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Living with flood risk

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The flooding of parts of New York in the aftermath of Hurricane Sandy in October 2012 provided dramatic images of a global city and world financial centre struggling to cope with a natural disaster. At times, many neighbourhoods, particularly in Manhattan, seemed to struggle to function. This moved beyond those directly affected by flooding in their homes and businesses, to the wider city as critical infrastructure was damaged, including electricity sub-stations leading to hospital evacuations following power-cuts, and the closure of public transport networks along with petrol/gasoline shortages disrupting the mobility of New York citizens. While the initial debate in the aftermath of such flooding events often centres on the immediate recovery efforts, increasingly flood risk (and the potential for increased risk from climate change impacts) raises more fundamental questions concerning how cities and communities should prepare or transform in order to cope with increased exposure to flooding events.

International literature on flooding has, until recent years, tended to focus upon flood defence measures to reduce the probability of flooding. However, the potential costs of flooding have driven a renewed interest in flood risk management around the globe. As a result, in many countries, flood risk management is currently undergoing a paradigm shift as it moves beyond a one-dimensional “keep floodwater out” approach, towards a more strategic, holistic and long-term approach characterised by *mitigating* both flood risk and *adaptation*, or increasing resilience to flooding events. This is typified by the Dutch “room for the river” approach and also reflected in the enactment of EU legislation in the form of the Water Framework Directive 2000/60/EC (CEC, 2000) and the Floods Directive 2007/60/EC (CEC, 2007). Within this context, spatial planning has increasingly moved centre stage as part of a “whole catchment” framework to risk management.

The challenge for spatial planning is multifaceted. Flooding is damaging to the environment, human health and local and regional economies, and the reduction of both the threat and impact of flooding is an issue of international scope and significance. Although flooding is a natural process and provides benefits (e.g. by enriching soils, maintaining natural habitats), it can also generate environmental problems. For example, flash flooding can damage aquatic habitats and contaminated storm water run-off from agricultural land and urban areas creates diffuse pollution and water quality problems (Carter et al., 2009). Additionally, flooding is costly, causing enormous damage to the built environment, housing and commercial property, critical infrastructure and public services, and has a disruptive impact on well-being, quality of life and causes social distress (Newbery et al., 2010).

Recent years have been marked by increased flood risk vulnerability caused by intensive urbanisation processes, shifting agricultural practices, outdated urban drainage systems and fragmented policy responses (Howe & White, 2002). Moreover, the impact of climate change processes is likely to increase flooding vulnerability, both inland and coastal – for example caused by sea level rise and storm surges in coastal locations, and increased frequency of extreme precipitation events is expected to increase risks associated with surface, fluvial and groundwater flooding, with consequences for property, livelihoods, infrastructure, agricultural production and ecosystems (EEA, 2008). In terms of physical characteristics of flooding, flood risk management is

complex, uncertain and involves large temporal and spatial scales. Added to this complexity, flood risk management also involves competing societal demands for water resources and land use, conflicting interests between stakeholders, a plurality of different standpoints, and diffuse responsibilities and impacts.

Within the context of increased exposure to risk and a heightened sense of uncertainty, “resilience thinking” has emerged as a key framework in examining the role of spatial planning within flood risk management. While conservative interpretations of resilience emphasise self-reliance and the ability of a place to “bounce back” in the aftermath of a major shock, as Davoudi et al. (2012) highlighted in a recent *Planning Theory & Practice Interface*, a more progressive view is to consider resilience in terms of adaptability and transformability; to not only bounce back but also to reduce exposure to future risks. Therefore, an “evolutionary perspective” of resilience places significance on *transformation*, whereby social systems (through individual or collective agency) can adapt or search for and develop alternative development trajectories (Davidson, 2010). Similarly, Hudson (2010) argues that a resilient system is an adaptive system:

Creating resilience is therefore most appropriately thought of as a process of social learning, using human capacities and knowledge to reduce vulnerability and risk in the face of the unknown and unexpected (p. 12).

This approach towards resilience enables us to ask questions and take a more critical stance towards existing urban development, planning and governance processes. For example, are path dependencies and entrenched interests facilitating sub-optimal urban development? How can we transform the built environment to become more adaptable in the face of uncertain risk? How can effective risk governance processes be developed based on social learning and capacity building? Do existing socio-economic inequities underpin vulnerabilities and exposure to risk, for example based on poverty, class or race?

These themes are addressed in this *Interface* on Living with Flood Risk. In the opening paper, Iain White charts the paradigm shift from flood defence to flood risk management in which society should live with water and possibly expect to experience periodic flooding. The main thrust of White’s paper is a discussion on “uncertainty” in relation to effective flood risk management, in particular shifting calculations of exposure to flood risk and its implications for spatial planning. White argues that there is a growing realisation that not all floods can be predicted, let alone prevented. Drawing on recent experiences in the UK, White examines the multidimensional nature of flood risk to include not only fluvial, tidal and coastal flooding, but also exposure to flood risk from surface water including urban run-off and local drainage failure – climate change adds a further layer of complexity. White argues that the lessons of flood risk management in England over the last decade highlight the dangers of “false precision” when calculating flood risk and translating these risks into spatial plans. Instead, White calls for a more critical stance towards flood risk data and for empowering planners to intervene on a more precautionary basis.

The second paper further elaborates on some of these themes by examining resilience and social learning as a framework for managing flood in the context of uncertainty. In this paper, Christian Kuhlicke and Annett Steinführer suggest that resilience, with its rejection of a given equilibrium, certainty and prediction, offers a promising frame for risk (and uncertainty) management, focusing on adaptability and transformation. Kuhlicke and Steinführer’s paper addresses issues surrounding flood risk governance and “governance of preparedness”, which are becoming increasingly complex in the context of the shift from a purely engineering solution to flooding towards a more holistic flood risk management approach. This includes not only complex administrative arrangements, but also the inclusion of those at risk (e.g. residents, business owners) who are being gradually transformed into active risk managers. Within the context of flooding resilience, Kuhlicke and Steinführer focus on social learning and capacity building processes as a means to cope or

reduce exposure to flood risk, emphasising social capacity building as an iterative (rather than linear) and participatory process. The authors identify a typology of social capacities relevant to flood risk management – knowledge capacities, motivational capacities, network capacities, financial capacities and governance capacities – with Kuhlicke and Steinführer arguing for enhanced understanding of capacity building processes and interactions between different forms of capacity as regions increasingly embrace multi-stakeholder risk governance approaches.

Issues of governance and participation are also explored in the third paper, by Parvin Sultana and Paul Thompson. This paper reminds us that while flooding events in Europe and North America may prove hugely disruptive and costly, the scale of flooding events in low lying “developing world” countries, such as Bangladesh, can be devastating for the lives of millions. Sultana and Thompson’s paper charts a series of policy shifts for floodplain management in Bangladesh from an “engineering coalition” to a broader “environmental coalition” stressing the importance of local participation and co-management. Drawing on their extensive experience of action-research projects in Bangladesh, their paper focuses on the challenges of participation, particularly giving voice to the least powerful in society, and outlines community-based institutional arrangements for floodplain management. Similarly to the previous paper, Sultana and Thompson emphasise *adaptive learning* and the role of learning networks.

The following two papers focus specifically on the role of land-use regulation and urban design in creating more resilient and adaptable urban places. Firstly, John Minnery explores the issue of retrofitting the existing built environment to cope with and adapt to flood risk, drawing on the recent experiences of Brisbane in the wake of devastating floods in Queensland in late 2010/early 2011. Minnery argues that a weakness of planning systems is their focus on the future and a regulatory framework that is applied to *new* development. However, as Minnery highlights, the Brisbane floods clearly exposed the vulnerabilities of existing built-up areas; indeed recent planning policies around riverfront development increased this exposure. In this context, this paper outlines some of the challenges for retrofitting the built environment, including people’s resistance to change, perceptions of risk and regulatory complexity. Minnery argues that retrofitting the built environment should be related to risk and vulnerabilities – for example, this may be in relation to critical infrastructure or due to the vulnerable nature of some of the city’s residents (e.g. residents of an old people’s home). The paper usefully identifies a number of mechanisms for retrofitting, including land buy-backs and land swaps, removing houses, and using land for less vulnerable purposes (e.g. open spaces), although these may prove expensive options. This is followed by a paper by Eoin O’Neill, which examines urban design issues at a neighbourhood scale drawing on debates within the Thames Valley catchment area in the south of England. O’Neill considers a range of options in both the short-term and long-term temporal scale. This includes housing allocations that recognise the constraints imposed by floodplains, the sequential allocation of zoned land to result in a more hydrologically sensitive urban environment, and urban realignment schemes that provide space for natural flooding processes. The paper also discusses the role of masterplanning to achieve a net reduction in risk (e.g. an enhanced role for green infrastructure considerations) and design measures at the building scale to increase resilience to flooding events.

The final paper provides a practitioner perspective on implementing the EU Floods Directive within Ireland. The authors – Jonathan Cooper, Mark Adamson and Elizabeth Russell – have played a leading role in developing both national flood risk guidelines and in the commissioning and implementation of catchment-based flood risk management projects. In the paper, the authors reflect on their experiences of attempting to provide a more integrative policy framework for flood risk management where spatial planning plays a more central role, and outline the institutional barriers and challenges that exist in Ireland (and most countries) in developing holistic policy agendas. Ireland provides an interesting case study as the local political culture has traditionally

been dominated by a pro-development discourse, and an improved evidence base for flood risk assessment has challenged some development orthodoxies and entrenched interests. In this regard, the authors suggest that central government guidance has helped to empower planners to communicate issues of flood risk more effectively with elected representatives. The paper also highlights the importance of integrating risk assessment with existing planning instruments, particularly land-use zoning and Strategic Environmental Assessments. The authors conclude their paper by discussing issues surrounding the effective communication of flood risk with key stakeholders, stressing the importance of bottom-up, interactive processes in developing catchment-based flood risk management plans.

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The more we know, the more we know we don’t know: Reflections on a decade of planning, flood risk management and false precision

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Introduction

It ain’t what you don’t know that gets you into trouble. It’s what you know for sure that just ain’t so.
Attributed to Mark Twain.

Mark Twain’s opening remark highlights the potential pitfalls of assigning too much weight to information and emphasises the value of adopting a position of uncertainty. Yet, there is no

evidence that he ever said it. Unusually for a writer of Twain's fame, the remark cannot be traced back to one specific source, leading to a reasonable suspicion that it may simply be a form of generic cod philosophy rather than a moment of exceptional insight from a lauded writer. The opaque origin serves to heighten its appeal however, particularly in the context of the following discussion. It draws attention to the false certainty inherent in both the central message of the quotation and, more ironically, the way that people confidently attribute the aphorism to the incorrect source. If anything, one thing that we can be relatively sure of is that when you are certain of information then problems often start.

Similarly, there is a creeping realisation with regard to planning for flood management that the data used to manage flooding may not be as accurate as initially thought. Perhaps even more worrying for those concerned with interpreting risk, is that the whole approach to probabilistic flood mapping and assessment does not capture the sheer dynamism of changing precipitation regimes, urban water cycles and additional development. To cite the example which informed the title of this article, John Maynard Keynes famously objected to the use of statistics to analyse the credit cycle, owing to its inherent complexity, variability and irreducibility. He argued that there was a need to demonstrate the method was applicable, rather than just applying it, otherwise it could result in a "false precision" that neither the method nor the statistics could support (Keynes, 1973, p. 289).

This paper reflects on the experiences of a comparable false precision in planning and flood risk management since the first release of UK Government's *Planning Policy Guidance Note 25: Development and Flood Risk* over a decade ago (Department of the Environment, Transport and the Regions, 2001). The article examines the changes to flood management by charting how various reports into a series of catastrophic events exposed errors in both the evidence base and governance frameworks. It will argue that there has been a gradual retreat from a firm confidence in data accuracy as significant flaws in knowledge became apparent. Such a shift is further underpinned by the emergent realisation that not all floods can be predicted, let alone prevented. It also considers confidence issues resulting from the lessons of the flood risk management science-policy interface and, in doing so, highlights the need for planners to take a critical stance to address the potential risk of a false precision of data that often presents simplistic spatial interpretations of complex geo-climatic phenomena. Lastly, it highlights the importance for planners to positively engage with uncertainty as a means to address this problem. Here concepts such as resilience, concerning the ability to absorb shocks "and still persist" (Holling, 1973, p. 17), hold value as a means to help people and places adapt to the inexact threat of flooding.

A period of false precision

Surprisingly, given the rise in knowledge concerning aspects such as flood forecasting, modelling and mapping, detrimental events continue to occur making it one of the most frequent and widespread natural hazards. A series of extremely damaging UK flood events, most notably in 1998, 2000, 2004, 2007 and 2012, supported by more localised, but high profile incidents occurring in areas such as Boscastle, Carlisle and Cockermouth, have helped to both highlight the impact of the hazard and provide the political stimulus to gather new data regarding the exposure to flooding. However, this evidence has subsequently been found to be subject to significant change.

After particularly serious national flood events, reports and public inquiries into their causes were helpful both in terms of ascertaining the reasons why individual events occurred and in providing a recent historical perspective of planning and flood risk management. Gradually they revealed a changing awareness of the nature of flood risk that challenged three long held perceptions: the first concerned the actual sources of flooding, which were initially thought to come from rivers and the coast, the second related to the governing of floods at a national level, and the third was regarding the efficacy of large-scale flood defences as the most effective intervention approach.

In the aftermath of the 2000 flood, the National Audit Office (2001) gave the very precise figure of 1,724,225 properties at risk of fluvial, tidal and coastal flooding, the first real national indication of exposure. At this time there was no indication of flooding emerging from outside these traditional areas. In the wake of continued flooding, the *Foresight* report (Evans et al., 2004) gave another snapshot of risk. Here, climate change and urbanisation were highlighted as powerful driving forcers, drivers and exposure from surface water (incorporating urban runoff and local drainage failure) was newly included. It was projected that 80,000 properties were at risk from this source, but that this figure could rise sharply due to high data uncertainty. In the same year, a Defra scoping study further identified around 1,100,000 properties at risk from groundwater flooding, 112,855 of which were also in the 1-in-a-100-year indicative floodplain (Jacobs Engineering UK, 2004).

The high-profile flood events stimulated the provision of a scientific evidence base that drove a policy shift from flood “defence” to flood “risk management”. Increasingly, a new pragmatic public message emanated from policy circles in which society should live with water and expect to experience periodic flooding (Department of the Environment, Food and Rural Affairs, 2004). Meanwhile, developments in modelling, mapping, and planning policy continued apace and, combined with new mechanisms such as Flood Risk Assessments (Department of Communities and Local Government, 2006), helped engender a growing sense of planning control. Even so, in the summer of 2007, floods inundated whole areas that were previously deemed not to be at risk and seriously undermined the effectiveness of this evidence and risk-based approach. The subsequent Pitt Review into this catastrophe demonstrated that the errors were not just minor aspects, such as an inaccurate distinction between medium or high-risk areas, or a slight miscalculation of floodplain boundaries; rather a complete failure to realise serious national flooding could come from multiple sources, in particular from surface water and inadequate drainage (Pitt, 2008).

Further reviews following the Pitt recommendations again revised the overall figure upwards, but this time in a dramatic fashion. The 80,000 properties projected to be at risk from surface water flooding were upscaled to 3.8 million, making this hitherto largely unrecognised source the greatest threat (Environment Agency, 2009). The failure of risk management to address this significant element until after the 2007 event also led to a stronger engagement with flood resilience, a precautionary managerial approach which argues for the ability to cope with and recover from events, particularly where risks are uncertain (Cabinet Office, 2008). The data continues to evolve with one recent report adding an estimated 1,100,000 properties threatened by reservoir failure (Environment Agency, 2011), a new risk which nearly occurred in 2007 at the Ulley Reservoir in South Yorkshire after heavy rainfall.

Table 1 captures the developing knowledge within these reports to provide an accessible overview of how quickly information has changed concerning both the estimated number of properties at risk of flooding and from which source. Although the definition of “risk” can vary over time between documents, the table is useful as a didactic device; not necessarily with regard to attaching a firm significance to the number of properties, but rather as a demonstration of the way that a false precision can be seen to be operating in flood risk management. It should demonstrate the value of confidently engaging with uncertainty and in critically approaching what may ostensibly appear to be very accurate scientific datasets.

There are a number of issues raised by this table. First is regarding the growth of the total number of properties at risk from flooding. Between 2001 and 2011 this has gone from 1,724,225 to “around” 7.9m, with incremental jumps in between. We can reasonably anticipate that the most recent figures will change again in the near future. For example, there are also an unknown number of properties at risk from pluvial flooding, whereby sewers may become blocked or overloaded. Although water companies keep records of high-risk locations, there have been questions over the

Table 1. The changing knowledge of the sources of flood exposure in England between 2001 and 2011 (Environment Agency, 2009; 2011; Evans et al., 2004; Jacobs Engineering UK, 2004; National Audit Office, 2001).

Year	Estimated properties at risk by source				Total
	Rivers and sea	Surface water	Groundwater	Reservoir Failure	
2001	1,724,225	0	0	0	1,724,225
2004	1,740,000	80,000	1,700,000	0	3,420,000 ¹
2009	2,400,000	3,800,000	1,700,000	0	6,800,000 ²
2011	2,400,000	3,800,000	1,700,000	1,100,000	7,900,000 ²

Notes

¹ 112,855 properties are at risk from both rivers and the sea and groundwater flooding (Jacobs Engineering, 2004).

² Note that 112,855 properties are at risk from both rivers and the sea and groundwater flooding, and 1 million properties are at risk from both rivers and the sea and surface water flooding (Jacobs Engineering, 2004; Environment Agency, 2009).

reliability of the data (Douglas et al., 2010) and the extent to which risk may change as new building developments and climatic changes place extra demands on drainage networks.

Furthermore, every time the exposure to flood risk was recalculated more homes were added, which inevitably casts doubt upon the veracity of the current data. Beyond their face value it may be difficult to assign surety to these figures. Furthermore, the way the information subsequently becomes interpreted within planning as lines on a map or a probabilistic value in a report can result in their methodological processes, assumptions and caveats not being translated easily into practice (Pender & Faulkner, 2011). Moreover, the sheer number of properties at risk, now over a third of the 23m housing stock of England recorded in the 2011 census, produces challenges for managing present and future risks. This exposure will continue to rise even if all unsafe construction stopped immediately, due to a gradual incremental rise in urbanisation elsewhere in the catchment and possible increases in rainfall intensity due to climate change.

There is also evidence of a shift from precise to fuzzy data, a factor that runs counter to most reasonable assumptions that increased evidence accumulation should gradually lead to better accuracy. The very specific figure of properties at risk in 2001 feigns a degree of scientific authority that inevitably inspires confidence within decision-makers, but the experience of the last decade argues for a more critical, uncertain and resilient approach. This strategy is now more noticeably pursued by scientists who report less precise figures than those given a decade ago, with the nearest 100,000 now used as the norm.

Each report into flooding further reveals an increase in the number of sources, from a sole focus on rivers and the sea to new sources continually unveiled throughout the last decade. Properties are now considered to be at risk from multiple sources, with surface water, not even properly calculated until 2009, now believed to be the current main threat of flooding in England. The inclusion of reservoir failure in 2011 provides another interesting addition. It offers a more sophisticated view of causality by recognising artificial flood sources for the first time and highlighting the potential for cascading events to widen the impact beyond those immediately affected.

There is also an added complexity concerning direct and indirect impacts, not reflected in the data. Where, as realised after the 2007 floods, not only may properties be flooded that were not believed to be at risk according to the flood risk maps, but you can suffer the impacts of a hazard without even being directly affected, particularly where significant infrastructure is rendered vulnerable. For example, the Mythe water treatment plant in Tewksbury flooded during the 2007 event. While it had a small direct impact on the site owners and their insurers, the cascading nature of interlinked critical infrastructure networks also meant that around 140,000 homes were without clean water for 17 days (White, 2010). In this case, too much water contrived to cause water

scarcity and led to people not perceived to be at risk from flooding nevertheless suffering from its effects. In the wake of this operational failure the Environment Agency (2009) conducted research to establish the extent to which similar infrastructure assets were exposed, and, amongst other vulnerabilities, discovered that 55% of the total of pumping stations and treatment works in England were at risk from flooding. Indirect exposure from an inundation of roads, rail and other infrastructure demonstrates the need to view flood management in a more integrated and precautionary manner, taking into account aspects such as connectedness across sectors and the criticality of specific nodes in a network, in addition to properties at direct risk.

The above review provides an interesting snapshot of just how far, and fast, flood risk management has progressed in a decade and the relatively quick response of the scientific and policy-making community to identify, and adjust to, new and emerging risks should be recognised. A combination of detrimental events and a growing evidence base rapidly impacted on the ways floods are understood and governed, with each flood event highlighting a spectrum of possible action from reflection to revolution, emphasising their inherent potential in mobilising agendas (Kingdon, 1984) or creating the required momentum for policy change (Johnson, Tunstall, & Penning-Rowsell, 2005). The reactive approach has also gradually been tempered with a more pragmatic outlook where collective awareness is shifting from a feeling of safety toward the more realistic cyclical viewpoint of “before the next catastrophe” (Perrow, 2007), a view which can galvanise action to protect people and places and challenge managerial norms.

Planning in a period of uncertainty

The clearest message from the changing evidence base over the last decade concerns the dangers of false precision and the value of uncertainty. With regard to flooding, the data appears to be particularly subject to rapid and fundamental change and raises questions as to the extent to which it can be distilled to a probabilistic figure or clear spatial delineation between “safe” areas and those “at risk”. This is partly due to the dynamism of the system within which the knowledge is constructed, where climate change exerts an unknowable forceful effect. Equally, where planning and policy interventions occur they may serve to drive risk. For example, flood defences also increase exposure via the “escalator effect” (Parker, 1995) or “safe development paradox” (Burby, 2006), whereby they subsequently make the land behind them appear “safe” and attractive for development. Furthermore, the general increase in urbanisation within a catchment will increase surface water runoff in ways that challenge accurate quantification (White & Howe, 2004). As Adams (1995, p. 29) puts it: “risk is constantly in motion”.

This is a spatio-temporal problem that is related to how flood risk data has traditionally been collected, which relies on a hydrological time series based on historical events. Although there may be seasonal or annual variability, over longer periods it is assumed to be stable with records comparable over time (Zevenbergen et al., 2010). The resultant terminology is found in phrases such as the “1-in-a-100-year event”, which can undermine efforts to communicate the realities of ever-present risk. The continuously changing system that the methodology is applied to challenges both this core principle of stationarity and the probabilistic approach more generally, lending more weight to precautionary arguments and resilience strategies to mitigate uncertainties in data accuracy. These may include a host of technical and managerial measures from the strategic to the building scale – for example, by increasing water storage areas, promoting infiltration opportunities, reconsidering the location of critical infrastructure or adopting construction techniques that keep water out of properties. It can also include more socially orientated policies that can address the vulnerability of people, such as by developing strategies that target particular groups or providing building modifications that allow residents to avoid property damage or recover from the effects more quickly (White, 2010).

Therefore there are issues connected with the collection of flood risk data, not just from a robust methodological perspective, but also with regard to its translation into planning and its reasonable interpretation. To help mitigate this threat those concerned with planning need to be able to access and understand the evidence in its entirety, including its methodology, assumptions and caveats, and so forth, which entails a degree of scientific literacy. This can be hard to communicate or contest at times, but experience points towards the need for a stronger criticality of the evidence base. In addition to the threat of “false precision” mentioned earlier, Keynes also stated that an overly mechanical methodological approach would displace insight and intuition and unduly confine the scope for analysis (Leeson, 2000). The way in which the data on flood risk has continually changed over the last decade supports a similar interpretation. This is partly evidenced by the recent moves towards integral resilience and a more positive engagement with uncertainty and resilience, combined with a renewed valuing of planner interpretations and collaborative approaches rather than a narrow, quantitative and procedural application (Davoudi, 2011).

A strategy that moves towards embracing uncertainty is partly connected with combating a perception, particularly amongst policy-makers, that science should be about providing assurance as shown in the following logic: more data = more evidence = more confidence. Such surety is a common prerequisite to identifying and justifying intervention strategies, and conforms to how the scientific community is believed to contribute to effective planning and, more generally, to benefit society. However, this perception of science as the search for a clearer “truth” places unreasonable demands on the research and researchers to attach a precise figure or spatial location to findings and highlights an elementary tension in the science–policy interface. Scientists often couch their findings with carefully caveated statements but this does not have strong synergies with the policy requirement for convincing and defensible decisions that demonstrate tangible benefits and inspire trust. Perhaps more significantly, the political demand for certainty is fundamentally in opposition with the long-established foundations of scientific inquiry that rest upon doubt (Popper, 1968). As the sociologist Robert K. Merton underscores, scepticism is key to science in a way that political and social institutions can find hard to grasp: “most institutions demand unqualified faith; but the institution of science makes skepticism a virtue” (Merton, 1979, p. 265). The embracing of uncertainty in planning for flood risk management therefore goes beyond scientific literacy and incorporates the political need to accept the necessity of this undesirable position.

Turner (1978, p. 189) suggested that disasters were a result of poor foresight and inadequate information expressed in the equation: disasters = energy + misinformation. This view not only includes the problem of inaccurate data but also its subsequent uncritical acceptance into policy. If we are to learn from the lessons of recent flood disasters then the importance should be placed on “ignorance” in addition to “knowledge”. If planning practitioners are to take anything from the above discussion it should be that gathering more information to illuminate any ignorance may not help. More data does not lead to enlightenment. It may, however, lead to greater ignorance, or, in the more colloquial terms detailed in the title, *the more we know, the more we realise we don't know*. Ignorance is not the opposite of knowledge: both are rooted in the social construction of science and differ over time and space and between actors and agencies (Funtowicz & Ravetz, 1993). For example, what uncertainties were unrecognised or unweighted? Or what new issues does this unveil? The high, but uncertain, level of risk means that planners should not use ignorance as an excuse for inaction. Indeed, the profession is explicitly designed to operate within the contested and volatile political sphere. Table 1's lessons, if any, lie in the need for planners to recognise the data gaps as well as the data findings, acknowledging their perhaps inevitable level of ignorance and, consequently, to give a stronger role for resilience strategies as a managerial approach to uncertainty.

Conclusion

Although societies have never known as much about flood risk as they do at the current time, events continue to occur and seem to do so more frequently. As in many other policy contexts, from urban regeneration to wind power, past decisions and entrenched working methods can create a path dependency (Couch, Sykes, & Börstinghaus, 2011). Previous decisions constrain the ability to innovate and act in the present and behaviour may become “locked in” (Geels, 2004; Simmie, 2012). This applies to both the overwhelmingly quantitative methodology mainly utilised for risk management *and* the previous developments that may now be seen to be newly at risk from flooding. The rise of scientific evidence in planning decisions can be traced back to the rise of positivism, the belief in technical and scientific progress, and the primacy of the expert (Davoudi, 2011; Faludi & Waterhout, 2006), yet the knowledge is still applied in a normative context. The importance of this note cannot be emphasised enough: regardless of developments in science, evidence or planning processes, *risk management* is essentially the authoritative mask behind which *risk-taking* hides.

Although the series of flood disasters provided useful learning experiences, it is not sustainable to continually suffer detriment before action occurs. The reliance on evidence can be reassuring but the fallacy of false precision is that once uncertain data is encoded it can appear precise and the view of “science” as being objective leads to a strong, uncritical reliance upon it. This may be rooted in both the rational and procedural elements of planning combined with the sometimes rather linear and utilitarian view of policy-based research (Davoudi, 2006). What we know to be scientific fact is itself a social construct: the language that scientists use aims at being technical. For some social scientists this is an indication that there are some very human and more subjective processes that go on behind the practice of science (Latour & Woolgar, 1979) that require acknowledgment in the science–policy interface. The evidence in the paper suggests that a similar subjectivity in planning for flood risk management should lead to a stronger engagement with uncertainty and collaborative approaches rather than a reliance on data that may be subject to false precision and opaquely reside somewhere between firm certainty and mathematical convenience.

The conundrum for evidence-based policy is that an expectation and demand for precision in decision-making can conflict with the variable robustness and mercurial nature of information. Evidence is neither neutral nor infallible. It can be selectively commissioned and utilised, or the nuances poorly communicated to practice – all of which can influence its interpretation. Whilst modellers, statisticians and other researchers write carefully worded qualifications regarding accuracy and application, when this is communicated to planners it may become reduced to a simple line on a map or a simple numerical figure on a page. Once uncertain data is encoded, translated and interpreted it can appear expert, guileless and effortlessly convincing. With a decade of hindsight, it can be argued that the fear of a damaging “false precision” of which Keynes accused his economic critics could be equally relevant to the issue of flood risk management. Whilst the focus of the recent past has been to gather evidence and set up new processes, the near future may be profitably occupied by interpreting this information more critically and empowering planners to intervene on a more precautionary basis.

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Searching for resilience or building social capacities for flood risks?

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Introduction

While for a long time the notion of resilience has only been known to some well-informed students of ecology or psychology, over the last decade it has started its triumphal march and is now referred to in academic discourses and policy documents as a matter of course. The reasons for making its way into such different fields as (flood) risk management, urban studies, spatial planning or the fight against terrorism are not easy to identify; however, some observers argue that it is regarded as a response to an increasing awareness of uncertainties and an acknowledgment of the dynamic nature of social and natural processes that can no longer be treated as an ephemeral condition societies can overcome by improved management activities or by scientific progress. On the contrary, uncertainties and dynamics are seen as a constant companion of our times. Traditionally flood risk assessments, for instance, have been calculated based on historically observed flood frequency statistics and return periods, following what might be termed a ‘classical’ approach to risk analysis. However, it is increasingly acknowledged that much of what is termed flood risk management is, in fact, uncertainty management. Particularly for catastrophic flood events, data on likely outcomes and consequences are approximate at best. Furthermore, in the face of climate change the past is considered no longer as a reliable guide to the future, and flood risk assessment, like water resource management more generally, can no longer be based on the classical assumption of stationarity (Milly et al., 2008).

In this context, the notion of resilience seems promising as it rejects the idea of a given equilibrium and puts an “emphasis on inherent uncertainty and discontinuities” by providing “insight into the dynamic interplay of persistence, adaptability and transformability” (Davoudi, 2012, p.306). To paraphrase Wildavsky (1988), the notion of anticipation and its associated ideas of stability, predictability and control appear somehow old-fashioned as scientists, policy-makers and planners alike are increasingly engaged in searching for resilience by trying to specify what “resilience thinking” (Berkes, 2007) implies for current management and planning approaches.

While this task is as challenging as it is relevant, this contribution develops a slightly different perspective and focuses on recent governance changes in flood risk management that are resulting in quite far-reaching shifts in how flood risks are managed and governed (see also Walker, Whittle, Medd, & Watson, 2010).

The changing landscape of flood risk governance

As Walker et al. argue (Walker et al. 2010, Johnson & Priest, 2008), although the management of floods has always involved multi-actor networks, recent shifts can be observed towards a greater diversity of actors, the development of new roles and different forms of both horizontal and vertical collaboration (Christoplos, Mitchell, & Liljelund, 2001). According to Medd and Marvin (2005) this results in a new “governance of preparedness” through which different types of actors are brought together into new configurations also impacting on the very administrative practice of flood risk management as it creates new tasks and challenges for authorities and professionals involved in this field. What is more, “The increasingly prominent role of non-structural measures requires a much larger involvement of the public, and a functioning dialogue on the flood risk and mitigation options is an essential element of an integrated flood risk management” (Merz, Hall, Disse, & Schumann, 2010, p. 522). In the UK and in Switzerland, a number of flood-related policies explicitly refer to the idea of “good governance” (Defra, 2005; PLANAT, 2008). At the European level, the European Floods Directive 2007/60/EC (CEC, 2007) encourages member states to involve “interested parties” within the development of flood risk management plans (CEC, 2007, Article 10). As a result, the management of natural hazards requires continuous communication with a multiplicity of state and non-state actors, including individual citizens and those from the private sector, joining those with more established hazard management roles in the risk governance process. The task of risk communication has thus become more challenging and more complex (Höppner, Whittle, Bründl, & Buchecker, 2012).

At the same time, this shift towards a governance of preparedness is quite often associated with new forms of authority and control as well as a changing distribution of responsibilities. While governments still set flood policy, they at the same time seek to shift responsibility for costs and actions to other segments of society (Watson, Deeming, & Treffeny, 2009). As a result, those at risk – residents, businesses, farms, infrastructure companies, etc. – are no longer simply exposed to the risk of flooding; rather, they are gradually transformed into active risk managers as they are encouraged to make decisions and choices with regard to the prevention and mitigation of flood risks.

As a consequence of this transition, authorities and organisations involved in managing natural hazards as well as residents and local communities exposed to such hazards are increasingly faced with new challenges and tasks that they need to consider and address. This not only relates to the potentially increasing risks associated with the occurrence of natural hazards due to, among other drivers, the consequences of climate change and on-going urbanisation processes in metropolitan areas. But new demands are also imposed upon them by changing legislative frameworks (e.g. the European Floods Directive). We argue that within this changing context of an increasing complexity of the management process, the ideas of social capacity building to deal with flood risks is gaining prominence. More precisely, we understand the transformation of risk management into a wider frame of risk governance both as a major trigger and the context within which the need to consider social capacity building at different scales should be considered and understood.

Social capacity building for flood risks

Social capacity building is defined here as the process of (re-)discovering, enhancing and developing different types of capacities. In this framing it is a normative and at the same time a rather abstract concept that is further discussed below.

Social capacity building is an iterative learning process

Generally, the idea of capacity building is closely linked to some kind of process or performance, as it usually starts either from an observed lack of skills, resources, practices, abilities, knowledge etc.,

which need to be remedied, or from some kind of inadequate performance which needs to be improved by a specific process (e.g. training, education, discussion, partnership, participation, empowerment or experience exchange). This process, however, should not be seen as a linear one; on the contrary, social capacity building is an iterative learning process which needs to take into account unexpected consequences, reflections upon past behaviour, feedback loops and interactions with others. This learning process can be seen in a range of documents compiled after major disasters, as for example, the Kirchbach Report in Germany after the 2002 flood (Kirchbach, Franke, & Biele, 2002). Besides such one-off reviews, there are also long-term iterative processes, as, for example, after the 2007 floods in England (Pitt, 2008) or after a series of catastrophic events in Switzerland in 1999 (PLANAT, 2004). The Pitt review for England was followed by a government response paper and two progress reports (Defra, 2008, 2009a, 2009b). Therefore, disaster events provide the possibility to scrutinise previously established policies, practices and actions (see also Felgentreff, 2003). In this sense, social capacity building should be organised as a learning process that recognises and takes into account the mismatch of expectations and actual results; that is to reflect and if appropriate adapt established practices, norms and policies (Kuhlicke & Steinführer, 2010). Such attempts may even lead to questioning the very basis of practices, norms, structures and cultures of the entity of interest itself as well as the context of actors and structures involved (Johnson & Thomas 2007, Ramalingam, 2008) and result in more transformative practices.

Social capacity building is participatory and interventionist

Furthermore, instead of being paternalistic, social capacity building needs to pay particular attention to the interrelation of capacity builders and those lacking capacities. Attempts at building capacities always face the potential problem of taking a paternalistic stance, in the sense that an actor or a group of actors are considered by an outsider as lacking a certain skill, a resource or a capacity. According to Beazley, Griggs, and Smith (2004), the weakness of the “deficit model” is that it pays no attention to the capacity of institutions to overcome inherent barriers to engagement.

Similar findings can also be found in the field of flood risk management. Most policies, plans, measures and projects in flood risk management are communicated to “the public” through a process of information distribution, most importantly in a one-way manner and with only limited opportunities for the population to interact. There are even fewer cases where the public is involved in co-decision-making processes. Thus, social capacity building also needs to take place at the level of the organisations in charge of flood risk management. At this stage, many organisations do not have a clear understanding of how to organise the involvement of interested parties (Begg, Luther, Kuhlicke, & Steinführer, 2011). This finding supports the argument that the problem often lies not with communities but with the institutions, structures and processes that affect them (Supramaniam, Di Masso, & García Sastre, 2011). This implies that the interrelations of “capacity builders” and those “deficient” in a certain capacity need to be carefully taken into account. This is surely a central challenge of social capacity building for flood risks: Who defines what and based on which (empirical) grounds, who is lacking what kinds of capacity, by which means or processes capacity should be improved (with which resources, which actors involved) and what should the outcomes look like?

Therefore a complementary strategy of social capacity building seems necessary, focusing both on communities at risk as well as the wider organisational and institutional environment of flood risk management. Participatory approaches focus mostly on communities and aim at empowering actors by increasing their autonomy and agency to “develop their own self-confidence and skills to challenge prevailing local and wider structures of domination” (Pelling, 2007, p. 375). Here the focus is on locally driven and locally owned capacity development processes. The Hyogo Framework for Action 2005–2015 clearly supports such approaches by identifying it as one of its

Table 1. Typology of social capacities

Knowledge capacities	Knowledge comprises various types and is available in different forms and degrees of codification. This capacity thus includes both formal knowledge (e.g. written down) and non-codified knowledge (e.g. local)
Motivational capacities	Motivation relates to the general willingness to take notice of and deal with natural hazards. It includes awareness, responsibility and ownership
Network capacities	Social networks relate to the possession and exploitation of social capital which describes the “aggregate of the actual or potential resources which are linked to possession of a durable network of more or less institutionalised relationships of mutual acquaintance and recognition” (Bourdieu 1986, 248)
Financial capacities	Financial resources include incentives, public and private funds as well as insurance policies
Governance capacities	Governance capacities relate to participation opportunities and fair governance and focus on the “terms of the ways in which decisions are made, who is involved and has influence” (Walker, 2012)

priorities: “Both communities and local authorities should be empowered to manage and reduce disaster risk by having access to the necessary information, resources and authority to implement actions for disaster risk reduction” (UNISDR, 2005, p. 5). This is a relevant statement as it clearly underlines the interconnectedness of disaster risk reduction efforts with an empowering and participatory approach (Pelling, 2007).

At the same time there is also a need to focus on the public sector and organisations involved in the management of natural hazards as they might aim at stimulating and supporting capacity building in specific sectors, localities, or regions by providing measures, strategies, and entire policy frameworks. Such an external institutional framework is set up in order to intervene and to initiate and promote endogenous processes (Land, 2009); it is therefore aimed at enabling social capacity building (Gualini, 2002) by including rules and norms “structuring the interaction” of people and creating the “power to achieve purposes that would be unreachable in their absence” (Scharpf, 1989, p. 152, quoted in Gualini, 2002, p. 36). Importantly, these organisations and authorities are not only developing other actors’ capacities but need continuous capacity development themselves.

Social capacity building means to consider and build different capacities

There are different kinds of capacities and different ways of developing them. Based on a thorough literature review as well as the input of participants in different workshops within the framework of the FP7 project CapHaz-Net, a typology was developed comprising five different types of social capacities (Höppner et al., 2012; Kuhlicke et al., 2011). These are knowledge, motivation, social networks, financial resources and governance capacities (Table 1).¹

These social capacities are either owned by an individual, an organisation or a community (knowledge, motivation, finances) or these actors have access to them (social networks, governance capacities). Governance capacities are considered to be a key resource to enable interactions between private and institutional actors (such as local communities and risk management organisations). Social networks, then, can be regarded as transmitters of knowledge, motivation and financial capacities and establish links among and between local communities and organisations and beyond.

Conclusion

In this paper we argued that the transformation of flood risk management into a wider frame of risk governance is both a major trigger and also the context within which the need for social capacity

building at different scales should be considered and understood. Due to changing landscapes of risk governance (Johnston & Priest, 2007), more demands are posed on organisational actors to engage with risk communication and risk participation. This poses new tasks and demands on the organisations and actors involved. Quite often, however, responsible organisations seem to be insufficiently prepared for these new tasks, for example when risk communication is still considered as a mere one-way information effort rather than a true interaction leading to mutual understanding. At the same time, increasing responsibility is given to communities at risk to manage their own flood risk including decisions about actions and investments. There is thus a need to more systematically understand the relevance of social capacity building both on the side of communities at risk and organisations in charge. As an implication, social capacity building should not be restricted to the general public. Rather it is a cross-cutting challenge of local and social communities but also of different types of organisations, whether they are highly professionalised (e.g. emergency corps) or operate on a more general level (e.g. regional environmental authorities).

Whether and to what extent “resilience thinking” is relevant in this context surely needs further critical attention. With its demand for adaptability, learning and self-organisation (Berkes, 2007) it can become a quite ambivalent concept as it might support activities that opt for decentralising responsibilities and putting greater emphasis on the capacities of individuals and communities in order to make them adaptable and self-organised and by doing this the notion of resilience is rather reinforcing current governance changes instead of offering a new way of handling flood risks more fairly in the long run.

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Notes

1. In a previous paper (Kuhlicke et al., 2011) we distinguished six types of capacities, but when further developing the concept of social capacity building we decided to integrate “procedural capacities” (i.e. knowing how to elicit and apply capacities, skills and knowledge stocks) into knowledge capacities.

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Participatory floodplain management: Lessons from Bangladesh

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Introduction

Bangladesh is one of the poorest, most densely populated and disaster-prone countries in the world. Exceptional floods and cyclones can devastate the lives of millions. In the last 200 years, 70 major cyclones have hit the coastal belt of Bangladesh, and nearly 900,000 people died in these events during the last 35 years (Mallick & Vogt, 2009). In the last three decades, major floods have occurred in Bangladesh in 1987, 1988, 1998, 2004 and 2007; each event killing hundreds of people and causing damages as high as several billion US dollars. However, normal monsoon season inundation of the floodplains that cover much of the country is an everyday feature of life with which people are well adjusted (Brammer, 2004; Paul, 1984). Indeed, the majority of Bangladesh's 150 million population still depend for food and livelihoods on these floodplains. This paper summarises recent research and development initiatives in natural resource management in floodplains, particularly participatory approaches to management of fisheries and water crop systems, in the context of wider policies for flood and water management. The authors have worked in development initiatives to establish community-based organisations (CBOs) and in research and evaluations related to participation, floodplain management and adaptive learning among CBOs in Bangladesh since 1996.

Changing policies

In the 1960s to 1980s modern floodplain management initiatives in what is now Bangladesh were, as in many countries, dominated by an “engineering coalition”, but from the 1990s onwards policy and practice have been increasingly influenced by and responsive to what has been termed an “environmental coalition” (Sultana, Johnson, & Thompson, 2008) that has also stressed local participation and co-management. Major floods were found to have catalysed aspects of flood and floodplain management policies, in some cases accelerating existing policy directions or adjusting them; for example, there was a move towards smaller scale structural “solutions” after the major 1974 flood. After the major floods of 1987 and 1988 the multi-donor multi-study Flood Action Plan (FAP) (Brammer, 2000) started from the premise of initial responses to those floods that proposed major engineering works, but through a combination of studies, pressure from external and internal

civil society and good practice became, to some extent, part of the move towards environmentally sustainable participatory flood and water management. Eventually the donor consortia, which had allied with government, consultants, professionals and public opinion as part of the “engineering coalition” concluded by the close of FAP in 1995 that they could not justify implementation of major embankments.

One legacy of FAP lies in a contested process that accelerated emphasis on public participation, smaller scale hazard adjustments, and maintaining a wider range of floodplain resources including conserving and restoring fisheries. However, when mainstreamed into a technical and bureaucracy dominated public sector there remains a risk that the principles and flexibility of local responsiveness will be watered down or made a hurdle to pass without critical consideration or understanding local power relations – the new orthodoxy or even tyranny of participation (Cooke & Kothari, 2002).

Participatory planning

All co-management initiatives depend on community participation, so a major issue has been developing appropriate and effective ways to initiate new institutional arrangements and to understand what participatory planning methods are effective, given the (often considerable) diversity of interests among local communities. In response to criticisms, guidelines for public participation in water sector projects were initiated under FAP (Brammer, 2000; Hanchett, 1997). After FAP these evolved into a formal process under the National Water Policy-formulated Guidelines for Participatory Water Management (MWR, 2001). These guidelines emphasise participation of all stakeholders in decision-making. This was reflected in the Bangladesh Water Development Act, 2000 which made stakeholder consultation and participation at all stages of the project cycle mandatory. The Local Government Engineering Department, which is responsible for constructing smaller scale water control works, was also involved in finalising the guidelines and has adopted a policy of formally handing over water control structures with command areas of up to 1000 ha to be owned and managed by local communities.

In parallel in the fisheries sector, community management was promoted from the early 1990s by funding agencies such as the Ford Foundation, NGOs (including one that had its origins in studies under FAP), and a Department of Fisheries that lacked any direct control over waterbodies until it gained a role through projects. This was influenced more by international research by Ostrom and others on how local institutions regulate and manage common pool resources, such as fisheries and water, which gave rise to understanding of complexity and recommendations on the design of more effective bottom-up management systems (Ostrom, 1990; Stern, Dietz, Dolsak, Ostrom, & Stonich, 2002).

Operationalising these changes has involved innovations in local institutions (further discussed in the next section) and participatory planning. There are many approaches to participatory planning, but it is notable that in Bangladesh a systematic methodology has been developed for consensus building for floodplain resource management that has been named Participatory Action Plan Development (PAPD) (Sultana & Thompson, 2004), and that there have been assessments of its effectiveness.

PAPD involves a series of linked local workshops where different stakeholder groups participate separately and together to develop a plan for management of the common aquatic resources that they depend on. The process was designed to ensure that poor people’s interests are voiced and represented on an equal footing with those of more powerful stakeholders. The basic principle is that members of any stakeholder category, but especially the disadvantaged are better able to express their views separate from other (dominant) categories of people. However, separate workshops will fail to develop a shared understanding of common problems and possible win-win

solutions (consensus building). Therefore PAPD is structured to have two rounds of divergent and convergent sessions as a practical way of overcoming criticisms of participatory processes that do not address local social and power relations. This approach has been adopted and adapted quite widely in Bangladesh for planning in wetlands and community managed fisheries, and in coastal areas, including planning for coping with hazards. A study of 36 sites where community management of fisheries was facilitated by NGOs resulting in the establishment of local fisheries management institutions found that communities were able to reach agreement faster, took up more conservation-related interventions and faced fewer conflicts in the 18 sites where a PAPD was the basis for collective action and institution development compared with the other sites (Sultana & Abeyasekera, 2008).

Community-based institutions

Institutional arrangements are a key issue for sustainable natural resource management. Recent water and fisheries management projects in Bangladesh have established new local institutions for floodplain management based on community organisations; these occupy a space between the formal institutions associated with government agencies and the informal local institutions and social relations that had determined access to natural resources.

Case studies and more extensive assessment of these local organisations indicate that after projects end, CBOs appear generally successful in sustaining themselves and continuing floodplain resource management. Facilitation, the extent of consensus among different stakeholders, and fit between institutional arrangements and scale of resource were all important influences on effectiveness (Sultana & Thompson, 2010). Local organisations have sustained in smaller floodplains, but in larger areas co-management bodies were a key to effective coordination and troubleshooting among a series of linked community organisations. Local leaders tend to dominate after projects end, especially where planning was less participatory and organisational structures were determined from above. CBOs have remained active as there is a continued benefit to members in the arrangement, such as revolving funds or control of water bodies. But considerable time can be taken up in meetings, and this is a particularly high cost for the poor who depend on each day's work to feed their families. Hence it appears inevitable that the better off who can afford more time will take a leading role, which leaves ensuring accountability of leaders and good governance as significant challenges. At least in fisheries CBOs, some elites (local opinion leaders such as teachers and religious leaders) have played a positive and constructive role as advisers or champions to CBOs comprised mostly of landless people. These CBOs have enhanced the social capital of poor group members by moving beyond building *bonding* social capital (between peers) to building *bridging* social capital (from less powerful to more powerful groups). CBO members in different forums and reviews have stressed that for continued success, formally recognised well-run organisations are needed with accountable and adaptable decision-making processes and good leaders.

Adaptive learning

The many CBOs that have been formed in Bangladesh have been left to continue managing natural resources after projects ended. Locally most of these institutions have shown considerable resilience and ability to sustain, but they were isolated from one another. With the spread of community-based approaches to resource management, adaptive co-management is now regarded as a specific management approach. It incorporates both a hierarchy of institutional arrangements to share management responsibilities over scales of resource and an explicit commitment to learning among these partners but there are deficiencies in learning goals, approaches and outcomes (Armitage, Marschke, Doubleday, & Ryan, 2008).

One of the recent innovations in Bangladesh since 2007 has involved action research to test how a learning network could be developed among over 250 existing CBOs managing floodplain natural resources (Sultana & Thompson, 2012). The adaptive learning process evolved through regular workshops and exchange visits. CBOs that earlier concentrated on either culture or capture fishery management or water management for rice analysed together constraints and opportunities, lessons and good practices. The outcomes were improvements in governance and natural resource management. Most CBOs adopted win–win practices arising from a system-based view of the links between agriculture, water management and fisheries that were encouraged by sharing different perspectives and lessons. This has enhanced the overall productivity of floodplains and resilience to uncertain environmental conditions. Over four years, 84% of participating CBOs acted to improve fisheries management – mostly through measures such as fish sanctuaries and closed seasons that help sustain native wild fish populations and diversity. Moreover 62% of CBOs tested and promoted dry season crops that were new to their areas (such as maize, sunflower and garlic) that need a third or less of the water used by irrigated rice. This preserved more surface water for fish to survive, enhanced capacity to cope with drought, and gave better financial returns than rice.

An adaptive learning network among similar but diverse CBOs has brought more widespread, rapid and systematic learning than individual trial and error, as trust and common understanding developed among CBOs. It encouraged innovation and improved linkages with service providers, and importantly generated peer pressure among CBOs to improve governance and participation of women, as well as natural resource management. This federation of CBOs is a basis for communities entering dialogue with policy processes and attempting to resist threats to their access to common water resources.

Conclusions

The growth of local floodplain management institutions can be seen as a response to the earlier debate over participation in FAP. Participation in planning, built on participatory guidelines from FAP, has been formalised in the water sector but the resultant local institutions have not addressed hazard risks. More generally decentralised community-based management of floodplain resources has spread to many locations. These institutional arrangements do appear to have been effective, but have depended on project initiatives to establish them. Community-based management has sustained but is most appropriate where the resource base and communities are geographically limited. Co-management bodies that link local organisations with wide community participation and local government have been tested with partial success in managing larger more complex floodplains.

At the policy level, for effective community-based co-management in floodplains there needs to be recognition of the rights of CBOs to manage local resources, and to be on an equal footing with government in co-management bodies. Co-management bodies should be formally recognised and provide for checks and balances on the key stakeholders by including CBOs, government agencies, local councils, and NGOs. Enabling policies, such as those covering waterbody leasing, should favour long-term access rights for sustainable management by well-governed CBOs, and should also devolve management responsibilities to local institutions, while providing coordinating forums to help CBOs link together and take on shared responsibilities with government.

Community resource management institutions have increasingly developed a more integrated approach that internalises the interactions between water, land and fishery management. So far, local planning for floods has been a notable gap, but the enhanced social capital and understanding of environmental inter-linkages generated among CBOs is a basis for adaptation to climate change.

To strengthen this, an enabling policy environment is needed that encourages open high profile debate on floodplain issues where community organisations can voice their concerns and recommendations.

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Planning and retrofitting for floods: Insights from Australia

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Land-use planning and retrofitting

Planning for greenfield sites is relatively easy; planning for existing built-up areas faces entrenched interests and standing structures even when inadequate past information and poor decisions have made these areas vulnerable to natural hazards. So how can planners retrofit such vulnerable areas? This paper will use urban flooding to explore this issue, but other forms of natural disaster would have served equally well – in discussing an earthquake in Greece, Athanasopoulou, Despoiniadou, and Dritsos (2008, p. 1899) noted that “the need for both state and disaster victims to return back to normalcy resulted in low priority being assigned to changing the town planning. The urban planning system itself was unable to respond to this challenge.”

A structural issue for planning systems is their focus on the future. Most regulations can be applied only to new developments (Minnery, 2011). Existing vulnerable areas come under the headings of “existing” flood problems (i.e. buildings and development that “by virtue of their presence and location, are exposed to ‘existing’ risks”) or “residual” flood problems (i.e. developments that are in areas where the risks exceed current management measures) (SCARM, 2000, p. 7).

The vulnerabilities of existing built up areas are clearly exposed in the aftermath of a natural disaster. The focus in this paper is the state of Queensland, Australia, and its capital city, Brisbane. After the major floods in December 2010 and January 2011, the government set up a Queensland Floods Commission of Inquiry which, amongst other things, explored the links between land-use planning and the managing and prevention of floods. Its reports and the evidence given to it are the main sources of information used here (QFCI, 2011, 2012). The problems were summarised by the QFCI thus:

Many existing uses have been established historically without regard to flood or by reference to what was accepted wisdom at an earlier point in time ... Planning systems do not operate retrospectively. Improvements in land planning regulation are only realised when development applications are assessed against the improved regulation. Where residential uses have been established historically, there is little the planning system can do to mitigate their risk of flooding. (QFCI, 2012, p. 146)

This difficulty can be seen in the Queensland State Planning Policy linking planning and floods, *Mitigating the Adverse Impacts of Floods, Bushfires and Landslip* (QLDGP and QDEP, 2003), which applies only to new development.

Australian planning and floods

Australians are used to dealing with natural hazards. The poet Dorothea Mackellar described it as a “land of drought and flooding rains” (Mackellar, 1908). A more recent report noted that, “Natural disasters such as floods, bush-fires and tropical cyclones occur regularly across the Australian continent. They cause more than \$1.14 (AUS) billion damage each year to homes, businesses and the nation’s infrastructure, along with serious disruption to communities” (HLOG, 2004, p. vi). Because the early European settlers located close to rivers, Australia’s cities can be dangerously affected by floods. As the cities grew, the population exposed to floods also grew (Geoscience Australia, 2012).

Yet whilst floods have always been with us, and will continue into the future, they are often downplayed in the planning process, in some cases to the extent that vulnerability to floods may be

used to apply additional conditions on the land-use consent rather than as grounds for actually refusing the consent (Gillen & Minnery, 2007; Minnery, Gillen, & Smith 2008).

The problems with retrofitting

The difficulties that may arise with retrofitting for floods include the social and economic commitment residents and owners have made to their properties, people's resistance to change, poor public understanding of flood risk, the limited resources of owners and governments, unclear legal powers and problems of social justice. How these problems play out can be seen from the aftermath of the 2011 Brisbane floods. Inundated areas included some of the city's lowest as well as some of the highest value properties: some potentially floodable land is often cheap and is occupied by lower income households, whilst land with river views is sold at a premium. Poor households had inadequate financial resources to move or to repair their dwelling whilst richer properties owners were committed to retaining their expensive housing.

Brisbane residents have also, since the 1990s, become much more engaged with their river. A demonstration of this is the Queensland Gallery of Modern Art (QGOMA), which opened in December 2006. In the past many public buildings ignored the river but the QGOMA was built on the riverfront and designed to provide panoramic water views (but it flooded badly in 2011). Standards and regulations have also changed. The Brisbane Lord Mayor's Task Force on Suburban Flooding noted that in some older areas of the city, "If these areas were to be subdivided or developed today then it would be to a higher level or no development would occur" (LMTFOSF, 2005, p. 2).

A number of submissions to the QFCI dealt with the problems people have in understanding concepts of flood risk. Buckley Vann Town Planning Consultants (2011) and Grech (2011) both dealt extensively with this problem in relation to town planning and the incorporation of flood risk into town planning instruments. A limitation that flows from the current Queensland planning legislation (the *Sustainable Planning Act 2009*) is that the legislation, being performance-based, does not allow a planning scheme to "prohibit development of flood constrained land" although the scheme can identify the levels of assessment an application must undergo and that may lead to refusal (Adams, 2011, p. 13). The legislation is also not clear on legal responsibilities for payment of compensation to landowners when regulations to reduce development intensity are changed. These factors lead both to inappropriate development on floodable land and to difficulties in dealing with those already developed areas.

Ways of retrofitting

A fundamental aspect of retrofitting for floods is to use levels of risk to prioritise where actions should be taken. Risk should not be measured just by probability or Annual Exceedance Probability, as it is now. Risk is better related to both the nature of the hazard or consequences and the probability of the occurrence of that hazard (sometimes expressed as exposure) (Grech, 2011; QFCI, 2011). An extension of this idea is a "risk triangle" in which the risk is related to consequences and probability but also to vulnerability (Crichton, 1999; Geoscience Australia, 2011). Community perception of the risks and impacts of floods is important. The central area of the town of Gympie on the Mary River north of Brisbane floods frequently but rather than moving the centre, the community has chosen to live with the risk.

Current mapping used in land-use planning tends to concentrate on flood probability. But floods are of many different types; and different parts of a floodplain are impacted on differently even during the same flood event. For example, the swift deep flow in a river channel can be more destructive than the slowly rising water on a flat floodplain (SCARM, 2000). Retrofitting priorities should be related to the level of risk. For example, an old persons' home in a flood affected area

should be given a high priority because of the vulnerability of the residents, whilst a storage area for hazardous materials should be given a high priority because of the nature of the hazard. Similarly evacuation routes, communications infrastructure and hospitals should be given high priority because they represent a different kind, but still high level, of vulnerability.

Perhaps the most commonly discussed forms of retrofitting are land buy-backs and land swaps (QFCI, 2012, pp. 272–280). As the Standing Committee on Agriculture and Resource Management (SCARM 2000, p. 7) notes, “voluntary property purchase may be the only feasible and economically justified management measure for the more hazardous area of the floodplain.” Removing houses and using the land for less vulnerable purposes such as public open space or environmental conservation may be necessary. A variant of this process was the move of the small town of Gundagai, New South Wales, out of the flood plain of the Murrumbidgee River after the floods that devastated it in 1852 and 1853 (Australian Government, 2008). A more recent example occurred at Grantham near Brisbane, which was overwhelmed by a powerful flash flood. The response of the local council, supported by the state government, was to buy land above the floodplain and offer sites in the new location in a voluntary exchange for sites in the floodplain. This had the additional benefit that it enabled “collective relocation of a community, which carries social benefits as well as achieving floodplain management goals” (QFCI, 2012, p. 276). Special master planning and development approval processes were put in place, utilising the powers and resources of the newly created Queensland Reconstruction Authority, but working with the council and the community to make this happen (QFCI, 2012, p. 276ff).

Buying back hazardous land, whether voluntarily or through compulsory purchase, is a potentially extremely expensive undertaking. A number of local authorities across Queensland have initiated buy-backs for particularly hazardous properties, but they rely on funding support from the state or Australian governments. This funding has in the past been ad hoc and unreliable. A clear implication from the discussion in the QFCI is that large-scale buy-backs are not feasible without substantial funding from central and state governments (QFCI, 2012, p. 273–275). Godschalk (2003, p. 138) reports that in the USA, federal government funding helped the city of Tulsa to establish “a floodplain clearance effort that removed some 875 buildings by 1993”.

Where buy-backs are not feasible other retrofitting measures need to be considered. One option is “down-zoning” flood-affected areas so that the planning scheme provisions discourage future approvals for residential development. The Ipswich City Council’s Temporary Local Planning Instrument initiated after the 2011 floods contains “special opportunity areas”, in which the council is encouraging the transition of existing residential precincts to “low impact, non-residential uses” (QFCI, 2011). This is not a zone change, but rather involves reducing the level of assessment for certain non-residential uses, making it easier to obtain a development approval. However, this may result in claims by affected landowners (the liability for such actions is not clear in the Queensland legislation) and existing communities may be resistant to non-residential uses being introduced into their neighbourhood.

Development and building controls on existing development may also provide an avenue for retrofitting. Brisbane again provides an example. After the recent floods, the Brisbane City Council implemented a Temporary Local Planning Instrument that permitted the habitable areas of rebuilt houses to be raised above the 2011 flood level (plus a 500-millimetre freeboard) even if that meant the roof level would exceed the 8.5metre limit normally applied across the city (BCC, 2012). This was helped by the common building form of older Brisbane houses which are raised above the ground on stumps.

There are a limited number of reports of replanning to totally retrofit vulnerable areas. Mandarano (2010) reports such an example for an office park in the USA. But many aspects of retrofitting are normally outside the reach of the planning system. A lesson learned from the 2011 Brisbane floods was the necessity to raise essential electrical equipment above flood levels. Some city buildings that were

otherwise intact were unusable because of damage to the electrical systems located in basements. Similarly, buildings can be constructed from materials that are relatively flood resistant. Construction of levees and other engineering works (including improvement of stormwater and overland flow) to protect built-up areas is obviously possible. Such physical protection may also be possible for exposed infrastructure, such as mobile phone towers, evacuation roads and the like.

Conclusions

Retrofitting of existing vulnerable urban areas seems to be a relatively neglected consideration in land use planning. The examples given in this paper show that there are ways for planning systems to deal with retrofitting vulnerable areas. Understanding the risks involved and allocating priorities is the first step. The examples given illustrate both the potential barriers to retrofitting and the ways these barriers can be overcome.

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Neighbourhood design considerations in flood risk management

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Climate change adaptation is receiving increasing levels of attention in academic research arising from recent findings that suggest that the impacts of climate change are already being experienced (Min, Zhang, Zwiers, & Hegerl, 2011; Pall et al., 2011). Whilst the traditional focus to reduce flood risk was to build flood defences and constrain rivers through “hard” engineering solutions, increasingly it is recognised that such an approach on its own will not be appropriate in future, especially when climate change impacts are considered. Consequently the role of spatial planning is increasingly being recognised as having a crucial role to play in the adaptation of urban environments, and in mediating the competing tensions between mitigation policies seeking to prevent further climate change and adaptation policies seeking to cope with implications of its arrival.

The existing urban fabric in many of our towns and cities was built without consideration of flood risk (White, 2008), and where such flood risks were considered, “hard” solutions were frequently implemented. As a result, our existing urban environments, through the location and design of past developments, have frequently interrupted natural flooding processes, removed vegetation buffers, covered large areas with artificial and impermeable surfaces (increasing runoff), removed natural water storage capacity, and interrupted potential flood flow paths. However, in line with, for example, the EU Floods Directive (CEC, 2007), rather than structural solutions alone, combining with “soft” or non-structural solutions that “live with” or “make space for” water and the application of risk-based principles has become the approach to flood risk management (Merz, Hall, Disse, & Schumann, 2010). Consequently a number of authors such as Berke, Song, and Stevens (2009); Fields (2009); Pardoe, Penning-Roswell, and Tunstall (2011); Tunstall, McCarthy, and Faulkner (2009); White (2008); Stevens, Song, and Berke (2010); and, Stevens, Berke, and Song (2010) and have started to consider the integration of issues surrounding planning, urban design and flood risk management.

Prior to outlining the type of initiatives that the planning system can undertake, it is worthwhile exploring the scale of potential impact that might be anticipated. Most recently in 2012, the impacts arising from the severe storm damage and flooding experienced in New York from the impact of Hurricane Sandy demonstrated the scale of social and economic impacts that are anticipated to become more frequent in future years. In addition to the direct human suffering and social costs experienced at the household level, there were also wider indirect costs arising from loss of electricity and water supplies across neighbourhoods, and also disruption to the wider electricity network, transport systems and fuel supplies. As a result, for a time many neighbourhoods across New York City ceased to function efficiently and arguably the city as an economic entity demonstrated

a limited level of resilience to this scale of weather event (see Coaffee, 2008; Godschalk, 2003; White, 2010, for discussion about city resilience). Separately, on a national scale, the UK has undertaken some of the most comprehensive analysis of the likely impacts of flooding in the future. The *Foresight Future Flooding* report (Evans et al., 2004) estimated the annual losses, depending on the approach taken towards future land, environmental and economic management, at between £1 billion and £20 billion by 2080s (based on medium-low and high greenhouse gas emission scenarios respectively). Under these scenarios, assuming a continuation of pre-existing trends associated with poor planning controls, increasing urbanisation and poor levels of social resilience, the social and economic impacts of flooding would be considerable. Apart from anticipated increases in flood risk arising from fluvial and coastal sources, one of the most significant implications from the study is the need for strong action to prevent major urban flooding problems. Engineering solutions to address flooding (from all sources) were found to be prohibitively expensive, but, with the application of an integrated portfolio of responses, importantly including land use planning, *Foresight Future Flooding* (Evans et al., 2004) considered that annual damages could be reduced from worst-case scenario of approximately £20 billion to about £2 billion.

In parallel, there has been a perceptible shift in flood management policy emphasis from the public sector to the private sector (Johnston & Priest, 2008). The implications of this shift will be experienced at the neighbourhood level and will be substantially implemented through the planning system. The question that must be considered thereafter, from a planning perspective, is how can the planning system deliver long-term reductions in flood risk? In the first instance this requires that strategic decision-making at the catchment or regional scale informs design considerations at the neighbourhood scale. Supported by legislative requirements arising from the likes of the EU Floods Directive, this type of thinking is now permeating planning systems across Europe and internationally.

For example, in the south-east of England, the Thames Catchment Flood Management Plan (CFMP) (Environment Agency, 2009) (which covers the River Thames and all its tributaries),¹ identifies a variety of combinations of flood risk management actions required to manage flood risk at different locations according to their: physical characteristics, level of flood risk, and pre-existing level of flood management actions (Environment Agency, 2009). In summary, the Thames CFMP suggests, in the first instance, that the undeveloped floodplain is its most important asset, and that in urbanising locations, flood risk should not increase as a consequence of development taking place, provided development is located in the lowest areas of risk and surface run-off is managed appropriately. Furthermore, it identifies that large-scale redevelopment is planned within flood risk areas in many parts of London, and that this provides an opportunity to achieve a net reduction in flood risk by ensuring that new developments have a better layout and design that recognises the current and future flood risks to which they are vulnerable (Environment Agency, 2009). However, the implementation of such plans requires wider co-ordination across all aspects of the planning system that ultimately impact at neighbourhood level.

A good example of such strategic co-ordination is how the Greater London Authority has used the same risk-based principles from Thames CFMP (Environment Agency, 2009) and PPS25² to inform its Strategic Housing Land Availability Assessment (SHLAA) and Housing Capacity Study (HCS) (GLA, 2009; see also Atkins & BNP Paribas, 2010), and thereafter its housing allocations. The SHLAA/HCS employed a probability approach to take account of uncertainty related to development constraints, including flood risk which was identified as a strategic development constraint. This resulted in reduced site capacities being applied to sites at flood risk (and with a zero capacity assigned to sites of highest risk), thereby reducing the notional net-developable area in recognition of the space required for flood mitigation measures such as river-corridor riparian buffers, surface water drainage systems, and space for flood storage. When aggregated the constrained capacities provide an estimate of large site capacity at each spatial scale, and informed the borough housing allocations in *The London Plan* (GLA, 2011), outlining the spatial

development framework for the next 20 to 25 years. By allocating reduced housing targets to boroughs with significant numbers of sites at medium to high flood risk, the rate of floodplain development and consequently flood damage should be reduced. Furthermore, the principles outlined in the Thames CFMP (Environment Agency, 2009) relating to using redevelopment opportunities to achieve reductions in flood risk have also been incorporated into *The London Plan* (GLA, 2011). In essence, over time, the footprint of the city will adapt to recognise the constraints imposed by floodplains.

This idea of transforming the footprint of the city requires consideration of a long-term strategic vision of the city – moving from one driven solely by functional socio-economic considerations to one that is hydrologically sensitive (White, 2008). As noted by O'Neill and Scott (2011), spatial planning has the capacity to adapt the built environment to climate change by delivering a more multifunctional built environment that is safe and resilient to climatic extremes such as flooding. Such an approach should seek to accommodate the desire to not only protect property from flooding, but to facilitate regenerative development, and also protect and where possible enhance the environment by accommodating the natural process of flooding. So, what will happen at the neighbourhood scale?

At the neighbourhood scale, the avoidance of development on existing floodplains, through the sequential allocation of greenfield land so that development is avoided at locations at highest flood risk, will result in a more hydrologically sensitive urban environment. However, the challenge is greatest for the existing built environment and its stock of buildings. There, masterplanning of redevelopment areas provides opportunities for long-term structural change to the urban environment to achieve a net reduction in overall flood risk. This includes opportunity for properties to be relocated and designed to be safer and resilient to flooding, and also urban realignment and river restoration schemes that provide space for natural flooding processes to occur, for example, the Lent-Nijmegen Dyke relocation scheme on the River Waal in the Netherlands). However, for existing buildings located in the floodplain where relocation or flood defences are not viable or appropriate, resilience measures that seek to minimise the damage caused and facilitate rapid recovery (e.g. concrete floors, raised electrical fittings and appliances, use of waterproof plaster, and waterproof cabinets, doors and skirting boards), and resistance measures aimed at keeping water out (e.g. raising floor levels, air brick covers, installation of flood gates, sink and toilet valves, sump and pump) can help to minimise the damage from flood water and also reduce the recovery time for a building (Bowker, 2007; CLG, 2007). Furthermore, adaptation of the urban environment to include green infrastructure that can help store floodwaters and reduce flood peaks, whilst also providing wider ecological benefits, can also reduce the probability of flooding. Consequently, for new development (whether on green- or brownfield lands), the location, urban layout, and building design will determine its future adaptive capacity (Lindley, Handley, McEvoy, Peet, & Theuray, 2007).

For redevelopment schemes in neighbourhoods at flood risk, or where the risk of a flood defence breach exists, it is also critical that masterplans integrate the requirements for emergency management and response into the built environment (Bosher, Carrillo, Dainty, Glass, & Price, 2007). In practice this means identifying dry access and egress routes from neighbourhoods at flood risk, the identification of safe refuges within neighbourhoods or even within buildings, and also addressing the requirements of people located on “dry islands”. When considering urban form and layout, it is also important to provide for potential flow paths for surface water that flows overland when the capacity of drainage systems are exceeded, and also for overtopping or breaches of flood defence during extreme events. However, the management of flooding is complicated by the fact that flooding can occur from multiple sources (fluvial, tidal, coastal, sewers, surface/pluvial, ground), and interactions between these sources in urban areas during flood events can also compound impacts experienced, and complicate efforts to manage it. Indeed urban flooding is

likely to become the major source of flooding for properties in the future. The urban area of Guildford in Surrey in the south-east of England provides a good example of this type of challenge.

In Guildford, approximately 67 hectares of its urban area are located within the 1-in-100-year floodplain of the River Wey, and contains about 620 at-risk properties within it (Guildford BC & EA, 2009). Furthermore, about 47 hectares of this area would be ordinarily defined as functional floodplain (annual probability of flooding of 1 in 20 years or greater). In the absence of a viable structural option, the challenge for Guildford, as outlined in a risk reduction measures publication, is to balance competing sustainability trade-offs: to identify a solution to not only prevent urban blight, but also reduce flood risk in the Guildford urban area by “using redevelopment opportunities to provide increased safety, additional floodwater storage, and improved floodwater flows, whilst making space for water and the enjoyment of the River Wey” (Guildford BC & EA, 2009, p. 2). This risk reduction measures document states that where it is not possible to relocate development to areas of lower flood risk, that safe occupation achieved through site layout and building design, including consideration of emergency planning procedures, will be critical so that no properties will be inundated by future flood events, that future residents have safe access and egress to their homes, and also, that the wider urban realm is designed to be resilient to flooding. When redevelopment opportunities arise, reducing the probability of flooding can also be addressed by ensuring that new building footprints are set back from the River Wey to create more space for floodwater, and where possible restoring floodplain and flood flow pathways by identifying space for flood storage where flooding can occur safely. In general, the incorporation of such considerations into an urban environment master plan can provide for the potential use of roads, car parks, green-space, or other unimpeded pathways as relief channels or temporary flood storage. These are examples of how the multi-functional potential of the wider urban environment can be maximised by combining the need for temporary flood storage with other ongoing functional, recreational and ecological uses (White, 2008). Furthermore, the Guildford risk reduction measures document also states that the consequences of flooding can also be reduced in Guildford through incorporation of resilience and/or resistance measures, depending on flood depths, and this can reduce the cost of flood damage to a building by between 65% and 85% (Guildford BC & EA, 2009).

There are numerous challenges at the neighbourhood scale associated with the development of many of the measures noted above. Whilst recent planning literature has substantially considered the requirements to achieve “compact city” development or the attributes associated with achieving liveable cities, research gaps still remain. Although the literature has started to consider some of these from various perspectives, consideration of urban design and how it can address urban environmental hazards and human safety, and the acceptability of people’s experience of such “places”, is less well explored, perhaps arising from the fact that there continues to be uncertainty about the scale of flood risk associated with climate change (as outlined by White’s opening *Interface* paper on p. 151–161). Questions remain about whether you can recreate a sense of place by relocating a town and its community - as undertaken by the town of Valmeyer, Illinois in the Mississippi Valley, following a devastating flood in 1993 – or whether the design measures associated with climate change adaptation will undermine the vibrancy and vitality of urban neighbourhoods. For example, in the context of the latter question, the requirements to achieve safe places for people to live, recreate and work may eliminate certain vulnerable land uses from flood-prone locations or create ground floor activities that, whilst less vulnerable to flooding, potentially eliminate vibrant street life, or require ground floor voids for flood storage. This idea of using redevelopment to design safer places to live (at potentially greater density) and thereby achieve a net reduction in flood risk, is becoming an area of exploration in the literature, with for example Stevens, Song and Berke (2010) wondering whether this approach contributes to “safe development” or “safe development paradox”. Nevertheless Pyke et al. (2011) have identified the benefits of a site redevelopment approach, particularly in the context of managing stormwater run-off.

Alternatively, given people's attachment to place (Mishra, Mazumdar, & Damodar, 2010), securing the future of certain neighbourhoods may (assuming its economic viability) require the erection of large flood walls that change a place's relationship with its river. Using the example of Guildford again, in terms of critical infrastructure and services, its police station, fire station, hospital, key access roads, and also a number of electricity substations, are all located within the area of highest flood risk. In the long run, some of these may have to be redesigned or relocated to safer, and potentially less central, locations in order to ensure that they can function continuously during all major emergencies. This challenge of striving to balance the desire for compact urban development with the need for certain vulnerable land uses to be relocated away out of the flood plain (the town centre) and the need for additional space to be devoted to floodwater storage, is perhaps illustrative of the type policy tensions that will confront planners and policymakers.

However, perhaps the biggest difficulty that faces planning practitioners and policy-makers in addressing this challenge is a general lack of awareness amongst the wider public about the scale of that future challenge and the imperative for change. Therefore, assessing communities' true perception of risk, their perception of what "safe" is, and undertaking visioning and scenario exercises to involve and inform the wider public will be critical to identifying joint visions about the future design of adapted urban environments. In effect, climate adaptation may mean we have to reconceptualise the way we think about urban locations in future, and how we achieve a safe place or what we consider a safe place to be, is likely to be a subject of intense debate.

Notes

1. The Thames River catchment covers the area from its source in Gloucestershire through London to its estuary in Essex, and includes parts of Wiltshire, Oxfordshire, Berkshire, Hampshire, Buckinghamshire, Hertfordshire, Surrey and Middlesex, inclusive of all its tributaries.
2. The principles and most of the obligations from England's planning policy statement *PPS25 Development and Flood Risk* have been incorporated in the *National Planning Policy Framework* which replaced all Planning Policy Statements, including PPS25.

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Flood risk management – Challenges to the effective implementation of a paradigm shift

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Introduction

The Irish government has embarked on an ambitious change in flood risk management and the prevention of inappropriate development in areas at flood risk. Two main strands of this culture

shift were the publication of Section 28 planning guidelines on flood risk and development (DEHLG/OPW, 2009), and the commissioning of the Catchment-based Flood Risk Assessment and Management (CFRAM) projects, involving the development of flood maps and flood risk management plans, across the seven river basin districts in Ireland. The pace of these initiatives has been driven by the EU Floods Directive (CEC, 2007), enacted in 2009. On the surface, the Directive reassures those with the responsibility for flood risk management that a business as usual approach can be adopted. However, the underlying theme of the directive is to capture the paradigm shift in land-use planning as part of a holistic approach to flood risk management that will be needed to sustain our communities under the threat of climatic change.

The implementation of these two complementary projects illuminates the institutional barriers that exist in Ireland, and in most other countries. They demonstrate the challenges that are specific to managing a natural phenomenon, the deep emotional impacts that flooding has and the perceived and real impact on the value of land and property. It is clear that successful adoption needs to start at the community level, and to fully engage with this often neglected stakeholder group. This paper reviews the legislative and consultation frameworks that are to be established to truly implement the Floods Directive.

Land-use planning and flood risk – unhappy bedfellows?

In 2003, the cross-sectoral Flood Policy Review Group was established by the Irish Government in response to increasing incidents of flooding in Ireland and Europe. The group identified an integrated suite of initiatives to be pursued by the Office for Public Works (OPW) (the lead national agency for flood management) and other public bodies for the sustainable management of potential future as well as existing flood risk in Ireland (OPW, 2004). It highlighted the important role of the planning system in reducing potential future flood risk and identified the need for a step-change away from a purely development control approach to proactive zoning of appropriate land uses early in the planning process. As a result, OPW and the then Department of Environment, Heritage and Local Government, commissioned JBA Consulting and Loci planning consultants in 2006 to prepare guidance on integrating flood risk management into the planning system.

The initial activity was to map the drivers for change, to identify available instruments aimed at proper planning and sustainable development and established practice in both planning authorities and the develop sector, to assess the capacity for change and the scale of flood risk issues across the state and within key settlements, to be captured in a position paper. This essential process challenged perceptions and embedded understanding of how flood risk management was developing in Europe, and the societal issues associated with flood risk. The main outcome of the position paper was to agree the principles of the guidance, a touchstone for when the guidance would be examined during consultation. The principles were drawn from the other major initiatives being launched by OPW, such as the Catchment Flood Risk Assessment and Management (CFRAM) programme, and current planning guidance across Europe, USA and New Zealand. This process gave cause for reflection on how prescriptive or relaxed such guidance should be, how to manage expectations for quality flood risk datasets, how its implementation could profit from the experiences in the UK, and how quickly uptake may occur.

The Planning Guidance (DEHLG/OPW, 2009) was issued for consultation in September 2008, and was well received by most parties. Demonstrating a balance between managing flood risk and supporting sustainable redevelopment in traditional riverside areas is at the heart of a sequential approach to appropriate development and the two-part Justification Test (JT) that, in very specific and limited circumstances, permits vulnerable development in flood-prone areas. The guidelines can be applied effectively within the hierarchy of planning decisions. This was successfully achieved by ensuring close links with the Strategic Environmental Assessment process used in

preparing Regional, County and City/Town plans, and enables flood risk to be balanced within the wider societal sustainability objectives and not to be regarded only as a problematic issue to be overcome after the key decisions have been made. Initial reaction to this multi-layered assessment process was sceptical but it was seen as the most effective way to stop development engineering its way out of a flood problem, by land raising or flood defences. This was an early failing of guidelines in England.

Four years on, the policy has been effective due to its clarity and explicit links it draws over the potential difficulties of achieving good place-making in areas subject to flood risk. In addition, the demise of the so-called Celtic Tiger took much of the angst out of having to reject new and 'urgent' development being proposed in floodplains. Also, as a result of obvious over-zoning for residential purposes during the recent housing boom (from the mid 1990s until 2007), the review and variation of development plans have sought to use flood risk as an effective means of scaling back on the amount of zoned lands. However, would the situation have been the same had the scale of development continued? The robustness of the first principle of avoidance, unless a tightly defined reason on proper and sustainable planning grounds can be presented, was designed to be a simple message which planning officers could relay to elected members and the wider development community. Forcing the planners to consider whether it was sustainable to build on floodplains was considered an improvement on guidance in operation in the UK, where the regulator, the Environment Agency, has become a planning body by proxy and not the adviser on flood risk it is designed to be.

The OPW has a role, but has been clear on the limits of its advice. Therefore the guidance was written around those with the greatest impact within the planning system – the local authority planners and developers. Research has shown (JBA Consulting & Entec, 2009) that flood risk issues are most effectively dealt with at the zoning stage and so two variants of the JT were developed. The development management JT can only be used once the strategic land zoning has been undertaken. This is perhaps a draconian measure, but has prompted planning authorities to undertake a strategic flood risk assessment before the development plans are up for review. An interesting finding has been that those local authorities who have been early adopters, who drew together all functions from across the council and have published flood maps have a much smoother time when it comes to development management decisions. By lowering expectations through land zoning and presentation of a consistent message, difficult discussions regarding "acceptable" levels of risk have been limited to commercial developments.

There were early concerns that the planning guidelines on flood risk management, which are predicated on a "have regard to" basis, would need to be implemented in case law via appeals to *An Bord Pleanála*, the Irish planning appeals commission. In reality this was not needed and effective implementation was achieved by national training sponsored by the OPW and support by government, case studies and published Strategic Flood Risk Assessments for others to follow.

The biggest hurdle was, and still is, producing an evidence base to allow the delineation of flood zones and effectively communicating their validity to the target audience. These were the fundamental triggers that required a site allocation to pass through the JT. With elected members claiming multi-generational knowledge of the lack of flooding on a land parcel, the communication challenge over flood probabilities and flood mechanisms became critical. The concept of the residual risks that occur when building behind defences often proved a step too far at the preliminary stage of land allocation, and the deliberate choice of having flood zones shown without the benefit of defences often brought into question the benefit of the schemes to a town, with the result that the professional judgement of the flood engineer was examined closely, and sometimes overridden. This reinforces the need to have access to the best available technical data within an effective and clear policy framework.

Sustainable flood risk management – a concept that can be easily communicated?

CFRAM projects are being implemented for around 300 communities across Ireland which were designated as areas where the flood risk might potentially be significant through a preliminary screening process required by the EU Floods Directive (CEC, 2007). By necessity of the EU deadline, the screening was done nationally and, on the basis of the assessment being just a screening exercise, through simple approaches to identifying flood-prone areas. With few hydraulic river models and limited cross-sectional data upon which to build new models, Ireland is data poor when compared with other northern European nations, and it was necessary to develop national, indicative flood maps as part of the screening assessment.

Another initiative set out in the Report of the Flood Policy Review Group (OPW, 2004), and outlined in more detail in the subsequent implementation strategy developed by the OPW, was the promotion of public and institutional awareness of, and preparedness for, flooding and flood risk. This was initially implemented at a generic and national level through information websites and widely distributed booklets. However, this would not achieve the level of understanding and awareness required within individual communities and among potentially affected residents, and the policy and strategy recognised that there was a strong local dimension to this initiative. They identified that close engagement with local communities should be progressed, with strong involvement of local authorities once the CFRAM programme began developing locally specific flood hazard and risk information. This initiative represents a paradigm shift from a top-down consultative approach limited to the implementation of capital (structural) flood relief schemes that was the norm prior to the policy review.

The four-year CFRAM programme is proving a fantastic opportunity to engage and change mindsets across a broad group of stakeholders. Engagement rather than consultation will prove important if the flood risk management plans are not only adopted institutionally but also embraced by the communities as the most sustainable way forward. The role of the OPW is well accepted, among local authorities and elected council members, but as with most national bodies, often has a perceived lack of legitimacy within remoter communities. This barrier can be removed by working through a network of trusted partners within the local context.

The Floods Directive (2007) requires consideration of the impacts of flooding taking into account social, environmental, cultural and economic objectives, and the CFRAM process has developed best practice in option appraisal using strategic environmental assessments informing a multi-criteria analysis that balances interests for these four objectives. Involving and communicating the multi-dimensional balancing act takes skill and patience. A good evidence base is essential if the foundations of trust and engagement are to be achieved. The Western CFRAM project, still at an early stage, has started to scratch the surface of the local context of the issues surrounding flood risk. Building the relationship with the stakeholders and communities will require significant further work throughout the project. This will leave a legacy that will support awareness and preparedness initiatives and, where relevant, detailed development of potential structural measures is worked through with the communities.

The Western CFRAM team, made up of OPW, six local authorities and JBA Consulting, is working to establish long-term relationships and two-way dialogue with key stakeholders and communities to build a greater awareness of flood risk and confidence in the approach and project deliverables. By helping internal and external stakeholders understand and respond to each stage of the project, the team are able to:

- Manage expectations;
- Share information effectively;
- Provide feedback;
- Develop an approach where people feel enthused, valued and included for the project

- duration, both internally and within key stakeholders;
- Build trust during the study period and in the final outputs;
- Minimise risk and delays to the project.

In addition, the Floods Directive requires an evidence base to demonstrate how stakeholders have been involved and engaged through the CFRAM programme and how they have informed key work stages. In order to deliver this, the approach adopted in the Western CFRAM is shown in Table 1.

It is an imperative that a good communication strategy is not a bolt-on or standalone process. The OPW, in consultation with JBA and the other CFRAM consultants, have developed an overarching strategy that will support the approaches listed in Table 1; however, the challenge is always in the implementation and not being put off by “talking to an empty church hall”. Institutional arrangements and community networks in the west of Ireland are strong, and it was recognised that the councils and their community forums are the more

Table 1. Approach to stakeholder engagement in WESTERN CFRAM

Approach	Objective
Listen to stakeholders and communities, noting concerns and building long-term relationships	<p>To listen to and understand people’s issues and concerns</p> <p>To provide responses to concerns during the CE process and in our project deliverables</p> <p>To build long-term relationships with stakeholders and communities</p>
Educate, explain and ensure understanding	<p>To make people aware of flood risk</p> <p>To help people understand and react to the level of risk by being prepared for flood events</p> <p>To explain our work and how this links to flood management policies and plans</p> <p>To educate and inform stakeholders and the public of how our work has informed our recommendations</p> <p>To be honest with our stakeholders</p> <p>To keep stakeholders and communities updated through regular communication to eliminate surprises</p>
Manage expectations	<p>To make stakeholders and communities aware of the limits and the parameters we are working within (what we can and cannot do)</p> <p>To make clear the extent to which stakeholders and communities can influence the outcome of our studies</p> <p>To be clear as to how people can meaningfully participate in the process and how we will use that information</p>
Encourage involvement and participation	<p>To stimulate public debate on project findings</p> <p>To encourage participation in engagement events from all stakeholders and interested parties, including those deemed “hard to reach”</p> <p>To make use of local networks and “trusted messengers” to convey our messages to as wide an audience as possible</p> <p>To encourage stakeholder “buy-in” and public support for our recommended management options and to avoid total adverse reactions</p> <p>To provide feedback at appropriate stages to demonstrate how we have taken or not taken views on board with explanations. To engender ownership of the levels of flood risk and the selected management options.</p>

effective route to building up a trusted network of messengers, along with parish level bodies and schools for the delivery of notices and raising awareness. As long as the community leaders are kept informed they are useful reinforcers of the messages and purpose of the study. In the more remote areas and communities, consideration has been given to “pop up” flood fairs and information vans, that can target community events such as farmers’ markets, agricultural shows and cultural events.

Conclusion

Land-use planning remains one of the most influential instruments flood risk managers have at their disposal. The policy enacted by the Irish government is one of the tougher planning guidelines in Europe, but it is clear and limits the degree of compromise that is always involved when accepting some residual risk in new development built in the floodplain. It has altered the way in which land will be zoned for development in the future. Having achieved that objective, the bigger challenge is to reduce flood risk in our existing communities. The CFRAM process will provide that link and provide the evidence base to take action where appropriate and economically worthwhile.

Delivering resilient and adaptive communities, in light of the increasing scale of climatic change, will need brave leaders who have been engaged in this debate and have been persuaded by a clear and understandable scientific evidence base. As a result of an effective communication strategy, these leaders will be prepared to deliver a lasting and sustainable legacy. This involves more than a presentation of technical data, but an impassioned argument to change hearts and minds.

Building trust at a local level using those institutions that are already embedded and can act as a respected network or conduit for communications of flood risk messages is key. The implementation of the paradigm shift from defending our communities by building higher walls or dredging channels deeper, to managing flood risk through a number of different strands of cross sectoral policy and measures requires good communication and engagement at a community level.

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