

Changing social contracts in climate-change adaptation

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Risks from extreme weather events are mediated through state, civil society and individual action^{1,2}. We propose evolving social contracts as a primary mechanism by which adaptation to climate change proceeds. We use a natural experiment of policy and social contexts of the UK and Ireland affected by the same meteorological event and resultant flooding in November 2009. We analyse data from policy documents and from household surveys of 356 residents in western Ireland and northwest England. We find significant differences between perceptions of individual responsibility for protection across the jurisdictions and between perceptions of future risk from populations directly affected by flooding events. These explain differences in stated willingness to take individual adaptive actions when state support retrenches. We therefore show that expectations for state protection are critical in mediating impacts and promoting longer-term adaptation. We argue that making social contracts explicit may smooth pathways to effective and legitimate adaptation.

It is clear that climate change will not be experienced as a smooth change in mean conditions, but as a series of extreme weather events, possibly leading to crises in policy and planning. These can offer opportunities for investment and legislation while there is public support and attention^{3,4}. Understanding how events shape the direction of adaptation requires a theory of the process of change.

Social contract theory has a long history in political philosophy. It explains how governments and responsibility evolve over time as emerging risks pose challenges to the established consensus concerning the role of the state. Social contract theory is contested: there are profound debates on the balance of power between civil society and the state. Recent applications suggest that adaptation and resilience could lead to renegotiation of social contracts because of the co-evolving nature of risks and multi-actor influences on change⁵. Some theories suggest that environmental risks create new roles for states⁶, but that there are limits to social contracts: they can exclude those who may not recognize the legitimacy of governments; they can emerge from less-than-legitimate lobbying among key actors⁷; and they fail to represent citizens of the future¹. Climate risks are particularly problematic for consensus building for government because of uncertainty and uneven distribution of burdens⁸.

An emerging body of research suggests that the potential scale, scope and interconnectedness of many climate-change risks will require radical change in economic and social structures, and terms this as transformation^{9,10}. The Intergovernmental Panel on Climate Change Special Report on managing extreme events also shows that both incremental adaptation and transformations are required for resilient societies¹¹. Early indications of resistance to resettlement and conflict in adaptation planning also highlight that populations

directly affected will have much to say about planning into the future^{12,13}. Hence we conclude, in line with ref. 14, for example, that extreme events can have significant roles in both small regulatory changes and in large political upheavals. Renegotiations of social contracts are therefore probably a primary mechanism for both adaptation and transformation.

The purpose of this study is to examine the changing social contract where the vulnerability of citizens is being altered by changing weather extremes. Such changes happen when the status quo is disrupted by major catastrophic events such as floods. Previous research on flooding shows significant social differentiation in populations vulnerable to flood risk, and their differential access to services and insurance^{15,16}. Across different exposures to risk, experience of flooding has also been demonstrated to have significant impacts on perceptions of responsibility for action^{17,18}.

A natural experiment of exposure to extreme flood events occurred across Ireland and in Cumbria, northwest England in November 2009. Of course this natural disaster occurred at a time of significant economic crisis in both economies and a profound renegotiation of implicit state responsibility around social protection and economic management, particularly acute in Ireland.

Following on from a very wet summer in the British Isles, a stream of Atlantic depressions moved across Britain and Ireland through the autumn of 2009. An atmospheric river established by mid November and became entrained in the westerly circulation¹⁹. During the month of November in Ireland, and in particular 16–20th November in Cumbria, record-breaking rainfall was recorded in both countries²⁰, resulting in widespread flooding, with property loss, economic disruption and a small number of fatalities. Flood events in both jurisdictions were well beyond the experience of living memory. Flooding in Cumbria has been associated with a return period of 2,100 years²¹, and the flood event for the river Suck in Ireland has been estimated as having a return period in excess of 1,000 years²².

We designed a study to explore the success of, and changes to social contracts following the 2009 floods in both jurisdictions. We implemented a survey of households eight months after the event, stratified by direct experience of flooding and adjacent less-affected households. In addition, we documented perceptions of government performance in dealing with the aftermath; perceptions of fairness in response; and willingness to take action, using a range of socio-cognitive constructs.

We also analysed policy documents and statements from governments, flood advocacy groups and media reports.

The main features of social contracts associated with flood risk in Ireland and England are outlined in Table 1, based on the documentary analysis. They differ in subtle but significant ways: by

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Table 1 | Critical elements of the social contract for flood risk management in England and Ireland.

| | England | Ireland |
|---|--|--|
| National policy and legislative setting | <p>Legislation addressing flood risk and response is framed by the Flood and Water Management Act (enacted in 2010 after the floods) CCA (2004). Department for the Environment, Food and Rural Affairs (DEFRA) outlines national policy.</p> <p>The Environment Agency (EA) is responsible for flood forecasting and warning. It operates its own flood defence infrastructure. Planning Policy Statement 25 (PPS 25) gives the EA a role in determining planning permission in flood risk areas. Local Authorities:</p> <ul style="list-style-type: none"> ● Implement flood management works. ● Manage planning permission and therefore development in flood risk areas (in line with Planning Policy Guidance 25). ● Liaise with Local Resilience Forums on emergency planning. ● Responsible for providing emergency shelter and food post-floods. | <p>Legislation addressing flood risk is framed by the Review of National Flood Policy 2002–2004 and the Framework for Emergency Management 2006. Office for Public Works is the lead agency for coordinating flood risk management with particular focus on risk reduction and work programmes.</p> <p>The Department of Environment, Community and Local Government.</p> <ul style="list-style-type: none"> ● Develop planning guidelines and development control. <p>Local Authorities:</p> <ul style="list-style-type: none"> ● Responsible for operating and maintaining flood forecasting and warning. ● Manage planning permission and therefore development in flood risk areas. ● Develop and coordinate emergency response (with Health services and Gardai). |
| The role of the private sector | Insurance sector: Agreement between government and insurance sector (see text and below). At present, there are negotiations for coverage beyond 2013. | Insurance sector: Flood cover governed by market forces. |
| Voluntary sector | The roles of voluntary organizations are formally integrated into civil protection through the Voluntary Sector Civil Service Forum. At national level, groups with vested interest can lobby for change: for example, the Royal Society for the Protection of Birds (RSPB), Wildlife trusts, flood action groups. At the local level voluntary groups work with local government on flood risk planning; during a flood voluntary groups work with responders on warning and evacuation (Royal National Lifeboat Institution, RNLI); and post floods provide individuals with assistance (financial, legal)—as did flood actions groups and the Red Cross in Cumbria. | At national level, groups with vested interest can lobby for change: for example RSPB, Wildlife trusts, flood action groups, Irish Farmers Associations, Business Associations. Post-floods humanitarian aid is distributed by the Department of Social and Family Affairs and through the Irish Red Cross and community welfare workers. The Department of Agriculture and Food provides assistance for farmers. |
| Individual capacity | <p>Homeowners can:</p> <ul style="list-style-type: none"> ● Obtain flood insurance if the risk of flooding is no worse than 1 in 75 annual probability of flooding (subject to change in 2013). ● Make changes to their property to reduce the risk of flooding. ● Move away from a flood risk area. ● Participate in consultation processes regarding planning and flood defences. <p>Individuals: can join local interest groups, contribute to fund-raising efforts, join charities, lobby councillors and members of parliament.</p> | <p>Homeowners can:</p> <ul style="list-style-type: none"> ● Obtain flood insurance but there are not laws or protocols obligating insurance companies to provide insurance. ● Make changes to their property to reduce the risk of flooding. ● Move away from a flood risk area. ● Participate in consultation processes regarding planning and flood defences. <p>Individuals: can join local interest groups, contribute to fund-raising efforts, or join charities, lobby councillors and members of parliament.</p> |

the mechanisms by which representation occurs, the responsibilities devolved to individuals, and in government intervention in insurance markets. In England, the legislative setting for the social contract related to flooding sits in a much wider context of civil protection and management; for example, emergency planning and response is set out in the Civil Contingency Act (CCA) of 2004 (see Table 1). This context affects how individuals perceive responsibility and demand change when events occur.

The survey results indicate that it is primarily the differing contexts across jurisdictions that bear a significant influence on the evolution of the social contract. Independently of direct experience of flooding, householders expect government to be responsible for reducing future flood occurrence ($Z = 14.15$, $p < 0.001$),

although householders were also ascribed some responsibility, significantly more in Cumbria than in Galway ($\chi^2 = 20.49$, $p < 0.001$; see Fig. 1a).

We find contrasting evidence on the influence of direct experience of flooding on individuals' perceptions of future risk and responsibility to act. Overall, very similar proportions of flooded and non-flooded respondents in Cumbria believed, or did not believe respectively, that they would experience a similar event in the next five years ($\chi^2 = 0.20$, $p > 0.05$). The difference was considerably starker in Galway: those who had experienced direct flooding were significantly more likely to believe they would be affected by flooding again, in comparison with those who had not been flooded (Fig. 1b; $\chi^2 = 39.32$, $p < 0.001$).

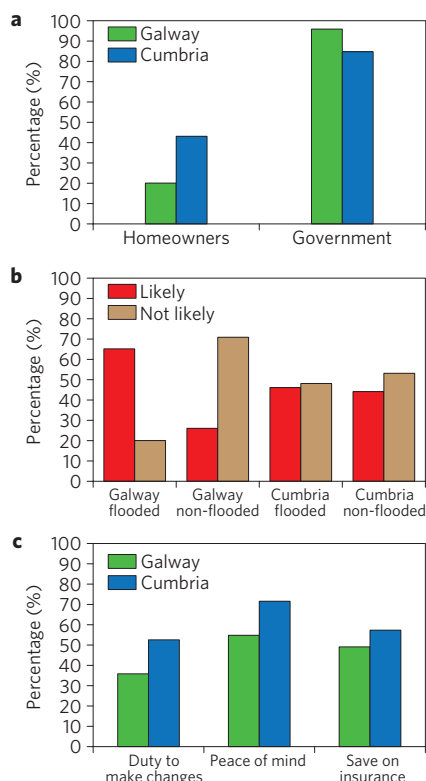


Figure 1 | Impact of flood experience across Galway (Ireland) and Cumbria (England) on perceptions of responsibility, risk and motivations for adaptation.

a, The percentage of respondents (both flooded and non-flooded) that agreed or strongly agreed that action to reduce the likelihood of flooding is the responsibility of homeowners or Government ($n = 356$). **b**, The percentage of respondents who said that they thought they were likely to experience flooding in their local area in the next five years ($n = 356$). **c**, Of the people that had been flooded and who believed that they would be flooded in the next five years (Galway $n = 53$, Cumbria $n = 42$) the percentage who agreed or strongly agreed that: 'I feel it should be my duty to take more responsibility if the risk of flooding increases'; 'I would consider making changes to my house to prevent flood damage to give me peace of mind' and that 'I would consider making changes to my house to save on my insurance bill'.

Of those who had experienced flooding and believed they would be affected again in the foreseeable future, Cumbrians indicated a stronger sense of personal duty and willingness to adapt through modification of their homes ($\chi^2 = 3.62$, $p < 0.05$; for peace of mind as well as for insurance) than Galway respondents (Fig. 1c).

There are significant differences in perceptions of fairness in its dimensions of fair outcome and fair process. When asked whether respondents agreed that everyone in their community received the same level of flood protection before November 2009, 45% of respondents in Galway agreed that they had and in Cumbria 32% of respondents agreed ($\chi^2 = 5.05$, $p < 0.05$). Following the flood, not all households were treated equally. When asked if everyone in their community had received help promptly following the flood, 74% of respondents in Cumbria agreed, but in Galway less than half of respondents agreed with this statement (44%; $\chi^2 = 44.12$, $p < 0.001$). With regards to the allocation of resources, 74% of respondents in Cumbria felt resources had been distributed to those who needed them the most, and again, in Galway this number was smaller with 56% agreeing ($\chi^2 = 10.19$, $p < 0.01$).

In Galway authorities were deemed to be falling short of the responsibilities expected by their citizens as part of the social contract, resulting in a sense of helplessness among sections of the

population. This helplessness is then manifest in an unwillingness to take personal responsibility for flood protection. Reliance on charitable organizations, outside the formal humanitarian aid provided, was a source of government-directed anger from many Galway respondents and seen as a failure of government to meet the needs of the most vulnerable. The government's response in Ireland has been widely critiqued, fostering resentment and leading to litigation: affected Irish citizens initiated legal proceedings against authorities^{23,24}. Liability has not been so critically contested in Cumbria where there are processes to help ensure that charitable organizations work with formal institutions both during and following flood events (such as Cumbria's Council for Voluntary Services)²⁵. Actions taken by services on behalf of and funded by government, however, were not necessarily perceived as help from the state. To some extent, government action may be camouflaged by different interpretations on lines of command. Hence, perceptions of responsibility, even if they deviate from the policy landscape, are important in how individuals experience and negotiate the social contract.

Cumbrians surveyed, in contrast, manifest greater resilience in the face of recurrent adversity. This seems to stem as a response to previous experience of dealing with flooding in the context of a peculiar—but rapidly evolving—social contract. In other words, the relationship between past and recent experiences of flooding and their management, through significant past policy developments (for example, the Pitt Report²⁶, government's response to the 2007 floods) as well as imminent changes, is reflected in their willingness to adapt.

Context is therefore crucial. The expectations of present and future social contracts influence perceptions and behaviours; concurrently, social contracts develop in response to the specific jurisdictional circumstances in which they apply.

We find that adaptation options for changing risks are mediated by the social contract between state and citizen in every risk context. This means that vulnerable communities, where possible, use the means of political representation to create change that deals with the risks. At present, the government and insurance sector in England are renegotiating significant changes to flood insurance cover related to public management. A move towards risk-sensitive insurance would represent a significant development of the social contract, in terms of responsibility for adaptation between state, market and individuals but could also alter the profile of moral hazard (given that public consultation induces government emphasis on the more vulnerable that voice their concerns)^{27,28}. Such developments may lead to unjust outcomes: underpinning these discussions are tensions extant in the English context, where millions already inhabit areas prone to flooding. Were flood insurance to become unavailable or unaffordable, relocation to low-risk areas may be curtailed for those with limited resources and choice²⁹.

Where underlying economic structures shape risk and responsibilities, adaptation is a contested process constituted by a series of related but not concatenated events. Fairness, blame and liability therefore become dominant discourses among citizens who may be made more vulnerable by shifts in responsibility of states. We find in particular, that the expectation of the social contract on flood risk was breached in Ireland as a result of the 2009 floods, but is unlikely in either England or Ireland to be renegotiated to enshrine long-term resilience, given constraints on public sector financing of key agencies in both countries. Although individual extreme events, such as the floods in Cumbria or Galway, cannot solely be ascribed to a climate-change influence, there is increasing evidence for a higher likelihood of more precipitation extremes due to anthropogenic warming³⁰. Hence, we argue that climate-change adaptation is likely to proceed as a series of crises that are likely to disrupt planning and adaptation processes as instant solutions are sought.

This study sets an agenda for researching renegotiation of social contracts between citizens and states as a primary mechanism for adaptation. There are benefits to expanding methods in this area beyond detecting and forensically examining evolving contracts towards, for example, action-oriented research to provide platforms for transformative action with communities and political processes. This study also points to the fundamental importance of specific events as threshold elements in turning incremental adaptation into transformational change. Such thresholds are likely to be detected in many climate-change risks. If social contracts can be fruitfully negotiated through enhancing collective responsibility and citizenship, adaptation is likely to advance more smoothly and at less real cost to vulnerable groups.

Methods

We developed a survey and piloted it in the study areas in June and July 2010 in Ireland and in September 2010 in Cumbria. The main survey was administered face-to-face with individuals from households who had either directly experienced (at their place of residence at the time) flooding or not experienced flooding in November 2009, in selected geographical areas: during 9–23 August 2010 in Galway (west Ireland) in Ballinasloe, Claregalway, Athenry and Gort; and 18–30 September 2010 in Cumbria (northwest England) in Keswick, Cockermouth, Braithwaite and Workington. The questionnaire used was identical in both regions, with the exception of references to location-specific organizations and agencies.

Respondents were stratified into flooded and non-flooded areas, and surveyed every third house in randomly selected roads (with the exception of smaller settlements in Ireland where, owing to the small numbers of households flooded, every house was approached), at different times during the day. No-response households (or individuals who indicated interest in participating in the survey but were otherwise engaged at the time) received a paper copy of the survey that was collected later by the research team. A maximum of one interview with an adult per address was undertaken. Each interview took approximately 20 min to complete. No incentives for participation were offered.

In analysing the differences between locations and groups, we conducted non-parametric tests including Chi-squared (χ^2) to examine the differences between groups (flooded/non-flooded and Galway/Cumbria) and the Wilcoxon signed rank test (Z) to test within groups in the survey. The significance of all results was assessed at the 0.05 level.

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References

- O'Brien, K., Hayward, B. & Berkes, F. Rethinking social contracts: Building resilience in a changing climate. *Ecol. Soc.* **14**, 12 (2009).
- Adger, W. N. *et al.* Are there social limits to adaptation to climate change? *Climatic Change* **93**, 335–354 (2009).
- IPCC *Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation: Summary for Policymakers* (eds Field, C. B. *et al.*) (Cambridge Univ. Press, 2012).
- Johnson, C. L., Tunstall, S. M. & Penning-Rowsell, E. C. Floods as catalysts for policy change: Historical lessons from England and Wales. *Wat. Res. Dev.* **21**, 561–575 (2005).
- O'Brien, K. Global environmental change II: From adaptation to deliberate transformation. *Prog. Human Geogr.* **36**, 667–676 (2012).
- Dryzek, J. S. *et al.* Environmental transformation of the state: The USA, Norway, Germany and the UK. *Polit. Stud.* **50**, 659–682 (2002).
- Weale, A. New modes of governance, political accountability and public reason. *Gov. Oppos.* **46**, 58–80 (2011).
- Pelling, M. *Adaptation to Climate Change: From Resilience to Transformation* (Routledge, 2011).
- Kates, R. W., Travis, W. R. & Wilbanks, T. J. Transformational adaptation when incremental adaptations to climate change are insufficient. *Proc. Natl Acad. Sci. USA* **109**, 7156–7161 (2012).
- Park, S. E. *et al.* Informing adaptation responses to climate change through theories of transformation. *Glob. Environ. Change* **22**, 115–126 (2012).
- O'Brien, K. *et al.* in *Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation* (eds Field, C. B. *et al.*) 437–486 (Cambridge Univ. Press, 2012).
- De Sherbinin, A. *et al.* Preparing for resettlement associated with climate change. *Science* **334**, 456–457 (2011).
- Few, R., Brown, K. & Tompkins, E. Climate change and coastal management decisions: Insights from Christchurch Bay, UK. *Coast. Manag.* **35**, 255–270 (2007).
- Pelling, M. & Dill, K. Disaster politics: Tipping points for change in the adaptation of sociopolitical regimes. *Prog. Human Geogr.* **34**, 21–37 (2010).
- Tapsell, S. M., Penning-Rowsell, E. C., Tunstall, S. M. & Wilson, T. L. Vulnerability to flooding: Health and social dimensions. *Phil. Trans. R. Soc. A* **360**, 1511–1525 (2002).
- Walker, G. & Burningham, K. Flood risk, vulnerability and environmental justice: Evidence and evaluation of inequality in a UK context. *Crit. Soc. Policy* **31**, 216–240 (2011).
- Harvatt, J., Petts, J. & Chilvers, J. Understanding householder responses to natural hazards: Flooding and sea-level rise comparisons. *J. Risk Res.* **14**, 63–83 (2008).
- Whitmarsh, L. Are flood victims more concerned about climate change than other people? The role of direct experience in risk perception and behavioural response. *J. Risk Res.* **11**, 351–374 (2008).
- Lavers, D. A. *et al.* Winter floods in Britain are connected to atmospheric rivers. *Geophys. Res. Lett.* **38**, L23803 (2011).
- Walsh, S. *Report on Rainfall of November 2009* Climatological Note No. 12 (Met Éireann, 2010); available via <http://go.nature.com/OfxYAY>
- Miller, J. D., Kjeldsen, T. R., Hannaford, J. & Morris, D. G. A hydrological assessment of the November 2009 floods in Cumbria, UK. *Hydrol. Res.* (in the press, 2012); available at <http://www.iwaponline.com/nh/up/nh2012076.htm>.
- HydroEnvironmental Ltd. *Ballinasloe Flood Relief Study* Report No. 628-v1.3 (HydroEnvironmental, 2010).
- Cahill, A. Flooding victims take compensation case to Europe. *The Irish Examiner* (14 April 2011); available at <http://www.irishexaminer.com/ireland/kfojkfeyausn/rss2/>
- Jeffers, J. M. The Cork City flood of November 2009: Lessons for flood risk management and climate change adaptation at the urban scale. *Irish Geogr.* **44**, 61–80 (2011).
- Riding, K. *The Role of the Third sector in Helping Communities in Cumbria Recover from the November 2009 Floods* (Cumbria Voluntary Services, 2012).
- Pitt, M. *The Pitt Review: Lessons Learned from the 2007 Floods* (Cabinet Office, London, 2008); available via <http://go.nature.com/clZHXO>
- Johnson, C. L. & Priest, S. J. Flood risk management in England: A changing landscape of risk responsibility? *Int. J. Wat. Res. Dev.* **24**, 513–525 (2008).
- Harries, T. & Penning-Rowsell, E. Victim pressure, institutional inertia and climate change adaptation: The case of flood risk. *Glob. Environ. Change* **21**, 188–197 (2011).
- Pryce, G., Chen, Y. & Galster, G. The impact of floods on house prices: An imperfect information approach with myopia and amnesia. *Housing Stud.* **26**, 259–279 (2011).
- Coumou, D. & Rahmstorf, S. A decade of weather extremes. *Nature Clim. Change* **2**, 491–496 (2012).

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Author contributions

W.N.A. and I.L. conceived the study. W.N.A., I.L., T.Q. C.M. and J.S. designed the study. C.M. and T.Q. implemented the survey. All authors contributed to writing the paper.

Additional information

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Competing financial interests

The authors declare no competing financial interests.