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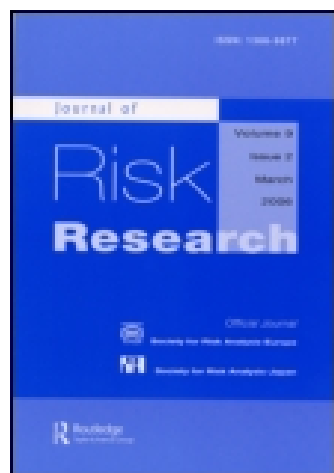
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Understanding householder responses to natural hazards: flooding and sea-level rise comparisons

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Starting from a general understanding that experience of hazards is important in motivating protective response, this paper reports a novel study to understand the relationship between householder experience, understanding and response to two natural hazards – flooding and sea-level rise – in three contrasting high-risk areas of England. It presents a generic Individual Understanding and Response Framework (IURF) as a simple but potentially valuable means of comparing hazards and expressing the dynamic processes that appear to heighten or attenuate understanding and drive or constrain responses to specific natural hazards. The IURFs confirm the complexity of factors underlying householder understanding and response. Even in high-risk areas a lack of recent direct personal experience of flood events serves to attenuate understanding and to constrain motivation to take personal action. For sea-level rise, as yet a largely ‘unknown’ hazard in the local context, perceived responsibility to act is transferred to others. Social networks are confirmed as important local sources of information often more important than the official. People evaluate potential protection or mitigation measures in terms of their efficacy, cost and implementation barriers. The paper concludes with discussion of the communication and engagement implications for communities at risk from natural hazards.

Keywords: flooding; sea-level rise; social amplification; natural hazards; responses; perceptions

Introduction

Natural hazards are part of human history. However, over time population growth, urbanisation and the enhanced value of capital stock have served to increase significantly natural hazards exposure, vulnerability and incurred economic losses (Parker 2000; [Mitchell 2003](#); Wisner et al. 2004). Global climate change is enhancing the interactions between people and their environment. For example, in some areas the interaction of river flooding and sea-level rise could produce substantial increases in flood risk (e.g. [Bronstert 2003](#)). As losses grow, both tangible (physical and economic) and more intangible (e.g. pain and suffering), there is an urgent need to understand the relationship between people and natural hazards ([Mileti 2001](#)). Natural hazard management requires a careful ‘combining of individual, community and national action’ (Burton et al. 1993, 163).

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Taking precautionary measures can reduce householder vulnerability, either before an event or by reactive adaptation during an event (Grothmann and Reusswig 2006). However, there is significant evidence that householders living in natural hazard areas often fail to act, or do little to lessen their risk of death, injury or property damage (e.g. Kunreuther 1978; Peek and Mileti 2002; Siegrist and Gutscher 2008).

It is essential to understand the factors that influence mitigation behaviour including whether people are motivated to take preventative actions (Siegrist and Gutscher 2008). This is certainly the case in the UK, perhaps a country not normally associated with devastating natural hazard events but one particularly affected by flooding and increasingly climate-change induced sea-level rise. An estimated 2.4 million homes in England are at risk of flooding, 0.5 million of these at serious risk (Environment Agency 2009). Over 1.5 million people in England and Wales have a greater than one in 75 annual chance of experiencing a flood (Evans et al. 2004). The most recent widespread severe flood event occurred in June/July 2007 impacting Hull, Sheffield, Gloucester and Tewkesbury in particular, with 13 people killed, 55,000 properties flooded and 7000 people having to be rescued. The estimated costs of the 'event' have been put at £3–6 billion (The Pitt Review 2008). Other recent serious flood events have occurred in Boscastle (2004) and Carlisle (2005) and in November 2009 across Northern Ireland, Cumbria and south-west Scotland.

The impact of sea-level rise due to ongoing isostatic adjustment combined with climate change impacts could have significant impacts particularly in the south and east of England. Hulme et al. (2002) predicted that under high-emissions climate impact scenarios rises could be as high as 80 cm by 2080s compared with the 1990 baseline. However a reassessment as part of The Pitt Review (2008) suggested that larger rises up to 1.6 m could be a small but real possibility, with the H++ scenario under the latest (UKCP09) projections varying between 93 cm and 1.9 m (albeit 'highly' unlikely) (Jenkins et al. 2009). The UK Foresight project predicted that flood damage could increase in real terms by between 2–20 times by the 2080s, due to a combination of climate change (primarily through changes in storm patterns and sea levels) and increased wealth in flood risk areas placing more assets at risk (Evans et al. 2004).

To date, most research in the UK has examined public responses 'after an event' and focused on one hazard (flooding). There has been a significant deficiency of work examining the understanding and potential responses of people who are at risk but who have no recent direct experience of the effects of flooding (riverine or coastal). Furthermore, no work has attempted to compare responses to different (but linked) hazards. This paper reports the findings of a novel comparative study (see Harvatt 2008 for detail) of householders' understanding and responses to both flooding and sea-level rise in the UK and presents a new explanatory framework in relation to natural hazards – the Individual Understanding and Response Framework (IURF). Before discussing the results and their implications the next section provides further theoretical background.

Background

Direct experience of hazards is an important factor influencing an individual's risk perception increasing personal salience, heightening understanding and strengthening mitigation behaviour (e.g. Kates 1962; White 1974; Weinstein 1989; Zaleskiewicz,

Piskorz, and Borkowska 2002; Kreibich et al. 2005; [Siegrist and Gutscher 2008](#)), with knowledge about flooding and response requirements increasing with repeated exposure. Certainly, direct experience of flood damage has been seen to be important in encouraging insurance purchase to protect against future losses (Baumann and Sims 1978; [Zaleskiewicz, Piskorz, and Borkowska 2002](#)). If experience is so important this raises key questions about whether and how people can be motivated to action if they have little prior experience of the potential value of that response. This question was the primary motivation for this study.

[Kates \(1971\)](#) and [Burton et al. \(1993\)](#) postulated that for residents in high hazard areas there is a perception threshold below which no action is taken. The threshold is unique to the individual, relating to their previous experiences as well as their personality traits and propensity to gamble. Thus, [Burton et al. \(1993\)](#) examining the attitudes and behaviour of people in US hazard zones identified four behavioural patterns:

- (1) Absorb – denial of a risk or that the hazard poses a threat to them personally.
- (2) Accept – understanding of hazard effects may be significant but no perception of a personal action role.
- (3) Reduce – understanding of potential damage and willingness to take emergency action upon receipt of a warning.
- (4) Change – willingness to take preventative action to reduce a future hazard, for example moving house or changing land use.

Such response typologies have been criticised as representing little more than a crude behavioural gloss contributing little to understanding of individual adjustment processes ([Torry 1979](#)). A greater emphasis has been placed on the socio-political factors that underlie natural hazard events (e.g. [Mitchell, Devine, and Jagger 1989](#); [Blaikie et al. 1994](#); [Parker 2000](#)), risk being experienced not only through direct physical harm, but as a result of processes by which people and groups learn, acquire and create interpretations of risk. [Mileti \(2001\)](#) argues that social and economic factors influence response (not least in the absence of experience), and economic considerations have a powerful influence on mitigation. Risk perception research confirms that the way that an individual chooses to respond to a hazard depends on both the threat (certainty, severity, immediacy, etc.) and the personally available alternative actions (due to cost, efficacy, time requirements, etc. ([Fishbein and Stasson 1990](#))).

Flood warnings are important in energising immediate response to an event and a rich literature has developed around the effective construction of messages (e.g. [Parker 1992](#); [Handmer 1997](#); [Parker, Tunstall, and McCarthy 2007](#)). The ways in which people understand such messages is a function not only of how and when they are disseminated, but also the content. As in all risk communication, trust in the communicator is crucial, with evidence that those unsure about the source of warnings tend to rely more on their social networks than on official communication ([Drabek 1986](#); [Parker and Handmer 1998](#)). Indeed, recent work argues that second-hand experience (i.e. information) about flood risk is less likely to produce action than direct knowledge and social interaction ([Whitmarsh 2008](#)). People may be able to envisage that their house would be ruined during a flood but may not be able to envisage the negative effect (including emotional). Knowledge might

exist but may not be sufficiently advanced for proper awareness (Knocke and Kolivras 2007).

Sea-level rise would seem to offer even greater challenges in terms of communication to engender response not least because of the uncertainty surrounding the scale and extent of likely future rise and the chronic rather than episodic nature of the effects. Compared to flooding, people's responses to sea-level rise are largely unknown. But we can draw some evidence from the climate change literature. In both the US and UK people have been seen to attenuate the personal risks from climate change (Lowe et al. 2005; Lorenzoni and Pidgeon 2006). Niemeyer, Petts, and Hobson (2005) found that attributions of cause and effect, responsibility for action and levels of trust were important in perceptions of, and responses to, rapid climate change, with responses varying from concern to scepticism, and from action to apprehension. Similarly, Bickerstaff, Simmons, and Pidgeon (2004) found that even when individuals considered that they might be vulnerable to the effects of climate change they had difficulties relating the consequences to their everyday experience of their local area.

While it might be hoped that people will respond to sea-level rise if their concern and motivation to act is heightened by a serious flood, recent work (Whitmarsh 2008) suggests that flood victims and non-victims alike are sceptical about whether climate change is a primary cause of flooding. Furthermore, response appears potentially to be limited if people continue to believe that personal action is of little use unless there is also strong national and international action (Niemeyer, Petts, and Hobson 2005). Diffused responsibility for the problem could be a form of denial 'that creates the bystander effect' (Marshall 2001, 41).

The Social Amplification of Risk Framework (SARF) (Kasperson et al. 1988; Renn 1991; Kasperson 1992; Pidgeon, Kasperson and Slovic 2003) is one conceptual framework for studying the general processes that explain why some risks come to be amplified in society while others are attenuated. SARF recognises that amplification occurs in both the transfer of information about risk and in the response mechanisms of society. Thus, 'risk events' will be largely irrelevant to people unless they directly observe them and then communicate them to others. This study sought particularly to elaborate upon these components. But one problem with SARF has always been around its central metaphor of amplification and the sender-message-receiver model of communication on which it rests which can appear to downplay the social construction of risk (e.g. Rayner 1988; Svenson 1988; Murdock, Petts, and Horlick-Jones 2003; Wardman 2008). Its original authors have always argued that the complex social interactions that underpin risk responses can be accommodated in the framework, although it certainly can be interpreted as supporting instrumentalism in terms of a risk message model and having a rational actor slant (Jaeger et al. 2001; Wardman 2008). As Pidgeon, Kasperson, and Slovic (2003) argue, the experience of risk is not only that of physical harm but results from the processes by which individuals and groups create interpretations of the risks. Meaning, social interaction, context and setting (spatial/physical, experiential, social) all play a role in shaping the sense that people make of, and the way in which they co-construct, any specific risk issue (Petts, Horlick-Jones, and Murdock 2001; Horlick-Jones 2008).

Slovic et al. (2004) identified emotional responses (the affect heuristic) as a way in which people deal with risks and there is a suggestion that effective risk responses may only occur when both affective and deliberative-analytic

considerations come into play (Wardman 2006). Harries (2008) has linked affective responses with the positive (rather than negative) assessment that people seem to be able to apply to living in an area at risk of flooding through a focus on the social representation of 'home'. He argues that people's apparently 'irrational' refusal to prepare for flooding is in fact entirely functional in the context of their own motivational priorities, not least personal representations of their 'home' as innately safe and of 'nature' as inherently benign. In such a context an expert/authority discourse that stresses the importance of individuals taking flood-risk mitigation actions could be 'drowned out' unless it can be turned into a more effective dialogue with communities.

The other limitation of SARF is its focus on centres of political and economic power which amplification processes tend to devalue in terms of their knowledge, expertise and attempts to manage risk (Murdock, Petts, and Horlick-Jones 2003). In the context of the two hazards explored here there are significant but different interests (not least of the regulatory agencies and of the insurance industry) whose assumptions and frames of meaning clearly achieve a central position in any local risk management context. What is of interest is how and to what extent these impact on householders' responses to the risks and to what extent personal and social resources can be mobilised to enhance individual behavioural responses.

So, while fully acknowledging that SARF carries the price of simplification nevertheless it did seem to offer at least a basic explanatory metaphor for collating the evidence gathered about the relationship between people's experience, understanding and response to flooding and sea-level rise. This would be the first time that this relationship had been analysed in a comparative context amongst people who are at high risk from both of the hazards but who have no recent experience of the impacts of either.

The study

The study focused on three contrasting locations in England at high risk in terms of both flooding and sea-level rise: Aldeburgh in Suffolk, Barnstaple in North Devon, and Truro in Cornwall (see Figure 1). Aldeburgh is a small town on the low-lying Suffolk coastline vulnerable to sea invasion and with a potential flooding hazard relating to the location of the River Alde. Aldeburgh was one of the areas affected by the major East Coast storm surge of January 1953, unique in modern British hazard experience in terms of nature, impact and severity, with 24,000 homes flooded, 32,000 people evacuated and 307 killed. The majority of current properties on Aldeburgh's sea frontage are defended by a beach backed by a seawall (which is frequently overtopped in storm events). At the time of this study, the Suffolk Estuarine Strategies options appraisal was underway by the Environment Agency and the flood interest group (the Alde and Ore Association) was active in contributing to the public discussion of the latter.

Barnstaple, in North Devon, is at risk from flooding from a combination of the River Taw, one of its tributaries, the Yeo, and the tidal estuary. Following floods in 1981 and 1984 a major flood defence scheme was installed which if breached could leave 1400 properties at risk. Unlike Aldeburgh, there is no active local flood group, with direct experience of serious flooding limited. Truro in south Cornwall similarly has no significant local flood interest groups but is prone to flooding from the rivers Kenwyn and Allen exacerbated by house building on the flood plain. The last major



Figure 1. Map of England and Wales showing locations of the sites selected.

flood was in 1999 with 17 properties directly affected. Like Barnstaple it was hypothesised that the estuarine rather than direct shoreline location of the town may mitigate awareness of direct threats from the sea, nevertheless a predicted sea-level rise of 16–76 cm by 2080 could have a major impact on the local drainage system increasing flood risk further.

Devon and Cornwall have suffered extreme flood events in the past, most notable being the devastating Lynton and Lynmouth (North Devon) floods of 1952 which killed 34 people. In 2004, a major flood in Boscastle (North Cornwall) resulting from an extreme local rainfall event resulted in catastrophic damage to property in the small coastal village but fortunately no deaths. In terms of both Barnstaple and Truro these events have potentially less directly impacted on local families compared with Aldeburgh's collective experience of the 1953 storm, but nevertheless local general knowledge was expected to be heightened.

Multi-site work provides the significant advantage of interpreting public knowledge and response across different social, physical, economic and political contexts. It allowed the research to respond to the local context of natural hazard experience and response. The study used two interrelated components: in-depth, face-to-face interviews and a structured questionnaire. Potential interviewees were recruited by identification from electoral registers and telephone directories of addresses in postcode areas at high risk, judged from Shoreline Management Plans, and/or the Environment Agency's Flood Maps. To optimise the chance of gathering a wide range of experiences, sampling parameters included length of time resident in the area and in current property (from less than 5 years to more than 20 years), property tenure (ownership vs. rental), age (as an indicator of both experience and familial responsibility) and gender. Thirty-five interviews across the three areas were analysed and the analysis informed the design of a questionnaire to test the strength of the views and whether these were more widely prevalent.

A sample of addresses from which to recruit respondents for the questionnaire was selected to represent a larger set of the households classified as at risk for the interview component. One hundred and eighty questionnaires were posted to addresses across the three locations and 77 responses (43%) were received. All 77 answered questions on flooding but only 43 of these also answered questions relating to sea-level rise (the latter limited to the Aldeburgh and Truro questionnaires).

Individual Understanding and Response Framework (IURF)

In summary, the study has shown that individual householders' understanding and response to both flooding and sea-level is driven by a diversity of evidence and experience drawn from and reflecting people's immediate physical and social environments. We have drawn on the SARF framework to present an IURF to collate and characterise dynamic processes identified as underlying or constraining individual understanding and responses to flooding and sea-level rise. The IURF identifies key processes that seem to heighten (amplify) or attenuate understanding and drive or restrict precautionary responses/adaptations. Given the limitations of SARF we are not suggesting that the IURF fully explains the complex social and individual processes and responses to these two hazards. But it does help to gather and collate evidence around key components that appear to amplify and attenuate understanding and behavioural response. The link from understanding to response is explicitly presented through this approach, something that has rarely been analysed. In doing so, it is hoped that the IURF at least offers a useful comparative lens which could inform further work.

Figures 2 and 3 respectively present the IURFs for flooding and sea-level rise. The characteristics of the hazard are presented on the left of each Figure. Thus, flooding (Figure 2) presents acute effects to property, has immediate and highly visible impacts and is both a natural hazard and one affected by anthropogenic actions. Sea-level rise (Figure 3) presents more chronic effects on property not being episodic and is currently largely 'invisible' to people. However, like flooding it has both natural and anthropogenic causes.

The IURF for each hazard then identifies the factors that seem to either amplify or attenuate understanding. These represent a combination of experience and individual understanding. Experience is both direct (i.e. personal) and indirect via social networks, through media reporting and direct official communication. In our

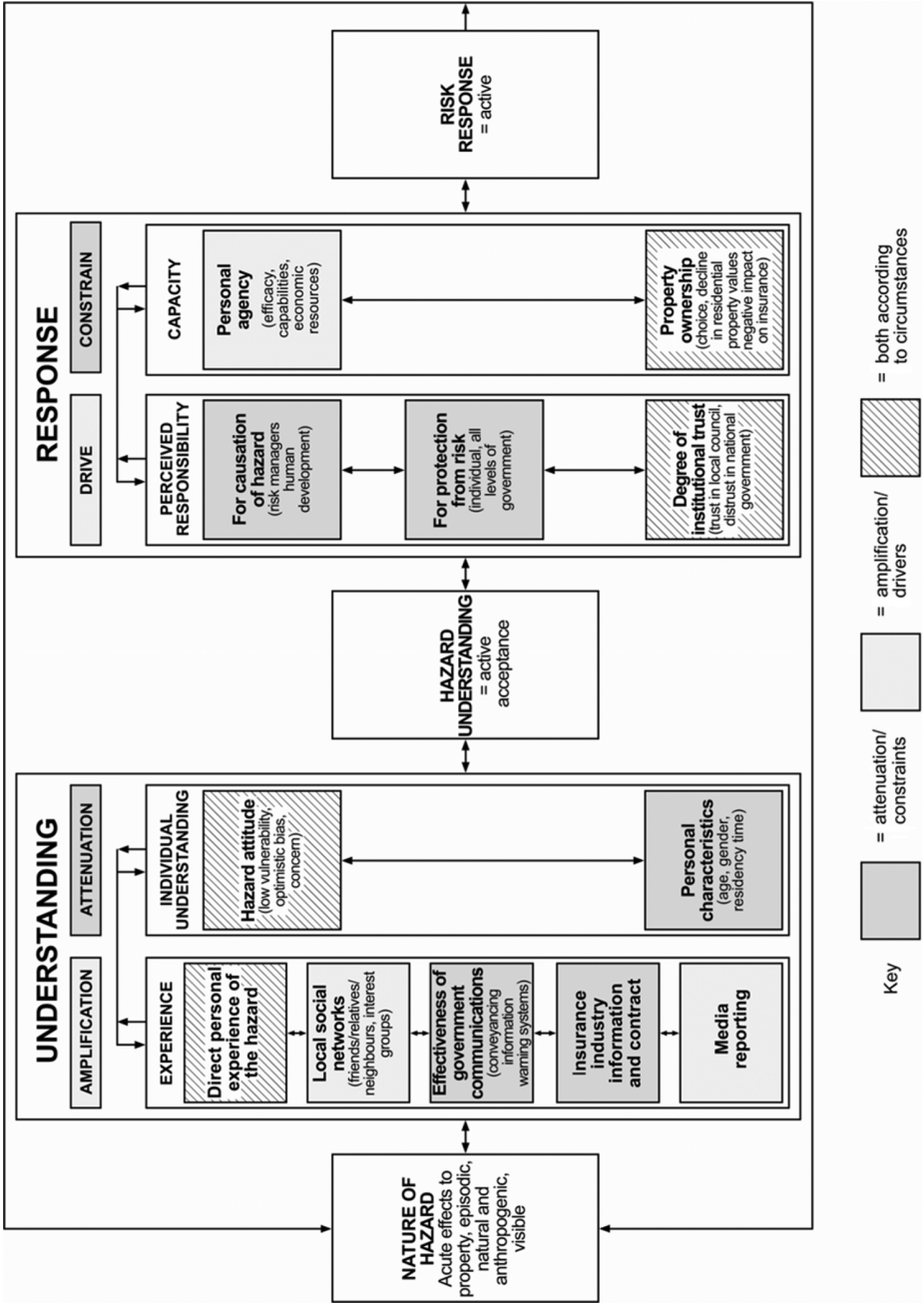


Figure 2. Individual Understanding and Response Framework (IURF) for flooding.

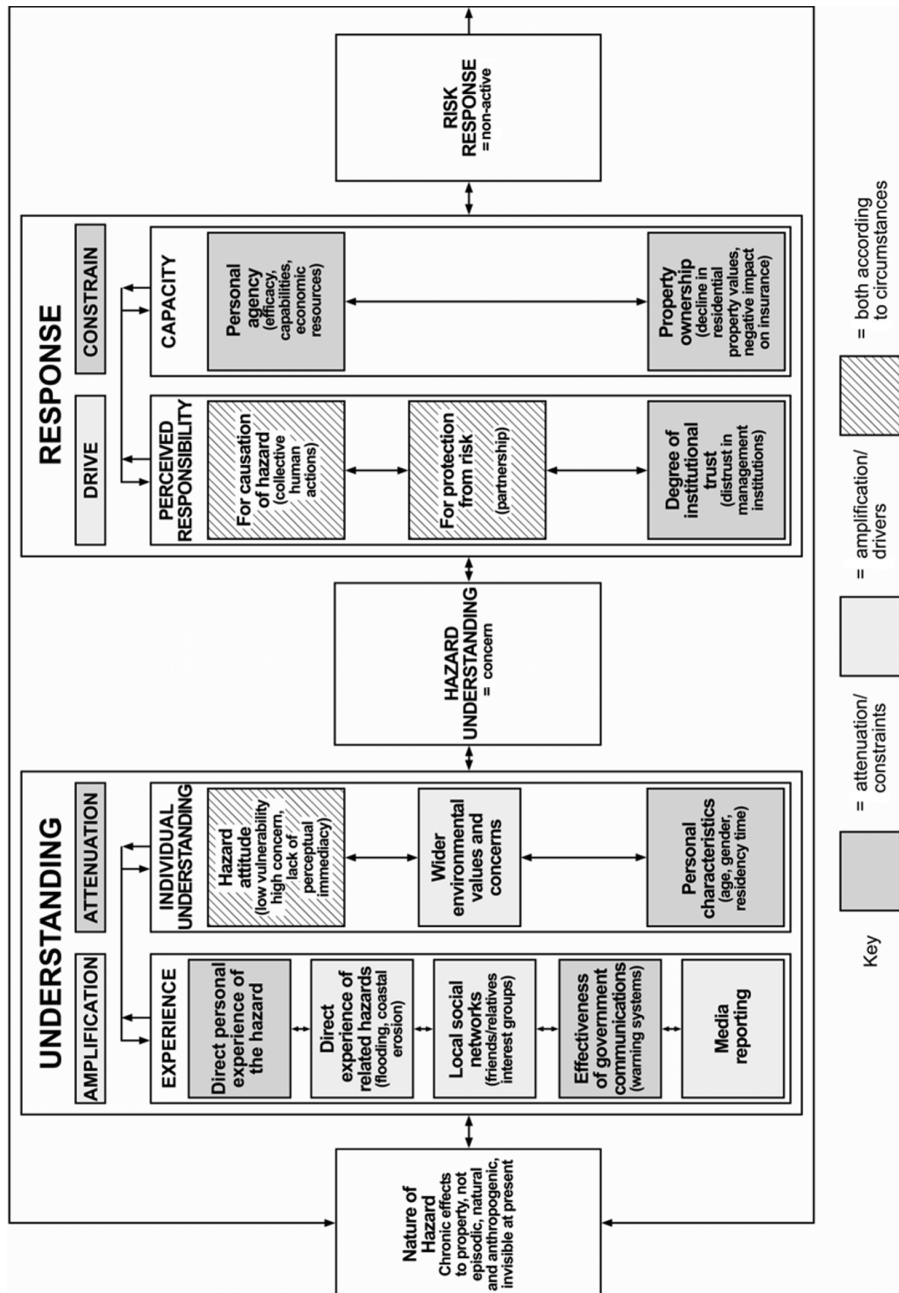


Figure 3. Individual Understanding and Response Framework (IURF) for sea-level rise.

case studies, despite all three locations being high-risk areas it is the latter (i.e. indirect experience) that dominates. Individual understanding arising from indirect experience generates a 'hazard attitude' focused on denial of susceptibility or vulnerability.

In this study, the influence of socio-demographic factors such as age, gender and residency time revealed subtle, but largely weak and inconsistent relationships with risk perceptions ('Personal Characteristics' in Figures 2 and 3) and for this reason are not discussed in detail here. We are not suggesting they are unimportant and of course Slovic (2000) has collated multiple strands of evidence of a 'white male effect' in terms of risk perceptions. However, all we can conclude in our relatively small study in specific local contexts is that there was little evidence of strong gender differences of response.

Only for a small group of individuals in high-risk areas is there evidence of the impact of wider environmental values and concerns in relation to global climate change that manifest themselves in discussion and understanding of sea-level rise (Figure 3). In both cases we characterise the nature of the hazard understanding as either 'active acceptance' (Figure 2 – flooding) or 'concern' (Figure 3 – sea-level rise).

This understanding directly impacts on the response, which for both hazards is driven by perceived 'responsibility' and the 'capacity to act'. Again different factors either drive or constrain response. 'Perceived Responsibility' combines both causation of the hazard and protection from the risk and where neither reveals any individual or personal culpability the degree of trust in institutional response becomes important. 'Capacity' combines both personal agency (efficacy, capability, economic resources) and dimensions of property ownership. Home ownership provides more choice and greater freedom and opportunity to take independent action (e.g. through purchasing insurance, making physical alterations, etc.). Yet for those who own property there are also negative outcomes of living in high-risk areas, for example in property value depreciation.

Each IURF culminates on the right-hand side in a risk response characterised as either 'active' in the case of flooding (Figure 2) or a non-active simple 'acceptance' in the case of sea-level rise (Figure 3). In both IURFs, we use shading to signify the influences that 'amplify' understanding of risk (light) and those that 'attenuate' (dark). In the response stage shading signifies influences that 'drive' active response (light) and those that act as 'constraints' (dark). Where a 'hatched' shading is used this suggests influences that can both drive and constrain response in different personal, social and environmental circumstances.

The following discussion draws on the evidence from both the interviews and survey to explain further the dimensions of the IURF for each hazard.

Experience and understanding

Interestingly, despite living in high-risk flood areas (as defined by the Environment Agency), over half of the interviewees did not perceive themselves to be personally at risk from flooding. Indeed in Truro 70% ($n = 25$) of the survey respondents ranked the risk as 'low' or 'very low'. Only in Aldeburgh did some 60% ($n = 15$) of respondents consider themselves as at 'moderate' or 'high' risk. Here, in both the interviews and the survey responses there was clear evidence that the very close proximity of the sea and its interrelationship to the river estuary served to present a tangible and visible hazard. But still for the small minority of our householders who had experienced an

event in the past memory seems to have faded. For the majority who had no direct personal experience of the acute effects of a flood hazard understanding of the risks has been attenuated.

In Truro, flood defence improvements were evidently one reason for the low concern seeming to suggest to householders that the risk had been eliminated or at least minimised, for example:

We have already had major flood aversion work done so the risk is now minimal ... the whole of Truro City Centre used to get flooded but since they have widened the river or done something, the problem is not so bad. (Graham, Truro)

Figure 3 depicts a lack of sea-level rise response, arising from the inability of individuals to conceptualise a hazard that has not yet happened. Unlike flooding where the memory of an event has simply faded, experience of sea-level rise has yet to be realised. With the lack of opportunity to learn from previous experience, indirect experiences became more important. For both flooding and sea-level rise householders drew on knowledge derived from other people in their social networks to validate perceptions and contextualise the hazards, for example:

Going back there was a lot of flooding in this area. It was just before I moved in fortunately ... my neighbour was flooded out next door and they had to have new carpets in. That's basically how I knew about it. (Urika, Barnstaple)

I wasn't here, but my first husband at the time was the then Mayor of Barnstaple and he went round after the floods had died down, helping to drum up money to give to the householders to help them with all the damage that had occurred, but I did not see it myself but he did and he told me. (Sarah, Barnstaple)

But while people commonly recounted acquiring knowledge about events, very few were collecting information about protection. Even in Aldeburgh where the local environmental group (Alde and Ore Association) was reported by some as having raised personal awareness of flooding (40% ($n = 10$) of survey respondents) and of sea-level rise (32% ($n = 8$)), there was little evidence of active response to reduce personal risk.

Figure 3 suggests that sea-level rise was understood through other local concerns that were directly experienced and/or personally relevant (such as coastal erosion). Similarly, there was evidence that perceptions of sea-level rise were conflated with those of flooding. All survey respondents were asked to rank their personal risk from the case study natural hazards compared with other environmental and societal hazards (such as traffic, air pollution, water pollution, radioactive waste, terrorist attacks, etc.). Sea-level rise was ranked higher in Aldeburgh (first) compared with responses in Barnstaple (seventh) and Truro (eighth). Issues of location and experience were evident, Aldeburgh being visibly affected by the impacts of the sea if only during a storm event when the coastal road might be affected by heavy spray and debris. A significant minority of interviewees in Aldeburgh recognised that changes in sea level could increase the flood risk in the area, for example:

The two go together that the river is only going to flood from the sea tide, that's never going to flood from rainfall. It's essentially a tidal estuary ... so really a sea flood and a river flood is actually the same thing, it's merely about which defences are stronger. (Matthew, Aldeburgh)

If the sea rose and hit the river and they joined, then the river would come over here from the marshes. (Paula, Aldeburgh)

Heavy and sustained media coverage of flooding in other parts of the country and of global sea-level rise appeared to be an important means of raising general (but not local) awareness. For most interviewees the media seemed to remain a source of relatively impartial fact, a construction of reality, but not one sufficient to support sustained personal concerns. The profile given to sea-level rise was quite different, the media seeming to contribute little understanding even in Aldeburgh where the general risk had been ranked comparatively high, for example:

Only really what you hear on TV and things about global warming, ice melting, and sea levels rising everywhere, that's really my knowledge and that's limited to what I have heard on various TV programmes. (Katie, Aldeburgh)

I don't see any significant global warming, yes the seasons are not quite so marked as they were, its not warmer or colder or whatever, it is this awareness when you see ice caps melting on television, I suppose it's from the media as much as anything. (Frederica, Truro)

These findings resonate with earlier climate change studies (e.g. [Bostrom et al. 1994](#); [Bord, Fisher, and O'Connor 1998](#)) that observed how public concern and interest was heightened only temporarily by media coverage.

Whilst individuals were concerned and aware of flooding and sea-level rise this was not grounded in knowledge gained from interaction with government agencies (illustrated using dark shading in Figures 2 and 3). Official information on flooding (e.g. flood warning advice) was widely dismissed or reportedly ignored, seeming to lack relevance to most people. Despite the Environment Agency publishing the online Flood Risk Map, a majority (67% ($n = 52$)) had not seen the flood map for their area, 63% reportedly unable to access it. Of those who had seen the information few seemed to be using it to determine their personal risk and none discussed the information in terms of personal preparation for floods. A fundamental criticism related to the insufficient definition of risk bandings, with the maps at too coarse a scale to usefully define specific risks, for example:

We went in and put in our postcode, we were a two, medium risk ... the trouble is it is too broad, they have taken too big an area, it is badly thought out, it's worse than useless ... because it does not take into account the small scale local geography. (Clive, Truro)

Interestingly, it was evident that the majority of residents still perceived that government should be the primary source of risk information, even if it was not locally specific, for example:

The EA are the ones producing the Flood Map, so they should let people know that they are in a hazardous area. (Robin, Aldeburgh)

I don't see who else I could make responsible for this sort of specialist thing. You could argue that local government should, but they do not possess the specialist expertise like the Environment Agency. So, it has to be the Government. (Luke, Aldeburgh)

The context within which risk information is provided, perceived, processed and accepted is important because unless it can be directly related to their own situation,

people may ignore it. Institutions like the Environment Agency were often perceived as being distant from the local context and therefore lacking immediately relevant information. Local knowledge proved to be a key factor in increased hazard awareness, but at the same time it seemed to support a lack of acceptance of, and need for, personal responsibility and action.

Those who had experienced a flood in the past (a minority) were quick to recall the essential nature of unofficial warnings within their neighbourhood and community, suggesting that 'popular' science and 'folk' wisdom have much to offer in encouraging behavioural responses (Irwin 1995) and that social networks are powerful and influential modes of communication. This contrasts with the generic spatial resolution of government flood warnings. Indeed, in relation to flooding, individuals seemed unable or unwilling to respond 'appropriately' given the top-down approach to communication and information provision, which lacked any real appreciation of the context of people's behaviour (depicted by dark shading in Figure 2). The key risk agency might think that it is in a situation of power in terms of risk understanding in the local context but it still seems to have some way to go before its arguments are treated as credible and authoritative. It might have established the dominant agenda (Murdock, Petts, and Horlick-Jones 2003) but has yet to achieve legitimacy and trust.

Related to the perceived and actual problems in obtaining flood insurance and buying and selling property in the flood plain, public support for the flood risk map was extremely muted, with interview discussions centred on the adverse insurance implications (of being able to obtain adequate cover) and blight on property values. Expert assessments of risk levels were met with scepticism, especially when viewed as impacting negatively on the responses of the insurance industry, for example:

If insurance companies just slap on a premium by a postcode they are going to shoot themselves in the foot. It may take a couple of years for people to realise they can get insurance cheaper elsewhere. (Kevin, Barnstaple)

I would argue and fight like hell if they said because I am in the postcode IP15 that I am going to flood, because I live higher up and I am not going to flood ... I know people's premiums have gone up in the town for being IP15. (Ian, Aldeburgh)

Complex power dynamics appear to be at play here between the Environment Agency's goal to raise risk awareness and an insurance industry perceived as seeking to make money from 'lines on a map'. Clearly some householders may have the ability to argue their case against seemingly 'unfair' insurance premiums but for others initial amplification of understanding of risk could result in denial if they lack the resources (time, money, knowledge, ability) to find cost-effective cover – i.e. they may opt to leave their property uninsured.

Response and adaptation

Householders fell into two main response categories according to the extent of mitigation taken and the effort involved in doing so. We broadly classify this as 'active' and 'non-active'. Non-active was the dominant mode in relation to sea-level rise (64% of survey respondents ($n = 27$)) whilst active responses were more evident for flooding (59% of survey respondents ($n = 45$)), although our definition of 'active' is cast quite broadly.

Table 1. Hazard attitudes and modes of responses to flooding and sea-level rise.

Response mode and attitude		Example response
Non-active	Denial of hazard	Optimistic bias, others more at risk
	Accept risk	Limited choice, perceived lack of efficacy, transferring responsibility for causation and protection, seeking information from social networks
Active	Reduce (active response to prevent losses)	Using flood warning service, reading emergency response information, purchasing insurance, obtaining sandbags (flooding), reducing carbon emissions (sea-level rise)
	Adapt/change (a proactive personal change)	Moving from the hazard location or planning to do so

Table 1 provides an overview of the types of responses householders described during the face-to-face interviews, which map largely with Burton et al.'s (1993) general hazards response categorisation (discussed earlier). The mode of non-active response included active denial of personal risk and the belief that others in different locations are at greater risk. Passive acceptance of the risk was articulated at best as seeking information from friends and families but there was a lack of belief in any personal responsibility for action.

Active responses ranged from those that reduce the economic impact of individual losses through loss sharing (insurance purchase) to those that reduce loss through active mitigation, to the extreme of actually moving from the hazard location (change). Warning mechanisms were also included in this category; not only those that have been provided, such as the Environment Agency flood information packs, but also warnings in advance of a flood event, for example, through weather forecasts. For the small number of respondents who had experienced a flood event actions such as obtaining sandbags were included within the category of active responses.

It was evident that there was a general reluctance to accept a share of personal responsibility for the existence of the hazards (even those associated with anthropogenic causes). Regardless of the level of risk interview respondents often declared that they were not personally at risk or that they were less vulnerable than others, for example, 'I would think that other areas of the south-east would have problems [related to sea-level rise] before Barnstaple' (Stephen, Barnstaple). This optimistic bias (Weinstein, Klotz, and Sandman 1988) seemed to constitute a barrier not only to acceptance of the risk but also to active responses. Of course, denial of a threat is in itself a potential coping mechanism (Taylor and Gollwitzer 1995). As Harries (2008, 487) concludes 'to acknowledge that your home is not safe, that society will not always protect you against floods and that nature is not always benign is to enter a phenomenological territory where material security is no longer certain and new anxieties must be faced'. In denying their susceptibility to a threat individuals weaken their intention to act, for example:

Some areas in North Devon have a problem with flooding, but not where we live. I suppose if it was a massively severe event then you might be in danger, but I would not consider myself one of those vulnerable people. (Stephen, Barnstaple)

For most people it actually seemed pointless to take personal responsibility for action. For example, water was perceived as having 'a nasty habit of getting round most

things. So it's no use trying to protect a particular house, you need the whole river bank protecting' (Clive, Truro), Ian (Aldeburgh) did not believe that anything could be done by him to stop sea-level rise but 'nationally there are ways to stop it'.

The diminished sense of perceived individual responsibility for causation of flooding acts as an important barrier to action (depicted by dark shading in Figure 2). In common with evidence in other health and environmental contexts (e.g. Harrison, Burgess, and Filius 1996; [Bickerstaff and Walker 2002](#); [Petts 2005](#)), householders commonly transferred responsibility to others for both causation of the hazards and for action, in the case of our hazards to risk managers in local and central authorities. For example, flood-prone areas were believed to lack adequate maintenance of drains and tidal barriers were perceived as being poorly planned, for example:

It was raining very hard the tide had backed up the drains so that they were full of tidal water. The fresh water coming down had nowhere to go, that was the main reason for flooding. (William, Barnstaple)

One of the problems is if everything is in the wrong direction and they don't open the gates allowing the water to come in, it builds up in Truro and that's when you get flooding. (Fred, Truro)

Certainly, human development was conceived as having a substantial impact on sea-level rise. In this respect, the complex causality of sea-level rise plays particularly strongly to the natural tendency towards collective responsibility for causation. For the majority of interviewees, members of the public, risk managers, society generally and even other countries were all blameworthy (depicted using the 'hatched' shading in Figure 3).

Blame for increased carbon emissions encompassed inadequate control of carbon emissions by other countries, a lack of renewable energy and the general reliance on personal vehicles, for example:

I think we are all to blame really, unless we try to use less fossil fuel it will go on [sea-level rise]. I think emissions have a lot to do with it. I personally think we all ought to go in for renewable energy. (Harriet, Truro)

We are all to blame to a certain extent because we want the lifestyles of having cars, washing machines, driers, we use fossil fuels. But, I do feel that there are countries that are causing it to happen more. The United States of America, they drive everywhere, you can't even walk anywhere because there are no paths for walking. (Paula, Aldeburgh)

Hence, in relation to sea-level rise, the obligation to act to reduce risk was firmly placed upon central government, which was perceived as having greater scope for action and decision-making than individual householders. Both decisions and action to halt future sea-level rise were also demanded of other countries, for example:

I don't think the Government knows nor has a policy on it at the moment. They are doing things like the Kyoto Protocol that type of thing, but it's too little too late. They are trying to do something about CO₂ and Australia and America would not sign up to it. (Clive, Truro)

As depicted in Figures 2 and 3, capacity to respond and perceived personal responsibility for protection seem to have a crucial role in mediating behavioural responses to flooding and sea-level rise. From the survey data it was apparent that the public hold

authorities most responsible for providing protection against natural hazards, correlating with other work on responsibility in relation to earthquake risk (e.g. Jackson 1981; Turner, Nigg, and Paz 1986). Individual householders were rarely perceived as responsible for protection from either flooding or sea-level rise. 'National government' and the 'Environment Agency' were perceived as those having most responsibility for protection against sea-level rise (75 of respondents ($n = 58$) for both), whereas 'local government' was regarded as particularly responsible for protection against flooding (81% of respondents ($n = 62$)), an interesting response as local government's responsibility generally only extends to protection from pluvial as opposed to fluvial flooding.

In relation to sea-level rise, individuals doubted their ability to take action (perceived behavioural control) and thought that any action they could take was unlikely to make a difference (as depicted in Figure 3). Socio-economic characteristics were seen (particularly during the interviews) to impact on capacity to respond. People who were more politically and economically empowered (often homeowners) tended to hold both a greater knowledge of the opportunities for action available and to have greater financial means to act. For those without tenure and on low incomes choice in relation to action was constrained, and these individuals tended to articulate the least capacity to act. The survey data suggest that 'active responses' tended to correlate with home ownership – for sea-level rise 46% compared to 27% of those renting properties. For flooding there was a less marked differential – 66% owning a property compared with 61% renting, possibly because even simple precautions such as putting a temporary physical barrier in front of your front door are more widely 'available'.

In relation to flooding, property ownership acts as both a primary constraint upon, as well as a driver of, response (illustrated using the 'hatched' shading in Figure 2). Homeowners have more choice and greater freedom and opportunity to take independent action through purchasing property insurance (flooding), and making more permanent physical alterations. Yet as discussed before the insurance industry was not necessarily supporting risk responses through its perceived insensitivity to the specific risk context of an individual property (as opposed to the generic risk rating of an area). For those who own their property there are negative implications of living in risk areas. Householders expressed reluctance to offer flood risk information such as personal experience during a house sale, lest this had a negative impact on the buyer and stigmatising impact on the property. This means that risks could become neglected (or at least poorly articulated) at the very point when opportunities for enhanced awareness and proactive response to mitigation could be taken. Even the introduction in England of the requirement for Home Information Packs to be provided by vendors appeared to potentially not provide the vital personal experiential or 'soft' information that could supplement and make real the formal flood risk information. Harries' (2008) work suggests that protection of the personal representation of the 'home' may be one reason for a reluctance to openly accept a risk to property. Our fieldwork predated this study but it certainly suggests that a more detailed understanding of the complex emotions that underpin denial of risks is appropriate.

In our study, individuals tended to focus on actions requiring minimal effort and cost, such as seeking further information. One person, an engineer by training, seemed to adapt his professional experience in that he accepted the risks but also justified why he had not purchased flood defences or made flood emergency preparations based on a cost-benefit analysis:

With the Severn they know flooding is quite common, so it's easy for them to put stuff in a cupboard and then once every couple of years get it out. It's not flooded here ever even though we know it is two feet below sea level and when does flood it will be four feet deep, so do you keep stuff in a cupboard for 40 years waiting for the next flood, it is a cost-risk thing isn't it? (Robin, Aldeburgh)

In relation to flooding only two survey respondents (3%) had signed up to the Automated Voice Messaging service (now Flood Warning Direct) reflecting the low national uptake at the time. There was a more positive response to the regular checking of weather forecasts (43% ($n = 33$) claiming to do this when flooding was possible) and almost half (49% ($n = 38$)) claimed to have responded in this way to sea-level rise risks. But these results seem highly questionable given the other evidence and perhaps could be considered more an intrinsic part of everyday life, even a habit, rather than a response to hazard perceptions.

Flooding attracts individuals' attention and requires responses to protect property but the increased attention is short-lived. As Kates (1962, 140) claims, 'without frequent experience learned adjustments wither and atrophy with time'. Jackie in Barnstaple described a classic protection action decision response (Lindell and Perry 1992) in relation to own her flood experience:

A young lad came and said 'the river is coming down the road' and it was, it just came over the top of the banks and filled the park ... It's surprising how much it builds up at the doors ... it did not dawn on us to cover the airvents. We all had our Wellington boots on trying to do what we could. They did come round and give us sandbags.

But as with most respondents there was little evidence that this experience had served to prompt any preparation by her for the next flood.

Moving house to a safer place (i.e. adaptation) was a minority position (four interviewees in relation to flooding and three in relation to sea-level rise). These were individuals who considered the potential risks significant and who had the capacity and opportunity to make alternative location decisions, for example:

My friends use to live in Aldeburgh and because of flooding they have panicked and most of us have now stopped buying houses in Aldeburgh. We have all thought about it you know. We have all just recently moved properties, so that was an issue that we did discuss when we were moving. (Nancy, Aldeburgh)

For Richard (Aldeburgh) who was aware of the predicted sea-level rise risk in the area his 'programme is to sell the pair of them [houses] in 10 years because I think much after that it won't be safe'. Only time will tell as to whether such awareness translates into action. Further, if an area becomes stigmatised through the publicity of the official risk maps does sale of a property become more difficult? Our evidence would suggest not necessarily because of the way in which people interpret and deny the risks but more work is required in this respect.

Implications

The study raises important questions about how risk managers can positively influence public risk responses when experience is lacking and what is a reasonable level of intervention. The IURFs identify differing barriers to understanding and response even across our two interrelated natural hazards. Therefore, encouraging greater

householder action will require a complex mixture of actions and interventions. Fundamentally, there is a need to increase understanding of both the need to take action and the efficacy of individual householder responses.

There are immediate implications for locally focused and individually relevant communication which is more sensitive to regional and social diversity and localised experiences than national risk campaigns not least if it draws upon local networks as communication aids. For example, one way of improving unofficial warning systems is to encourage local environment interests groups to become part of the 'flood response landscape' (Wachira and Sinclair 2005). In relation to sea-level rise there is a need to make the highly uncertain risk 'real' to people perhaps through the drawing of stronger links with flooding.

Decision-makers and responsible authorities need to have a deeper understanding of the socio-cultural processes through which people construct meanings to natural hazard problems and personal actions. In our two natural hazards contexts risk managers tend to remain oriented to 'education' rather than to engagement of those at risk in decision-making. There remains considerable scope for more direct engagement of local communities in decisions about flood protection schemes and in shoreline management plans. Not just engagement with recognised and organised local groups but a genuine effort to engage with all sections of communities. Considering the lack of willingness to assume greater personal responsibility for risk reduction there is a need to test and evaluate information provision exercises and more direct engagement methods not least in the context of promoting social learning and behavioural change.

Conclusion

This novel study has, for the first time, confirmed the complexity of factors underlying householder understanding and response to two interrelated natural hazards in the UK – flooding and sea-level rise. It has confirmed that even in high-risk areas, a lack of direct personal experience of flood events serves to attenuate understanding and to constrain motivation to take personal action. For sea-level rise, as yet a largely 'unknown' hazard not understood well in the local context, perceived responsibility to act is firmly transferred to others. In relation to both hazards there is strong confirmation of the impact of the processes by which people and groups learn, acquire and create interpretations of risk. Social networks provide important local sources of information often more important than official sources. People evaluate potential protection or mitigation actions in terms of their efficacy, cost and implementation barriers. A weak understanding of the potential personal losses that may be incurred seems to support perceived incapacity to act. Importantly, in relation to both hazards a lack of perceived personal responsibility for either the causes or solutions acts as an important barrier to action – it is someone else's problem. Context is crucial, even if people have the resources and personal capacity to act they may not choose to do so. Whether this changes when people have directly experienced a serious flood warrants further study.

We have presented an IURF as a simple means of comparing the two hazards and expressing the dynamic processes that may heighten or attenuate understanding and drive or constrain responses to natural hazards. Of course, public understanding and responses do not occur in a social vacuum, the wider social and institutional context are strong influences. In borrowing the SARF framework as an organising tool we are certainly not supporting any oversimplification of the complex social constructions of

risk, of the role of emotion nor the power struggles on the risk 'field of play' (Murdock, Petts, and Horlick-Jones 2003).

The IURF certainly indicates the need for more responsive (to local contexts) communication and engagement with communities at risk. Communication is likely to prove a crucial link in enhancing understanding of the potential effects of natural hazards and the capacity to take appropriate protective measures not least where personal experience is lacking. The IURF certainly bears testing in other locations, retrospectively where details of actual responses are known, and with other hazards that could affect the UK such as high winds and heat waves. With an increased understanding of the impacts of climate change this seems an important time to anticipate public responses. But this study also prompts two (possibly more worrying) questions – will the 'natural' ever be real to people? and is it too challenging to encourage precautionary personal action before adverse effects are experienced?

References

- Bauman, D.D., and J.H. Sims. 1978. Flood insurance: Some determinants of adoption. *Economic Geography* 54: 189–96.
- Bickerstaff, K., P. Simmons, and N.F. Pidgeon. 2004. Public perceptions of risk, science and governance: Main findings of a qualitative study of five risk cases. Unpublished working paper, Centre for Environmental Risk, University of East Anglia, Norwich.
- Bickerstaff, K., and G. Walker. 2002. Risk, responsibility, and blame: An analysis of vocabularies of motive in air-pollution(ing) discourses. *Environment and Planning A* 34, no. 12: 2175–92.
- Blaikie, P., T. Cannon, I. Davis, and B. Wisner. 1994. *At risk: Natural hazards, people's vulnerability and disasters*. London: Routledge.
- Bord, R.J., A. Fisher, and R.E. O'Connor. 1998. Public perceptions of global warming: United states and international perspectives. *Climate Research* 11: 75–84.
- Bostrom, A., M.G. Morgan, B. Fischhoff, and D. Read. 1994. What do people know about global climate change? 1. Mental models. *Risk Analysis* 14, no. 6: 959–70.
- Bronstert, A. 2003. Floods and climate change: Interactions and impacts. *Risk Analysis* 23: 545–57.
- Burton, I., R.W. Kates, and G.F. White. 1993. *The environment as hazard*. 2nd ed. New York: Oxford University Press.
- Drabek, T.E. 1986. *Human system responses to disaster: An inventory of sociological findings*. New York: Springer-Verlag.
- Environment Agency. 2009. *Flooding in England: A national assessment of flood risk*. Bristol: Environment Agency.
- Evans, E., R. Ashley, J. Hall, E. Penning-Rowsell, A. Saul, P. Sayers, C. Thorne, and A. Watkinson. 2004. *Foresight: Future flooding scientific summary: Volume 1 – Future risks and their drivers*. London: Office of Science and Technology.
- Fishbein, M., and M. Stasson. 1990. The role of desires, self-predictions, and perceived control in the prediction of training session attendance. *Journal of Applied Social Psychology* 20: 173–98.
- Grothmann, T., and F. Reusswig. 2006. People at risk of flooding: Why some residents take precautionary action while others do not. *Natural Hazards* 38: 101–20.
- Handmer, J.W. 1997. *Flood warning: Issues and practice in total system design*. Middlesex: Flood Hazard Research Centre.
- Harries, T. 2008. Feeling secure or being secure? Why it might seem better not to protect yourself against a natural hazard. *Health, Risk & Society* 10, no. 5: 479–90.
- Harrison, C.M., J. Burgess, and P. Filius. 1996. Rationalizing environmental responsibilities. *Global Environmental Change* 6, no. 3: 215–34.
- Harvatt, J.E. 2008. Natural hazards and the public in the UK: Integrating understanding and precautionary response. PhD thesis, University of Birmingham, School of Geography, Earth and Environmental Sciences

- Horlick-Jones, T. 2008. Communities of risk research and risk practice: Divided by a common language. *Journal of Risk Research* 11, nos. 1–2: 169–74.
- Hulme, M., G.J. Jenkins, X. Lu, J.R. Turnpenny, T.D. Mitchell, R.G. Jones, J. Lowe, et al. 2002. *Climate change scenarios for the United Kingdom: The UKCIP02 scientific report*. Norwich: Tyndall Centre for Climate Change Research, University of East Anglia.
- Irwin, A. 1995. *Citizen science*. London: Routledge.
- Jackson, E.L. 1981. Response to earthquake hazard: The west coast of North America. *Environment and Behaviour* 13: 387–416.
- Jaeger, C.C., O. Renn, E.A. Rosa, and T. Webler. 2001. *Risk, uncertainty, and rational action*. London: Earthscan.
- Jenkins, G., J. Murphy, D. Sexton, J. Lowe, P. Jones, and C. Kilsby. 2009. *UKCP09 briefing report: UK climate projections June 2009*. <http://ukclimateprojections.defra.gov.uk>
- Kasperson, R.E. 1992. The social amplification of risk: Progress in developing an integrative framework of risk. In *Social theories of risk*, ed. S. Krimsky and D. Golding, 153–78. Westport, CT: Praeger.
- Kasperson, R.E., O. Renn, P. Slovic, H.S. Brown, J. Emel, R. Goble, and J.X. Kasperson. 1988. The social amplification of risk: A conceptual framework. *Risk Analysis* 8, no. 2: 177–87.
- Kates, R.W. 1962. *Hazard choice and perception in floodplain management*. Department of Geography, Research Paper 78. Chicago, IL: University of Chicago Press.
- Kates, R.W. 1971. Natural hazards in human ecological perspective: Hypotheses and models. *Economic Geography* 47, no. 3: 438–51.
- Knocke, E.T., and K.N. Kolivras. 2007. Flash flood awareness in southwest Virginia. *Risk Analysis* 27: 155–69.
- Kreibich, H., A.H. Thielen, T. Petrow, M. Müller, and B. Merz. 2005. Flood loss reduction of private households due to building precautionary measures – lessons learned from the Elbe flood in August 2002. *Natural Hazards and Earth System Sciences* 5: 117–26.
- Kunreuther, H. 1978. Even Noah built an ark. *The Wharton Magazine*, Summer: 28–35.
- Lindell, M.K., and R.W. Perry. 1992. *Behavioural foundations of community emergency planning*. Washington, DC: Hemisphere Press.
- Lorenzoni, I., and N.F. Pidgeon. 2006. Public views on climate change: European and USA perspectives. *Climatic Change* 77: 73–95.
- Lowe, T., K. Brown, S. Dessai, M. De Franca Doria, K. Haynes, and K. Vincent. 2005. *Does tomorrow ever come? Disaster narrative and public perceptions of climate change*. Working Paper 72. Norwich: Tyndall Centre for Climate Change Research, University of East Anglia.
- Marshall, G. 2001. The psychology of denial. *Ecologist* 31: 40–1.
- Mileti, D.S. 2001. *Disasters by design: A reassessment of natural hazards in the United States natural hazards and disasters*. Washington, DC: Joseph Henry Press.
- Mitchell, J.K. 2003. European river floods in a changing world. *Risk Analysis* 17: 341–52.
- Mitchell, J.K., N. Devine, and K. Jagger. 1989. A contextual model of natural hazards. *Geographical Review* 79, no. 4: 391–409.
- Murdock, G., J. Petts, and T. Horlick-Jones. 2003. After amplification: Rethinking the role of the media in risk communication. In *The social amplification of risk*, ed. N.F. Pidgeon, R.E. Kasperson, and P. Slovic, 156–78. Cambridge: Cambridge University Press.
- Niemeyer, S., J. Petts, and K. Hobson. 2005. Rapid climate change and society: Assessing responses and thresholds. *Risk Analysis* 25, no. 6: 1443–56.
- Parker, D.J. 1992. Flood disasters in Britain: Lessons from flood hazard research. *Disaster Prevention and Management* 1: 8–25.
- Parker, D.J. 2000. Introduction to floods and flood management. In *Floods*, ed. D. Parker, 3–39. London: Routledge.
- Parker, D.J., and J.W. Handmer. 1998. The role of unofficial flood warning systems. *Journal of Contingencies and Crisis Management* 6: 45–60.
- Parker, D.J., S.M. Tunstall, and S. McCarthy. 2007. New insights into the benefits of flood warnings: Results from a household survey in England and Wales. *Environmental Hazards* 7, no. 7: 193–210.
- Peck, L.A., and D.S. Mileti. 2002. The history and future of disaster research. In *Handbook of environmental psychology*, ed. R. Bechtel and A. Churchman, 511–24. New York: John Wiley.

- Petts, J. 2005. Health, responsibility, and choice: Contrasting negotiations of air pollution and immunisation information. *Environment and Planning A* 37: 791–804.
- Petts, J., T. Horlick-Jones and G. Murdock. 2001. *Social amplification of risk: The media and the public*. Contract Research Report 329/2001. Sudbury: Health and Safety Executive.
- Pidgeon, N.F., R.E. Kasperson, and P. Slovic. 2003. *The social amplification of risk*. Cambridge: Cambridge University Press.
- Rayner, S. 1988. Muddling through metaphors to maturity: A commentary on Kasperson et al. 'the social amplification of risk'. *Risk Analysis* 8, no. 2: 201–4.
- Renn, O. 1991. Risk communication and the social amplification of risk. In *Communicating risks to the public: International perspectives*, ed. R.E. Kasperson and P.J.M. Stallen, 287–324. Dordrecht: Kluwer Academic Press.
- Siegrist, M., and H. Gutscher. 2008. Natural hazards and motivation for mitigation behavior: People cannot predict the effect evoked by a severe flood. *Risk Analysis* 28, no. 3: 771–8.
- Slovic, P. 2000. Trust, emotion, sex, politics and science: Surveying the risk-assessment battlefield. In *The perception of risk*, ed. P. Slovic, 390–412. London: Earthscan.
- Slovic, P., M. Finucane, E. Peters, and D.G. McGregor. 2004. Risk as analysis and risk as feelings: Some thoughts about affect, reason, risk and rationality. *Risk Analysis* 24, no. 2: 311–22.
- Svenson, O. 1988. Mental models of risk communication and action: Reflections on the social amplification of risk. *Risk Analysis* 8, no. 2: 199–200.
- Taylor, S.E., and P.M. Gollwitzer. 1995. Effects of mindset on positive illusions. *Journal of Personality and Social Psychology* 69: 213–26.
- The Pitt Review. 2008. *Learning lessons from the 2007 floods*. London: Cabinet Office.
- Torry, W. 1979. Hazards, hazes and holes: A critique of the environment as hazard and general reflections. *Canadian Geographer* 23: 368–83.
- Turner, R.H., J.M. Nigg, and D. Paz. 1986. *Waiting for disaster: Earthquake watch in California*. Berkeley, CA: University of Chicago Press.
- Wachira, J.K., and A.J. Sinclair. 2005. Public participation in the emergency response phase of flooding: A case study of the Red river basin. *Canadian Water Resources Journal* 30, no. 2: 145–58.
- Wardman, J.K. 2006. Toward a critical discourse on affect and risk perception. *Journal of Risk Research* 9, no. 2: 109–24.
- Wardman, J.K. 2008. The constitution of risk communication in advanced liberal societies. *Risk Analysis* 28, no. 6: 1619–37.
- Weinstein, N.D., M.L. Klotz, and P.M. Sandman. 1988. Optimistic biases in public perceptions of the risk from radon. *American Journal of Public Health* 78, no. 7: 796–800.
- Weinstein, N.D. 1989. Effects of personal experience on self-protective behaviour. *Psychological Bulletin* 105: 31–50.
- White, G.F., ed. 1974. *Natural hazards: Local, national, global*. New York: Oxford University Press.
- Whitmarsh, L. 2008. Are flood victims more concerned about climate change than other people? The role of direct experience in risk perception and behavioural response. *Journal of Risk Research* 11, no. 3: 351–74.
- Wisner, B., P. Blaikie, T. Cannon, and I. Davis. 2004. *At risk: Natural hazards, people's vulnerability and disasters*. 2nd ed. London and New York: Routledge.
- Zaleskiewicz, T., Z. Piskorz, and A. Borkowska. 2002. Fear or money? Decisions on insuring oneself against flood. *Risk and Decision and Policy* 7: 221–33.