

# From flood science to flood policy: the Foresight Future Flooding project seven years on

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## Abstract

**Purpose** – *The Foresight Future Flooding (FFF) project researched flood risk in the UK to the year 2100 for central government, using scenarios and a national risk assessment model backed by qualitative analysis from panels of some 45 senior scientists. The purpose of this paper is to assess the impact of the project, both nationally and internationally.*

**Design/methodology/approach** – *This paper assesses the impact of the FFF project, both nationally and internationally, using web searches, document analysis, and a questionnaire survey of key actors in the flood risk management policy field.*

**Findings** – *It was found that the penetration of the project into professionals' consciousness was high in relation to other comparable projects and publications, and its impact on policy – both immediately and continuing – was profound. The FFF initiative did not create policy change, however, but facilitated its legitimisation, adding impetus to what was already there, as one element of a part-catalytic and part-incremental process of policy evolution.*

**Research limitations/implications** – *Special circumstances, internal and external to the project, mean that this cannot be a simple model for matching research to policymakers' needs in the future.*

**Practical implications** – *Important lessons may be learnt from this project about both the methods of forward-looking foresight-type research, and the way that its results are disseminated to its target audiences.*

**Originality/value** – *This is an innovative attempt to assess the impact of a new type of foresight project.*

**Keywords** *Floods, United Kingdom, Risk assessment, Risk management, Strategic planning, Forecasting, Flooding*

**Paper type** *Research paper*

## Introduction

This paper reports on an investigation of the legacy of the Foresight Future Flooding project (abbreviated to “FFF”, below), some seven years after the 2004 reports that concluded the project and publicised its results (Evans *et al.*, 2004a, b). The aims of our investigation were agreed with the Government Office for Science (GOS), the sponsoring body that commissions and oversees all the UK's Foresight projects (GOS, 2010).

Essentially the research reported here sought to assess the impact of the project, but the nature and assessment of the impact of research is highly contentious (Donovan, 2011): here a somewhat limited perspective is taken in relation to other impact studies (e.g. Scott *et al.*, 2011). Our research looked for impact in terms of awareness of the project, rather than relying on seeing changes to flood risk management (FRM) in terms of new engineering schemes or different portfolios of other measures implemented “on the ground”. This is because the FFF project looked many years ahead, and many such changes – if they are to occur – will take decades to emerge. This evaluation, also, did not seek to assess the “value for money” of the project, as might other policy analyses: that would be altogether too difficult, as the paper will hopefully demonstrate.

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Instead, favourable impact is seen as represented by a consensus among key opinion formers that the results were rigorously obtained, relevant, and useful: this may well be just at the level of ideas, but that is nonetheless important. Our investigations also looked for other impact in terms of the practice of risk assessment and an influence on FRM policy. The latter is judged as citations in subsequent policy documents or in speeches by those with the power to change policy, again rather than necessarily a change in risk management schemes, although this could have occurred. Those scheme impacts may come later, but even policy change in this field moves slowly (Penning-Rowsell *et al.*, 2006), and it was not our expectation that changes in scheme practice would be the dominant impact after just seven years. As Johnston (2010, p. 9) wisely puts it “the potential longer timeframe for the impact of foresight requires a recognition that the assessment of impact at any time is necessarily incomplete”.

Such an investigation of impact is not without its problems, principally those of objectivity and attribution, but it is nevertheless considered that the results have merit and lessons can be learned from them about both the future of flood risk management in the UK and the relations between its science and policy making. This paper, then, reviews briefly the nature of the 2004 Foresight Future Flooding project, and investigates its impact in the science, policy and public arenas using methods which it is believed are as objective as possible and complemented by subjective judgements of a number of key stakeholders in the flood risk management field.

It should be noted therefore that this is not a paper about risk and different interpretations of the meaning of risk as debated, for example, by Luhmann and Giddens and reviewed by Peterson (1997); many other commentators have also discussed these issues, which are self-evidently important. Other by-products of the FFF project have touched on some of these matters (e.g. Ball and Green, 2007), but our aim here is to draw back from those debates and focus only on the project's impact as gauged and perceived by others. Indeed any debate here about the nature of risk would have carried the danger of confusing our views with those from whom the research sought to obtain critical judgements.

### **The 2004 Foresight Future Flooding project (FFF)**

To summarise, the 2002-4 FFF project produced a challenging vision of future flood risks and risk management responses throughout the UK over a 30- to 100-year timescale, expressing risk as the social, economic and environmental dimensions of flooding (Evans *et al.* 2004 a, b). Importantly, this was the first of a new breed of Foresight projects after the previous seminar-based approach “rather ran into the sands in 2000” (Martin, 2010a, p. 8). The new Chief Scientist Sir David King at the time “replaced it with a micro-level form of Foresight focusing on chosen areas” (Martin, 2010a, p. 8), and this was the first of such investigations, involving a significant research element rather than just an expert review and forward look.

The FFF research employed two forms of analysis. A qualitative analysis examined the drivers of flood risk going forward, and a quantitative, probabilistic, computer analysis then provided numerical results and nationwide maps using very large Geographical Information System (GIS) databases and the Risk Assessment for Strategic Planning software (RASP) developed by the Environment Agency (Sayers *et al.*, 2003; Hall *et al.* 2003, 2005). The former used a structured method to elaborate on evidence-based expert knowledge to estimate the impact of the various drivers of increased flood risk and responses to that risk under different future scenarios, and to provide input for the GIS model.

The analyses used the well-established Source-Pathway-Receptor (SPR) model of the flooding system as its conceptual framework (Hall *et al.*, 2003). “Sources” are weather events, or sequences of events, that may result in flooding (e.g. intense rainfall or coastal storm surges). “Pathways” are mechanisms that convey floodwaters to where they may impact on receptors (e.g. flows in and out of river channels and urban overland flows). “Receptors” are the people, businesses and the built and natural environments that can be adversely affected by flooding.

The results highlighted potentially large rises in future flood risk under the baseline (current) flood management regime, varying by factors of some 1.5 to 20 times under four contrasting

scenarios (Tables I and II). Portfolios of engineering and non-structural responses could possibly hold flood risk at near present-day levels, with favourable benefit-cost ratios under all scenarios. However, to do this the annual spend on flood risk and coastal erosion risk management (FCERM) needed to rise substantially over the next 50 years and, if carried out in an appropriate way, these sums could provide sustainable solutions.

The 2004 Foresight Future Flooding reports' principal conclusions include:

1. Under every scenario, if current flood-management policies remain unchanged, the risk of flooding and coastal erosion will increase greatly over the next 30 to 100 years.
2. Integrated flood risk management needed to lie at the core of our response to changes in the drivers of flooding and coastal erosion, combining sensitive engineering with adaptive non-structural measures.
3. To hold flood risk at current levels, flood management investment would need to rise to an average over the next 50 years of somewhere between £1 billion and £2 billion per annum in real terms for rivers and coasts, and between £400,000 and £800,000 per annum for intra-urban systems.
4. The task of controlling risk would be substantially easier with mitigation policies that will reduce climate change and associated flooding through the control of greenhouse-gas emissions.
5. The mitigation of climate change has, however, little potential to reduce flood risk by the middle of this century, but will become increasingly important towards the end of the century as other responses reach their limits. But mitigation must start now, if it is to deliver its benefits in time.
6. Science and technology have a key role in the development of long-term policies in flood risk management.

The qualitative analysis was updated within the Pitt Review of the 2007 floods in England (Pitt, 2008), with similar conclusions (Evans *et al.*, 2008).

### The impact of science on policy: ideas and suggestions

This subject needs to be seen within the context of previous work on the science-policy nexus. This is not the place for a comprehensive review of these matters, which is best found elsewhere (e.g. Hoppe, 1999; Bailey, 2010), but the conclusions of others can inform our

**Table I** Baseline case: future flood risk for England and Wales (catchment and coastal; intra-urban) by the 2080s under the four scenarios

	<i>Present day</i>	<i>World markets</i>	<i>National enterprise</i>	<i>Local stewardship</i>	<i>Global sustainability</i>
Baseline case, EAD £million/year	1,040	20,500	15,100	1,500	4,860
Baseline cost £million/year	500	500	500	500	500

**Note:** Flood risks expressed as Expected Annual Damage (EAD) and the baseline costs of flood defence for the business as usual option (continuation of current flood-management policies and expenditure into the future) – catchment and coastal

**Table II** Baseline case: future flood risk for England and Wales (catchment and coastal; intra-urban) by the 2080s under the four scenarios

	<i>Present day</i>	<i>World markets</i>	<i>National enterprise</i>	<i>Local stewardship</i>	<i>Global sustainability</i>
Baseline case, EAD £million/year	270	7,880	5,060	740	1,870
Baseline cost £million/year	320	320	320	320	320

**Note:** Flood risks expressed as Expected Annual Damage (EAD) and the baseline costs of flood defence for the business as usual option (continuation of current flood-management policies and expenditure into the future) – intra-urban

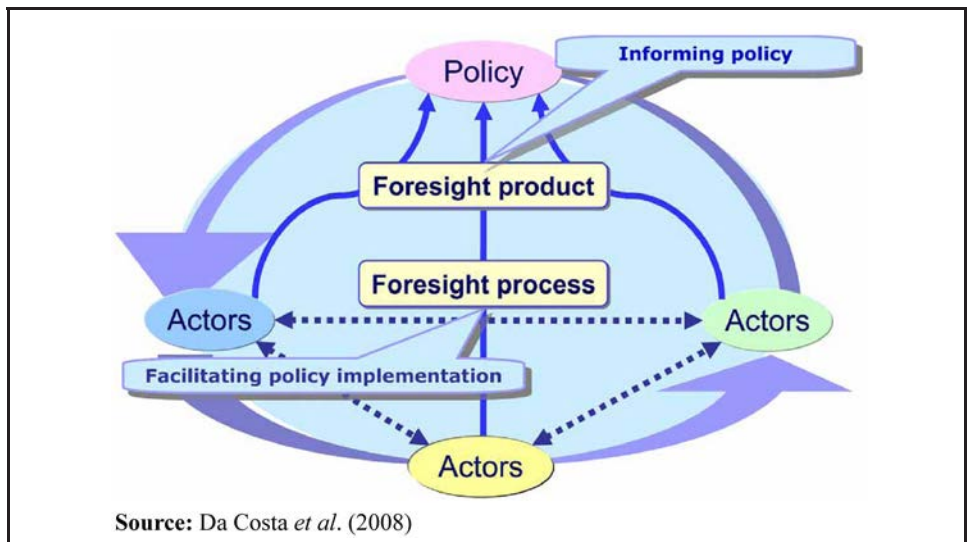
understanding of what the FFF project was attempting and provide some benchmarks against which to assess its success, problematic though this is.

In this regard the Foresight process (Martin, 2010b), as with all policy analysis, aims at “speaking truth to power” (Hoppe, 1999, p. 201). As such it clearly embodies some form of political process or input, obviously informed by its funding source at the centre of government. The FFF project was more positivistic than “argumentative” (i.e. designed to debate policy options) and in that respect somewhat old-fashioned in relation to twenty-first century policy analysis. Herein lies a tension: those who seek guidance as to policy direction generally want clear answers from objective analysis, but policy scientists have long ago concluded that this is somewhat of a mirage and that the true aim of policy science – often within a participatory mode of public and professional engagement – is not to draw conclusions but to pose questions and arrange arguments.

Notwithstanding this point, Foresight projects are clearly aimed at policy and “decision makers”, within a process neatly summarised by Da Costa *et al.* (2008) (Figure 1). But the literature on the relation between science and decision making suggests that the latter is not nearly as straightforward as researchers often believe. Weiss (1980, p. 381) suggested here that “knowledge is not often ‘utilised’ in direct and instrumental fashion” in policy formulation, rather that its influence is more subtle and only occasionally does it supply an “answer” that policy actors employ. Instead “it provides a background of empirical generalisations and ideas that creep into policy deliberations”. Martin (2010a), citing Weiss, suggests that the factors affecting the impact of science on policy are a combination of “timeliness” and a clear line of sight between the scientific results and the policies being considered at the time (Tables I and II), but that this is an unpredictable process with no guarantee of success.

This resonates with the conclusions arrived at by Nutley *et al.* (2002) that the role of evidence in policy development is sometimes limited, and that this should cause us no surprise “because the use of evidence is just one imperative in effective policy making” (Nutley *et al.*, 2002, p. 1). And in any case “the research literature is dominated by small, *ad hoc* studies, often diverse in approach and of dubious methodological quality” lacking a strategic focus (Nutley *et al.*, 2002, p. 4). Such a focus requires close stakeholder involvement in the creation of research strategies, and therefore a partnership between evidence providers and evidence users may be the best way forward towards increasing the up-take of evidence in policy development.

**Figure 1** One useful interpretation of the foresight process



## Our aims and methodology here

In terms of detailed aims the research sought, first, to determine as objectively as possible the penetration of awareness of the FFF project in the scientific, policy making and public domains. Second, the research aimed to gauge the opinions of key stakeholders as to the merits or demerits of the project and its findings. Thirdly the research attempted to assess the significance of the project's findings in influencing the emergence of new policy initiatives or directions. While we did not explicitly use Johnston's foresight Impact Schema (Johnston, 2010, 2012) the "influencing" measure on his "staircase" of impacts was our benchmark.

In terms of methodology, a demonstration of objectivity was of the utmost importance in ensuring that this evaluation had credibility in the scientific, policy making and public domains. To this end three complementary methods were employed, each undertaken at the Department of Engineering Science, University of Oxford, by the fourth author here and an assistant, neither of whom had been involved in any way in the original FFF investigations. Their findings are presented in independent, factual reports (van Damme and Borthwick, 2010; Borthwick, 2010), which this paper uses as its evidence base.

In terms of our methods, comprehensive web searches were first undertaken. These explored the penetration of awareness in the scientific, policy making and public communities and involved web searches (via Google, the Web of Knowledge and Scirus) of citations of the FFF project in scientific outputs, both UK and internationally. This involved analysing the results numerically and textually and reporting them in a format suitable for peer-review. Secondly, a survey was undertaken of stakeholder opinions, to solicit evidence from a small number of key actors involved in the relevant flood-related policy areas (Figure 1). To achieve this, the Oxford scientists determined a list of up to 20 key stakeholders in consultation with GOS and drafted a short set of questions to be put to these in tailored letters seeking their opinion as to the impacts, merits or demerits of the FFF project and its findings.

The third strand to our methodology was to investigate evidence of impact, intended to cover impacts on policy and civil society. This used a combination of results from the web searches and the stakeholder survey. To this end the Oxford scientists determined a list of flood risk management policy documents that have appeared in the UK since 2004 (covering England; Scotland; Wales; Northern Ireland), which might have drawn on the Foresight outputs, and they also investigated similar international policy documents and impacts cited there. Documents and impacts were also sought from civil society sources – NGOs, the media, etc. – and in all cases the researchers sought to record the instances of FFF citations as objectively as possible (i.e. as direct quotations rather than in summary form).

This methodology can never be completely objective. Investigators who were completely outside the field might well have taken a different approach, but undoubtedly would not have had the insight or knowledge to approach the stakeholders most closely associated with the field of flood risk management. The choice of documents to review may always be biased, but our methods sought to ensure that the web investigations were based on a strictly quantitative approach. Yet nevertheless here some choices had to be made, including with what words to use in our searches (see below).

## The penetration of awareness in scientific and public domains

### *Methods*

Our view is that there can be little impact without awareness (Johnston, 2010, 2012), but awareness is tricky to gauge. To assess the penetration of awareness, comprehensive web searches were carried out, and both quantitative and qualitative analyses were performed on documents citing the FFF report. Our approaches reviewed searching on "Foresight Flooding", "Foresight Future Flooding" or "Evans, E.P." (the main FFF report's first author), each of which inevitably produced different results. In the end the numbers of "Google citations" related to the phrases "Foresight Future Flooding" and "Foresight Flood and

Coastal Defence,” and citations of the FFF reports. The results have been reported in full by van Damme and Borthwick (2010).

Web of Science was chosen as the bibliographic database, and Scirus as the internet search engine, recognising that different engines will give different results. Of the three main bibliographic databases (PubMed; Web of Knowledge/Web of Science; Scopus), the Web of Science covers a very large range of 21,000 peer reviewed journal titles, 55 million records, and about 50 million conference papers. Web of Science also provides online citation indices (provided by Thompson Reuters) and impact factors, it is wider in scope than PubMed which originated as a medical database, and is not owned by any publisher, unlike Scopus which is produced by Elsevier. Internet search engines are less reliable than bibliographic databases, and include Scirus, IngentaConnect, and Google Scholar. Scirus was selected because of its focus on science, unlike Google Scholar which is less discriminating in coverage, and because it covers a wider range of high quality journals.

### *Numerical analysis of web citations*

The numbers of Google and journal citations were compared against results related to benchmark documents in order to determine objectively the penetration of awareness (Table III). Our research also looked at citations on Google country sites (e.g. the German site [www.google.de](http://www.google.de)), in order to obtain an assessment of the impact in national journals outside the UK. Figure 2 displays the results obtained for those G20 countries where the search recorded at least one citation, along with results for all European countries with a coastline where again the search recorded at least one citation. A score of 10 per cent corresponds to 16 web citations. The total number of citations outside the UK by December 2010 was 400.

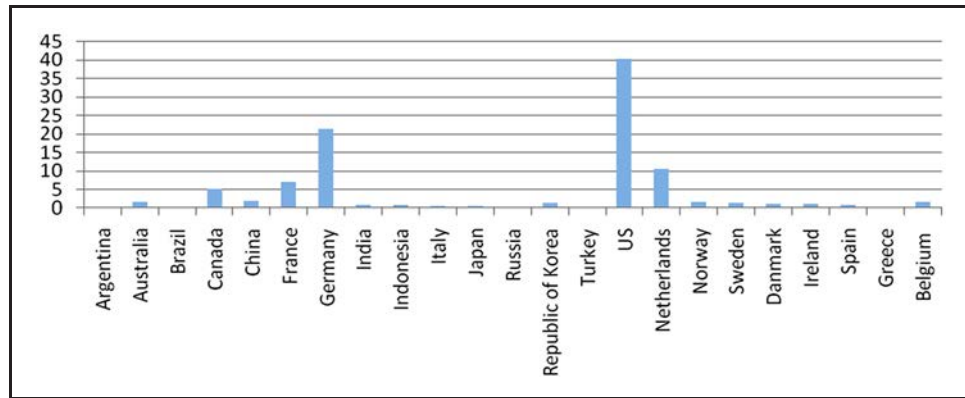
In order to explore the citations in greater depth a Google search was performed within UK web sites using the keywords “Foresight Future Flooding” extended with selected science- and policy-related secondary keywords. This showed that the majority of citations are obtained with the science-related keywords “scenarios”, “sources”, “drivers”, “emissions”, and “pathways”. In particular, the scenario-based approach to flood risk management futures that was a key characteristic of FFF appears to have had a large impact, measured in this way. By comparison, the impact of FFF was more evenly spread across policy keywords, with the most important ones being “risk”, “policy” and “government”.

**Table III** Summary of search results

<i>Search parameters</i>	<i>Year of publication</i>	<i>Google citations</i>	<i>Web of Science and Scirus citations</i>
Total foresight flood defence and future flooding results (Evans <i>et al.</i> 2004a, b)	2004	12,300	81
<i>Foresight Drugs Futures</i> (OST, 2005)	2005	610	1
<i>Foresight Cyber Trust and Crime Prevention</i> (OST, 2004)	2004	5,510	1
<i>Foresight Infectious Diseases</i> (OSI, 2006)	2006	33,800	5
<i>Making Space for Water</i> (Defra, 2005a)	2005	167,000	23
<i>The Benefits of Flood and Coastal Risk Management</i> (Penning-Rowsell <i>et al.</i> , 2005)	2005	8,320	6
<i>Floods, Flood Management and Climate Change in The Netherlands</i> (Olsthoorn and Tol, 2001)	2001	8,470	7
<i>Working Together With Water</i> (Delta-Committee, 2008)	2008	1,760	1
<i>Coastal Flood Risk and Trends for the Future in the North Sea Region</i> (Safecoast, 2008)	2008	91	1
<i>The New map of Denmark- spatial planning under new conditions</i> (Danish Ministry of the Environment, 2006)	2006	4	0
<i>The Future Oceans – Warming Up, Rising High, Turning Sour</i> (Schubert <i>et al.</i> , 2006)	2006	69,200	2



**Figure 2** The percentage breakdown of citations on Google country sites



The sheer number of Google citations may impress, but what is important is what the documents that cite the FFF say about its methods and results. The aim of the next part of our research was therefore to explore further, within the somewhat limited time resources available, where and how the project was cited and used. The most relevant 37 documents citing the FFF project were selected (the number being a function simply of the time available) and this list was divided into international, science-related, civil society, and policy-related categories. The last of these is discussed later in this paper; the first three fields are discussed below.

#### *Textual analysis of the web citations: international citations*

As identified in this way, the FFF research has been used in several distinct ways. First, it is often used to support contentions within other investigations. Thus, in terms of international citations, the IPCC Technical paper VI (Bates *et al.*, 2008) uses the FFF report to support its statement that "... the overall cost of flood damage would double by 2100, relative to what might be expected if there was no climate change". Other documents from non-UK countries also quote findings from the FFF project as evidence in justification of an argument they wish to promote. Deltares (2009), the Dutch research and consultancy group, for example, indicates that the FFF project offers a means of identifying potential increases in flood risk, noting that the Foresight project found that flood risk in the UK in 2080 could be approximately 20 times that in 2004.

Second, other citations either use or comment on the FFF methodology: the former a clear compliment. References come from the UK-Chinese Taihu project (Harvey *et al.* 2009) which adapted the FFF methodology to Chinese conditions and culture and evaluated the current and future flood risk for the Taihu basin during the next 50 years, as one of the most important regions of China containing Shanghai and a number of other major cities. However this project was significantly assisted by some members of the UK FFF team, so that set of citations has to be seen in that context. A more useful contribution as far as gauging impact is concerned is in a conference paper by Raadgever and Becker (2008) which cites use of FFF scenarios for a case study of the Rhine basin. Another example of the application of the FFF methodology by several European partners is the CABANA project (Zevenbergen, 2007) which addressed the need for knowledge transfer, capacity building, and the promotion of resilience at a range of scales, following the procedures recommended by FFF. The Thames Estuary 2100 project used a scenario-based assessment of future risk, based as in FFF on the RASP software system (Environment Agency, 2010a).

Third, other authors or organisations use the FFF project for comparison purposes. One is a report of a special session on 'River Flood Risk Management' organised by The Netherlands Centre for River Studies, which discusses the approach taken by the FFF project and then compares this – favourably – with other approaches used in different parts of the world (Samuels *et al.*, 2006). Cohen (2007) in the Dutch *Terra et Aqua* magazine published for the

International Association of Dredging Companies provides an overview of the contents of *Future Flooding and Coastal Risks* (Thorne *et al.*, 2007) – the science volume published with a fuller description of the FFF methods and results - together with a summary of the conclusions of the FFF report.

#### *Further textual analysis: science-focused documents*

Many of the scientific documents identified by the web search refer to the FFF project as an example of a change in approach to flood risk. In this regard the UK/Chinese Taihu project has already been noted. The Flood Risk Management Research Consortium (2008) programme has been a major UK research programme designed to increase our ability to manage flood risk and in its Final Report it states:

The programme of (Flood Risk Management Research Consortium) work has been designed to complement Defra/EA Foresight, UKWIR and Research Council projects on flooding... The research supports the integrated approach to flood risk management recommended by the Foresight Future Flooding report.

O’Riordan *et al.* (2006) from the Tyndall Centre for Climate Change Research explore new forms of governance for sustainable coastal futures. The paper describes the FFF project as providing an example of the pro-active approach of the UK Government. An example of the use of both data and ideas from the FFF report in a scientific paper is the one by Tompkins *et al.* (2008). In the wider European context, the major EU funded FLOODsite project (2004-09) recognised the value of the inheritance from Foresight (Samuels, 2009). Thus the FLOODsite report on a decision support methodology (Report T18-09-02) indicates that the work reported there:

... builds on existing best practice as developed in other recent projects, including... the Foresight Futures Project which produced a challenging and long-term (30 - 100 years) vision for the future of flood and coastal defence in the whole of the UK that takes account of the many uncertainties, is robust, and can be used as a basis to inform policy and its delivery.

The impact of the FFF report has also been investigated by means of a journal article citation search using Scirus. The search was based on the keywords “Foresight Future Flooding”. Citations were then graded in terms of quality using a ratings list developed in conjunction with the Australian Research Council. The grading showed that the cited publications fall into all categories C to A\* (i.e. from relatively low esteem to very high esteem), but a significant number were published in A and A\* journals such as the *Philosophical Transactions of the Royal Society*.

In terms of impacts on civil society – NGOs, the media, etc. – our investigations were not nearly so successful. In the six years between the publication of the FFF Report and our researches there were at least 28 references to the project in UK national newspapers. At the time of the reports’ release there were significant pieces in *The Times* and other broadsheet newspapers, but the incidence of citations there dropped markedly after that. References by NGOs are also rarer than citations in scientific journals, probably as a result of few of them explicitly focusing on flooding, but the project is cited as significant by the Chartered Institute of Environmental Health in relation to floods and their likely adverse health impacts (CHIEH, 2012).

#### **The opinions of key stakeholders**

This part of our research was based on sending letters to key stakeholders in the FCERM field (all from the fourth author here, from Oxford University’s Department of Engineering Science), including to those in government, in arms-length agencies and in research organisations (both in the UK and overseas), each tailored to the role and responsibilities of the recipient. Twenty-three letters were sent and 15 replies were received. Some of these replies combined the opinions of several targeted stakeholders so that the effective response rate is approximately 75 per cent. The replies to our questions are reproduced in full by Borthwick (2010) and some extracts are provided below, with the relevant attributions.



The survey was kept as simple as possible. Question areas were restricted to assessments of:

- The particular strengths of the project and its results.
- Any weaknesses that may have reduced its credibility or inhibited its impact.
- The impact of the project generally. How far was the project influential in informing development of flood risk management awareness, policy and practice in the period since 2004.
- Whether the results continue to be useful and influential.
- Whether the project and its results had helped to heighten awareness of climate change.

In addition, the letters' recipients were asked to cite relevant documents, where appropriate, to demonstrate policy or other impacts, and to summarise – in a phrase or two – their personal assessment of the impact or otherwise of the project and its results. The responses are discussed below, in turn.

### *Perceived strengths of the project*

Without exception, respondents reported significant strengths. Features mentioned several times were the long term nature of the time horizon used, and the long “vision” of the research. The study was seen as comprehensive, integrated, and commended for its systems approach. In terms of the methods used, the results were seen as “robust, objective, extensive and scientific” (Government of Wales). The inclusion of social, environmental and governance issues was also commended, “as opposed to the traditional hydro-technical “flood defence” type of assessment” (Samuels).

Many respondents commented on the quality and diversity of the scientific team that produced the report, and the professionalism of its management and the commitment of those with oversight responsibilities. The project was seen as disciplined in the timescale it kept to, and the resources deployed were seen as “very reasonable” for the scope of the work at a national scale. The independence of the work from government was cited as an important strength by two key respondents, the Association of British Insurers (ABI) and the Department of Environment Food and Rural Affairs (Defra: Phippard).

The FFF research was seen as timely and as being a trigger for changing attitudes and approaches to flooding issues. A strength was its influence on governments in England, Wales and Northern Ireland. The report and its research were praised for their understanding of the science/policy interface. One comment was the “unique link” here between policy and science, whereas “all too frequently in the UK there has been poor involvement and buy-in of key stakeholders and (science) users” (Bramley).

One of the more interesting statements came from Sir John Harman, Chairman of the Environment Agency at the time:

At the outset I was worried that the exercise would be either too academic or too mandarin or both, but it avoided those failings. I have no real criticisms – any subsequent failings were down to how the report was taken forward, and they were few. Its impact would have been smaller without the commitment shown by Sir David King, whose initial scepticism on the subject soon became missionary zeal.

### *Perceived weaknesses*

Three of the respondents reported no weaknesses or no significant weaknesses. Most of the perceived weaknesses of the project were seen to be the size, density and hence the lack of user-friendliness of the reports. “Even the Executive Summary was 55 pages long” (ABI). This was seen to limit dissemination, and the visibility of the work was not as good as it might have been: “This meant that the central ideas were disseminated to a limited few” (Rooke). One respondent considered that the target audience was too diffuse, such that some of those who needed to take notice could “hide”. One respondent complained that the work had been too costly (Defra: Phippard).

Interpretation of the results was also seen by some as difficult. Two respondents considered that the close coupling of the socio-economic and the climate change scenarios made this interpretation problematic “because a number of factors (affecting flood risk) were changed at once”. Also the different methods used in the analysis of flooding in Scotland and in Northern Ireland (forced on the project by non-comparable property databases) made inter-country comparison difficult.

In terms of the research “depth”, the evidence base for the erosion predictions was seen as sparse, and the treatment of the intra-urban flooding was seen as “somewhat cursory” (Rooke) and “understandably weak” (ABI). One respondent considered that “the handling of environmental issues was superficial” (Natural England) and criticised the report for implying (as they saw it) that “we will be able(to) engineer our way out of many of the anticipated problems and that this can be funded by increased wealth” which they saw – in autumn 2010 – as “no longer . . . . a realistic prospect”. Another respondent saw the high growth scenarios as perhaps not credible “following the recession” (Defra: Phippard).

From the scientists consulted came the criticism that an insufficient range of climate change uncertainties had been examined (Met. Office) and that the uncertainties inherent in large scale risk assessments had not been properly stated (Samuels). Other points made were that the FFF linear cost model did not indicate how costs for risk mitigation might be phased over time, and that not enough attention was given to resilience rather than flood resistance in the treatment of adaptation measures.

But the main weakness concerned the problems inherent in the presentation and hence the dissemination of the results. The Government of Wales respondent indicated that:

My personal view is that the complexity and comprehensiveness of the report has made it difficult for the wider business to take ownership of the results. This is all about communications and distilling from the project the simple messages and distributing these across the business.

#### *The impact of the project generally and its influence on policy development*

Correspondents were asked specifically for their opinions on the project’s influence on flood risk management awareness, policy and practice in the period since 2004.

Sir John Harman reported that the Foresight outputs were an important part of the evidence and argument that created a significant step change in flood risk management. Without this “the internal changes that had been taking place within the business (i.e. in the Environment Agency) would have taken much longer to emerge as changes in practice – and some, such as (coastal) realignment – would probably have proved to be wholly unacceptable to Government”. Natural England indicated, while noting its disappointment regarding environmental matters in the FFF work, that “The Foresight report has been considered in the development of our own approach to flood and erosion risk management”.

In the devolved administrations, Foresight was of “fundamental importance” and used “as the touchstone”, for example, in Northern Ireland. In Wales it was reported that it provided the evidence for and has driven the need to change (their) . . . approach to flood and coastal risk, and “has been extremely influential”.

Policy change and development at central government level was certainly seen to have been influenced by the FFF research. The Department for Communities and Local Government (CLG) reported that the impact has been “substantial”:

Policy in Defra’s ‘Making Space for Water’ initiative and CLG planning policy for managing flood risk to and from development (PPS25) were directly influenced by the report. The report was very important in providing the justification for, and setting the approach and scope of planning policy.

Defra responded to our question by indicating that the impact of the project had been “very high” (Defra: Hurst). “(It) had a major role in Making Space for Water” (the government’s new FRM strategy for England that followed Foresight, in 2005 (Defra 2005a, b)). Moreover “It was used in the development of the Flood and Water Management Act” (HM Government, 2010). One respondent noted that the “Making Space for Water” consultation invitation mentioned Foresight in the fourth line of the Ministerial Foreword and it was also cited in the

Chancellor of the Exchequer's 2007 budget speech. In Europe, the work showed DG Environment in Brussels that "the UK approach was at the front of the European practice" (Samuels), thus influencing the Commission's agreements with Member States about the viability of basin-scale risk assessments. In China the Taihu Basin Authority and IWHR, the leading Chinese institute for water resources research, found the project of great value in introducing new thinking.

Not just governments and their agencies were affected. The ABI reported that "The findings have been informing our work on flood risk management and the discussions with government around the provision of flood insurance and investment levels as part of the Statement of Principles agreement". Regarding their funding for flood risk management, Defra stated that FFF "had a major role. . . in (the) ZBR (zero baseline review), and in (the) spending review". In the arms-length agencies the effect was also felt. The Environment Agency's Long Term Investment Strategy (LTIS) adopted the risk based approach that was central to Foresight. Foresight "made it quite clear that investment must increase" (Rooke), noting also that:

It developed understanding on the investment need(ed) to rise to some of those future risks. It fundamentally changed the approach taken by the Environment Agency and Defra in the analysis of budget need and provided a much needed and reliable evidence base for future budget planning and the development of different policy(-)driven approaches to managing flood risk (Rooke).

### *The continued use and influence of the results*

This area of questioning received fewer responses, partly because several respondents did not have the same role that they did in 2004 and therefore did not know so intimately the detail of the current situation.

The Met. Office reported that the FFF report was "not directly" useful to the Hadley Centre. However the ABI stated that the report continued to provide context to their discussions with government. But the report is obviously used in several different ways:

Foresight is quoted more by way of providing "authority" as distinct from being used as a more detailed platform for developing future policy response. Importantly, its recommendations for funding have not been adhered to in the recent funding cuts, however I can't say how useful it might have been in reducing the extent of cuts! (Bramley).

The comments from CLG were broadly very favourable, and they made this comment about Foresight: "It has had ongoing value in justifying the planning policy approach to managing flood risk, which was endorsed by the Stern Review and (the) Barker (Report)" (Barker, 2006; Stern, 2007).

Defra reported that "Ministers have moved on since then, however it is still influencing policy and having an impact. It has been (is) very influential on policy and funding decisions. It was used in the last Spending Review (checks were done to see if the investment was consistent with Foresight) and the Long Term Investment Strategy". For the Environment Agency "the update of the qualitative part (in 2008) . . . was very helpful . . . in providing a reality check after a major event (the summer 2007 floods)" (Rooke). In Wales "It... will continue to be the main driver for our change of policy" (Government of Wales).

In terms of the FFF methodology, the response here was also favourable from members of the Adaptation Sub-Committee of the Committee on Climate Change (one member of which is our third author here), in particular in relation to its influence on the UK's Climate Change Risk Assessment (first published in January 2012) which the UK government is obliged by the Climate Change Act (2008) to lay before Parliament every five years:

The Foresight Future Flooding project is one of the studies that has been particularly influential, both in the CCRA (Climate Change Risk Assessment) Scoping Study and in the development of the methodology for the CCRA itself. Thanks to Foresight, flooding stands out as one of the few areas where reasonably high resolution national-scale risk assessment is feasible. Other dimensions of climate risk will not be dealt with at the same resolution in this cycle of the CCRA. In methodological terms the influence of Foresight on the CCRA process (which is to be repeated every five years henceforth) will be lasting.

### *Heightening awareness of climate change*

This topic received the most unanimous positive support. Many comments were similar, and adding “reality” was a theme: “I think it also raised climate change awareness generally because it made the impacts much more real” (Harman). The Met. Office saw “No evidence of significant effect” in the scientific community, but in Northern Ireland the answer was “Most definitely, for example, Rivers Agency advised the Planning Service for NI of the intention to flood map at Strategic level with allowance for climate change(;) they were quick to adopt this as their basis for consideration of planning issues”.

One respondent added a cautious note:

Yes, the project has heightened awareness of climate change in that it's provided details of the scale of future flood risk and particularly on the way in which this might develop in the future as well as the impact of different future scenarios. . . . However. . . the Foresight report is locked into a series of other major Government and EA strategies, policy and practice documents all of which are responses to climate change so it's not easy to say that Foresight was specifically responsible for this or that heightened awareness of climate change (Bramley).

### *The stakeholders' summary statements*

Respondents were asked the question: “How would you summarise – in a phrase or two – your personal assessment of the impact or otherwise of the project and its results”? This was designed, obviously, to force a succinct judgement.

The response can again be summarised as favourable (Table IV). The opinion of Sir David King has been included; although clearly not an unbiased person as he commissioned the FFF project, we consider that his views are nevertheless very valuable. Comments from Professor XT Cheng have also been included on the Taihu project in China which was assisted by our team, as has been made clear above.

### **Other insights into the FFF contribution to new policy directions**

The stakeholder opinions quoted above concerning the policy impact of FFF are complemented by our review of documentary evidence. To demonstrate this all the policy documents have been listed as identified in both our web and our opinion surveys which cite the FFF project:

- ABI (2004).
- ABI (2005a).
- ABI (2005b).
- Barker (2006).
- DCLG (2007/2010).
- Defra (2004a).
- Defra (2004b).
- Defra (2004b).
- Defra (2005a).
- Defra (2005b).
- Defra (2008).
- Defra (2010b).
- Environment Agency (2009).
- Environment Agency (2010a).
- Environment Agency (2010b).
- EU (2007).
- Hansard (2006).

**Table IV** Summary judgements; selected quotations from stakeholder replies

ABI	The Foresight Future Flooding report has provided us with the much needed evidence base for developing a holistic long-term flood risk management framework. The good work needs to be continued, especially in the context of surface water flooding. And: The ABI continues to consider this project as a very important contribution to flood risk management efforts in the UK. We are very keen to see this good work being continued and we would certainly (be) prepared to provide our input into any future work in this area
Adaptation Sub-Committee (drafted by Hall but agreed by the Committee)	The Foresight Future Flooding project provided a timely stimulus to development of policy and practice for sustainable flood risk management in the UK. (It) demonstrated how quantified assessment could provide useful evidence about the scale of future climate risks in the UK. This was an important precursor to the UK Climate Change Risk Assessment
Bramley	The results of the Foresight project have underpinned the long-term focus on the nature and management of future flood risk that we now have in the UK
CLG – Hackland/Bide	The project had a significant impact on the development of Government policy for flood risk management
Defra – Hurst [Personal view]	A high impact project, which played a major role in changing informed government and public opinion and which undoubtedly led to greater government funding for floods than would otherwise have been the case
Defra – Phippard	Good synthesis of the best available science at the time to produce a credible assessment of the long term challenges in FCERM. It has been very influential in the development of policy and decisions on funding investment
Environment Agency – Harman	... It served to bring organisation to the existing reservoir of expertise. . . By presenting the long term economic impacts of changing flood risk in a robust manner, it drew the attention of economic policy makers and thereby made space for other long standing strategic issues such as coastal realignment, land-use practices etc. to enter their considerations. And: It may just be because I was close to the Foresight Flooding work, but my perception was and is that it was one of the most successful and influential Foresight outputs - it certainly had enormous practical impacts, taken in conjunction with other drivers such as the series of severe floods from 1998 onwards and the shift from defence to risk management within the profession
Environment Agency – Rooke	The project has helped to change the culture from one of reacting to floods to one based on managing risk. It provided a seminal assessment of the future risks and options for long term management of flood risk, vital for supporting policy change in the UK. It also provides an evidence base for the impacts of climate change, and the possible measures needed to combat its effects. Its rich resource could have been better presented in the final reports. There is no meaningful web based material from the project, and if you want to read the report, and you don't have a copy, you need to buy one. All this, and its style and format, meant we suspect, that it was not as well read as it could have been by large numbers of people
Met. Office	Little evidence of significant impact. It would be useful if future work could have more "metrics of effectiveness" included at the design stage
Natural England	The project has had a marked influence on the development of the national approach to flood and erosion risk management over the last 6 years most notably in helping to shape Defra's influential Making Space for Water Strategy. It is disappointing that the Foresight report did not look more seriously at natural environment issues
Northern Ireland Rivers Agency	It created a structure and acted as a catalyst for many of the concepts and issues at the time and brought new ones to light. It introduced the use of scenarios which had not been used previously which dovetailed with the UKCIP approach. It proved very effective in bringing forward Strategic Flood Mapping and the Floods Directive for NI
Samuels	A comprehensive, integrated review of the flood risk system
USACE – Durden	(It) provided (a) clear context and focus for a very challenging and important topic. It is a model for other governments
Welsh Government	This project has driven fundamental change to the way we approach flood and coastal risk in Wales. While the 2007 floods and the subsequent review by Sir Michael Pitt has highlighted the challenges we face and has accelerated the move to a risk management approach the work undertaken as part of this project very much set the scene and prepared the ground
Sir David King	There are very few projects of this magnitude in my opinion that have had such a big impact both nationally and internationally
Prof XT Cheng (IWHR Beijing)	... the project introduced a new concept of foresight future flooding from UK to China, and the Taihu Basin is the first one in China who utilized the results of scenario analysis for long term and with multi-disciplines research in making flood management planning... ... Foresight ... not only shows us what will happen in the future, but also what should we do today wisely to ensure the sustainable development in the long term

- IPCC (2007).
- Northern Ireland Office of the First Minister and Deputy First Minister (2006).
- Pitt (2008).
- Welsh Assembly Government (2006).
- Welsh Government (2007).

Foresight appears to have affected thinking, the direction of policy change, the policy reviews that often preceded this change (e.g. Pitt; Stern), and its impact also spread into the private sector through the insurance industry. The list represents the essence of all the major policy innovations in UK flood risk management of the last decade, and the policy documents of every relevant central government agency except those for Scotland have content which is Foresight-informed (no reply was received from Scotland to our stakeholder letter). Organisations and agencies less close to central government have also seen changes to their policies and practices over the last decade, with the Environment Agency and the ABI both important in this respect, and again prominent in the list.

The Draft Flood and Water Management Bill 2009 used the FFF report as a source of background data (i.e. values of the increase in expected flood damage cost per property under the various scenarios considered in the FFF research). The latest UK Government strategy for FCERM, *Making Space for Water* (Defra, 2005a), mentions that the FFF report "... highlighted the need for Government to develop a comprehensive, integrated and forward-thinking strategy for managing future flood and coastal risks in England". The resulting strategy addresses messages from the FFF report and reflects on lessons learned from the flood events in the recent past.

The Pitt Review (Pitt, 2008) reports that "...both the Foresight Future Flooding report (2004) and the Stern Review (2006) have been internationally recognised as credible studies looking into climate change". HM Treasury (2007) in its Pre-Budget Report and Comprehensive Spending Review in 2007 noted that "... the 2004 Foresight Future Flooding report both highlighted that climate change in the UK is likely to increase the severity and the frequency of flooding events. In line with this, total Government expenditure on flood and coastal erosion risk management will rise from £600 million in 2007-2008 to 800 million in 2010-2011."

There are numerous references in the *Hansard* record of parliamentary debates to the FFF findings. In the Government response to the Environmental Food and Rural Affairs Select Committee's report on the Environment Agency (Recommendation 9), the Government welcomes the FFF report, "We warmly welcome Foresight report's approach to examining long term flood risk and congratulate those involved on their work".

The UK Government's water strategy for England utilises risk values taken from the FFF report. The Government's response to the Environmental Food and Rural Affairs Select Committee's report on the Environment Agency is also an example of a recommendation for further study – "... The Government's Foresight Future Flooding report in 2004 recognised the potential for flood risk to increase as a result of climate change and sea level rise and also the increased value of assets at risk".

### Some discussion of the factors affecting impact

Several factors appear to have been important in producing the impacts as summarised above (see also van Damme and Borthwick, 2010; Borthwick, 2010). These impacts are related to both the way that the project was implemented and to the context in which it sat, much in accordance with the wider ideas on the science/policy nexus discussed above. They are interrelated, but the latter is discussed first, because in many ways this was abnormal for a science project, and lessons learnt here may well not be applicable to impact enhancement elsewhere. It is important to note that the section below comprises our judgements as to the factors affecting impact, and should be seen as separate from the quantitative analysis and opinion survey results described above.



### *Factors “external” to the implementation of the FFF project*

The project had a “top” champion, in the then Chief Scientific Adviser to the government. Sir David King initiated the project and opened doors for the project team across Whitehall and beyond. In turn Sir David reported to Prime Minister Tony Blair, who apparently was pursuing a mission to persuade those in the USA with power that climate change was a real threat: here was quantified evidence of potential climate impacts. Thus while all Foresight projects involve the attention of the Chief Scientific Adviser, this particular project appeared to be his top priority. To this end Sir David was instrumental in persuading other government departments of the importance of the project and the impending threat from flooding that it forecast. The sponsoring Department (Defra) also had in Elliot Morley a strong supporter of the research who paid attention to its results, following some opposition from some of his senior staff at the outset.

A second factor here was also that the results appeared not to have any threat to any particular stakeholder group. Important here were relations with HM Treasury, and significant attention was given by those within the team and close to it to persuading the Treasury that the resource implications of increasing risk were likely to be manageable, rather than requiring a step change, and Defra officials acknowledged a Foresight-induced success here in enhanced FRM budgetary allocations. Another group concerned about the project could perhaps be characterised as the “environmental lobby”. The project team were at pains to stress – successfully – that the results did not indicate an engineer’s charter (an early fear from some), and recruiting Professor Andrew Watkinson (an expert ecologist) into the team was important to that process.

A further success factor must be that the results were well “liked” by the community to which they were addressed. Clearly this was partly because the results showed substantial increases in flood risk, and this was a message welcomed by the Institution of Civil Engineers, researchers and most other stakeholders. More flooding meant more budget! Important also was the fact that the results and the messages were a natural progression of existing thinking at the time. The need for a more strategic approach was set out in the MAFF 1993 Strategy for Flood and Coastal Defence, and the FFF report provided ammunition for a direction of travel that was already tacitly preferred by key civil servants. It also must be remembered that the project followed closely on the UK flooding in 2000, which had raised both public and political awareness of possible future risks not least through the Bye report following the 1998 floods (Bye and Horner, 1998), *Learning to Live with Rivers* from the Institution of Civil Engineers (ICE, 2001), a Select Committee report on flooding (ETRA, 2000): the FFF results in this respect were seen perhaps as somewhat unsurprising.

In general, and partly as a result, the project findings were almost entirely uncontested, perhaps partly because almost every member of the flood risk management research community in the UK was involved in the project. Nevertheless some opposition came from those who considered that the scenarios should have incorporated changes to the flood risk management governance structure, but the project team considered that this was an over-complication, and would dilute the central message. It should be obvious to anyone who reads the FFF report that the governance arrangements for flood risk management would have to change if the scale of increased risk that it forecast were to be realised; those changes, in terms of a new funding regime for FRM, have now been seen (Defra, 2010a, 2011a, b).

### *Factors “internal” to the project*

Most members of the research team had worked with others in the team for many years, and the members of the core team had worked already for the team leader. Within the project another of the important success factors was that the project was well resourced and extremely well supported by highly skilled and motivated civil servants within the Department of Trade and Industry. While this is true about many Foresight projects, this one was experimental in the sense that this methodology had not been tried before, and the DTI staff set up a high level team to work collaboratively with the researchers.

The project, secondly, was undoubtedly assisted by its focus on a relatively limited field (i.e. just flooding and coastal erosion), and in that respect the research was relatively unproblematic. It also built on a coherent body of knowledge and practitioners, many of whom joined the project team. In turn the core team stripped the project down to manageable tasks, for example by taking the climate change scenarios as external to the project. There was a relatively clear focus on questions to be asked, and agreement from the client and the stakeholder panel on that list. It is our view that some later Foresight projects have had a wider focus leading to a more difficult process.

A third factor of significance – part internal and part external – was the development of a coherent communication plan, to take the results of the projects at each stage to a wider audience. In this regard many stakeholders were “warmed up” as phased reports were drip-fed from the project, and several specialist meetings were held to explain the methodology being adopted and to interpret the results: the project sought a “no surprises” approach to managing its reporting. This included the devolved administrations in Wales, Scotland and Northern Ireland, but also to other stakeholders including local government authorities and insurance industries. The approach was developed by the team within the Department of Trade and Industry, and pursued in concert with the research team, in a wide-ranging series of bilateral meetings and workshops. No stone was left unturned in seeking to get the message across that this was a serious project with significant results. Important to that process was that the members of the research team, and particularly its team leader, were able to “speak the language” of those to whom they talked in both the flood risk management field and the wider political community.

An important motivating factor was that the techniques being applied were relatively state of the art, producing results that the researchers had not seen before. This was not a simple consultancy project. The innovation was not about new techniques of mathematical modelling, rather an innovation in its application (i.e. for future climate, socio-economic and flood risk management scenarios). The project extended the techniques of scenario analysis, and showed that quantification and scenario building could go hand-in-hand.

The Department of Trade and Industry staff were concerned as the project drew to its conclusion, and they were implementing their communication plan, how the project team was going to draw out clear messages for its senior clients – and other government departments – from the mass and complexity of the scientific work and the reports that had been produced. A great deal of effort was therefore put into producing these messages, conveyed by simple diagrams and maps showing increasing risk and its implications. Not all of the results from the project were equally compelling – some were complex to explain and rested more on methodological assumptions than realistic insights. Yet a small number of robust results, presented in clear graphics, communicated the essence of the analysis and its implications. In hindsight these reports were far too extensive as publicly available documents, but nevertheless the project team was concerned to make the messages as clear and well supported as possible. In this respect the many maps that were produced meant that certain straightforward messages were easily picked up by the press, and this contributed to the relatively high profile, at the time, of the implications of the project in the popular media.

## Conclusions

The FFF project clearly had an impact. It certainly matches both Da Costa *et al.*'s (2008, p. 371) suggestion that “in the best cases, foresight activities would initiate changes in the way decisions are made and policies are designed” and Johnston’s “influencing” level of impact as “shaping both the thinking and the consequent outputs, be they policy, law, standards, services and their delivery” (Johnston, 2010, p. 2).

But two caveats should be noted. First, in terms of a more comprehensive “test” of impact, the effect of FFF on flood risk management scheme design and implementation is still modest, if at all, as the lag between ideas being developed and practice being changed is a large one. So that “test” is yet to come, and even here it is complicated by the determination

of causality: attributing such changes to FFF as opposed to other contextual factors will not be easy, and perhaps even impossible. Secondly, the FFF research was not without its critics, both at the time and since, although these were few, as indicated.

Bearing these points in mind, it is hoped that this paper's elucidation of our approach to assessing the impact of one foresight project might help to enhance the design of other such studies in the future. In this respect, in terms of our methodology and the relevance for other impact studies, it is clear that the timing of assessments is crucial – and some policy change takes decades to materialise – and attribution must be the subject of the most serious consideration and substantial effort. Objectivity is also of paramount importance, but difficult to judge when perfected. The problem here, of course, is that the longer the timescale the more difficult attribution becomes, and objectivity may be compromised by the passage of time diminishing the accuracy of the memories of those from whom opinions are sought, and these issues must be of concern to all who wish to evaluate any research in terms of its impact.

Notwithstanding those points, what conclusions can be reached? In terms of Martin's (2010a) policy lessons and Nuteley *et al.*'s (2002) aspirations, FFF ticked virtually all the boxes.

Science policy lessons (adapted from Martin (2010a)) Include:

- The “demand pull” from policy makers can be weak, but is needed for success.
- Policy research needs a “champion” in a position of power and authority.
- “Perseverance” is needed for full impact.
- Some messages are not actually liked.
- The political circumstances have to be right.
- There is a need (for researchers) to be opportunistic.
- A balance is needed (in the messages) between simplicity and complexity.
- Researchers need to identify clear policy needs.

Evidence into policy: Nutley *et al.*'s (2002) conclusions on the relation between research and policy making – attention is more likely to be paid to research findings when:

- The research is timely, the evidence is clear and relevant, and the methodology is relatively uncontested.
- The results support existing ideologies, are convenient and uncontentious to the powerful.
- Policy makers believe in evidence as an important counterbalance to expert opinion, and act accordingly.
- The research findings have strong advocates.
- Research users are partners in the generation of evidence.
- The results are robust in implementation.
- Implementation is reversible if need be.

This does not make the process in the FFF project a model for future research, because not all projects can be supported personally by the Chief Scientific Adviser to the government, and not all projects in future will be so well resourced and promoted. Regarding Hoppe's “speaking truth to power”, clearly the FFF project was a great success, partly because of its inherent qualities as a piece of evidence-based policy research but also because it followed on from pre-existing emerging policy trends and provided practical and feasible options to match the contemporary political requirements, while giving a challenging forward look. Nevertheless policy analysis purists might well now consider FFF not argumentative enough, and hence somewhere bereft of clear recommendations. But this was something expressly

ruled out in the briefing provided by Defra (effectively “we do policy; you do research”). Our judgement remains that a more argumentative result would simply have been ignored.

In terms of policy impact, the FFF project promoted a whole systems approach, supporting the later inclusion of that philosophy in *Making Space for Water*. The results indicated that the future risk was not amenable to tackling by an engineering approach alone, leading to the same philosophy within *Making Space for Water* and the PPS 25 guidance. The forecast that substantial resources would be needed in future even to maintain current levels of risk supported the development in 2011 of the partnership approach to the funding of flood risk management.

None of these policy directions were the direct result of the FFF project alone, but reinforced trends already in place (see Penning-Rowsell *et al.*, 2006) in the kind of incremental “creep” suggested by Weiss (1980). The movement towards risk management and away from flood defence was already in place well before the FFF reports were published in 2004, but that movement was strongly supported by their dramatic results. Here is encountered, of course, the problem of attribution. The FFF initiative did not create policy change but facilitated its legitimisation, adding impetus to what was already there, as one element of a part-catalytic and part-incremental process of policy evolution. The time was right and the results were useful.

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