Institution: University of Nottingham

Unit of Assessment: UoA17 - Geography

Title of case study: Informing national and international policy on Integrated Flood Risk Management

1. Summary of the impact

Thorne's research for the Flood Foresight project changed UK policy towards sustainable Integrated Flood Risk Management (IFRM), as implemented by the Floods and Water Management Act (2010). This legislation introduced new systems of governance to clarify responsibilities, support co-ordinated actions, strengthen the roles of local stakeholders, foster the co-production of knowledge, and work with natural processes. Flood Foresight has attracted international attention and stimulated projects and policy changes elsewhere, including in the Taihu Basin in China and around the city of Gold Coast in Queensland, Australia.

2. Underpinning research

Research by Thorne (Professor of Physical Geography) on flood risk and flood policy was completed as part of the Flood Foresight project commissioned in 2002 by Sir David King, the UK Government's Chief Scientific Advisor. The project was a response to unprecedented flooding in 1998 and 2000 and predictions that future flood damage will increase due to climate change and poorly planned urban development. The government accepted Flood Foresight's headline message that increasing flood risk represents a major challenge to UK civil society and that 'business as usual' is no longer an option.

Flood Foresight drew on an international team of nearly 90 experts. The aim was to challenge existing flood risk management practices. The objective was a 30-100 year vision for the future of flood and coastal defence in the UK that considers uncertainties and can inform national policy. Thorne led the 'Rivers and Environment' group and oversaw the qualitative assessment of future flood risk. He investigated the contribution that working with natural processes can make to managing future increases in flood severity in a sustainable way. He edited the Flood Foresight volume (1), co-authored five of its chapters, co-authored the main reports presented to government (2 and 3), and published aspects of this work in a peer reviewed journal (4).

Thorne developed innovative approaches to the assessment and ranking of future flood risks which were refined and applied across a range of potential responses to increasing flood risk. He established the importance of properly aligning flood risk and environmental regulation to avoid conflicting river and coastal management actions that would otherwise amplify future flood risk. His key findings are that a co-ordinated portfolio of structural and non-structural measures are necessary to keep flood risks at current levels; that it is essential to work with natural processes wherever possible; and that decision-making and governance are of primary importance to reducing future UK flood risks sustainably.

In 2008, Flood Foresight was updated as part of the Pitt Review, an independent government review following the summer 2007 floods. Thorne was the Principal Investigator on the Pitt Review and was responsible for reviewing and updating the qualitative assessment of future flood risks and responses related to river morphology and sediment supply, environmental regulation and river vegetation and conveyance (5).

Between 2006 and 2009, Thorne was Principal Investigator on a three-year project that adapted Flood Foresight approaches for the Taihu Basin in China. His research involved characterising, assessing and accounting for flood risks related to sediment, debris and geomorphology and identifying how these risks can be managed sustainably (6). In 2010, the Environment Agency of England and Wales (EA) commissioned Thorne to synthesise and transfer knowledge on qualitative assessment developed in China back to the UK.

Flood Foresight involved two other researchers based at Nottingham at the time: Charlton (Lecturer in Physical Geography and Research Associate 2003-4) who contributed to the 2004 reports (2, 3), and Harvey (Research Associate and Project Administrator for the Taihu Basin Study 2006-9) (6).

3. References to the research

1. **Thorne, C. R.**, Evans, E. P. and Penning-Rowsell, E. (2007) *Future Flooding and Coastal Erosion Risks* (London: Thomas Telford). Thorne co-authored chapters 1, 6, 12, 24 and 28. Restricted view available at: http://www.icevirtuallibrary.com/content/book/100416
2. Evans, E. P., Ashley, R., Hall, J., Penning-Rowsell, E., Saul, A., Sayers, P., **Thorne, C. R.** and Watkinson, A. (2004a) *Foresight. Future Flooding. Scientific Summary: Volume 1 - Future Risks and their Drivers*, DTI/pub 7183/2k/04/04/NP, URN 04/939 (London: Office of Science and Technology). Thorne contributed and co-edited all chapters, led the writing of chapter 2 and appendices A and D. Available at: http://www.bis.gov.uk/foresight/our-work/projects/published-projects/flood-and-coastal-defence/project-outputs/volume-1
3. Evans, E. P., Ashley, R., Hall, J., Penning-Rowsell, E., Saul, A., Sayers, P., **Thorne, C. R.** and Watkinson, A. (2004b) *Foresight. Future Flooding. Scientific Summary: Volume 2 – Managing Future Risks,* DTI/pub 7184/2k/04/04/NP, URN 04/946 (London: Office of Science and Technology). Thorne contributed and co-edited all chapters and led the writing of chapter 2 and appendices A, C, and D. Available at: http://www.bis.gov.uk/foresight/our-work/projects/published-projects/flood-and-coastal-defence/project-outputs/volume-2
4. Evans, E. P., Hall, J. W., Penning-Rowsell, E. C., Sayers, P. B., **Thorne, C. R.** and Watkinson, A.R. (2006) Future flood risk management in the UK *Proceedings Institution of Civil Engineers: Water Management* 159: 53-61. DOI: 10.1680/wama.2006.159.1.53
5. Evans, E. P., Simm, J.D., **Thorne, C. R.**, Arnell, N. W., Ashley, R. M., Hess, T. M., Lane, S. N., Morris, J., Nicholls, R. J., Penning-Rowsell, E. C., Reynard, N. S., Saul, A. J., Tapsell, S. M., Watkinson, A. R., Wheater, H. S. (2008) *An Update of the Foresight Future Flooding 2004 Qualitative Risk Analysis* (London: Cabinet Office). Thorne led the production of this report with Evans and Simm. Available at: http://webarchive.nationalarchives.gov.uk/20100807034701/http://archive.cabinetoffice.gov.uk/pittreview/_/media/assets/www.cabinetoffice.gov.uk/flooding_review/evidence/foresight_report%20pdf.pdf
6. **Harvey, G. L.**, **Thorne, C. R.**, Cheng, X., Evans, E. P., Simm, J. D. and Wang, Y. (2009) Qualitative analysis of future flood risk in the Taihu Basin, China, *Journal of Flood Risk Management* 2: 85-100. DOI: 10.1111/j.1753-318X.2009.01024.x

Copies of all of the above are also available from HEI on request.

<u>Grants (all to Thorne)</u>

- Department of Trade and Industry, Office of Science and Technology (£173,513) for 'Foresight Project on Flood and Coastal Defence: Phase 1&2, WP A, 2002-2004'.
- Cabinet Office (£25,100) for 'Flood Foresight Update, 2008'.
- Department for Trade and Industry (£155,000); NERC (£100,000); Defra (£50,000); Foreign and Commonwealth Office (£60,000); and United Nations (£47,260) for 'Taihu Basin Study, 2006-2009'.
- Government Office for Science (£34,696) for 'Flood Foresight Workshop, Washington DC, 2008'.
- Environment Agency (£26,500) for 'Taihu Flood Study: Knowledge Transfer Project, 2010-2011'

4. Details of the impact

Flood Foresight established a radically different approach to the study of future flood risks and their management, based on a long-term examination of the entire UK flooding system. Effective stakeholder engagement was crucial to achieving the aims of Flood Foresight and was delivered through 'buy-in' workshops organised by Thorne. Research outcomes were targeted to government, policy makers and technical specialists with the aid of a science writer. The findings led to a significant shift in UK flood risk management, enacted by the Floods and Water Management Act 2010 (a). The Act includes multiple recommendations from Flood Foresight, several stemming specifically from Thorne's research. These include accounting for environmental as well social and economic flood risks, and working with natural processes. Implementation of the 2010 Act changes and clarifies the responsibilities of different parties, supports co-ordinated actions, strengthens the roles of local stakeholders and fosters the co-production of knowledge related to IFRM. Additionally, the management of flood risk is now better integrated with environmental regulation, notably through the promotion of Natural Flood Management in conjunction with conventional, structural and non-structural solutions.

Flood Foresight, including Thorne's research, has informed government, policy makers and implementing organisations at strategic and operational levels, changing the framework of delivery of flood and coastal risk management (g). It has directly improved the flood risk assessment capabilities of the EA where a significant amount of current research has its roots in Flood Foresight (g, h). The Director of Flood and Coastal Risk Management at the EA summarised Flood Foresight research as "***ground breaking and world leading science***", further explaining that "***you can go onto our website, you can type your postcode in and you'll see whether you are in a floodplain or not, and you'll also be able to, by a move of the mouse, determine what your level of risk is, and that is using the science that was provided through the Foresight Project***" (f). The EA uses Flood Foresight research to quantify the impact of flood risk and the costs of investment in reducing risk (h), and adopts this approach in *Thames Estuary 2100*, its plan for protecting London from flooding for the rest of this century (d, h).

The research continues to inform EA Flood and Coastal Erosion Risk Management (FCERM) planning through the Future National Flood Risk Assessment and Long term Investment Strategy. In relation to Thorne's research on working with natural processes, the EA's Director of Flood and Coastal Risk Management stated in 2013 that "***a really good example is the Steart Peninsula in Somerset where we are creating significant intertidal habitat but at the same time… protecting a community that is at risk of flooding and … providing future compensatory habitat for other works that may be needed in the Severn estuary***" (f).

Flood Foresight, and the 2008 Flood Foresight Update, have significantly influenced national policy on the management of flood risk across a range of government departments and operating organisations (a, b and c). For example, the Department for Environment Food and Rural Affairs (Defra) and the Department for Communities and Local Government (DCLG) now ensure that flood risk is fully taken into account at all stages in the planning process. As a DCLG spokesperson has stated: "***The [Flood Foresight] report was very important in providing the justification for, and setting the approach and scope of planning policy***" (e).

Thorne's research impacts are felt beyond the UK and extend overseas. According to the UK Government Office for Science, Flood Foresight's principles have, for example, now been adopted more widely in China, expanding the original impact on the Taihu Basin (h). The Director of the Department of Water Hazard Research and Vice-Chief Engineer of the China Institute of Water Resources and Hydropower Research states that: "***the value of the Flood Foresight study has been fully recognised and highly appraised. That's why the [Chinese] government gives continued support to such study in the 12th five-year science and technology support plan***." The Director also states that "***the significance of the [Taihu Basin] project is [in] giving us a model and approach of scientific decision-making to ensure sustainable development***" (j).

Catastrophic flooding in Queensland, Australia, in 2011 has also prompted a Flood Foresight mission in 2012, co-led by Thorne, and the Gold Coast City Council has now developed its own Foresight-style scenario-based planning approach (i).

5. Sources to corroborate the impact

Reports and Documents

a) House of Commons (2010) *Flood and Water Management Act 2010* (London: TSO). This corroborates the claim that the research has shaped national policy on IFRM. Available at: http://www.legislation.gov.uk/ukpga/2010/29/pdfs/ukpga_20100029_en.pdf
b) Cabinet Office (2008) *Learning Lessons from the 2007 Floods: The Pitt Review* (London: Cabinet Office), pp. xi, 16, 27-28, 33. This corroborates the claim that the research continues to influence national policy in relation to IFRM. Available at: http://webarchive.nationalarchives.gov.uk/20100807034701/http:/archive.cabinetoffice.gov.uk/pittreview/_/media/assets/www.cabinetoffice.gov.uk/flooding_review/pitt_review_full%20pdf.pdf
c) Government Office for Science (2011) *Mid-Term Review of the Impact of the Foresight Future Flooding Project* GO-Science (London: Department for Business, Innovation and Skills), chapter 7. This corroborates the claim that the research continues to influence national policy in relation to IFRM. Available at: http://www.bis.gov.uk/assets/foresight/docs/flood-and-coastal-defence/12-1044-flood-and-coastal-defence-mid-term-review
d) Environment Agency (2012) *Thames Estuary 2100: Managing Flood Risk through London and the Thames Estuary* (London: Environment Agency), pp. 25-6. This corroborates the claim that national policy has adopted the approach developed by the research. Available at: http://a0768b4a8a31e106d8b0-50dc802554eb38a24458b98ff72d550b.r19.cf3.rackcdn.com/LIT7540_43858f.pdf
e) Quoted in Penning-Rowsell, E. C., Evans, E. P., Hall, J. W. and Borthwick, A. G. L (2013) From flood science to flood policy: the Foresight Future Flooding project seven years on, *foresight* 15: 190-210, p. 199. DOI: 10.1108/fs-06-2012-0046.

Copies of all of the above also available from HEI on request.

Individual Beneficiaries

f) Transcript of an interview with Director of Flood and Coastal Risk Management, Environment Agency, 8 May 2013. This corroborates the claim about changes to UK flood risk management policy. Available from HEI on request. The beneficiary can be contacted by the panel if further testimony is required.
g) Transcript of an interview with Head of Strategy and Engagement, Environment Agency, 16 May 2013. This corroborates the claim about changes to UK flood risk management policy. Available from HEI on request. The beneficiary can be contacted by the panel if further testimony is required.
h) Transcript of an interview with the Head of Foresight Follow-up, Government Office for Science, 13 May 2013. This corroborates the claim about the impact on Environment Agency flood risk assessment capabilities and the impact of the research in China. Available from HEI on request. The beneficiary can be contacted by panel if further testimony is required.
i) Transcript of an interview with the Principal Project Officer for Floods, Queensland Regional Government, 6 August 2013. This corroborates the claim that the research had impact in Australia. Available from HEI on request. The beneficiary can be contacted by the panel if further testimony is required.
j) Transcript of an interview with the Director of the Department of Water Hazard Research and Vice-Chief Engineer of the China Institute of Water Resources and Hydropower Research, 24 September 2013. Available from HEI on request. This corroborates claims regarding the influence of the Flood Foresight study in China. The beneficiary can be contacted by the panel if further testimony is required.