Public attitudes towards flooding and property-level flood protection measures

PUBLIC ATTITUDES TOWARDS FLOODING AND PROPERTY LEVEL FLOOD PROTECTION MEASURES

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Abstract

The number of residential properties at risk from flooding is predicted to rise in the future, and it is clear that large scale flood defence schemes are not always feasible. There is thus an increasing onus on the public to protect their own properties. This paper reports the results of a stakeholder consultation investigating public attitudes towards flooding and property level flood protection (PLFP) in general, and peoples' "willingness to pay" for PFLP specifically. The findings show that flooded households have suffered significant financial and social impacts. Despite some continued uncertainty surrounding flood risk responsibility, the majority of the public surveyed were willing to pay for property level flood protection, with a mean contribution of approximately £800. Whilst this paper broadly confirms some of the findings of earlier studies, it also indicates that public education and promotion campaigns have been effective in raising awareness and uptake of PLFP, and that people are willing to pay more to protect their properties. The findings also support the notion that an increased awareness of PFLP, and an increased willingness to pay for PLFP, is linked to the scale of flooding and impacts, rather than just the frequency, as well as financial subsidies. The results of the study are particularly relevant to institutional stakeholders, as they can help guide the development of strategies to increase the uptake of such measures. Whilst the project focuses on the situation in Scotland, the findings will have resonance in similar countries throughout Europe and beyond.

Keywords

Flood impacts; Property level flood protection; Willingness to pay.

1. Introduction

Globally, the annual damages associated with flooding are highly significant; in 2007 alone, there were 200 major floods throughout the world, affecting some 180 million people, causing more than 8,000 deaths and resulting in over £40 billion in direct financial damages (Pitt, 2008). Although the majority of fatalities normally occur in Asia, the economic damages are more evenly spread, and insured losses due to flooding within Europe between 1998 and 2002 were ~€25 billion (EEA, 2003). In England and Wales alone, Environment Agency figures indicate that over 5.5 million properties and 2.4 million people are at risk of flooding (EFRAC, 2013), whilst in Scotland the National Flood Risk Assessment estimates that some 125,000 properties are at risk (SEPA, 2011). As a result, estimated average annual damage costs are more than £1 billion in the UK, with the extreme floods in England in 2007 alone resulting in £3.2 billion damages (Pitt, 2008; Environment Agency, 2010). However, the already high levels of flood risk in many parts of the world are increasing, primarily due to climate change and the increasing urbanisation of our societies (Evans et al., 2004; OST 2007; IPCC, 2007; Ramsbottom et al., 2012). In particular, there now appears to be clear evidence that climate change will lead to an increase in the frequency and severity of extreme precipitation and other weather events (IPCC, 2007); for the UK this may well result in wetter winters and more intense/frequent summer storms (UKCIP, 2009). Similarly, urban drainage infrastructure is coming under ever increasing pressure from burgeoning urban populations, which are predicted to swell from less than 40% of the world's population in 1990 to ~70% by 2050. Within Europe, the situation is even more extreme, with three quarters of all Germans, Britons and Dutch living in urban areas (UNICEF, 2012). It is predicted that these pressures will at least double, and could increase by twenty-fold, the risk of fluvial and coastal flooding in the UK by the 2080s. Moreover, it is predicted that the number of people at high risk of flooding in the UK will rise from 1.5 million to 2.3-3.5 million over the same period, and that associated annual average damages could soar to some £27 billion (Evans et al, 2004; Ramsbottom et al., 2012).

On a more local level, the direct financial damages related to the flooding of residential properties can also be significant. Depending on flood depth, it is estimated that the cost of flooding can be £10-50k for a single residential property and its contents (Bowker, 2007). Flooding at the household level can also result in less direct, insurance-related impacts (Ball et al., 2012), with premiums and flood-related excesses typically increasing following a flood event. Flood excesses of £10,000 are relatively common for UK households who have experienced repeated flooding, and such households have often had difficulty in obtaining insurance cover following a flood event (Werritty et al., 2007; O'Neil et al., 2012).

Existing problems could well be exacerbated in the future as the insurance industry looks to stem the rapid increase in flood related insurance costs, e.g. global insurance losses in the 1990s exceeded US$200 billion and insured losses from the 2002 European floods alone being put at €3.4bn (Munich Re, 2005). Flood insurance provision varies from country to country, and is generally classified depending on how cover is funded (i.e. public or private) and how it is sold (i.e. as an option or as part of a wider "bundle" of insurance cover). For example, the National Flood Insurance Program (NFIP) in the USA is subsidised by the federal government for properties in defined flood risk zones, termed Special Flood Hazards Areas (SFHA), but only once their community has opted to become an SFHA (Swiss Re, 2012). In Germany, flood insurance is offered by private companies to home owners as a supplement to standard building and contents cover, whilst in France the flood insurance pool is backed by government but operated by the private sector (Swiss Re, 2012). Unlike most other countries, the UK provides insurance as a standard feature of household insurance policies through the Association of British Insurers (ABI) (Crichton, 2005). This approach has historically been market-based, in that neither local nor national governments subsidise premiums or underwrite any flood losses incurred by insurance companies (Ball et al., 2012). Instead, the *Statement of Principles* between the UK Government and the ABI has ensured that insurance cover for properties in flood prone areas has essentially been cross-subsidised by those in low risk areas (ABI, 2011a). However, this agreement expired in July 2013, and failure to renegotiate a similar arrangement could lead to insurance premiums and excesses increasing towards the true market price (Ball et al., 2012), which may make some properties effectively uninsurable; across the UK, the current estimate of the number of such properties is 200,000 (O'Neil et al, 2012). Whilst the UK Government and the ABI have recently agreed a Memorandum of Understanding on the *Flood Re* scheme to replace the existing *Statement of Principles* (ABI, 2013), the precise details of the scheme are yet to be agreed and there remains uncertainty about the future of flood insurance within the UK. Similarly, there are concerns surrounding the long-term sustainability of the insurance schemes operated in other countries, with the US NFIP incurring debts of $18 billion following Hurricane Katrina and the poor uptake of optional flood insurance in Germany forcing the government to step in and pay considerable compensation costs following the August 2002 floods (Swiss Re, 2012).

In addition to financial costs, flooding also has other, less tangible and often longer lasting "social" impacts (e.g. the stress of the flood event, worry about future floods, etc). Although little emphasis has historically been put on such impacts, presumably due to a general focus on direct financial impacts and difficulties in

quantifying less tangible impacts, recent research within the UK suggests that social impacts are of great significance to flood victims (RPA, 2004; Tunstall et al., 2006; Werritty et al., 2007; Paranjothy, 2011), with survey respondents often "scoring" such impacts higher than the direct financial impacts of flooding. Some attempt has been made to quantify the impact of less tangible social impacts for use in some form of monetary cost-benefit analysis (e.g. £1065 for the "avoidance of stress and ill health" in FHRC, 2010), however such approaches are necessarily coarse and represent a vast oversimplification.

Although large scale flood defences can be effective in reducing widespread flood risk, such developments are costly, both in terms of time and financial resources, and cost benefit analysis does not always yield a favourable result. In response to these cost pressures, and with more growing awareness of flood risk, there has been a shift towards a more integrated and sustainable flood risk management approach. In Europe, the principal driving force behind these new approaches has been the EU Floods Directive (EU, 2007), which has been transposed into each member state's flood policies and strategies. At its heart, the Directive seeks to make flood risk management a shared responsibility, with flood risk responsibilities being devolved to relevant stakeholders at various designated levels. This philosophy of shared responsibility, allied to increasing flood risk and a more general lack of resources for centralised defence schemes, has strengthened calls for greater use of property level flood protection (PLFP) measures (Pitt, 2008).

The main aim of the research reported herein was to gain a better understanding of public perception of flood risk in general, and PLFP in particular, and hence contribute to the evidence base needed to inform the effective promotion of PLFP measures. Whilst the project focuses on the situation in Scotland, the findings will have resonance in similar countries throughout Europe and beyond.

2. Property Level Flood Protection (PLFP)

Unlike large scale flood defences, PLFP measures are often temporary, demountable, and simple to install products (Wingfield et al., 2005), which can help prevent and/or slow floodwater ingress (Bowker, 2007; DEFRA, 2008). Two main types of measures are used for property-level protection, namely resistance measures and resilient measures.

Resistance products either totally prevent floodwater from getting into a property, or "buy time" for the householder to move valuable possessions to safety (DEFRA, 2005). They tend to be particularly effective for shallow floods, and can eliminate or reduce many of the damages associated with flooding. Such measures are generally applicable, although there are specific scenarios where they would not be effective (e.g. ground water flooding in properties with suspended wooden floors). Typical costs for a temporary, demountable property-level resistance solution (e.g. door and window boards, airbrick and service duct covers) range from £2-4k. However, individual products such as airbrick covers can cost as little as £50, whilst floodgates for door openings start at around £330 (Thurston et al., 2008). The cost of more permanent resistance measures (water-proof doors, windows, and airbricks) range from £3-10k for a single property (Bowker, 2007). The correct installation of a total property-level solution can reduce the financial costs associated with a flood event by 50-80%, and flood resistance packages have been found to be cost-effective for households with an annual risk of flooding of 2% or above, with the largest savings being residential properties subjected to an annual risk of flooding of 4% or greater (Thurston et al., 2008).

In contrast to resistance products, resilience measures are those with the ability to minimise flood damages when floodwater actually enters a property (Wingfield et al., 2005; Joseph et al., 2011). Such measures are normally permanent, and include replacing permeable floors with water resistant material (e.g. solid concrete), using waterproof wall plasters, replacing kitchen and bathroom units with plastic units, and raising electrical sockets (ABI, 2004; Bowker 2007). Since the cost and disruption associated with the installation of resilience measures can be significant (e.g. £10-30k), they are often implemented during major renovation or repair works. Resilience packages are considered to be more effective for deeper floods (60-90cm), as corresponding resistant products are often overwhelmed at such depths (Thurston et al., 2008). However, the higher cost of installation generally makes resilience measures less cost effective than resistance products, although recent research indicates that they can reduce damage costs by up to 73% (Joseph and Proverbs, 2011). In common with resistance products, implementing resilience measures can be worthwhile where the annual chance of flooding is greater than 2%. For buildings not already in need of repair or refurbishment, resilience measures are only cost-effective in areas with a 4% or greater annual chance of flooding (Thurston et al., 2008).

A recent DEFRA funded project in England predicted that for every £1 spent on PLFP measures in English pilot households studies, ~£5 could be saved in flood damage (JBA, 2011); as it is estimated that up to 330,000 properties in England alone could benefit from PLP by 2035 (CCRA, 2010), it would seem clear that

such measures can be a valuable flood risk management tool at the national level. Elsewhere, there are further examples of the beneficial impact of PLFP measures, e.g. the installation of water resistant barriers are considered to have contributed to a decrease in the damages associated with seemingly similar floods in Cologne (Germany) from €65bn in 1993 to €30bn in 1995 (Fink et al., 1996).

The problems associated with increased future flood risk, coupled a with lack of resources to fund the construction of large scale flood defence systems and potential changes to flood insurance cover, will shift the onus of flood protection even more onto individual property owners. However, the uptake of PFLP measures in residential properties remains stubbornly low (DEFRA, 2008), with one UK study finding that only 16% of households and 32% of SMEs in areas of significant flood risk have taken practical steps to reduce their exposure to flood damage (Thurston et al., 2008). Common reasons for low uptake include underestimation of flood risk, a lack of understanding about flood protection responsibilities and concerns over the costs and aesthetics of such measures (Werritty et al., 2007; Thurston et al., 2008; ABI, 2011b). Moreover, the low level of awareness of PLFP products has been a major obstacle to their increased use, and it is commonly accepted that many property owners are unaware of the options, benefits and cost of such measures (DEFRA, 2008; Thurston et al., 2008; Kazmierczak and Bischard, 2010). Increasingly, researchers are seeking to gain a better understanding of the type of modifiable psychological factors that may affect people's attitudes towards climate change adaptation, and this has led to the development of some interesting approaches to predicting individual behaviour. For example, psychology and behavioural economics has been used as the basis of a socio-cognitive model of Private Proactive Adaptation to Climate Change (MPPACC), which has been shown to give a better explanation of behaviour over traditional approaches, with clear implications for helping to promote adaptation (Grothmann and Pratt, 2005).

To improve PLFP uptake, there have been a number of incentivisation schemes including the DEFRA Property-level Flood Protection Scheme in the UK (JBA, 2011) and the Toronto Basement Flooding Protection Subsidy Program in Canada (City of Toronto, 2011), as well as a series of smaller local level schemes, such as those run in a number of Scottish Local Authority areas (Gill, 2011). Although the number and scope of PLFP incentivisation schemes remains relatively modest (White et al, 2012), there is a growing realisation that some form of incentive, through either subsidisation of PLFP measures or reduced insurance premiums, is required to promote flood mitigation behaviour in the private sector (e.g. Bubeck et al, 2012; Meyer et al. 2013). In addition to financial incentivisation, it is well recognised that improved communication of the effectiveness and cost of PLFP measures, rather than just communication of the risk of flooding, is a key factor in increasing uptake (Grothmann and Reusswig, 2006).

At a higher level, there has been substantial efforts to integrate flood resistance and resilience technology into EU policy and planning processes, with the key driver being the EU policy on living with floods within the Floods Directive (Garvin, 2013). Within this context, the EU funded SMARTeST project (Smart Resilient Technologies, Systems and Tools) has highlighted that, notwithstanding some significant challenges, innovative products and technologies have very real potential to contribute to effective flood risk management at all scales (Garvin, 2013; Garvin, 2014). Importantly, the SMARTeST project has also clearly identified that improved stakeholder understanding is crucial to the promotion of all flood resistance/resilience technology at both the community and property level, and has developed a range of stakeholder-focussed guidance, from the "Six Steps to Flood Resilience" information for Local Authorities and professionals through to more PLFP focussed guidance for the general public (White et al., 2012).

3. Methodology

To achieve the primary project aim it was necessary to undertake extensive stakeholder consultations, through the use of both questionnaire surveys and follow-up focus groups. These survey techniques are generally regarded as effective in collecting primary data for empirical studies, and similar approaches have been used in a number of flood related studies within the UK (RPA, 2004; Werritty et al., 2007; Thurston et al., 2008). As resources and logistics did not permit undertaking the required number of individual face-to-face interviews, self-completion questionnaire surveys were used; it was thus imperative that the questionnaire developed was both simple to understand and straightforward to complete. To ensure the suitability of the questionnaire, a pilot survey was conducted in an area of known high flood risk (Eddleston, Scottish Borders). Feedback from the pilot was generally positive, both in terms of content and coverage, but indicated that the questionnaire was overly long and complex to encourage widespread participation. As a result, the initial questionnaire was shortened and simplified.

The final questionnaire was developed to garner information in five key categories:
1. *Flood experience* (flood frequency/timing, flood type/characteristics, knowledge of flood risk).
2. *Flood impacts* (insured/uninsured financial losses, social impacts).
3. *Flood responsibility* (responsibility for community-level and property-level protection).
4. *Property level flood protection* (uptake, type, rationale).
5. *Willingness to pay* (maximum contribution, rationale).

Data on households willingness to pay (WTP) for PLFP measures was collected using the stated preference method, which is an accepted survey technique (Pearce et al., 2006). Participants were initially asked whether, and for what reason they would be wiling to pay for PLFP measures, before being presented with details and pictures of different PLFP products, differentiated by attributes including mode of operation and cost bands, ranging from manually operated airbrick covers and door guards through to automatic resistance packages. This approach was followed to help people make informed decision on their WTP, whilst avoiding hypothetical WTP values and the likely problems associated zero bids (protest votes), and was felt particularly important given traditional difficulties in eliciting WTP information from the public.

The survey locations (see Figure 1) were identified from a database of past flood events, complied specifically for this research from Local Authority and SEPA datasets, which provided the street-level information needed to identify property addresses in survey location areas. Importantly, the areas selected included households that were at flood risk but had not previously been flooded, as well as those that had been previously flooded.

The questionnaire was available in both hard copy (postal return) and online formats, and a total of 1530 questionnaire surveys were distributed. To maximise participation rates, on-the-ground personnel with a detailed local knowledge (e.g. Local Authority staff, flood action groups, etc) were used to distribute the majority of the hard copy questionnaires and publicise the online survey portal. In total, 256 completed questionnaires were returned, representing a response rate of 17%, which is considered a reasonable return for a postal/online survey format.

Statistical analyses of the survey responses were undertaken using the Social Package for Social Scientist (SPSS) software. The nature of the questions meant that simple descriptive analyses (e.g. mean, frequency) were largely used, although inferential analysis using Spearman's correlation (r) was used to assess statistical significance ($p < 0.05$) where relevant. Further Chi-squared testing was also undertaken to determine whether there were statistically significant differences between the responses from different sub-groups (e.g. previously flooded and not previously flooded).

Following analysis of the questionnaire responses, focus group discussions were carried out to verify, and delve deeper into, some of the findings from the questionnaire surveys. Two locations (Edinburgh and Hawick) were selected, with each participant group having a unique flood experience history. Flooding within Edinburgh primarily affects communities along the Water of Leith (e.g. 2002 and 2012), and has led to the recent construction a flood prevention scheme in the city. Fluvial flooding is also the main source of flooding within Hawick, and although overtopping of the River Teviot has resulted in significant damages to residential properties in the recent past (e.g. 2005 and 2009), there is no existing or planned flood prevention scheme. The focus group locations were therefore selected to capture information about attitudes from those living in a town with no large scale defences (Hawick) and those living in a major city with some large scale defences (Edinburgh).

4. Results and discussion

Unless otherwise stated, the data reported in this section refer to the questionnaire survey responses.

4.1 Flood experience

Whilst just over half of the survey respondents (n = 256) had not experienced flooding in their current property (58%), there was still a high awareness of the flood risk associated with their property amongst this group (68%). Fluvial flooding accounted for almost two thirds of all flooding (n = 107), followed by sewer (17%) and surface water (10%) flooding. The surprisingly high reported incidence of groundwater flooding (9%), which is uncommon in Scotland, is thought to be due to respondents mistaking water entering via airbricks for groundwater flooding. Given the survey locations shown in Figure 1, it is unsurprising to see that coastal flooding only accounted for 4% of the reported incidents.

The overall results indicate that 59% of flooded households experienced flooding above ground floor level, with the remaining events resulting in floodwaters below ground floor level. Some 61% of flooded households had been flooded once in their current property, whilst 20% had been flooded at least three times. Further analysis highlights that over two thirds of these floods (78%) occurred in the last ten years, which may indicate that people either move home or invest in some form of flood protection in order to avoid repeated flooding.

Those respondents that had previously been flooded were asked further questions about the floodwaters that entered their property. As shown in Table 1, the majority of respondents (62%) experienced low-medium floodwater depths (< 50cm), whilst 24% experienced extreme depths (75cm +). As would be expected, the most common floodwater pathways were via doors, airbricks and floors/basement, with only very isolated cases of floodwater entry via windows. These findings are significant as PLFP measures are considered particularly effective for flood depths up to 60cm and for the commonly noted floodwater pathways, and indicate that simple flood resistant products (e.g. door cover, airbrick and vent covers) could have proved beneficial in preventing the majority of the reported flooding incidents. Conversely, the respondents that suffered extreme floodwater depths (75cm +) would probably not benefit from PLFP as these measures can often be overwhelmed at depths above 60cm.

In addition to floodwater depths and pathways, respondents were also questioned about the length of time floodwaters were present in their homes (flood duration). Of those who responded to this question (n = 98), just 7% experienced flood durations of less than 1 hour, whilst 40% experienced durations over 5 hours and 21% experienced durations over 24 hours. Again these findings are significant, as longer flood durations suggest greater impacts as well as longer recovery times.

4.2 Flood impacts

The financial costs of flooding were assessed by consideration of both the insured and uninsured costs that were incurred. Approximately 90% of flooded households (n = 107) suffered some damage to their property and possessions, and almost 92% of these households had buildings and contents insurance. For those that provided information on costs, the mean insured building and contents costs were £30,123 and £10,493 respectively, and the mean uninsured costs were £2,616. Whilst the majority of reported costs were associated with flood durations between 1-5 hours, the maximum values occurred with longer flood durations (10-24 hours), emphasising the influence of flood duration. These figures are at the upper end of those previously reported. Werritty et al. (2007) surveyed flood victims in Scotland and determined that buildings and contents losses were £31,980 and £13,552 respectively, whilst Bowker (2007) used measured flood depths to estimate total losses of £10-50k. RPA (2004) reported that the mean total losses (insured buildings and contents, and uninsured) for a flooded property in England was approximately £30k, whilst insurance claims following the 2007 floods in England were reported to be £23-30k (Environment Agency, 2010).

The focus group findings confirm the scale of flood impacts on households, with one participant commenting:

> *"I have been flooded twice, it cost £63,000 to repair the January one. I got back to the house after 6 months, and the 2005 October flood hit again. I was wiped out again, this time it cost £100,000. So the two floods have cost me £163,000…which obviously nobody has enough house insurance because nobody ever expects to lose everything they have in their house". [Hawick participant]*

To determine the social impacts of flooding, respondents were asked to rate five separate variables based on their last flood experience, using a scale of 0 (no impact) to 10 (maximum impact). As shown in Table 2, all of the variables had a significant impact on flooded households, with the most noteworthy being "the stress of the flood event itself" and "worry about future flooding". These findings are supported by the focus group findings which highlight the scale of intangible impacts, as well as insurance related problems:

> *"You can go over with the insurance thing, the financial impact…but the problem is the long term psychological effect, the effect is major…it doesn't matter how people help". [Hawick participant]*

> *"With insurance it all went up…I know I can't move on if I don't stay with the insurance company I've got, then I won't get covered for floods. My house insurance has really gone up over the years. I now pay £900 per year; it used to be about £400 a year". [Hawick participant]*

"We were flooded in July (2012), and when the insurance came in November it was tripled, we pay £1500 for a year now…this is ridiculous. We asked our broker if he could find us new deal but no we had to stick with this one". [Edinburgh participant]

The social impact results show a similar pattern to an earlier Scottish study (Werritty et al., 2007), and broadly similar findings to an English based study (RPA, 2004). However, it is interesting to note that respondents from both Scottish based studies placed far higher emphasis on "worry about future flooding". In addition, and despite all studies indicating that the vast majority of people had to stay in temporary accommodation with friends or relatives, the Scottish based respondents placed far less emphasis on "having to stay in temporary accommodation". These variations perhaps reflect the relative availability of emergency accommodation or the scale of flood impacts in the different survey locations, or even the relative state of preparedness for future events. More likely, the differences can be attributed to local influences; for example, the English-based study highlighted significant variation in "worry about future flooding" depending on the scale of any post-flood mitigation works (RPA, 2004).

4.3 Flood responsibility

Figure 2 details how the survey respondents viewed the burden of responsibility for both community level (i.e. large scale, centrally funded) and property level flood protection. As shown, only 22% of the public felt they were responsible for their own protection, whilst over 70% of the public felt some other public body was responsible. These findings were confirmed by the focus group findings, are consistent with earlier similar studies (Werritty et al., 2007, and Terpstra & Gutteling, 2008), and indicate that the majority of the public remain uncertain about their responsibility towards their own flood protection.

Interestingly, 14% of respondents felt they were responsible for community level flood protection schemes, though perhaps these responses refer to a more general, "societal responsibility" expressed through payment of the taxes that fund such schemes. Alternatively, these respondents may have classified their participation in a local incentivisation schemes (e.g. purchased discounted PLFP products) as contributing to community level flood protection.

4.4 Property level flood protection

Despite the low numbers of respondents being aware of their own responsibility to protect their property, awareness of PLFP measures was relatively high for both flooded and non-flooded households, yielding an overall mean of 63% ($n = 256$); as would be expected, there was a statistically significant difference between the two sub-groups ($p < 0.001$), with 77% of flooded households ($n = 107$) and 53% of non-flooded households ($n = 149$) stating that they were aware of PFLP measures. This issue was further investigated in the focus group discussions where two diverging scenarios emerged; a high awareness of PFLP measures was strongly associated with communities who had been exposed to recent public education campaigns, either by local councils or flood volunteer groups, whilst a low awareness of such measures was associated with areas who had not been exposed to any form of flood education campaign. These results differ from earlier studies, which suggest a lower level of awareness of PLFP products (DEFRA, 2008), and seem to indicate that recent flood education campaigns have been successful in getting key messages across to the public. As an example, the Scottish Flood Forum has been influential both in getting key messages across to flood affected residents and in helping at-risk communities set up Flood Volunteer Groups to assist during and after flood events (SFF, 2015). The focus group findings from this project also attest to the impact of community level Flood Volunteer Groups, particularly the Hawick Flood Group, which has been effective in promoting flood awareness and flood resilience (Hawick Flood Group, 2015).

Amongst households that had previously been flooded, the survey results point to a link between the scale of the costs incurred due to flooding and awareness of PLFP products, to the extent that the average insured buildings and contents losses amongst those PLFP aware were approximately ten times those amongst the PLFP unaware. In addition, those aware of PLFP rated two of the social impacts ("stress of flood event itself", "having to stay in temporary accommodation") higher than those who were PLFP unaware, although this was not found to be statistically significant. This would seem to indicate that it is the scale of the flooding and impacts, rather than just the frequency, that encourages people to investigate options to protect their own property. The majority of respondents that were aware of PLFP measures ($n = 163$) had taken up some form of flood protection (61%); again, analysis confirms that there is a statistically significant difference ($p < 0.001$) in PLFP uptake between flooded and non-flooded sub-groups. Just over a third of people who purchased PLFP products received some financial aid, with the average contribution being £223 or 39% of the total costs. Figure 3 shows the distribution of PLFP measures employed by households which include the use of sandbags (31%), the use of door/window floodguards (25%) and airbricks or vent covers (25%). Taken together these findings differ from those of earlier studies (Werritty et al., 2007; Thurston et al., 2008),

who report far lower uptakes of PFLP. However, the survey results again indicate the reactive nature of people's behaviour, as only one third of respondents purchased flood protection products before flooding.

Common perceptions related to the use of PLFP products were also examined. Those aware of the products were asked to rank views on flood protection uptake using a scale of 0 (disagree strongly) to 10 (agree strongly). As shown in Table 3, it would appear that most people recognise that PLFP products can "reduce flood damage and save money" and are "effective and simple to use". In contrast to previous studies, the householders surveyed rejected the type of negative perceptions that have often been seen as a barrier to greater uptake of PLFP products (RPA, 2004). This would again seem to imply a growing acceptance and confidence in PLFP products, linked perhaps to the impact of flood education campaigns and a more general acceptance of the concept of flood risk.

4.5 Willingness to pay (WTP) for PLFP measures

In total, 57% of respondents stated that they were willing to pay for PLFP (n = 256). When asked to explain their willingness to pay, at least three quarters of respondents agreed with each of the proffered reasons, namely: to avoid the impacts associated with current flooding, to avoid the impacts associated with future flooding, and to avoid increases in insurance premiums and/or excesses. As shown in Figure 4, the total amount households were willing to pay for PFLP ranged from £50 to £10,000, with almost 80% of respondents selecting a figure of either £100 (equivalent to air brick covers for the whole property) or £1000 (equivalent to air brick covers and door guards for the whole property). This perhaps understandable clustering of responses around two specific values could reflect the sensitivity of the stated preference method used and the mode of questioning. Interestingly, whilst the overall mean WTP figure was £795, that for those who had previously been flooded (£734) was less than for those who had never been flooded (£834), which may indicate that people without previous flood experience tend to overestimate the cost of protecting their property. As with PLFP awareness and uptake, these findings are again at odds with earlier research, both in the UK and elsewhere; for example, a recent survey of UK residents determined that the median willingness to pay for PLFP was less than £100 (Kazmierczak and Bischard, 2010), whilst a Dutch study reported that surveyed residents were only willing to pay a mean of ~€120 per year in exchange for discounted flood insurance (Botzen et al., 2009).

Generally, understanding people's WTP is a complex decision that can be influenced by several flood experience factors and socio-economic determinants, such as home ownership, age and household income (RPA, 2004; Grothmann & Reusswig, 2006). In view of this, correlation analysis of the survey variables was undertaken to investigate the factors that were likely to influence peoples WTP for PLFP. This revealed statistically significant relationships between WTP and a number of socio-economic factors, including household income level ($p < 0.01$), age distribution of household members ($p < 0.01$) and the employment status of respondents ($p < 0.01$); these relationships were all positive, indicating that better off households with older people (particularly retired) were more willing to contribute towards the cost of PLFP. Given that households who had previously installed PLFP products would presumably be well aware of the benefits of such measures, and therefore more willing to contribute towards the cost of protecting themselves, it was not surprising to see that the total previously spent on PLFP products was positively correlated with WTP ($p < 0.01$).

WTP was also found to be strongly linked to previous financial and social flood impacts, with statistically significant positive relationships between WTP and both the scale of insured losses ($p < 0.05$) and the "rating" of several social impacts ("*staying in temporary accommodation*" and "*getting house back to order after flooding*", $p < 0.05$). Interestingly however, the "*stress of the flood event itself*", which was the highest rated social impact, was not statistically correlated with WTP. Finally, although there was no statistically significant relationship between property ownership and WTP, those who owned their property (outright or with a mortgage) represented 86% of the total responses, perhaps indicating a greater general interest in flood protection.

For those not willing to pay (n = 111), just over half of respondents felt that they could not afford PLFP measures, and a similar proportion stated that the government/council should pay for such protection. Approximately a third of respondents indicated that they already had PLFP measures, and a further third felt that they were not at risk from flooding. A considerable number of people (13%) felt that such measures were simply not effective. Follow up focus group sessions highlighted that households that felt unable to afford PLFP were more likely to contribute towards the total cost if subsidies or incentive packages were introduced by government.

5. Conclusions and recommendations for future work

The findings reported herein are part of ongoing research into public perception of flood risk in general, and property level flood protection (PLFP) in particular. In addition to broadly confirming the findings of earlier studies into public attitudes to flooding and flood risk, the consultation results have shed some light onto some of the key issues surrounding PLFP. Analysis of floodwater pathways into properties has shown that very simple PLFP measures, such as door barriers and airbrick covers, would prevent ~60% of reported internal flooding events. In contrast to previous findings, and despite the low numbers of respondents being aware of their own responsibility to protect their property, the findings also suggest that the emergence of effective public education campaigns may have led to an increase in awareness of PLFP measures, amongst those both previously flooded and non-flooded households. The drive to investigate PLFP options has also been shown to be linked to the scale of flooding and impacts, rather than just the frequency. Although this research indicates a significantly higher uptake for PLFP than previous studies, much of this has again been reactive rather than proactive, with the majority of households only acting after being flooded.

The consultation results also confirm that the public appear more willing to pay for PLFP than previous studies have suggested, both in terms of the number of households willing to contribute and the scale of these contributions. In addition, the results indicate that people without previous flood experience may over estimate the cost of protecting their property. Unsurprisingly perhaps, there appears to be a link between people's willingness to pay for PLFP and the level of building damage previously sustained and household income. However, it should be noted that the WTP findings could be slightly biased due to the survey technique used; in common with other approaches, the stated preference method is generally sensitive to the mode of questioning, and in this work the clustering of the WTP values around two main values could point to the sensitivity of the approach.

Throughout Europe, the EU Floods Directive, and its transposition into member state legislation, has sought to make flood risk management a shared responsibility. Whilst in practice this places new responsibilities on relevant stakeholders, it also requires these stakeholders to consider a wide range of different measures to manage flood risk; given their potential to reduce flood damages, this must include PLFP products. Therefore, it is important for institutional stakeholders to understand the reasons why some households are unwilling to pay for PLFP, as this is a key step in developing strategies to increase the uptake of such measures. Interestingly, whilst just over half of survey respondents felt that they could not afford PLFP measures, these groups were found to be more likely to contribute towards the cost if subsidies or incentives packages were available. A similar number also felt that the government/council should pay for such protection, which again highlights the need for better education of the public with respect to flood protection responsibilities.

In terms of future work, the correlation analysis undertaken has identified some of the factors likely to influence people's WTP for PLFP, however more in-depth (face to face) surveys would be beneficial to better appreciate which individual factors are most significant in predicting peoples WTP for PLFP. As part of this project, a whole life cost model, using flood depth data from a case study area in Scotland and industry standard depth/damage relationships (FHRC, 2010), has been developed to better understand the Benefit-Cost-Ratio of PLFP measures and the potential impact of incentivisation. The results of this work will be published in due course.

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Table 1. Floodwater depths and pathways

Floodwater pathway	Floodwater depth (%)					Total
	0-25cm	25-50cm	50-75cm	75-100cm	100cm+	(%)
Through doors	9.4	8.9	4.2	3.3	3.8	29.6
Through windows	-	-	0.5	-	0.5	0.9
Through airbricks	11.7	8.5	2.8	2.8	3.3	29.1
Through drains	4.2	1.4	1.4	1.4	2.8	11.3
Through walls	2.8	2.4	0.5	1.4	0.9	8.0
Through floors/cellar/basement	7.5	5.2	3.3	2.4	2.8	21.1
Total	35.7	26.3	12.7	11.3	14.1	100.0

Table 2. Social impacts in flooded properties

Impact	Mean score*	Mean score ** (Werritty et al., 2007)	Mean score* (RPA, 2004)
Stress of flood event itself	6.97	2.03	7.1
Worry about future flooding	6.86	2.14	6.6
Getting house back to normal	6.62	2.21	7.8
Having to stay in temporary accommodation	5.31	1.62	7.0
Loss of irreplaceable items (e.g. photos)	5.22	1.53	5.6

* Score: 0 = no impact, 5 = mild impact, 10 = maximum impact
** Score: 0 = no impact, 1 = mild impact, 3 = extreme impact

Table 3. Perceptions on the use of PLFP products

Perception	Mean score
They can reduce flood damage and save me money	7.08
They are effective and simple to use	6.42
They would make me feel safe	5.63
I feel they are too expensive to buy and maintain	4.87
They would make my house look odd and unattractive	4.84
They would reduce the value of my house	4.71
I do not feel able to choose the right products for my property	4.12
They can increase the value of my property	3.73

Score: 0 = disagree strongly, 5 = neutral, 10 = agree strongly

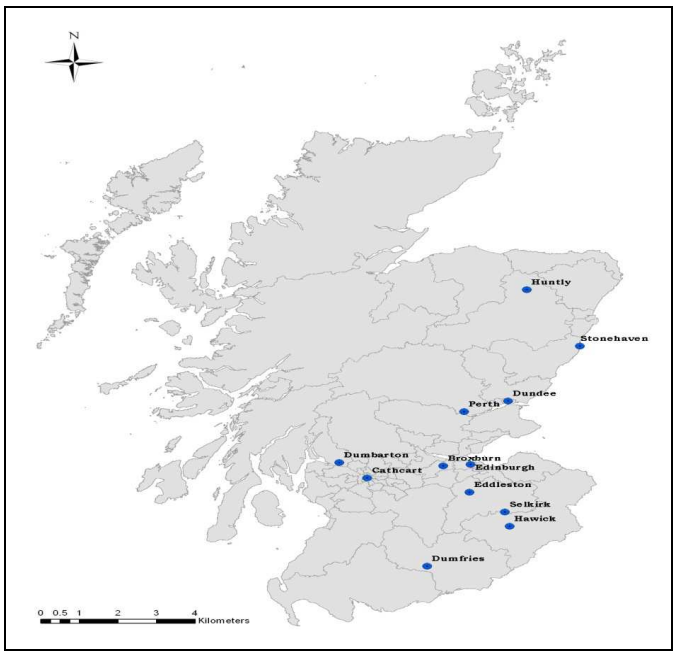

Figure 1. Survey and focus group locations

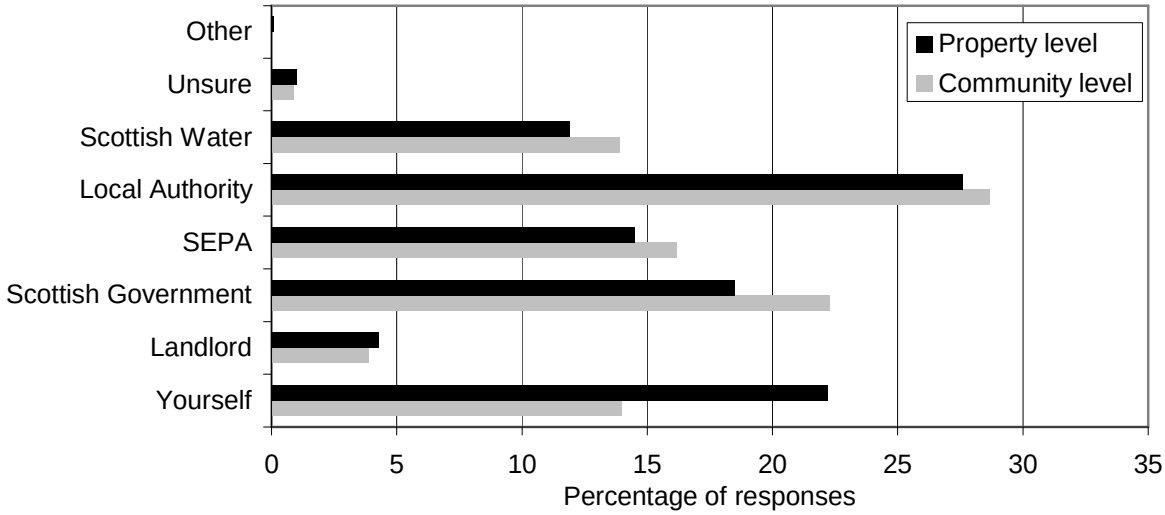

Figure 2. Flood protection responsibility at the community and property level

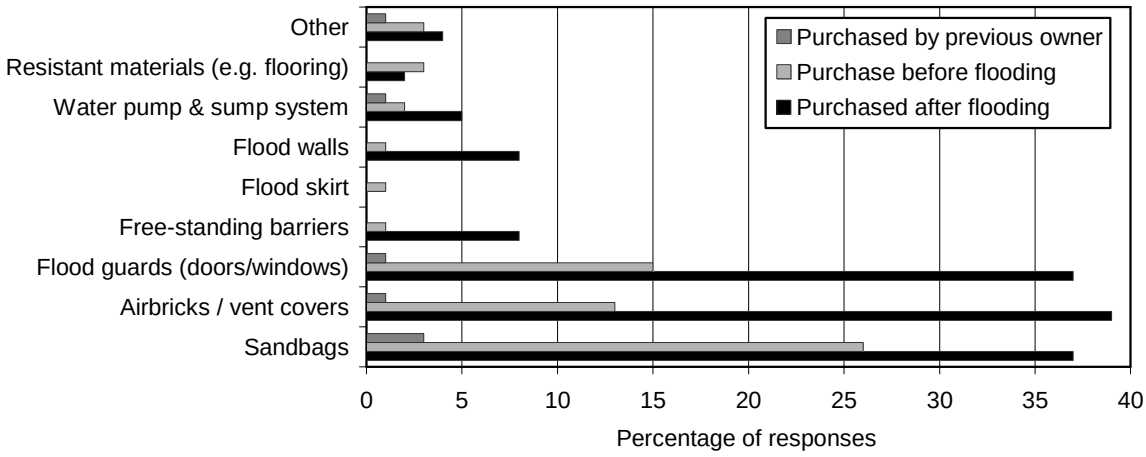

Figure 3. Distribution of PLFP uptake measures

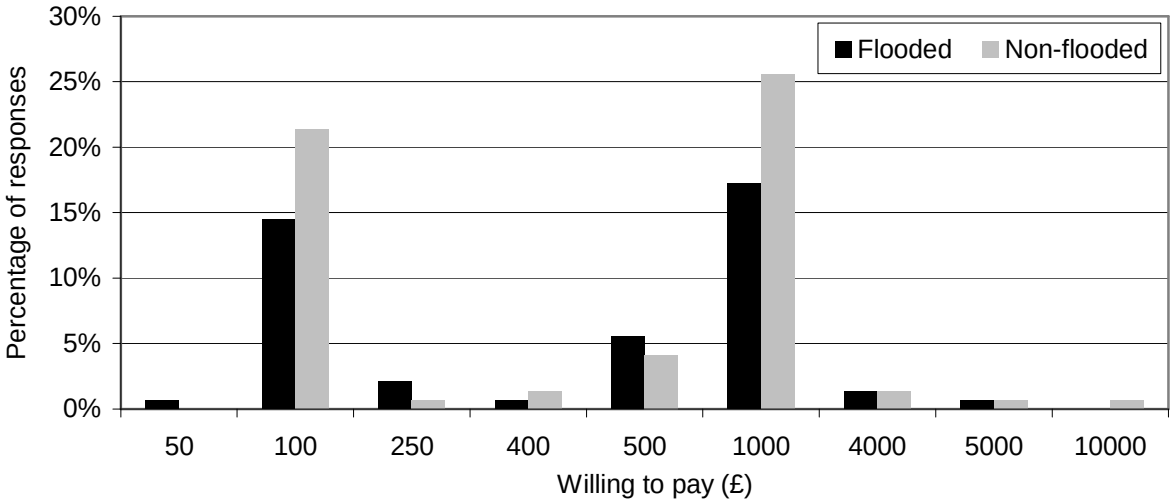

Figure 4. Willingness to pay for property-level flood protection measures