

# A Systematic Review of Climate Emotions and Mental Health in Adults

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Global Environmental Psychology, 2023, Vol. 1, Article e11405, <https://doi.org/10.5964/gep.11405>

**Received:** 2023-02-20 • **Accepted:** 2023-06-29 • **Published (VoR):** 2023-11-06

**Handling Editor:** Charles Ogunbode, University of Nottingham, Nottingham, United Kingdom

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**Related:** This article is part of the GEP Special Topic "Living with Environmental Change", Guest Editors: Charles Ogunbode & Susan Clayton, Global Environmental Change (2023), Vol. 1. <https://doi.org/10.5964/gep.v1>

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## Abstract

There is increasing evidence of negative mental health implications associated with climate change. However, more knowledge is required to inform effective responses. This study systematically reviewed literature regarding the relationship between climate emotions and mental health in adults. The goal was to synthesise existing research and identify future research priorities. The review followed PRISMA guidelines and involved searching seven electronic databases. The inclusion criteria specified peer-reviewed studies published in English after 2000, focusing on climate emotions and mental health in participants over 18 years old. Two authors independently reviewed the studies and assessed their quality. Out of 8,495 identified papers, 36 studies meet the criteria. Most studies included in the review were cross-sectional ( $n = 27$ ) and used quantitative descriptive surveys ( $n = 27$ ). A large majority of studies primarily involved participants from high-income countries ( $n = 32$ ) and were published between January 2020 and January 2023 ( $n = 26$ ). Results from the included papers suggest a relationship between climate emotions and negative mental health in most cases (30 out of 36). However, this finding must be interpreted cautiously since just over half of included studies were considered lower quality (19 of 36). Future research should aim to improve the conceptual clarity of climate emotions and explore potential causal and resilience factors. Additionally, investigations should consider vulnerable



populations outside of high-income countries. Furthermore, increased collaboration between researchers and practitioners is necessary to improve conceptual coherence, and practice.

## Keywords

climate emotions, climate anxiety, climate change, mental health, systematic review

### Non-Technical Summary

#### Background

There is growing interest in how humans react emotionally to the climate crisis, and the relationship this may have with mental health.

#### Why was this study done?

Our goal was to review research evidence about the relationship between climate emotions and mental health and make suggestions for future studies that can help to better understand this relationship, and in turn inform supports for people experiencing climate distress.

#### What did the researchers do and find?

We conducted a review of studies and found most of them suggested a possible positive relationship between climate emotions and negative mental health.

#### What do these findings mean?

Results from the current study suggest there may be a link between negative emotions related to climate change and poor mental health in adults. However, more research is needed to fully understand this relationship, including investigating what factors may protect people from these negative effects. Also, as most of the studies were conducted in high-income countries, more research is required in other regions of the world.

### Highlights

- Research investigating the relationship between climate emotions and mental health is growing rapidly.
- Emotional responses to climate change are complex, varied, and affect a broad range of individuals and communities.
- The results of this systematic review suggest a possible positive correlation between climate emotions and negative mental health in adults.
- However, the included studies used a diverse array of measurement tools and had heterogeneous methodological quality, making it difficult to generalise these findings.
- The research to date is primarily focused in high-income countries, indicating an uneven distribution of studies.

In 2022 the World Health Organization reported that the climate crisis can lead to psychological distress and called for an increase in psychosocial and mental health support in response (World Health Organization, 2022). There have been several calls to action for mental health professionals as concern about climate change in the public is high, rising, and mental health will reportedly be negatively impacted (Clayton et al., 2014; Fritze et al., 2008; Li et al., 2022), which will result in increased need to provide support for those experiencing negative climate emotions. There are numerous pathways in which climate change and mental health outcomes may be linked, both directly through acute or sub-acute weather events, and indirectly via physical health or changes in the physical environment or social environments (Berry et al., 2010). Further, theorists suggest it is logical that concern about climate change could affect individuals psychologically, even if they are not directly impacted, given the increase in frequency and attribution of extreme weather events to climate change (Doherty & Clayton, 2011). An individual with awareness of the deleterious existential threat of the climate crisis can experience emotional distress (Albrecht et al., 2007; Hayes et al., 2018; Ogunbode et al., 2023; Whitmarsh & Capstick, 2018). Therefore, anyone who can access climate change information is potentially susceptible to experiencing emotional responses such as anxiety (Clayton, 2020; Fritze et al., 2008; Pihkala, 2020). A recent description labels these stress and emotional responses as the subjective impacts of climate change on mental health (Doherty et al., 2022).

The psychological responses to the climate crisis have been given several different labels, including climate or climate change anxiety (Clayton, 2020; Pihkala, 2020); eco or ecological grief (Cunsolo & Ellis, 2018); environmental grief (Kevorkian, 2004); ecological stress (Helm et al., 2018); climate trauma (Woodbury, 2019); climate related despair (Woodward, 2019); climate change distress (Australian Psychological Society, 2020; Reser et al., 2012) and pre-traumatic stress disorder (Van Susteren, 2017). Although these ideas have received considerable media attention, there remains a lack of empirical evidence regarding the relationship between emotions related to climate change and mental health outcomes. The current systematic review uses the term climate emotions as a general term for the many kinds of affective phenomena related to the climate crisis (Pihkala, 2022) listed above, and searched research databases using a wide range of these different labels in an effort to find all relevant information.

The relationship between climate change and mental health is a growing field of research and a diverse range of reviews have been published. A recent summary of the climate change and mental health literature suggests several climate-related exposures (such as temperature and humidity, drought and rainfall, fire, and flood) are related to negative mental health outcomes including hospital admission, mortality, self-harm and burden of disease (Charlson et al., 2021). These reviewers identified a number of vulnerable populations, specifically those with pre-existing mental illness, youth, indigenous populations and those residing in low- and middle-income countries (Charlson et al.,

2021). Another descriptive overview of emotional responses to climate change concluded that whilst a range of negative emotions can emerge in response to climate change, there are mixed results regarding the relationship between mental health and negative emotions about global environmental problems (Ojala et al., 2021). An investigation of the multiple ways mental health and climate change interact suggests factors known to support positive mental health, such as cultural, environmental, and socioeconomic conditions are being disturbed by climate change, with negative impacts on mental health, and the worst effects felt by already disadvantaged groups, such as those with pre-existing social and economic disadvantage and those with, mental health issues, and climate change increases these inequalities (Lawrance et al., 2022). A systematic review of qualitative literature suggests symptoms of anxiety, helplessness and disempowerment are key themes in response to climate anxiety (Soutar & Wand, 2022). A review and summary of the characteristics of eco-anxiety (a term often used interchangeably with climate anxiety to discuss a similar phenomenon) suggests vulnerable populations include Indigenous Peoples, young people, children, and those living in connection with nature (Coffey et al., 2021). Further, recent reviews regarding the experiences of children with awareness of climate change have suggested mental health outcomes such as depression, anxiety, worry and extreme negative emotions can result (Léger-Goodes et al., 2022; Ma et al., 2022; Martin et al., 2022). These findings parallel results in adult populations which show Indigenous populations or others with close connection to the land as being at increased risk of experiencing the mental health impact of climate change (Charlson et al., 2021; Coffey et al., 2021; Lawrance et al., 2022).

Previous reviews have summarised the large body of knowledge regarding the relationship between climate change and mental health. The current review used a systematic approach to review both qualitative and quantitative peer-reviewed published literature and provided a quality assessment of included studies to provide a rich picture of the different research investigating the relationship between climate emotions and mental health in adults. We focus on adults, as there is evidence this population is increasingly experiencing climate emotions, and they are also the group responsible for the support of younger generations. The objectives of this review were to: a) summarise research regarding climate emotions and mental health, i.e., locations, study designs, methods; b) describe the nature of the relationship between climate emotions and mental health; c) assess the methodological quality of included studies; and d) provide recommendations for future research focused on climate emotions and mental health.

## Method

### Systematic Review

We conducted a systematic review following the methodology outlined by the Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines (PRISMA) (Page et al., 2021). To identify relevant studies examining the relationship between climate emotions and mental health, we searched the following electronic databases: Medline (Ovid), EMBASE (Ovid), PsychINFO (Ovid), Web of Science Core Collection, Scopus, CINAHL (EBSCOhost), and Psychology and Behavioural Sciences Collection (EBSCOhost). These databases were selected as they are recognised as key collections hosting psychological studies likely to explore the intersection of climate emotions and mental health.

To ensure a comprehensive search, we compiled an extensive list of relevant terms related to “psychological responses to negative changes to the state of the earth” (Albrecht, 2011, p.48). This allowed us to capture a broad range of literature on climate emotions. The detailed search strategy can be found in [Appendix A](#). The inclusion criteria required that papers be peer-reviewed original research published in English and involve participants aged 18 years and over. Only studies published from January 2000 onwards were included due to the contemporary nature of research in this field. This was informed by previous reviews which included papers from 2006 and 2007 (Charlson et al., 2021; Soutar & Wand, 2022). Studies that involved child populations were included if separate data on adult participants was reported. Additionally, the research needed to explicitly specify a psychological response relating to climate change (excluding extreme weather events), along with a diagnosable mental health disorder or symptom (e.g., prolonged anxiety, suicide, distress, insomnia) distinct from climate emotions. Articles that focused solely on a single extreme weather event were excluded.

We conducted a preliminary search on August 10, 2020, in the International prospective register for systematic reviews (PROSPERO), Cochrane and Joanna Briggs Institute databases of systematic reviews to ensure no current or ongoing reviews were specifically examining the relationship between climate emotions and mental health in adults. The initial search of the identified databases was performed on September 20, 2020, with subsequent updates until January 30, 2023. Furthermore, the lead author conducted forward (searching of articles that cite eligible articles) and backward (manual searching of reference lists of eligible articles) citation searching, using Google Scholar on January 31, 2023, to identify additional studies not captured in the database search. At both the title and abstract and full-text stage, the first two authors independently screened each record, with any disagreements regarding inclusion or exclusion resolved through discussion and consensus. The systematic review software Covidence was used for this purpose. The review was registered in the international prospective register of systematic reviews (PROSPERO; Pitt et al., 2020). A summary outline of minor changes made to this protocol can be found in [Appendix B](#). Data collection was performed by the first

author using a spreadsheet specifically developed for this review, with headings directly corresponding to Tables 1, 2, 3, and 4 which appear in the Results section of this paper.

## Quality Assessment

The methodological quality of all 36 included studies was independently assessed by the first and second author using the Mixed Methods Appraisal Tool (MMAT) Version 2018 (Hong, Pluye, et al., 2018) with the ratings for each criterion examined and verified until consensus was reached. The MMAT was chosen for this review as it allows for the critical appraisal of research using quantitative, qualitative, and mixed methods study designs.

Previous studies have shown this tool to be valid, reliable, and efficient (Hong et al., 2019; Hong, Fàbregues, et al., 2018; Hong, Gonzalez-Reyes, et al., 2018; Hong, Pluye, et al., 2018; Pace et al., 2012; Souto et al., 2015).

The MMAT assesses studies across criteria that vary depending on the type of study design. For qualitative and quantitative studies, there are five criteria each, which mixed methods designs have a total of 15 criteria. The first and second authors evaluated each included study according to its design, assigning a value of 'yes,' 'no,' or 'can't tell' for each criterion. Following suggestions from the tool authors (Hong, 2020), for qualitative and quantitative studies a score of 20% was given for each criterion met a 'yes', with a maximum obtainable score of 100%. For mixed method designs, the overall quality score was determined by the lowest score among the components (quantitative, qualitative, or mixed methods) as the developers suggest that the overall quality of the study cannot exceed the quality of the weakest component. In cases where there was missing information, the corresponding author of the article was contacted for further information.

A ranking system which has been used in other reviews was used to determine an overall quality score for each study (Kucharczuk et al., 2022; Wong et al., 2020), in which if a study received a score of 81–100% it was classified as high, 61–80% medium and low 60% or less. The results of the quality appraisal were used to inform the evidence synthesis and subsequent discussion. It is important to note that the purpose of conducting a quality assessment was not to exclude studies based on their quality, rather to provide insights into the quality of published research in this emerging field and aid in the interpretation of the current review's results. Therefore, none of the eligible studies were excluded based on the results of the quality appraisal.

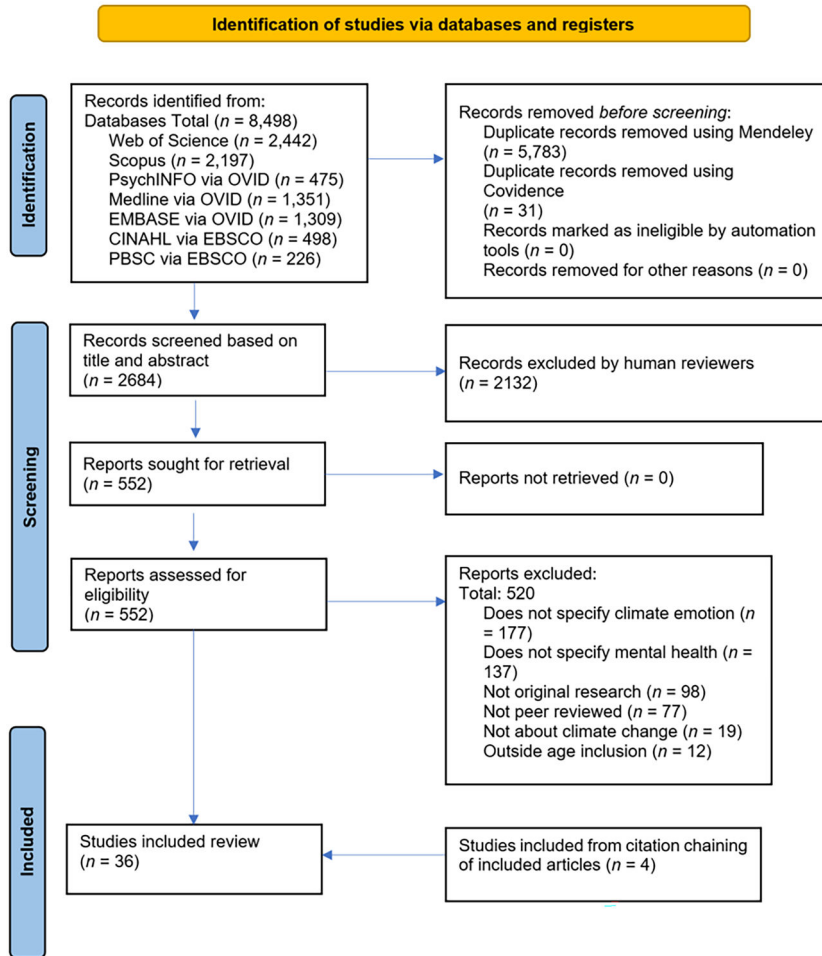
## Study Selection

The comprehensive electronic database search yielded a total of 8,498 articles. After removing 5,814 duplicates, the title and abstracts of the remaining 2,684 remaining articles were screened for eligibility, leading to the exclusion of 2,132 articles. The full text of 552

articles were then reviewed, resulting in a further exclusion of 520 articles. As a result, 32 studies were determined to meet the inclusion criteria. An additional four studies were included through forward and backward citation searching, bringing the total number of included studies in this review to 36. Please refer to Figure 1 for the PRISMA flow diagram.

**Figure 1**

*PRISMA Flow Diagram of Study Selection*



Note. Diagram adapted from Page et al. (2021).

The most common reason for studies not meeting the inclusion criteria was they did not specify climate emotion ( $n = 177$ ) or mental health ( $n = 137$ ). Several papers were initially considered for inclusion but were excluded because they did not meet all of the pre-specified inclusion criteria. For example, Hogg et al. (2021) included participants who were 17 years old, falling outside of the specified age range criteria, Doig (2016) did not specify a mental health response to climate change, and Verlie (2019) did not involve original empirical research.

## Results

### Study Characteristics

Although we searched for studies from 2000 onwards, the earliest study meeting inclusion criteria was published in 2010 and the most recent in January 2023. The highest number of included studies were published in 2022 (13 studies) and over half of included studies ( $n = 18$ ) were published since 2021 (Table 1). All except four studies were conducted solely in countries with a World Bank classification of high-income, with the exceptions conducted in Tuvalu (upper-middle) (Gibson et al., 2020), the Philippines (lower-middle) (Reyes et al., 2023) and across countries spanning different classifications from low-income to high-income (Ogunbode et al., 2022, Ogunbode et al., 2023). Participant sample sizes ranged from 22 to 13,453 individuals. The most commonly used method of participant recruitment was online studies, with four studies recruiting university students, six using online paid survey participants, and an additional four studies incorporating items into existing surveys.



**Table 1**

*Characteristics of Included Studies*

<b>Authors and Date</b>	<b>Country</b>	<b>World Bank Classification</b>	<b>Study Population</b>	<b>Sample Size</b>	<b>Study Period</b>
Berry and Pecl (2015)	Australia	High-Income	Australians living in regional and rural areas (all states except Tasmania) participating in the Australian Regional Wellbeing Survey <sup>b</sup>	6,674	2013
Cáceres et al. (2022)	Chile	High-Income	Inhabitants of locations exposed to forest fires and prolonged droughts over the last 10 years <sup>a</sup>	223	NR
Clayton and Karaszka (2020)	United States of America	High-Income	Amazon MTurk participants <sup>c</sup>	613	NR
Cunsolo Willox et al. (2012)	Canada	High-Income	Inuit community residents from Rigolet, Nunatsiavut, Canada <sup>a</sup>	184	2009–2010
Cunsolo Willox et al. (2013)	Canada	High-Income	Inuit community residents from Rigolet, Nunatsiavut, Canada and health professionals and community-based health workers <sup>a</sup>	67	2010
Curll et al. (2022)	Australia	High-Income	Australian adults participating in an online study of climate change attitudes <sup>b</sup>	3,875	Aug–Sept 2020
Ellis and Albrecht (2017)	Australia	High-Income	Farmers and their families from Newdegate, Western Australia, Australia <sup>a</sup>	22	2013–2014
Feather and Williams (2022)	Australia and New Zealand	High-Income	Prolific participants <sup>c</sup>	771	2021
Fraser et al. (2013)	United States of America	High-Income	Front-line conservationists, environmental educators, climate science graduate students <sup>a</sup>	228	2010
Gago and Sá (2021)	Portugal	High-Income	Portuguese university students <sup>c</sup>	106	Feb–Apr 2020
Gibson et al. (2020)	Tuvalu	Upper-middle	Tuvalu residents <sup>a</sup>	100	2016
Hajek and König (2022)	Germany	High-Income	German adults <sup>c</sup>	3,091	Mar 2022

World Bank		World Bank		World Bank	
Authors and Date	Country	Classification	Study Population	Sample Size	Study Period
Heeren et al. (2023)	France, Belgium, Switzerland	High-Income	French speaking adults <sup>c</sup>	874	NR
Helm et al. (2018)	United States of America	High-Income	Amazon MTurk participants who were required to have at least one child between 3–10 years old <sup>d</sup>	342	NR
Howard et al. (2020)	United States of America	High-Income	Ranchers and farmers residing in Montana <sup>a</sup>	125	2017
Innocenti et al. (2021)	Italy	High-Income	Italian adults <sup>c</sup>	130	Jan–June 2021
Jones et al. (2012)	Australia	High-Income	Inpatients with OCD checking subtype, Sydney, Australia <sup>a</sup>	50	2008–2009
Larionow et al. (2022)	Poland	High-Income	Polish adults <sup>c</sup>	603	NR
McBride et al. (2021)	New Zealand	High-Income	New Zealand adults participating in the New Zealand Attitudes and Values Survey <sup>b</sup>	13,453	2017–2018
Middleton et al. (2020)	Canada	High-Income	Inuit community residents from Rigolet, Nunatsiavut, Canada and health professionals and community-based health workers <sup>a</sup>	116	2012–2013
Mouguiana-Daouda et al. (2022)	France	High-Income	French adults <sup>c</sup>	1,205	2021
Ogunbode et al. (2023)	Global (25 countries)	Multiple – spanning Low to High income <sup>d</sup>	People in 25 countries recruited through university research participant pools <sup>c</sup>	11,158	2019–2020
Ogunbode et al. (2022)	Global (32 countries)	Multiple – spanning Low to High income <sup>e</sup>	People in 32 countries recruited through university research participant pools <sup>c</sup>	12,246	2019–2022
Ostapchuk et al. (2015)	Canada	High-Income	Inuit elders from Rigolet, Nunatsiavut <sup>a</sup>	97	2009–2010
Patrick et al. (2023)	Australia	High-Income	Australian adults <sup>c</sup>	5,483	Aug–Nov 2020
Qi et al. (2022)	United States of America	High-Income	Online survey participants in United States of America <sup>c</sup>	224	NR
Reyes et al. (2023)	The Philippines	Lower-middle	Filipino Gen Z <sup>c</sup>	433	NR
Schwaab et al. (2022)	Germany	High-Income	German medical students <sup>c</sup>	216	May–Dec 2021

Authors and Date	Country	World Bank		Study Population	Sample Size	Study Period
		Classification	Country			
Schwartz et al. (2023)	United States of America	High-Income	United States of America	United States of America university students <sup>c</sup>	546	Oct–Dec 2020
Searle and Gow (2010)	Australia	High-Income	Australia	Queensland university students and general public <sup>c</sup>	275	2008
Stanley et al. (2021)	Australia	High-Income	Australia	Subset of online survey participants who accept Climate change <sup>b</sup>	3,063	2020
Tiatia et al. (2023)	Pacific	High-Income	Pacific	Experts in climate change and mental health from Niue, the Cook Islands and Aotearoa New Zealand <sup>a</sup>	70	NR
Verplanken and Roy (2013)	Europe and United States of America	High-Income	Europe and United States of America	Online survey participants in Europe and United States of America <sup>c</sup>	132	2012
Verplanken et al. (2020)	Europe and United States of America	High-Income	Europe and United States of America	Online survey participants in Europe and United States of America <sup>c</sup>	865	2018–2020
Whitmarsh et al. (2022)	United Kingdom	High-Income	United Kingdom	Online survey participants in the United Kingdom <sup>c</sup>	1,338	Oct–Nov 2020, May 2022
Wullenkord et al. (2021)	Germany	High-Income	Germany	German speaking participants from online survey platform Repondi AG <sup>c</sup>	1,011	NR

<sup>a</sup>Population deemed more at risk of climate emotions. <sup>b</sup>Items were added to a representative sample survey. <sup>c</sup>Online survey participants recruited specifically for the study. <sup>d</sup>Ogunbode et al. (2023) included one low-income, six low-middle income, four upper-middle and 14 high-income countries. <sup>e</sup>Ogunbode et al. (2022) included one low-income, nine lower-middle, six upper-middle and 16 high-income countries.

Eleven of the studies in this review specifically focused on vulnerable populations who are at a higher risk of experiencing the impacts of climate change within their respective contexts. These participants included residents and key stakeholders from areas that are either geographically vulnerable and already dealing with climate change related issues, or individuals who are vulnerable due to their close connection to the natural world. For example, four studies focused on an Indigenous population on a remote coastal Inuit community in Rigolet, Nunatsiavut, in Canada. These studies highlighted the vulnerability of this population due to their cultural and subsistence resilience on the land (Cunsolo Willox et al., 2012, 2013; Middleton et al., 2020; Ostapchuk et al., 2015). A further two studies focused on farmers who are dependent on the environment for their livelihood (Ellis & Albrecht, 2017; Howard et al., 2020) and Pacific Island nations were represented in another two studies (Gibson et al., 2020; Tiatia et al., 2023). Further populations deemed vulnerable to experiencing mental health outcomes associated with climate emotions within the included studies were climate scientists and activists (Curll et al., 2022; Fraser et al., 2013) and individuals with previous mental health diagnoses (Jones et al., 2012). Results from each of these studies which focused on more vulnerable populations suggest more research is required to investigate how these unique populations experience climate emotions and what forms of nuanced supports may be of benefit.

## Study Design and Quality Assessment

Most studies were cross-sectional, meaning that data was collected from participants at a single time point ( $n = 29$ ). The remaining were case studies ( $n = 5$ ) or longitudinal studies ( $n = 2$ ) which collected participant data at multiple times. Most studies used quantitative descriptive surveys ( $n = 27$ ), with the remaining using qualitative case studies ( $n = 3$ ), mixed-methods convergent design ( $n = 4$ ) and mixed methods sequential exploratory designs ( $n = 2$ ) (Table 2).

**Table 2**

*Study Design and Quality Assessment*

Authors and Date	Study Type		Quality Assessment <sup>a</sup>
	Methodology	Scope	
Berry and Peel (2015)	Quantitative descriptive – survey	Cross-sectional	20 / lower
Cáceres et al. (2022)	Quantitative descriptive – survey	Cross-sectional	100 / high
Clayton and Karazsia (2020)	Quantitative descriptive – survey	Cross-sectional	40 / lower
Cunsolo Willox et al. (2012)	Mixed-methods - sequential exploratory design	Case study	100 / high
Cunsolo Willox et al. (2013)	Qualitative - case study	Case study	100 / high
Curll et al. (2022)	Quantitative descriptive – survey	Cross-sectional	100 / high

Authors and Date	Study Type		Quality Assessment <sup>a</sup>
	Methodology	Scope	
Ellis and Albrecht (2017)	Qualitative - case study	Case study	100 / high
Feather and Williams (2022)	Quantitative descriptive – survey	Cross-sectional	80 / medium
Fraser et al. (2013)	Mixed-methods - sequential exploratory design	Cross-sectional	60 / lower
Gago and Sá (2021)	Quantitative descriptive – survey	Cross-sectional	60 / lower
Gibson et al. (2020)	Mixed-methods - convergent design	Cross-sectional	60 / lower
Hajek and König (2022)	Quantitative descriptive – survey	Cross-sectional	80 / medium
Heeren et al. (2023)	Quantitative descriptive – survey	Cross-sectional	80 / medium
Helm et al. (2018)	Quantitative descriptive – survey	Cross-sectional	40 / lower
Howard et al. (2020)	Mixed-methods - convergent design	Cross-sectional	40 / lower
Innocenti et al. (2021)	Quantitative descriptive – survey	Longitudinal	60 / lower
Jones et al. (2012)	Quantitative descriptive – survey	Cross-sectional	40 / lower
Larionow et al. (2022)	Quantitative descriptive – survey	Cross-sectional	60 / lower
McBride et al. (2021)	Quantitative descriptive – survey	Longitudinal	80 / medium
Middleton et al. (2020)	Qualitative - case study	Case study	100 / high
Mouguiama-Daouda et al. (2022)	Quantitative descriptive – survey	Cross-sectional	40 / lower
Ogunbode et al. (2023)	Quantitative descriptive – survey	Cross-sectional	60 / lower
Ogunbode et al. (2022)	Quantitative descriptive – survey	Cross-sectional	60 / lower
Ostapchuk et al. (2015)	Mixed-methods - convergent design	Case study	100 / high
Patrick et al. (2023)	Quantitative descriptive – survey	Cross-sectional	80 / medium
Qi et al. (2022)	Quantitative descriptive – survey	Cross-sectional	60 / lower
Reyes et al. (2023)	Quantitative descriptive – survey	Cross-sectional	40 / lower
Schwaab et al. (2022)	Quantitative descriptive – survey	Cross-sectional	100 / high
Schwartz et al. (2023)	Mixed-methods - convergent design	Cross-sectional	40 / lower
Searle and Gow (2010)	Quantitative descriptive – survey	Cross-sectional	40 / lower
Stanley et al. (2021)	Quantitative descriptive – survey	Cross-sectional	100 / high
Tiatia et al. (2023)	Quantitative descriptive – survey	Cross-sectional	100 / high
Verplanken and Roy (2013)	Quantitative descriptive – survey	Cross-sectional	40 / lower
Verplanken et al. (2020)	Quantitative descriptive – survey	Cross-sectional	40 / lower
Whitmarsh et al. (2022)	Quantitative descriptive – survey	Cross-sectional	80 / medium
Wullenkord et al. (2021)	Quantitative descriptive – survey	Cross-sectional	100 / high

Note. As per Hong (2020) and Hong, Pluye et al., (2018), (20% was given for each criteria met, for mixed methods the lowest category score was provided. Studies which met 100% of criteria = high quality, 80% = medium and 60% or less = low.

<sup>a</sup> Percentage (%) of criteria met / descriptor.

Quality assessment of methodological quality of studies was conducted using the Mixed Methods Appraisal Tool (MMAT) (Hong, Pluye, et al., 2018). Methodological quality of

just over half of the studies most studies was assessed as low (19 of 36); a further six were considered medium, and eleven were considered high. All qualitative studies ( $n = 3$ ) were rated as meeting all criteria of the MMAT, indicating a high level of research quality in these studies. However, for mixed methods and quantitative descriptive studies, there was a degree of variability in research quality (Table 2). The fundamental issues of quality were found to be in the quantitative descriptive studies, specifically the risk of non-response bias (18 studies), the potential for non-representative samples (19 studies) and whether the sampling strategy was appropriate (16 studies). The supplementary material includes more detailed quality assessment results.

## Climate Emotions and Mental Health Measures

The Climate Change Anxiety Scale (CCAS) (Clayton & Karazsia, 2020) was the most commonly used questionnaire to assess climate emotions across the included studies in this review. In 30% of the studies ( $n = 12$ ), a form of the CCAS was used, including translations into Italian, Polish, French, and German (Table 3). The second most common method for investigating climate emotions in participants was through interviews. Five studies included in this review employed interviews to allow individuals to describe their observations of the link between climate change and mental health and wellbeing. Although mental health was not explicitly mentioned by the researchers in these studies, it emerged as a theme derived from participant response data (Cunsolo Willox et al., 2012, 2013; Ellis & Albrecht, 2017; Gibson et al., 2020; Middleton et al., 2020).

Additionally, several studies used traditional mental health measures that were specifically adapted to focus on climate change (Gago & Sá, 2021; Ogunbode et al., 2023; Schwaab et al., 2022). For example, a modified version of the Generalized Anxiety Disorder Scale-7 (GAD-7; Howard et al., 2020; Löwe et al., 2008) was used to measure how strongly a participant felt symptoms of anxiety when they thought of climate change. A further three studies used single-item measures to gauge the severity of participants' worry about climate change, such as "I am worried about global warming" (Berry & Peel, 2015), or "How worried are you about global warming/climate change?" (Curll et al., 2022) or "I am deeply concerned about climate change" (McBride et al., 2021).

**Table 3**  
*Climate Emotions and Mental Health Measures*

<b>Authors and Date</b>	<b>Climate emotions measure/s</b>	<b>Mental health measure/s</b>
Berry and Peel (2015)	One item: I am worried about global warming.	Kessler 10-item Psychological Distress Scale (Kessler et al., 2003).
Cáceres et al. (2022)	Scale of Solastalgia (Cáceres et al., 2022)	Short post-traumatic stress disorder rating interview (Leiva Bianchi & Gallardo, 2013).
Clayton and Karazsia (2020)	Climate change anxiety scale (Clayton & Karazsia, 2020)	Patient Health Questionnaire-4 (Kroenke, Spitzer, et al., 2009).
Cunsolo Willox et al. (2012)	Environmental Distress Survey (Higginbotham et al., 2006); Interviews regarding individual observations of climatic and environmental change, and linkages between climatic and environmental change health and wellbeing.	Interview responses of participants reported that they were feeling depressed and down and their mental health was suffering.
Cunsolo Willox et al. (2013)	Interviews which focused on perceived and observed impacts on health and well-being of changes in climate.	Interview responses reporting potential increases in drug and alcohol usage, suicide ideation and magnification of previous and current trauma.
Curll et al. (2022)	One item: How worried are you about global warming/climate change?	Depression Anxiety and Stress Scale-21 (Lovibond & Lovibond, 1995).
Ellis and Albrecht (2017)	Interview questions about the effect of changes in climate on wellbeing.	Interview responses of participants reported worry and depression.
Feather and Williams (2022)	Climate change anxiety scale (Clayton & Karazsia, 2020) with items 3-8 removed; the climate change concern index (McCright, 2010).	Patient Health Questionnaire-4 (Kroenke, Spitzer, et al., 2009); Multidimensional Psychological Flexibility Inventory (Roffis et al., 2018).
Fraser et al. (2013)	Self-assessments to describe participants emotional experience related to reading or seeing environmental degradation. Further items: How would you rate your degree of worry about the current environmental condition of the planet? How would you	Examination of the extent to which the experiences mirror or paralleled those expressed by victims of acute stress or trauma.

Authors and Date	Climate emotions measure/s	Mental health measure/s
Gago and Sá (2021)	rate your degree of worry about the future environmental conditions of our planet? Positive and negative affect regarding climate change; Environmental worry questionnaire (Gago & Sá, 2021).	Portuguese version of the Brief Symptom Inventory (Canavarro, 2007; Derogatis & Melisaratos, 1983).
Gibson et al. (2020)	Interviews to understand distress associated with knowledge of climate change. A scale using Tuvanuan words with which participants indicated their distress levels regarding climate change stressors.	A culturally adapted version of the 25-item Hopkins-Symptom Checklist (Derogatis et al., 1974).
Hajek and König (2022)	German version of Climate Change Anxiety Scale (Clayton & Karazsia, 2020; Wullenkord et al., 2021).	De Jong Gierveld Loneliness Scale (Gierveld & Van Tilburg, 2006); Perceived social isolation (Bude & Lantermann, 2006).
Heeren et al. (2023)	Climate Change Anxiety Scale (Clayton & Karazsia, 2020)	Penn State Worry Questionnaire (Meyer et al., 1990).
Helm et al. (2018)	Perceived ecological stress and ecological coping (Homburg et al., 2007).	Depressive symptoms 10-item Center for Epidemiological Studies Depression Scale (Radloff, 1977).
Howard et al. (2020)	A modified Generalised Anxiety Disorder Scale (Spitzer et al., 2006).	Patient Health Questionnaire-9 (Kroenke et al., 2001).
Innocenti et al. (2021)	Italian version of Climate Change Anxiety Scale (Clayton & Karazsia, 2020).	Kessler 10-item Psychological Distress Scale (Kessler et al., 2003).
Jones et al. (2012)	Obsessive-Compulsive disorder symptoms related to climate change that were spontaneously reported through clinical assessment.	Yale-Brown Obsessive Compulsive Scale (Goodman, 1989); Padua Inventory - Washington State University Revision (Burns et al., 1996); Vancouver Obsessional Compulsive Inventory (Thordarson et al., 2004); Beck Depression Inventory (Beck et al., 1996); Depression Anxiety and Stress Scale-21 (Lovibond & Lovibond, 1995).



Authors and Date	Climate emotions measure/s	Mental health measure/s
Larionow et al. (2022)	Polish version of Climate Change Anxiety Scale (Clayton & Karazsia, 2020).	Patient Health Questionnaire-4 (Kroenke, Spitzer, et al., 2009).
McBride et al. (2021)	One item: I am deeply concerned about climate change <sup>a</sup> .	The Kessler-6 Screening Scale (Kessler et al., 2010).
Middleton et al. (2020)	Interviews that invited participants to discuss the mental and emotional responses to climate change.	Interview responses regarding depression and emotional experiences.
Mouguiama-Daouda et al. (2022)	French version of Climate Change Anxiety Scale (Clayton & Karazsia, 2020).	Generalised Anxiety Disorder Scale (Spitzer et al., 2006); Beck Depression Inventory-II (Beck et al., 1996).
Ogunbode et al. (2023)	Index based on state-trait anxiety inventory (Spielberger, 1983).	Bergen Insomnia Scale (Palleen et al., 2008); self-rated mental health was measured with a single-item scale.
Ogunbode et al. (2022)	7-item scale based on state anxiety section of the state-trait anxiety inventory (Spielberger, 1983).	World Health Organization (WHO-5) wellbeing index (World Health Organization, 1998).
Ostapchuk et al. (2015)	Questionnaire, including perceived health impacts of climate change.	Self-reported feelings of isolation and depression.
Patrick et al. (2023)	11-items Climate Change Anxiety Scale (Clayton & Karazsia, 2020).	Post-Traumatic Stress Disorder-8 (PTSD-8) (Hansen et al., 2010) was used for participants who responded yes to having a direct experience of climate change. For those who self-reported to not have been exposed directly to a climate change event Pre-trauma - PTSD-8 with questions changed to focus on the future for participants who did not self-report exposure to a direct climate change event.
Qi et al., (2022)	Climate Change Worry Scale (Stewart, 2021); Eating-Related Eco-Concern Scale (EREC: Qi et al., 2022).	Eating Disorder Examination Questionnaire (Fairburn & Beglin, 1994).
Reyes et al. (2023)	Climate Change Anxiety Scale (Clayton & Karazsia, 2020).	Mental Health Inventory (Veit & Ware, 1983).
Schwaab et al. (2022)	The mental health questionnaires were used twice, once in their original format and once in a modified way to specifically ask about psychological burden of climate change.	Brief Patient Health Questionnaire (Lowe et al., 2004); Generalised Anxiety Disorder Scale (Spitzer et al., 2006); Posttraumatic Stress Scale-10 (Siegrist & Maercker,

Authors and Date	Climate emotions measure/s	Mental health measure/s
Schwartz et al. (2023)	Climate Change Anxiety Scale (Clayton & Karazsia, 2020).	2010); Perceived Stress Questionnaire (Levenstein et al., 1993).
Searle and Gow (2010)	Questionnaire worded "Thinking about climate change now makes (me) feel concerned, tense, worried, anxious, depressed, hopeless, powerless, sad, helpless, stressed, angry".	Depression Anxiety and Stress Scale-21 (Lovibond & Lovibond, 1995).
Stanley et al. (2021)	For each of the words indicate how the issue of climate change makes you feel 'depressed, miserable, anxious, afraid, angry, frustrated.' Which emotion do you experience most often in relation to climate change?	Depression Anxiety and Stress Scale-21 (Lovibond & Lovibond, 1995).
Tiatia et al. (2023)	Mental health experiences, impacts, and influences.	Links between climate change and mental wellbeing.
Verplanken and Roy (2013)	Habitual worry regarding ecological issues and Habit Index of Negative Thinking (Verplanken et al., 2007).	Penn State Worry Questionnaire (Meyer et al., 1990).
Verplanken et al. (2020)	Habitual worry regarding ecological issues and Habit Index of Negative Thinking (Verplanken et al., 2007).	Penn State Worry Questionnaire (Meyer et al., 1990); Habitual worry regarding personal issues and Habit Index of Negative Thinking (Verplanken et al., 2007).
Whitmarsh et al. (2022)	Climate change anxiety scale (Clayton & Karazsia, 2020); Climate change concern one item "How worried are you personally about the following issues at present: Climate change" listed as one of 11 current issues.	Generalised Anxiety Disorder Scale (Spitzer et al., 2006).
Wullenkord et al. (2021)	German version of Climate Change Anxiety Scale (Clayton & Karazsia, 2020; Wullenkord et al., 2021).	Patient Health Questionnaire-4 (Kroenke, Spitzer, et al., 2009).

The most frequently used mental health questionnaires were different versions of the patient health questionnaires (Kroenke et al., 2001; Kroenke, Spitzer, et al., 2009; Kroenke, Strine, et al., 2009) used in six studies, and the Depression Anxiety and Stress Scale (DASS-21; Lovibond & Lovibond, 1995) used in four of the included studies (Curll et al., 2022; Jones et al., 2012; Searle & Gow, 2010; Stanley et al., 2021). The GAD-7 (Löwe et al., 2008) which had been applied in a modified version to assess climate emotions was also used in five of the included studies to assess mental health in general (Innocenti et al., 2021; Mouguiama-Daouda et al., 2022; Schwaab et al., 2022; Schwartz et al., 2023). Three studies applied the Kessler Psychological Distress Scales (Kessler et al., 2003, Kessler et al., 2010), and the remaining studies employed various other forms of climate emotions and mental health self-assessments.

## Relationship Between Climate Emotions and Negative Mental Health

Most studies identified a relationship between climate emotions and mental health ( $n = 30$ ) (Table 4). However, six of the 36 included studies found no statistical relationship between climate emotions and mental health outcomes. For example, authors reported a near-zero correlation between pathological worry and habitual ecological worry (Verplanken & Roy, 2013) and others have found no evidence that climate change worry was significantly linked to mental ill-health in the general population (Berry & Peel, 2015). In a clinical population of individuals with obsessive compulsive disorder (OCD), 28% identified as having obsessions and compulsions focussed on climate change (Jones et al., 2012); however, there was no difference in OCD severity, mood disturbance, stress, or anxiety, between those who had OCD symptoms that focussed on climate change and those who did not. Similarly, a study of German medical students found that stress about climate change did not have a relationship with depressive, anxious, or traumatic symptoms (Schwaab et al., 2022). The majority of studies (30 out of the 36) support a positive relationship between negative mental health outcomes and climate emotions.

**Table 4**

*Relationship Between Climate Emotions and Negative Mental Health*

Author and Date	Relationship between climate emotions and negative mental health	Relationship?
Berry and Peel (2015)	No significant relationship between climate worry and mental health.	N
Cáceres et al. (2022)	Significant medium positive correlation between solastalgia scores and PTSD symptoms ( $r = 0.308$ ).	Y
Clayton and Karaszia (2020)	Dep and anx had significant large positive correlation with CACI ( $r = 0.60$ , $r = 0.54$ ) and CAFI ( $r = 0.56$ , $r = 0.47$ ).	Y

Author and Date	Relationship between climate emotions and <i>negative</i> mental health	Relationship?
Cunsolo Willox et al. (2012)	Climate change induced feelings and emotional reactions experienced because of changes in landscapes and place attachment, which had a relationship with negative mental health outcomes.	Y
Cunsolo Willox et al. (2013)	Climate change is an additional stress on mental health and wellbeing.	Y
Curl et al. (2022)	Climate worry had small positive correlations with dep ( $r = 0.19$ ), anx ( $r = 0.21$ ), and stress ( $r = 0.24$ ).	Y
Ellis and Albrecht (2017)	Climate change is increasing place-based distress, and related negative mental health outcomes with perceived higher risk of dep and suicide.	Y
Feather and Williams (2022)	Small significant positive correlation between anx and dep and climate change anxiety ( $r = 0.17$ ). A medium significant positive correlation between psychological inflexibility and climate change anxiety ( $r = 0.33$ ), very small significant negative correlation between psychological flexibility and climate change anxiety ( $r = 0.07$ ). Further, the interaction between climate distress and psychological inflexibility was significant, meaning in those with the same level of climate change concern, participants with higher psychological inflexibility had higher climate distress levels.	Y
Fraser et al. (2013)	Ongoing stress from exposure to negative environmental narratives associated with climate change may cause negative mental health states and be a risk factor for developing symptoms of dep, anx, or trauma related responses such as acute stress disorder or PTSD.	Y
Gago and Sá (2021)	Environmental worry had a significant medium positive correlation with psychopathological symptoms; negative affect ( $r = 0.457$ ); general severity index ( $r = 0.298$ ); positive symptom total ( $r = 0.378$ ); positive symptom distress index ( $r = 0.174$ ) (small).	Y
Gibson et al. (2020)	A majority reported psychological distress associated with climate change stressors (both locally experienced observations and abstract knowledge of climate change), with these relating to reduced functioning in one or more areas of daily life.	Y
Hajek and König (2022)	Higher climate anxiety significantly associated with higher loneliness ( $B = 0.06$ ) and perceived social isolation ( $B = 0.10$ ).	Y
Heeren et al. (2023)	Network models shows CACI acts as a potential hub bridging general worry and CAFI.	Y
Helm et al. (2018)	Perceived ecological stress had a very small positive association with dep ( $r = 0.06$ ).	Y

Author and Date	Relationship between climate emotions and <i>negative</i> mental health	Relationship?
Howard et al. (2020)	Nearly three quarters of participants when thinking of climate change and its impact experienced moderate to high levels of anx and distress.	Y
Innocenti et al. (2021)	Anx significantly positively correlated with CACI ( $B = 0.898$ ), and CAFI and CACI also significantly positively correlated with distress ( $B = 0.437$ ), dep ( $B = 0.287$ ), and anx ( $B = 0.141$ ) symptoms.	Y
Jones et al. (2012)	28% of a sample of participants with OCD identified as having symptoms related to climate change. There was no difference in OCD severity, mood disturbance, stress or anx, age, or gender, between those who had climate change related OCD symptoms and those who did not.	N
Larionow et al. (2022)	Climate anxiety had a small positive association with dep ( $r = 0.26$ ), but no association was found for anx.	Y
McBride et al. (2021)	A very small significant positive association between psychological distress and climate concern ( $r = 0.06$ and $r = 0.07$ ).	Y
Middleton et al. (2020)	Most participants described their mental wellness in relation to their experiences of the climate.	Y
Mouguiama-Daouda et al. (2022)	Dep was significantly small positive associated with CACI ( $r = 0.28$ ) and CAFI ( $r = 0.27$ ), no association was found with anx.	Y
Ogunbode et al. (2023)	Negative climate-related emotions had a significantly small positive association with symptoms of insomnia ( $r = 0.16$ ) and small negative relation to self-rated mental health ( $r = -0.25$ in western countries) ( $r = 0.21$ in non-western countries).	Y
Ogunbode et al. (2022)	Climate anx had a significant inverse relationship with mental wellbeing ( $\beta = -0.240$ ) however, varies across countries.	Y
Ostapchuk et al. (2015)	Mental and emotional health has been negatively related to climate change, including feelings of isolation and dep.	Y
Patrick et al. (2023)	9.37% of participants had significant levels of eco-anx and 15.68% with pre-traumatic stress.	Y
Qi et al. (2022)	Climate worry was positively significantly associated with eating-related eco-concern; however, not significantly associated with disordered eating characteristics.	N
Reyes et al. (2023)	Climate anx had a significant medium positive association with psychological distress ( $r = 0.39$ ).	Y
Schwaab et al. (2022)	Significant perceived stress related to climate change; however, worries were not related to clinical impairment.	N
Schwartz et al. (2023)	CACI and CAFI both had small positive significant associations with anx ( $r = 0.28$ ) and dep ( $r = 0.24$ ).	Y
Searle and Gow (2010)	Small significant positive relationship between climate change distress and dep ( $r = 0.22$ ) anx, ( $r = 0.24$ ) and stress symptoms ( $r = 0.28$ ).	Y

Author and Date	Relationship between climate emotions and <i>negative</i> mental health	Relationship?
Stanley et al. (2021)	Eco-depression predicted higher levels of depression with a large effect size ( $r = 0.63$ ) and stress ( $r = 0.31$ ) and anxiety ( $r = 0.30$ ) (moderate effects). Further, eco-anxiety predicted higher level of stress ( $r = 0.41$ ) and anxiety ( $r = 0.49$ ) (moderate effects).	Y
Tiatia et al. (2023)	Link between climate change and mental health in the Pacific was identified by Delphi panellists as eliciting emotions such as anxiety, hopelessness, and fear.	Y
Verplanken and Roy (2013)	Near-zero non-significant correlation between pathological worry and habitual ecological worry ( $r = -0.05$ ).	N
Verplanken et al. (2020)	Significant medium positive correlations between global warming worry and pathological worry ( $r = 0.30$ ; $r = 0.35$ ) however, when controlling for personal issues, world economy and COVID-19, this relationship was non-significant.	N
Whitmarsh et al. (2022)	Climate anxiety and generalised anxiety had a significant small positive correlation ( $r = 0.23$ ).	Y
Wullenkord et al. (2021)	Climate anxiety had a small significant positive correlation with anxiety ( $r = 0.25$ ) and depression ( $r = 0.25$ ).	Y

*Note.* Y = positive relationship between climate emotions and negative mental health; N = no relationship; dep = depression; anx = anxiety; PTSD = Post Traumatic Stress Disorder; CACI = climate anxiety cognitive-emotional impairment; CAFI = climate anxiety functional impairment;  $r$  = Cohen's  $d$  correlation coefficient where 0.1 = small, 0.3 = medium and 0.5 = large;  $B$ , linear regression coefficient.

### Analysis by Type of Measurement

Differences in the measures of climate emotions used in the included studies were evaluated in terms of their associated results with negative mental health outcomes, yielding the following findings. Firstly, all studies using the CCAS indicated a positive relationship between climate anxiety and mental health ( $n = 12$ ), although in two studies, this relationship specifically manifested as depression rather than anxiety symptoms. The strength of this positive relationship varied from small through to strong effect, with most results falling into the small-medium category. Considering that the CCAS was designed to capture clinically relevant responses to climate change, and is based on psychopathology measures, these findings are not surprising. Secondly, all five studies employing interviews to assess the health impacts of climate change identified a relationship between mental health and emotional responses to climate change. This is logical given that these studies were focused on climate change and mental health, and they centred on vulnerable populations more likely to experience negative impacts of climate change.

However, when examining studies beyond those using the CCAS and interviews, mixed results emerged. Among studies using existing mental health measures adapted to capture climate emotions, four out of six reported a relationship between climate emo-

tions and mental health. Similarly, among studies using single-item measures of climate emotions, two out of three indicated a relationship with mental health. In contrast, some studies, such as those focusing on specific mental health disorders like OCD (Jones et al., 2012) and disordered eating (Qi et al., 2022), found no relationship climate emotions. Overall, the results of this review suggest a general relationship between climate emotions and negative mental health outcomes. However, this finding must be interpreted with some caution due to the diversity of measurement tools for climate emotions and mental health outcomes.

### **Analysis by Quality Assessment Rating**

An analysis based on the quality assessment rating using the MMAT percentages (Table 2) was conducted to further explore the relationship between climate emotions and negative mental health outcomes. Studies rated as high or medium quality (100 or 80%, 17 studies) tended to indicate a relationship between climate emotions and negative mental health. Almost all of these studies, except for one, supported the existence of a relationship between climate emotions and negative mental health. Conversely, studies of lower quality (60% MMAT score or below) were more likely to suggest no relationship between climate emotions and negative mental health. All but one of the six studies indicating no relationship had a lower quality assessment rating. These findings suggest that variations in results regarding the relationship between climate emotions and negative mental health may be related to limitations in study design or methods.

## **Discussion**

The current study aimed to systematically review literature regarding climate anxiety and mental health in adults to develop a better understanding of the nature of the relationship, and to provide suggestions for future research. Given the ongoing pervasive nature of climate change and the escalation of its impacts, understanding the association between climate anxiety and mental health outcomes is critical. Over half of studies that met our inclusion criteria were published since 2021, indicating a recent rise in prevalence of interest in this topic.

A key finding from the present review is the indication of a relationship between negative mental health and climate emotions. This relationship was observed across all types of studies, including qualitative, quantitative, and mixed-method studies. Further, the higher quality studies included in this review tended to identify this relationship. However, synthesis of this body of research is challenging due to the diversity of climate emotions and mental health measures and variability of study design and quality.

The included studies in this review highlight the fact that climate emotions are a complex phenomenon that can affect a wide range of individuals in different communities. There is growing evidence suggesting populations with a close connection to the

natural world, such as Indigenous communities, farmers, climate scientists, and activists are more likely to experience climate emotions (Cunsolo Willox et al., 2012, 2013; Ellis & Albrecht, 2017; Fraser et al., 2013; Gibson et al., 2020; Howard et al., 2020). Therefore, understanding the nuanced and diverse experiences of these populations is important for future research in order to develop tailored and appropriate support systems based on specific population needs.

It is important to note that the results of this review do not allow for causal claims to be made regarding the relationship between climate emotions and mental health, which remains a crucial area for future research. Some researchers have begun to suggest that climate change, acting as a direct stressor, has the potential increase biopsychosocial vulnerability to negative mental health outcomes, while also impacting on various indirect pathways (Thoma et al., 2021). It is also noteworthy that none of the included studies provided evidence suggesting a relationship between climate emotions and positive mental health. The studies included in this review meant the focus primarily centred around the negative mental health implications of climate emotions. Further exploration is needed to understand if there are potential effects of climate emotions on positive mental health outcomes.

A further key finding from the present review is the uneven spread of research being conducted across socioeconomic regions, as most studies included in this review were situated in high-income countries. Consistent with previous reviews investigating mental health and climate change (Charlson et al., 2021), the literature included in this review is highly under-represented from low- and middle-income countries, as most studies were conducted in Australia, Canada, and the United States of America. This suggests a key gap in research regarding the nature of the relationship between climate emotions and negative mental health across diverse cultures, countries, income, and demographics. The lack of cross-cultural research in environmental psychology has been discussed as an important limitation in this area, with previous findings showing that western participants have dominated samples and authors have failed to attend to the cultural limitations of their findings (Tam & Milfont, 2020). This is particularly concerning as the impacts of climate change are most greatly felt in low- and middle-income countries (Pörtner et al., 2022), and that human-environment relationships likely to influence mental health outcomes are culturally dependent (Tam & Milfont, 2020).

## Suggestions for Future Research

The results of the current review indicate several areas that would benefit from future research. Firstly, there is a need to address conceptual and measurement issues in the field of climate emotions and mental health. Whilst the findings of this review suggest a relationship, inconsistencies in results may be from conceptual and measurement challenges. It appears important for more high-quality research to be conducted to enhance the understanding of the complex relationship between climate emotions and



mental health. Previous suggestions have also emphasized the need for further research to clarify and refine the conceptualisation of different climate emotions, such as climate anxiety, and to develop and validate measures (Charlson et al., 2021).

To achieve more consistent and refined conceptualisation in this area, the development of specific measures that capture climate change related mental health outcomes. For example, measures could be designed to assess specific measures related to climate change, such as trauma (Patrick et al., 2023) or obsessive-compulsive disorder (Jones et al., 2012). Additionally, comparing existing measures of climate anxiety to establish their construct validity could contribute to the advancement of measurement in this field (Mouguiama-Daouda et al., 2022).

However, it is crucial to develop measures that are sensitive to avoid unnecessary pathologising of individuals with appropriate emotional responses to the challenges posed by climate change. While the relationship between climate emotions and negative mental health is acknowledged, none of the included studies in this review suggest that climate emotions should be defined as diagnosable mental health disorders, which aligns with the perspectives of others in this field (Bhullar et al., 2022). Moreover, the highly contextualised nature of climate emotions is an important consideration, with some commentators raising the point that self-report tools for measuring climate emotions may not be appropriate and alternative approaches may be necessary. (Lertzman, 2015; Wullenkord et al., 2021). Future research could explore alternative methodologies.

The current review also highlights the need for further investigation into different populations that experience climate emotions. It is vital to understand the specific needs of these populations and the types of support required. This includes considering the role of social and political contexts in increasing individuals' vulnerability to negative mental health outcomes from climate emotions (Charlson et al., 2022; Hogg et al., 2021). This review suggests that populations deemed more vulnerable to climate change and associated mental health implications include those living in geographically vulnerable areas (e.g., Pacific), Indigenous populations, climate scientists, activists and those who have experienced climate events. However, further research is needed to explore the risk and resilience factors that may moderate the relationship between mental health and climate emotions. This ongoing research will provide valuable evidence for practitioners, policymakers, and researchers to develop relevant support strategies for these populations. Research regarding demographic variables such as educational background, religion, climate risk from residence location, and gender differences should be considered to tailor support to specific demographic needs (Mouguiama-Daouda et al., 2022; Reyes et al., 2023). It is paramount that future research extends beyond Western countries and encompasses diverse geographical and cultural areas, as well as interdisciplinary collaborations (Coffey et al., 2021; Helm et al., 2018; Ogunbode et al., 2023; Soutar & Wand, 2022).

Additionally, the investigation of effective psychological support strategies for individuals with elevated levels of climate distress is crucial, including programs that provide supportive group spaces for expressing and working through climate emotions. Broad scale research on psychosocial interventions at the individual, community and societal levels is needed to address the social and environmental causes of climate emotions (Patrick et al., 2023).

This review also indicates the need for different research methodologies, such as longitudinal studies, mixed method approaches, quantitative studies, and qualitative in-depth focus groups. These will contribute to the understanding the causal relationship between climate change and mental health over time (Curl et al., 2022; Howard et al., 2020; Larionow et al., 2022; Ogunbode et al., 2023; Schwaab et al., 2022; Stanley et al., 2021; Wullenkord et al., 2021). It is suggested that replicating this review in a few years' time will provide new evidence and insights as the field rapidly evolve. Furthermore, with the growing body of research in this area, a meta-analysis in the future may provide a valuable addition.

Result from the present review suggest a need for future research that explores conceptual and measurement issues, ensures sensitivity to avoid inappropriate pathologising, works to reduce cultural and socioeconomic diversity issues, and develops effective support strategies. This future research will enhance the accuracy, reliability, and validity of findings, leading to more effective and comparable research outcomes in the field of climate emotions and mental health. Moreover, this ongoing research will build the understanding of the complex ways psychological responses to climate change are related to mental health, the needs of specific populations, and assist in the development of evidence-based understanding interventions for affected individuals and communities.

## Strengths and Limitations

To our knowledge this is the first review to synthesise results of the relationship between climate emotions and negative mental health in adults. The findings of this review provide useful insights into the current state of literature in this area. The study's strengths include its clear methodological approach of using of multiple databases, including both quantitative and qualitative studies for a comprehensive review, and the inclusion of an assessment tool to evaluate the quality of studies. By focusing on published peer-reviewed articles, this review provides a cohesive discussion of literature on this topic and suggests future investigations in this area.

However, this review also has limitations. Firstly, these results require careful interpretation as more than half of all included studies were overall of lower quality, suggesting a potential for high degree of risk of bias. Additionally, the inclusion of only English language articles from peer-reviewed journals may have resulted in the exclusion of relevant non-English studies and grey literature. The focus on studies explicitly measuring mental health introduces a bias towards a psychological perspective that aligns with

Western view of mental health. Also, this review focused on empirical studies focusing on mental health and climate emotions, which is a specific sub section of the literature in this large and growing field of emotional responses to climate change. Furthermore, the exclusion of studies focused solely on children limits the contribution of that population to the research body. However, the findings of this review align with another review that specifically examined young people, suggesting that negative emotions about climate change are associated with mental health symptoms across different age groups (Ramadan et al., 2023).

## Conclusion

This systematic review synthesized and assessed primary research investigating the relationship between climate emotions and mental health in adults. This review provides important insights into the state of literature in this area as the findings indicate an association between climate emotions and negative mental health outcomes, with evidence emerging from qualitative, quantitative, and mixed-method studies. While the heterogeneity of measures and methodologies presents challenges in synthesizing the research, higher quality studies consistently support the existence of this relationship. This review suggests a need for more research into the relationship between climate emotions and mental health, particularly in low- and middle-income countries, diverse cultures, and populations, into conceptual and measurement issues, psychological strategies to support populations. As humans continue to face the increasing impacts and stressors of climate change, ongoing evidence regarding the intensity and scale of mental health impacts is required to inform response at individual, community, and policy levels. The mental health burden of climate emotions is predicted to increase as the climate crisis continues, therefore it is a compelling reason for global governments to act meaningfully on reducing the impact of climate change.

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## Openness and Transparency Statements

The present article has been checked by its handling editor(s) for compliance with the journal's open science and transparency policies. The completed *Transparency Checklist* is publicly available at:  
<http://doi.org/10.23668/psycharchives.13552>

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### Author Contributions.

CLARE PITT: Conceptualization. Methodology. Formal analysis. Investigation. Writing – original draft.

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GRETTA PECL: Methodology. Writing – review & editing. Supervision.

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**Acknowledgments.** Thank you to Louise Earwaker, Carolyn Philpott, Elizabeth Leane, Peter Pitt, Ben Sanderson, Victoria Heinrich, Samuel van den Bosch and Jessica Hughes for their input and advice.

**Funding.** The authors have no funding to report.

**Competing Interests.** The authors have declared that no competing interests exist.

**Diversity Statement.** In the list below, the check mark (☑) indicates which steps were taken to increase diversity within the context of this paper. Steps that were not taken or did not apply are unmarked (☐).

- Ethnically or otherwise diverse sample(s)
- Gender balanced sample(s)
- Inclusive gender measure
- Inclusive materials
- Sampling justification
- Extensive sample description
- Discussion of generalizability
- Diverse reference list
- Underprivileged / minority author(s)
- Early career author(s)
- Degree of privilege/marginalization considered in authorship order
- Author(s) from sampled population (avoiding 'helicopter science')

**Supplementary Materials.** The following table provides an overview of the accessibility of supplementary materials (if any) for this paper.

Type of supplementary material	Availability/Access
<b>Data</b>	
Quality assessment of methodological quality of studies.	Pitt et al., 2023
<b>Code</b>	
The search queries used to identify relevant studies.	See Appendix A
<b>Material</b>	
No materials to share.	—
<b>Study/Analysis preregistration</b>	
The review was registered in the international prospective register of systematic reviews (PROSPERO).	Pitt et al., 2020

**Badges for Good Research Practices.**

Open data: NO.

Open code: NO.

Open materials: NO.

Preregistration: YES.

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## Appendices

### Appendix A

*Search Strategy*

Database	Platform	Year	Searched	String
Medline	Ovid	2000– Current	Abstract, Title	ecoanxiety OR eco anxiety OR eco-anxiety OR ecological grief OR ecogrief OR eco grief OR eco-grief OR ecological anxiety OR environmental anxiety OR environmental grief OR “climate change anxiety” OR climate anxiety OR “climate change grief” OR climate trauma OR climate grief OR pre-traumatic OR pretraumatic OR solastalgia OR ecoparalysis OR econostalgia or psychoterratic OR worry OR distress OR ecoguilt OR biospheric concern OR anxiety OR mental health OR grief OR fear OR mental illness climate change or global warming 1 and 2
PsychINFO	Ovid	2000– Current	Abstract, Title	
EMBASE	Ovid	2000– Current	Abstract, Keyword, Title	
Psychology and Behavioural Science Collection	EBSCOhost	2020– 2022	Author, Subject, Keyword, Title and Abstract	ecoanxiety OR “eco anxiety” OR eco-anxiety OR “ecological grief” OR ecogrief OR “eco grief” OR eco-grief OR “ecological anxiety” OR “environmental anxiety” OR “environmental grief” OR “climate change anxiety” OR “climate anxiety” OR “climate change grief” OR “climate trauma” OR “climate grief” OR “pre-traumatic” OR pretraumatic OR solastalgia OR ecoparalysis OR econostalgia OR psychoterratic OR worry OR distress OR ecoguilt OR “biospheric concern” OR anxiety OR “mental health” OR grief OR fear OR “mental illness” AND “climate change” OR “global warming”
CINAHL	EBSCOhost			As above
Web of Science Core Collection	Web of Science	2000– current	Topic Search	ecoanxiety OR “eco anxiety” OR eco-anxiety OR “ecological grief” OR ecogrief OR “eco grief” OR eco-grief OR “ecological anxiety”

Database	Platform	Year	Searched	String
				OR “environmental anxiety” OR “environmental grief” OR “climate change anxiety” OR “climate anxiety” OR “climate change grief” OR “climate trauma” OR “climate grief” OR “pre-traumatic” OR pretraumatic OR solastalgia OR ecoparalysis OR econostalgia OR psychoterratic OR worry OR distress OR ecoguilt OR “biospheric concern” OR anxiety OR “mental health” OR grief OR fear OR “mental illness” AND “climate change” OR “global warming”
Scopus		2000– 2022	Title, Abstract, Keyword	TITLE-ABS-KEY (ecoanxiety OR “eco anxiety” OR eco-anxiety OR “ecological grief” OR ecogrief OR “eco grief” OR eco-grief OR “ecological anxiety” OR “environmental anxiety” OR “environmental grief” OR “climate change anxiety” OR “climate anxiety” OR “climate change grief” OR “climate trauma” OR “climate grief” OR “pre-traumatic” OR pretraumatic OR solastalgia OR ecoparalysis OR econostalgia OR psychoterratic OR worry OR distress OR ecoguilt OR “biospheric concern” OR anxiety OR “mental health” OR grief OR fear OR “mental illness”) AND TITLE-ABS-KEY (“climate change” OR “global warming”)

## Appendix B

- The search terms were changed from the original protocol after a discussion with a research librarian discussing the scale of this review. The following were removed as they were identified as being a different construct: cope, coping, wellness, well-being, wellbeing, and cognitive function.
- The search was not limited to English studies; however, no studies published in a language other than English met the inclusion criteria.
- Review and opinion papers were excluded, which differs slightly from the protocol. This was to maintain the focus on original empirical research.