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**The relationship between risk experience and risk response: a study of farmers and climate change**

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**Abstract**

Within the existing literature, the role of experience of risk on attitudinal and behavioural risk response has been relatively neglected. Recent research that draws on the psychological distance of climate change as a concept notes the importance of local, significant experience as a driver for encouraging appropriate response. The experience of flooding was used as the stimulus in this paper, and emphasis placed on whether direct and/or indirect experience of flood risk is associated with different responses to climate change risk. In order to explore the relationship between climate change risk experience and response in the form of on-farm mitigation and adaptation, this paper draws on a case study of farmers in England, many of whom have experienced flooding. Results from a quantitative survey undertaken with 200 farmers in Gloucestershire, England are discussed. Statistical analysis found experience of flooding to be significantly associated with a heightened concern for climate change. Although also finding an association between experience and behavioural response, the sample were most likely to be taking adaptive behaviour as part of normal practice, with factors such as lack of overall concern for climate change risk and absence of information and advice likely to be the main barriers to action. Risk communication needs to further emphasise the connection between climate change and extreme weather events to allow for farmers to perceive climate change as a relevant and locally salient phenomenon, and subsequent tailored information and advice should be offered to clearly illustrate the best means of on-farm response. Where possible, emphasis must be placed on actions that also enable adaptation to other, more immediate risks which farmers in this study more readily exhibited concern for, such as market volatility.

**Keywords**

Experience, response, risk, climate change, flooding, farmer

**Introduction**

The provision of risk information to individuals alone has not been found to necessarily lead to a desired attitudinal response nor attitude automatically lead to an associated behaviour (Carlton 2014). A range of behavioural studies therefore seek to understand how individuals form a response to risk. Various individual, societal and contextual factors have been cited as mediators when interpreting information and forming a response (Lorenzoni, Nicholson-Cole, and Whitmarsh 2007; Mills et al. 2013). One of the most tested models within the literature, the Theory of Planned Behaviour (TPB) (Azjen and Madden 1986), puts forward a range of perceived personal and societal barriers and motivators that influence behaviour. The TPB model has been adapted and applied to various practices and settings, whereby its adoption has been not only validated but also critiqued (Beedell and Rehman 2000; Artikov et al. 2006; Wauters et al. 2010). Although these theoretical approaches are useful in identifying particular factors that may influence behaviour, the role of experience of risk in forming a response has often been omitted. It is generally well established that individuals are more likely to take a self-protective response out of a feeling of concern and worry, which in turn, can be initiated by past experience (Haden et al. 2012). Moreover, the notion of ‘heuristics’, i.e. cognitive cues (Kahneman and Tversky 1979; Nicholls 1999) implies that individuals use less relevant but more available information (such as past experience) in place of more diagnostic, but less accessible information in belief generation (Zaval et al. 2014). Thus, memories of significant experiences are likely to be called on when forming a relevant response to a given situation. In the context of climate change, personal experience has been shown to go hand in hand with social identity to influence knowledge and thus affects how an individual perceives themselves in relation to others and to risk (Frank, Eakin, and López-Carr 2011). Kuruppu and Liverman (2011) emphasise that gaining an insight into an individual’s physical environment and the way it is interpreted can give way to an understanding of how that individual perceives risk. This, they suggest, can provide an insight into the likely adaptive response of distinct local communities to climate change risk. Grothmann and Patt’s (2005) process Model of Private Proactive Adaptation to Climate Change derived from Protection Motivation Theory (Rogers 1983) gives further attention to the relationship between risk perception, risk experience and adaptive capacity and incorporates the cognitive process of ‘risk experience appraisal’ whereby, it is assumed that experience is important for motivating people to take adaptive action against climate change risk through influencing risk perception. Moreover, Lo (2013) identified an indirect pathway between risk perception and coping behaviour, whereby the decision to purchase flood insurance after an experience of flooding was mediated by social norms.

Building on these studies, this paper explores the association between farmer experience and response to climate change risk, and makes a distinction between ‘attitudinal’ and ‘behavioural’ response specifically. Previous research into attitudinal response of UK farmers to climate change has found there to now be a relatively low level of scepticism over the existence of climate change, but higher levels of scepticism over the risk that it poses (Farming Futures 2011; Islam, Barnes, and Toma 2013).

In the context of this study, the term ‘behavioural response’ can be considered to encompass both the elements of mitigative and adaptative actions. The Intergovernmental Panel on Climate Change (IPCC) differentiate between ‘mitigation’ being an intervention to reduce the sources of Greenhouse Gases (GHGs) or enhance carbon sinks, and ‘adaptation’, seen instead as adjustments in natural or human systems in response to actual or expected climate effects (IPCC 2001). Examples of prominent options for on-farm mitigation and adaptation, and actions presented to farmers in this study are outlined in Table 1 (Farming Futures 2008a, 2008b). Studies have shown that current behavioural response to climate change amongst UK farmers is limited, and is largely undertaken as a drive to reduce input costs rather than consideration of the potential impacts of a changing climate (Farming Futures 2011; Wiles 2012).

It is suggested that an overarching reason for farmers’ lack of behavioural engagement is the invisible and intangible nature of climate change, often leading individuals to deem it ‘psychologically distant’ (Kollmuss and Agyeman 2002; Pidgeon and Fischoff 2011). Apart from exposure to some media attention, farmers are not expected to have extensive experience and observation of climate change, and it is thus easy for non-experts to conflate ‘climate’ and ‘weather’, and many studies have proven their perceived association amongst the general public (Joireman, Truelove, and Duell 2010; Akerlof et al. 2013).

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| --- | --- |
| **Mitigation actions** | **Adaptation actions** |
| * Installing renewable energy generator(s) * Reducing energy use * Reducing inorganic fertiliser * Increasing use of minimum tillage * Growing biomass crops | * Improved water management (e.g. on-farm reservoirs) * Planting shelter belts to protect crops and/or livestock from warmer weather * Improving field drainage/soil water retention capacity for potential flooding * Undertaking an Integrated Pest Management Plan * Maintaining/preparing building(s) for stormy weather * Adjusting growing practices and/or growing new crop varieties |

***Table 1. Prominent on-farm climate change mitigation and adaptation options for response (Farming Futures 2008a, 2008b)***

In this respect, experience of local significant weather events can promote concern and encourage a response towards climate change risk (Whitmarsh 2008; Spence and Pidgeon 2010). Thus, in this study, flooding is considered as an example of a climate change risk experience. For some farmers, flooding is a phenomenon that happens to someone else, and for others it is a ‘lived’ experience; leading to the premise that farmer experience with regard to flooding is not homogeneous across the industry but situational depending on location and local environment. Previous research (outlined above) would suggest that this construct, situational risk will ultimately influence their willingness to respond to the cognitive cues that they receive. This paper draws on a quantitative assessment of Gloucestershire farmers’ attitudinal and behavioural response to climate change, considering the level of experience of flooding. The study findings thus make an important contribution to the under-researched area of risk experience and risk response in the context of farmers and climate change in England.

**Type of experience and type of response**

While weather is a short-term state that deviates daily, the classic time period used to measure climate variability is 30 years. Akerlof et al. (2013) therefore argue its quantitative detection lies solely in the realm of the scientists. However, to support their own operations many farmers have permanent weather stations on their farms and record weather variation over the time span of their business activity and have the ability to make comparisons from year to year and, if records allow, decade to decade. Farmers may therefore be in a unique position to quantify changes in their situational ‘climate’ and this in itself may be a strong cognitive cue for attitudinal response.

Amongst the general public in the USA, various studies have found changes in seasons and weather to be described as personal experiences of climate change risk, and that experience can drive willingness to respond to reduce its effects, i.e. judging there to be situational risk (Joireman, Truelove, and Duell 2010; Akerlof et al. 2013). Within the agricultural context, Islam, Barnes, and Toma (2013) found Scottish farmers with a greater experience of disease and pest infestations were less likely to be climate change sceptics, while other research suggests that individuals often focus on wet weather related events when forming climate change beliefs, with flooding and precipitation being perceived to have increased in particular (Brody et al. 2008, Spence and Pidgeon 2010; Capstick, Pidgeon, and Whitehead 2013, De Bruin, Wong-Parodi, and Morgan 2014, Taylor, Bruin, and Dessai 2014, Capstick et al. 2015), although Whitmarsh (2008) and Lawrence et al. (2013) suggest an opposing view.

While evidence suggests a clear link between experience and response, the nature of the experience in question may have a bearing on an individual’s perceptive cues concerning risk, which in turn may determine the type of behaviour that prevails. Thus, it is important to focus on the relationships between specific risk experience and the response taken relevant to those experiences (Weinstein 1989), to understand the mechanisms involved. Importantly, attitudes motivating climate change mitigation and adaptation behaviour have tended to be cognitively represented at different ‘construal’ levels (Sanna et al. 2009), reflecting construal level theory which suggests that individuals experience cognitive perceptions of climate change that can be either close or distant. Direct experience at the local level, e.g. a farm being physically flooded (psychologically ‘close’), generally encourages action to safeguard a farmer’s own self interest via adaptation. Indirect experiences, such as reading about, or knowing of someone directly affected (psychologically ‘distant’), will lead to cooperative environmental behaviour, such as mitigation practices (Haden et al. 2012). Scannell and Gifford (2013), however, dismissed this idea, finding that climate change engagement did not differ amongst a sample who had read a global message (representing a distant construal level) and those who had read a local message (close construal level) concerning risk.

Direct experience and indirect experience of risk follow different pathways towards establishing concern or the feeling of being at risk; namely an ‘affective’ or an ‘analytical’ processing system (Weber 2006) with direct experience resulting in affective responses such as feelings of fear and dread (Nisbett and Ross 1980; Peters and Slovic 2000; Loewenstein et al. 2001). Emphasising the importance of repeated experience, Carlton (2014) suggests that adaptive response may only be initiated by repeated and prolonged exposure to risk, after agricultural advisors in the USA did not exhibit greater belief in climate change risk following one season of extreme drought.

More generally, previous studies across a range of natural hazards and countries show that people who experience loss in a disaster may be more likely to have heightened risk perception of that type of disaster in the future and undertake risk reduction activities (Grothmann and Reusswig 2006; Solberg, Rossetto, and Joffe 2010; Reser et al. 2012). In cases where harm is experienced on a large scale, risk and the idea of possible precautions have been found to be more prominent in the minds of a population (Weinstein 1989). However, studies have also found that in natural hazard cases, there may be a tendency for individuals to perceive risk to be cyclical in nature, so perceived risk is lower directly after the experience (Slovic, Krunreuther, and White 1974). Additionally, familiarity with a hazard, such as daily exposure, has been found to lower perception of the said risk (Weber 2006). Within the context of this study, this may be of relevance to farmers who are situated on river floodplains and experience frequent flooding.

The evidence reviewed above notes a number of key points of significance to this study. Firstly, experience of a particular risk has been shown to influence levels of risk perception. Secondly, the same risk can be experienced differently. An individual may experience a risk directly or indirectly or may have had a one-off, or repeated and frequent experience. The different ways that risk is experienced is likely to influence how an individual may perceive that risk. Thirdly, when harm or loss is experienced, levels of perceived risk are likely to be heightened. While these findings support the idea that experience of an externalised environmental event can lead to a heightened attitudinal response (e.g. heightened risk perception), there has been less of an apparent concrete association between experience and behavioural response within the literature. This study will address this important gap in the current literature by exploring the association between specific flood experience and specific climate change response amongst farmers.

**Methodology**

In order to determine whether experience of an environmental event (in this case, flooding) led to a response amongst farmers, it was important to identify a sample of farmers who had either directly experienced the impact of flooding on their own business, or who had observed the impact of flooding on neighbouring farming businesses in their location. This would then allow for the testing of the relationship between specific experience and specific response, as previously outlined. The English county of Gloucestershire was chosen as a case study based on its varied landscape and vulnerability to flooding. The county is crossed by the lower reaches of the River Severn, flowing from north-east to south-west, draining Mid-Wales and the western Midlands of England and its confluence with the Stratford Avon at Tewkesbury, draining the rest of the West Midlands. Gloucestershire has a long flood history and it has been recent events such as the summer flooding of 2007, spring flooding of 2012 and winter flooding of 2013/14 that have been most recently notable, in terms of impact (Posthumus et al. 2008, 2009).

A farmer postal survey was undertaken during November 2013. The design used closed structured questions in order to enable quantitative data collection, and questions similar to those posed by Whitmarsh (2008) and Capstick, Pidgeon, and Whitehead (2013) were developed to allow for direct comparisons between results The total number of farm holdings in Gloucestershire according to DEFRA (2013) statistics, is 2449. Due to there being no complete and available database of farmer contacts, an ordnance survey map of Gloucestershire was studied and the names of farms present in the county identified. Google searches with the name of each farm allowed for the identification and compilation of a mailing list of 1400 farm addresses. All 1400 farm addresses collected were sent a copy of the survey, a covering letter providing a brief background to the project and the researcher/institution, as well as a pre-paid envelope to return the completed survey. Due to limitations with the method used to obtain addresses, 42 respondents replied to confirm that they did not live on working farms, while 38 respondents returned surveys with more than 10% survey data missing and were thus excluded from the sample. The final sample was therefore based on 200 completed surveys (response rate of 15.2%).

Respondents were asked for information about their farm, and past flooding events requiring them to reflect on both experience of risk and degree of impact. Further questions were designed to elicit farmer perceptions of the cause of flooding, the magnitude of risk and their perception of and belief in climate change risk, including extent of personal response. The data were analysed using the statistical analysis software SPSS. Descriptive analysis was performed, and multivariate analysis conducted using t-tests and the chi-square test for independence to identify statistically significant differences between flood groups and non-flood groups.

**Results**

The majority of respondents were male (82%) and belonged to the elder age categories with only 15% less than 45 years old. Age of the respondents is broadly reflective of the wider farmer population in England. According to government data 81% of full-time agricultural workers are male with an average age of 59 years (DEFRA 2012a). Just over one third (36.5%) of respondents were from a mixed farm enterprise, and 41% from livestock farms (22% beef, 8% dairy, 2.5% equine, 0.5% poultry, 0.5% pigs and 7.5% mixed livestock). The remaining farmers were from arable enterprises or horticulture enterprises. The average farm size was 165 ha, but ranged from 0.4 to 1821 ha. Almost half (47%) of respondents had farms over 100 ha.

Non-response bias was examined by comparing the sample characteristics to that of the wider regional population, based on available data. The Rural Business Research Farm Business Survey (FBS) is the largest survey of farms in England. The survey is restricted to farms which have at least 25,000 € of output thus ignoring smaller holdings, or hobby/non-commercial farmers (DEFRA 2012b). Based on the FBS 2013/14 county level data which examines characteristics of a sample of 1309 farmers, the final sample for this study in Gloucestershire does provide an over-representation of farmers from mixed farms, and a slight under-representation of farmers from livestock farms, whereby according to the FBS estimates, mixed farms represent 19.3% of farms and livestock farms represent 62% of farms in Gloucestershire, respectively (Farm Business Survey 2015). The lack of census data for Gloucestershire limits the extent to which the exact non-response bias can be established for this research. However, the relatively large sample size for this research indicates some adequate representation, but some care may need to be taken in interpreting the results.

***Experience of flooding***

Respondents were more likely to report indirect experience of flooding, with 94% (n = 188) reporting at least one indirect experience (outlined in Table 2). Meanwhile, 64.5% (n = 129) of farmers had reported at least one direct experience of flooding, most commonly, in the form of flooded land. When asked the extent to which their past flood experiences have had a personal impact on them, the majority claimed to have experienced ‘no impact’ (30%) or a ‘small level’ (39%) of impact, personally. Farmers who had identified the direct impact of flooding stated that they had experienced a loss of yield (41.5%); loss of crop quality (40.5%); interrupted harvest (31.5%) and the requirement of additional labour (28.5%). Respondents could select multiple impacts, and repetition of impact was assessed. The number of reported flood impacts per respondent ranged from 0 to greater than 12 impacts.

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| **Experience** | **Percentage of respondents (%)** | | |
| **Yes** | **No** | **Don’t know** |
| **Indirect experience** |  |  |  |
| I have read about the effects of flooding in my local area | 83 | 17 | 0 |
| I know other farmers who have been affected by flooding | 78 | 22 | 0 |
| I have seen first-hand the effects of flooding in the area within five miles of where I live | 72 | 28 | 0 |
| **Direct experience** |  |  |  |
| My land has been flooded (any area of land) | 60.5 | 39.5 | 0 |
| My buildings have been affected by flooding | 15.5 | 84.5 | 0 |
| My home has been affected by flooding | 10 | 89.5 | 0.5 |

***Table 2. The extent of respondents’ past flood experience (n = 200)***

Farmers were asked if they had been ‘affected’ or had land flooded during the most recent floods of 2007 and 2012 specifically. Respondents were posed with a series of defined factors to select what they considered to be the most likely cause of recent flooding in the UK (Figure 1). Lack of watercourse maintenance was identified as the most predominant (skew –1.14); general increase in rainfall (−0.607), land use change (−0.365), compared to climate change (−0.170) and lack of maintenance to urban sewers (0.087). Therefore, climate change as a factor was seen as one of the least predominant causes of flooding of those put forward in the study for the respondents to consider.

***Figure 1. Respondents’ perceived cause of recent flooding***

***Experience of flooding and response to climate change***

While exploring general attitudes towards climate change risk, three-quarters (71.5%) of farmers acknowledged that the climate is changing. A lower proportion (40.5%) believed that climate change was actually affecting their land/farm, while 54% believed that climate change will affect their farm/land in the next 10 years. The data together with the responses in Figure 1 show that, on the whole, farmers were not overly concerned about climate change, with over half of respondents (57.5%) ‘not at all’ or ‘slightly concerned’ about climate change, while 29% stated that they were fairly concerned and 14.5% very concerned. Thus, while belief that a changing climate exists, it has not generally lead to a particularly high level of concern regarding its impact on the farming business. Moreover, salience of climate change with regard to other risk factors was examined in this study. Farmers were most likely to rate climate change as a low risk to business, when presented with other potential threats, such as risk from market price fluctuations, animal disease, changes to agricultural policy and extreme weather. When exploring sub-groups of farmers, a significant association is identified between experience of flooding and attitudinal response to climate change in the form of heightened concern. Those who were more concerned about climate change, were more likely to have reported various impacts and losses from flooding in the past (p < 0.05), and were more likely to perceive climate change as a more major cause of recent UK flooding (relating to Figure 1) (p < 0.05), thus, supporting previous research with the UK public (Whitmarsh 2008; Spence and Pidgeon 2010).

Farmers were questioned about their current and future adoption of common climate change adaptation and mitigation practices (Table 1). Respondents were also able to report whether the activity was not applicable. The most common actions taken by farmers in the study were reducing energy use (64.5% of farmers), maintaining and preparing of buildings for stormy weather (59.5%), followed by reducing inorganic fertiliser use (52%), increasing use of minimum tillage (46%) and improving field drainage (44%). Respondents were, however, most likely undertaking these actions as part of normal practice/routine, with a minimal number of farmers citing that they do so to address climate change. It is important to emphasise that although the actions undertaken may not represent a conscious behavioural response and relevant engagement with climate change, the behaviour still reflects a meaningful response within the context of the IPCC literature. Funding availability was not particularly relevant for adoption of mitigating activities, although 24% of respondents would consider installing a renewable energy option if funded. Respondents were least likely to grow biomass crops for mitigation purposes, with 22.5% of the sample claiming they would never consider this as an option. Some respondents claimed certain actions to be non-applicable to their situations, thus underpinning the concept of situational response by farmers.

Focusing on the number of adaptation activities undertaken per individual, 25% of respondents had not adopted any adaptation activities compared to 18% of respondents not undertaking any mitigation actions. In many cases, farmers did respond by carrying out multiple actions, with 55% of farmers carrying out more than one of the listed adaptation actions, and 74% carrying out come than one of the listed mitigation actions; not supporting the findings of Weber (1997, 2006). Statistically, the group of farmers undertaking adaptation activities were not necessarily the same group of farmers carrying out mitigation actions. Farmers who believed climate change is currently affecting their farm/land now and would do so in the next 10 years were significantly more likely to undertake a greater number of the adaptation and mitigation measures, compared to those who do not believe (p < 0.05).

Generally, farmers who have greater experience of flooding were more likely to be the group undertaking a behavioural response to climate change. T-tests were undertaken to establish differences in risk response between groups of farmers based on extent of direct and indirect flood experience, and reporting of specific impacts/losses. Each statistically significant result is outlined for climate change adaptation response (Table 3), and climate change mitigation response (Table 4). These results demonstrate that those who have reported the experience were more likely to be the group to be undertaking the action.

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| **Type of direct experience** | **Climate change adaptation** | **Sig value** |
| ***Direct*** | | |
| My land has been flooded | Adjusting growing practices and/or growing new crop varieties | *p*<0.01 |
| Loss of livestock | Maintaining/Preparing buildings for stormy weather | *p<0.05* |
| Interrupted harvest | Improving field drainage for potential flooding | *p<0.01* |
| Loss of crop quality | Improving field drainage for potential flooding | *p<0.01* |
| Loss of crop quality | Undertaken an Integrated Pest Management Plan | *p<0.05* |
| ***Indirect*** | | |
| I know other farmers affected by flooding | Improving field drainage for potential flooding | *p<0.01* |

***Table 3. Significant associations between flood experience and climate change adaptation***

|  |  |  |
| --- | --- | --- |
| **Type of experience** | **Climate change mitigation** | **Sig value** |
| ***Direct*** |  |  |
| My land has been flooded | Installed renewable energy generator(s) | *p<0.01* |
| Loss of yield | Reducing energy use | *p<0.05* |
| Loss of crop quality | Reducing energy use | *p<0.05* |
| Loss of livestock | Reducing inorganic fertiliser use | *p<0.05* |
| Interrupted harvest | Increasing use of minimum tillage | *p<0.05* |
| Loss of crop quality | Increasing use of minimum tillage | *p<0.01* |

***Table 4. Significant associations between flood experience and climate change adaptation***

There were no statistically significant trends between type of risk experience and type of risk response, as inferred by the work of Haden et al. (2012). The notion that farmers who report indirect experiences are more likely to respond by undertaking mitigation actions has not been observed in this study, as outlined in Table 3 and Table 4. Whereas, the idea that farmers who report direct experiences are more likely to take self-protective action in the form of adaptation, was only witnessed in the case of farmers improving field drainage, whereby those who had indirectly experienced flooding (through other farmers), were more likely to adapt their practices compared to those who did not know of other farmers affected.

Overall, farmers were not necessarily taking adaptive behaviour out of concern for climate change. Concern for climate change was only associated with behavioural response to climate change in the case of growing biomass crops, whereby those who were very concerned were more likely to be the ones growing (p < 0.05). For farmers who believe climate change is more anthropogenic in nature (as opposed to a natural phenomenon), they were more likely to improve water management (p < 0.01), plant shelter belters to protect crops and/or livestock from warmer weather (p < 0.05), reduce energy (p < 0.05) and grow biomass crops (p < 0.01). Farmers who were reducing energy use were also more likely to believe that climate change is a major cause of recent UK flooding (p < 0.05).

With regard to socio-economic and demographic factors, there were some associations with response to risk. Female farmers were more likely to be concerned about climate change, than male respondents (p < 0.05). Farmers who had stayed in education for longer were more likely to believe that their farm/land would be affected by climate change in the next 10 years (p < 0.01). Farmers who reported better financial situations were more likely to be installing renewable energy generator(s), and adjusting growing practices and/or new crop varieties (p < 0.05). Farmers from larger sized farms were also more likely to be adjusting growing practices and/or new crop varieties (p < 0.01), as well as improving field drainage for potential flooding (p < 0.01). Organic farmers were significantly less likely to grow biomass crops (p < 0.01), but more likely to improve water management on farm (p < 0.01).

Farmers were presented with various attitudinal statements related to climate change risk response in attempts to elicit information concerning perceived barriers to making such a response. Funding was not a significant motivator and instead, lack of overall concern for climate change risk and lack of information and advice is likely a more relevant barrier to action. Seventy-five per cent of farmers agreed that they would like more information and advice about climate change; while 33% of farmers felt they had too many other concerns to worry about than climate change and 33% that the current economic situation makes responding to climate change seem less important. Lack of resource to take action against climate change was claimed to be a barrier for one-third of respondents (30%) to adopt adaptation or mitigation practices, which does not match up with farmers’ lack of intention to respond to climate change, when presented with the idea of funding. Fifty per cent of farmers agreed that it is the government’s responsibility to tackle climate change; shifting accountability.

**Discussion and conclusion**

This study finds that although concern over climate change was not very high amongst the sample of Gloucestershire farmers, a heightened concern (attitudinal response) was associated with experience of flooding. Although, it is important to note that farmers do not automatically consider climate change and flooding to be related. This disconnection was a major conclusion of the work by Whitmarsh (2008), who noted that flood victims readily identify blame for flooding locally and often within the realm of localised political decision-making. This finding was also reported by Milne, Stenekes, and Russell (2008) when investigating Australian farmers’ perception of drought risk. Generally, reliance on the efficacy of administrative adaptation will lead to low precautionary action taken at the personal level (Grothmann and Patt 2005). Institutional response to flood risk and climate change is thus important and affects how the public interpret and value measures required to reduce such risks (Messling et al. 2015). In this case, such disconnect could be a major barrier in enabling an effective pathway between experience of flooding, and adaptive behaviour to climate change. Without farmers feeling that they have personally experienced climate change through the impact and observation of flooding, then that experience cannot be a filter to forming perceptual cues about climate change risk (Fazio 1986; Joireman, Truelove, and Duell 2010; Akerlof et al. 2013). The influence of other factors related to experience that have not been explored here, such as frequency of experience, may need to be investigated further.

There was an association between experience and behavioural response, but a weak association. Moreover, there was no specific pattern between type of flood experience and type of response (as previously implied by Haden et al. 2012). As illustrated in Tables 3 and 4, the specific experiences and specific responses cannot necessarily be assumed to be connected. This is particularly apparent for the experience of flooding and response of reducing energy use and installing renewable energy generator(s). Though not a direct, conscious response to climate change, the sample were still carrying out actions that are part of the IPCC’s termed ‘adaptation’ and ‘mitigation’ measures. This would warrant qualitative exploration to determine the exact process and underlying factors involved, and sparks debate over whether engagement in climate change is important, if the relevant response practices are being undertaken due to different motivations, such as to maximise profit. As explained by Frank, Eakin, and López-Carr (2011) there are key differences between factors that motivate conscious climate change adaptation and those that motivate indirect and unconscious behaviour. Therefore, for climate adaptation policy development, the nature of these different motivators for farmers needs to be better established. Such qualitative exploration could also be used to appraise the type of response actions chosen for this study. Some researchers have noted caution in assuming particular response actions to match that of the perceived response actions of the individual of study, posing a question, i.e. If a flood resulted in damage to a farmer’s property but nobody is personally injured, should the influence of this experience be evaluated solely by whether the farmer improves farm field drainage? (Weinstein 1989).

It is important to note that concern for climate change was not a significant motivation for behavioural response, and climate change is overall considered a low priority risk in relation to other common threats to business. A farmer’s attitude about environmental management generally will sit alongside his or her attitude about the needs and priorities of the farm business and farming in general (Mills et al. 2013), and above all there is the tendency to have a finite pool of worry (Weber 2006), crowding out new concerns such as climate change. Therefore, a farmer may well focus on this week, this month or this season rather than the longer term. This resonates with the need to understand the farmer’s wider decision-making environment in studying behaviour (Mills et al. 2013). With this in mind, risk response behaviour may be predicted by the type of farmer and his/her underlying values and wider environment, rather than shaped by his/her experience. This was not fully explained by demographic variables within this study, such as financial situation, education, gender or age, but may be linked to a desire to save money in business, convenience or feelings of obligation (Whitmarsh 2009) that were not inherently explored in this quantitative assessment. Such factors correspond to ‘adaptation incentives’ in the process Model of Private Proactive Adaptation to Climate Change; a term that defines perceived external incentives that drive adaptation intention, such as tax reductions, laws and social norms (Grothmann and Patt 2005). It is therefore likely that incentives within the general policy environment such as the attractive feed-in tariffs (FIT) for renewable energy in recent years, and associated grants that make desirable behaviours easier and cheaper to adopt (Pike 2008), are important cues for farmers, particularly where climate change risk perception and concern are low. In 2012, the UK government cut the FIT rate to reduce overall costs, and further FIT reductions are expected in 2016. The implications of this on future uptake of on-farm renewable energy (climate change mitigation) are inherently important, based on the findings of this study.

Farmer attitudes towards climate change risk did not significantly differ from the findings of previous studies, although acknowledgement of some human influence over climate was slightly higher than observed in the work by Gramig, Barnard, and Prokopy (2013). There were, however, some unique results from this study. Stark differences to existing literature were noted in the adoption of certain adaptation and mitigation practices, whereby Gloucestershire farmers appeared to be more proactive in responding than the national sample surveyed by Farming Futures (2011). Specifically, 49.5% more farmers in this study were improving buildings, 22% more respondents were adjusting crop practices and 38% more farmers were improving soil management (via improving drainage). Fifty per cent more farmers in the Gloucestershire sample were reducing fertiliser use compared to the national sample, while 64.5% were improving energy use in Gloucestershire, compared to 47% surveyed by Farming Futures (2011) and 55% surveyed by DEFRA (2013). The reasons for these differences are unknown, but could potentially be linked to characteristics of situational risk or opportunity, particularly associated with the aforementioned financial incentives offered through the UK policy environment, and a response to existing and new legislation such as Nitrate Vulnerable Zone regulations which require the reduction of fertiliser use. The difference may also potentially be attributed to the low response rate for this study.

The findings of this study have strong implications for the approach taken to communicate and frame climate change risk for farmers and demonstrate that this communication must be strategic in nature. With climate change scenarios projecting potential high flood risk periods, there is in theory, high value in promoting flood memories and local knowledge of changing flood character passed through communities as a way of making climate change less psychologically distant and removing barriers to engagement (McEwen et al. 2012). In this study in Gloucestershire, an automatic connection between flooding and climate change has not been found to exist amongst farmers and any attitudinal response to climate change risk has not translated into a high uptake of relevant adaptive and mitigative behavioural response action. Although communication aimed at farmers should illustrate, rather than the remote, global trends, the local and immediate impacts of climate change, this study resonates with Scannell and Gifford’s (2013) findings, whereby messages need to further emphasise the connection between climate change and extreme weather events, and subsequent information and advice should be offered to clearly illustrate the best means of on-farm response. This may adjust perception of risk amongst farmers in Gloucestershire, from the current situation whereby local environmental factors often outside farmers’ personal control are considered the overarching cause of climate change. The findings, although highlighting statistically significant associations, illustrate that the farming sector is not homogenous in nature, instead being made up of complex sub-groups, characterised by different factors, beyond the simple influence of experience. Further study is needed to help characterise and frame these different sub-groups of farmers, especially in relation to their attitudinal and behavioural response to climate change risk. Furthermore, to increase motivation to act, farmers need to receive information on possible, effective and not too costly adaptation options (Grothmann and Patt 2005) that also resonate with, or target other more immediate, short-term risks that farmers show concern for, such as market risks. As a result, it may be more effective to clearly illustrate that some on-farm climate change response options, such as installing renewable energy also allow for greater resilience in light of the immediate risks for which farmers in this study more readily exhibited concern, and a diversification of income in the face of an uncertain agricultural economic market with ongoing volatility in market prices.

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