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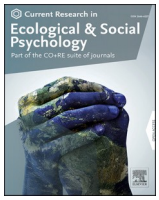

# The emotional depth of flood experience: the role of positive emotions in shaping perceptions and action on climate change

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ABSTRACT

Flooding is an ongoing and predicted impact of climate change in many parts of the world. Previous research shows that many people who have experienced flooding exhibit a greater preparedness to act on climate change, especially when the experience relates to more pronounced emotional responses. However, this research has mainly focused on general negative emotional reactions to flooding. Here, we re-analysed a large UK survey dataset ($N = 1997$) using mixed-methods to examine discrete emotional responses to flooding, including positive emotions, and their relationship with environmental intentions and policy support. Whilst anxiety, anger, helplessness, and distress, dominate people's experience, positive emotions were also reported as significantly higher in our flooded group, particularly gratitude and pride in response to the receipt of external and community support; surprise was also observed. Thematic analysis highlighted perceived impacts of flooding, and the experience of positive support, as being key to alleviating distress and anxiety, as well as promoting subsequent positive long-term actions to reduce flooding. Notably indirect experience of flooding was also impactful with a range of emotional responses also reported by observers. Regression analysis indicated that higher levels of anxiety, distress, and gratitude were associated with greater intentions to act environmentally in the future (alongside greater levels of anger and lower levels of indifference), and to support for environmental policies (alongside greater levels of sympathy). We suggest that the provision of support following flooding may promote considerations of morality and climate change and increase the likelihood (of both recipients and observers) to undertake pro social and pro-environmental behaviour themselves in the future.

## Introduction

Substantial behaviour changes, as well as public backing for wider societal changes, are needed if we are to rapidly reduce carbon emissions to effectively mitigate climate change (Creutzig et al., 2022), but there are wide variations in the extent to which people are prepared to act pro-environmentally. One influence upon environmental behaviour that has been highlighted by previous research is people's direct experience of environmental change. There is increasing evidence that people who have been exposed to adverse climate change impacts (or extreme weather that can plausibly be attributed to climate change) tend to report stronger intentions to behave pro-environmentally in the future (e.g., Spence et al., 2011; Demski et al., 2017; Bergquist, et al., 2019; Li et al., 2011; Hornsey et al., 2016). However, research here has obtained somewhat mixed results, with some studies finding null results and indicating that the mechanisms by which experience of climate change impacts relate to public perceptions of climate change require further elucidation (Howe et al., 2019; Sisco, 2021).

The experience of flooding, a key impact of climate change, has been found to impact people's perceptions of climate change and intentions to act pro-environmentally (e.g., Spence et al., 2011; Demski et al., 2017). In terms of the process by which this might come about, existing evidence indicates that emotions have a key role in the relationship between flooding experiences and environmental intentions. However, previous research has focused on negative emotional reactions to flooding and has tended to operationalise negative emotions as broad negative affect rather than discrete emotions such as anger or fear. Little is known about the effects of specific negative emotions, or any potential positive emotions, arising from flooding experiences; however, other research points to important distinctions between different types of

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emotions as drivers of behavioural intentions and policy support (Gregersen and Bye, 2023 Kovács et al., 2024). Considering that positive emotions, like pride in the community, are often observed following a disaster (Silver and Grek-Martin, 2015), it is possible that positive emotional responses may also play a part in how people respond to flood experiences and in determining subsequent behaviour.

*Perceptual and behavioural impacts of climate change experiences*

There is now substantial evidence that experiences of weather-related phenomena, such as flooding, can impact environmental perceptions (Spence et al., 2011; Myers et al., 2013; Broomell et al., 2015; Taylor et al., 2014; Demski et al., 2017; Hoffman et al., 2022). Historically, it is noted that those who are closely dependent on a stable climate, such as farmers, are likely to notice and report observations of changes in the climate (Battaglini et al., 2009) which often correspond well with climatological evidence (Amadou et al., 2015; Islam et al., 2019). Furthermore, increased levels of concern and intentions to act on climate change have been observed following specific experiences that can be linked to climate change impacts – some of which may be life-changing for those affected – including flood experiences (Spence et al., 2011; Demski et al., 2017), extreme weather events (e.g. hurricanes: Bergquist, et al., 2019), local temperature increases (Li et al., 2011), local weather changes (Hornsey et al., 2016), and power cuts (Spence, et al., 2021).

However, it is noted there are some mixed results in studies examining the effects of weather experiences on perceptions and behaviour indicators (Cutler, 2016; Marlon et al., 2018; McCright et al., 2014; Lyons et al., 2018; Spence et al., 2021). We note that some weather experiences are more likely to translate into changes in climate perceptions and intentions to act than others, that this is more likely for some people, and may also focus people on certain types of behaviour. Interpretations of weather events as climate change are influenced by prior beliefs, political leanings (left-leaning individuals more likely to do so), and personal impacts from the events (Cutler, 2016; Demuth et al., 2016; Marlon et al., 2018). It has also been suggested that the focus on individual behaviour in previous studies may contribute to mixed results, as social forms of environmental behaviour intentions (actions undertaken in collaboration with, or directed at, others) have exhibited greater impacts (from flood and power cut experiences) when distinguished from individual behaviour intentions (Spence et al., 2021).

Furthermore, Hoffman et al's (2022) recent comprehensive study which converges high-resolution climate data with survey data from across Europe finds that environmental concern and voting intentions are impacted by climate extremes to a greater extent in countries with favourable economic conditions and in regions with temperate and colder climates. It is suggested that economic concerns can overshadow concerns about the environment (Jakobsson, et al., 2018), and that people in warmer climates may already have adapted to more extreme weather making them less sensitive to further extremes.

Conceptually, it is asserted that direct experience of flooding can impact attitudes and behaviour through three main mechanisms: increasing the salience of climate change; reducing the psychological distance of climate change; and eliciting affective responses (Sisco, 2021). Studies consistently show that individuals who connect their extreme weather experiences to climate change and perceive increased salience of climate change are more likely to express concern about climate change and demonstrate intentions to act on climate change (Demski et al., 2017; Ogunbode et al., 2019). The psychological distance of climate change refers to how distant people perceive it in terms of time, geographical impacts, social proximity, and uncertainty (Spence et al., 2012). It is suggested that experiencing extreme weather events can diminish this psychological distance and make climate change feel more real. Moreover, negative emotional responses to extreme weather have been identified as an important mediator for intentions to mitigate climate change, adapt to climate risks, and support environmental taxation (Bergquist et al., 2019; Demski et al., 2017).

*Emotional responses to adverse environmental events*

Research examining adverse environmental events and subsequent behaviour change has primarily focused on generalised negative affect rather than discrete emotions (e.g., Demski et al., 2017; Massazza et al., 2021). However, it may be that examining specific emotions provides more informative insights than overall emotional valence, as different emotions with the same valence can lead to distinct behavioral responses. For example, fear and anger elicit different types of responses, thought to emphasise consequences and morality, respectively (Lerner and Keltner, 2000; Böhm and Tanner, 2019; Gregersen and Bye, 2023). We note that emotions examined in the literature here are most commonly emotions directly associated with the event (known as integral emotions within decision science: Loewenstein and Lerner, 2002; Vastfjall et al., 2016). Emotions are often contrasted with mood that is unrelated to the judgement target. Our review of the literature (and of our investigation) focuses on emotions noting that for some people, these will turn more enduring sentiments which will be reactivated whenever the event is considered (Castell, 2006).

Negative emotions commonly identified following adverse environmental events include fear, distress, sadness, anxiety, anger, and worry (Holley et al., 2022; Qian et al., 2021). While the focus on negativity after environmental events is understandable due to their often-devastating consequences, there is evidence of a mix of responses, including positive emotions (Silver and Grek-Martin, 2015; Massazza et al., 2021; Sapkota et al., 2021). Key positive emotions identified include hope, pride, and gratitude. In the aftermath of a disaster, there is often uncertainty about outcomes, which can be associated with anxiety for some but also with hope, and joy when fears are unfounded (Massazza et al., 2021). Hope is also linked to expectations of future normality and optimism in community resilience, sometimes connected to religious beliefs (Joakim and White, 2015; Wani et al., 2022).

Following a disaster, communities also often show extensive prosocial behaviour, with people donating goods and traveling from neighbouring areas to provide assistance (Walker-Springett et al., 2017).[1] Victims of such events also often provide each other with important emotional support, sometimes referred to as a 'therapeutic community', characterised by hard work, cooperation, and an optimistic outlook (Zieglar, et al., 1996): though this does not always occur (Zieglar, et al., 1996; Moore et al., 2004). The increased community support is associated with feelings of gratitude, optimism, and pride (Silver and Grek-Martin, 2015), and can foster a sense of belonging (Wani et al., 2022).

*Discrete emotions and relationships with behaviour*

Few comprehensive studies have explored the connection between discrete emotions and environmental behaviour (see Landmann, 2020, for a review). Emotions are often assessed using a dimensional method, which includes an approach-avoidance dimension. This dimension is generally associated with a positive-negative spectrum, where positive emotions relate to approach, and a greater likelihood of behaviour, and negative emotions relate to avoidance (Mauss and Robinson, 2009). However, anger is an exception to this pattern, as it can elicit approach behaviour (Harmon-Jones and Allen, 1998; Lerner and Keltner, 2000).

Selective in-depth examinations have explored specific discrete emotions in the environmental domain, categorizing them based on appraisal (Landmann, 2020). In terms of emotions relevant to disaster experiences, fear, anxiety, and hopelessness are described as threat-related, arising from anticipated negative consequences, and

[1] This is linked with the concept 'Commnitas' – the idea of an upsurge in community spirit following a crises (Turner, 1985)

leading to escape-type, or helping, behaviours (Bohm and Pfister, 2000). Anger, on the other hand, is associated with aggression and punishment behaviour (Bohm and Pfister, 2000; Landmann, 2020), if options for such actions are available. Pride and gratitude are linked to supportive behaviour, with pride focusing on self-support and gratitude emphasizing support for others (Harth et al., 2013; Landmann, 2020). And although not previously directly examined, sympathy appears to align with emotions arising from others' suffering (including compassion and empathy) and is therefore also likely associated with helping behaviour (Landmann, 2020).

Pride has been the focus of much research in Environmental Psychology, being characterised as an emotion with a moral basis, arising from self-reflection where the individual meets personal standards (Tracy and Robins, 2007). A recent meta-analysis indicated medium to large effects of pride on environmental behaviour (Shipley and van Riper, 2022). Interestingly this study distinguished experienced pride from anticipated pride and found larger effects for anticipated pride. However, it was also observed that experienced pride was more likely to be examined experimentally and anticipated pride more likely to be examined in correlational studies with no previous correlational studies identified that examined the relationship between naturally experienced pride and pro-environmental behaviour which thus remains a research gap (ibid).

Interestingly, gratitude has recently received increased attention within environmental psychology. It has been characterised as a morally relevant emotion in that it is thought to result from, and to motivate further, moral behaviour - both towards the benefactor and to others (McCullough et al., 2001). This implies that gratitude could promote further prosocial behaviour including environmental behaviour. Indeed, recent research has found that gratitude is linked with a reduction in overconsumption in resource dilemmas where a limited resource is shared between people (Kates and DeSteno, 2021). Similarly, further research found that individual differences in gratitude were linked with increased responsibility towards the environment for future generations (Syropoulos et al., 2020) and the idea of being grateful towards nature has been linked with pro-environmental behaviour (Tam, 2022). Evidence further suggests that gratitude may support happiness through enhancing relationships and reinforcing coping ability (Watkins, Gelder and Frias, 2009) highlighting the potential utility of gratitude in enhancing resilience in flood victims. The specific experience of gratitude arising from support following flooding has not been explored to date to our knowledge however, nor has its implications for future behaviour.

As noted, previous research on environmental experiences has linked negative emotional responses to flooding with intentions to behave pro-environmentally, adapt to future environmental impacts, and support climate-related policies (Spence et al., 2011; Demski et al., 2017). This is in line with the idea that negative emotions generally lead to avoidance behavior, aiming to mitigate climate change and prevent future climate-related experiences. However, when it comes to mitigation behavior, we highlight that the approach of positive environmental goals are important alongside the avoidance of adverse environmental events (cf. Carver and Scheier, 1998) and that approach behaviour is more commonly linked to positive emotions. It is important to note that there has been no investigation into behavioural responses regarding positive emotions following disaster experiences, nor consideration of discrete emotional responses and subsequent behaviour.

### *Current research*

This research is the first study, to our knowledge, to examine a wide range of discrete emotions, including positive emotions such as pride and gratitude, relating to flood experiences and subsequent environmental behaviour intentions. We re-analyse quantitative data obtained from a large UK population sample (Pidgeon et al., 2016) to examine the relationship between specific emotional responses to a flood experience and behavioural intentions in populations that have and have not experienced flooding. We also use qualitative data (ibid) to uncover the reasons underlying a range of emotional responses to flooding. Our design is therefore explanatory-sequential: applying mixed methods whereby qualitative data is used to provide insight into a parallel quantitative analysis.

Based on previous research examining emotions expressed following disaster experiences, we hypothesised that flood victims will experience higher levels of several emotions, specifically anxiety, distress, sadness, anger, pride, gratitude, and sympathy, than those who have not experienced flooding when thinking about the specific flooding event that they had experienced.[2] Considering the limited literature on discrete emotions in the environmental domain and relationships with environmental behaviour intentions, we provide specific hypotheses for only some of the emotions examined. We predicted that anxiety, distress, anger, pride, gratitude, and sympathy will positively relate to environmental behaviour indicators (intentions of future environmental behaviour and support for environmental policies). Additionally, emotions of sadness, helplessness, surprise, and indifference were examined but specific predictions were not formulated due to a lack of prior evidence. Alongside the testing of these predictions, we considered the reasons underlying people's emotional responses to flooding in an exploratory and open-ended manner.

## Methods

### *Design*

We conducted a secondary analysis of a publicly available existing cross-sectional dataset (Pidgeon et al., 2016; Capstick et al., 2015). The original dataset was obtained to examine climate change perceptions, flooding experience, and attitudes towards society and the environment. Here, we focus specifically on emotional responses to a flood experience, justifications of those emotions, and experiences of flooding. Key demographics (age, gender, and social grade) are included as covariates so we can increase our confidence that relationships and differences observed are due to the factors of interest.

### *Participants*

The overall sample comprised a national UK sample of 1002 participants and an additional 995 participants drawn from areas known to have recently experienced a major flooding event (total $N = 1997$). Within the whole sample, 162 participants had reported direct impacts of flooding on their property from the November 2013 – February 2014 floods in the UK and 1832 participants did not. Three responses were missing on this question and were excluded from analyses. Those who reported direct impacts of flooding were primarily, but not exclusively, from areas known to have experienced flooding. Data was gathered between 28 August and 31 October 2014 meaning the lag between the flood experience and data collection was between 6 and 11 months.

The national UK sample was geographically representative across the UK whereas the flood-affected sample was primarily drawn from five regions within the UK (City of Hull by the river Humber, areas by the River Thames west of London between Sunbury and Windsor, areas by the River Severn between Tewkesbury and Gloucester, in Aberystwyth, and along the coast at Dawlish in Devon), that were specifically oversampled in order to gain a higher proportion of people who had experienced flooding recently. For flood-affected samples, it was ensured that all respondents had lived in the area prior to February 2014 so that participants were in residence at the time of the flooding. All participants were aged 16 years or older with most of our participants

[2] Note, we would also hypothesis greater levels of hope but this was not measured in the dataset available

reporting an age category of between 45 and 54. Just over half (53.1 %) of our sample described themselves as male, see Supplementary materials Table 1, for full descriptive statistics of age, gender, and social grade.

### *Materials*

The questionnaire was designed by the original project research team in conjunction with an advisory panel consisting of stakeholders from government, non-government organisations and additional academics from varying disciplines; see Supplementary Materials Table 2, for full question wording. The full questionnaire comprised: questions examining climate change perceptions including causes and consequences of climate change, the psychological distance of climate change, attitude strength towards climate change, support for climate policies, support for actions to mitigate climate change and perceived changes to weather; questions examining participants' flood experience including impacts on property, travel and services; and questions examining participants' perceptions of their flood experience including effects on wellbeing, ability to cope, social support and impacts on finances and health (see Capstick et al. (2015) for the full survey instrument and top line results).

The research approach that was used to derive the data used a more objective measure of flood experience than in many comparable studies, by gauging whether participants had experienced specific types of property damage from the flooding. This is considered a measure less prone to biases, whereby climate-concerned respondents might have been more inclined to indicate that they had been affected in some way by flooding. The question used in the current analysis asked participants if their current or previous property was affected by the floods between November 2013 and February 2014, with response options of Yes/No/Don't know. The question also detailed a specific description of what might be considered flood damage to ensure that people interpreted this in a similar way; see Table 2, supplementary materials.

Respondents were also asked about their emotional response to the specific flooding event that occurred between November 2013 and February 2014: note that all respondents were asked this question, not just those with personal flood experience; this was a relevant question to ask of all participants, given that the floods had occurred across many parts of the country over a sustained period of time and been covered extensively in the news. The question asked participants, 'When you think about the floods how strongly, if at all, have you felt each of the following emotions…'; this was therefore able to be answered both by those who had directly experienced the flooding and those who had heard about the flooding (e.g., on the news or through friends or family). Participants were asked this for each of 10 discrete emotions: Sadness, Anxiety, Pride, Gratitude, Anger, Helplessness, Sympathy, Surprise, Indifference, and Distress. These emotions were described to assess emotions related to the flood experience and were partly selected from the Positive and Negative Affect Schedule (PANAS; Watson, Clark, Tellegan, 1988), partly identified as those most relevant to flooding experience, and refined to comprise a range of both consequence-based (those that result from the anticipation or experience of consequences) and ethics-based emotions (the violation of ethics or norms: Bohm and Pfister, 2005). Participants were asked to rate each emotion on a 10-point scale ranging from 1 – 'I have not felt this at all' to 10 – 'I have felt this extremely'. A further open-ended question then asked respondents to say a little more about why they experienced that emotion. This question was designed to examine what features of the flood experience underpin different emotional responses observed.

Intentions for future pro-environmental behaviour were examined using a scale of six questions that asked participants how likely they were to carry out a range of pro-environmental actions. These were designed to assess both infrequent, larger impact actions, e.g., buy appliances that are more energy-efficient, and actions that are more regularly undertaken, e.g., cut down the amount you travel by car. Behaviours examined covered both those performed individually, e.g., cut down the amount you travel by car, and those that involved others, e.g. write letters, email, or phone your local MP about climate change. It is important that behaviour intentions cover a range of types of behaviour given previous research indicating that environmental experiences may have a differential impact on different types of action (Spence et al., 2021). Responses were examined on a Likert type scale which rated the likelihood of the action. Items formed a reliable scale as assessed using Omega total: 0.76 (see Supplementary materials for calculations: McNeish, 2018). For comparison Cronbach's alpha also indicated reliability: $\alpha = 0.75$.

Support for environmental policies was examined with a scale of 3 items that asked participants to what extent they would support these national or international actions on climate change. These comprised: road pricing schemes to reduce traffic in town and city centres; tax increases to pay for more renewable energy; and international agreements to limit carbon emissions. Responses were examined on a Likert type scale which asked participants to rate how much they supported or opposed the action. Items formed a scale with acceptable internal reliability with Omega total: 0.68 (see Supplementary materials for calculations). Cronbach's alpha also indicated acceptable reliability: $\alpha = 0.67$.

Demographics examined included gender, age, and social grade. Social grade classifications were based on those used by the Institute of Practitioners in Advertising which categorise respondents based on their occupation. A: Higher managerial, administrative or professional; B: Intermediate management, administrative or professional; C1: Supervisor or clerical and junior managerial, administrative or professional; C2: Skilled manual workers; D: Semi and unskilled manual workers; and E: State pensioners, and others with no additional earnings.

### *Procedure*

Computer Assisted Personal Interviews (CAPI; undertaken in person at respondents' homes) were carried out by Ipsos MORI (a social research company) to gain survey data. Notably questions regarding behavioural intentions and policy support were asked ahead of questions about flood experience so consideration of experiences could not have influenced responses to these questions.

### *Data analysis*

Our approach to analysis combined quantitative and qualitative methodologies to provide insights into the types of emotions that flood victims reported in relation to the flood experience and how these might impact subsequent behaviour with generalisable breadth, as well as a depth of understanding as to the reasons that emotions may have been experienced.

For all our parametric quantitative statistical analyses, age, gender and social grade were included as covariates so that differences, and relationships, between variables could be examined above and beyond the impact of these factors. This is important given that age and gender have been observed to have impacts on environmental risk perceptions (e.g., Subiza-Perez et al., 2020; Poortinga, Demski and Steentjes, 2023; Ergun, Karadeninz, and Rivas, 2024) and given that social grade is observed to differ between our flooded and non-flooded samples (see Table 1, Supplementary materials). For each analysis where age, gender, and social grade are included as covariates, the analysis was rerun and detailed in the supplementary materials for transparency; it is noted that the pattern of results remain highly similar with and without covariates

included.

First, a MANCOVA was used to examine differences in emotional responses to the flood experience reported by flooded and non-flooded groups to consider all discrete emotions together in one analysis. We then used two linear regression analyses to consider how emotional responses to the flood experience related firstly to future pro-environmental behavioural intentions and then also how these related to environmental policy support. We also examined correlations between emotions reported in relation to the flood experience and behaviour measures (intentions and policy support) separately for flooded and non-flooded groups to provide further insight into the relationship between emotions and likely subsequent behaviour.

To explore emotional responses to the flood experience in more depth, we analysed people's self-reported reasons for emotions experienced when they considered the floods. An inductive thematic analysis was used to allow the data to drive categorisations of reasons provided (cf. Braun and Clarke, 2021). Manual coding was undertaken in preference to computer assisted topic modelling given the relatively reasonable sample size and given that computerised coding may miss meaning and interpretation within the data.

We then examined how frequencies of reasons of emotions differed across different emotions experienced, using a Fisher's exact test with Monte Carlo sampling (given the high computational demands of an exact test), to examine relationships given that frequency data was being examined, and given that several cells (5) had an expected frequency of <5. We also descriptively examined the most common justifications for emotions reported when people considered the floods, focusing only on those emotions that were higher for those that had experienced flooding for clarity.

## Results and discussion

### *Emotional responses between flooded and non-flooded samples*

Differences in emotions reported by flooded and non-flooded groups, when considering the recent flood event, were examined using a MANCOVA, see Supplementary Materials, Table 3 for details of means, see Fig. 1 for an illustration of differences. This included flood experience as a between subjects factor with two levels (flooded, not flooded), the ten discrete emotional responses reported as dependent variables, and age, gender, and social grade as covariates. It is observed that Box's test of equality of covariance matrices was significant ($M = 98.56$. $F = 1.75$, $p < 0.001$) and Levene's test of equality of error variances was significant ($p < 0.05$) for five emotions: anxiety, pride, anger, surprise, and distress. This is perhaps unsurprising given the sample size differences between flooded and non-flooded samples. We consequently consider Pillai's Trace values within the MANCOVA which is considered robust to departures from homogeneity of variance assumptions.

Fig. 1– Emotional responses of flooded and non-flooded participants

There were significant differences in reported discrete emotions between those who did or did not experience flooding ($F$ (10, 1980) = 13.21, $p < 0.001$, $\eta^2 = 0.06$. Age, gender, and social grade were significant covariates ($F$ (10, 1980) = 10.72, $p < 0.001$, $\eta^2 = 0.05$, $F$ (10, 1980) = 11.47, $p < 0.001$, $\eta^2 = 0.06$, and $F$ (10, 1980) = 5.91, $p < 0.001$, $\eta^2 = 0.03$ respectively). Follow up tests indicated that flooded participants had significantly higher levels of anxiety, pride, gratitude, anger, helplessness, surprise, and distress compared to those who had not experienced flooding (all significant at $p < 0.01$, except for surprise which was significant at $p < 0.05$). Note that we repeated the analysis without covariates and report this within Supplementary Materials, noting that the pattern of results was highly similar; in this analysis surprise became borderline significant at $p = 0.05$ and sympathy additionally became borderline significant (with higher levels amongst the non-flooded group) at $p = 0.05$.

### *Predicting behaviour intentions based on emotional responses to flooding*

We examined how reported flood experience, and emotional responses to the flood experience related to stated future pro-environmental behavioural intentions and environmental policy

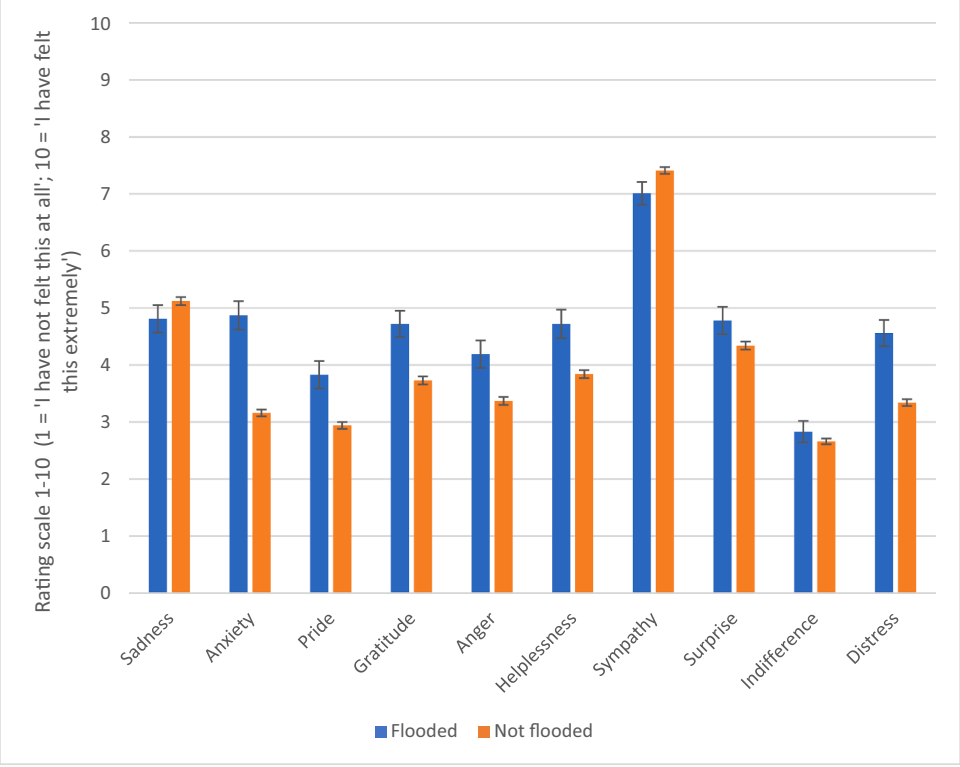


**Fig. 1.** Mean discrete emotional responses for flooded ($N = 162$) and non-flooded ($N = 1832$) participants. Error bars represent standard error of the mean.

**Table 1**
Regression of reported emotions relating to the flood experience on future environmental behavioural intentions and policy support.

| Predictor | Behavioural intentions | | | | Policy support | | | |
|---|---|---|---|---|---|---|---|---|
| | r | B | t | 95 % CI B | r | B | t | 95 % CI B |
| Age | −0.12** | −0.07** | −7.72 | −0.09, −0.05 | −0.05** | −0.04** | −3.70 | −0.06, −0.02 |
| Gender | 0.04* | 0.00 | 0.02 | −0.07, 0.07 | 0.05* | 0.04 | 1.07 | −0.04, 0.13 |
| Social grade | 0.15** | 0.11** | 7.13 | 0.14, 0.08, | 0.15** | 0.12** | 6.40 | 0.16, 0.08 |
| Flood experience | 0.06** | 0.05 | 0.72 | −0.08, 0.17 | 0.09** | 0.20* | 2.50 | 0.04, 0.35 |
| Sadness | 0.17** | 0.02 | 1.82 | −0.00, 0.03 | 0.10** | −0.01 | −0.50 | −0.02, 0.01 |
| Anxiety | 0.18** | 0.02* | 2.56 | 0.01, 0.04 | 0.15** | 0.03** | 3.12 | 0.01, 0.05 |
| Pride | 0.11** | 0.01 | 0.66 | −0.01, 0.02 | 0.07** | −0.01 | −0.74 | −0.03, 0.01 |
| Gratitude | 0.15** | 0.02* | 2.54 | 0.00, 0.03 | 0.13** | 0.03** | 3.12 | 0.01, 0.04 |
| Anger | 0.15** | 0.02* | 2.15 | 0.01, 0.03 | 0.07** | −0.00 | −0.25 | −0.02, 0.02 |
| Helplessness | 0.14** | 0.01 | 0.83 | −0.01, 0.02 | 0.06** | −0.01 | −1.49 | −0.03, 0.00 |
| Sympathy | 0.13** | 0.01 | 1.52 | −0.00, 0.03 | 0.11** | 0.03** | 2.51 | 0.00, 0.04 |
| Surprise | 0.07** | −0.01 | −1.28 | −0.02, 0.01 | 0.04 | −0.01 | −1.21 | −0.03, 0.01 |
| Indifference | −0.04* | −0.03** | −3.39 | −0.04, −0.01 | −0.02 | −0.01 | −1.42 | −0.03, 0.01 |
| Distress | 0.17** | 0.02* | 2.00 | 0.00, 0.04 | 0.15** | 0.04** | 3.53 | 0.02, 0.06 |
| $R^2$ | | 0.11 | | | | 0.07 | | |
| F | | 16.94** | | | | 11.26** | | |
| df (residual) | | 1979 | | | | 1972 | | |

N.B. Betas provided are unstandardised coefficients. Higher values indicate higher levels of the construct, e.g., higher numbers indicate older age, higher social grade. For gender, 1 = Male; 2 = Female. For flood experience, 1 = Not flooded; 2 = Flooded. $N = 1997$; ** = $p < 0.01$, * = $p < 0.05$. r values are Pearson's r correlations.

support (including both flood victims, and those who were not directly affected by the flood event), using two forced entry multiple regressions, see Table 1. Flood experience and the ten discrete emotions examined were regressed on behaviour intentions and policy support respectively. Age, gender, and social grade were included in each model. Pairwise deletion was used for missing values.

For behavioural intentions, people who were younger and of a higher social grade were more likely to intend to behave pro-environmentally. In addition, people who reported having experienced greater levels of anxiety, gratitude, anger and distress, or lower levels of indifference were more likely to intend to behave pro-environmentally in the future. Comparable direct Pearson's correlations are also listed in Table 1 and indicate that all discrete emotions measured were significantly related to behavioural intentions. Flood experience was also significantly related to behavioural intentions with those who had experienced flooding reporting greater behavioural intentions to act pro-environmentally, though this relationship became non-significant when included in the regression indicating some overlap with other variables in the model. VIF levels were acceptable however with no levels over 2 and a mean of 1.42 indicating collinearity was not an issue. Note that we also repeated the regression analysis excluding demographics (see supplementary materials, Table 6) and the pattern of results was broadly the same but variance contributed by distress was slightly reduced and it became a non-significant predictor.

When environmental policy support was the outcome variable, again people who were younger and of a higher social grade were more likely to indicate their support. People who reported having experienced greater levels of anxiety, gratitude, sympathy, and distress were also more likely to support environmental policies, compared to others. Here flood experience was also significantly related to policy support with those who had experienced flooding more likely to support environmental policies presented. Most direct Pearson's correlations between discrete emotions and policy support (except surprise and indifference) were also significant. Again VIF levels indicated collinearity was not an

**Table 2**
Correlations between emotions and behaviour indicators for flooded and not flooded groups.

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. BI | | | | | | | | | | | |
| 2. Policy support | 0.50** (0.58**) | | | | | | | | | | |
| 3. Sadness | 0.17** (0.13) | 0.10** (0.03) | | | | | | | | | |
| 4. Anxiety | 0.18** (0.11) | 0.14** (0.12) | 0.44** (0.68**) | | | | | | | | |
| 5. Pride | 0.12** (0.01) | 0.07** (−0.01) | 0.29** (0.29**) | 0.31** (0.31**) | | | | | | | |
| 6. Gratitude | 0.16** (0.03) | 0.13** (0.03) | 0.31** (0.42**) | 0.26** (0.36**) | 0.49** (0.55**) | | | | | | |
| 7. Anger | 0.14** (0.13) | 0.06* (0.07) | 0.38** (0.62**) | 0.36** (0.56**) | 0.24** (0.32**) | 0.25** (0.35**) | | | | | |
| 8. Helpless-ness | 0.13** (0.16*) | 0.05* (0.13) | 0.47** (0.63**) | 0.44** (0.61**) | 0.24** (0.23**) | 0.27** (0.35**) | 0.52** (0.66**) | | | | |
| 9. Sympathy | 0.14** (0.10) | 0.12** (−0.01) | 0.51** (0.39**) | 0.19** (0.27**) | 0.22** (0.33**) | 0.29** (0.46**) | 0.24** (0.29**) | 0.34** (0.37**) | | | |
| 10. Surprise | 0.06* (0.10) | 0.03 (−0.01) | 0.27** (0.47**) | 0.24** (0.45**) | 0.23** (0.31**) | 0.24** (0.42**) | 0.19** (0.40**) | 0.29** (0.47**) | 0.27** (0.25**) | | |
| 11. Indifference | −0.05* (0.01) | −0.03 (0.02) | 0.03 (0.03) | 0.10** (0.06) | 0.13** (0.21**) | 0.11** (0.03) | 0.13** (0.19*) | 0.12** (0.12) | −0.08** (0.09) | 0.11** (0.20**) | |
| 12. Distress | 0.17** (0.13) | 0.14** (0.13) | 0.52** (0.64**) | 0.57** (0.74**) | 0.28** (0.29**) | 0.29** (0.38**) | 0.44** (0.58**) | 0.48** (0.53**) | 0.28** (0.31**) | 0.26** (0.39**) | 0.12** (0.16*) |

Note: Values are Pearson's r correlations. Data for the flooded group is reported in brackets below the non-flooded group data. BI = Behaviour Intention. Note sample size is higher for the non-flooded group (Ns between 1825 and 1832) than the flooded group ($N = 162$).

issue here with no VIF levels over 2 and a mean of 1.42 across predictors (correlations can be viewed in supplementary materials, Table 7). Again, we repeated this analysis without demographics (see supplementary materials, Table 6) and results had the same pattern of significance.

We also examined Pearson's correlations between all self-reported emotional responses to the flood experience and behaviour measures of environmental behaviour intention and environmental policy support separately for those who had and had not experienced flooding (see Table 2). It is notable that the relationships observed between emotions reported and outcome variables (behavioural intentions and policy support) were significant for those who did not report flood experience and not significant for those that did report flood experience.

*Reasons underlying emotional responses to flooding*

To understand why people may have experienced different emotions when thinking about the flood experience, we analysed people's self-reported reasons for emotions experienced when they thought about the floods for both those who had experienced flooding and those who had not. An inductive thematic analysis was used to identify themes within justifications given across participants (cf. Braun and Clarke, 2021). Two researchers independently coded a subsample ($N = 200$) of the data and then discussed themes identified to refine category definitions, see coding guide included within Table 2. Codes identified were then used independently to code the full data set ($N = 1994$). Inter-rater reliability was calculated by correlating codes applied by each researcher, giving a score of 98 % agreement.

Where respondents described several ideas, the most salient idea was chosen and coded; where the most salient justification was difficult to discern, the first justification was used. Thirteen distinct themes were identified: *Attribution of the flooding event; Disruption caused by flooding; Financial stress; Impact on property and possessions; Lack of control; Lack of mitigation; Media reporting; Lack of personal impacts; Impact on flood victims; Aid to self or others; Reoccurrence; Severity*; and *Miscellaneous*, see Table 3; See supplementary materials Figure 3 for a graphical illustration of the percentage frequency with which each theme was identified.

*Impact on flood victims* and *Impact on property and possessions* were the most frequent reasons given for emotions reported. When considering *Impact of flood victims*, people often referenced those who had suffered more than themselves (with flood victims expressing this too), for example:

*"I was aware that there were a lot more people worse off than I was"*.

People often used personal experiences to relate to others, and relief they had not suffered, or not suffered as badly. *Impact on flood victims* related to almost all emotional reactions indicating the centrality of considering others and perspective taking to emotional reactions: *Impact on flood victims* was particularly related to emotional experiences of sadness, distress, sympathy, and gratitude. Similarly, *Impact on property and possessions* was related to many emotional reactions, but primarily more negative reactions: sadness, anger, and helplessness.

*Lack of Control* was also a prevalent reason given for emotions felt and characterised anxiety and surprise, as well as to a lesser extent, helplessness and distress. Respondents tended to report that they, or others were powerless in relation to the flooding experience and the impact it had on their property, for example one person described:

'*A futile situation, there was nothing they could do about it."*

Some described being away from home at the time of the flooding and being unable to prevent the damage incurred. Others describe high levels of anticipation and uncertainty relating to what might happen, and a general loss of sense of security:

*"What can I do if it happens, never been in to situation before" (sic).*

Flooding was also referred to as unexpected, particularly so by those who identified themselves as first-time victims who thought their area would be unaffected. Some responses were also characterised by disbelief of how flooding could be so severe and impactful in the UK, as a developed country:

**Table 3**
Themes identified within justifications of emotional responses to the flood experience.

| Theme | Definition | Example | Frequency in flooded group ( %) | Frequency in non-flooded group ( %) |
|---|---|---|---|---|
| Impact on flood victims | Observations of how the flooding impacted flood victims, including perspective taking and general concern. | *"because my sister was directly involved in it, she had to leave her house…"* | 42 (25.9) | 602 (32.9) |
| Lack of control | Flooding as beyond the control of themselves or others. | *"I can't control the situation of rising water…"* | 33 (20.4) | 153 (8.4) |
| Impact on property and possessions | Mention of negative impacts on livelihoods, damage to property, and possessions. | *"damage caused to people's houses…"* | 20 (12.3) | 368 (20.1) |
| Aid to self or others | Support offered in the aftermath of floods | *"…the local community acted together… helped everyone within the village when the houses started flooding…"* | 16 (9.9) | 75 (4.1) |
| Lack of flood mitigation | A dissatisfaction with prevention measures in place pre-flood and delays in responding post flooding. | *"they spent a lot of money on sea defences and they seem to have made things worse"* | 12 (7.4) | 178 (9.7) |
| Lack of personal impacts | Described themselves as not personally impacted by the floods in any way. | *"did not know anything about the flooding, never heard of it"* | 6 (3.7) | 99 (5.4) |
| Disruption caused by flooding | Reference to restricted mobility or amenities caused by the flooding. | *"…our village was cut off by water"* | 6 (3.7) | 42 (2.3) |
| Financial stress | Description of costly repairs, or insurance pay outs and problems. | *"some people did not have insurance"* | 5 (3.1) | 24 (1.3) |
| Severity | Describing intensity of the weather leading up to the flooding or the extent of the damage caused. | *"how quickly water had risen in local canal which caused red alert for our area"* | 4 (2.5) | 61 (3.3) |
| Reoccurrence | Description of the floods as commonplace or observation of people suffering repeatedly. | *"I have experienced it in 2007…"* | 2 (1.2) | 55 (3) |
| Media reporting | Reference to seeing the impact of the flooding through | *"…seeing what people had gone through and* | 2 (1.2) | 54 (2.9) |

(*continued on next page*)

**Table 3** (*continued*)

| Theme | Definition | Example | Frequency in flooded group ( %) | Frequency in non-flooded group ( %) |
|---|---|---|---|---|
| | different forms of media. | *lost on the news"* | | |
| Attribution of the flooding event | Describing, or assigning cause, to the flooding event. | *"it was because of climate change…"* | 1 (0.6) | 18 (1) |
| Miscellaneous | Rare responses including victim blame, faith, personal resilience, or non-specific responses including the repetition of the emotional response or a nonsensical answer. | *"some of them could have helped themselves more"* | 13 (8) | 103 (5.6) |

"*it was a shock this happened in the UK, normally happens in poor countries*" (sic).

*Lack of flood mitigation* was also mentioned frequently, particularly in relation to anger and helplessness. There was reference to the government not meeting mitigation expectations and reacting poorly to the flooding with relief and aid, and some mention of relief being unfairly distributed. In contrast to this *Aid to self or others* referred particularly to community support in the aftermath of the floods, including descriptions of neighbours housing flood victims, and people delivering food and raising funds to help people affected. *Aid to self or others* was particularly associated with the positive emotions, pride, and gratitude.

Interestingly, *Attributions of the flooding event* were not spontaneously reported as a frequent basis of emotions experienced. When this was mentioned, respondents were most likely to attribute the causes of flooding to observable factors such as the ineffectiveness of mitigation efforts, only infrequently mentioning climate change.

We examined the association between flooding experience (flooded/not flooded) and types of justifications for emotions reported. Given 5 cells had an expected frequency of <5, we used a Fisher's exact test, with Monte Carlo sampling using a confidence level of 99 % and number of samples set to 10,000, to examine relationships; see Supplementary Materials Table 8 for expected and observed frequencies of justifications of emotions provided. This demonstrated that types of justifications for emotions reported by people who did and did not experience flooding were significantly different, Fisher's Test = 44.75, $p < 0.001$, 99 % CI [0.00, < 0.01] with a small effect size: Cramer's $V = 0.16$, $p < 0.01$, 99 % CI [0.00, < 0.01]. References to *Lack of control*, and *Aid to self or others*, were higher for those with flood experience (standardised residuals = 4.6 and 3.2 respectively), than expected. References to *Impacts on property and possessions* were lower for those with flood experience (standardised residual = −2.1), than expected.

We also examined the most common justifications provided for emotions reported when people (both flooded and non-flooded samples) thought about the flood event using frequency data, see Table 4. It may be particularly noteworthy to look at those emotions that are reported to be significantly higher for those who have experienced flooding: anxiety, pride, gratitude, anger, helplessness, surprise, and distress. A *Lack of control*, the *Perceived impact on victims, Impact on property and possessions*, and *Positive responses/aid* tended to characterise these emotions indicating that they may be particularly important experiences for flood victims. It is interesting to examine justifications for positive emotions in particular. Pride and gratitude were related to justifications that highlighted *Perceived impacts on flood victims,* and *Aid provided to flood victims*. However, it is important to acknowledge that, whilst pride and gratitude were expressed more commonly by flood victims, these emotions were also expressed by those who had not been impacted by flooding with a common justification for gratitude being that they had no direct impact from flooding. *Perceived impact on victims* and *Aid to self or others* (expressed for both gratitude and pride) also often involved references to others rather than the self. It is also noted that sympathy was by far the most commonly expressed emotion and particularly related to justifications considering the *Perceived impact on victims* and *Impact on property and possessions*.

## General discussion

Beyond general negative emotions observed in previous studies (Spence et al., 2011; Demski et al., 2017), for the first time, we identified that people who had experienced flooding reported greater levels of specific emotions including: anxiety, pride, gratitude, anger, helplessness, surprise, and distress, when thinking about the flood experience, than those who had not experienced flooding. We analysed how these discrete emotions related to environmental behaviour intentions demonstrating that greater levels of anxiety, distress, and gratitude related to both personal environmental behavioural intentions (alongside greater levels of anger and lower levels of indifference) and future environmental policy support (alongside greater levels of sympathy). Justifications given for emotions reported when thinking about the flood experienced (from both the flooded and non-flooded sample) have not been examined in previous literature. Our analysis provides insights into aspects of the experience that may be important in determining emotional reactions. Our flooded sample more frequently highlighted a lack of control and the experience of aid to themselves or others as underlying their emotions. We propose that it is important to consider the specific emotions that arise from thinking about flooding – and by extension, to other types of extreme weather events linked to climate change – beyond a generic acknowledgement of negative emotions because, alongside the analysis of the justifications of the emotions, these can help us understand how to best support and communicate with affected communities, as well as understand how emotional responses may underpin people's perspectives on climate action.

The mix of emotions reported by people who had experienced flooding supports previous research in disaster research that highlights the cooccurrence of a range of emotions (Silver and Grek-Martin, 2015; Massazza et al., 2021; Sapkota, et al., 2021). The range of discrete emotion that relate to subsequent behaviour intentions (both in terms of personal behaviour intentions and policy support) also resonates with the idea of dual processes by which emotions might impact likelihood of subsequent action (Carver and Scheier, 1998), i.e., both prompting approach of positive environmental behaviour and avoidance of further flood experiences.

Interestingly when correlations between emotions and behavioural indicators were examined between flooded and non-flooded samples separately, relationships tended to be not significant for the flooded sample and significant for the non-flooded sample. This is despite the flooded sample indicating significantly higher levels of most of the discrete emotions reported. It is possible that emotions relating to the flood experience are less likely to lead to environmental actions in the flooded sample in the aftermath of flooding given other immediate demands that are placed on the flooded group. Whether these emotions might relate to pro-environmental behaviour in the longer term is an interesting question for further research over longer time periods. We also acknowledge the relationships observed in the non-flooded sample between discrete emotions reported in relation to the flood experience, and environmental intentions and policy support, demonstrating the importance of indirect experience of flooding events and the potential importance of associated media coverage and discussion of flood events in strengthening this link.

Examining justifications for discrete emotions reported provide an

**Table 4**
Most common justifications provided for each emotion type across flooded and non-flooded samples.

| | Justification 1: Frequency (Percent) | | Justification 2 Frequency (Percent) | | Justification 3 Frequency (Percent) | |
|---|---|---|---|---|---|---|
| Sympathy (*N* = 1479) | Perceived impact on victims | 584 (39.5%) | Impact on property and possessions | 351 (23.7%) | Lack of mitigation | 119 (8%) |
| Sadness (*N* = 396) | Perceived impact on victims | 127 (32.1%) | Impact on property and possessions | 86 (21.7%) | Lack of mitigation | 46 (11.6%) |
| Surprise (*N* = 365) | Lack of control | 87 (23.8%) | Perceived impact on victims | 60 (16.4%) | Impact on property and possessions | 55 (15.1 %) |
| Helplessness (*N* = 285) | Lack of mitigation | 74 (26%) | Lack of control | 48 (16.8%) | Perceived impact on victims | 41 (14.4%) |
| Gratitude (*N* = 284) | Perceived impact on victims | 63 (22.2%) | Aid to self or others | 57 (20.1%) | No direct impact of flooding | 52 (18.3%) |
| Anger (*N* = 231) | Lack of mitigation | 74 (32%) | Impact on property and possessions | 34 (14.7%) | Perceived impact on victims | 26 (11.3%) |
| Anxiety (*N* = 185) | Lack of control | 50 (27%) | Perceived impact on victims | 35 (18.9%) | Impact on property and possessions | 18 (9.7%) |
| Indifference (*N* = 172) | No direct impact of flooding | 49 (28.5%) | Impact on property and possessions | 22 (12.8%) | Perceived impact on victims | 20 (11.6%) |
| Pride (*N* = 170) | Aid to self or others | 45 (26.5%) | Perceived impact on victims | 34 (20%) | Impact on property and possessions | 21 (12.4%) |
| Distress (*N* = 142) | Perceived impact on victims | 24 (16.9%) | Lack of control | 23 (16.2%) | Lack of mitigation | 22 (15.5%) |

N.B. Justification 1 = Most common justification; Justification 2 = second most common justification; Justification 3 = third most common justification. Shaded rows indicate emotions expressed more highly by flood victims. *N* = samples sizes of participants who rated this emotion as the highest of those experienced when thinking about the floods and for which they were asked to provide an open-ended justification (including both flooded and non-flooded participants).

insight into both how these arise and into potential related behaviour from the individual. Commonly reported emotions of anxiety and distress appear to support a link with helping behaviour. The most common justifications for both were focused on a lack of control and the perceived impact on victims. Anxiety is known to heighten attentiveness to significant stimuli (Raghunathan and Corfman, 2004), as such increased anxiety relating to a flood experience may result in greater attention towards climate change. We know that climate anxiety appears to be a rising phenomenon, both in the UK and in many other countries (Hickman et al., 2021). However, climate anxiety can lead to unproductive responses such as excessive rumination and inaction (Clayton, 2020). Distress is a negative state associated with malaise, depression, and anxiety (Mirowsky and Ross, 1986). From examining justifications for these emotions, which include a lack of control and the consideration of the impact on flood victims, it seems that external and community support may help to alleviate these states, to help individuals regain a sense of control, and promote adaptive behavioural responses.

Gratitude was also found to relate to the perceived impact on victims, and references to aid received underline the importance of providing support to flood victims, not only in terms of immediate material recovery, but also in terms of a long-term positive response to the

experience. This is consistent with literature on disaster research that highlights the extensive help that communities often receive following a disaster (Silver and Grek-Martin, 2015; Walker-Springett et al., 2017; Massazza et al., 2021; Zieglar et al., 1996), and previous research relating gratitude to coping ability (Watkins, Gelder and Frias, 2009). Our data adds to recent research highlighting the potential role of gratitude in promoting pro-environmental behaviour (Kates and DeSteno, 2021; Syropoulos et al., 2020; Tam, 2022). However, this research is the first (to our knowledge) to consider gratitude in relation to support following an environmental disaster.

Our findings suggest that the positive moral experience (observed or directly received) in the form of support after flooding, may promote further prosocial behaviour in the form of pro-environmental behaviour intentions. It would be beneficial to consider gratitude further in relation to environmental experiences and consider the boundary conditions and contexts in which this is likely to occur. Interestingly whilst gratitude was expressed to a greater degree by flood victims, it was also expressed by those not directly impacted by the floods, as was pride, indicating the significance of indirect experiences of flooding. Sympathy was also particularly expressed by the non-flooded example examined here and despite having not previously been examined (to the authors knowledge) in relation to pro-environmental behaviour (Landmann, 2020) it was found to be the most common emotion expressed, and was related to future behaviour indicators, particularly strongly with future environmental policy support indicating it should be considered in further research.

Pride was also found to be significantly higher amongst our flooded sample. It was particularly linked to justifications around aid provided to flood victims and perceived impacts on flood victims. Despite positive correlations with behaviour intentions and policy support, pride was not a significant predictor in regression analyses indicating that variance explained in outcomes was crowded out by other emotions included in the analysis and implying that pride does not have a strong relationship with behaviour indicators here. This adds to a previous lack of data examining correlations between experienced pride and pro-environmental behaviour indicators and supports the idea that relationships between experienced pride and behaviour measures may be fairly weak (Shipley and van Riper, 2022).

In contrast, anger has previously been associated with people's reactions to adverse environmental events (Holley et al., 2022; Qian et al., 2021), and our findings align with this. Justifications provided for reporting anger here focused on dissatisfaction with measures taken to mitigate flood impacts and concrete negative impacts including those on property and possessions. This is consistent with characterisations of anger as being an emotion directed at others and based on considerations of ethics or fairness (Bohm and Pfister, 2000; Landmann, 2020). We note that anger was a significant predictor of individual pro-environmental behaviour but not of policy support. Given the significance of direct correlations between anger and policy support, it is likely that the lack of significance in regression analyses is due to overlapping variance with other factors in the model, e.g. distress, age, or gender. Indeed, distress has been described as encapsulating a range of other discrete emotions including anxiety and anger (Clayton, 2020; Stanley et al., 2021). The inclusion of distress here may have masked the individual contributions of other emotions.

We have confidence in the results reported here given the large sample and specificity of survey questions used, which were carefully structured to avoid demand characteristics (Demski et al., 2017). However, it's important to note that the reported data is cross-sectional, so causality cannot be assumed. Note that the emotions we measure are related to the flooding experience though and therefore insofar as people are able to provide insight into how their emotions have arisen can be assumed to be caused by the flood experience. This is not the case with the relationship between emotions measured and behavioural indicators used of behavioural intentions and policy support: these relationships are simple associations rather than causal relationships. It could be argued that individuals who act environmentally are more likely to report the observed emotions due to experiencing flooding, or that causality works in both directions. It is also possible that flooding experiences impact other variables, not measured here, which result in changes to our behaviour indicators (Rohrer et al., 2022; Hayes, 2022). In addition, it is possible that variables not measured here may be having an impact on the experience of flooding, emotions experienced, and the outcome measure. For example, it is possible that wealthier people are more likely to live near water and therefore be more likely to be flooded, and that wealthier people are more likely to intend to be pro-environmental in their behaviour choices. We have probed the likelihood of such variables by examining demographic differences (age, gender, and social grade) between flooded and non-flooded samples) and the pattern of results remained the same – however this does not rule out the possibility of further unmeasured variables exerting an impact. Longitudinal surveys assessing changes in emotions, perceptions, and behaviour over time would be valuable but should consider the risks of demand characteristics and participant overload.

Future research should further explore positive emotions' role in environmental experiences and action. We acknowledge that variance explained by our models here was fairly small but also note that these are remembered or re-activated emotions rather than initially experienced emotions from the event which are likely to have lessened their impact. We consider examining discrete emotions important given differences (e.g. between pride and gratitude) observed in self-reported levels of those who had, and had not, experienced flooding and their relationships with behaviour intentions. Further investigations should include other important emotions like hope, which have been overlooked in previous studies (Landmann, 2020) and could consider whether environmental experiences, and associated emotional responses, are likely to lead to specific types of behaviour (cf. Spence et al., 2021). We note that this line of enquiry has parallels with the idea of post-traumatic growth (e.g. Jayawickreme, et al., 2021) and may fruitfully draw on research from this field.

It is also important to acknowledge the length of time that has passed since the data analysed here were gathered in 2014. Climate change has gained more attention in that period (Steenjes, 2020), suggesting that people today might be more inclined to attribute environmental experiences to it. Emotional responses to environmental events are expected to remain similar or possibly heightened due to increased numbers affected, extreme events, and media coverage linking events to climate change.

We propose that further research examining people's specific experiences in relation to flooding and how these relate to people's emotional responses is an important research direction, given the continued rise in flood experiences in the UK and around the world. Understanding the mix of emotions experienced and how these relate to situational factors will help in providing aid to meet people's needs and designing communications to help support the consideration of a more sustainable future.

## Ethics & informed consent statement

This study did not undergo ethical review because it involved secondary analysis of publicly available data.

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## Open science statement

This study adhered to open science practices. The original dataset used for this project is available at the UK Data Archive here https://doi.org/10.5255/UKDA-SN-851835; the expanded qualitative dataset created during this project is also available at the UK data archive here https://doi.org/10.5255/UKDA-SN-857577. Further details and code for analyses are available in the Open Science Forum here https://osf.io/a45vn/ All measures have been reported and/or links provided to the full report of measures. All data exclusions have been reported. This study was not pre-registered.

## Declaration of competing interest

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests:

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## Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.cresp.2025.100221.

## Data availability

The original dataset used for this project is available at the UK Data Archive here https://doi.org/10.5255/UKDA-SN-851835; the expanded dataset created during this project is also available at the UK data archive here https://doi.org/10.5255/UKDA-SN-857577.

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