeholder expectations. Above all, the industry must show some leadership by coming out in support of the principle of Contraction and Convergence. The Kyoto Protocol is purely tactical, and unless more fundamental strategies are agreed soon, there is a real possibility that dangerous levels of climate change could occur. Figure 10.11 summarises the comprehensive programme which is required.

- Assist research on weather patterns
- Identify key hazards
- Educate property stakeholders
- Co-operate with government/professionals etc. to
  1. improve physical risks
  2. provide 'essential' cover/recovery
  3. build up reserves
  4. control exposure
- Develop new products
- Back renewables against carbon
- Lobby on emission controls

Figure 10.11. A proactive response to climate change

CHAPTER 11: ACTION PLAN

Research Group

To cope with climate change, corporate bodies and individuals will need to move the issue up the agenda by regular action. The guiding principle is

INFORMATION—acquire it, use it, share it.

The various stakeholders all have interlocking roles for which they must take responsibility, like the players in a football team. To carry out their action plan will require resources. Allocating these resources means either demoting other issues, sequestering more funds or becoming more efficient, and the various bodies therefore need to remember this aspect, not merely make pious statements about the desirability of the work. Whether sufficient resources are being allocated will become evident to observers seeking timescales for the completion of the action plan.

However, the actions should not be viewed as additional burdens which prevent 'real work'. If they are not addressed, there will be considerable disruption to 'normal' activity.

Government

- Seek international and domestic agreement on climate change mitigation and adaptation policies, in particular
  —advocate 'contraction & convergence'
  —set challenging domestic targets for emissions reduction
  —seek to provide assistance for less developed countries at risk.
- Implement 'no regret' strategies, in particular
  —support the development of renewable energy.
- Provide information to stakeholders on climate change.
- Consult on climate change strategies.
- Formulate policy and embed it in practical regulations, procedures and guidelines, in particular
  —define an appropriate framework for land development and construction design which will identify, quantify, and respond to the risk of natural hazards, now and in the future.

Individuals

- Consciously monitor and learn about climate change
  —seek information on the internet, read articles in the press.
- Apply this knowledge in your work
  —include climate change/weather variability on the checklist of items for each project or process.
- Conserve energy directly and indirectly.
- Lobby politicians to ensure that climate change receives proper priority.
- Ask how the companies you invest in are planning to
  —cope with climate change
  —help to decelerate global warming.

Media

- Give the issue regular coverage, both as news and review items.
- Reflect the overwhelming scientific consensus that there is a discernible human influence on the climate system.

Association of British Insurers

- Continue and extend the programme of research into the risk management of natural hazards associated with climate change, particularly flood.
- Improve communication on these initiatives
  —by systematic inclusion in public relations work outside the industry
  —by a coherent strategy of passing information to members and providing them with opportunities to access scientists.
- Become proactive with other stakeholders on insurability issues in high-hazard areas
  —in particular influence local and central government on planning control and building design
  —initiate discussion of the issues with other European insurance associations.
- Address the issue of environmental policy more actively (eg, briefings for members).
- Address the issue of asset management and the mitigation of climate change (eg, briefings for members, dialogue with government on energy and transport policy).

Chartered Insurance Institute

- Raise the profile of climate change as an issue with members (eg, journals/conferences/seminars).
- Identify any CIP and ACII syllabuses where climate change might be assessed.
- Commission further studies on issues related to climate change (eg, economic exclusion, renewable energy, alternative risk transfer).
- Commission a review of the climate change issue in 2005, perhaps in conjunction with other professions.

Enterprises (insurance underwriting)

- Collect information on exposure and claims to improve the knowledge base for climate change impact studies
  —in particular consider adopting common procedures, which will also facilitate claims-handling.
- Engage with external bodies on regulatory issues in support of industry strategies.
- Address insurability issues responsibly, recognising the needs of different stakeholders.
- Develop products and services to improve society's robustness in the face of climate variability and change (eg, to deal with weather variability, not only 'events').
- Adopt environmental policies.
- Communicate the issues to staff, customers, intermediaries and suppliers.

Enterprises (asset management)

- Actively seek to influence the detail of how to implement the UN Framework on Climate Change Convention, in particular through support of the 'contraction and convergence' principles.
- Develop products and services to improve society's robustness in the face of climate variability and change (eg, support for renewable energy investment).
- Adopt environmental policies.
- Communicate the issues to staff, customers, intermediaries and suppliers.
- Exert pressure as shareholders to ensure other enterprises take climate change seriously.